

**Methodology to
Identify
Characteristics of
Successful Chapter 11
Reorganizations**

**The Effect of Financial, Strategic, and
Operational Decisions on the Probability
to Emerge Successfully from Bankruptcy**

Philippe Hespel

Naftali Golzgaker¹

¹ Both authors are MBA students at the University of Chicago Graduate School of Business

Foreword

We are conducting the research described in this paper in the context of a part-time internship with the Turnaround Management Association (TMA). We are therefore the Chicago TMA-Chapter very grateful for providing us with this unique opportunity. We would like to specifically express our gratitude towards William J. Hass (TeamWork Technologies) and Ray Anderson (Burnham Venture Management) for their guidance and support.

This endeavor is realized while being full-time MBA-students at the University Of Chicago Graduate School Of Business. We would like to express our gratitude towards the academic faculty for being exposed to world-class research and knowledge. This ongoing education sharpens our mind and makes us every day more fluent in analyzing the drivers of the economic and business world. Specifically we would like to thank Professors Zvi Gilula and Guenter J. Hitsch for their guidance during our journey in the world of statistics.

Naftali and Philippe – Chicago, May 2005.

Executive Summary

Our study has two main objectives: (1) develop a comprehensive methodology to identify the characteristics of successful Chapter 11 reorganization; and (2) execute the methodology to identify these characteristics and to set up a predictive model to forecast the likelihood of successful reorganization. To date, the first objective is achieved and documented. The first steps towards the second objective have already been tested and, based on a limited sample of companies there is a great potential to accomplish the second objective

The key elements and main findings of our study are:

1. The selected research variables (defining the characteristics) cover three main areas:
(a) nine external factors; (b) nine financial and bankruptcy factors; and (c) twenty strategic and tactical factors.
2. ‘Successful Chapter 11 reorganization’ is defined as emerging from Chapter 11 protection and not refiled for bankruptcy for at least four years. In addition, the company cannot be acquired by or merged with another entity.
3. To obtain as much information as possible we select public listed companies. To isolate the impact of financial, strategic and operational decisions as much as possible from other effects, we select companies with an asset size of less than \$500MM, also defined as ‘pure play’ organizations.
4. The main sources of information we use to define the selected research variables are secondary sources: SEC-filed 10-K’s, Hoover’s and Factiva data-bases. This should be complemented with interviews of executives who were involved in the restructuring.

5. The Logistic (Logit) procedure and the Generalized Linear Model (GLM) procedure from SAS/STAT are selected for statistical analysis. Both procedures are used sequentially in a two-step process with 'adjusted R-square' functioning as guide.
6. The first step in the statistical analysis reduces the number of independent research variables by means of the 'forward variable selection' method within the Generalized Linear Model procedure (significance level $p=0.15$). The output of this step is the research variables that describe the characteristics of successful Chapter 11 reorganization.
7. The second step in the statistical analysis models the Maximum Likelihood Estimation for success and failure by means of the 'full model selection' method within the Logistic procedure. This model can associate predicted probabilities with the observed variables.
8. The two main limitations today are the limited sample of eleven companies and the secondary research sources used to define values for the variables.
9. These limitations are only temporary and are no real obstacle for achieving the two main objectives of our research study.
10. To make the results statistically significant, the total number of companies should be increased to at least sixty.

Table of Contents

Foreword.....	2
Executive Summary.....	3
Table of Contents.....	5
Background.....	7
Introduction.....	9
Methodology.....	11
Selection of Variables.....	14
External Factors.....	14
Bankruptcy and Financial Factors.....	15
Strategic and Tactical Factors.....	16
Selection of Companies.....	18
Criteria for Selecting Companies.....	18
Overview of Selected Companies.....	23
Data Collection.....	25
General idea.....	25
External Factors.....	26
Bankruptcy and Financial Factors.....	27
Strategic and Tactical Factors.....	27
Data tables.....	27
Regression Model.....	31
Logistic Model.....	31
Generalized Linear Model.....	32
Variable Selection Methods.....	32

Regression Analysis Approach.....	35
R-Square.....	35
Approach for the Logistic Regression.....	36
Approach for the Generalized Linear Model Regression	38
Summary	40
Limitations	42
Proposed Next Steps	44
Conclusion	46
References.....	47

Background

Is Turnaround Management of companies out of Chapter 11 protection an art, science, luck or magic?

Many readers will agree that bringing distressed companies successfully out of Chapter 11 protection is a complex but rewarding endeavor. This could indicate that Turnaround Management is an art, or even magic. It is less obvious to imagine that science might be involved. This is however the approach we take when examining more in detail what it takes to guide companies successfully out of bankruptcy.

Managing a business is about People, Strategy, Finance and Operations. Managing a business successfully is about integrating these four elements in a balanced way. When in distress, these four elements are interlinked in a dysfunctional way, or are maybe not at all interlinked (any more).

A lot of resources and energy have been devoted in understanding the human component, the strategic component, the financial component or the operational component of both performing and under-performing companies. ‘Why Smart Executives Fail’ examines the People aspect. ‘The PIMS Principles’ studies extensively which strategic elements lead to greater performance. Jim Collins in his book makes the link between strategy, operations and people. Edward Altman and James A. Ohlson focus on financial ratios to predict corporate bankruptcy. These are only a few examples (see Ref. [01]-[05]) proving that a lot of resources and energy have been devoted to study this subject.

However, not much is known about the integration of these four elements. Even less is known about the same four elements in Turnaround situations. This research

paper is a significant contribution to the development of knowledge in the world of Turnaround Management through a scientific approach.

We are not alone in this task since our research is done under the terms of a Turnaround Management Association (TMA-Chicago Chapter) internship. In addition, one author has a strong finance background and the other author has a strong strategy and operations background. Lastly, our current MBA-education develops our confidence for realizing cross-fertilization in each other's area.

The objective of our research is twofold: first, to develop a methodology and second, to execute the steps of this methodology to identify strategic, financial and operational characteristics that lead to successful Chapter 11 reorganizations. The People aspect has not been incorporated in this study since a previous TMA-internship team has focused its research completely on that aspect (see Ref. [06]).

Introduction

The *first objective* of our study and the main focus of this research paper is the development of a comprehensive methodology to identify characteristics of successful Chapter 11 reorganizations. The second objective is the execution of the methodology to identify characteristics of successful Chapter 11 reorganizations. The extent of the execution is dictated by the statistics of the regression model used. To date, only a limited number of data points (companies) are collected. As a consequence, the regression results would have limited statistical validity. However, where possible we include in this research paper results of the execution of the methodology.

In the chapter ‘Methodology’ we briefly describe the major steps in our approach: selection of variables – selection of companies – data collection – regression model – regression analysis – limitations – proposed next steps.

The chapter ‘Selection of Variables’ describes in great detail the different variables we are using in our model. The variables are split into three different categories: external factors, financial/bankruptcy factors, and strategic/operational variables. Some of these are continuous variables, other are discrete variables.

In a next chapter ‘Selection of Companies’ we first identify the relevant criteria for selecting companies for our study. The main reason for selecting companies is to test whether we can find the relevant information as input to our research process. We also list the names of the different companies selected so far, together with some of their key characteristics.

The chapter ‘Data Collection’ explains how we collect the information for the three categories of variables. This is the first crucial part of our methodology. The data

of the selected companies is summarized in two tables, one for successful and one for unsuccessful companies.

The description and the selection of the regression method in the chapter ‘Regression Model’ is the second crucial part of our methodology. We select both the Logistic procedure and the Generalized Linear Model procedure in the statistical package SAS/STAT, and we describe our rationale for this selection.

Not only the model selection is crucial but also the regression analysis for variable selection in to the model is paramount. The ‘Regression Analysis Approach’ chapter indicates that (adjusted) R-square is an important variable in achieving this. The remainder of the chapter describes the most suited variable selection methodologies for both regression models.

The *second objective* of our study is more predictive in nature. To achieve this, the developed methodology needs first to be executed with a bigger number of selected companies. In addition to the limited sample size, the ‘Limitations’ chapter highlights other constraints.

We are convinced that our research will contribute in a structured way to the development of knowledge in the field of Turnaround Management. The ‘Proposed next Steps’ chapter describes several possibilities for further enhancing the developed approach.

