An Analysis of Second Time Around Bankruptcies Using a Split Population Duration Model

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Abstract

A significant proportion of firms that reorganize under Chapter 11 file for a second Chapter 11 protection or liquidate. This paper examines the performance of firms after they have reorganized under Chapter 11 and provides crucial insights to the stockholders and the creditors of these firms regarding factors that could lead to a second bankruptcy. We use a "split population" duration model to estimate the instantaneous probability (hazard) of a firm re-entering bankruptcy. We find that the probability of re-entering bankruptcy is lower for firms that have spent a long period of time undergoing a first reorganization, have reduced their debt-to-assets ratio during reorganization, have not divested heavily during reorganization and have not emerged from their previous bankruptcy simply because of a high industry capacity utilization. We do not find evidence to support the belief that a change in the firm's CEO during reorganization contributes to the future success of the firm. Further, we find that the financial woes of a reorganized firm persist for a significant length of time. In fact, the instantaneous probability of an average firm re-entering bankruptcy increases for about four years before declining.

Introduction

Since the modification of the bankruptcy laws in 1978 the provision under Chapter 11, that financially distressed firms can seek the protection of the court from its creditors, has been under close scrutiny. A central issue has been if the Chapter 11 provision has achieved its objective of transforming distressed firms into healthy enterprises. Jensen (1991) argues that certain features of the Bankruptcy Code give rise to "chronic inefficiencies". Hotchkiss (1995) reports that almost forty percent of the firms in her sample continue to experience operating losses in the two years following emergence from Chapter 11 protection and fifteen percent of the firms re-enter Chapter 11 a second time. LoPucki and Whitford (1993) and Gilson (1996) also find a large incidence of firms filing for bankruptcy or restructuring their debt a second time. Overall, public opinion appears to be that the Chapter 11 process is inefficient and many observers (e.g. Aghion et. al. (1992)) have proposed new "optimal" bankruptcy procedures.

Until recently, the ability of a reorganized firm to avoid post-reorganization financial distress and a second Chapter 11 filing or liquidation was considered to be one of the definitions of "success" in the reorganization of financially distressed companies. However, arguments have been made in the literature to suggest that liquidation costs (Shleifer and Vishny (1992)) and agency costs (Mooradian (1994)) often lead inefficient firms to reorganize. In the presence of these costs a reorganization under Chapter 11 can be "successful", even if the firm earns a low return on assets and files for a second Chapter 11 protection, as long as the cash flows to the firm's claimants exceed what they would have been in liquidation. A broader definition of "success" thus is needed to analyze the performance of reorganized firms. However, whether or not a firm re-enters Chapter 11 remains an important issue to policy makers who monitor the

bankruptcy process and also to the creditors and the stockholders of reorganized firms, even if the second Chapter 11 filing is not necessarily a failure of the first reorganization effort. Further, there is evidence to suggest that re-organized that do not re-enter bankruptcy or restructure their debt a second time outperform those firms that do so. For example, Alderson and Betker (1995) examine if accumulated cash flows from a reorganized firm exceed the cash flows that would have been available from investing the estimated proceeds from liquidation in the S&P 500 index. They find that more than eighty percent of all reorganized firms created more wealth by continuing rather than liquidating. However, firms that do not restructure their debt a second time around have significantly greater mean excess return as compared to firms that undergo a second reorganization.

In this paper, we address the following issues: How long does it take before a firm that has been reorganized under Chapter 11 files for a second Chapter 11 protection or liquidate (henceforth referred to as "the firm re-entering bankruptcy")? Why do some firms never re-enter bankruptcy? Is the relative vulnerability of a firm to re-enter bankruptcy influenced by firm-specific differences or by the changes in industry and economy-wide conditions? In order to address these issues, we observe firms that file for Chapter 11 and subsequently emerge as reorganized firms between 1979 and 1990. We track these firms until 1993 to determine if they re-enter bankruptcy. The variable of interest is the time to the second bankruptcy filing, which enables us to analyze the vulnerability of a firm over time. We examine how the characteristics of the firm and the general business environment in which the firm operates affect this variable. Some firms in the sample have not re-entered bankruptcy by the end of 1993. These firms might re-enter bankruptcy after 1993 (giving rise to censored observations) or might continue to operate

without ever re-entering bankruptcy. A split population duration model (see Schmidt and Witte (1989)) is used in the estimation. The duration model incorporates censoring to estimate the instantaneous probability (hazard) of a reorganized firm re-entering bankruptcy. The "split" parameter is included to control for the fact that some firms may never go bankrupt once they have emerged from Chapter 11.

The hazard is specified as a function of firm specific characteristics, industry and economy-wide factors. This hazard is also influenced by the time elapsed after emergence from Chapter 11. A lower hazard at a point in time implies a smaller instantaneous probability of re-entering bankruptcy. We find that firms with a lower hazard (a) have spent a longer period of time under their first reorganization, (b) have had a larger reduction in their debt-to-assets ratio during reorganization, (c) have experienced a smaller decrease in their lines of businesses during reorganization and (d) are part of an industry that had a lower capacity utilization at the time of emergence. We also find that the estimated hazard of an average firm goes up for about four years before it begins to decline. This result suggests that a firm that emerged, say, four years ago is *more likely* to encounter another bankruptcy as compared to a firm that emerged two years ago.

As mentioned earlier, we use a split population model to estimate the hazard. The above results on the hazard are conditional on the fact that some firms may never eventually re-enter bankruptcy. We estimate the probability of a firm eventually re-entering bankruptcy and find that it is lower for firms that have reduced their debt-to-assets ratio during reorganization and for firms which belong to low demand growth industries. For an average firm this probability is sixty nine percent.

The rest of the paper is organized as follows. In Section 2, the dependent and the independent variables are described. The methodology used is discussed in Section 3. Results and interpretation appear in Section 4. Section 5 concludes.

