Corporate Bankruptcy: Assessment, Analysis and Prediction of Financial Distress, Insolvency, and Failure

By

Konstantin A. Danilov

MBA
HEC Paris School of Management, 2014
B.A. Economics
University of Massachusetts Amherst, 2005

SUBMITTED TO THE MIT SLOAN SCHOOL OF MANAGEMENT
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE IN MANAGEMENT STUDIES AT THE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

JUNE 2014

Signature of Author: _____
MIT Sloan School of Management
May 9, 2014

Certified By: _____
S.P. Kothari
Deputy Dean, Gordon Y Billard Professor of Management
Thesis Supervisor

Accepted By: _____
Michael A. Cusumano
SMR Distinguished Professor of Management
Faculty Director, M.S. in Management Studies Program
MIT Sloan School of Management

Page intentionally left blank

Corporate Bankruptcy: Assessment, Analysis and Prediction of Financial Distress, Insolvency, and Failure

By

Konstantin A. Danilov

Submitted to the MIT Sloan School of Management on May 9, 2014 in partial fulfillment of the requirements for the degree of Master of Science in Management Studies

ABSTRACT

This paper is divided into three sections that address the various elements of understanding, predicting and analyzing corporate failure and bankruptcy. Part I covers the definitions of corporate failure, explains the bankruptcy process and then classifies various potential causes of failure into broad categories. The causes are bifurcated into company-specific versus external factors. The company-specific factors include an in depth discussion and analysis of business causes versus financial causes, as well as the interrelation between the two. The most important factors, such as financial and operating leverage, are explored in great detail to gain a better understanding of their implications and impact on corporate failure. Part II covers various approaches for analyzing corporate risk and predicting corporate failure. It first details the credit analysis process from the perspective of lenders and credit agencies as a method for credit evaluation and prediction of default. Then, it provides an in depth explanation of financial ratio analysis as a prediction method and provides an overview of the main statistical prediction models. It concludes with a discussion of the implications of the model findings with respect to the causes detailed in Part I. Lastly, Part III describes the outcome of the study performed to analyze the causes of failure as described in Part I by using a combination of the methods highlighted in Part II. The purpose of the study is to identify the sequence and magnitude of relative ratio deterioration in failed firms in order to establish the relative frequency of the various categories of causes of failure. Various ratios and metrics were used as proxies for relative liquidity complications, profitability issues, business problems, and leverage concerns. The impact of macroeconomic events is also evaluated by isolating the impact of the 2008-2009 recession on the relative ratio measures.

Thesis Supervisor: S.P. Kothari
Title: Deputy Dean, Gordon Y Billard Professor of Management

Page intentionally left blank

Table of Contents

Introduction

This paper is divided into three sections that address the various elements of understanding, predicting and analyzing corporate failure and bankruptcy. Part I presents the definitions of corporate failure, explains the bankruptcy process and explores the myriad of potential causes of failure. Potential causes can be classified into two broad categories of factors: company-specific causes and external causes. The company-specific causes of failure can further be sub-classified into "business" causes versus financial causes. Business causes encompass an infinite number of scenarios that result in the company's operating performance falling below expectations, including a lack of competitiveness, poor business planning, unexpected liabilities or lack of effective leadership. Financial causes encompass a variety of scenarios that can lead to failure as a result of deteriorating financial performance, including high financial leverage, working capital mismanagement, or high operating leverage.

Part II presents an overview of the various approaches are employed for predicting corporate failure. This section details the credit analysis process from the perspective of lenders and credit agencies and provides an in depth explanation of financial ratio analysis as a prediction method. The findings in the literature on financial ratios analysis appear to imply that the overall level of financial leverage may play a more important role than short-term liquidity. Liquidity problems appear to be less prevalent in failed firms than the issue of unsustainable debt levels. Interestingly, the ratios' predictive power is not equal for failed and non-failed firms; non-failed firms could be classified as such with a higher success rate than failed firms. It is more probable that firms with favorable ratios will avoid failure than firms with unfavorable ratios will end up in bankruptcy.

Lastly, Part III describes the outcome of the study performed to analyze the causes of failure by using a combination of ratios and metrics highlighted in Part II. The purpose of the study is to identify the sequence and magnitude of relative ratio deterioration of failed firms versus peers in order to establish the relative frequency of the various causes of failure. It is found that liquidity issues and overall leverage

problems intensify in magnitude as bankruptcy approaches, while revenue volatility peaks several years prior. Profitability problems and interest coverage deficiencies remain consistently elevated throughout the entire 5-7 year period leading up to bankruptcy. Overall, it appears that the vast majority of failures are precipitated by overleverage, liquidity issues or a combination of both. A lack of profitability or interest coverage deficiencies do not appear to be major triggers of failure. The impact of macroeconomic events is also evaluated, but no conclusive evidence is found that external shocks intensify the ratio differences between the failed and non-failed firms.

Part I: Causes of Failure

This section examines the two broad categories of corporate failure – economic and financial failure - and will explain the bankruptcy process in detail. Bankruptcy law is specifically designed to address the nuances of corporate failure, and to efficiently separate those companies that should continue as going concerns from those that should cease to exist. Once the process of failure and bankruptcy is well understood, the segment that follows will detail the various proposed causes of failure, from company-specific characteristics to external industry and economic factors.

1.1 Corporate Failure and Bankruptcy

Corporate failure comes in two distinct – yet often interrelated – categories, economic failure and financial failure. Economic distress or failure constitutes a fundamental flaw in the company's business model; the products or services it provides are simply not competitive in the marketplace or it is not able to efficiently utilize its assets to produce an economic profit. It also occurs when a firm is unable to generate a *sufficient* level of profits to justify the level of capital investment and labor effort. A firm in economic distress may still generate a profit, but not enough to offset the opportunity costs of the inputs. Financial distress or failure is a situation that arises when the revenues generated by the company are insufficient to repay its debts in a timely manner, as originally promised to its creditors. This condition is a symptom of an inappropriate capital structure, one that is not a good fit for the company's business model. The two types of distress often coexist, or are causal – it's easy to see how continued economic distress can lead to eventual financial distress for any company that has financial debts. (Alternatively, economically distressed firms with unrestricted access to capital can continue to operate indefinitely). Financial distress can also lead to economic distress in the case where a company is forced to sell off its most profitable assets to pay down its debts. Alternatively, other companies face financial distress as a result of external shocks or temporary setbacks despite being economically viable overall.

Financial failure comes in two forms: technical insolvency or bankruptcy. A technically insolvent firm has more assets than liabilities on its balance sheet, but is unable to meet current obligations as they come due. If the company were to be liquidated, in theory there would be at least enough proceeds generated by the sale of assets to repay all of the creditors in full. Despite the fact that there may be net equity on the balance sheet, there is not enough cash to meet current financial obligations such as interest expenses or trade payables. In contrast, a "bankrupt" firm has a true value of assets that is less than its liabilities; its net worth is negative, and creditors would not be repaid in full if the company was liquidated. Either type of financial failure must be resolved by either a renegotiation with creditors or through formal bankruptcy proceedings ("bankruptcy" as defined in the legal sense), which may result in a reorganization or a liquidation of the firm.

The Bankruptcy Process

When a company with financial obligations to outside creditors becomes insolvent, its creditors have several options. They can either negotiate directly with the company (i.e. the debtor) to turn things around or choose to pursue legal action against the company. A secured creditor, one that has a claim (i.e. obligation) that is backed by a specific asset, can move to seize the asset and sell it to fulfill the obligation owed to it by the debtor. An unsecured creditor can pursue legal action by suing the debtor to obtain a lien on an asset that it could then seize and sell to fulfill its obligation. Alternatively, instead of pursuing non-bankruptcy legal remedies, the creditors can collectively force the debtor into a bankruptcy proceeding. (The company can also voluntarily enter bankruptcy proceedings in order to seek the court's protection from creditors).

Bankruptcy law was designed to deal with insolvency by addressing the shortcomings of the legal system in this area. If a company is insolvent, then it by definition does not have enough assets to pay all of its liabilities; as such, not all creditors will be able to recover their claims in full once a debtor becomes insolvent. This creates an adverse incentive for each creditor to seize the debtor's assets before other creditors lay claim to them first, which creates two negative outcomes. First, the assets of the debtor are

seized and sold off in an inefficient "fire-sale" fashion, destroying any collective value the assets may hold. Second, each creditor expends increased amounts of resources trying to beat the other creditors in a collective "race" to the debtor's assets. Bankruptcy law prevents this senseless destruction of value by imposing an orderly process where each creditor (or "claimant") is given an equal opportunity to establish the priority of its claim on the debtor's assets. It also increases the certainty that a creditor will be fairly compensated for its claim by the debtor. (Fair compensation in this case may not be the full amount of the obligation, but an amount roughly approximate to what the creditor could have expected to receive outside of bankruptcy adjusted by the weighted probabilities of getting to the assets before the other creditors). Other than preventing a detrimental impact on creditors, the bankruptcy process also provides a major benefit to the debtor company itself; in certain instances it allows for a "fresh start", a chance for the company to start over despite default. As such, it can be viewed as a form of insurance for all debtors against financial and economic misfortune (which must be paid for in the form of higher overall interest rates).

The Chapter 11 section of the Bankruptcy Code allows for the financial and economic rehabilitation of companies that – in the opinion of the relevant stakeholders and the courts – should survive and continue to operate as a going concern. Companies that become insolvent and enter bankruptcy are by definition experiencing a form of "financial distress", which may or may not be caused by underlying "economic distress", as discussed in an earlier section.

The role of bankruptcy proceedings is to separate the companies that possess a going-concern surplus from those that should be dismantled and liquidated. The reasoning is that companies that can utilize a particular set of assets in a more effective way than anyone else should be worth more as a going concern than if those assets were sold off to other companies. It is in the spirit of the Bankruptcy Code that these companies be given an opportunity for a "fresh start". This gives the creditors an opportunity to recoup their claims (or at least an opportunity to receive more than they would get if the debtor was liquidated, whether via repayment or an ownership stake in the new firm) and society as a whole benefits from the

continued existence of an economically viable firm. Alternatively, if a company has no going concern surplus, then there is no point for it to continue to exist; it should be liquidated with the proceeds going to repay its creditors. The Chapter 7 section of the Bankruptcy Code deals with an orderly liquidation of a debtor's assets in the case that the relevant stakeholders and the judge decide that this is the appropriate course of action.

A company that is merely suffering from financial distress is prime candidate for rehabilitation through Chapter 11 proceedings. The process allows the court to reduce its debt obligations (in a fair and equitable manner) to ensure that the new capital structure is consistent with the company's projected future earnings. However, companies that are also facing economic distress (in addition to financial distress) can also be helped. In the latter case, the goal of the bankruptcy process is to investigate, and if possible, eliminate the sources of the economic distress through a reorganization plan. Since buy-in from creditors and approval by the court is necessary in either case, the process ensures that any restructuring or reorganization plan meet the stringent requirements of all the parties involved (Adler, Baird, & Jackson, 2007).

Costs of Bankruptcy

Financial distress and the bankruptcy process exert a toll on the troubled firm in the form of direct and indirect costs. The process of reaching the condition of distress is also a "cost" imposed on the value of the pre-distressed firm. The pre-distressed value (PDV) of the firm can be seen as comprised of three categories: the loss causing distress, the firm's cost of dealing with the distress, and the gross amount eventually recovered by claimholders. Because the claimholders must also incur costs in recovering their claims, the gross claim amount is further separated into the cost of recovery and the net recovery amount. Thus, the sum of the firm's and claimholders' costs represents the overall cost of bankruptcy; these costs have been estimated to be as high 20% or more of the firm's pre-distressed value (Branch, 2002).

The firm's costs are comprised of direct and indirect costs. One of the most explicit direct costs is the need to employ various outside professionals to help deal with the situation at hand. Lawyers, accountants, consultants, investment bankers and many others provide the necessary professional services that are paid for by the firm. It is estimated that on average these costs amount to 0.7-2.5% of the PDV. Aside from paying outside professionals, the company incurs internal costs because various employees must now dedicate a portion of their time to dealing with the bankruptcy process. From senior management to employees in the legal, accounting and personnel departments, time and energy must be spent on coordinating with the outside professionals. Estimates of internal costs range between 0.07% and 1.4% of the PDV. (Claimholders such as banks, bondholders, trade creditors, and employees also incur direct costs similar in nature to those of the firm itself. Large creditors will often employ their own legal and accounting professionals to help them deal with the bankruptcy process. All claimholders must also expend time and energy assessing their position and participating in the proceedings, thus incurring internal costs. Claimholder recovery costs are estimated to be approximately 2.4% of the PDV.)

The indirect costs are imposed by the disruption in the company's ability to effectively compete in the marketplace and from the loss of reputation constitute the largest portion of the overall bankruptcy costs. Customers are less inclined to purchase a product if they believe that the manufacturer will go out of business. Suppliers may refuse to enter into contracts with the firm, key employees will likely leave to work for competitors and business partnerships may be dissolved. From a management perspective, the short-term focus on cash conservation and damage control will likely result in the avoidance of profitable long-term projects. Assets are sold at distressed prices while R&D and nonessential maintenance is put hold. Senior managers, forced to deal with creditors and outside professionals, are distracted from focusing on effectively running the business. As a result, market share and profits decline, which further compounding the already dire situation of the troubled firm. These indirect costs, while difficult to estimate, are assumed to be quite large and likely represent 10-20% of the PDV (Branch, 2002).

Other intangible costs arise because financial distress creates adverse incentives from a capital budgeting and financing standpoint. A troubled firm's equity holders are incentivized to take on risky projects (even those with negative expected value) because their claim is essentially becomes a call option. If the firm goes into bankruptcy, they will likely lose whatever equity value that remains, so taking a gamble with the bondholders capital seems like an attractive proposal. In the unlikely event that the risky project succeeds, they will keep the upside; if it fails, they've only lost the equity value that was going to be wiped out anyway, and the bondholders absorb the remainder of the loss. This misguided capital budgeting strategy imposes a cost not only on the firm and but also on the broader economy. Even if an opportunity for a profitable project presents itself, the *debt overhang* problem creates adverse financing incentives. If cash is needed to buy a new asset, equity holders will not inject capital into the firm since any proceeds gains from the asset accrue to the bondholders as well. Holding business risk constant, any increase in a distressed firm's value is shared between bond and equity holders. (Unlike a non-distressed firm, debt holders have upside because their pre-project recovery value is less than the full value of the debt). Therefore, the company may forego profitable projects because contributing new equity capital is not in the stockholders' self-interest. Once again, the troubled firm faces additional costs as a result of distress (Bearly, Myers, & Allen, 2011).

The costs of distress are also dependent on the type of assets the firm owns. Tangible assets like real estate, or equipment that can be used in various applications, can pass through bankruptcy with their value relatively intact. Conversely, intangible assets like brand, human capital and proprietary technology are likely to diminish in value significantly and as such give rise to higher distress costs.

1.2 Causes of Business Failure

Corporate failure can be caused by either company-specific factors, external factors or, more frequently, a combination of both. It's often difficult to truly separate the impact of external factors, such as an economic downturn, from the influence of company-specific characteristics which arise as a result of

mismanagement. (The term "mismanagement" is used broadly to include every aspect of decision-making in running the business, not just the narrow function of managing the employees). With the exception of truly unique events, such as industry-wide deregulation or disruptive demand shifts that completely transform the industry, external shocks serve to weed out the firms that were structurally weak to begin with. If a firm fails during a recession, it is likely that company-specific factors influenced its level of vulnerability to the downturn. Argenti (1976) argues that most external factors constitute normal business hazards, which should never be a valid excuse for a company's failure. He makes the analogy of a bankruptcy as a sunken ship; if the ship had been in good condition with a competent captain, measures would have been taken to avoid the storm that sunk it.

1.2.a Company-Specific Causes

Company specific factors that lead to failure can be further classified into two broad – and often interrelated – categories of mismanagement: business causes and financial causes. Business causes arise when the company's performance falls below expectations due to a lack of competitiveness, operational issues, or poor leadership. (Other types of mismanagement such as fraud can also lead to corporate failure and although sensational, they are rare). These arise as a result of poor decisions, bad timing, or just bad luck. Financial causes arise either because the company's capital structure is inappropriate given its level of business risk, or poor financial decisions are made by management during the day-to-day operations. The distinction is the same as that between economic and financial distress; business causes will eventually lead to financial problems, but the reverse can also occur.

Non-Financial ("Business") Causes

Business causes encompass an infinite number of scenarios that result in the company's operating performance falling below expectations. Although is often difficult to measure, quantify or isolate these factors in practice, it is helpful to separate them into several broad categories such as lack of competitiveness, poor business planning, unexpected liabilities or lack of effective leadership.

One broad category is the lack of competitiveness of the company's product or service in the market. This can occur for a variety of reasons like the entry of new competitors into the market, a lack of differentiation and pricing power, or shifting consumer tastes. New or existing competitors may provide a better product at the same price, or are able to price at below-market levels due to cost leadership. Either way, customers are no longer willing to purchase the company's offering. If management is not able to adapt the product or service, sales will fall below forecasted levels and the company will eventually fail.