Methodology

A first step in gaining insight into the characteristics of successful Chapter 11 reorganizations is to define the scope of the potential characteristics and to describe what defines ‘success’. The characteristics are captured through the research variables we want to quantify and analyze. These variables capture, on one hand, a balance of strategic, financial and operational information from the selected companies and, on the other hand, a mix of external market factors and internal company-specific information. What all the analyzed companies have in common is the fact that they filed for Chapter 11 protection and that they emerged from bankruptcy after the confirmation of the reorganization plan. The difference between successful and unsuccessful companies is the fact that successful companies continue to exist past the four year mark of emergence. Unsuccessful companies on the other hand have made one step forward, but two steps backward and have been liquidated or filed for bankruptcy again. In addition, since we want to ensure that relatively recent data is available, the date of emergence out of Chapter 11 is not before 2000. On the other hand, enough time is needed to prove that the successful companies are truly successful. Therefore, the cut-off date is end of 2001 for re-emergence.

Next, we select a set of companies, both successful and unsuccessful, for which we will research the information across the different dimensions. The primary source for selecting companies is the Lynn M. LoPucki's Bankruptcy Research Database (BRD) (Ref. [07]). Since we want to have companies that are ‘pure players’ we limit the asset size to \$500MM. An initial test with a privately owned and a publicly owned company makes us decide to focus on publicly owned companies. Mainly because the availability

of the information is very limited for privately owned companies for the periods before, during and after bankruptcy filing. The same applies for publicly owned companies while they are under Chapter 11 protection. However for these companies, information is sufficiently available for the periods before and after Chapter 11 filing. For that purpose we are using Edgar, Factiva and Hoover's research databases (Ref. [08]-[10]).

We are focusing on companies that are small in asset size and emerged in either 2000 or 2001. We do not limit the research based on the length of the reorganization process and not based on the industry sector. It is true that different industry sectors have different dynamics. However, we want to come with insights independent of the industry sector. Therefore, we assess the transition from one period (pre-bankruptcy) to another period (post-bankruptcy) rather than a snapshot at a certain time. The values for the selected variables are identified for the fiscal year before and the fiscal year after Chapter 11 protection through several reliable sources. The change in these variables is modeled into input variables for the model.

In the last step, we select the regression model and a variable selection procedure to analyze the collected data. This complex task is handled by the statistical module of SAS, the leader in business intelligence and analytics. SAS/STAT has an extensive library of programmable procedures for performing regression analyses. A logistic regression is ideally suited since we have a binary response model (either success or failure of the company). We will also use the generalized linear model since it is a very explorative procedure that allows interactive changes in both the regression model and the data.

By executing these research steps in our proposed methodology we are convinced we will, on one hand, gain insight into what it takes to successfully orchestrate Chapter 11 reorganizations, and, on the other hand, contribute to the knowledge development within the expanding field of Turnaround Management.

Selection of Variables

When selecting the list of variables for our research study, we need to take into consideration the availability of data as well as the potential contribution of such variable to the success of emerging from bankruptcy. To identify the variables, we divide these into three main groups: External, Financial and Strategic factors. Each of these main groups consists of the key variables we see as important on the re-emergence of companies. In this chapter we describe each of these variables.

External Factors

This group consists of variables that are exogenous to the company, meaning that these factors are mainly out of the control of the firm. The main purpose to include this group of variables is to assess whether a company has a better chance of emerging from bankruptcy under certain market conditions. The factors we include are:

Name	Description	Range
Market differentiation	The level of differentiation in the market (commodity product vs specialty product)	1: high (high margin product) 0: low (commodity product)
Market growth	The growth phase of the market in which the firm operates	-1: decline 0: stable 1: growth
Number of direct competitors	The level of competitive pressure	0: low 1: average 2: high
Market maturity stage	The life cycle stage of the market in which the firm operates	1: start-up 2: growth 3: maturity 4: extension 5: decline
Entry conditions	The level of barriers to enter into the market in which the firm operates	2: high barriers 1: normal barriers 0: no barriers
Unionization	The level of unionization (of employees) of the market in which the firm operates	2: high 1: average 0: low

Name	Description	Range
Capital intensity	The level of capital the firm needs to operate in the selected market	2: high 1: average 0: low
Customer transaction amount	The average dollar-amount of a typical customer purchase	[\$0,∞]
Selling price inflation	The nominal price increase due to economic exogenous reasons	1: inflation 0: stable -1: deflation

Bankruptcy and Financial Factors

We choose to examine this group of factors because the company, under Chapter 11 and beyond, makes financial decisions based on its operations and financial strategy. These decisions significantly impact the results of the firm and technically are the reason for the firm to enter Chapter 11. Often a drastic change in bankruptcy and financial factors is required to emerge from bankruptcy. In our analysis, we mainly focus on the relative change in value of the selected variables rather than on the absolute amount the firm allocates to a certain asset, liability or expense. The factors we include are:

Name	Description	Range
Amount of time in bankruptcy	The total amount of time, in months, the firm was under Ch 11 protection	[0,∞]
Asset size	The asset size of the firm for the fiscal year prior to its filing for Ch 11 protection	[\$0,500M]
% change of debt/total capital	The percent change of the D/D+E ratio between one year before Ch 11 filing and one year after the emergence of Ch 11	0% - 100%
% change of equity/total capital	The percent change of the E/D+E ratio between one year before Ch 11 filing and one year after the emergence of Ch 11	0% - 100%
% change of R&D expense/sales	The percent change of the ratio R&D expense to sales between one year before Ch 11 filing and one year after the emergence of Ch 11	0% - 100%
% change of COGS/sales	The percent change of the ratio COGS expense to sales between one year before Ch 11 filing and one year after the emergence of Ch 11	0% - 100%

Name	Description	Range
% change of revenue	The percent change of the revenue between one year before Ch 11 filing and one year after the emergence of Ch 11	0% - 100%
% change in inventory levels/sales	The percent change of inventory to sales ratio between one year before Ch 11 filing and one year after the emergence of Ch 11	0% - 100%
% change in SG&E spending/sales	The percent change of the SG&E expense to sales ratio between one year before Ch 11 filing and one year after the emergence of Ch 11	0% - 100%

Strategic and Tactical Factors

These factors are chosen to identify the effect of strategic and tactical decisions made while in bankruptcy on the emergence from bankruptcy.

The factors are:

Name	Description	Range
Change in pricing policies	The change pricing policy while in bankruptcy	0: no significant change 1: significant change
Change in rate of new product introductions	The change in frequency of the introduction of new products	0: no significant change 1: significant change
Change in product or service offering	The change in the number of services or products	-1: reduction 0: no significant change 1: increase
Change in product or service standardization	The change in product or service standardization	-1: more standardization 0: no significant change 1: more customization
Change in capacity utilization rate	The change in capacity of its machinery, factories, labor, in the number of services, products	-1: reduction in utilization 0: no significant change 1: increase in utilization
Change in multiplicity of distribution channel	The change in the number of distribution channels while in bankruptcy	-1: reduction 0: no significant change 1: increase
Change in propriety of distribution channels	The change in outsourcing of its distribution channels	-1: reduction 0: no significant change 1: increase
Change in access to patents and trade secrets	The change in access to patents of new or existing products	-1: reduction 0: no significant change 1: increase
Change in centralization	The change in the control system of its operations (less or more centralized)	-1: reduction 0: no significant change 1: increase

Characteristics of Successful Chapter 11 Reorganizations

Name	Description	Range
Change in geographic spread	The change in its global presence of manufacturing and distribution locations	-1: reduction 0: no significant change 1: increase
Change in portfolio balance	The change in its product portfolio strategy with regards to the relative importance of some products	-1: more balanced 0: no significant change 1: more focused
Change in customer balance	The change its relative focus on specific customer groups	-1: reduction 0: no significant change 1: increase
Change in workforce productivity	The change in the productivity of the labor force	-1: reduction 0: no significant change 1: increase
Change in concentration of suppliers	The change in the number of suppliers	-1: reduction 0: no significant change 1: increase
Change in the multiple sourcing of suppliers	The change in the number of suppliers for its key components	-1: reduction 0: no significant change 1: increase
Usage of external experts during bankruptcy	The fact whether or not external bankruptcy advisors were used while in bankruptcy	1: used 0: not used
Change in investment strategy - automation	The change in the automation of its operations	-1: reduction 0: no significant change 1: increase
Change in investment strategy - capacity	The change in its installed production capacity	-1: reduction 0: no significant change 1: increase
Change in vertical integration - forward	The change of vertical integration forward into the supply chain	-1: reduction 0: no significant change 1: increase
Change in vertical integration - backward	The change of vertical integration backward into the supply chain	-1: reduction 0: no significant change 1: increase

Selection of Companies

When selecting a list of companies for our research study, we need to take into consideration several aspects: availability of data, size of company, industry sector, definition of success, timeframe, lines of businesses. In this chapter we go through each of these factors.

