Analysis of Length of Time Spent
in Chapter 11 Bankruptcy

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Abstract

This paper investigates original issuers of high yield bonds in Chapter 11 bankruptcy to determine which factors affect the length of time spent in Chapter 11. In order to do this analysis we propose a flexible new duration model, the censored partial regression model. This model allows us to consider the effect of some variable on the duration using a nonparametric functional form. We find that the choice of prepackaged Chapter 11, the length of time negotiating before filling for Chapter 11, the profitability, the highly leveraged transactions, the participation on different disputes, the role of vulture funds and some institutional changes turn out to be relevant to analyze this duration.

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I. INTRODUCTION

The purpose of this paper is to analyze the effect of several factors on the duration or time that original issuers of high yield bonds spend under Chapter 11 of the U.S. Bankruptcy Code. That is, the period from a firm filing for Chapter 11 until its emergence. When a firm goes into default or has some financial distress, it can choose between private renegotiation or out-of-court restructuring and file for a formal bankruptcy. The first option implies to renegotiate with its creditors privately outside court. Gilson et al. (1990) present a comprehensive study of the different determinants for the choice between bankruptcy and private renegotiation. They analyze the relative cost of formal bankruptcy versus private renegotiation and the factors affecting creditor's willingness to settle outside of Chapter 11. If the firm chooses the option of formal bankruptcy, it has two possible alternatives: the possibility of liquidating the firm under Chapter 7 or the possibility to reorganize under Chapter 11. The reason for having two different procedures when a firm files for bankruptcy is that there are two types of firms in the market. On the one hand, viable firms that are temporarily in financial distress and that, after a reorganization procedure, can solve their problems. Therefore, Chapter 11 can be understood as a mechanism to protect the firm from the creditors pressure while it tries to reorganize. Under this situation, the filing firm has the control and the exclusive right to propose the first plan of reorganization within 120 days following the filing date and the creditors have 60 additional days to accept it. There are two possibilities to approve the proposed plan. The first one is known as the "unanimous consent procedure" (UCP), under which all classes of creditors must consent the plan. The other one, applicable only when the first one is not possible, and known as "cram-down", under which the court unilaterally imposes the plan on dissenting classes. Cram-down plans usually involve higher cost than UCP. That is one of the reasons for cram-downs to be rare in practice. On the other hand, there are not viable firms for which the best solution is to finish with their activities and liquidate the firm under Chapter 7[1].

In addition, we have to point out that the Chapter 11 procedure described above is the traditional Chapter 11 procedure, but there is another possibility to deal with default, the prepackaged bankruptcy. This possibility is viewed as a hybrid form of corporate reorganization combining some of the features of an out-of-court restructuring with some of the features of a traditional

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[1]For the procedures of Chapter 7, and also of Chapter 11, see White (1989).

Chapter 11 reorganization. As in the out-of-court case, the creditors negotiate the terms of the plan outside the court. As in traditional Chapter 11, a bankruptcy petition and a plan of reorganization must be filed (in this case, together) and ratified by the court. Tashjian et al. (1996) carry out an empirical analysis of prepackaged bankruptcies presenting a comparison of the length of time from the initial restructuring announcement to the resolution of financial distress for out-of-court restructurings, prepackaged and traditional Chapter 11 bankruptcies. For the last two classes, they also analyze the duration in Chapter 11 and the one previous to the filing for Chapter 11 (the pre-Chapter 11 duration).

We would also like to mention that, apart from the papers already mentioned (i.e., Tashjian et al., 1996 and Gilson et al., 1990), other studies have investigated the duration in Chapter 11, as, for example, Weiss (1990), Franks and Torous (1989, 1994). These studies provide an extensive descriptive information of Chapter 11 bankruptcies using different samples for different periods of time. In Bandopadhyaya (1994), Li (1999) and Orbe et al. (2000), we can find an analysis of the same problem but using different regression models. A similar analysis, but one that concentrates on the study of the time of a firm in default, can be found in Helwege (1999). While Bandopadhyaya (1994) and Li (1999) assume a given probability distribution for the duration (i.e., the Weibull and log-logistic distributions, respectively), Helwege (1999) and Orbe et al. (2000) examine the duration without assuming any distribution for the response variable. However, Helwege uses ordinary least squares estimation, which is inconsistent under censorship in the sample, and this is the usual situation (i.e. samples with censored observations) when the duration of some event is analyzed. In our case, we have a censored observation when the study has finished and the firm still remains in Chapter 11. Therefore, if we have censored observations in the sample, the methodology presented in Orbe et al. (2000) is, in our opinion, the most flexible and appropriate one.