2. Description of the variables

2.1. The Dependent Variable

A list of firms that filed for protection under Chapter 11 between 1979 and 1990 is obtained from the annual reports of the Securities and Exchange Commission (SEC). This document and the *Corporate Changes Reporter* (CCR) are used to determine which of these firms are reorganized. After a firm has emerged from Chapter 11 protection it is tracked until 1993, the year that is chosen for the end of our study.[1] A record of whether or not the firm either re-enters Chapter 11 protection or files for liquidation under Chapter 7 is made. The filing and the emergence years are denoted by t_f and t_e, respectively. The exact filing and emergence dates are obtained from the CCR, the *Directory of Obsolete Securities* (DOS), the *Wall Street Journal Index* (WSJI) and the *Bankruptcy Almanac* (BA). If no information on the firm re-entering bankruptcy is obtained in the above publications, it is assumed that the firm continues to operate. To verify that the firm is indeed operating, the Standard and Poor's *Register of Corporations, Directors and Executives* and the *Compustat* database are used. This is done to

[1] Firms that are merged or acquired as a part of the reorganization plan are generally deleted from the sample. This is necessary since it is not possible to track merged or acquired firms to determine if they re-enter bankruptcy. For example, Evans Products Company (which filed for protection on 3,12,85 and emerged on 7,2,86) merged with Grossman's Incorporated as a part of the reorganization plan. It is not possible to determine if Evans Products Company re-enters bankruptcy since only Grossman's Incorporated can be tracked after 7,2,86. However, there are a few instances when the firm continues to operate as a separate entity even after the merger. For example, HRT Industries Inc. (which filed for protection on 11,23,82 and emerged on 2,10,84) merged into a subsidiary of McCrory Corporation, effective 4,19,85. We are able to track HRT Industries Inc. since it continued to operate as a

ensure that just because the CCR, DOS, WSJI or the BA do not report a re-entry into bankruptcy, it is not erroneously assumed that the firm continues to operate.[2] The sequence of events after a firm files for its first Chapter 11 protection is described in Figure 1.

The dependent variable is the time (duration) between the firm's emergence from Chapter 11 and the firm's re-entry into bankruptcy. This variable enables us to analyze the vulnerability of firms over time. Data are available for 107 firms, of which 42 firms re-enter bankruptcy.[3] The frequency distribution of firms re-entering bankruptcy is presented in Figure 2. These firms are associated with completed observations since the exact duration of time to bankruptcy on these firms is known. A firm that does not re-enter bankruptcy results in a censored observation since we do not when, and indeed if, such a firm will file for bankruptcy. The sample, thus, consists of completed and censored durations that are appropriately handled in the maximum likelihood estimation of the model.

2.2. The Independent Variables

The following independent variables represent the postulated firm specific, industry and economy-wide factors that contribute to the future success of a reorganized firm:

The time the firm spends under Chapter 11 (Duration 1): This is defined as the period between t_f

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separate entity.

[2] There are instances when the CCR, DOS, WSJI and BA did not report the re-entry into bankruptcy of a reorganized firm *and* no information regarding the firm subsequent to its emergence from Chapter 11 is available in either the Standard and Poor's *Register of Corporations, Directors and Executives* or the *Compustat* database. In such cases the firm is deleted from the sample. For example, Altec Corporation (which filed for protection on 9,26,83 and emerged on 5,21,87) is dropped since no additional information regarding this firm is available after 1988.

[3] Some firms had to be dropped from the sample because firm specific variables were not available from any of the following sources: (a) *Compustat*, (b) *Disclosure* (c) Moody's Manuals (d) the firm's annual 10K filings with the SEC.

and t_e, the time the firm spends under Chapter 11 protection while it reorganizes. There are several reasons for the inclusion of Duration 1 as a control variable. Many authors (see, e.g., Jensen (1989) and Gilson et. al. (1990)) point out that the primary disadvantage of reorganization under Chapter 11 is its relative cost. Both direct costs (fees to accountants and lawyers) and indirect costs (lost sales or profits due to the constraints imposed by the trustee) of Chapter 11 filing depend on the length of a firm's stay under Chapter 11 protection. A higher cost of reorganization could enhance the possibility of future financial difficulties. On the contrary, a longer time in Chapter 11 may provide the firm with sufficient protection needed to reorganize successfully. Maksimovic and Phillips (1998) find that the length of time a firm spends under Chapter 11 reorganization has a bearing on the productivity of the firm. Since a majority of the firms in Chapter 11 are from low demand growth industries, a longer protection period enables such firms to enhance their productivity relative to other firms in the industry. A longer Chapter 11 protection may also enable the firm to obtain favorable terms from creditors who are more anxious to see the firm emerge and, thus, are willing to make concessions. For the reasons outlined above the effect of Duration 1 on the failure probability is ambiguous, *a priori.*

Assets of the firm when it emerges from its first Chapter 11 protection (Log Assets): This variable, measured by the natural log of total assets at the time the firm emerges from Chapter 11, is included to control for firm size. Creditors of large firms are more willing to make concessions to ensure the future viability of the firm. Moreover, large firms have greater ability to raise additional funds in the capital market (White (1984), Casey et. al. (1986)). For these reasons it is expected that the larger the firm the lower is the probability of the firm re-entering bankruptcy.

The change in the leverage of the firm during reorganization (Change in Debt/Assets): This

variable, measured by the difference between the debt-to-assets ratio of the firm at the time it emerges from the time it files for Chapter 11, is included to capture the ability of the firm to lower its indebtedness. A firm in financial distress is likely to have a high debt-to-assets ratio. Opler and Titman (1994)) show that high debt adversely affects operating performance since in an industry downturn, high debt firms lose more sales than firms with low debt. Alderson and Betker (1995) show that firms with poor growth opportunities emerge from bankruptcy with high debt ratios. Firms that emerge from bankruptcy with high debt tend to be firms with liquidation value of assets close to its going-concern value. It is important to note that high debt ratios may actually be the optimal capital structure for a reorganized firm. For instance, Harris and Raviv (1991) and Hart and Moore (1995) show that high levels of debt curbs the managers' ability to make unprofitable but empire-building investments, and to trigger liquidation if the firms' assets become more valuable elsewhere. However, it is postulated that a higher debt-to-assets ratio, irrespective of its optimality, contributes to a greater risk of the firm encountering another bankruptcy.[4]