Based on the relevant criteria seven ‘successful’ companies and four ‘unsuccessful’ companies are selected. We include a very brief description of each of their main line of business.

Criteria for Selecting Companies

With almost five million companies in the United States and with many thousands of these filing each year for Chapter 11 protection, one could think it is an easy task to randomly select companies for conducting an analysis leading to characteristics of successful Chapter 11 reorganizations. However, according to the Small Business Economic Indicators (SBEI), over 99.5% of these firms in the United States are classified as private small- to medium-sized businesses. An initial test to collect information on the variables listed in previous chapter for a private company (e.g. Yipes) leads to the conclusion that this cannot be achieved through the indicated research databases. Therefore we will focus on publicly traded companies.

In 2001, a record 257 publicly traded companies, with a combined \$258.5 billion in assets, filed for bankruptcy, more than doubling the annual average for the previous decade (see Ref. [11]). While the number of public companies filing for bankruptcy, according to the same source, decreased to 191 in 2002, the value of the assets brought

into bankruptcy increased to \$368 billion. This means that the number of potential candidates for our research study is limited and that the average asset size is more than \$1billion. If we want to assess the effect of financial, strategic and operational decisions of the existing management team on the probability to emerge successfully from bankruptcy, we want to make sure that this is the consequence of their decisions and not due to cross-subsidization among different unrelated lines of businesses of the same company. Therefore we want to focus our research study on ‘pure play’ organizations with an asset size of less than \$500MM. This limits again the number of potential candidates.

A source that yields companies corresponding to our two criteria (public companies and asset size of less than \$500MM) is the Lynn M. LoPucki's Bankruptcy Research Database (BRD) (Ref. [07]).

The next element we assess in our company selection process is the timeline of the information linked to the restructuring activities. The critical element in this is our definition of ‘success’. We define ‘successful Chapter 11 Reorganization’ as a company that still exists after at least four years since its emergence of Chapter 11 protection without having to refile during the time described. In addition, the examined firm needs to stay a ‘pure play’ organization in the sense that it has not merged with or been acquired by another company. In this way the selected company can be analyzed and compared throughout the whole timeframe.

In addition, we want to make sure we have access to fairly recent information. Therefore, we want to restrict our time-frame over the last ten years. When consulting the BRD we see there are 315 companies for the period 1994 to 2004 for which an

organization plan has been confirmed. When sorting these companies according to their asset size and status, we obtain the following table:

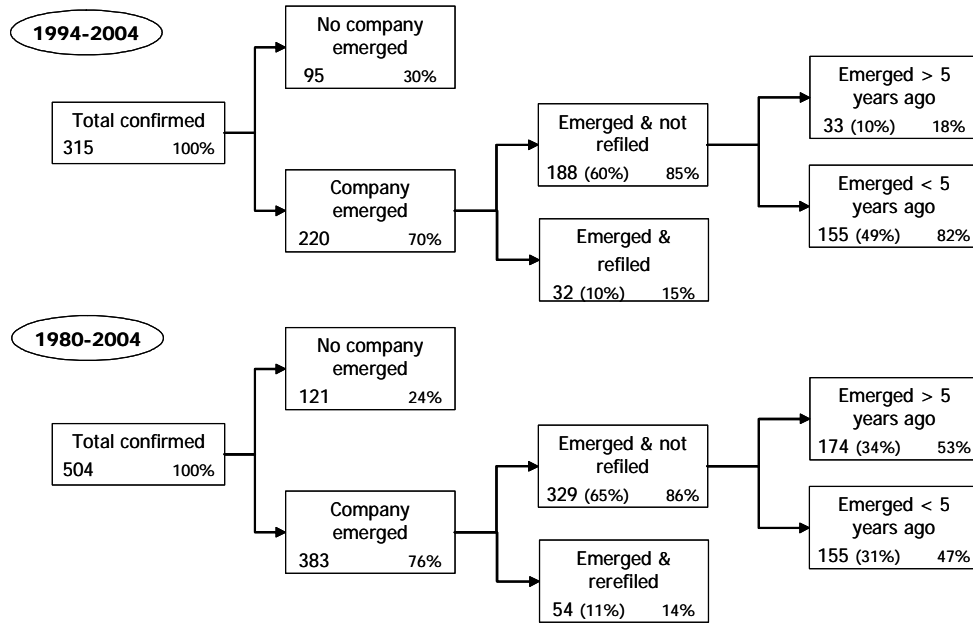
Status	Asset size			Total
	<\$500MM	\$500MM-\$1B	>\$1B	
Emerged and not refiled	22	6	5	33
Emerged but not 5 years ago	56	41	58	155
Emerged and refiled	11	7	14	32
No company emerged	42	23	30	95
	131	77	107	315

This means we have at least 22 companies in our category ‘successful’ since the companies with the status ‘emerged and not refiled’ emerged more than five years ago from Chapter 11. This number of twenty-two companies can become bigger if we dig into the companies with status ‘emerged but not 5 years ago’ and select those that have emerged more than four years ago. On the other hand there are only 11 potential companies in our sample set that can account for being ‘unsuccessful’. A majority of the companies has either not emerged out of bankruptcy or has still an uncertain future (the category ‘emerged but not 5 years ago’). A common size table calculated per asset size highlights this better:

Status	Asset size			Total
	<\$500MM	\$500MM-\$1B	>\$1B	
Emerged and not refile	16.8%	7.8%	4.7%	10%
Emerged but not 5 years ago	42.7%	53.2%	54.2%	49%
Emerged and refiled	8.4%	9.0%	13.1%	10%
No company emerged	32.1%	29.8%	28.0%	30%
	100%	100%	100%	

In addition, when we look across the three defined asset size categories, we see that this finding is persistent. Overall, 30% of the companies do not emerge and 49% of the companies have still an uncertain future.

We focus our research on the last ten years, which includes the bubble burst at the beginning of this century. To check whether we have a relevant and representative company set we analyze the same type of information over a longer time horizon: from 1980 to 2004 with almost 25 years of information covering 504 companies. The summary comparison is represented in following graph:



Percentages between brackets are fractions compared to total number of companies
 Percentages no between brackets are fractions compared to previous step

Approximately the same fraction of companies does not emerge out of Chapter 11 (24% for the period 1980-2004 compared to 30% for the period 1994-2004). The fractions ‘emerged and refiled’ are almost identical across the two time periods (14% for the period 1980-2004 compared to 15% for the period 1994-2004). A significant difference exists across the two time periods when we dig one level deeper into the ‘emerged and not refiled’ category. The longer time horizon has an additional 141 companies that emerged more than five years ago. This means that the average internet bubble company has the same ratio of emerging out of Chapter 11. In order for the time

horizon 1994-2004 to be similar to the time horizon 1980-2004 in terms of ratios, 67 companies out of the 155 companies from the category ‘emerged less than 5 years’ would have to survive more than five years. This is approximately 42% of the already re-emerged companies. Obviously, we have no similar time horizon to compare this with, but this is certainly not an unrealistic working assumption. Even if it would be slightly lower, we can state that the time horizon 1994 to 2004 is a representative period for our analysis under the assumption that the time horizon 1980 to 2004 is representative.

Two additional elements we can control for are the industry sector and the length of Chapter 11 protection. A first reason not to include these two limitations is the fact that we already have a limited set of companies. Second, it is true that different industry sectors have different dynamics. For instance: access to capital for a biotech company is more complex than for a chemical company that has more tangible assets and less intangible assets; a telecom equipment manufacturer faces shorter product cycles than a truck manufacturer. However, we want to come to insights independent of the industry sector. This is to a large extent accounted for by evaluating the relative change of the different variables between the situation before bankruptcy and the situation after bankruptcy. For example, a 10% reduction in the ratio of SG&E to revenue is, not taking into considerations second order effects, equally difficult for a compressor manufacturer as for a retail outlet company. Since we want to assess what impact management actions have on financial, strategic and operational dimensions, we will assess the relative change from one status (pre-bankruptcy) to another status (post-bankruptcy) rather than taking a snapshot at a certain moment in time. Since companies are in complete flux and

transition just before, during, and just after Chapter 11 filing, we will focus on parameters linked to the fiscal year before and the fiscal year after the bankruptcy period.