In this paper, we analyze the length of time spent by a firm in Chapter 11 using an even more flexible model, the censored partial regression model proposed in Orbe (2000). The need for a more flexible model is explained in detail in the following section. We generalize the effect of the covariables on the duration by allowing a nonparametric component that may be interesting to take into account in situations where we do not know the functional form of the effect of the covariables on the variable of interest or situations where assuming any distributional form can

be considered very restrictive or maybe it does not make any sense.

The rest of the paper is divided in the following sections. Section II provides the motivation to use the proposed flexible model. In Section III we present the model and describe the estimation process. The inference of the model is carried out using bootstrap techniques and Section IV describes a new procedure to generate the bootstrap resamples, adequate for the proposed model. In Section V we present the dataset describing the information given by the covariables. In Section VI we present the results of the estimation and, finally, Section VII concludes the paper with a discussion of the results.

II. MOTIVATION FOR A MORE FLEXIBLE MODEL

The sample contains a group of original issuers of high yield bonds that go into default from 1982 to 1991 and end up filing for Chapter 11. During this period of time, several changes considered relevant to analyze the duration of the firms in Chapter 11 have taken place. This situation has been considered in some of the papers mentioned above, such as, for example, Li (1999) and Orbe et al. (2000), using a dummy variable that divides the period under study in two parts, after and before 1990. There are two reasons to introduce this variable. One reason is based on the resolution of default problems of the LTV firm[2]. This resolution was negative to bondholders and, even though this situation was finally revoked, it derived in a major uncertainty for the bondholders. The other reason is that, after 1990, if a firm reduced its debt outside Chapter 11, it should pay taxes over the reduced debt whereas, if the firm was inside Chapter 11, it did not have to pay for it. These two situations were also remarked by Helwege (1999).

On the other hand, Helwege (1999), Hotchkiss and Mooradian (1997) and Betker (1995) pointed out that the eventual participation of vulture funds in the restructuration process of the firms with financial problems was increasing, and Hotchkiss and Mooradian (1997) found out that these funds provoked a more efficient restructuration of the firms. As a result, those firms emerge earlier from Chapter 11. However, we are not able to determine when these funds entered in the restructuring process.

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[2]The LTV Corporation filed for Chapter 11 in the summer of 1986 and the plan to repay the creditors was confirmed in June 1993, after nearly seven years of negotiations, representing this case, the longest high yield bond default.

In addition, Helwege (1999) suggests a trend over time which reflects a possible reduction on the default durations because of, eventually, major facilities to present plans of reorganization different from the one offered by the management. Helwege (1999) introduces several indicator variables to control the effects of these changes over time, dividing the total sample period in different intervals.

Li (1999) also suggests that the courts and bankruptcies professionals are going to acquire more experience, as time goes by, resolving different conflicts and that this would derive into faster negotiations and, therefore, in a shorter period of time in Chapter 11.

Finally, we want to add that this trend of time could be affected by other reasons such as, for example, the evolution in time of the frequency of defaults. Stock and Watson (1993) present the bankruptcy and default rates and, for the period under study, we can observe an increment of this frequency until 1985, a decrease between 1985 and 1990 and, again, an increase in the 90's. Therefore, we would expect that, if there are fewer bankruptcies in the economy, the time necessary to resolve these bankruptcies should be shorter.

It seems more logical to think that the effect of some of these changes would be gradual, and that these progressive changes cannot be captured using indicators or dummy variables since they only consider sudden or immediate effects. Therefore, we propose a more flexible and less restrictive approach to capture these effects using a new model, the censored partial regression model. The main idea consists of not giving any specific functional form for these effects on the duration. In order to put this into practice, we consider an additional nonparametric component in the model presented in Orbe et al. (2000). That is, we are considering a nonparametric time trend, where all the changes occurring during the period under study would be reflected.

III. THE CENSORED PARTIAL REGRESSION MODEL

In the literature on regression models in duration or lifetime data analysis, we can find two classes of models: The proportional hazard models proposed by Cox (1972) with the hazard function specified as:

$$\lambda(t, x) = \lambda_0(t) h(x, \beta),$$

where T is the duration variable, $\lambda_0(t)$ is known as the baseline hazard function and x is the k-

dimensional vector of covariables[3]. The other important class of models is the accelerated failure time models (see, for example, Kalbfleisch and Prentice, 1980) with the the hazard function specified as:

$$\lambda(t, x) = \lambda_0(t \cdot h(x, \beta))h(x, \beta),$$

where, if $h(x, \beta) = e^{-x\beta}$, we can rewrite the model in log-linear terms as

$$\log T = x\beta + \epsilon. \tag{1}$$

In practice, the most applied model is the first one because it allows the estimation of the parameters of interest without assuming any probability distribution for the duration variable[4]. However, this model assumes proportional hazard functions and this assumption may not be verified by the data. The other class of models usually estimated assuming a probability distribution for the duration variable, which, in most cases, is unknown by the researcher[5] (see, e.g., Bandopadhyaya, 1994 and Li, 1999). Bandopadhyaya (1994) considers a Weibull probability distribution for the duration fitting a Weibull regression model with the following hazard function