The change in the CEO while the firm undergoes reorganization (Change in CEO): Some observers contend that the Chapter 11 process is inefficient, in part, because of the provision of the bankruptcy code that allows incumbent management to retain control of the firm in bankruptcy and propose a reorganization plan. It is alleged that managers acting on the behalf of the shareholders (Bebchuk and Chang (1992)) and in their own self interest (Boot (1992)) are biased towards the continuation of an insolvent firm. Jensen (1993) adds that when managers

[4] In fact, our raw data suggest that of the twenty firms with the highest value of Change in Debt/Assets, eleven re-enter bankruptcy by 1993. By comparison only six firms out of the twenty with the lowest value re-enter bankruptcy.

shut plants or liquidate firms, this process "... causes personal pain, creates uncertainty and interrupts or sidetracks careers. Rather than confronting this pain, managers generally resist such action as long as they have cash flow to subsidize the losing operations." The CEO change variable is included to examine if a change in management (or lack thereof) has an impact on the future success of the firm. If the incumbent management does indeed bias the Chapter 11 process towards the continuation of inefficient firms, then firms that appoint a new CEO during reorganization should have a lower probability of re-entering bankruptcy.

The change in the number of lines of businesses during reorganization (Change in #SIC): It is argued that firms that are more diversified at the time of the Chapter 11 filing are more successful after emergence, since they have the capability to operate after divesting unsuccessful lines of businesses. The immediate benefit of divesting is an increase in liquidity and a return to core lines of businesses. However, since the market for assets of a bankrupt firm is generally thin, it is easier for firms to sell only those assets that are in relatively high demand. Maksimovic and Phillips (1998) find that bankrupt firms that sell and close plants over time are associated with a decrease in overall firm performance. The Change in #SIC variable, measured by the change in the number of four digit Standard Industrial Classification (SIC) codes listed for the firm during reorganization, is included to control for these factors. The impact of this variable on the likelihood of future success of the firm is ambiguous.

Industry capacity utilization when the firm emerges from Chapter 11 (Capacity Utilization): Often, firm performance is dictated by industry-wide conditions. Lang and Stulz (1992) find that the performance of a firm is affected by Chapter 11 filings by other firms in the industry. Shleifer and Vishny (1992) argue that the market for a firm's assets will be illiquid when other

firms in the same industry are also distressed. John et. al. (1992) find that distressed firms often cite exogenous, industry shocks as causes for their decline. The Capacity Utilization variable is included to control for these factors. This variable has been used by Bandopadhyaya (1994) to explain a firm's exit from Chapter 11 (see also Maksimovic and Phillips (1998)). The relative strength of an industry, measured by its capacity utilization as compared to full capacity in the year the firm emerges from Chapter 11, has two counteracting forces on the hazard of a firm re-entering bankruptcy. A healthy industry implies that a firm in that industry has a better chance of survival as compared to a similar firm in a poorly performing industry. However, a high capacity utilization might be the *reason* that the bankrupt firm was able to emerge from Chapter 11 protection, although inherently the firm was not financially viable. Thus, this variable has an ambiguous impact on the firm's probability of another bankruptcy.

Industry growth over a ten year period (Demand Growth): This is another variable that controls for industry-specific differences. It measures the long-term growth prospects of an industry.[5] Unlike, the capacity utilization variable that is computed at the emergence year, the demand growth variable is computed for a fixed period between 1982 and 1992. This allows demand growth to be more industry specific as compared to the capacity utilization variable which may also be influenced by idiosyncratic economy-wide conditions in the year the firm emerges from Chapter 11. Maksimovic and Phillips (1998) show that the average productivity of firms that become bankrupt, plant closures and asset sales during bankruptcy, and the optimal resolution of bankruptcy depend on the level of industry demand. A higher proportion of firms that file for bankruptcy are from low demand growth industries. However, while bankrupt firms in low

demand growth industries do not have significantly lower productivity than their industry counterparts, those in high demand growth industries are under-performers. Given these findings it is postulated that the higher the industry demand growth the greater is the probability of re-entering bankruptcy.

The interest rate during the time the firm emerges from Chapter 11 (Interest Rate): This variable, measured by the three year average of the prime rate after the firm emerges from Chapter 11, is included to control for economy-wide factors that affect the financial environment in which the firm is operating. A relatively high average interest results in a higher cost of funds for firms and thus should have a positive impact on the firm's probability of re-entering bankruptcy.

The actual filing and emergence dates used to compute Duration 1 are obtained from CCR, DOS, WSJI and BA. The total assets of the firm at t_e are used to compute Log Assets. The long-term debt/total assets ratio of the firm is obtained for t_e and t_f and the difference is used to calculate Change in Debt/Assets. Data on Log Assets and Change in Debt/Assets are obtained from *Compustat, Disclosure*, *Moody's Manuals* and *10K* filings of the firm with the SEC.

The Standard and Poor's *Register of Corporations, Directors and Executives* is used to collect data on the Change in CEO and the Change in #SIC variables. For each firm the names of the CEO as well as the number of 4 digit SIC categories listed are obtained for t_f and t_e. By comparing the names, the Change in CEO variable is constructed. If over time this position is created or dropped then it is recorded as a change. The Change in #SIC is constructed by taking the difference between the number of SIC listings at t_e and t_f. To obtain the Capacity Utilization variable, we first classify firms according to their SIC code at the time of emergence. The

[5] Maksimovic and Phillips (1998) point out that this variable also captures cost shifts from increased foreign imports or

capacity utilization corresponding to the firm's industry for the year it emerged from protection is obtained from the *Federal Reserve Bulletin*. The demand growth variable is also constructed on the basis of SIC codes. For each firm, it's industry growth rate between 1982 and 1992 of the value of product shipments is computed. The value of product shipments is available for the manufacturing industries. For other industries, similar measures are used to calculate demand growth. For example, the value of construction work is used to compute the demand growth for the construction industries. The data are obtained from various publications of the Census Bureau. The prime interest rate series is obtained from the *International Financial Statistics* database. Three-year moving average are created using the series and are used to construct the Interest Rate variable.