Another broad category can be classified as a fundamental problem with the company's business plan. Moyer (2005) describes this as a scenario where the firm fails despite the fact that its product or service is still demanded in the market place; instead of product or service offering issues, the failure is a result of unrealistic growth or margin expectations and/or poor planning. The result is that the company runs out of cash because its actual profitability cannot support the original capital structure, which was based on the projected profitability. Moyer describes three types of business plans that are especially vulnerable to this type of business failure. The most common are *leveraged buyouts (LBOs)*, which are premised on aggressive cost reduction and margin expansion projections that support a highly leveraged capital structure. If the lofty projections fail to materialize, it is easy for the firm to become financially distressed and eventually fail if it is not recapitalized. Because the failure or success of the firm as an investment is highly dependent on whether or not the projections can be met, the margin of error is typically very small.

The other two strategies that are potentially problematic are *rollups* and business plans premised on aggressive growth projections. A *rollup* is a business plan that consists of consolidating several smaller companies within a fragmented industry into a large player in order to gain economies of scale. In theory, the new entity will have a significant competitive advantage over the other smaller, less efficient rivals. These projected benefits, on which the strategy is highly dependent, often fail to materialize due to challenges with the integration of so many disparate entities. Other times, bidding wars may disrupt the timely acquisition of the needed companies, resulting in time delays and cost increases. Business plans that are based on the premise of rapid industry growth can be equally problematic. The sales and margin

projections are typically based on overly optimistic assumptions of future demand growth with a disregard for the number of competitors entering the space. The resulting failure results from below-expected sales and overcapacity issues.

Unexpected non-debt liabilities such as tort lawsuits or contract liabilities represent another potential source of business failure. Tort claims – a claim that a company has caused personal injury to another individual – can arise various types of businesses, but have been most prevalent in tobacco, silicon and asbestos related sectors. As a result of the potential for large punitive damage awards, a class-action lawsuit can destabilize a sound, profitable business and force it to seek bankruptcy protection. Contract liabilities arise as a result of contracts that are economically detrimental to the company. For example, a long-dated derivatives contract to hedge exposure to the price of an input can cause significant losses if improperly managed.

Lastly, the most difficult to evaluate and most subjective source business failure is a lack of effective senior leadership, or poor management. Moyer (2005) proposes that there are two types of bad managers: incompetent management or conflicted management. The actions of incompetent managers are difficult to disentangle from the other company specific causes – it is possible that all company specific causes can arise from the poor decisions made by managers, who may or may not actually be incompetent. On the other hand, conflicted managers are quite capable of making the right decisions, but their incentives are not aligned with those of the shareholders. For example, poorly structured compensation agreements can lead to actions that are detrimental to the firm's performance such as extensive acquisitions or a heavy focus on achieving short-term results at the expense of long-term investment in the firm. Argetnti (1976), in his extensive research on the subject, identifies several detailed symptoms of a defective management structure. From the autocratic leader, who controls the company completely without any input or discussion from colleagues, to a non-participating board, there is an infinite amount of ways that firm leadership can be inadequate. Other even more subjective non-structural factors, such as the inability to

respond to various types of change (for example, competitive trends, societal shifts, and technological developments) are also highlighted.

Financial Causes and Symptoms

Financial causes encompass a variety of factors that could potentially result in corporate failure due to the deterioration in the company's financial performance. These include factors such as high financial leverage, illiquidity due to working capital mismanagement, or high operating leverage due to increased fixed costs.

Financial Leverage

High levels of debt – by definition – represent a major source of bankruptcy risk. Despite its advantaged tax-status, leverage and the inflexible interest and principal payment demands that it imposes on a company's cash flows greatly amplifies the upside and downside of potential outcomes. More debt means that there is a smaller equity cushion that can absorb losses that occur as a result of adverse changes in the company's operations. Interest and principal payments represent a fixed cost that raises the company's breakeven point in the same manner as operating leverage, thus increasing earnings variability.

Capital Structure Theories

The *trade-off theory* of capital structure argues that the optimal debt level is set at the point when then present value of financial distress costs become greater than the present value of the tax advantages. Financial distress costs are a function of the probability of distress and the magnitude of the costs. Higher levels of debt in the capital structure increase the probability of distress, and at some point, the potential costs outweigh the tax shield benefits. According to the theory, the optimal level is reached when further borrowing results in a PV of tax savings that is fully offset by the increases in the PV of distress cost. While a detailed description of the costs stemming from financial distress is discussed in a separate section, it's important to note is that these costs vary depending on the type of assets a company has. Tangible assets like land, building and equipment that pass through the bankruptcy process tend to

diminish in value much less than intangible assets like human capital or brands. Because of this, and the fact that no all firms have expected profits to shield from taxes, the theory recognizes that optimal debt levels will vary across firms. An alternative view presented by the *pecking order theory* of corporate financing states that firms prefer internal funding over borrowing, and debt over equity funding because of information asymmetry. Managers are more informed than (rational) investors, and will prefer to issue equity as a last resort method of financing. Optimistic managers, who know that their stock price is currently undervalued relative to the company's future prospects, will not want to issue undervalued equity. They would rather use internal financing, or if unavailable, issue bonds. Conversely, pessimistic managers who know that their stock is overvalued (and that investors will realize this eventually) prefer to issue debt as well. Any attempt to sell stock would signal to investors that the stock is worth less than the current price, thus forcing down the stock price and lowering the proceeds from the stock issue. According to this theory, tax shields are of secondary consideration. However, equity issuance would be well received by investors if a firm is highly-levered or has many intangible assets, both of which imply a high cost of financial distress (Bearly et al., 2011).

Another way to analyze leverage levels is by evaluating a company's risk of illiquidity. Every asset and liability on a balance sheet can be classified by how quickly it transforms into cash. Assets represent potential cash inflows as inventory and products are sold in the near-term and equipment generates profits over its (long-term) useful life. Liabilities represent short- and long-term commitments that must eventually turn into cash outflows as they become due. Both have varying maturities, and the risk of illiquidity occurs when the "maturity" of the assets (i.e. the time it takes for the assets to transform into cash) is longer than that of the liabilities. For example, consider a new piece of equipment has a useful life of ten years, but is financed with a loan that must be repaid in two years. The maturity mismatch represents a large risk that the asset will not be able to generate the requisite cash-flows to pay off the debt as it comes due, and as such, other resources will be needed to fill the gap. New funds – which may or may not be available at that time – will be needed to pay for existing assets. If new funds are

unavailable, financial distress or bankruptcy may follow. As such, a balance sheet can be considered liquid if for each maturity more assets are transforming into cash than liabilities (Vernimmen, 2009).

Determination of Debt Levels

The "acceptable" level of debt varies between companies and across industries and sectors, depending on the stability and predictability of cash flows. For example, the consumer staples sector will tend to have cash flows that are less volatile than the consumer discretionary sector, given the pro-cyclical nature of the latter. Debt levels have also varied across time, with interest rate levels and economic conditions often determining "optimal" levels for a particular time period. In general, during periods of inflation combined with low interest rates, companies tend to overinvest and over-borrow; disinflation and high real rates result in the opposite phenomenon. Vernimmen, et al. propose that in practice, the capital structure decision is determined by factors such as competitors' capital structures, the need to preserve the credit rating, and the company's life cycle.

Companies within the same sector tend to have the same economic and financial characteristics, so the capital structure policies regarding debt should also be similar. A company that chooses to increase debt levels above competitors is making a large bet on its own future profitability, which is based on both internal (strategy, core capabilities) and external (economy, sector outlook) factors. The additional financial risk makes the company vulnerable to a business cycle downturn; if necessary, managers would prefer to take business risks than financial risks. As such, industries with volatile cash flows and low levels of tangible assets should have lower debt levels than stable industries with high levels of tangible assets. Therefore, the debt financing decision is not made on an absolute basis, but rather relative to other companies in the sector. Credit ratings have also gained increased importance when making financial decisions. Aside from lower debt costs and increased flexibility, a higher rating can benefit the company by expanding the pool of potential investors and reassuring the other stakeholders (trade creditors, etc.) of its financial viability. Because downgrades typically cause a sharp fall in share price, public companies actually protect shareholder value by preserving their credit rating. Lastly, use of debt is determined by

the stages of the company life cycle. Startups have high business risk, volatile and unpredictable cash flows, low tax shield needs, and few tangible assets, therefore unable to obtain (or benefit from) debt financing. As a company matures, it grows bigger, its cash flows become more predictable, and it accumulates profits and tangible assets, all of which makes it more appealing to creditors. The benefits of debt for mature companies outweigh the costs. However, in recent surveys of management, the top four factors affecting the amount of debt were financial flexibility, credit rating, tax shields and cash-flow volatility. Surprisingly, bankruptcy costs and industry norms were not cited as major influencing factors (Vernimmen, 2009).

A common way for lenders to analyze and compare companies' credit risk is through the use of financial ratios such as the net debt/EBITDA measure. Here, EBITDA serves as an approximation of annual cash-flows from operations, excluding working capital and income tax effects for simplicity. As a general rule of thumb, a value of 4 is considered a "critical level" above which leverage may be considered excessive. At this level a company could hypothetically repay its debts in four years, given that it could avoid capital expenditures and income tax (Vernimmen, 2009).

Types of Debt

To understand the various ways companies can employ financial leverage in their capital structure, it is helpful to review the various types of debt instruments that exist. Because different types of debt instruments typically have different seniority within the capital structure, the concept of *debt priority* – which determines the priority of a creditor's claims against the borrower relative to other creditors – plays a central role in bankruptcy.

The two main categories of debt financing available to companies can be classified into *bank financing* and *market financing*. Bank financing, also known as "intermediated" financing, consists of loans that are negotiated with banks or other financial institutions. Market financing consists of the issuance of debt securities (such as bonds or commercial paper) directly to financial investors, which allows the market to

determine the acceptable borrowing terms (such as the interest rates). Because of the cost, size and flexibility characteristics of each financing channel, bank borrowing is used more by small- and medium-sized companies, while larger companies tend to rely more on market financing. Banks may charge borrowing rates that do not reflect the actual risk of the borrower. Client relationships and cross-selling opportunities can result in more attractive terms for some borrowers, while geographical limits on lender competition or opportunity cost considerations (under the Basel framework) can result in higher fees for other borrowers with the same credit risk. Conversely, market financing costs depend on the size of the issue and the market's objective assessment of the borrower's credit risk. From a volume and size perspective, bank credit allows a company to borrow the exact amount needed; conversely, market issuance is limited to large issues by imposed minimum liquidity constraints. This acts as the main deterrent for smaller sized firms or for firms with limited borrowing needs. Bond issuance also presents an increase level of uncertainty with regards to the timing of the availability of funds. The issuance preparations and disclosure of information to investors may take several weeks, during which time market volatility may adversely impact the success of the bond issue. Meanwhile, bank loan proceeds can be made available to the company fairly quickly. Additional flexibility is created by the ability of the company to renegotiate a bank loan directly with the lender if necessary at a future date; a bond issue's characteristics are fixed upon issuance. To compensate for these favorable features, bank loans typically impose covenants that are more restrictive relative to bonds, thus placing greater constraints on a company's operations.

Covenant restrictions are often included in the loan agreement to ensure that the lender is protected from adverse actions that may be taken by the company in the future that could increase the lender's risk. Covenants typically fall into four major categories that cover a variety of actions or scenarios. *Positive* covenants require that the company complies with certain financial or capital structure ratios. *Negative* covenants prevent the taking on additional debt, pledging certain assets as collateral to other lenders, or engaging in share-buybacks. *Pari Passu* clauses give the lender the right to receive any additional

guarantees provided to future lenders. *Cross default* clauses specify that a default on an another loan can trigger a default on the lender's loan, even if there is no violation by the borrower with respect to the lender's loan. The violation of a covenant may result in the declaration of default on the loan, the levy of financial penalties on the borrower, or the immediate acceleration of all future payments due on the loan (Vernimmen, 2009).

Among the various types of borrowing instruments, there is a clear distinction between secured and unsecured debt. Secured debt gives the lender a security interest in a particular asset (or set of assets), which allows the lender to take possession of that asset if the borrower defaults on the loan. The types of assets pledged as collateral to secure a loan include accounts receivable, inventory, PP&E, intellectual property, or securities. If the sale of the asset does not provide sufficient funds to entirely repay the loan, the remaining amount becomes a general unsecured claim against the borrower. Secured loans lower the lender's risk, and thus carry a lower interest rate compared to equivalent unsecured loans. Depending on the borrower's credit risk and volatility of cash flows, lenders may require higher or lower amounts of collateral. Unsecured debt is not secured by a particular asset, but is based on the general credit and financial health of the borrower. If a default occurs, the creditor is able to "reduce its claim to judgment" by seeking a court's approval to seize and sell any unencumbered assets (i.e. those that are not pledged as collateral for another loan) to repay the loan (Adler et al., 2007).

The concept of *debt priority* determines the priority of a creditor's claims against the borrower relative to other creditors. Seniority can be established through contractual or structural subordination. Contractual subordination is established through subordination provisions, which state that the claims of the senior creditors must be satisfied before junior creditors. Secured debt or debt given by the borrower a priority claim on repayment is repaid first, and is typically called senior debt. Unsecured debt has the next highest priority, followed by *subordinated debt* and, lastly equity claims. The decreasing level of priority increases the lender's risk, which is compensated by the ability to charge higher interest rates. Structural subordination addresses the priority of creditors between different legal entities within a company. For

example, the debt obligations of an operating company are senior to those of the holding company unless there is a guarantee on the debt of the holding company provided by the operating company (Rosenbaum & Pearl, 2009).

Long-Term Debt Instruments

Market financing debt instruments consist of medium- and long-term *bonds*, and *asset-backed securities*. Fixed interest rate bonds in the five- to ten-year segments are the most widely used by corporations and present a large variety of features. *High-yield bonds* are a type of subordinated debt issued by companies with poor credit and offer high interest rates commensurate with their increased level of risk. *Asset-backed securities* are credits that are secured by a pool of assets such as loans, accounts receivables, inventories, or buildings. If the asset quality in the pool is higher than the overall quality of the borrower's balance sheet, this financing arrangement provides a lower financing cost than would be available otherwise. Bank lending instruments consist of business and secured loans, which are custom tailored for each individual borrower. Business loans are based on market interest rates and the individual creditworthiness of the borrower, while secured loans are collateralized by a specific set of assets. The major types of credit facilities include committed facilities (a bank commits to lend up to a certain amount), revolving credits, term loans, or letters of credit. Term loans have a set maturity, a floating interest rate based on a market reference rate plus a spread, and a set schedule of principal repayment (amortization) over the life of the loan. The repayment schedule may be spread out evenly over the life of the loan, or may be concentrated at the end of the term (i.e. a "balloon" repayment). Term loans can also be structured as second-lien loans, which are secured by assets already used as collateral for other "first-lien" secured loans. (In a liquidation proceeding, these claims are satisfied after the collateral sales proceeds have been applied to the first-lien loans, but before unsecured creditors receive any proceeds). These types of loans typically do not amortize, and provide an alternative to high-yield bonds for larger borrowers (Rosenbaum & Pearl, 2009).

Syndicated loans are facilities for large loans that allow a lender to share the risk of underwriting with other banks. A lead bank structures the loan and a syndicate of 5-20 banks each lends part of the total amount. The loans are tradable, whereas pieces of the loan can be bought and sold by other banks or financial institutions. The borrower benefits from lower interest rates and the ability to borrow larger amounts than would be available from a single bank. The lender is able to diversify its loan portfolio and reduce the risk of default, as well as access deals that may otherwise be unavailable.

Leases can also be considered a type of debt financing, whereas the company enters a commitment to make fixed payments in exchange for the ability to use a particular asset. A default on a lease will typically result in a loss of access to the asset or, in some cases, bankruptcy. Leases come in two principal categories: operating and financial. An operating lease term is shorter than the economic life of the asset, and the asset is returned to the lessor at the end of the lease. The present value of the lease payments represents an amount that is less than the market value of the asset. Conversely, a financial lease term lasts for the entire life of the asset, and typically the lessee can purchase the asset at a reduced price at the end of the lease. In this case, the PV of the lease payments is equal to the market value of the asset. Leases provide companies with an alternative source of financing that allows for the avoidance of bond covenants (Vernimmen, 2009).

Working Capital Mismanagement

The firm's day-to-day capital needs can result in financial distress or bankruptcy if not managed properly. Depending on the industry, a firm will usually obtain credit from suppliers to purchase production inputs, and will extend credit to customers to facilitate the sale of its products. This creates payables and receivables that flow to and from the firm on a regular basis as part of a continuous cash-flow cycle. The difference in timing between when the company purchases inputs and creates the finished product and when it actually receives funds from customers for goods sold creates a "time factor" (Platt, 1985). Because the company may not have sufficient cash on hand to finance production, banks will often extend credit to help firms fund this gap.

The magnitude of the time factor can be influenced by management's decisions regarding credit purchases and sales, the production process, and the receipt and offering of trade discounts. Extending credit to more customers (or increasing the repayment period) will increase the time factor due to fewer cash sales. While overall sales may increase, the allowance for bad debts must also increase. Making quicker payments to suppliers (often in exchange for trade discounts) will also increase the time factor. Conversely, improvements in the production process that increase production speed and efficiency will decrease the time factor, as will offering discounts to customers for cash payments. Some firms may actually seek to increase the time factor if the overall increases in profits outweigh the additional financing costs incurred in doing so. Additionally, companies that experience high levels of seasonality in their business must take extra efforts to ensure their working capital needs are adequately met (Platt, 1985).