$$\lambda(t) = \lambda p(\lambda t)^{p-1},$$

where the effect of the covariables is introduced through the λ parameter and, usually, considering the $\exp(-x\beta)$ specification. In this case, using the logarithmic transformation for the duration variable, this model can be rewritten in log-linear terms as

$$\log T = x\beta + \sigma\epsilon, \tag{2}$$

where ϵ has an extreme value distribution and $\sigma = p^{-1}$. This model, together with the exponential regression model, are the only ones that belong both to the classes of the proportional hazards and accelerated failure time models. Li (1999) uses the log-logistic probability distribution with the following hazard function

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[3]The usual specification for $h(x, \beta)$ is the exponential function, because with this specification we guarantee the nonnegativity of the hazard function without putting any restrictions on the β parameters.

[4]The estimation procedure for this model consists of maximizing the partial likelihood function, Cox (1975).

[5]After assuming the distribution function, the estimation process consists of maximizing the likelihood function, where the contribution of the censored observations is given by the survival function and the contribution of the uncensored ones by the density function.

$$\lambda(t) = \frac{\lambda p (\lambda t)^{p-1}}{1 + (\lambda t)^p}.$$

In this case we have model (??), but considering that ϵ has a logistic distribution.

Orbe et al. (2000), based on the fact that the probability distribution of the duration was unknown[6], decided to use a weighted least squares estimator proposed by Stute (1993). His methodology allows us to estimate model (??) without assuming any probability distribution for ϵ. In addition, this methodology does not assume proportional hazard functions.

In this paper, and as a consequence of the reasons mentioned in Section II, we use an extension of this methodology for the case of a semiparametric model. That is, we use a model where the effect of the covariables can be separated into two components: a parametric and a nonparametric one, where, in the latter case, we do not specify a specific functional form for the effect of the covariable on the duration. In other words, we introduce a smooth function $h(\cdot)$ to model the effect of the covariable R on the duration. Thus, the proposed model is

$$\ln T_i = X_i \beta + h(r_i) + \epsilon_i \tag{3}$$

$$Y_i = \min(T_i, C_i), \qquad \delta_i = \begin{cases} 1; & \text{if } T_i \leq C_i \\ 0; & \text{if } T_i > C_i \end{cases}.$$

Because of the censoring, we do not observe $T_1, \ldots, T_n$, and, instead we observe $Y_1, \ldots, Y_n$. $C_1, \ldots, C_n$ are the values of the censoring variable C, which is independent of the duration variable T, and δ_i is an indicator of whether T_i has been observed or not.

Under this generalization, we can model situations where we do not know the functional form of the effect of one covariable on the response variable, or situations where the assumption of a lineal dependence, or any other different one between some covariable and the duration variable is a restrictive assumption, or, maybe, does not make any sense. In our case, we will introduce a nonparametric trend over time only assuming that the effect is modeled by a smooth function. This component captures the effects pointed out in section II.

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[6]Usually, when we are studying duration data, we do not know the probability distribution, and, if we choose an incorrect distribution, we would make an important specification error that could derive in false conclusions. This may be the reason why Bandopadhyaya (1994) obtained surprising results of not significant covariables when, a priori, they seemed to be significant ones and covariables whose effects are contrary to the sign assigned a priori.

In order to estimate model (**??**), we propose to minimize the following penalized weighted sum of squares

$$\sum_{i=1}^{n} W_{in}[\ln Y_{(i)} - X_i\beta - h(r_i)]^2 + \alpha \int h''(r)^2 dr, \tag{4}$$

where W_{in} represents the Kaplan-Meier weight and can be calculated using the expression:

$$W_{in} = \hat{F}_n(\ln Y_{(i)}) - \hat{F}_n(\ln Y_{(i-1)}) = \frac{\delta_i}{n - i + 1} \prod_{j=1}^{i-1} \left[\frac{n - j}{n - j + 1}\right]^{\delta_j}.$$

Here, $\hat{F}_n$ is a Kaplan-Meier estimator of the distribution function F (Kaplan and Meier, 1958) and $Y_{(i)}$ is the i-th ordered value of the observed response variable. We use these weights in order to take into account the existence of censored observations in the sample. The goodness of the fit is controlled by the sum of the weighted squared residuals and, with the integral of the square of second derivatives, we control the smoothness of the $h(\cdot)$ function. In (**??**), α is the smoothing parameter that gives more or less relevance to these two terms. If α is relatively small, then the main contribution to the expression to minimize will be the weighted residual sum of squares. However, if α is large, the main component is the roughness penalty term.