Descriptive statistics on the independent variables appear in Table 1. The mean, the median and the standard deviation are reported in the first three columns using all the firms in the sample. The last column reports the difference in means of the variables between the firms that re-enter bankruptcy and the ones that continue to operate at the end of 1993. We find that the means are significantly different for the Duration 1, the Log Assets, the Change in Debt/Assets and the Interest Rate variables. The averages of all the firms in the sample indicate that the average firm:

a. spends almost 2 years in its first reorganization,

b. at the time of emergence has total assets of $509 million with a high standard deviation of $2,660 million. The median assets is $41 million.[6]

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shocks to production costs, as well as demand changes in the industry.

[6] The natural log of total assets is used as an independent variable to control for a high variability and skewness of total assets. Results do not change qualitatively when total assets is used instead.

c. emerges as a firm with a slightly higher debt-to-assets ratio,

d. has a 50.5% chance of a change in CEO while it reorganizes,

e. undergoes a reduction in the number of lines of businesses it owns while it reorganizes,

f. is part of an industry that has a capacity utilization of 80.66% in the firm's emergence year,

g. is part of an industry that has a ten year demand growth of 70.7 percent,

h. operates in a financial environment where the average interest rate is 9.22%.

The 107 firms are distributed across 83 different four digit SIC categories. The largest concentration is in the "eating places" and "variety stores" industries with six and four firms, respectively. Overall, there are fifteen industries that have two or more firms.

3. The Methodology

Since the dependent variable is a duration, the appropriate estimation methodology is duration (alternatively known as hazard rate) models. As is customary in applications of duration models it is the hazard rate that is analyzed. The hazard rate is the instantaneous probability of an agent making a transition from one state to another, given that the transition has not already occurred. In the context of this paper, the hazard is the instantaneous probability that a firm that has emerged from Chapter 11 protection moves from a solvent to a bankrupt state.

An implicit assumption made in most survival time models is that of certain exit, which in this context implies that all reorganized firms will eventually go bankrupt. We use a split population duration model that takes into account the possibility that the transition from one

state to another may *never* occur.[7] This adjustment is appropriate since the firm that has emerged from Chapter 11 once may never re-enter bankruptcy. Thus, the probability that a firm will eventually fail is postulated to be less than one. The model estimates both the instantaneous probability of failure at a point in time and the probability of eventual failure; both probabilities are specified in terms of firm specific, industry and economy-wide factors discussed in Section 2.2.

Let U be an unobservable variable that equals 1 if the firm eventually fails and 0 otherwise. Then,

(1) $P(U=1)=\delta, \; P(U=0)=1-\delta.$

The duration variable is T which denotes the length of time that a reorganized firm takes to re-enter bankruptcy. Let f(t;X), S(t;X), h(t;X) denote the density, survivor and hazard function of T, conditional on the independent variables, X.[8] Further, let C be an indicator variable that equals 1 if the duration is complete and 0 if it is censored. The duration is complete for firms that re-enter bankruptcy. For a firm that has re-entered bankruptcy, we have T = t and C = 1. The appropriate density for such a firm is therefore,

(2) $P(U=1)f(t;X,U=1) = \delta f(t;X,U=1).$

For a censored observation (C=0), all we know is that the firm has not re-entered bankruptcy during the observation period. We need to entertain two possibilities, (a) that the firm would have re-entered if it were followed longer and (b) that this firm would never re-enter bankruptcy.

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[7] For other applications of "split population" duration models see Schmidt and Witte (1989) and Douglas and Hariharan (1994).

[8] See Kiefer (1989), Jaggia and Thosar (1995) and Baek and Bandopadhyaya (1996) for a description and applications of duration models.

Specifically,

(3) $P(C=0) = P(U=0) + P(U=1)P(T>t;X,U=1) = 1 - \delta + \delta S(t;X,U=1).$

The likelihood function consists of expressions (2) and (3) above for completed and censored durations, respectively. This likelihood function can be constructed once the hazard function is parameterized. In this paper we use a log-logistic hazard function that has a property that it declines for sufficiently large T. This function is appropriate since, for a reorganized firm that has operated successfully for a reasonably long period of time, the probability of re-entering bankruptcy is expected to decline. The log-logistic hazard function is given by:

(4) $h(t;X,U=1) = \exp(X\beta)\alpha t^{\alpha-1}(1+\exp(X\beta)t^{\alpha})^{-1}$

where $X\beta = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + ... + \beta_k X_k$ and the X_j's are the firm-specific, industry and economy-wide variables and α is the shape parameter of the hazard. It is useful to note that if a regressor has a positive impact on the hazard, then it has a negative impact on the duration to second bankruptcy. The log-likelihood function for a split population model that uses (4) to compute (2) and (3) above is:

(5) $$\ln L = \sum_{i=1}^{N} C\left[\ln\delta + \ln\alpha + w - 2\ln(1+\exp(w))\right] + (1-C)\left[\ln\left(1-\delta+\delta(1+\exp(w))^{-1}\right)\right]$$

where $w = X\beta + \alpha \ln t$ and $\delta = 1/(1+\exp(-Z\theta))$. The X's are all the independent variables that are discussed in Section 2.2 and the Z's represent the variables that influence the probability of eventual failure. The parameter estimates are obtained by maximizing the above log-likelihood function.[9]

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[9] Maximum likelihood estimates are obtained using the MAXLIK module of the GAUSS programming language.