Commercial banks are the leading source of working capital financing, which can take several forms (Seidman, 2002). A *line of credit* is an ongoing "revolving" loan that a company can draw upon or repay at any time during the loan period, which is typically one year. There is a set credit limit, and interest is only paid on the actual amount borrowed; the loan may be secured on unsecured. For the convenience of this increased flexibility, the borrower must also pay a fee to the bank (regardless of actual borrowing) and maintain a current balance of cash on deposit equal to a set percentage of the credit limit. The loan balance must be paid off in full during the course of the one year term period, and the loan must be extended annually with consent from the lender.

Accounts receivable financing is a method of secured borrowing employed by companies that are unable to obtain an unsecured line of credit due to lack of credit quality. This type of loan ties the maximum amount available to the borrower's account receivable balance; as the latter increases, the amount available to borrow also goes up. The percentage of the accounts receivable (AR) balance that can be converted into a loan is influenced by the credit-worthiness of the firm's customers and the age of the outstanding receivables debt. The borrower is obligated to use the AR repayment proceeds to repay the

loan; since the loan is secured by the AR assets, in case of default the bank is able to "seize" the collateral and collect directly from the customers. Since the borrowing limit is directly tied to sales, it grows proportionately as the company expands. However, due to the higher costs incurred by lenders in order to manage the collateral, higher fees or interest rates may be charged to the borrower.

Under a *factoring* financing arrangement, the company sells the accounts receivable directly to a third-party (called the "factor"), who then assumes both the costs of collection and the risk of default. Individual customer credit limits and collection periods are set at levels mutually agreed to by both the company and the factor. The factor can either advance a portion of the money to the company when the sale of products takes place or transfer payment upon receipt of funds from the customer. The factor receives a portion of the proceeds as a fee, and may charge additional interest on the advanced funds. This fee may be higher than the interest on a direct AR loan, depending on the credit quality of the customers. Some of the benefits of this type of financing are that it can reduce the timing uncertainty of cash-flows from sales and lower the company's receivables collection costs.

Inventory financing is a similar type of secured borrowing, albeit with inventory instead of AR assets pledged as collateral to obtain working capital loans. Because inventory is much less fungible and represents a riskier type of collateral (it can be difficult to resell or may even be perishable), the loan amounts and interest rates are often higher than when using AR financing. Because of the complexity in managing the collateral that arises, inventory financing also involves higher transaction and administrative costs than other types of financing. It is a feasible option for companies that lack the ability to obtain either of the aforementioned types of financing either due to poor credit or lack of account receivables.

Lastly, secured or unsecured *term loans* can be used to provide a sufficient cushion for working capital needs over a longer time period. This is typically an amortizing 3- to 7-year loan with a floating interest rate and a set of financial covenants. While these loans provide a company more breathing room to fund

working capital, they carry a higher interest rate relative to other types of working capital financing due to the longer repayment period (Seidman, 2002). Large companies with high credit ratings that have access to market financing can typically issue *commercial paper* on an unsecured basis to finance short-term borrowing needs. This is a money market instrument with a term between one and three months (or up to a year) that allows a company to borrow directly from the financial markets at lower interest rates than a bank line of credit.

Since most companies choose to finance their working capital needs through external sources, working capital mismanagement can result in financial distress or bankruptcy if creditors lose faith in the company's ability to generate profits going forward.

Current Asset Imbalance

An imbalance of current assets relative to long-term assets in a company's asset mix can lead to financial distress. More specifically, extremely high or low levels of inventory and accounts receivable can lead to trouble if they reach unacceptable levels. A large buildup of inventory can leave a company exposed to negative price fluctuations and the risk of product obsolescence. This can occur if management projects high levels of growth that fail to materialize, or there is overproduction to take advantage of economies of scale. Conversely, extremely low inventory levels result in costly stock-outs and shortages that can lead to lost sales and profit declines. As discussed in the working capital section above, disproportionately high levels of accounts receivable assets can be an indicator that the company has either relaxed its credit standards or that customers are taking longer to repay. The former can lead to increases in uncollectible accounts, while the latter can be an indication that the company's customer credit policies need to be reviewed and adjusted. Regardless of the cause, an increase in uncollectible accounts will lead to lower profits. On the other hand, abnormally low levels of receivables resulting from credit policies that are too stringent can result in lost sales if creditworthy customers forgo purchases (Platt, 1985).

During financial analysis, the current ratio – defined as the ratio of current assets to current liabilities – is often used as a measure of short-term liquidity. If the ratio is above one, the company has more assets maturing in less than one year than it has liabilities maturing during that time. This difference provides a necessary margin of safety to creditors since current assets are subject to devaluation (as discussed above, or more generally, as a result of decreases in sales) while liabilities remain fixed. An additional point is that a current ratio less than one implies that some current liabilities are being used to fund long-term, fixed assets. This creates a dangerous liquidity mismatch since the liabilities will come due in the very near term, while the assets have a long-dated maturity (Vernimmen, 2009). However, the appropriate upper bound for the current ratio is a more subjective metric that is less frequently addressed in literature.

Operating Leverage

Operating leverage increases the breakeven point and earnings variability of a company and is a major contributing factor to corporate failure. Formally defined as the percentage change in operating profit (EBIT) that results from a one percent change in sales, operating leverage measures the relationship between a company's level of fixed and variable costs. Increased investment in fixed assets such as property, plant and equipment will decrease overall variable costs at the expense of increasing fixed costs. While long-term assets have the potential to generate more profits than current assets, they also carry a higher level of risk due to the reduction in cost structure flexibility.

Higher fixed costs increase the sales breakeven point that a company must attain in order to generate a profit. This point is achieved when the contribution margin amount (sales minus variable costs) is equal to the fixed costs. Depending on the type of breakeven that is being calculated, the fixed costs may or may not include financing costs. For operating breakeven, only production fixed costs are used; for financial breakeven, interest payment costs are also included. (The first calculation fails to take into account the necessary return on the borrowed capital invested in the company. Interest expenses also represent an important factor when it comes to discussions on insolvency and bankruptcy. The implication here is that companies with large amounts of operating profit variability must compensate by employing less

leverage). Holding everything else equal, a company with higher fixed costs will have higher earnings volatility relative to a company with lower fixed costs; EBIT and net income will increase (decrease) more given a similar increase (decrease) in sales. Additionally, EBIT volatility is highest when a company is operating close to its breakeven point, as opposed to when its sales are far above (or below) it.

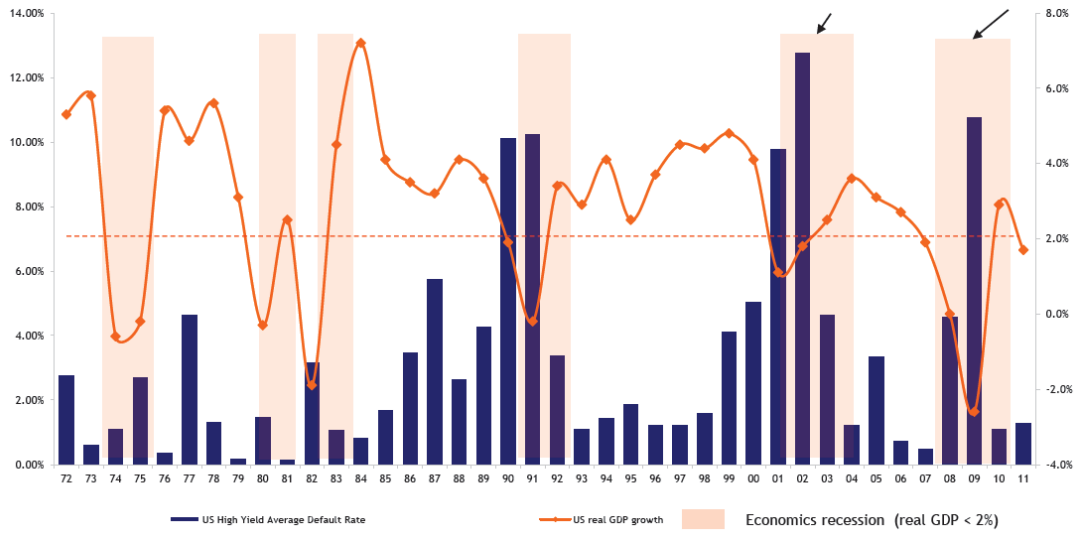
Operating leverage is an especially important factor for companies in highly cyclical industries, where the business cycle can cause dramatic swings in sales volume. High operating leverage and inflexible cost structure in cyclical industry can create significant problems and often leads to bankruptcy. Reducing a company's breakeven point once it has been set entails significant restructuring of industrial and commercial operations, such as reduction in production capacity and overhead. This is a very challenging process, and may in fact lead to a reduction in the size of the company's overall business and other negative consequences. Companies can employ several strategies to lower the level of operating leverage in their business model. Increasing labor flexibility and linking compensation to financial performance can help reduce short-term fixed costs. Outsourcing noncore activities or entering into joint ventures can decrease the necessary amount of fixed assets and reduce overall fixed costs (Platt, 1985; Vernimmen, 2009).

1.2.b External Causes

While company-specific factors lead to structurally fragile companies which may fail at any time, external macroeconomic conditions greatly exacerbate the incidence of bankruptcies across industries. A downturn in the broader economy reduces aggregate demand, exposing weaknesses in marginal firms with uncompetitive products and forcing them to go out of business. A reduction in credit availability can result in liquidity problems for over-levered companies that would have continued to operate otherwise. While most macroeconomic factors are interrelated, aggregate measures and such as GNP growth, money supply, financial market performance and number new business starts seem to be correlated with increased rates of corporate failure and financial distress.

Economic Conditions

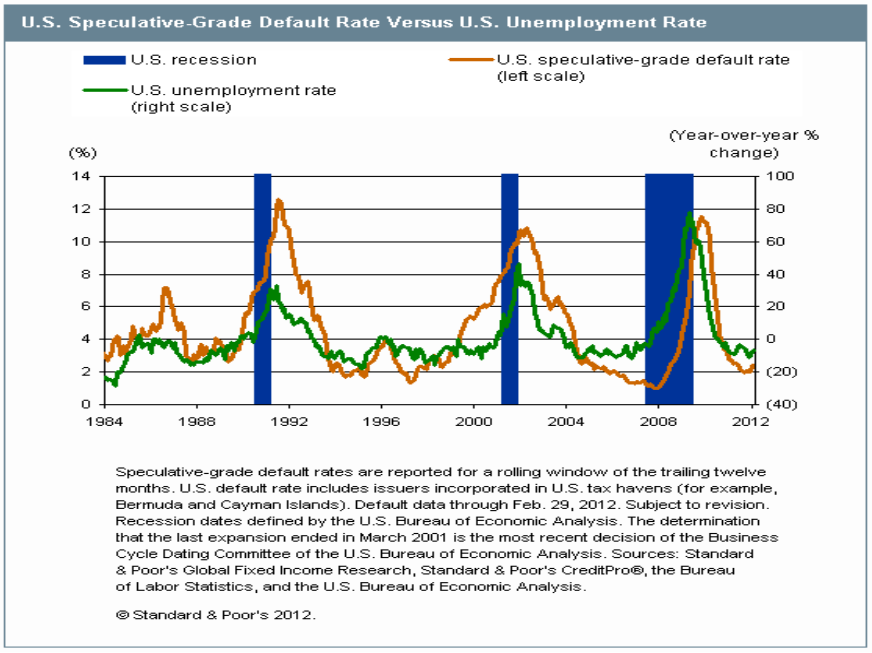
One of the most impactful macroeconomic variables is the growth rate of the economy; there is a sharp increase in loan defaults and bankruptcies during recessionary periods. Economic downturns reduce overall business activity and place stress on all except the most countercyclical businesses. As such, it is unsurprising that overall failure rates increase during recessions.



Source: Professor Nicholas Ducarre, HEC Paris

Despite being a company-specific characteristic, the age of the company can be used as a macroeconomic factor when viewed from the perspective of aggregate business formation. Younger firms tend to fail in greater numbers than older companies: over 50% of all companies that fail are firms five or fewer years old, and 25% are three or fewer years old. New companies are more susceptible to the various business and financial risks that precipitate bankruptcies and are thus especially vulnerable. From a macroeconomic perspective, large increases in new business formation rates – which occur during expansionary periods – would likely influence the overall failure rates two to five years later (very few business fail in the first year of operation) (Altman, 1983).

Since firms often fail because they are unable to obtain or refinance debt, the prevailing credit conditions play a major role as well. Troubled firms may be able to obtain large amounts of debt during periods of low interest rates and easily available credit. However, as credit becomes scarce, banks will refuse to lend to weaker companies, forcing them into bankruptcy. General credit conditions are influenced by capital markets' supply and demand as well as the monetary policy actions of the Federal Reserve. Investor flows into high-yield bond funds are correlated with new issuance activity by firms; less demand by investors translates to lower demand for bonds by portfolio managers, and in turn, lower supply of new issues by investment banks. During times of low investor demand, as measured by fund flows, tight credit conditions are likely indicative of increased failure rates. The outstanding quantity of low-rated (high yield) bonds provides a proxy for credit availability effects and appears to show a significant correlation with future default rates. Since low-rated bonds (B or less) have a higher probability of default (bond ratings are discussed in the section on predictive methods), a larger number of outstanding bonds means that more companies are likely to go into technical insolvency. The number of low-rated bonds is influenced by both, the level of issuance and the level of downgrades. Large increases in the number of new issues are typically indicative of a period of easily available credit and the loosening of credit standards. This is more likely to occur during times of economic expansion, as was seen in the period preceding the 2008 financial crisis. Conversely, increased numbers of downgrades usually occur in recessionary periods when companies' overall financial outlook deteriorates (Moyer, 2005).



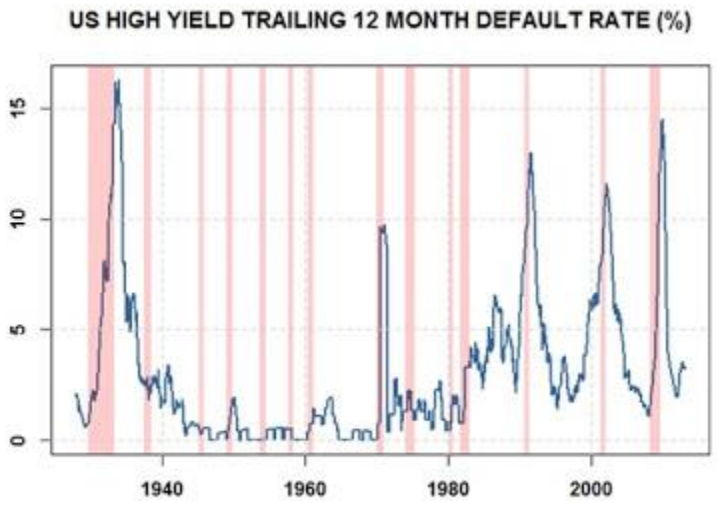
Source: standardandpoors.com

High rates of inflation can potentially help delay bankruptcy by helping fragile firms inflate their way out of debt. While interest payments on some debt are tied to benchmark rates, principal and fixed interest payments can be paid down with "cheaper" money. Price increases are typically passed along to the consumer, resulting in potential temporary increases in profits because of artificially low inventory and depreciation book values. This can help weaker firms survive for a longer period of time than they would under normal conditions. It is documented that unexpected price increases are inversely correlated with business failure rates.

Financial Market Indicators

While somewhat counterintuitive, investor expectations as reflected in the equity markets can also play a role in influencing business failure rates. While typically both falling stock prices and business failures were considered to be leading indicators of business downturns – both likely influenced by expectations of deteriorating economic conditions – there may be a more direct relationship between the two. Referring

to the earlier discussion on definitions, bankruptcy insolvency was defined as the case when the fair value of a company's assets is less than its liabilities. Since the book value of assets on the balance sheet may not be an accurate indicator of the economic fair value, accounting measures may mask the true net worth of the firm. A struggling firm with negative true net worth that is still able to meet its near-term obligations will be reluctant to voluntarily file for bankruptcy if management is optimistic about the company's future prospects. Equity markets provide external validation that may or may not support management's outlook as well as a more accurate valuation of the firm's net worth. As such, a drop in the stock price to a negligible value may precipitate a bankruptcy filing that may have been delayed if the stock was still trading at some tangible positive value. As aggregate equity prices are more likely to fall during bear markets, it could be argued that the incidence of bankruptcies increases *as a result of* falling stock prices. Investor expectations as reflected through bond yield spreads provide another variable that is correlated with business failures. Across all time periods, investors expect a higher return from risky assets relative to risk-free assets, or from assets that are less risky. The spread between yields on junk bonds and investment grade bonds will always be positive because of the risk premium. However, it is well documented that the risk premium varies in magnitude over different time periods. As investors become less optimistic about the overall economic outlook and the ability of firms to fulfill their financial obligations, the spread between risky and risk-free bonds (i.e. the general credit risk) widens. At the same time, the relative spread between high risk and low risk securities also widens in magnitude; the increased level of uncertainty impacts riskier assets proportionately more as investors lose their appetite for risk. Since this often occurs during periods of economic stress when business failure rates are at increased levels, the two variables will likely be correlated (Altman, 1983).