It can be shown that a smoothing cubic spline function is the resulting function to minimize the penalized weighted least squares and, in this way, (**??**) can be rewritten as

$$(\ln Y - X\beta - Nh)^T W (\ln Y - X\beta - Nh) + \alpha h^T K h,$$

where h is a vector of values $h_j = h(r_j)$ for $j = 1, \ldots, d$, being d the number of distinct values of the covariable R, N is the incidence matrix which assigns the respective value of the covariable R to each individual, W is a diagonal matrix with the Kaplan-Meier weights on its main diagonal, $\ln Y = (\ln Y_{(1)}, \ldots, \ln Y_{(n)})$, $X = [X_1^T, X_2^T, \ldots, X_n^T]^T$ is the matrix of the covariables and K is obtained using the properties of the cubic spline function (see, e.g., Green and Silverman, 1994). Taking derivatives with respect to β and h in the expression above and reordering the terms, lead us to obtain the pair of simultaneous matrix equations

$$\begin{aligned} X^T W X \beta &= X^T W (\ln Y - Nh) &(a) \\ (N^T W N + \alpha K)h &= N^T W (\ln Y - X\beta) &(b) \end{aligned} \tag{5}$$

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We can obtain the estimations of β and h iterating between equations 5(a) and 5(b), solving repeatedly for β and h, respectively, until convergence is achieved (i.e., using the backfitting algorithm, Buja, Hastie and Tibshirani, 1989).

The complete estimation process and some simulation studies to analyze the goodness of this procedure and the effect of the censorship on the estimation of the parametric and nonparametric components are presented in Orbe (2000).

IV. INFERENCE USING BOOTSTRAP TECHNIQUES

After obtaining the estimation of the coefficients β and the function h, we would like to analyze the significance of the different covariables. In this paper, we make this analysis using bootstrap techniques. The bootstrap presents the important advantage that allows us to study the properties even for small samples.

In the literature on the bootstrap with censored observation, we can find basically two different possibilities to obtain the bootstrap samples: one proposed by Reid (1981) and another one proposed by Efron (1981).

The procedure in Efron (1981) consists of estimating, by Kaplan-Meier, the distribution functions for the duration variable and for the censoring one, $\hat{F}_n$ and $\hat{G}_n$. Then, using these estimated distribution functions, generate one sample for the duration variable, $t_1^*, \ldots, t_n^*$, and another one for the censoring variable, $c_1^*, \ldots, c_n^*$. Finally, we consider the following bootstrap resample:

$$y_i^* = \min\{t_i^*, c_i^*\}, \qquad \delta_i^* = \left\{ \begin{array}{ll} 1; & \text{if } t_i^* \leq c_i^* \\ 0; & \text{if } t_i^* > c_i^* \end{array} \right. .$$

On the other hand, the procedure proposed by Reid (1981) consists of estimating the Kaplan-Meier estimator for the distribution function of the duration variable $\hat{F}_n$ and, using this, generate the bootstrap resample. Akritas (1986) showed that the procedure proposed by Efron is better than the one considered by Reid.

However, these two resample generating methods were proposed to be applied in homogeneous models. That is, for models without covariables. In our case, we have covariables and the proposed resample procedures are not adequate. However, the procedure by Efron could be valid if we assume that the censoring variable follows the same regression model as the duration one, but this assumption is a very restrictive one.

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In order to solve this problem, we propose a new procedure to generate the bootstrap sample for this sort of models. This procedure is very flexible because we do not assume any model for the relationship between the censoring variable and the covariables. This procedure was used in Orbe et al. (2000), but for the completely parametric version of the model. Here, we adapt the procedure to extend it to semiparametric models.

The complete procedure to obtain the bootstrap estimations is presented in the next steps:

- **Step 1:** Estimate model (**??**)

- **Step 2:** Obtain the residuals of the previously estimated model:

$$\hat{\epsilon}_i = \ln Y_i - X_i \hat{\beta} - \hat{h}(r_i), \quad \text{for} \quad i = 1, \ldots, n$$

- **Step 3:** Center the residuals

- **Step 4:** Obtain the bootstrap resample for the residuals $\epsilon_1^*, \ldots, \epsilon_n^*$

- **Step 5:** Obtain the bootstrap sample of the variable under study by doing model based bootstrap

$$\ln T_i^* = X_i \hat{\beta} + \hat{h}(r_i) + \epsilon_i^*, \quad \text{for} \quad i = 1, \ldots, n$$

- **Step 6:** Obtain the bootstrap censored indicator by generating a vector of Bernoulli variables δ^* where

$$P(\delta_i^* = 1 | \ln T_i^* = \ln t_i^*, X_i = x_i) = 1 - G(\ln t_i^{*-}), \quad \text{for} \quad i = 1, \ldots, n$$

- **Step 7:** Estimate model (**??**), in the bootstrap sample, using the same estimation procedure as in Step 1. That is,

$$\min_{\beta, h} \sum_{i=1}^n W_{in}^* [\ln Y_{(i)}^* - X_i \beta - h(r_i)]^2 + \alpha \int h''(r)^2 dr,$$

- **Step 8:** Go back to Step 4 and repeat the process M times (i.e., M bootstrap samples are obtained).