4. Results and Interpretation

As mentioned earlier, the main purpose of this paper is to ascertain the influence of various factors on the probability that a firm re-enters bankruptcy. We track 107 re-organized firms and find that 42 firms re-enter bankruptcy by 1993, the year we choose to end our study. For the 65 firms that do not file for bankruptcy, some may file for bankruptcy after 1993 and some may never do so. A standard hazard model is not appropriate since it incorrectly assumes that all of the above 65 firms will eventually go bankrupt. A simple logit model used to study the probability of eventual failure also incorrectly assumes that these 65 firms will never re-enter bankruptcy.[10] The appropriate methodology is a split-population hazard model that estimates the hazard along with the probability of eventual failure. For reasons of parsimony, a sub-set of regressors is used to estimate the eventual failure given by the split parameter, δ. A preliminary logit model is run to identify the variables that significantly explain the probability of eventual failure. The variables, Duration 1, Change in Debt/Assets, Demand Growth and Interest Rate are found to be significant at a five percent level. These variables are subsequently used in the estimation of δ along with the duration parameters, β and α (see Table 2). The estimates of the log-logistic model are presented along with those of a split log-logistic model for comparison.

We begin with a discussion of the impact of the characteristics of the firm and the general

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Consistent estimate of the variance-covariance matrix of the parameters is derived as $H^{-1}(G^{T}G)H^{-1}$ where H and G denote the hessian and the gradient evaluated at the maximum likelihood estimates of the parameters.

[10] Hotchkiss (1995) uses a logit model to estimate the probability of a firm re-entering bankruptcy. She tracks re-organized firms for three years and firms that have not re-entered bankruptcy by that time are implicitly treated as ones that will never do so. We find that fifty seven percent of the firms in our sample that re-enter bankruptcy do so after three years.

business environment in which the firm operates on the instantaneous probability of the firm re-entering bankruptcy. The time the firm spends under Chapter 11 the first time (Duration 1) has a significant, negative influence on the hazard. This implies that the longer a firm spends under its first reorganization, the lower is the hazard of a subsequent bankruptcy. A longer reorganization process is often perceived as inefficient, because it imposes higher bankruptcy costs. However, as documented by Maksimovic and Phillips (1998), a relatively longer protection period enables many firms in bankruptcy to enhance their level of productivity, which makes the costs related to bankruptcy worthwhile to incur. The inverse relationship between Duration 1 and the hazard could also be explained by the fact that firms that stay under protection for a long period of time are often able to obtain more favorable terms from their creditors, who are keen to terminate the protection period.

The change in the debt-to-assets ratio variable is significant with a positive coefficient. The higher the debt-to-assets ratio at the time of emergence relative to the ratio at the time of filing the greater is the hazard. This result is of significant importance since we find that the average firm in our sample emerges with a higher debt-to-assets ratio as compared to when it files for protection. Gilson (1996) also reports an increase in leverage during reorganization and reports a higher incidence of recurring bankruptcy for firms that remain more leveraged after restructuring their debt. Our result is consistent with the argument that firms that emerge from bankruptcy with relatively high debt ratios are adversely affected by the leverage (Opler and Titman (1994)) and are ones that have poor growth opportunities (Alderson and Betker (1995)). As argued before, a relatively high debt/asset ratio may be optimal for the firm, an argument that is not contradictory to our finding. Firms that emerge with high debt ratios that are optimal are

ones whose monitors have determined that the high leverage is necessary to impose discipline on the managers and use it as a means to trigger liquidation if necessary. Perhaps, high leverage can be interpreted as a signal that the firm is more likely to encounter another bankruptcy because its growth opportunities are likely to be limited and/or the stakeholders have perceived that liquidation is a possibility.

The change during reorganization of the number of SIC codes listed for the firm has a negative impact on the hazard. The more the number of lines of businesses that the firm has, at the time it emerges relative to when it filed for protection, the lower is the hazard. The average firm in our sample emerges with a smaller number of lines of businesses. This is consistent with the finding in John et. al. (1992) that, in response to decline in earnings, diversified firms retrench quickly and increase their focus on core operations. Our result indicates that, on balance, for the future viability of the firm excessive divesting may not be prudent. This could be because bankrupt firms seeking liquidity often have to sell their more profitable lines of businesses leaving the firm with plants that are less productive (Maksimovic and Phillips (1998)), which contributes to a higher probability of repeated bankruptcy in the future.

The capacity utilization variable is significant with a positive sign. This indicates that the higher the capacity utilization of the firm's industry at the time of emergence, the greater is the probability of the firm re-entering bankruptcy. Bandopadhyaya (1994) reports that it is easier for a firm to reorganize if it is in a high capacity utilization industry. The finding in our paper suggests that the firms that took advantage of the favorable industry conditions at the time of their emergence, without necessarily being healthy enterprises in themselves, are more likely to encounter financial difficulties in the future. Firms that emerge from Chapter 11 protection in

spite of hostile industry conditions are more likely to succeed in the future.

Interestingly, the change in the CEO of a firm has an insignificant impact on the hazard. Arguments in the literature suggest that incumbent managers inefficiently continue a losing enterprise when it should have been liquidated (Jensen (1993), Hotchkiss (1995)). This tendency of managers gives rise to the possibility that firms that undergo reorganization with their original managers are more likely to encounter further financial difficulties. The evidence in this paper suggests that a management change, or a lack thereof, does not influence the probability of the firm re-entering bankruptcy. This result is consistent with findings in Hotchkiss and Mooradian (1997), who argue that the dynamics of the bankruptcy process have changed with the rise of "vulture" investors, who frequently take over the management of the firms in which they have invested. Thus, for samples including bankruptcies in the late 80's and early 90's management may not be insulated from external discipline.

Finally, the total assets, demand growth, and the interest rate variables have an insignificant effect on the hazard suggesting that firm size, the long term growth prospects of the bankrupt firms' industry, and the general economy wide financial environment do not play a significant role in determining the probability of future financial difficulties.