Overview of Selected Companies

The companies, with a very brief description of their activities, we have identified so far for our research study are:

01	Eagle Food Centers, Inc. Regional supermarket chain operating 64 supermarkets
02	Golden Books Family Entertainment Publishes, produces, licenses and markets an extensive range of children's books and family related entertainment products
03	Laclede Steel Manufacturer of a wide range of carbon and alloy steel products
04	Trism Transportation of heavy machinery and equipment and over-dimensional commodities, explosives,...
05	American Homestar Corp. Construction of manufactured housing
06	Safety Components International, Inc. Independent supplier of automotive airbag fabric and cushions
07	Imperial Sugar Company Processor and marketer of refined sugar
08	Applied Magnetics Corporation Design and manufacture of micro-electro-mechanical system
09	KCS Energy Acquisition, exploration and production of natural gas and crude oil
10	Vista Eyecare Retail optical company
11	Thermadyne Manufacturing LLC. Designer and manufacturer of cutting and welding products

Companies 01 to 04 are the ‘unsuccessful’ companies, and companies 05 to 11 are the ‘successful’ companies.

Characteristics of Successful Chapter 11 Reorganizations

An overview of the most important dates (period of Chapter 11 protection, fiscal years selected for data gathering) for each of the companies is as follows:

Company	Chapter 11		Fiscal Year end	Fiscal Year used		Last filing
	from	to		pre C11	post C11	
Eagle Food Centers	29-Feb-00	7-Aug-00	31-Jan	2000	2002	19-Apr-04
Golden Books Family Entertainment	26-Feb-99	27-Jan-00	25-Dec	1998	2000	17-Aug-01
Laclede Steel	30-Nov-98	29-Dec-00	31-Dec	1997	2001	15-May-02
Trism	16-Sep-99	15-Feb-00	31-Dec	1998	2000	16-Jan-03
American Homestar Corp.	11-Jan-01	29-Sep-01	30-Jun	2000	2003	n/a
Safety Components International, Inc.	10-Apr-00	11-Oct-00	30-Mar	2000	2002	n/a
Imperial Sugar Company	16-Jan-01	29-Aug-01	30-Sep	2000	2002	n/a
Applied Magnetics Corporation	7-Jan-00	16-Nov-01	30-Sep	1998	2003	n/a
KCS Energy	18-Jan-00	20-Feb-01	31-Dec	1999	2001	n/a
Vista Eyecare	5-Apr-00	31-May-01	31-Dec	1999	2002	n/a
Thermadyne Manufacturing LLC.	19-Nov-01	23-May-03	31-Dec	2000	2004	n/a

Data Collection

An earlier chapter describes in detail the definition of each of the variables. The objective of this chapter is to explain the conceptual approach of how we obtain the different values, rather than to explain the value itself for each of the variables for each of the companies. We briefly highlight each of the different approaches based on concrete examples. We include the complete table for all variables for each of the companies that are used as input for the regression analysis.

Depending on the category and type of variable, we use different approaches, methods and/or different sources to identify the value of the fifty-seven regression variables.

General idea

The common approach across all variables is that we use two reference years: the fiscal year before and the fiscal year after Chapter 11 filing as indicated in the table of previous chapter.

To facilitate the programming and the manipulation of the data in SAS/STAT we introduce a uniform description of variables. The dependent variable (success) is denominated as DEPd2. The small 'd' stands for discrete variable, and the '2' represents the two possible states (success or failure). The independent variables all start with the same trunk 'VAR' and they all receive a numerical sequence. The character after the figure is either a 'c' or a 'd' for respectively describing a continuous or discrete variable. In the case of a discrete variable, the next character is again a figure, representing the

different possible states as indicated in the chapter ‘Selection of Variables’. The list of ‘SAS-ready’ variables is:

SAS Variable	Variables	SAS Variable	Variables
VAR01d4	Market differentiation	VAR30d2	Change in investment strategy - automation
VAR02d3	Market growth	VAR31d2	Change in investment strategy - capacity
VAR03d3	Number of direct competitors	VAR32c	% change in inventory levels
VAR04d2	Market maturity stage	VAR33d3	Change in vertical integration - forward
VAR05d2	Entry conditions	VAR34c	Debt year before bankruptcy (\$)
VAR06d3	Unionization	VAR35c	Debt year after bankruptcy (\$)
VAR07d2	Capital intensity	VAR36c	Equity year before bankruptcy (\$)
VAR08d4	Customer transaction amount	VAR37c	Equity year after bankruptcy (\$)
VAR09d3	Selling price inflation	VAR38c	COGS year before bankruptcy (\$)
VAR10c	Amount of time in bankruptcy (months)	VAR39c	COGS year after bankruptcy (\$)
VAR11c	Asset size	VAR40c	Revenue year before bankruptcy (\$)
VAR12c	% change of debt	VAR41c	Revenue year after bankruptcy (\$)
VAR13c	% change of equity	VAR42c	SG&E spending year before bankruptcy (\$)
VAR14c	% change of COGS	VAR43c	SG&E spending year after bankruptcy (\$)
VAR15c	% change of revenue	VAR44c	Inventory level year before bankruptcy (\$)
VAR16d2	Change in pricing policies	VAR45c	Inventory level year after bankruptcy (\$)
VAR17d3	Change in rate of new product introductions	VAR46c	Ratio COGS to Revenue year before bankruptcy (%)
VAR18d3	Change in Product/Service offering	VAR47c	Ratio COGS to Revenue year after bankruptcy (%)
VAR19d3	Change in Product/Service standardization	VAR48c	Ratio SG&E to Revenue year before bankruptcy (%)
VAR20d3	Change in Capacity utilization rate	VAR49c	Ratio SG&E to Revenue year after bankruptcy (%)
VAR21c	% change in SG&E spending	VAR50c	Ratio Inventory Level to Revenue year before bankruptcy (%)
VAR22d3	Change in distribution channels - multiplicity	VAR51c	Ratio Inventory Level to Revenue year after bankruptcy (%)
VAR23d3	Change in distribution channels - proprietary	VAR52c	%Change ratio COGS to Revenue
VAR24d2	Change in access to patents and trade secrets	VAR53c	%Change ratio SG&E to Revenue
VAR25d2	Change in centralization	VAR54c	%Change ratio Inventory Level to Revenue
VAR26d3	Change in geographic spread	VAR55c	Leverage before bankruptcy (D/D+E)
VAR27d3	Change in portfolio balance	VAR56c	Leverage after bankruptcy (D/D+E)
VAR28d2	Change in customer balance	VAR57c	%Change leverage
VAR29d2	Change in suppliers - concentration		

External Factors

We find most of the external factors in industry reports covering the sectors of the respective companies. Most of the research databases like Factiva and Hoover’s (Ref. [09]-[10]) deliver these reports. In addition, the company 10-K often contains relevant information in the ‘Business Description’ section. Sometimes the information is described in a qualitative way, and sometimes in a quantitative way. An example of a qualitative statement is e.g. following information contained in the American Homestar 10-K: “this created several competitive pressures in an environment where there were too many retail outlets serving a level (and most recently declining) end-user demand.” This is clearly an indication of a declining market growth.

Bankruptcy and Financial Factors

We find the majority of the bankruptcy and financial factors in the 10-K of the different companies in the financial statements (Balance Sheet and Income Statement). The different ratios and the percentage changes are calculated based on the absolute value of the different line items.

Strategic and Tactical Factors

External sources (like Hoover's and Factiva) are not useful sources for collecting this type of information. We find the information to some extent in the companies' 10-K through qualitative interpretations. Most often this information is buried in the "Management's Discussion and Analysis of Financial Condition and Results of Operations". This is of course not the most attractive lecture, but it often contains a richness of information for the attentive reader. Vista Eyecare states in its 10-K: "In July, we changed the in-store presentation and pricing strategy of our frame and lens options..." This is a qualitative description covering the variable 'change in pricing strategy'. In that same 10-K we find information around the variable 'change in suppliers – concentration': "Through this process, we substantially reduced the number of frame vendors, consolidated certain price points,..."

Data tables

There are some variables for which we are unable to find relevant information. This is a short list of variables, which we initially selected based on assumed relevancy to our problem statement but which we have to omit from our analysis due to lack of information:

Change in workforce productivity
Change in suppliers - multiple sourcing
Usage of external experts during bankruptcy
Usage of external experts after bankruptcy
R&D spent year before bankruptcy (\$)
R&D spent year after bankruptcy (\$)

We are especially disappointed not to find any information around the usage of external experts during or after the bankruptcy process. Insights on these variables might be gathered through analysis of either the disclosure statements or plans of reorganization.