We have to remember that, because of censoring, we observe Y instead of T, and the indicator δ. Therefore, the estimation in Step 1 will be obtained by applying the procedure described in Section III. In Step 4, we make nonparametric bootstrap, which consists of generating the bootstrap observations without assuming any probability distribution and this procedure is equivalent to generate samples without replacement from the original sample of residuals. In Step 5, using the bootstrap resample of residuals obtained in Step 4, gives us the bootstrap resample for the response variable following the specification of model (**??**). It can also be seen (Step 6) that we generate the bootstrap censoring indicator δ^* without assuming any relationship between the censoring variable and the covariables, which is less restrictive than assuming the same regression model as the one assumed for the duration variable. In this step, G denotes the cumulative distribution function of the censoring variable and, as this is unknown, we estimate it using the correspondent Kaplan-Meier estimator, $\hat{G}_n$. Thus, if $\ln T^* = \ln t^*$ and $\delta^* = 1$, we have that C^* is obtained from the distribution function $\hat{G}_n$ on the restricted interval $[\ln t^*, \infty)$. On the other hand, if $\ln T^* = \ln t^*$ and $\delta^* = 0$, then C^* is obtained from the distribution function $\hat{G}_n$ on the restricted interval $[0, \ln t^*)$. In Step 7, we have to carry out the estimation process presented in the previous section for the given bootstrap replication. The value of M, in Step 8, depends on the objective of the study. If we want to estimate the distribution of the estimators and to obtain confidence intervals we need a large value (i.e., at least $M = 1000$). However, if we want to estimate the standard deviations far lower values are sufficient. For more details about bootstrap procedures see, e.g., Davison and Hinkley (1997) or Efron and Tibshirani (1993).

V. DATA

We use the data kindly provided by Kai Li of the University of British Columbia. This dataset collects information about 83 original issuers of high yield bonds that go into default between 1982 and 1991 and finish filing for Chapter 11. Asquith et al. (1989) place the development of the original issue high yield bond market in 1977 (there were very few original issues of high yield bonds before that year) and their study reveals default percentages substantially higher than those reported in most previous studies.

The response variable shows us the length of time, in months, that a firm spends in Chapter 11 or, in some cases (i.e., for the censored observations), the number of months from the moment

of filing for Chapter 11 until finishing the follow up of the firms in July 31, 1994.

As for the explanatory variables, we have information about the special characteristics of each firm, as well as the type of industry it belongs to and, also, about the business cycle indicator of the moment when the firm enters in default. We start by describing the continuous covariables. **Prech11** measures the duration that the firm spent in out-of-court negotiations before filing for Chapter 11. Usually, the first step, after default, is to try to restructure their debt privately rather than through formal bankruptcy because the latter costs more (Gilson et al., 1990). **Hy/Tl** captures the relative importance of the high yield debt in relation to the firm total liabilities. Helwege (1999) indicates that, theoretically, a large fraction of the liability structure in the form of high yield bonds leads to a slow renegotiating procedure, although, unexpectedly, she obtains the contrary effect in her study. **Ebitda/Sales** measures the profitability of the firm dividing the earnings before interest, taxes, depreciation and amortization by its sales. Jensen (1991) points out that it is relatively easier and faster for profitable firms to exit from Chapter 11. **Iebitda/Sales** is the same as the previous variable but evaluated in average terms and for a particular industry. **TL** measures the size of the firm before its financial problems. This variable is used as a proxy variable for the complexity of the debt structure of the firm because the entire liability structure of the firms is often difficult to obtain. Helwege (1999) indicates that the larger firms typically have more creditors classes. **Termprem** is a business cycle indicator measuring the difference between the 30-years US government bond interest rate and the 3-month Treasury bill rate. This difference is lower when the economic conditions are strong and higher when the economic conditions are weak. The rest of covariables are indicators. **Prepack** indicates if the firm filed for prepackaged Chapter 11. As we have pointed out in the introduction, when a firm uses the mechanism of prepackaged Chapter 11, the bankruptcy petition and reorganization plan are filed together and the terms of the plan are negotiated in advance between the firm and its creditors. Tashjian et al. (1996) conclude that the length of time spent negotiating prior to filing for bankruptcy (measured by the variable Prech11) is substantially longer for prepacks than for traditional Chapter 11 filings. In addition, the length of time spent in court is substantially shorter for prepacks than for traditional Chapter 11 reorganizations and, apparently, firms that file prepacks substitute time negotiating out-of-court for time spent in Chapter 11 reorganizations. However, the total time used from the initial restructuring announcement to resolution of financial