As mentioned in the methodology section, a log-logistic function implies a hazard that declines for sufficiently long durations. The value of α determines the location of the point after which the hazard function declines. In particular, if $\alpha \leq 1$, the hazard declines monotonically; and if $\alpha > 1$, the hazard attains a maximum before it begins to decline. The estimated value of α is 1.76 for the standard and 2.31 for the split model, which are both statistically greater than 1. The

plots of the estimated hazard, evaluated at the mean values of the regressors, for both models are presented in Figure 3. Notice that the hazard of the split model increases initially, reaching a peak at about four years, and declines sharply thereafter. In comparison, the decline of the hazard of the standard model is very gentle. This result is not surprising since the standard model expects all firms to re-enter bankruptcy and consequently predicts a high hazard even beyond six years. The split model suggests a significant decline in the hazard after four years since it appropriately takes into account that not all firms will eventually fail. This shape of the estimated hazard for the split model is intuitively appealing. A firm that reorganizes under Chapter 11 has a low instantaneous probability of failure shortly after emergence. However, the firm remains vulnerable to another bankruptcy and this vulnerability increases over time. If the firm is able to endure this increased vulnerability up to a critical time period the probability of re-entering bankruptcy sharply declines.

It should be noted that the hazard stays quite high (about 10% or more) even up to six years after emergence, a finding that is consistent with the histogram in Figure 2. In fact, the specification of the split model is justified since the estimated hazard (Figure 3) emulates the actual frequency of bankruptcies (Figure 2) extremely well. It seems that firms that are reorganized under Chapter 11 stay vulnerable for a relatively long period of time. It can be argued that all firms, including the ones that have never been reorganized, are at some risk of bankruptcy. The obvious time dependence shown in the plotted hazard indicates that this hazard is associated only with firms that have been reorganized.

The duration parameters, β and α, of the "split-population" duration have been

interpreted above. The split parameter, δ, is specified as a function of Duration 1, Change in Debt/Assets, Demand Growth, and Interest Rate (see section 4). The estimated coefficients of these variables are represented by the θ's in Table 2. We find that Change in Debt/Assets has a positive impact on the firm's eventual survival probability. The likelihood of the firm's eventual survival is adversely affected by the high leverage. Poor growth opportunities and the creditors' concern about the future prospects of the firm which consequently lead to high, albeit optimal, debt ratios contribute to lower future viability. We also find that firms in relatively high demand growth industries have a lower probability of surviving in the long run. This is consistent with Maksimovic and Phillips's (1998) finding that productivity of bankrupt firms in relatively high demand growth industries is lower than their industry counterparts. The Duration 1 and the Interest Rate variables, on the other hand, have an insignificant impact on the probability of the firm eventually filing for bankruptcy. Finally, we also find that the calculated value of δ, evaluated at mean regressors, is 0.69, implying that an average reorganized firm faces a 69% probability of another bankruptcy.

In order to examine the influence of various explanatory variables on the hazard more closely, we estimate the average hazard for firms with different values of the variables. For each variable, we divide our sample into quartiles and compute the average quartile value. The hazard is then estimated at these average quartiles with the remaining variables evaluated at their overall averages. This enables us to highlight the magnitude of the influence of each variable on the hazard. For instance, the hazards in the four different demand growth quartiles is presented in Figure 4. Interestingly, even though the estimated hazard peaks at about year four for all demand

growth quartiles, it is more than double in the fourth quartile as compared to the first (0.21 vs. 0.09). We also estimate the average hazard at year four for different quartiles of each variable (see Table 3). Note that the average hazard for firms in the fourth quartile is almost three times more than that of firms in the first quartile for Change in Debt/Assets and almost three times for the Duration 1 variable.

The methodology that we employ explicitly accounts for the fact that some firms may never re-enter bankruptcy, unlike standard duration models where the probability of eventual failure is assumed to be one. Thus, the estimate of the hazard obtained within this framework is more reliable. We provide evidence on the influence of various factors on the probability that a firm, which has been re-organized under Chapter 11, files for another bankruptcy. Further, we capture the time element inherent in the failure probabilities and show how they change over time. Failure probabilities are different not only between firms but also for a given firm at different points in time after it emerges from Chapter 11. All the stakeholders of firms that reorganize under Chapter 11 should be aware that the vulnerability of these firms is both *factor* and *time* specific.

5. Conclusion

For the stakeholders of a firm it is important to know what the future prospects of the firm are after a reorganization under Chapter 11. Would the firm re-file for Chapter 11 or liquidate, and if so when, or would it continue to operate successfully? In this paper we examine *if* a reorganized firm will eventually go bankrupt and *when* for a vulnerable firm this will happen. Firms that emerge from Chapter 11 protection are observed over time and their performance after

emergence is recorded. We use a split population duration model that controls for the fact that some firms may never go bankrupt once they have emerged from Chapter 11. We find that the probability of an average firm eventually re-entering bankruptcy is sixty nine percent.

It has been documented that the financial woes of a firm are not only due to factors that are firm specific but also are linked to industry conditions. In a similar vein, one could argue that a re-occurrence of bankruptcy could be due to actions taken by the firm during re-organization or it could be dictated by industry and economy-wide factors. We use both sets of factors to estimate the vulnerability of a firm to another bankruptcy after it has been re-organized under Chapter 11. Of the firm specific variables, we find that this vulnerability is lower for firms that have spent a longer period of time under Chapter 11 protection, have lowered their leverage, and have retained a larger number of lines of businesses. The industry conditions also play a critical role in the re-occurrence of bankruptcy. We find that firms in the highest quartile of industry capacity utilization are two times more vulnerable than firms in the lowest quartile. Firms that experience the largest industry growth are almost three times as likely to file for another bankruptcy as compared to firms that are in low or negative demand growth industries.

The estimated hazard increases initially and then begins to decline after approximately four years, implying that the instantaneous probability of a firm re-entering bankruptcy continues to increase up to four years. Furthermore, we find that this instantaneous probability, although on the decline, remains high for almost six years after emergence. This suggests that the financial woes of a reorganized firm persist for a significant length of time. The vulnerability of a reorganized firm over a relatively long period of time, and the influence of various aspects of reorganization and industry conditions on this vulnerability has important implications for the

creditors and the stockholders of the firm and also for policy makers who monitor the bankruptcy process.