Source: http://macronomy.blogspot.com/2013/03/

1.3 Failure Trajectories

Argenti (1976) proposes a dynamic failure path and three distinct trajectories that a failing business can take. The dynamic failure path is laid out as follows: companies with defective management structures (for example, as discussed earlier) tend to first neglect accounting information systems and fail to respond to changes in the environment. Then, they over-expand beyond their capacity and increase their leverage above unsustainable levels, thus becoming highly vulnerable to external factors ("normal business hazards") that more sound firms are able to withstand. As a result, financial ratios start to deteriorate, and the company begins to employ creative accounting methods to delay its inevitable collapse. However, because not all companies display all of these symptoms or experience the same sequence of events, Argenti proposes three broad types of trajectories that he believes account for the vast majority of business failures.

Type 1 failures occur when a new business is simply unable to reach the necessary level of economic or financial viability, and eventually fails. While Argenti fits each trajectory into the dynamic failure path described above, it is reasonable to assume that new businesses may experience this scenario for a variety

of reasons other than those listed. The company's performance falls below expectations, which (as discussed in an earlier section) can occur due to an uncompetitive product, a poor business plan, or mismanagement. *Type 2* failures are young companies that are able to attain initial success and viability, but then stumble as they grow too quickly and over-expand beyond their capacity. The reasons for the eventual failure are due to any number of mismanagement causes, and failure occurs despite the fact that there is sufficient demand for the company's products. Lastly, *Type 3* failures are mature, relatively established companies that at some point lose their competitive edge and experience falling profitability. This results in a slow gradual process, where an initial collapse leads to a plateau before the final collapse and failure of the company. Again, a variety of business and financial causes can lead to this type of scenario.

Argenti estimates that 50-60% of failures are Type 1, which seems like a reasonable figure given the estimation by Altman (1983) that over half of the failures occur within the first five years of a company's life. The remainder is mostly Type 3 failures (20-30%), while incidences of Type 2 failures are fairly uncommon.

1.4 Mitigating Factors

Some companies may be able to reduce their downside business risk as a result of specific structural factors that help mitigate the impact of downturns. These "absorption factors" – which include size, diversification, excess resources, and low fixed costs – can help some companies withstand external changes in the environment better than less fortunate rivals (Sull, 2009).

Larger companies have the benefit of additional resources to weather difficult times. They also possess many assets that can be sold in the event of a downturn, and the ability to scale back operations if necessary. Shutting down plants and laying-off employees may not be an optimal corporate strategy, but it could help a firm stay solvent long enough to eventually recover. A large firm may also support an ecosystem of suppliers, customers or local government supporters; this ecosystem may be helpful in

helping the firm overcome difficult times by extending credit for inputs or by providing pre-payments for orders. (However, size often increases the level of complexity, which can increase risk and fragility).

Diversification of cash-flows arising from a diverse collection of product lines or segments can reduce the downturn risk for a company in the same way that a diversified portfolio of stocks reduces the overall portfolio risk for an investor. If the market segments in which the company operates are sufficiently uncorrelated, then downturns in one segment can be offset by robust performance in other segments. Geographical diversification can also help mitigate the impact downturns if the business units are in regions that are diverse enough to be uncorrelated.

Having a large amount of cash on the balance sheet can certainly serve as a buffer against adverse events and help prevent insolvency. Other assets, such as real estate, can also be a source of stored value, which can be liquidated if needed. Intangible resources, such as brand, IP or specialized core capabilities can be helpful in protecting a company against changing market conditions. Ironically, excess staff, while detrimental to overall company performance during normal times, can actually act as a store of value as well. A company with too many employees has the ability to reduce costs significantly through layoffs, thus providing an extra layer of "fat" that can be shed during difficult times.

Additional factors like barriers to entry can help firms in distress buy time to work through their problems by preventing competitors from having easy access to their market. High customer switching costs can also be an especially useful feature which can provide some protection during difficult times. Low fixed costs give firms the ability to withstand sustained decreases in gross margins and volume declines. Whether caused by price pressure, increases in input costs or overall declines in demand, these changes can have a large impact on firms with high levels of operational leverage.

All company-specific causes of business failure and bankruptcy can be classified as "mismanagement". The financial characteristics discussed in the previous section do not arise on their own, but are the results

– or symptoms – of poor decisions made at some level of the organization. Problems with working capital management or disproportionate levels of current assets can arise as a result of either business decisions that led to poor sales or financial decisions that led to a lack of liquidity. Unsustainable operating or financial leverage levels are either a result of a conscious decision to take on additional risk or a due to a lack of oversight by management. The same logic applies to non-financial causes – an uncompetitive product or an unsustainable business plan is also a result of a poor decision or critical oversight. Even failure as a "result" of external causes, such as business cycle downturns or unforeseen industry shifts, can be attributed to some form of mismanagement that made the failing firm somehow more fragile than the surviving competitors. (It's important to note that while some instances of mismanagement are detrimental in an absolute sense, some may be relatively harmful. Since companies compete for survival against a set of competitors to reach a particular segment of customers, decisions cannot be evaluated in a vacuum; relative degrees of mismanagement are crucial). Poor leadership – or what has traditionally referred to as poor management – is another type of mismanagement resulting from inefficient decision-making by senior managers in leadership positions, or from a poorly designed organizational structure. Conversely, the opposite can be said about the mitigating factors that may help prevent bankruptcy. As such, it is extremely difficult to identify the exact causes of a particular case of business failure, or to generalize broadly across companies and industries. Despite this, the company specific factors discussed above frequently arise as a result of diverse and often unknowable (to the outside observer) types of mismanagement. Because financial "symptoms" are the only factors that are evident on the outside, it makes sense to focus on them in Part II, which addresses the various methods developed to predict bankruptcy and corporate failure.

Part II: Prediction Methods

This section details the various approaches for analyzing corporate risk and predicting corporate failure. It first describes the basic credit analysis process from the perspective of lenders and credit agencies as a method for credit evaluation and prediction of default and then provides insight into how debt ratings for corporate bonds are assigned. Next, it provides a detailed overview of financial ratio analysis as a prediction method and provides an overview of the main statistical prediction models developed by academics. It concludes with a discussion of the implications of the model findings with respect to the causes of corporate failure as detailed in Part I.

2.1 Lender Credit Evaluation

Since insolvency, distress, and bankruptcy are all essentially consequences of the inability of a company to pay off its debts, it is important understand how lenders evaluate the credit capacity of a borrower. The earlier section on leverage levels presented several theories how companies establish their debt levels and presented the argument that there is no one-size-fits-all optimal capital structure. In practice, however, there are leverage levels above which prudent lenders would not continue to lend to a firm. Because of this, any effective method of predicting bankruptcy must incorporate these concepts into its methodology.

Credit Risk

To a lender, the borrower's credit risk is defined as the probability that the contractual payments associated with a loan – the interest and principal – are not repaid within the specified time period. Various financial and non-financial characteristics influence a borrower's level of credit risk. The financial factors include the borrower's current leverage level, the priority of the lender's loan relative to the existing debt, and the duration of the loan period. A high level of existing debt increases the credit risk because it places additional obligations on the borrower's cash flows and assets (in the case of liquidation) that could undermine the timely repayment of the loan. The priority or level of subordination

indicates where the lender's claim will be relative to the other lenders in the case of a liquidation of the borrower's assets; a lower priority increases the credit risk. A longer loan term period increases the risk that the company's actual performance deviates from the projected performance and also that other debt will need to be repaid before the loan principal becomes due. As such, the credit risk increases with the time duration of the loan period. Each of the three factors is inherently interrelated and must be accounted for on a relative, not absolute, basis. (Covenants, discussed in the earlier section on leverage, are a way to mitigate the lender's risk exposure to these factors).

The key non-financial factor that influences credit risk is the credit support for the loan, or the source of the funds that will be used to repay the loan. Any unsecured loan made to a company is implicitly backed by the present and future cash-flows generated by that company. Several factors can undermine the viability of those cash-flows from the lender's perspective. The company may be unable to generate a sufficiently high level of cash to satisfy the lender, the cash-flows may be too volatile and unpredictable, or too many other creditors may be competing for the same limited amount of funds. If this is the case, the lender can choose to make a secured loan where collateral is used as the credit support. As discussed in the earlier section on leverage, the collateral can be either in the form of a specific asset or a general lien on a collection of the firm's assets. The lender's rationale is that even if the company defaults on the loan, the loan principal can be repaid from the proceeds of the sale of the collateral. Therefore, the credit support for a particular loan can be classified as cash-flows or collateral.

Credit Capacity

Assessing the level of debt that can be sustained by the capital structure involves an analysis of the firm's credit capacity. Credit capacity is determined by either the level and stability of operating cash-flows (for unsecured debt) or the value of the collateral (for secured debt). It is a risk-adjusted measure in the sense that it is dependent on the desired confidence level of recovering the loan; a higher confidence level will lead to a lower credit capacity measure, and vice versa. Cash-flow support is the most stringent and most often used method for determining credit capacity. It is based on forecasting the overall level, growth and

stability of the future cash-flows to determine if the borrower can fund the timely repayment of the loan. Bank loans, unlike bonds, typically require periodic repayment of loan principal as well as interest throughout the life of the loan. This reduces risk by lowering the lender's exposure over time, and by also minimizing the probability that refinancing (which may or may not be an option) is needed to repay the loan principal at maturity.

Cash-flow Forecasting

The operating cash-flow forecast is highly subjective and is heavily dependent on the lender's judgment. Typically, EBITDA (earnings before interest taxes depreciation and amortization) is used as a simplified proxy for operating cash-flow to ensure the comparability between firms. The rationale for using EBITDA is multifold. For valuation purposes, interest expense is ignored in order to effectively compare results between firms with different levels of financial leverage, which represents a capital structure decision. (However, during credit analysis, the interest expense is examined closely and is taken into account at a later stage). Depreciation and amortization are ignored because they represent non-cash entries. Additionally, depreciation charges represent a firm's past capital investment decisions, which are not directly comparable between companies and should thus be ignored; only the cash-generation potential of the assets is relevant. Lastly, taxes are ignored despite the fact that they are a cash expense and are relatively uniform across companies. The reasoning behind this is that the taxable income calculation takes into account interest expense, depreciation and amortization, which again distorts comparability between firms. Despite the relative ease of calculation, the use of EBITDA presents several limitations. First, changes in working capital – which can reduce actual cash-flow – are not taken into account. Capital expenditures are also ignored, under the assumption that they are discretionary during a particular period and can be ignored. However, this may or may not be true, depending on the capital intensity of a particular business. (During credit analysis, current and future capital expenditure projections are typically used). As such, EBIT may be a better proxy in some instances because it assumes that depreciation is equal to the replacement and maintenance costs of the assets. Lastly,

EBITDA may need to be adjusted for one-time non-recurring charges (Ganguin & Bilardello, 2005; Moyer, 2005).

Credit Evaluation

The ability to repay the loan using internally generated cash-flows after interest expenses and capital expenditures is analyzed under various operating scenarios to establish the borrower's credit capacity. Projected EBITDA volatility – whether due to industry cyclicality, high operating leverage, or other factors – makes it more difficult to assess debt repayment ability, and therefore lowers the firm's overall credit capacity. Conversely, stable and predictable cash-flows increase the debt capacity. Several ratios such as Debt/EBITDA and EBITDA/Interest Expense are used to benchmark relative leverage levels across different time periods and between firms.

Along with the ability to fund repayment internally, other factors such as asset coverage, refinancing ability, and interest expense coverage are used to assess credit capacity. Asset coverage is similar to the notion of collateral support for a secured loan except that all of the assets of the firm are taken into account (not just those assets in which the lender has a security interest). The total asset value of the firm should sufficiently exceed the nominal value of the total debt. Asset coverage is typically measured as the ratio of enterprise value to total debt. The ability to refinance the loan at the end of the loan term is another critical element of borrowing capacity. If the internally generated funds are insufficient to completely repay the loan, the unpaid balance can be repaid by taking out a new loan. Asset coverage plays an important part in the firm's ability to refinance, given that it's difficult to borrow additional debt or raise additional equity if the firm has a negative net worth. Credit market conditions and short-term liquidity constraints, such as clustered debt maturities, could also impact refinancing ability. Lastly, interest expense coverage is an additional constraint on credit capacity. Typically measured as EBITDA over total interest expense, this gauges the probability that the borrower will default on an interest payment. If there isn't a sufficient cushion between the level of projected cash-flows and interest expense payments, any negative EBITDA volatility would result in either interest payment default, or the

avoidance of necessary capital expenditures. Either would be detrimental to the lender, the former directly, and the latter via its negative impact on the cash-generation capability of the firm going forward. Other forms of credit evaluation by lenders also take into account the general character and prior repayment history of the borrower (Moyer, 2005).

2.2 Debt Ratings

One of the most easily accessible predictors of financial distress for large companies is the bond rating provided by large rating agencies such as Moody's, Standard & Poor's (S&P) or Fitch. The rating represents the agency's best estimate of the probability of default by the company combined with the recovery expectation on the particular bond issue. A default is defined as the failure to make an interest or principal payment as specified in the bond contract, and the recovery expectation is what the creditor can expect to recoup if a default occurs. Together, the two measures represent the probability of loss to creditors. Understanding the methodology used by the rating agencies provides another perspective on how to predict corporate failure and bankruptcy.

In theory, rating agencies should be able to generate a superior assessment of a company's financial health due to better access to information. Unlike general market participants, agencies often obtain privileged access to nonpublic information and benefit from extensive in depth interactions with senior management. Often, companies are precluded by regulations from sharing similar types of information with investors. Also, given that the rating will significantly influence the company's cost of capital, managers are incentivized to comply with the agencies' requests for information as fully as possible. Firms are not required to obtain ratings, but instead pay the agencies to rate their debt offerings in order to reduce their cost of capital; investors will typically accept lower interest rates on higher rated debt. Fees paid to the rating agencies are the same regardless of the outcome of the rating process. In addition to a rating, the agencies also issue an outlook – stable, positive, or negative – that indicates the most likely progression of the rating over the subsequent two to three years.

Calculation Methodology

The main factors that influence overall credit ratings include debt ratios, return-on-assets (ROA), earnings variability, company size, interest coverage ratios, and subordination (of the specific debt issue). Ganguin and Bilardello (2005) provide an overview of the specific factors that go into S&P's credit scoring methodology. The overall score is derived from a credit score matrix that is subdivided into five categories ranging from 'very low risk' to 'very high risk'.

The *business risk* of a company is comprised of overall industry risk and company-specific factors. The key competitive factors for a particular industry are identified, and the firm is judged on how well it ranks against those factors. Industry risk is defined as the risk of a financial decline due to external factors such as structural shifts in consumer preferences, cyclicality, product obsolescence, or increases in competition. The goal of industry analysis is to assess the short- and long-term sales growth prospects of the industry, and also to determine how the target firm is positioned within the industry. Even though all participants face the same risks, each company is affected differently due to management actions; however, unfavorable industry characteristics can limit the credit quality of all of the competitors in that space. The characteristics that increase the variability of the company's performance – such as sales growth prospects, level of cyclicality, and barriers to entry – are especially important, as are industry-specific risk factors like regulation or infrastructure requirements. In the evaluation of the company's position, these factors are weighted to reflect their contribution to the sector's performance. (For example, in the forestry sector, where cost-leadership is critical, cost-position is given the largest weighting in the evaluation. Geographic and product diversity and degree of vertical integration are also important, but to a lesser extent and are thus given a lower weighting). The evaluation of company-specific factors focuses on competitive analysis, market position, earnings stability, financial flexibility and asset base quality. The management of the company is evaluated closely on the basis of performance, risk-tolerance, and financial policies especially as these elements relate to the support of the credit quality. The cumulative

impact of industry risk, company-specific risk, and management competence is used to determine if the company has high, low or average risk on a qualitative basis.

The evaluation of the company's *financial risk* is based on a firm's profitability level, balance sheet strength, cash-flow adequacy and financial flexibility. Historical and prospective credit ratios (based on cash-flow forecasts) are used to score the first three measures. Profitability measures include profit margins, return-on-investment (ROI), and growth rates viewed in the context of historical trends, future projections, and peer comparisons. These help evaluate the efficiency of the company's operations, the profitability of the investment decisions, and the company's rate of growth. Examples of the key ratios for each category are shown below.

Profit Margins	Returns On Investment	Growth
Net Income/Revenue	Net Income/Equity	YOY % Change Revenue
EBIT/Revenue	Net Income/Total Assets	YOY % Change EBIT
EBITDA/Revenue		YOY % Change Net Income
FFO/Revenue		

The balance sheet is evaluated for the purposes identifying the total amount of debt obligations and determining balance sheet quality. Debt obligations include everything from traditional debt securities to complex structured transactions involving asset-backed securities and project financing arrangements. Other financial obligations that must be taken into consideration include items such as operating leases, guarantees, pension obligations, potential litigation settlements, and many other examples. The quality of the balance sheet is determined not only by the overall leverage level, but also by the quality of the leveraged assets. High-quality assets with stable values and reliable cash-flow generation potential can withstand more leverage than low-quality assets with uncertain values and variable cash-flow potential.

Leverage Ratios
Total Debt/Total Debt + Book Equity
Total Debt + Off-Balance-Sheet Debt/All Debt + Book Equity
Total Debt/Total Debt + Market Value of Equity

The evaluation of the firm's ability to generate cash-flows represents the cornerstone of the credit analysis. The relevant credit ratios track overall debt payback, interest payments and capital investment. Debt payback ratios track how much cash a firm generates in relation to its total debt level, while payment ratios measure the amount of cash-flow available for making interest and principal payments. Additionally, capital investment coverage ratios track the amount of cash available to finance capital expenditures.