distress is less than the one used in traditional Chapter 11. This effect can be seen after analyzing the sample: there are 24 prepackaged bankruptcies with an average of 14 months to complete the pre-Chapter 11 stage and an average of 5 months to complete the Chapter 11 stage. On the other hand, for traditional Chapter 11 firms, the average length of time in pre-Chapter 11 is 5 months and, in Chapter 11, 26 months. **Complex** indicates if the firm has more than one layer of subordination among its high yield bonds. Gilson et al. (1990), in their descriptive analysis, observe that firms with more complex debt structure spend more time to solve their problems. **Hlt** indicates if the firm has realized highly leveraged transaction. Jensen (1991) and Wruck (1990) point out that creditors of highly leveraged transactions are estimulated to resolve defaults quickly in order to preserve the firm value. **Dispute** indicates if the firm is involved in different disputes such as, for example, underfunded pensions, environmental liabilities or subordination lawsuits among its creditors. Helwege (1999) argues that the situations described above make the restructuring process more difficult, thereby delaying the renegotiation process. In Table 1 we present summary statistics for the response and explanatory variables[7].

Table 1: Summary statistics for all variables

Response variable	Mean	Sdev	Median	Min	q_1	q_3	Max
Duration in Chapter 11 (month)	19.975	15.985	17.000	1.000	6.500	31.00	83.00
Covariables (Continuous)							
Prech11 (month)	7.651	8.277	5.000	0.000	0.500	12.50	29.00
Hy/Tl	0.347	0.213	0.310	0.037	0.162	0.490	0.861
Ebitda/Sales	0.055	0.143	0.053	-0.455	-0.006	0.112	0.547
TL (billion)	1.280	1.630	0.563	0.119	0.327	1.366	7.953
Iebitda/Sales	0.135	0.098	0.103	-0.021	0.066	0.182	0.478
Termprem(%)	1.933	1.054	1.690	0.120	0.990	2.900	3.630
Covariables (Indicators)	Sum						
Prepack	24						
Complex	34						
Hlt	31						
Dispute	32						

In addition, we know, as pointed out in Section II, that there are institutional changes and other factors that have complicated or facilitated the resolution of bond defaults over the sample

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[7] For a detailed description of the variables see Li (1998).

period (LTV case, changes in tax code, introduction of vulture funds, experience of courts, among others). Therefore, they are relevant factors to explain the duration in Chapter 11. The global effect of these factors and changes is not clear and it seems that the effect of some of them should be gradual. Thus, we have a clear application for model (??), proposed in Section III.

VI. EMPIRICAL RESULTS

We fit model (??) introducing in X all the covariables, except for the period of default (R), and assume a linear relationship for the effects on the duration. On the other hand, with $h(r)$, we try to capture the evolution on time on the length of time spent in Chapter 11. The effect of the different changes, previously commented on, will be reflected by the estimation of h. The variable R takes value 1 for firms that entry in default from 1982 to 1984, value 2 for those that entry in default in 1985 and so on, until finishing[8].

The results from the estimation process for the coefficients of the parametric component of model (??) are given in Table 2, together with the bootstrap standard deviations[9]. In Table 3, we present the 95% bootstrap BC percentile confidence intervals for the coefficients[10] β. Finally, in Figure 1, we present the estimation of the nonparametric component, the function h, together with its 95% bootstrap percentile confidence interval.

Table 2: Bootstrap estimates of the standard deviations for the coefficients β

VARIABLE	COEF.	SDEV.
Constante	0.3978	0.1654
Prepack	-1.2069	0.1236
Prech11	-0.0191	0.0065
Complex	0.0593	0.1138
Hlt	-0.2066	0.1123
Hy/Tl	-0.1811	0.2562
Dispute	0.5043	0.1231
Ebitda/Sales	-1.2598	0.3400
TL	0.0627	0.0416
Iebitda/Sales	0.5732	0.5645
Termprem	-0.0404	0.0293

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[8]first default years (i.e., 1982, 1983 and 1984) have been pooled together because we have few observations for these periods.

[9]The bootstrap resamples have been obtained following the procedure indicated in Section IV.

[10]For details on bootstrap confidence intervals see, for example, Efron (1987) or Efron and Tibshirani (1993).