Characteristics of Successful Chapter 11 Reorganizations

Following table contains the data for unsuccessful companies:

SAS variables	Variables	E C a e g n t l i t e e r F o o d l n c .	G F E I o a n t c l i m i t e d e l r n y t a i B i n o n m e n t s .	L a c t i v e S t e e l	T r i s m . I n c .
DEPd2	Success	0	0	0	0
VAR01d4	Market differentiation	0.25	0.25	0.00	1.00
VAR02d3	Market growth	0	0	-1	0
VAR03d3	Number of direct competitors	2	2	1	1
VAR04d2	Market maturity stage	3	3	3	3
VAR05d2	Entry conditions	1	1	1	1
VAR06d3	Unionization	2	1	1	0
VAR07d2	Capital intensity	1	1	2	1
VAR08d4	Customer transaction amount	0.00	0.00	1.00	0.50
VAR09d3	Selling price inflation	0	1	-1	0
VAR10c	Amount of time in bankruptcy (months)	6	11	25	5
VAR11c	Asset size	292	296	366	243
VAR12c	% change of debt	-0.1870	-0.5031	-0.3062	-0.2322
VAR13c	% change of equity	-0.7190	-0.7333	-0.6888	-0.6109
VAR14c	% change of COGS	-0.2242	-0.5369	-0.4653	0.0000
VAR15c	% change of revenue	-0.2248	-0.2331	-0.5071	-0.0351
VAR16d2	Change in pricing policies	0	1	0	0
VAR17d3	Change in rate of new product introductions	0	0	0	0
VAR18d3	Change in Product/Service offering	0	1	-1	-1
VAR19d3	Change in Product/Service standardization	0	1	0	0
VAR20d3	Change in Capacity utilization rate	0	0	-1	-1
VAR21c	% change in SG&E spending	-0.2166	-0.2495	-0.2043	-0.1791
VAR22d3	Change in distribution channels - multiplicity	-1	0	0	0
VAR23d3	Change in distribution channels - proprietarily	1	1	0	0
VAR24d2	Change in access to patents and trade secrets	0	0	0	0
VAR25d2	Change in centralization	0	1	1	0
VAR26d3	Change in geographic spread	-1	0	0	0
VAR27d3	Change in portfolio balance	0	-1	0	0
VAR28d2	Change in customer balance	0	0	0	0
VAR29d2	Change in suppliers - concentration	0	0	0	0
VAR30d2	Change in investment strategy - automation	1	0	0	0
VAR31d2	Change in investment strategy - capacity	0	-1	-1	0
VAR32c	% change in inventory levels	-0.1517	-0.3235	-0.5019	0.0000
VAR33d3	Change in vertical integration - forward	0	0	0	0
VAR34c	Debt year before bankruptcy (\$)	238,438	444,032	177,770	198,153
VAR35c	Debt year after bankruptcy (\$)	193,841	220,627	123,340	152,143
VAR36c	Equity year before bankruptcy (\$)	21,978	-189,081	21,101	15,799
VAR37c	Equity year after bankruptcy (\$)	6,175	-50,434	6,566	6,147
VAR38c	COGS year before bankruptcy (\$)	690,456	181,141	299,570	0
VAR39c	COGS year after bankruptcy (\$)	535,670	83,895	160,176	0
VAR40c	Revenue year before bankruptcy (\$)	932,789	194,226	325,029	291,631
VAR41c	Revenue year after bankruptcy (\$)	723,059	148,954	160,196	281,385
VAR42c	SG&E spending year before bankruptcy (\$)	205,820	98,293	13,654	111,223
VAR43c	SG&E spending year after bankruptcy (\$)	161,235	73,765	10,864	91,303
VAR44c	Inventory level year before bankruptcy (\$)	66,690	33,062	82,806	0
VAR45c	Inventory level year after bankruptcy (\$)	56,570	22,366	41,246	0
VAR46c	Ratio COGS to Revenue year before bankruptcy (%)	0.740	0.933	0.922	0.000
VAR47c	Ratio COGS to Revenue year after bankruptcy (%)	0.741	0.563	1.000	0.000
VAR48c	Ratio SG&E to Revenue year before bankruptcy (%)	0.221	0.506	0.042	0.381
VAR49c	Ratio SG&E to Revenue year after bankruptcy (%)	0.223	0.495	0.068	0.324
VAR50c	Ratio Inventory Level to Revenue year before bankruptcy (%)	0.071	0.170	0.255	0.000
VAR51c	Ratio Inventory Level to Revenue year after bankruptcy (%)	0.078	0.150	0.257	0.000
VAR52c	%Change ratio COGS to Revenue	0.001	-0.396	0.085	0.000
VAR53c	%Change ratio SG&E to Revenue	0.011	-0.021	0.614	-0.149
VAR54c	%Change ratio Inventory Level to Revenue	0.094	-0.118	0.011	0.000
VAR55c	Leverage before bankruptcy (D/D+E)	0.916	1.742	0.894	0.926
VAR56c	Leverage after bankruptcy (D/D+E)	0.969	1.296	0.949	0.961
VAR57c	%Change leverage	0.058	-0.256	0.062	0.038

Characteristics of Successful Chapter 11 Reorganizations

Following table contains the data for successful companies:

SAS variables	Variables	A H C m o o r r e p r i s . c a a a n r	S C I I a o n n f m t c e p e r a y n n e a t i s o n a l	I C m o p e p r a i n a y l S u g a r	A M C p a o p g r l n p i e o e t r a d c t i o n	K C S E n e r g y	V i s t a E y e c a r e	T M L h a L e n C r u . m f a d c y t n e r i n g
DEPd2	Success	1	1	1	1	1	1	1
VAR01d4	Market differentiation	0.50	1.00	0.50	0.00	0.00	0.00	0.00
VAR02d3	Market growth	-1	0	0	-1	0	1	0
VAR03d3	Number of direct competitors	2	1	2	2	2	1	1
VAR04d2	Market maturity stage	3	3	2	2	2	3	3
VAR05d2	Entry conditions	1	2	1	2	2	1	1
VAR06d3	Unionization	0	1	1	0	0	0	0
VAR07d2	Capital intensity	1	2	1	2	2	1	1
VAR08d4	Customer transaction amount	1.00	0.50	0.00	0.00	0.50	0.00	0.25
VAR09d3	Selling price inflation	-1	0	-1	-1	1	0	0
VAR10c	Amount of time in bankruptcy (months)	8.5	6	7.5	22	12	13	18
VAR11c	Asset size	395	217	606	339	322	245	342
VAR12c	% change of debt	-0.9244	-0.6346	-0.5290	-0.8902	-0.1476	-0.2864	-0.5077
VAR13c	% change of equity	-0.4736	-4.8669	-0.6916	-0.9120	-0.7367	-0.5169	-1.2364
VAR14c	% change of COGS	-0.8569	-0.1142	-0.2888	-0.9673	0.0000	-0.2390	0.0254
VAR15c	% change of revenue	-0.8395	-0.1093	-0.2874	-0.9849	0.4066	-0.2493	-0.0540
VAR16d2	Change in pricing policies	1	0	0	1	0	1	0
VAR17d3	Change in rate of new product introductions	0	1	0	1	0	0	0
VAR18d3	Change in Product/Service offering	1	-1	-1	1	0	1	0
VAR19d3	Change in Product/Service standardization	1	0	0	1	0	0	0
VAR20d3	Change in Capacity utilization rate	0	-1	0	1	0	0	0
VAR21c	% change in SG&E spending	-0.8077	-0.2910	-0.2628	-0.7551	-0.0977	-0.2735	0.2105
VAR22d3	Change in distribution channels - multiplicity	-1	0	0	1	0	-1	-1
VAR23d3	Change in distribution channels - proprietary	-1	0	0	1	0	-1	1
VAR24d2	Change in access to patents and trade secrets	0	0	0	1	0	0	0
VAR25d2	Change in centralization	0	0	0	0	0	0	0
VAR26d3	Change in geographic spread	-1	-1	-1	1	1	0	1
VAR27d3	Change in portfolio balance	-1	-1	-1	1	0	-1	0
VAR28d2	Change in customer balance	0	0	0	1	0	0	0
VAR29d2	Change in suppliers - concentration	0	0	0	1	0	1	0
VAR30d2	Change in investment strategy - automation	0	0	0	0	0	0	0
VAR31d2	Change in investment strategy - capacity	-1	-1	-1	-1	0	-1	-1
VAR32c	% change in inventory levels	-0.6682	0.1314	-0.1612	-0.8957	0.0000	-0.4784	0.0556
VAR33d3	Change in vertical integration - forward	1	0	0	0	-1	0	0
VAR34c	Debt year before bankruptcy (\$)	268,524	190,000	775,089	213,558	434,775	193,662	906,488
VAR35c	Debt year after bankruptcy (\$)	20,302	69,433	365,105	23,445	370,597	138,193	446,268
VAR36c	Equity year before bankruptcy (\$)	92,902	-14,440	318,601	85,960	-149,843	26,557	-658,357
VAR37c	Equity year after bankruptcy (\$)	48,905	55,838	98,260	7,564	-39,460	12,829	155,636
VAR38c	COGS year before bankruptcy (\$)	446,378	191,376	1,682,529	198,742	0	147,768	327,480
VAR39c	COGS year after bankruptcy (\$)	63,878	169,527	1,196,545	6,497	0	112,446	335,791
VAR40c	Revenue year before bankruptcy (\$)	574,036	228,266	1,821,231	183,597	136,491	329,055	510,146
VAR41c	Revenue year after bankruptcy (\$)	92,140	203,323	1,297,831	2,773	191,991	247,020	482,619
VAR42c	SG&E spending year before bankruptcy (\$)	153,769	16,353	87,004	6,514	9,847	177,162	102,578
VAR43c	SG&E spending year after bankruptcy (\$)	29,566	11,595	64,138	1,595	8,885	128,715	124,171
VAR44c	Inventory level year before bankruptcy (\$)	90,481	14,826	187,471	13,054	0	34,373	112,451
VAR45c	Inventory level year after bankruptcy (\$)	30,025	16,774	157,242	1,362	0	17,928	118,707
VAR46c	Ratio COGS to Revenue year before bankruptcy (%)	0.778	0.838	0.924	1.082	0.000	0.449	0.642
VAR47c	Ratio COGS to Revenue year after bankruptcy (%)	0.693	0.834	0.922	2.343	0.000	0.455	0.696
VAR48c	Ratio SG&E to Revenue year before bankruptcy (%)	0.268	0.072	0.048	0.035	0.072	0.538	0.201
VAR49c	Ratio SG&E to Revenue year after bankruptcy (%)	0.321	0.057	0.049	0.575	0.046	0.521	0.257
VAR50c	Ratio Inventory Level to Revenue year before bankruptcy (%)	0.158	0.065	0.103	0.071	0.000	0.104	0.220
VAR51c	Ratio Inventory Level to Revenue year after bankruptcy (%)	0.326	0.082	0.121	0.491	0.000	0.073	0.246
VAR52c	%Change ratio COGS to Revenue	-0.108	-0.005	-0.002	1.164	0.000	0.014	0.084
VAR53c	%Change ratio SG&E to Revenue	0.198	-0.204	0.034	15.212	-0.359	-0.032	0.280
VAR54c	%Change ratio Inventory Level to Revenue	1.067	0.270	0.177	5.908	0.000	-0.305	0.116
VAR55c	Leverage before bankruptcy (D/D+E)	0.743	1.082	0.709	0.713	1.526	0.879	3.653
VAR56c	Leverage after bankruptcy (D/D+E)	0.293	0.554	0.788	0.756	1.119	0.915	0.741
VAR57c	%Change leverage	-0.605	-0.488	0.112	0.060	-0.267	0.041	-0.797

Regression Model

Our objective is to test the hypothesis that strategic, financial and operational decisions made by the executive team, affect the probability of successfully emerging from bankruptcy. Therefore we take the econometric approach by modeling several parameters that explain the result variable.

We consider two main methods in modeling the relationship between the independent variables and the dependent outcome: the Logistic model and the Generalized Linear Model. We describe each of these in more detail.

Logistic Model

The Logistic regression (LOGISTIC procedure) enables to investigate the relationship between a categorical outcome and a set of explanatory variables. The outcome, or response, can be dichotomous (success, failure) or ordinal (low, medium, high). When testing a dichotomous response, a standard logistic regression is performed. When modeling an ordinal response, a proportional odds model is fitted. This model describes the probability of success in following form:

$$\log \left\{ \frac{\mathcal{G}_h}{1 - \mathcal{G}_h} \right\} = \alpha + \sum_{k=1}^t \beta_k x_{hk}$$

where α is the intercept parameter, β is a vector of t regression parameters, and x_h is a row vector of explanatory variables corresponding to the h^{th} subpopulation.

The main advantage of this model is that it provides a predictive model for a dichotomous outcome in the form of a continuous variable ($0 \leq \text{Prob}(\text{success}) \leq 1$), which gives a better variation to the outcome, rather than 2 exact results. The main disadvantage is that it requires a large sample in order to produce good results.

Generalized Linear Model

The Generalized Linear Model regression (REG procedure) is one of many regression procedures in the SAS System and is a general-purpose procedure for regression. While other procedures provide more specialized applications by selecting the best fitted model according to the sample tested. This procedure has several key features and advantages: First, it handles multiple regression models, so if there is a complicated sample or a small sample, it will try to fit several models to the data. Second, it allows interactive changes both in the model and in the data used to fit the model. Third, it allows linear equality restrictions on parameters and it tests linear hypotheses and multivariate hypotheses. Fourth, it produces collinearity diagnostics and influence diagnostics. Both are important in our case because of the small sample data and because we are equally interested in the influence diagnostic of each variable as we are interested in developing a predictive model. The REG procedure produces several models both single variable, of the form: $Y = \alpha + \beta * X$ and

multivariable of the form: $Y = \alpha + \sum_{i=1}^n \beta_i * X_i$.

Variable Selection Methods

For both regression models there are many variable selection methods available in SAS to define the right model. The nine most important ones, from which we will choose, are:

1. *Full Model*. This method takes all the variables and all the data points as input of the regression procedure. This method can be compared with the ‘brute force approach’.

2. *Forward Selection.* This method starts with no variables in the model and adds variables one by one to the model. At each step, the variable added is the one that maximizes the fit of the model. One can also specify groups of variables to treat as a unit during the selection process. An option enables to specify the criterion for inclusion.
3. *Backward Elimination.* This method starts with a full model and eliminates variables one by one from the model. At each step, the variable with the smallest contribution to the model is deleted. One can also specify groups of variables to treat as a unit during the selection process. An option enables to specify the criterion for exclusion.
4. *Stepwise Selection.* This method is a modification of the forward-selection method in that variables already in the model do not necessarily stay there. One can also specify groups of variables to treat as a unit during the selection process. Again, options enable to specify criteria for entry into the model and for remaining in the model.
5. *Maximum R-square improvement (MAXR).* This method tries to find the best one-variable model, the best two-variable model, and so on. The MAXR method differs from the Stepwise method in that many more models are evaluated with MAXR, which considers all switches before making any switch. The Stepwise method may remove the "worst" variable without considering what the "best" remaining variable might accomplish, whereas MAXR would consider what the "best" remaining variable might accomplish. Consequently, MAXR typically takes much longer to run than Stepwise.
6. *Minimum R-square improvement.* This model selection method is similar to the maximum R-square method, except each switch is chosen on the basis of the smallest increase in R-square.

7. *Mallows' C_p* . This method is similar to the adjusted R-square method, except the ranking criterion is Mallows' C_p statistic. While maximum R-square selects the variables based on largest variance explained, Mallows' C_p selects the variables based on the total square errors. Thus, the higher the R-square is, the better the model is; the lower the C_p is, the better the model is.

8. *R-Square method*. This method finds a specified number of models having the highest R-square in each of a range of model sizes.

9. *Adjusted R-square*. This method lists all possible subset regressions in decreasing order of adjusted R-square magnitude, without grouping the results by sample size.

Our approach is to run the SAS procedures on the limited sample data for both models. We know that due to the sample size, the results have limited statistical significance. However, the reason for including this step in our paper is to validate which methodology for variable selection (from the many available in SAS) is most suited for our purpose.

Regression Analysis Approach

To perform the regression analysis of the collected data across the different variables we use the SAS/STAT module, version 9.01. This software package has many procedures to solve regression problems. Due to the nature of the problem, we focus our effort – as described earlier – on the Logistic regression (LOGISTIC procedure) and the Generalized Linear Model regression (REG procedure).