Debt Payback	Payment	CAPEX Coverage
FFO/Total Debt	EBITDA/Interest	FFO/CAPEX
OCF/Total Debt	FCF + Interest/Interest	OCF/CAPEX
Total Debt/EBITDA	FCF + Interest/Interest + Annual Debt Maturities	
Total Debt/Disc. CF		

Financial flexibility refers to the company's ability to avoid default by maintaining options to for obtaining the necessary cash in case of an emergency. This liquidity analysis is qualitative in nature and brings together the business risk, financial policies and corporate strategy to understand the company's immediate and projected financial situation. A liquidity event can arise from unexpected external events or from regular operating activities such as debt maturities. Sources of additional liquidity may include cash and liquid assets, asset sales, and CAPEX flexibility.

Each of the elements of financial risk is then weighted to reflect its relative importance, with cash flow adequacy typically given the highest weight. If the debt service ratios are marginal, then financial

flexibility becomes more important, and should thus be given more weight. The overall credit score for the company is then determined by combining the business and financial risk scores into an overall weighted score. The weighting between the two categories is subjective in that the business risk weighting increases for companies with lower business risk. This adjustment allows companies with stable and predictable cash-flows to maintain higher levels of financial risk and more aggressive credit ratios. The general rule is that more emphasis should be placed on the financial score for companies with less stable business performance. The final corporate credit score represents a measure of the ability of the company to pay its debt obligations in a timely manner, or the firm-specific default probability. A separate recovery score is assigned to measure the recovery that a creditor can expect in the case that a default does occur. Recovery values are assessed based on the type of debt instrument, level of subordination and collateral type (Ganguin & Bilardello, 2005). An example of the disparity in financial ratios between low and high credit risk scores is shown below.

Standard & Poor's 'AA' Rating Ratio Medians, 2000–2002[1]

	Total Debt/ Capital (%)	Funds from Operations/ Total Debt (%)	Free Operating Cash Flow Total Debt (%)	EBITDA Interest Coverage (x)
2002	37.6	66.2	36.8	15.9
2001	36.6	66.3	36.7	14.7
2000	37.0	54.5	17.9	12.2

Source: Standard & Poor's CreditStats

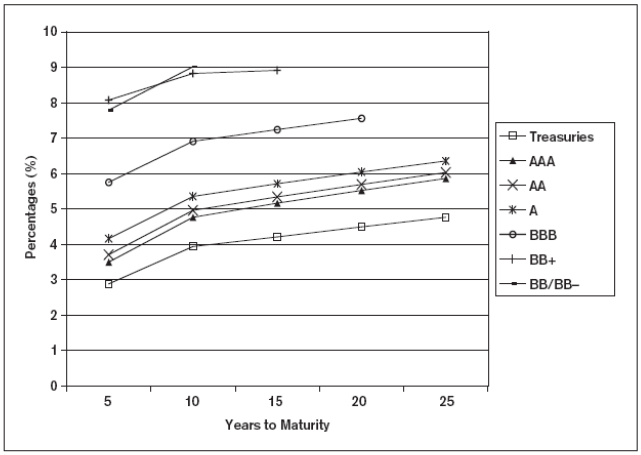
Standard & Poor's 'B' Rating Ratio Medians, 2000–2002[1]

	Total Debt/ Capital (%)	Funds from Operations/ Total Debt (%)	Free Operating Cash Flow Total Debt (%)	EBITDA Interest Coverage (x)
2002	78.5	10.8	2.5	1.8
2001	80.0	8.7	1.6	1.6
2000	81.8	8.4	(1.5)	1.6

Source: Standard & Poor's CreditStats

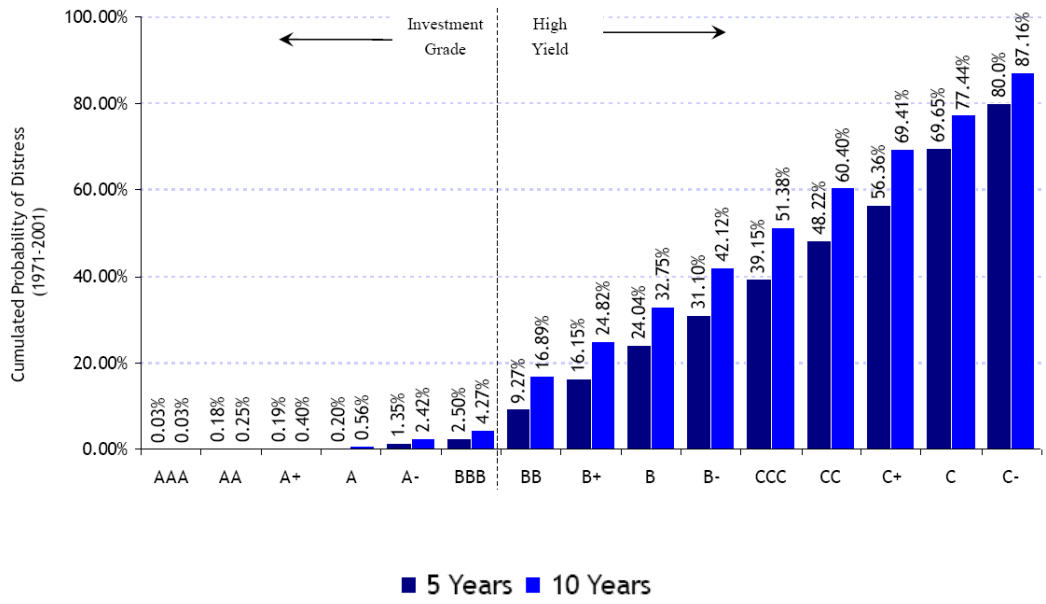
Predictive Ability

On a relative level, the ratings seem to reflect the probability of default over time. For example, since 1981 the number of AAA-rated bonds (at issue) that have defaulted within 10 years of issue is less than 0.5% while the default rate for CCC issues is over 50%. Credit ratings also appear to reflect relative risk levels as exhibited by debt pricing spread levels. The yield of a debt security is comprised of the risk-free rate the risk premium. The risk premium, or spread, reflects the credit risk and liquidity premium of the instrument. The former is determined by the aforementioned default probability and recovery expectation, while the latter is a factor of the supply and demand characteristics of the market. Credit ratings appear to be a good proxy for credit risk when pricing bond, because there is a significant correlation between spreads and ratings.



Source: Standard & Poor's Global Fixed Income Research

Despite this, rating agencies are sometimes faulted by investors for failing to adjust to adverse developments in companies' financial or economic circumstances in a timely manner. Also, because companies expecting a low rating can elect to issue non-rated debt, the ratings system is inherently biased towards relatively higher-quality issuers. Accordingly, non-rated bonds have overall higher default levels on average (Moyer, 2005).



Source: Altman and Kishore (2001)

Debt Pricing

The market price of publicly traded debt can also be used to infer the probability of default that is expected by investors. The methodology for calculating the implied default probability is conditional on knowing investors' recovery expectation in case of default. In a simplified form, the current price of the bond represents the probability-weighted average of two scenarios discounted at the risk-free rate: full recovery if the bond is repaid at maturity and partial recovery if the bond defaults. If the bond has coupon cash-flows remaining, the calculation is adjusted to reflect the conditional probability of non-default in each previous period. By making assumption that the probability of default during each coupon period remains the same, the formula below can be used to calculate the implied probability of default (Perry, 1995).

$$P = \sum_{i=1}^{n} \frac{c_i (1-d)^i + Rd(1-d)^{i-1}}{(1+r_i)^i}$$

where
P = dirty price of bond
c = cashflow
d = *the* probability of default in this period
R = *recovery* proceeds in event of default
r = *risk* free discount rate

2.3 Financial Ratio Analysis

A common bankruptcy prediction method is the use financial statement ratios to identify firms that are relatively weaker financially than their counterparts. Ratios can be compared within the firm over time or across a subset of comparable firms at given point in time. A change in a company's financial ratios can either be a sign that its financial condition has changed or that management has made a change in response to external circumstances. While the ratios themselves are highly objective quantitative measures, the causes that lead to a change in the ratios are often subjective in nature. Nevertheless, the evidence seems to indicate that, on average, there are substantial differences in the key ratios of failed firms versus their surviving counterparts.

Types of Financial Ratios

It's possible to calculate many different kinds of financial ratios, but only a subset of them are relevant to bankruptcy prediction. Generally, the types of ratios can be categorized into four broad categories according to the way they are calculated and the overall intent of the measurement. *Coverage ratios* measure the company's ability to meet a specific obligation. *Return and turnover ratios* measure the net and gross benefits gained, respectively, relative to the amount of resources expended. Lastly, *component percentage ratios* measure the relative size of a component of an item to the entire item. Grouping the ratios by area of focus produces six major categories that help evaluate the company's operating performance and financial health from various perspectives.

Liquidity ratios evaluate the firm's ability to meet current liabilities as they come due through the use of assets that are readily convertible into cash. Several commonly used liquidity ratios are listed in the table below. In general, higher ratios indicate a better ability by the company to satisfy immediate obligations, although levels that are too high may indicate an inefficient use of assets.

Current Ratio	Current Assets/Current Liabilities
Quick Ratio	Current Assets – Inventory/Current Liabilities
Net Working Capital to Sales Ratio	Current Assets – Current Liabilities/Sales

Profitability ratios reflect the ability of the company to turn sales revenue into various types of income, and are expressed as a portion of each dollar of sales. This helps evaluate the performance of different aspects of the business. For example, the commonly used ratios listed below measure how much of each dollar is left after cost-of-goods-sold, operating expenses, and all expenses respectively are taken into account.

Gross Profit Margin	Gross Income/Sales
Operating Profit Margin	Operating Income (EBIT)/Sales
Net Profit Margin	Net Income/Sales

Activity ratios measure how effectively the company is using its assets to generate revenue and can help identify inefficiencies in various parts of the operating process. Activity ratios can focus on specific items such as inventory or accounts receivable, or more generally on the firm's assets as a whole. For example, Inventory and Accounts Receivable ratios measure how many times inventory and credit sales have been created and reduced during a period respectively, while Total and Fixed Asset Turnover ratios evaluate the effective use of assets to generate sales.

Inventory Turnover	COGS/Inventory
Accounts Receivable Turnover	Credit Sales/Accounts Receivable
Total Asset Turnover	Sales/Total Assets
Fixed Asset Turnover	Sales/Fixed Assets

Financial leverage ratios measure the overall amount of debt financing used by the company and consist of component percentages and coverage ratios. The former evaluates the level of debt relative to its overall capital structure, while the latter reflects the ability to meet fixed payment obligations. Coverage ratios are frequently used in bank loan covenant agreements to assure the lender that the company has sufficient inflows to service its loans.

Total Debt to Assets Ratio	Total Debt/Total Assets
Long-Term Debt to Assets Ratio	Long-Term Debt/Total Assets
Debt to Equity Ratio	Total Debt/Total Shareholder's Equity
Interest Coverage Ratio	EBIT/Interest
Fixed Charge Coverage Ratio	EBIT + Lease Payments/Interest + Lease Payment

Lastly, *shareholder ratios* focus on evaluating the returns to the owners of the company. These ratios are of less relevance to creditors and managers because of the focus on returns on a per-share basis, such as earnings-per-share and dividend yield (Drake & Fabozzi, 2010).

Predictive Ability

Some of the earliest research on the topic of using financial ratios to predict financial failure was performed by Beaver (1966) using a univariate analysis method. The theory of ratio analysis explains the reasoning behind the methodology and the specific ratios chosen for the study. The theory views the firm as a "reservoir of liquid assets" that is filled by cash in the form of sales revenues (or financing) at one end and drained by outflows in the form of expenses on the other. The inflows are variable in nature, and the reservoir provides a necessary cushion when inflows and outflows are mismatched. Failure can be defined as the instance when the reservoir is drained and the company cannot pay its expenses or otherwise fulfill its financial obligations. This approach has four important implications when considering the probability of failure. First, the size of the reservoir is important since a larger reservoir reduces the likelihood of insolvency. The net flow of funds from operations is also critical, since higher cash-flows

have a similar beneficial effect of increasing the reservoir. Conversely, debt levels and operating expenses decrease it, and therefore higher levels of either increase the probability of failure. As such, the ratios that represent each of these components should vary, on average, between failing and non-failing firms.

The six ratios selected for the study were those that represented each category and had been previously accepted by practitioners or academics as reflecting key relationships within an organization. The ratios and their potential implications for failing firms are listed below.

- *Cash-flow to Total Debt*: this is a typical coverage ratio that measures how much cash is coming into the firm relative to the size of its total debt obligations. A higher ratio indicates that the company has plenty of cash coming in to pay interest and pay down debt and is thus less likely to go bankrupt. (It is very similar to the EBITDA coverage ratio discussed in the bank credit analysis section earlier).
- *Net Income to Total Assets*: this ratio is more commonly known as the return-on-assets (ROA) measure, which gauges how profitable the company is relative to the amount of assets it employs. While the ROA varies across companies and industries, a higher ratio would indicate that a firm is less likely to fail.
- *Total Debt to Total Assets*: this a common financial leverage ratio that measures how much of the company's assets are financed by debt. As previously discussed, while the optimal level of debt is highly dependent on the specific company, overall bankruptcy risk increases as more debt is added to the capital structure.
- *Working Capital to Total Assets*: in this ratio the numerator, net working capital, represents the difference between current assets and current liabilities. This is a measure of the company's near-term liquidity, and overall financial health. The dollar value of net working capital represents the amount of current assets financed by long term debt, which if substantial, decreases the chance that the company will face a short-term liquidity crisis in the near future. The denominator in the ratio adjusts the working capital level to the size of the company, which

makes it possible to compare across firms. While an extremely low level of working capital can indicate an imminent liquidity problem, there is generally no optimal level that can be deemed appropriate for all companies.

- *Current Ratio*: this is a very common measure of liquidity that measures current assets over current liabilities. This similarly measures the company's ability to handle short-term obligations, and a low level could indicate potential liquidity issues.
- *No-Credit Interval*: this is a somewhat less common ratio, which is calculated as net working capital (current assets minus current liabilities) over the amount of daily operating expenses. It measures the length of time that a company could finance its current daily expenses from its liquid assets, provided that it made no additional sales. The implication is that this value gauges the level of surplus cash relative to the company's regular expenditures. This represents another measure of liquidity; a higher ratio indicates a lower probability of failure.

The study was performed by using a paired selection of a failed and a non-failed firm of a similar size within the same industry. This method helped to control for industry and size factors that might otherwise influence the relationship between the ratio level and the failure probability. For one part of the analysis, the difference of the mean values for each of the ratios was computed for each pair of firms in each year up to five years before failure. The results showed that there were indeed significant differences in the mean values of failed and non-failed firms that are evident as early as five years before bankruptcy and these differences intensified over time as failure became imminent. A dichotomous classification test was then performed to identify which of the ratios had the most predictive power. The cash-flow-to-total-debt (CFTD) ratio performed best, and the net-income-to-total-assets (ROA) ratio performing second best; however, the two ratios had the highest correlation out of any of the ratios. The total-debt-to-total-assets (TDTA) ratio also performed well, while the three liquidity ratios showed the least predictive power (Beaver, 1966).

Beaver et al (2005) performed a similar mean ratio comparison across firms using an updated sample period and found similar results. Relative to the means of non-bankrupt firms, bankrupt firms differ substantially on measures of ROA, EBITDA/TL, and TL/TA as early as four years prior to failure. The unfavorable characteristics of decreased profitability and poor cash flow combined with high leverage become more drastic as failure approaches. These results are consistent with Beaver's initial findings discussed above. Subsequent research on the predictive power of financial ratios has included multivariate analysis methods such as linear regression, discriminant analysis, logistic regression and hazard analysis.

2.4 Altman's Z-score

One of the most well-known and widely-used bankruptcy prediction models is Altman's Z-score. This model was developed using an approach is based on a statistical technique called multiple discriminant analysis (MDA) and was one of many multivariate analysis studies that built upon Beaver's initial findings. MDA is a statistical approach borrowed from the biological and behavioral sciences that is used to classify an observation into one of multiple pre-determined groups based on the specific characteristics of that observation. In this application, the groups consist of the qualitative classification of bankrupt or non-bankrupt and the characteristics are selected financial ratios. The MDA model attempts to derive a linear combination of ratios that best discriminates between the bankrupt and non-bankrupt classification, and determines a set of discriminant coefficients. The coefficients are the appropriate weights that will separate the financial ratio values between the two groups as much as possible, while minimizing the statistical distance of each ratio from its own group mean. The discriminant coefficients can then be applied directly to the financial ratios within the discriminant function to produce an overall Z-score that can be used to classify the firm into one of the aforementioned categories. Compared with univariate analysis, this approach allows for the consideration of multiple characteristics at once, thus capturing any interaction effects.