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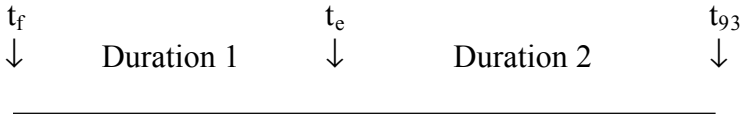
Figure 1

The Sequence of Events After the Firm's First Chapter 11 Filing



where:

t_f: represents the time the firm *files* for Chapter 11 protection;

t_e: represents the time the firm *emerges* from Chapter 11 protection;

t_{93}: All emerged firms (107) are tracked until the end of 1993. During this observation period, some firms re-enter bankruptcy (42) and some continue to operate (65).

Figure 2

Frequency Distribution Of Firms that Re-enter Bankruptcy

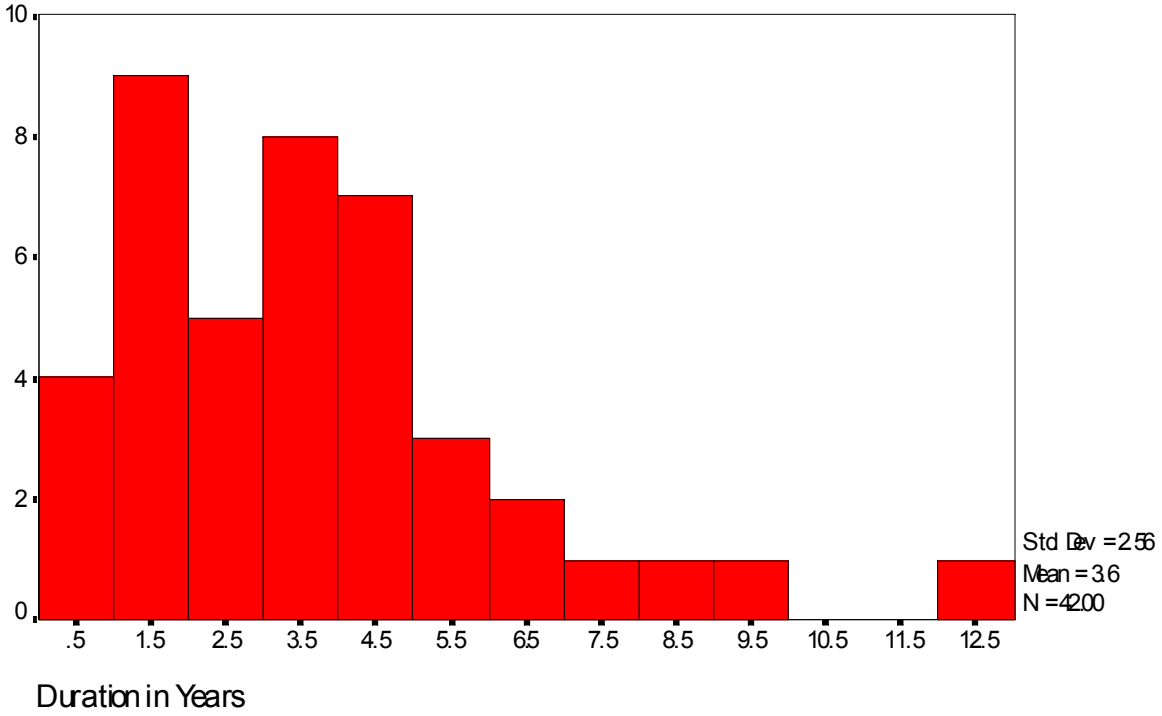


Figure 3

The Estimated Hazard of the Log-Logistic and Split-Population Log-Logistic Models

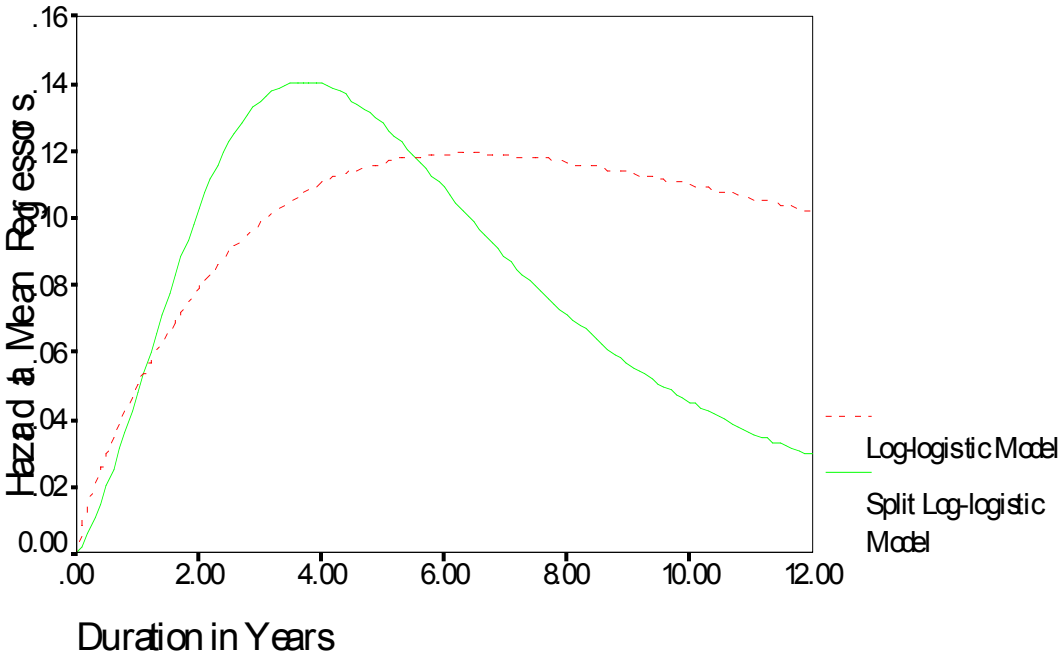


Figure 4

The Estimated Split Log-Logistic Hazard for Firms in Various Demand Growth Quartiles