Table 3: 95% bootstrap confidence intervals for the coefficients β

VARIABLE	Lower limit	Upper limit
Constante	0.0844	0.7211
Prepack	-1.4209	-0.9251
Prech11	-0.0344	-0.0084
Complex	-0.1786	0.2856
Hlt	-0.4466	-0.0064
Hy/Tl	-0.7207	0.2824
Dispute	0.2884	0.7873
Ebitda/Sales	-2.0444	-0.6647
TL	-0.0074	0.1491
Iebitda/Sales	-0.4701	1.7437
Termprem	-0.1014	0.0157

In relation with the estimation of the effect of the covariables introduced in a parametric way, we obtain the same results as in Orbe et al. (2000). Thus, we obtain, as in Weiss (1990), Gilson et al. (1990) and Franks and Torous (1994), that the firms which have filed for prepackaged Chapter 11 (**Prepack**) spend less time in Chapter 11, because the inscription in Chapter 11 and the restructuring plan are filed at the same time. We can see that, if a firm remains in negotiation during a large period between the date of default and the date of filing the formal bankruptcy (**Prech11**), this firm emerges faster from it. These two results confirm the ideas previously presented (Tashjian et al., 1996). The firms that have realized highly leveraged transaction (**Hlt**) in the past leave bankruptcy before others, as pointed out in Jensen (1991) and Wruck (1990). Confirming the point of view of Helwege (1999) and Gilson et al. (1990), if the firm is involved in different disputes (**Dispute**), as commented on before in the description of this variable, it has more difficulties to leave Chapter 11. The more profitable (**Ebitda/Sales**) the firm is the shorter the time it stays in Chapter 11. This is consistent with Jensen (1991)'s idea that the firm value is relevant to resolve financial distress. In addition, the size of the firm (**TL**), used as a proxy variable to measure the complexity of the firm's total debt structure, turns out to be significant to analyze the duration but only at the 10% significance level. The rest of the covariables, that is, the weight of the high yield debt in the total debt (**Hy/Tl**), the complexity of the high yield debt (**Complex**), the profitability of the industry to which the firm belongs to (**Iebitda/Sales**) and the economical situation reflected by the difference between large and short interest rates

(**Termprem**) as a business cycle advanced indicator, turn out to be non significant. However, all of them have the a priori expected sign to explain the length of time spent in Chapter 11.

Figure 1: 95% bootstrap confidence interval for the nonparametric component
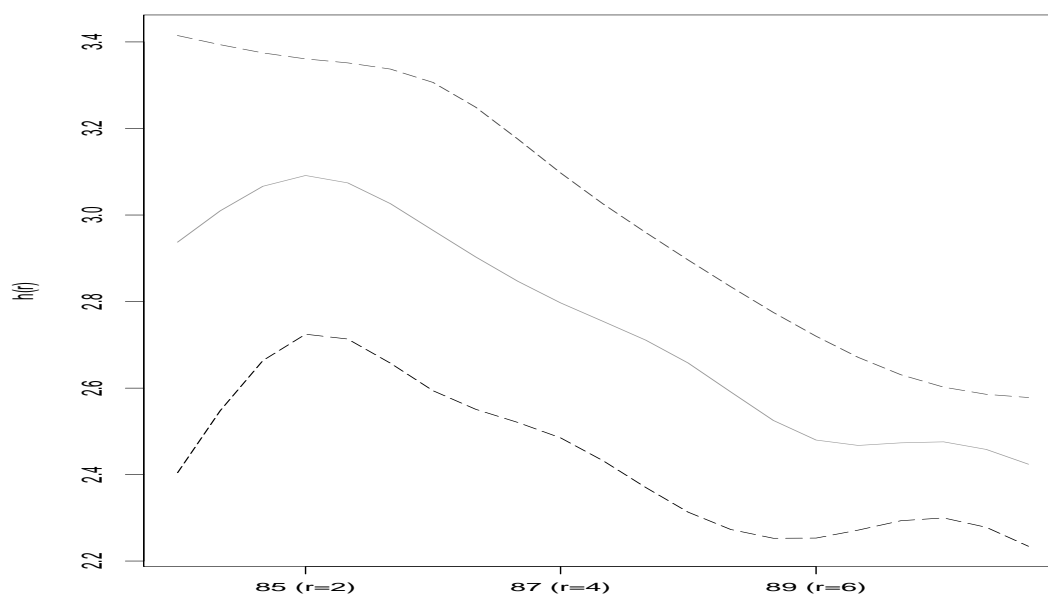
As for the estimation of the nonparametric component, we can observe an increasing function up to 1985, then a decreasing function but with a deceleration on this decrease in the final part.