Sample and Metrics

Similar to Beaver's analysis, the sample of firms used for analysis consisted of a paired set of bankrupt and non-bankrupt firms. Given the time period, 1946-1965, most of the firms were in the industrial and manufacturing sectors. The pairs were chosen to be reasonably similar in size and industry classification, and extremely large and small firms were eliminated from the sample. The initial pool of variables consisted of 22 key ratios across the five aforementioned category types. The ratios were selected based on popularity in academic literature and relevancy to the study; several novel ratios were developed as well. The final combination consisting of the five key ratios was derived after the evaluation of various profile combinations based on the statistical significance of the individual variables, the correlations between variables, and the overall predictive accuracy. The variables in the final profile are not necessarily the most significant predictors when evaluated independently, but the profile as a whole outperforms alternative combinations in predictive accuracy. The final discriminant function is described as follows:

$$Z = 0.012(WC/TA) + 0.014(RE/TA) + 0.033(EBIT/TA) + 0.006(MVE/TL) + 0.999(S/TA)$$

WC/TA	Working Capital/Total Assets
RE/TA	Retained Earnings/Total Assets
EBIT/TA	Earnings Before Interest and Taxes/Total Assets
MVE/TL	Market Value of Equity/Total Liabilities
S/TA	Sales/Total Assets

Ratio Significance

The WC/TA ratio was found to be the most valuable out of the three liquidity ratios that were tested (the Current Ratio and the Quick Ratio were also evaluated), although it was the least important contributor overall. This ratio was also highlighted in Beaver's analysis, and was also found to have lower predictive power relative to the other ratios in the study. To reiterate, the underling rationale is that a firm with

consistent operating losses will experience a decline in current assets (and thus working capital) and will be more likely to experience an adverse liquidity event. The RE/TA ratio, one of the "new" ratios referenced earlier, measures overall cumulative profitability via the amount of reinvested earnings over a firm's entire life. This implicitly penalizes younger firms, but since as discussed earlier it is more likely that a younger firm will go bankrupt, the bias is justified. This ratio also implicitly measures the leverage level, as firms with high levels of retained earnings have less reliance on external capital. (In later revisions of the model, the impact of this ratio was mitigated given the deterioration of average levels of retained earnings over more recent periods (Altman & Hotchkiss, 2005)). The EBIT/TA ratio, a variant of the ROA ratio highlighted by Beaver, is a measure the productivity of the firm's assets. Given that the ability of a firm to derive a sufficient level of earnings from its assets is crucial to its long term survival and viability, the relevance of this ratio in the context of bankruptcy is straightforward. Also, to the extent that EBIT approximates the long-term cash-flow generation ability of the assets, it is also relevant from the perspective of the overall value of the assets in relation to the liabilities (which measures the firm's solvency level). (Altman notes that the use of EBIT instead of a cash-flow measure, which is less subject to manipulation, does not detract from the predictive ability of this variable. The reason that cash-flow was not used instead is not provided).

The MVE/TL ratio adds a market-based variable into the analysis, which was a novel idea at the time as previous studies had not considered factors that were found outside of the financial statements. The MVE is calculated as the combined market value of all common and preferred shares of stock, and the combined ratio is a gauge of how much the firm's asset value can fall before the firm becomes insolvent. This financial leverage ratio is a variant of the more commonly used debt-to-equity ratio discussed earlier. Lastly, the S/TA ratio is a common measure of the overall sales-generating ability of the firm's assets. Notably, while this ratio has the lowest significance out of any of the variables on an independent basis, it ranks as second highest in its overall contribution to the predictive power of the model. This result is due to its relationship to the other variables in the set.

Model Performance

All of the variables except S/TA were found to be significant, indicating that there were sizeable differences between the average ratios of bankrupt and non-bankrupt firms (measured at one financial statement prior to bankruptcy). As expected, non-bankrupt firms showed higher values; given that the discriminant coefficients have positive signs, a lower overall discriminant score (i.e. "Z-score") indicates increased potential for financial distress. Using an optimal cutoff score of 2.675 and data samples across various time periods, the model was between 82 and 94 percent accurate in predicting bankruptcy within one year of failure. Notably, however, the incidence of Type II errors has increased in more recent time periods. The authors speculate that this is due to the to the overall increased risk profile of companies; according to the model, as many as 25% of US firms have a financial profile that is more comparable to bankrupt than non-bankrupt firms. The ratios that have exhibited the most drastic deterioration are RE/TA and MVE/TL, indicating an overall increase in the use of debt funding over time. It is also possible to assign probabilities of default to various Z-scores by evaluating the average scores of firms across the bond ratings spectrum. Using the historical probability of default calculations for each rating class compiled by the ratings agencies it is then possible to estimate the implied Z-score default probabilities. The authors' analysis shows that the average Z-scores range from 6.2 to 0.33 for AAA-rated and CCC-rated firms respectively (Altman & Hotchkiss, 2005; Altman, 1983).

2.5 Other Predictive Methods

Numerous methods for bankruptcy prediction based on financial ratios or other related metrics have been developed since Altman created the original Z-score model nearly 50 years ago. From logit and hazard analysis applications to cash-flow and market-based models, these methods vary in their inputs and approaches. An overview of some of the most popular models is provided below.

Logit Analysis

Ohlson (1980) used conditional logit analysis to address some of the statistical assumption violation problems with studies that used Multivariate Discriminant Analysis. According to the author, the independent variables for the model were chosen for their simplicity, and are presented in the table below.

Financial Ratios	Other Variables
Total Liabilities/Total Assets	Size log(TA/GNP price-level index)
Working Capital/Total Assets	Total Liabilities > Total Assets (yes = 1,no = 0)
Current Liabilities/Current Assets	2Y Negative Net Income (yes = 1,no = 0)
Net Income/Total Assets	1Y Change Net Income
Funds From Operations/Total Liabilities	

The profile analysis suggests that the ratios deteriorate prior to bankruptcy as expected, and the results are consistent with Beaver's analysis discussed earlier. In terms of predictive ability, the model indicates that several of the factors are statistically significant. Size, the amount of financial leverage (TL/TA), some combination of income metrics (NI/TA and FFO/TL), and a liquidity measure (WCTA) are all important when assessing the probability of bankruptcy. The addition of extra factors to measure profit margin and intangible asset levels proved to be unhelpful, as these variables were not statistically significant.

Hazard Analysis

Some researchers claim that single-period classification models that use multi-period bankruptcy data are biased and produce inconsistent estimates of bankruptcy probabilities. Shumway (2001) proposes a simple hazard model that has several advantages over static models. Because bankruptcies occur over time, static models must select a specific time period when to observe a particular firm's characteristics – typically, the year before bankruptcy occurs. This approach ignores the data on healthy firms that will eventually go bankrupt and introduces a selection bias into the probability estimates. Conversely, a hazard model is able to use all available information to estimate bankruptcy risk across all time periods. The three main advantages of hazard models over static models in bankruptcy prediction are as follows. First,

static models do not control for the length of time before an "at-risk" firm files for bankruptcy. In a given sample period, some "at-risk" firms may fail quickly while others may be considered "at-risk" for a long period of time prior to eventually failing. Hazard models automatically adjust for period at risk, while the failure to do so introduces selection bias into a static model. Second, hazard models allow for the incorporation of explanatory variables that change over time. This permits for the use of financial time-series data by including annual observations as time-varying covariates, which is important given the propensity of failing firms' financial health to decline over time. This feature can also be used to incorporate macroeconomic variables that impact all firms during a specific time period. Lastly, because each firm year is used as a separate observation, hazard models allow for the incorporation of more data from a given sample than a static model. This increased number of observations should result in more precise probability estimates.

Shumway uses a number of financial ratios cited in previous research on bankruptcy prediction as well as several key stock market indicators as the independent variables. The full list of variables is listed below. The first column represents the variables used by Altman's discriminant analysis (as discussed above), the second by Zmijewski's logit analysis (Zmijewski, 1984), and the last shows the market-based variables added by Shumway.

Altman	Zmijeski	Shumway
Working Capital/Total Assets	Net Income/Total Assets	Market Capitalization
Retained Earnings/Total Assets	Total Liabilities/Total Assets	1Y Excess Return
EBIT/Total Assets	Current Assets/Current Liabilities	Idiosyncratic Standard Deviation
Market Equity/Total Liabilities		
Sales/Total Assets		

Shumway's rationale for including the market-based factors is based on the idea that traders will discount the market equity of a failing firm, which will lead to a lower market capitalization and decreased returns

over the year prior to bankruptcy. The idiosyncratic standard deviation of the stock price, sigma, is a proxy for the firm's cash-flow variability which should increase the bankruptcy risk.

For the first set of variables (Altman's variables), the hazard model coefficient analysis confirms that firms with higher earnings relative to assets (EBIT/TA), that are larger with fewer liabilities (ME/TL) and higher working capital (WC/TA) are less likely to fail. However, contrary to Altman's original discriminant analysis, the t-test finds that out of five variables, the only statistically significant bankruptcy predictors are EBIT/TA and ME/TL. Shumway claims this discrepancy is due to the bias inherent in Altman's analysis. The hazard model also performs significantly better than the discriminant analysis (and several other models based on the same variables) in the out of sample test for forecasting accuracy. For the second set of variables (Zmijewski's variables), the hazard model coefficient analysis confirms the original findings that firms with high income (NI/TA) and low liabilities (TL/TA) are less likely to fail; the current ratio (CA/CL) likewise is not shown to be significantly related to bankruptcy. While the coefficients are similar in magnitude, the hazard model shows that only NI/TA is statistically significant. Using these variables, the hazard model does not perform significantly better than any of the competing models. Lastly, the hazard model that combined the market-based factors with the financial ratios (in this case NI/TA and TL/TA) produced the best overall results. The coefficients in the model indicated that, as expected, larger firms with lower standard deviation and higher prior year returns are less likely to fail than their smaller, more volatile counterparts. However, neither the NI/TA nor the standard deviation variables are statistically significant. This combined model produced the best overall predictive results out of any of the other models in the study (Shumway, 2001).

Cash Flow Models

Unlike ratio-based models that derive most of their data directly from financial statements, Aziz, Emanuel, and Lawson (1988) developed a prediction model based on expected future cash-flows. The model is based on the principle that bankruptcy is the result of a fundamental inability, due to lack of cash, to pay down debt obligations as they come due. Therefore, current cash-flows and predicted future

cash-flows should be a good indicator of the probability of bankruptcy. The total value of the firm is derived as the combination of cash-flows from operations, lenders, shareholders and government (in the form of taxes and tax breaks). Comparing bankrupt and non-bankrupt firms using an MDA approach, the authors found that operating cash flows and taxes paid differ significantly between bankrupt and non-bankrupt firms in as many as five years prior to failure. This makes intuitive sense in that healthier firms should generate higher cash-flows and earnings due to a more efficient use of assets, and as such, pay out more in taxes. Also, using a logit regression model, the authors are able to attain prediction rates that are better than the Z-score model (Aziz, Emanuel, & Lawson, 1988). The full list of cash-flow variables is given below.

Operating Cash-Flows	EBIT + Depreciation + Change in NWC
Net Capital Investment Cash-Flows	Capital Investment less Proceeds
Cash Taxes Paid	Taxes Paid
Change In Liquidity	Change in Cash and Marketable Securities
Net Cash Payments to Lenders	Interest Paid + Net Change in LT and ST Debt
Net Cash Payments to Shareholders	Dividends Paid + Change in Common/Pfd Stock

Expected Default Frequency (EDF) Model

Another method of prediction that is not based on financial ratios is the Expected Default Frequency Model. The EDF model – an approach for estimating the default probability of a firm – was developed by the KMV Corporation, which was later acquired by Moody's. The theoretical concept behind the model is that when a firm's market value of equity drops below a certain level relative to its liabilities the firm will default. The process for determining the EDF of a company is comprised of several steps. First, the expected market value of the company is derived from the value and volatility of its common stock. Next, the default point (market value relative to liabilities) is established based on the book value of liabilities, and a measure of the number of standard deviations from the expected market value to the default point is calculated (the "distance to default"). (While initially assumed to be the point when the market value falls

below book value of liabilities, an empirical analysis of defaults has established that the most frequent default point is when the firm value is equal to the current liabilities plus one-half of the long-term liabilities). Lastly, a default probability is assigned based on the historical default rates of firms with similar "distance to default" measures. Because the model assumes that all of the relevant risk measures are included in the market value, default point and asset volatility, no adjustments for company size or industry are made (Jackson & Wood, 2013). The model's overall prediction levels have been reported to be quite high (Altman & Hotchkiss, 2005).

Drawbacks of Financial Ratio-Based Models

Because the financial ratios used by most of the models are typically quite correlated, the exact combination of ratios used as predictive variables is less relevant to the overall explanatory power of the model. Beaver et al (2005) tested the three aforementioned models (Ohlson, Zmijewski, and Shumway) and identified that a linear combination of three variables captured essentially all of the explanatory power each of the models, which are the ROA, EBITDA/TL, and TL/TA. The reasoning is as follows: the ROA captures profitability of the assets, which evaluates the ability of the firm to repay its debts over time; EBITDA is a proxy for pre-interest and tax cash-flow from operations, while total liabilities represent the future obligations that those cash-flows need to repay; lastly, the TL/TA measures the amount of debt relative to the total assets available as a source of repayment (Beaver, McNichols, & Rhie, 2005).

Despite the simplicity of calculation and relative ease of interpretation, there are several drawbacks with using financial ratios as a predictor of failure. Because the use of ratios is so widespread among managers and investors, the detection of an adverse ratio measurement may push management to adjust their course of action in order to avoid financial distress or bankruptcy. In these cases, an adverse ratio can become the catalyst of positive change instead of the harbinger of failure and the predictive power of the ratio is undermined. Additionally, lenders are heavily dependent on financial ratios when assessing whether or not to extend or maintain credit. Breaching a predetermined ratio level may result in the company

violating a loan covenant, which may result in default. Thus, financial ratios can also become a cause of failure, in which case their predictive power is once again undermined. Both of these factors prevent the exact measurement of the real predictive power of financial ratios.

Additional concerns surround the propensity of financial statements to accurately convey the value of the underlying assets and liabilities. Because of the increase in the prevalence of intangible assets, such as assets tied to R&D-based technological innovation for example, there is some concern that the use of financial ratios overlooks important information. Likewise, the increased use of off-balance sheet financing and derivatives may distort the true leverage levels, thus undermining the accuracy of the information gleaned from these ratios. Conversely, the fairly recent implementation of FASB standards on fair value accounting may help to bolster the predictive ability of financial ratios if it helps to address some of the aforementioned issues. Beaver et al (2005) found that there has indeed been a slight decline in the predictive ability of financial ratios over time due to either increased discretion by managers when preparing financial statements or due to the increased prevalence of intangible assets. The additional FASB standards apparently were not sufficient enough to counterbalance these effects.

Implications for Causes of Failure

Referring back to the discussion on potential causes of failure, Beaver's (1964) findings appear to imply that in aggregate the overall level of financial leverage may play a more important role than short-term liquidity. If the liquidity ratios are viewed as a proxy for possible working capital problems or current asset imbalances, these problems appear to be less prevalent in failed firms than the issue of unsustainable debt levels. The relative importance of the CFTD and TDTA ratios over the liquidity ratios as predictors of failure seems to support that notion.

Interestingly, the ratios' predictive power was not equal for failed and non-failed firms; non-failed firms could be classified as such with a higher success rate than failed firms. It appears that it's more probable that firms with favorable ratios will avoid failure than firms with unfavorable ratios will end up in

bankruptcy. High cash-flows and low levels debt are a great way to avoid financial distress, but not all companies that fail to achieve these levels are destined to fail.

When performing out-of-sample tests on the Z-score financial ratio model used by Altman, and the cash-flow model developed by Aziz, Mossman, et al. (1998) found that the significance of the various types of variables varies as time to bankruptcy increases. In the year prior to bankruptcy, they found significant mean differences for all but one of Altman's variables (as in Atlman's study, S/TA was not significant); for the cash-flow variables, only taxes paid and liquidity flows were significant. (The latter result conflicts with the original findings by Aziz discussed earlier which found that operating cash-flows and taxes paid were significant). Notably, EBIT/TA and taxes paid are the only variables that are significantly different for the full five years prior to bankruptcy – the other variables are either insignificant or not consistent over the longer period. Further, when evaluating the discriminatory ability of each of the models, the authors found that while the cash-flow model produced consistent results as much as three years prior to bankruptcy, the Z-score model performed better in the final year prior to failure. As such, it would appear that cash-flow characteristics may provide advance warning of potential future problems, while ratio analysis is best at predicting imminent failure (Mossman, Bell, & Swartz, 1998).

Part III: Analysis of Failure

The purpose of the study is to identify the sequence and magnitude of relative ratio deterioration in failed firms in order to establish the relative frequency of the various categories of causes of failure as described in Part I. Various ratios and metrics are used as proxies for relative liquidity complications, profitability issues, business problems, and leverage concerns. As expected, notable differences are seen in the ratios of the failed firms relative to their non-failed peers on all of the measures. In aggregate, the measures of the failed firms are consistently worse than their peers over the period leading up to bankruptcy, with liquidity and leverage deteriorating at an increasing rate as failure approached. The impact of macroeconomic events is also evaluated by isolating the impact of the 2008-2009 recession on the relative ratio measures. However, the impact on the failed firms relative to their peers appears to be minimal. Lastly, the study examines the relative timing of the ratio deterioration of the failed firms during the period prior to bankruptcy. One half of the failed firms initially begin to show signs of increased financial leverage relative to their peers, while one third exhibited a deterioration in liquidity prior to any other characteristics.