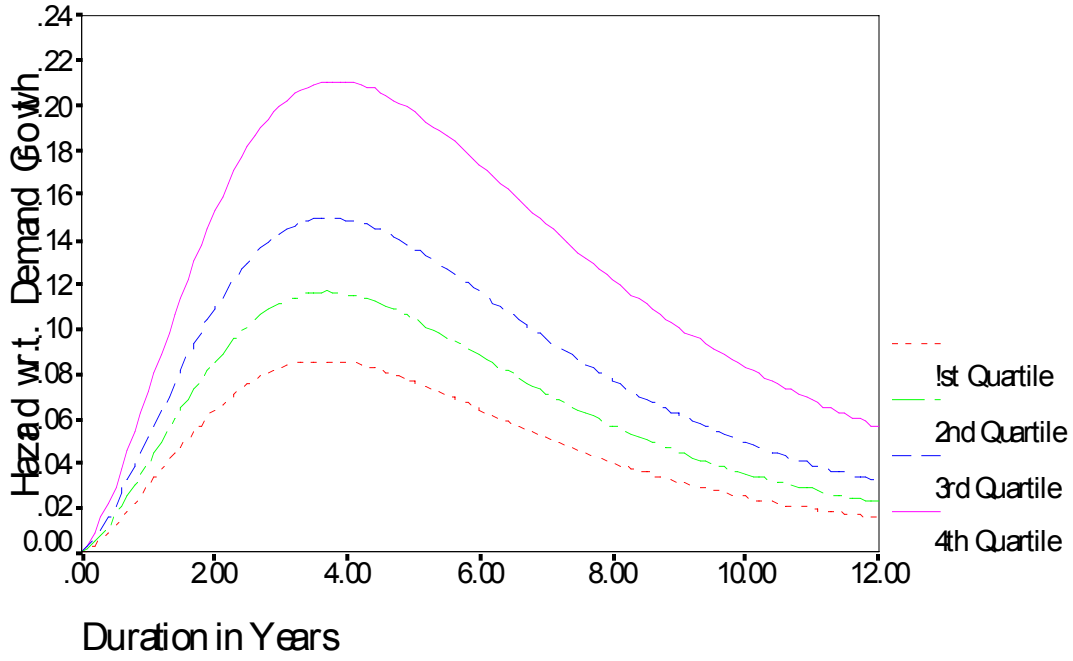


Table 1

Descriptive Statistics of Explanatory Variables

Variables	Mean	Median	Standard Deviation	Difference in Means*
Duration 1	1.973	1.728	1.257	-0.597[a]
Log Assets	3.748	41.21	2660	-0.867[b]
Change in Debt/Assets	0.079	0.012	0.337	0.112[b]
Change in CEO	0.505	1.000	0.502	-0.086
Change in #SIC	-0.551	0.000	3.286	0.163
Capacity Utilization	80.66	81.50	4.354	-0.622
Demand Growth	0.707	0.676	0.845	0.169
Interest Rate	9.225	9.483	1.975	1.093[a]

* represents the difference in means between the firms that re-enter bankruptcy and the ones that continue to operate at the end of 1993.

[a, b] denote significance at 5% and 10%, respectively.

Duration 1: The number of years that the firm spends under Chapter 11.

Log Assets: Natural log of assets, in millions of $, of the firm at emergence.

Change in Debt/Assets: The change in the debt to assets ratio during reorganization.

Change in CEO: 1 if CEO changes during reorganization; 0 otherwise.

Change in #SIC: The change in the number of 4 digit SIC listings during reorganization.

Capacity Utilization: The capacity utilization of the industry of the firm at emergence.

Demand Growth: The industry growth rate of the firm between 1982 and 1992.

Interest Rate: The average prime rate of three years after the emergence.

TABLE 2
Estimates of Log-Logistic and Split-Population Log-Logistic Models

A positive β_j implies that X_j has a positive influence on the hazard.
The shape parameter, α determines the point after which the hazard declines.
A positive θ_i implies that Z_i has a positive influence on the probability of eventual failure.

Variables	Log-logistic Model	Split Population Log-logistic Model
Constant (β_0)	-9.496[a]	-16.024[a]
	(-1.848)	(-2.272)
Duration 1 (β_1)	-0.444[a]	-0.560[a]
	(-3.074)	(-2.964)
Log Assets (β_2)	-0.144	-0.191
	(-1.205)	(-1.087)
Change in Debt/Assets (β_3)	1.595[a]	1.273[a]
	(3.077)	(2.256)
Change in CEO (β_4)	0.125	0.228
	(0.256)	(0.308)
Change in #SIC (β_5)	-0.072	-0.487[a]
	(-1.038)	(-3.204)
Capacity Utilization (β_6)	0.083[b]	0.172[a]
	(1.397)	(2.043)
Demand Growth (β_7)	0.332[a]	0.157
	(1.667)	(0.498)
Interest Rate (β_8)	0.023	-0.004
	(0.216)	(-0.037)
α	1.758[a]*	2.310[a]
	(3.637)	(4.236)
Duration 1 (θ_1)	-	-0.283
		(-0.767)
Change in Debt/Assets (θ_2)	-	1.432[b]
		(1.565)
Demand Growth (θ_3)	-	0.874[b]
		(1.640)
Interest Rate (θ_4)	-	0.067
		(0.934)

The t-statistics are presented in the parentheses.

[a, b] denote significance at 5% and 10%, respectively.

* The t-statistic is calculated for testing for α equal to 1.

Table 3

Average Hazard at Year Four for Different Quartiles of the Explanatory Variables

Variables	Quartile 1	Quartile 2	Quartile 3	Quartile 4
Duration 1	0.1934	0.1705	0.1287	0.0716
Log Assets	0.1605	0.1475	0.1327	0.1089
Change in Debt/Assets	0.0861	0.1243	0.1484	0.2094
Change in CEO	0.1339	0.1339	0.1456	0.1456
Change in #SIC	0.1573	0.1252	0.1252	0.1011
Capacity Utilization	0.0819	0.1317	0.1537	0.1636
Demand Growth	0.0856	0.1158	0.1493	0.2109
Interest Rate	0.1302	0.1383	0.1423	0.1488

The hazard is computed from the estimated split-population log-logistic duration model. For each explanatory variable, the average value in the four quartiles of the variable is calculated. The hazard is estimated for different quartiles of a given variable with the remaining variables evaluated at their means.