Therefore, we have obtained a decreasing tendency that indicates that the length of time spent in Chapter 11 is going to be shorter when we move the default date from the beginnings of the period under study, early eighties, to the end of the study in the early nineties. This conclusion of trend over time towards faster negotiations is reached by Helwege (1999), but analyzing the duration of firms in default[11]. Thus, it seems that the reasons leading towards an effect of reduction of the duration in Chapter 11 are stronger than the reasons to increase the time spent in this situation. Therefore, this result may suggest that the courts and bankruptcies professionals have been acquiring more experience resolving different conflicts and this derives in faster negotiations, as discussed in Li (1999). Other possible positive factor to provoke this gradual reduction of the

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[11] However, we have to indicate that with the indicators approach, we do not observe the final deceleration in this trend over time.

length of time in Chapter 11 is the growing participation of vulture funds in reorganizations procedures, as argued by Helwege (1999) and Hotchkiss and Mooradian (1997). The increase of the h estimated function during the first months can be explained with the increment of the defaults rates for this period, as we have previously mentioned. The final deceleration in the decrease of length of time spent in Chapter 11 could be reflecting the increment effect (larger durations) provoked by the sentence of the LTV firm and the change of tax treatments in 1990, as pointed out by Li (1999) and Helwege (1999).

We would like to add that in Li (1999) and Orbe et al. (2000) the use of a dummy variable that divided the period of default after and before 1990 to capture the effect of the last two indicated factors, resulted in a negative coefficient. Helwege (1999) would expect a positive coefficient (larger durations) because of these two factors. This negative coefficient indicates that the duration in Chapter 11, if the firm default date is in 1990 or 1991, is lower than the firm that goes into default in the eighties and this conclusion is correct. However, the explanation of this change in the a priori expected sign of the coefficient is due to other factors that operate in a contrary direction (generating shorter durations) such as, for example, that courts and bankruptcy professionals became more experienced in dealing with bankruptcies, as pointed out by Li (1998). Other reason to expect a negative coefficient is the major participation of vulture funds in restructuring distressed firms, as indicate by Helwege (1999). Therefore, the global effect of all of these factors is the deceleration of the decreasing trend after 1989, in our study, and, in Li (1999) and Orbe et al. (2000), a negative total effect comparing with the firms with default before 1990. However, the use of the dummy specification, does not allow us to see the evolution of the decrease trend of the duration in Chapter 11 when we move from the first default dates to the last ones, or to see the deceleration of this decrease trend on its last stage.

VII. CONCLUSIONS

We have examined the length of time spent in Chapter 11 bankruptcy by original issuers of high yield bonds that go into default between 1982 and 1991 and were followed through July, 1994. This analysis has been carried out using a general and flexible model proposed to study a response variable that presents censored observations. Therefore, the application of this model can be found in the analysis of any kind of duration data. The flexibility of this model can be seen

in the different characteristics of the model. This model does not need to assume any probability distribution for the response variable, representing in this way a good alternative for the Cox proportional hazards model. In addition, the proposed model does not need the assumption of the proportional hazard functions, which sometimes can be a very restrictive assumption. Another important characteristic about the proposed model is the possibility to consider situations where the functional form of the effect of some covariable on the duration is unknown or it is too restrictive to assume a given functional form.

After applying our model to our dataset, we find a significant influence of "prepackaged" firms, observing, for these ones, shorter durations than for firms that choose the traditional bankruptcy procedure. The time that one firm spends negotiating before filling for Chapter 11 also turns out to be relevant, reducing the time that this firm will spend in Chapter 11. The firms with highly leveraged transaction in the past emerge from bankruptcy before others. The different disputes in which the firm is involved make the restructuring procedure of the firm more difficult, delaying the exit from Chapter 11. The profitability of a firm is important. That is, the more profitable the firm is, the more likely for it to emerge earlier from Chapter 11. The complexity of the firm's total debt structure results to be a negative factor for a sooner solution of the firm's problems. In addition, we can appreciate a positive evolution, with a tendency of shorter durations, when we move from the first defaults in 1982 to the last defaults analyzed in the sample. This decreasing trend indicates that the courts and bankruptcy professionals have acquired more experience, with the passage of time, to deal with bankruptcies. Other relevant factor for this improvement is the gradual major participation of vulture funds in the restructuring of distressed firms. We have to indicate that this decrease trend suffers an important deceleration at the beginnings of the nineties, which may be due to two possible causes: the sentence of the LTV firm and the change of tax treatments. We have to point out that our model captures these effects in a less restrictive form than in Helwege (1999), where several indicators are used to do this. On the other hand, the technique of ordinary least squares estimation is inconsistent in the presence of censored observations, something very usual when analyzing duration data, as is the case here. In addition, the weight of the high yield debt in total debt, the complexity of this debt, the profitability of the industry to which the firm belongs to and the variable used as indicator of the economical situation, all having the expected signs, turn out to be non significant to explain the

duration under study.

Finally, we want to point out that this analysis is only possible under the flexible specification of the nonparametric trend.

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