3.1 Study Design

Similar to previous financial ratio experiments by Beaver and Altman, a paired study is employed to analyze the differences between the financial ratios of failed and non-failed firms. Instead of using a single comparator non-bankrupt firm (as was done in the aforementioned studies), a peer group of 3-10 firms is used to improve the accuracy of the result. The peer group is constructed by identifying non-failed firms of similar size operating in the same line of business as the bankrupt firm over the same time period. The average balance sheet total asset amount over the five years prior to failure is used to establish the size of the failed firms in order to eliminate any size diminution bias as bankruptcy approached. The study included publicly traded firms from major exchanges worldwide listed in the S&P

Capital IQ database. In line with prior studies, financial services firms are excluded due to their unique financial ratio characteristics and lack of meaningful comparability to non-financial firms. The time period of 2009, 2010 and 2011 was is to select the bankrupt firms; the financial crisis of 2008 provided an external macroeconomic shock that destabilized many companies and precipitated the failure of the weakest firms. In total, the sample consists of 133 bankrupt firms and 650+ comparator firms (across 133 peer groups). Quarterly data for 5-7 years (depending on availability of data provided by the firm) prior to the year of the bankruptcy filing is used to compute the financial ratios and metrics used in the analysis.

The ratios and metrics evaluated in the profile analysis cover a broad portion of the potential causes of failure as described in Part I. The specific ratios and metrics were selected based on proven relevance in prior studies or specifically developed to illustrate the impact of a potential failure variable (e.g. OL, Revenue Volatility). The full list is detailed in Table 3.1 below.

Table 3.1

Cause	Ratio Proxy
Liquidity Problems	WC/TA (Beaver, Altman)
High Operating Leverage	EBITDA Std Dev/Revenue Std Dev
Falling Profitability	EBIT/TA (Altman)
Business Causes	Revenue Volatility
High Financial Leverage	Total Debt/Total Assets (Beaver) EBITDA/Interest Expense EBITDA/Debt Service

The analysis is performed by calculating the difference in the measure of the selected ratio or metric for the failed company versus that of its peer group on a quarterly basis. To ensure comparability across firms filing for bankruptcy at different times, the time period for each data set is repositioned relative to the bankruptcy event. As such, period 1 represents the last calendar quarter prior to the year of the bankruptcy filing (i.e. Q4 of the prior calendar year), period 2 represents the preceding quarter (i.e. Q3 of the prior calendar year), and so on until up to seven years prior to bankruptcy. Because each of the measures is standardized by employing a ratio measure or percentage metric, the results across firms are averaged

using an interquartile average calculation to eliminate the effects of extreme outliers. Other than the aggregate differences in ratios (i.e. a profile analysis similar to that which was employed by Beaver), a second calculation highlights the percentage of failed firms in the sample that at a given time period showed a worse result relative to the peer group on a particular metric.

3.2 Sample Characteristics

As expected, the largest number of bankruptcies occurred within the Consumer Discretionary industry classification, which contained 31% of the failed companies in the sample (as mentioned above, the Financial sector was excluded from the study). IT and Healthcare were the next largest sectors, with 17% and 14% of the sample respectively. The detailed sector classification breakdown is shown in Exhibit 3.3 below. When adjusted for industry size, Healthcare and Consumer Discretionary had the largest failure rates at 0.64% and 0.61% respectively.

Exhibit 3.1

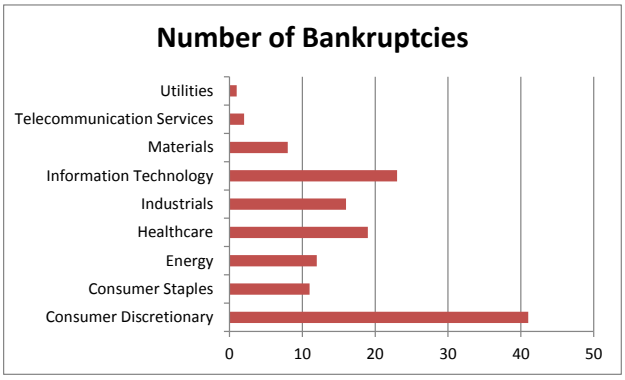


Exhibit 3.2

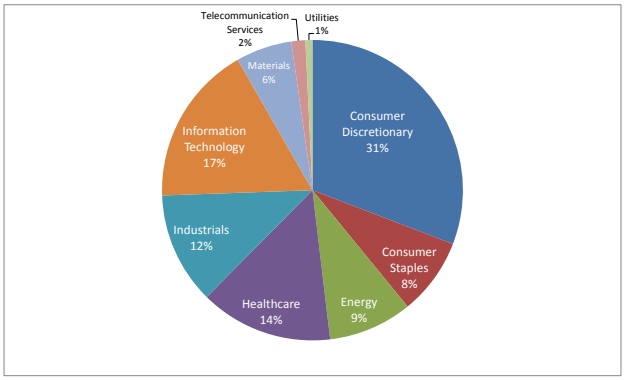
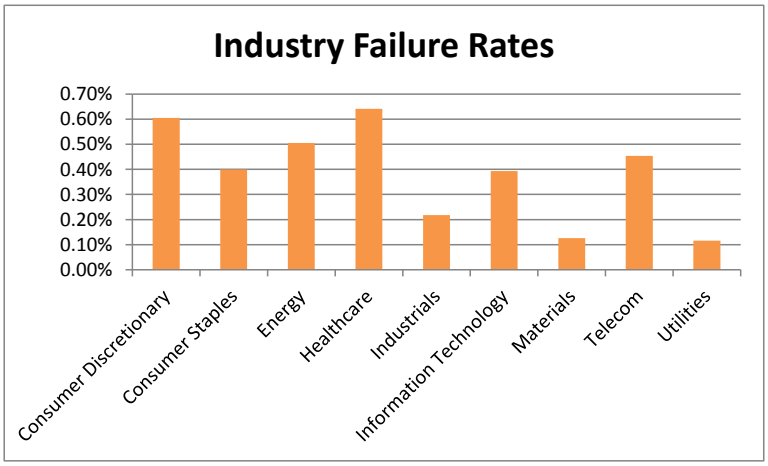


Exhibit 3.3

Industry	Sector	Companies
Consumer Discretionary	Advertising	1
	Apparel Retail	2
	Auto Parts and Equipment	5
	Automobile Manufacturers	3
	Broadcasting	2
	Cable and Satellite	1
	Casinos and Gaming	1
	Catalog Retail	1
	Consumer Electronics	1
	Department Stores	1
	Distributors	2
	Home Furnishings	1
	Homebuilding	3
	Hotels, Resorts and Cruise Lines	2
	Household Appliances	2
	Internet Retail	1
	Leisure Facilities	1
	Leisure Products	1
	Movies and Entertainment	1
	Publishing	4
	Restaurants	1
	Specialty Stores	4
Consumer Staples	Food Distributors	1
	Household Products	3
	Packaged Foods and Meats	3
	Personal Products	3
	Soft Drinks	1
Energy	Coal and Consumable Fuels	1
	Oil and Gas Equipment and Services	1
	Oil and Gas Exploration and Production	8
	Oil and Gas Refining and Marketing	1
	Oil and Gas Storage and Transportation	1
Utilities	Renewable Electricity	1
Healthcare	Biotechnology	7
	Healthcare Equipment	2
	Healthcare Facilities	1
	Healthcare Services	3
	Healthcare Supplies	1
	Life Sciences Tools and Services	2
	Pharmaceuticals	3
Industrials	Aerospace and Defense	3
	Airlines	2
	Construction Machinery and Heavy Trucks	1
	Electrical Components and Equipment	3
	Environmental and Facilities Services	1
	Heavy Electrical Equipment	1
	Human Resource and Employment Services	1
	Industrial Machinery	3
	Research and Consulting Services	1
Information Technology	Application Software	4
	Communications Equipment	2
	Electronic Equipment and Instruments	3
	Home Entertainment Software	1
	Internet Software and Services	5
	IT Consulting and Other Services	2
	Semiconductor Equipment	3
	Semiconductors	2
	Technology Distributors	1
Materials	Commodity Chemicals	2
	Construction Materials	1
	Paper Packaging	1
	Precious Metals and Minerals	1
	Specialty Chemicals	2
	Steel	1
Telecommunication Services	Integrated Telecommunication Services	2
Total		***133***

Exhibit 3.4



3.3 Profile Analysis Results

The results of the comparative profile analysis are detailed below. Notable differences are seen in the ratios and metrics of the failed firms relative to their non-failed peers across all of the measures studied. Overall, the ratio or metric measures of the failed firms are consistently worse than their peers (i.e. the specified ratio or metric shows a less favorable reading for the failed firm than the comparator peer group) over the period leading up to bankruptcy, with liquidity and leverage deteriorating at an increasing rate as failure approaches. All of the exhibits below titled "Average Difference" display the difference (peer group minus failed company or vice versa) in the specified ratio or metric on the y-axis and the time period in quarters prior to bankruptcy on the x-axis unless noted otherwise. As such, period 1 on the x-axis represents the last calendar quarter prior to the year of the bankruptcy filing (i.e. Q4 of the prior calendar year), period 2 represents the preceding quarter (i.e. Q3 of the prior calendar year), and so on until up to seven years prior to bankruptcy. The exhibits titled "Companies Performing Worse Than Peers" display the same data but instead show the proportion of failed companies that exhibited a ratio level that was worse (lower or higher, depending on the specific metric) than their peer group for each time period. The first exhibit type displays the overall average difference in *the magnitude* between the failed firms and their peers for each ratio or metric at each time period leading up to bankruptcy. The second exhibit type displays *the proportion* of the total sample of failed firms that performed worse than peers on that particular metric (i.e. the failed firm's ratio was either lower or higher, depending on the specific metric) at each time period leading up to bankruptcy. The distinction in necessary because the aggregate average difference in magnitude can be skewed by a small number of firms that exhibit a relatively large difference in a particular ratio or metric relative to peers. Contemporaneously evaluating the proportion of firms that are exhibiting an unfavorable ratio difference helps mitigate this effect. The 50% threshold – the time period when over half the failed firms in the sample are exhibiting an unfavorable ratio difference relative to peers – is viewed as a key indication that, at that point, the ratio difference emerges as a consistent trend.

Liquidity

The Working Capital/Total Assets ratio measures the amount of working capital available as a proportion of the company's overall assets, and provides a proxy for overall liquidity. A higher ratio means that there is more liquidity available. The average difference metric is calculated as the peer group ratio minus the failed company ratio at each time period; a positive average difference number means that the failed companies had less liquidity than their peers. Exhibits 3.5 and 3.6 below display the results, with the difference in the WC/TA ratio (peer group minus failed company) plotted on the y-axis and the time period (in quarters prior to bankruptcy) plotted on the x-axis. When looking at the aggregate measures, it appears that potential liquidity issues begin to arise approximately between 2 and 2.5 years prior to failure. Using the 50% metric as a threshold level for the proportion of failed companies that are performing worse than their peers using this ratio, a consistent liquidity deterioration trend emerges as early as 5 years prior to failure.

Exhibit 3.5

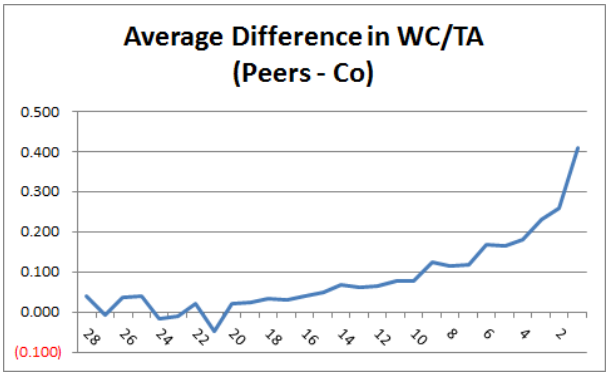
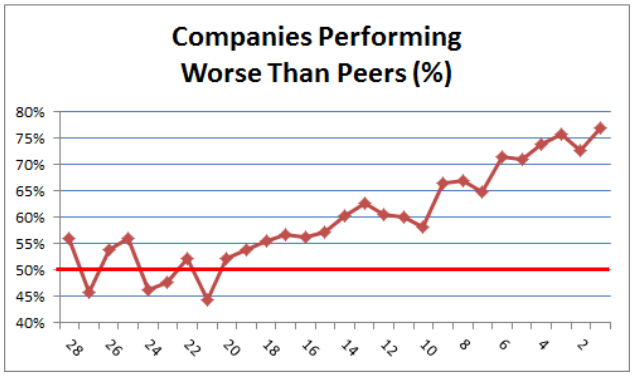


Exhibit 3.6



Profitability

The EBIT/Total Assets ratio measures the relative profitability of a firm from an operating income perspective adjusted for size. The ratio is higher for more profitable companies. The average difference metric is calculated as the peer group ratio minus the failed company ratio at each time period; a positive

average difference number means that the failed companies had lower profitability than their peers. Exhibits 3.7 and 3.8 below display the results, with the difference in the EBIT/TA ratio (peer group minus failed company) plotted on the y-axis and the time period (in quarters prior to bankruptcy) plotted on the x-axis. When looking at the aggregate measures, it appears that inferior profitability is persistent for as much as seven years prior to failure. Notably, unlike most of the other measures, there is no marked increase in the metric as bankruptcy approaches; it is consistently elevated during the entire time period. Using the 50% metric as a threshold level for the proportion of failed companies that are performing worse than their peers using this ratio, a consistent profitability lag is seen for a majority of the companies for the entire time period measured. A marked increase in the number of companies performing worse than peers occurs approximately 4.5 years prior to failure.

Exhibit 3.7

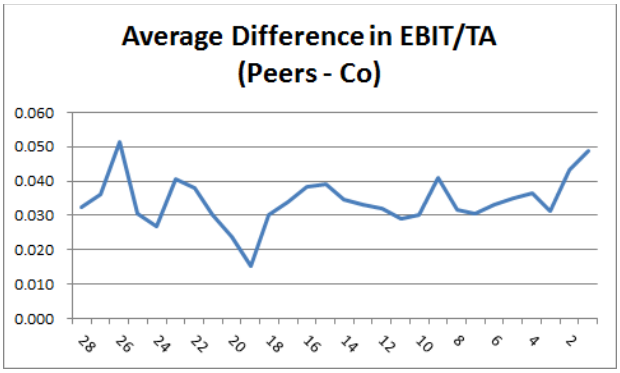
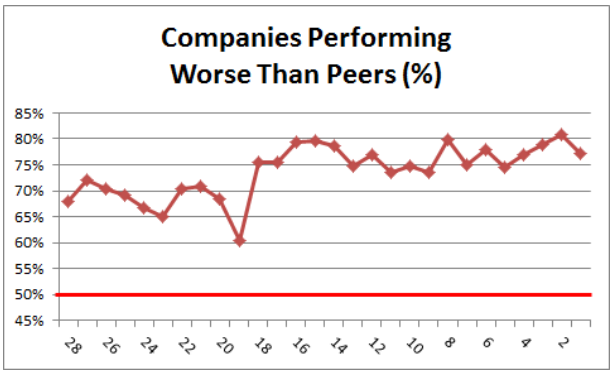


Exhibit 3.8



Financial Leverage

The Total Debt/Total Assets ratio measures the overall amount of debt in the capital structure. This ratio is higher for more leveraged companies. In this case, the average difference metric is calculated as the *failed company ratio minus the peer group ratio* at each time period; a positive average difference number means that the failed companies had higher leverage than their peers. Exhibits 3.9 and 3.10 below display the results, with the difference in the TD/TA ratio (failed company minus peer group) plotted on the y-

axis and the time period (in quarters prior to bankruptcy) plotted on the x-axis. When looking at the aggregate measures, it appears that higher leverage is persistent for the failed companies as much as 4 years prior to failure. A rapid increase in the difference at 2.5 years prior is likely caused by the combined effect of increased debt and falling total asset values as bankruptcy approaches. Using the 50% metric as a threshold level for the proportion of failed companies that are performing worse than their peers using this ratio, a consistent overleverage trend is seen for a majority of the companies as much as 6 years prior to failure.