In this chapter we first elaborate on the meaning of R-square and adjusted R-square, mainly because we use them as measures for the quality of our models and as comparison basis between the different models. Next, we describe the suggested approach for the regression analyses for both the Logistic regression and the Generalized Linear Model regression.

R-Square

In a multiple linear regression model, adjusted R-square measures the proportion of the variation in the dependent variable accounted for by the explanatory variables. Unlike R-square, adjusted R-square allows for the degrees of freedom associated with the sums of the squares. Therefore, even though the residual sum of squares decreases or remains the same as new explanatory variables are added, the residual variance does not. For this reason, adjusted R-square is generally considered to be a more accurate goodness-of-fit measure than R-square.

As predictors are added to the model, each predictor will explain some of the variance in the dependent variable simply due to chance. One could continue to add predictors to the model which would continue to improve the ability of the predictors to

explain the dependent variable, although some of this increase in R-square would be simply due to chance variation in that particular sample. The adjusted R-square attempts to yield a more honest value to estimate the R-squared for the population.

When using adjusted R-square it is important to remember that: first, if adjusted R-square is significantly lower than R-square, this normally means that some explanatory variable(s) are missing. Without them, the variation in the dependent variable is not fully measured. Finally, it is probably a good idea to assess how much the R-square might be inflated, especially with a small sample and many predictors.

The numerical value for R-square needs to be put in perspective depending upon the context. When evaluating clinical trials Phase 3, the FDA requires an R-square of at least 0.99 for most applications. This means that ‘no surprises’ is the mindset. At the opposite end of the spectrum are real-life situation like our research study. It is impossible to develop a model that accounts for that level of control for variability. Therefore, an R-square value of less than 0.50 is expected.

Approach for the Logistic Regression

For the Logistic regression model we first reduce the set of input variables in case the problem of ‘separation of data points’ might occur. This problem occurs when an independent discrete input variable (often dichotomous) has low occurrence for some state values.

The most relevant variable selection methods for the Logistic regression are the Full Model analysis and the Stepwise Selection analysis. For each of these analyses, we can model the Maximum Likelihood Estimation for both possible states of the dependent variable: success (1) or failure (0).

Providing there are enough observations, the Stepwise Selection method will first indicate which variables to include into the model. Second, the Full Model analysis provides us with all needed information: model convergence status, model fit statistics, analysis of maximum likelihood estimates and association of predicted probabilities with observed responses.

A typical output for the Full Model Logistic Regression is:

The LOGISTIC Procedure
Model Information

Data Set	_PROJ_.IMPORTED	
Response Variable	DEPd2	DEPd2
Number of Response Levels	2	
Model	binary logit	
Optimization Technique	Fisher's scoring	
Number of Observations Read		11
Number of Observations Used		11

Response Profile

Ordered Value	DEPd2	Total Frequency
1	0	4
2	1	7

Class Level Information

Class	Value	Design Variables
VAR01d4	0	1 0 0
	0.25	0 1 0
	0.5	0 0 1
VAR02d3	1	-1 -1 -1
	-1	1 0 0
VAR03d3	0	0 1 -1
	1	-1 1 -1
	2	1 1 -1

Model Convergence Status

Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	16.421	22.002
SC	16.818	26.379
-2 Log L	14.421	0.002

Testing Global Null Hypothesis: BETA=0

Test	Chi-Square	DF	Pr > Chi Sq
Likelihood Ratio	14.4186	10	0.1547
Score	11.0000	10	0.3575
Wald	0.0778	10	1.0000

Type 3 Analysis of Effects

Effect	DF	Wald Chi-Square	Pr > Chi Sq
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VAR10c	1	0.0022	0.9625
VAR11c	1	0.0021	0.9632
VAR12c	1	0.0028	0.9581
VAR13c	1	0.0000	0.9968

Analysis of Maximum Likelihood Estimates

Parameter	DF	Estimate	Standard Error	Wald Chi-Square	Pr > Chi Sq
Intercept	1	96.6994	1275.1	0.0058	0.9395
VAR10c	1	3.7700	80.2919	0.0022	0.9625
VAR11c	1	-0.1664	3.6072	0.0021	0.9632
VAR12c	1	357.3	6806.2	0.0028	0.9581

Odds Ratio Estimates

Effect	Point Estimate	95% Wald Confidence Limits
VAR10c	43.381	<0.001 >999.999
VAR11c	0.847	<0.001 995.809
VAR12c	>999.999	<0.001 >999.999

Association of Predicted Probabilities and Observed Responses

Percent Concordant	100.0	Somers' D	1.000
Percent Discordant	0.0	Gamma	1.000
Percent Tied	0.0	Tau-a	0.509
Pairs	28	c	1.000

Approach for the Generalized Linear Model Regression

The most relevant variable selection methods for the Generalized Linear Model regression are the Forward Selection analysis and the R-square analysis.

We are evaluating the Forward Selection analysis initially at the 0.05 significance level. However this might be too severe, especially when the R-square is 'lower' than usual. Therefore, an acceptable approach is to relax the value to p=0.15.

A typical output for the Forward Selection analysis (p=0.05) is

Forward Selection: Step 1

Variable VAR25d2 Entered: R-Square = 0.3889 and C(p) = .

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	0.98990	0.98990	5.73	0.0403
Error	9	1.55556	0.17284		
Corrected Total	10	2.54545			

Variable	Parameter Estimate	Standard Error	Type III SS	F Value	Pr > F
Intercept	0.77778	0.13858	5.44444	31.50	0.0003
VAR25d2	-0.77778	0.32500	0.98990	5.73	0.0403

Forward Selection: Step 2

Characteristics of Successful Chapter 11 Reorganizations

Variable VAR31d2 Entered: R-Square = 0.7381 and C(p) = .

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	1.87879	0.93939	11.27	0.0047
Error	8	0.66667	0.08333		
Corrected Total	10	2.54545			

Variable	Parameter Estimate	Standard Error	Type III SS	F Value	Pr > F
Intercept	0.33333	0.16667	0.33333	4.00	0.0805
VAR25d2	-1.00000	0.23570	1.50000	18.00	0.0028
VAR31d2	-0.66667	0.20412	0.88889	10.67	0.0114

Forward Selection: Step 3

Variable VAR33d3 Entered: R-Square = 0.8545 and C(p) = .

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	2.17508	0.72503	13.70	0.0026
Error	7	0.37037	0.05291		
Corrected Total	10	2.54545			

Variable	Parameter Estimate	Standard Error	Type III SS	F Value	Pr > F
Intercept	0.18519	0.14682	0.08418	1.59	0.2476
VAR25d2	-1.07407	0.19040	1.68368	31.82	0.0008
VAR31d2	-0.88889	0.18781	1.18519	22.40	0.0021
VAR33d3	-0.44444	0.18781	0.29630	5.60	0.0499

No other variable met the 0.0500 significance level for entry into the model.

Summary of Forward Selection

Step	Variable Entered	Label	Number Vars In	Partial R-Square	Model R-Square	C(p)	F Value	Pr>F
1	VAR25d2	VAR25d2	1	0.3889	0.3889	.	5.73	0.0403
2	VAR31d2	VAR31d2	2	0.3492	0.7381	.	10.67	0.0114
3	VAR33d3	VAR33d3	3	0.1164	0.8545	.	5.60	0.0499

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	2.17508	0.72503	13.70	0.0026
Error	7	0.37037	0.05291		
Corrected Total	10	2.54545			

Root MSE	0.23002	R-Square	0.8545
Dependent Mean	0.63636	Adj R-Sq	0.7921
Coeff Var	36.14629		

Parameter Estimates

Standardized Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t	Estimate
Intercept	Intercept	1	0.18519	0.14682	1.26	0.2476	0
VAR25d2	VAR25d2	1	-1.07407	0.19040	-5.64	0.0008	-0.86118
VAR31d2	VAR31d2	1	-0.88889	0.18781	-4.73	0.0021	-0.82295
VAR33d3	VAR33d3	1	-0.44444	0.18781	-2.37	0.0499	-0.39396

A typical output for the R-Square analysis

The REG Procedure
 Model: MODEL1
 Dependent Variable: DEPd2
 R-Square Selection Method

Number in Model	R-Square	Variables in Model
1	0.3889	VAR25d2
1	0.3243	VAR56c
1	0.2747	VAR06d3
1	0.2300	VAR37c

2	0.7381	VAR25d2 VAR31d
2	0.6563	VAR25d2 VAR30d2
2	0.6056	VAR33d3 VAR56c
2	0.5914	VAR04d2 VAR56c

3	0.8545	VAR25d2 VAR31d2 VAR33d3
3	0.8254	VAR05d2 VAR25d2 VAR31d2
3	0.8254	VAR04d2 VAR25d2 VAR31d2
3	0.8206	VAR25d2 VAR31d2 VAR43c

4	1.0000	VAR04d2 VAR17d3 VAR22d3 VAR30d2
4	1.0000	VAR05d2 VAR17d3 VAR25d2 VAR31d2
4	0.9627	VAR16d2 VAR33d3 VAR45c VAR56c
4	0.9605	VAR16d2 VAR33d3 VAR35c VAR56c

5	1.0000	VAR05d2 VAR14c VAR17d3 VAR25d2 VAR31d2
5	1.0000	VAR05d2 VAR17d3 VAR25d2 VAR31d2 VAR33d3
5	1.0000	VAR05d2 VAR11c VAR17d3 VAR25d2 VAR31d2
5	1.0000	VAR05d2 VAR12c VAR17d3 VAR25d2 VAR31d2

6	1.0000	VAR18d3 VAR19d3 VAR26d3 VAR28d2 VAR29d2 VAR30d2
6	1.0000	VAR05d2 VAR17d3 VAR25d2 VAR31d2 VAR48c VAR57c
6	1.0000	VAR05d2 VAR17d3 VAR25d2 VAR31d2 VAR56c VAR57c
6	1.0000	VAR05d2 VAR17d3 VAR25d2 VAR31d2 VAR48c VAR56c

Summary

The execution of the regression analysis is a two-step process. The objective is to model the probability of ‘success’ (1) and the probability of ‘failure’ (0) based on the Logistic regression model.

A first step is to reduce the number of independent variables from the initial set of variables. The Generalized Linear Model can handle that by using the forward selection analysis. Setting the significance level at p=0.05 will be too strict, therefore a relaxation to the p=0.15 significance level is appropriate. The output of this step is a list of independent variables to be included in the target model. These are the variables that define the characteristics of successful Chapter 11 reorganizations.

The second step is to run the Logistic regression model. The full model analysis provides the equations for modeling the probability of failure and success. These equations can then be used as predictive model.

Limitations

There is no silver bullet for approaching complex problems such as identifying the effect of financial, strategic, and operational decisions on the likelihood of emerging successfully from bankruptcy. We use a pragmatic approach in developing a methodology for approaching this problem. However, to date, we see following limitations to our approach:

1. Limited sample of companies. A sample size of eleven companies is not sufficient to obtain statistically significant results when using a model with fifty-seven variables. Although there are (linear) relationships between some of these variables, we still have thirty-three variables in our model. Eleven companies are not enough to capture enough variance among the independent variables to make the prediction statistically significant. This is especially true for the logistic regression methodology where the occurrence of the different state values need to be high enough across the data set.
2. Secondary research. We collect our data almost exclusively through indirect sources, mostly written and publicly available documents, containing relevant information about the companies, the industries, and the economic context in which these companies operate. We use this information to make subjective decisions about the value of the different variables. In some cases we may question the accuracy of the available data; in other cases the information is not even available.
3. Limited timeframe. We focus our analysis on a timeframe from roughly 1998 to 2003. This is helpful to collect information since we are talking about the recent past. However this past period is unique in history for obvious reasons. A legitimate question arises whether the results would be representative for a longer time horizon.

4. Usage of financial statements. Everyone knows that financial statements may not always be a true representation of the reality, especially for the timeframe we are considering. Moreover, many times we need to interpret the financial or strategic information provided in the financial statements, mainly because there is no direct indication of the variable we are looking for. This gives our analysis a somewhat subjective aspect that can potentially be interpreted differently by others.
5. Mix of industries. The mix of industries in which the selected companies operate is very diverse. By aggregating the information across different industries we may overlook some industry-specific characteristics that can contribute to a successful reorganization out of Chapter 11.
6. Hindsight. Throughout the process we use past data. We are therefore analyzing situations *ex post*. There is no guarantee that what is valid for the past remains valid for the future.

However, many of these limitations are in our eyes temporary constraints. These limitations have arisen over the course of our research, more so due to time and resource constraints than due to unsuccessful trial of alternative approaches in a comprehensive way.

Proposed Next Steps

Our primary objective of this internship study is the development of a methodology to explore the characteristics of successful Chapter 11 reorganizations. In addition to the development of such methodology we are testing this on a limited sample of companies.

Although the results described are not conclusive, they are a first indication of what these characteristics might be. Based on the limitations discussed in previous chapter, we propose several elements to further enhance our methodology in the light of obtaining robust results:

1. To increase the sample of companies to include into the regression models. A structural improvement that would be beneficial for the community of turnaround professionals is the set-up of a central database that captures the information in a structured way.
2. To complement the secondary research we suggest approaching existing or former executives at the companies included in our study. The objective is to validate the information contained in the regression inputs.
3. Together with increasing the sample of companies we would increase the time horizon further into the past. This will not only yield additional companies but also a test whether major shifts are present over time.
4. The outcome of the analysis will be a list of factors that increase the likelihood of successful restructuring. However, the aspect of implementation has not been covered. Therefore these interviews with involved executives will help us understand how feasible the execution and implementation is.

5. When we increase the sample size and the time horizon, companies can be clustered and analyzed per industry sector.
6. A famous Nobel-Prize winning economist once said that understanding hindsight improves foresight.
7. Analysis of PORs and Disclosure Statements could help us better understand the changes made, the advisors used in the reorganization, and the reasons for a second bankruptcy filing.

As mentioned in previous Chapter, none of these next steps are extremely complex to realize.

Conclusion

The first objective of our study and the main focus of this research paper is the development of a comprehensive methodology to identify characteristics of successful Chapter 11 reorganizations. The second objective is the execution of that methodology.

The successive steps of (1) variable selection, (2) company selection, (3) data collection, (4) regression model identification, and (5) variable selection analysis into the model, described in this paper constitute the key steps of our first objective.

Progress towards our second objective has been undertaken by selecting a first set of companies. An increase of this number is needed to populate the selected models and to come to a set of characteristics that define successful Chapter 11 reorganization.

The model obtained through the Logistic regression can then be used in a predictive manner to forecast the likelihood of successful reorganization. This is quite similar to the Z-score, but then at the other end of the restructuring process. In this way science contributes to the professionalization of Turnaround Management and restructuring relies less on luck or magic. However it will always remain an art!

References

- [01] Sidney Finkelstein. *Why Smart Executives Fail: What you can Learn From Their Mistakes*. Portfolio, 2004.
- [02] Robert D. Buzzell & Bradley T. Gale. *The PIMS Principles – Linking Strategy to Performance*. The Free Press, 1998.
- [03] Jim Collins. *Good to Great: Why Some Companies Make the Leap... and Others Don't*. HarperBusiness, 2001.
- [04] Edward Altman. *Financial Ratios, Discriminant Analysis, and the Prediction of Corporate Bankruptcy*. *Journal of Finance*, September 1968, pp. 589-609.
- [05] James A. Ohlson. *Financial Ratios and the Probabilistic Prediction of Bankruptcy*. *Journal of Accounting Research*. Spring 1980, pp. 109-131.
- [06] Rosalind Blaurock, Kumud Gupta and Spencer Malcolm. *Chapter 11 and 22: Leadership as Predictor of Success. Removing Subjectivity Surrounding Leadership*. The Chicago Chapter of TMA Summer Internship Program paper, 2004.
- [07] Lynn M. LoPucki. *Lynn M. LoPucki's Bankruptcy Research Database*. <http://lopucki.law.ucla.edu/>, 1998.
- [08] U.S. Securities and Exchange Commission. *Edgar Company Search*. <http://www.sec.gov/edgar/searchedgar/companysearch.html>, 1993-2005.
- [09] Dow Jones & Reuters research database, *Factiva*. <http://global.factiva.com/en/eSrch/search.asp>.
- [10] Hoover's research database, *Hoover's*. <http://www.hoovers.com>.
- [11] The Bankruptcy Strategist. *Total Bankruptcy Filings At Mid-Year*. October 18, 2004; Vol. 21; No. 12; pg. 1.
- [12] Built-in SAS/STAT manual, SAS/STAT 9.01 software package installed in the computer lab of the University Of Chicago Graduate School Of Business.
- [13] Mandy C. Webb et al. *An Analysis of Quasi-complete Binary Data with Logistic Models*. *Journal of Data Science*, 2004, Vol. 2, pp. 273-285.