Exhibit 3.9

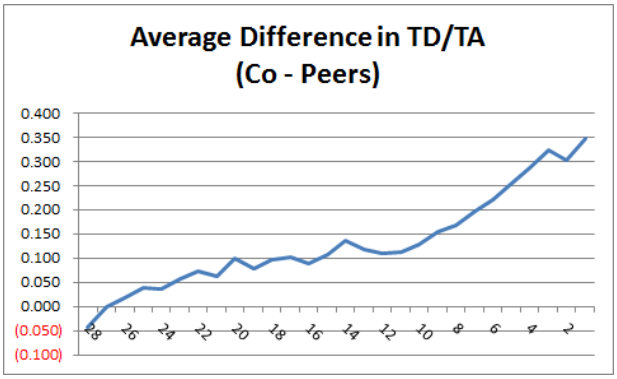
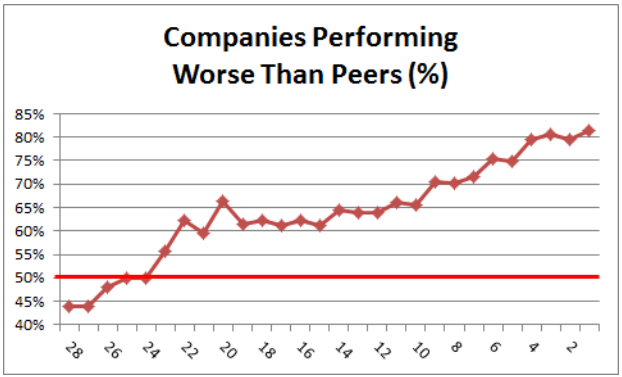


Exhibit 3.10



The EBITDA/Interest coverage ratio measures the amount of cash-flow available relative to the amount of the interest payments due. The ratio is higher for more financially sound companies with sufficient interest coverage and liquidity. The average difference metric is calculated as the peer group ratio minus the failed company ratio at each time period; a positive average difference measure means that the failed companies had lower interest coverage and liquidity than their peers. Exhibits 3.11 and 3.12 below display the results, with the difference in the EBITDA/Interest coverage ratio (peer group minus failed company) plotted on the y-axis and the time period (in quarters prior to bankruptcy) plotted on the x-axis. When looking at the aggregate measures, it appears that interest coverage issues and potential liquidity problems are evident for all seven years prior to failure. Notably, unlike most of the other measures, there

is no marked increase in the ratio difference as bankruptcy approaches; it is consistently elevated during the entire time period. Using the 50% metric as a threshold level for the proportion of failed companies that are performing worse than their peers using this ratio, a consistent interest coverage lag is seen for a majority of the companies for the entire time period measured. A marked increase in the number of companies performing worse than peers occurs approximately 6 years prior to failure. The peer group had interest coverage 5.7 times higher on average over the seven year period.

Exhibit 3.11

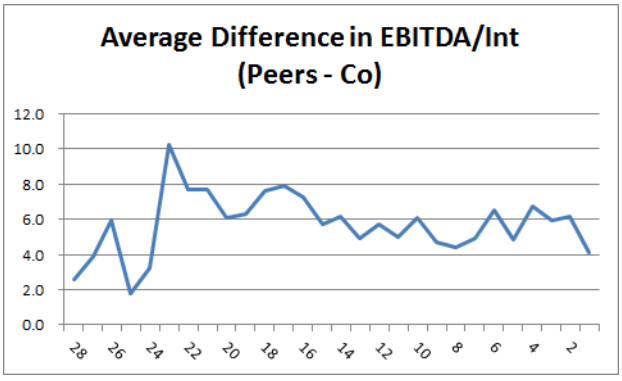
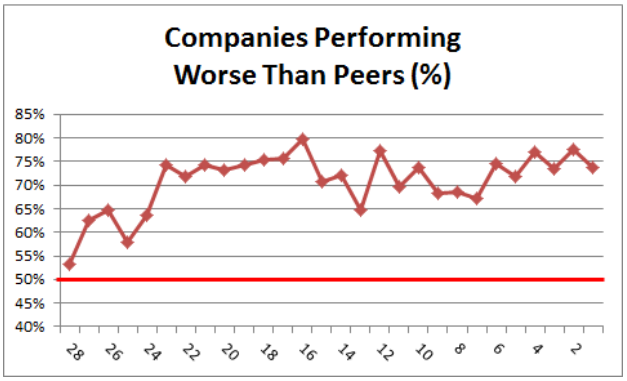


Exhibit 3.12



The EBITDA/Debt Service ratio measures the amount of cash-flow available relative to the amount of the total principal payments due. The ratio is higher for more financially sound companies with sufficient debt service coverage and liquidity. The average difference metric is calculated as the peer group ratio minus the failed company ratio at each time period; a positive average difference measure means that the failed companies had lower debt service coverage and liquidity than their peers. Exhibits 3.13 and 3.14 below display the results, with the difference in the EBITDA/DS coverage ratio (peer group minus failed company) plotted on the y-axis and the time period (in quarters prior to bankruptcy) plotted on the x-axis. When looking at the aggregate measures, the debt coverage differential peaks at various intervals across the seven year period and shows a jagged line as is consistent with the periodic amortization schedule of debt. Notably, unlike most of the other measures, there is no marked increase in the ratio difference as bankruptcy approaches; it is consistently elevated during the entire time period and actually shows a

slight *downward* trend. The gradual improvement in this this ratio in the failed companies can either be caused by an increase in EBITDA as bankruptcy approaches (which is unlikely), or a reduction in the principal amount due. The latter can potentially be explained by active deleveraging efforts by the company or debt restructuring through direct negotiations with lenders in an effort to reduce the imminent risk of bankruptcy. Using the 50% metric as a threshold level for the proportion of failed companies that are performing worse than their peers using this ratio, a consistent debt coverage lag is seen for a majority of the companies for the entire time period measured. A marked increase in the number of companies performing worse than peers occurs in peaks at approximately 6, 5 and 4 years prior to failure, at which point 75-80% of the failed companies exhibit a lower debt service coverage ratio than their peers. This observation is consistent with the debt deleveraging explanation presented above.

Exhibit 3.13

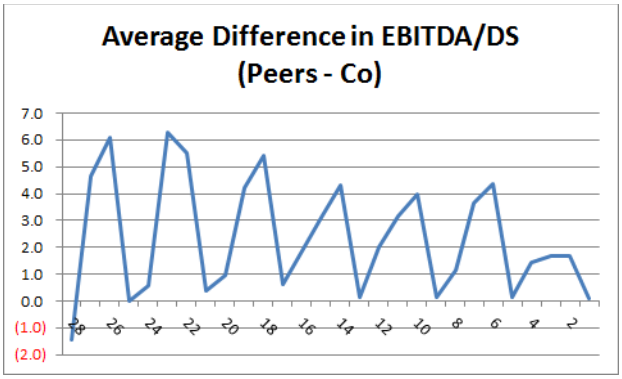
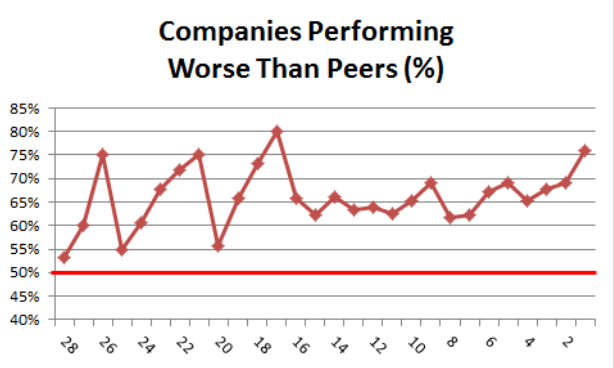


Exhibit 3.14



Business Volatility

Although not typically evaluated in bankruptcy studies, revenue volatility is a potential a proxy for underlying company-specific causes (see Part I). Applying a standard deviation measure calculated on a rolling 6 quarter basis, a higher relative number indicates increased revenue volatility which could stem from a lack of product competitiveness, mismanagement or a poor business plan, among other factors. In this case, the average difference metric is calculated as the *failed company rolling 6 quarter standard*

deviation minus the peer group rolling 6 quarter standard deviation at each time period; a positive average difference number means that the failed companies had higher revenue volatility than their peers. The exhibits 3.15 and 3.16 below display the results, with the difference in the revenue volatility (failed company minus peer group) plotted on the y-axis and the time period (in quarters prior to bankruptcy) plotted on the x-axis. When looking at the aggregate measures, it appears that large relative revenue volatility differences begin to arise approximately 4 years prior to failure. (To provide some sense of the magnitude of the difference, the average revenue volatility of the failed companies is approximately 45% compared to 25% for their peers over this time period). Using the 50% metric as a threshold level for the proportion of failed companies that are performing worse than their peers using this ratio, a consistent trend emerges as early as 4.5 years prior to failure. Notably, the relative volatility decreases drastically in the final year prior to bankruptcy, although this is likely due to the decrease overall business levels for failed firms.

Exhibit 3.15

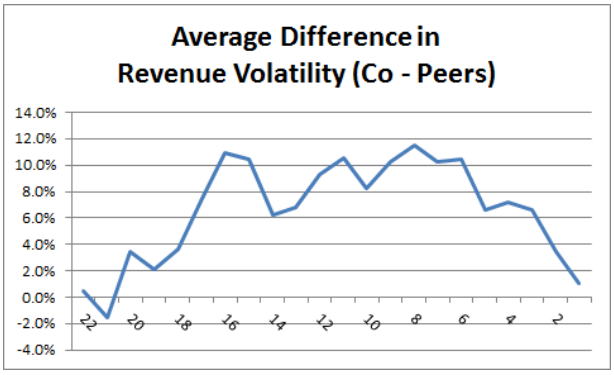
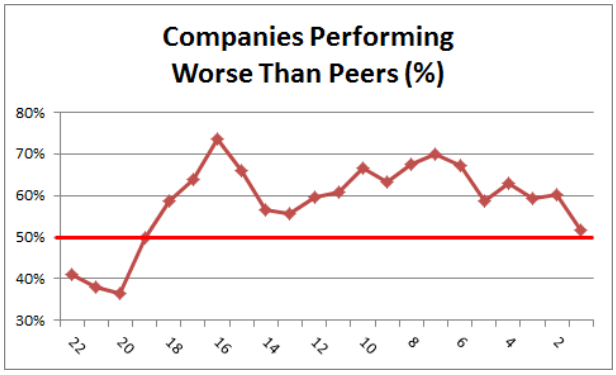


Exhibit 3.16



Operating Leverage

The accurate measurement of the relative degree of operating leverage is extremely challenging in practice. To use the formula *Contribution Margin/EBIT* it is necessary to identify the split between variable and fixed costs for each company in the study, which is impossible to do with any level of

precision given the paucity of information available in public statement data. When using the alternative formula *% Change in EBITDA/% Change in Revenue*, problems arise due to nonsensical measures caused by frequently negative EBITDA experienced by the failing companies. To overcome the latter calculation problem, the following formula was employed:

Modified Operating Leverage Ratio = Standard Deviation of EBITDA / Standard Deviation of Revenue

The rationale behind the modified OL ratio is that companies with higher operating leverage experience larger dollar amount changes in EBITDA relative to dollar changes in revenue and therefore should show a higher volatility of EBITDA relative to the volatility of revenue over time. Exhibits 3.17 – 3.19 below show the results. Despite the differences in the relative OL ratios between the failed firms and their peers, it is difficult to draw any meaningful conclusions from the results. Specifically, because a failing company is more likely to be operating closer to its breakeven point than its peers, its operating leverage will tend to be at its highest point regardless of its fixed cost structure. As such, it is difficult to isolate and remove this effect for the purposes of better understanding the impact of high fixed costs on corporate failure. (Because of the ambiguity in both the calculation and the meaning of the output, this measure was dropped from the analysis that follows. Further research is needed to better measure and evaluate the impact of operating leverage as a cause of bankruptcy.)

Exhibit 3.17

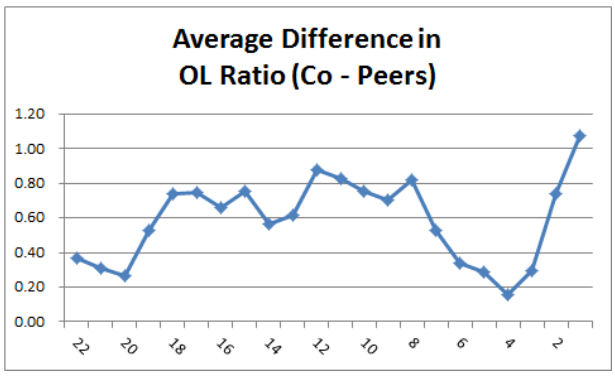


Exhibit 3.18

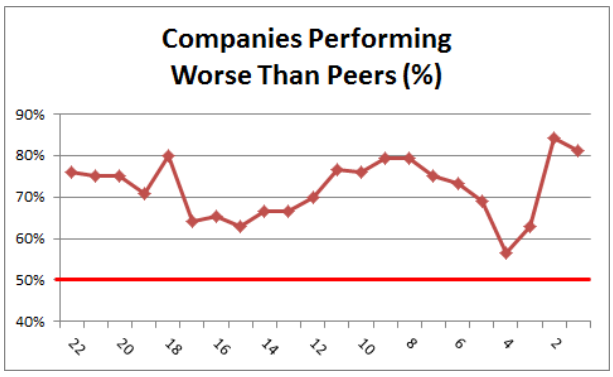
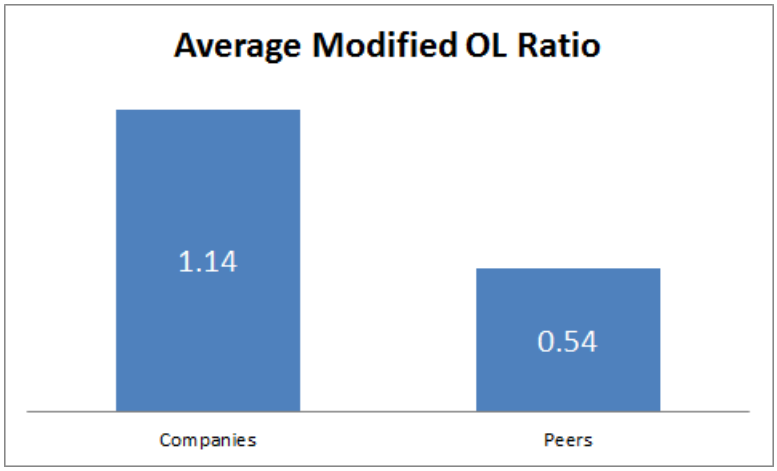


Exhibit 3.19



3.4 Macroeconomic Impact Evaluation Results

Given the propensity of firms to fail during period of economic stress, it is helpful to analyze the impact of the 2008-2009 recession on the relative performance of failed and non-failed firms. Exhibits 3.20-3.25 below display the aggregate sample of firms grouped by year of bankruptcy in order to isolate the impact of the recessionary period on the metrics presented above. The recessionary period, officially beginning in Q3-2008 and ending in Q1-2009, is highlighted on the graph as a red box showing the corresponding time period on the x-axis (which is listed in quarters prior to bankruptcy, as previously). Based on this evaluation, it appears that the only major impact of the recession was on the liquidity and potentially the revenue volatility of the failed firms relative to their peers. Exhibit 3.23 shows a noticeable spike in the WC/TA ratio difference during this period for all three groups, meaning that the failed firms experienced a decrease in the relative level of working capital available. The relative spike in revenue volatility is shown in Exhibit 3.25, although it only appears to be sizeable for the 2011, and to a lesser extent, the 2010 group. The other measures do not appear to show a substantial difference between the recessionary

period and the other time periods. That the relative impact of macroeconomic factors on the demise of these firms seems to be minor compared to the existing company-specific deficiencies that had already manifested themselves prior to the recession.

Exhibit 3.20

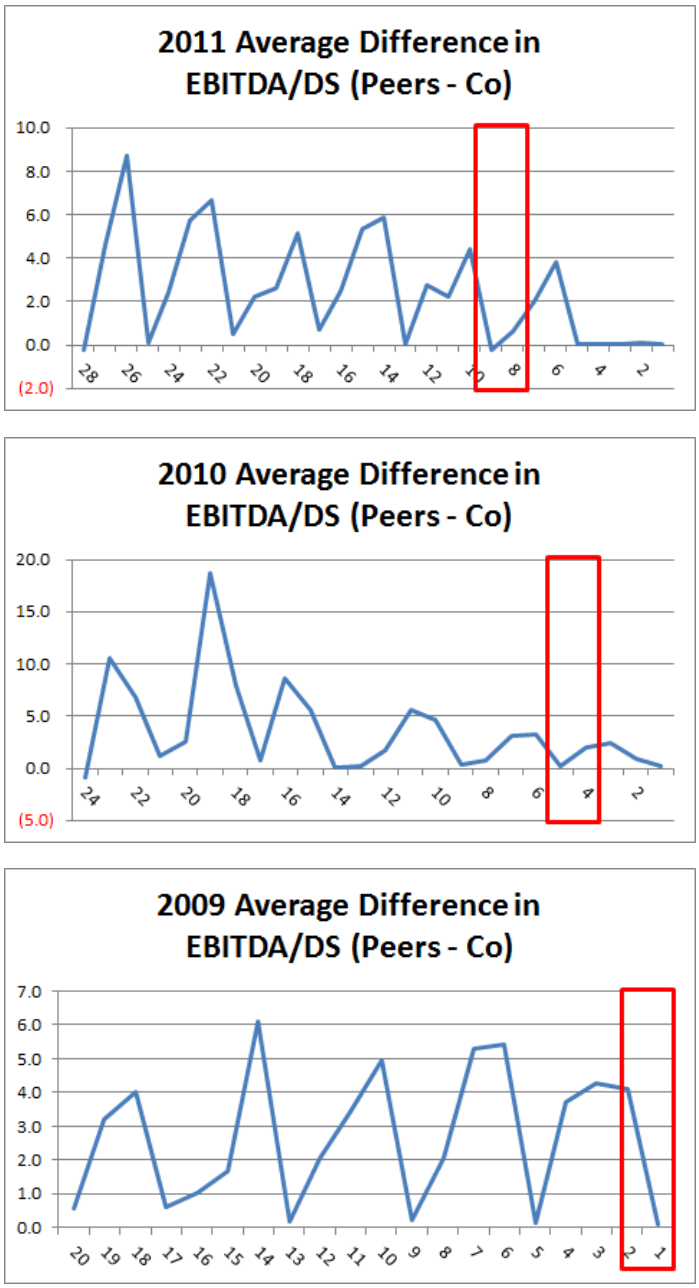
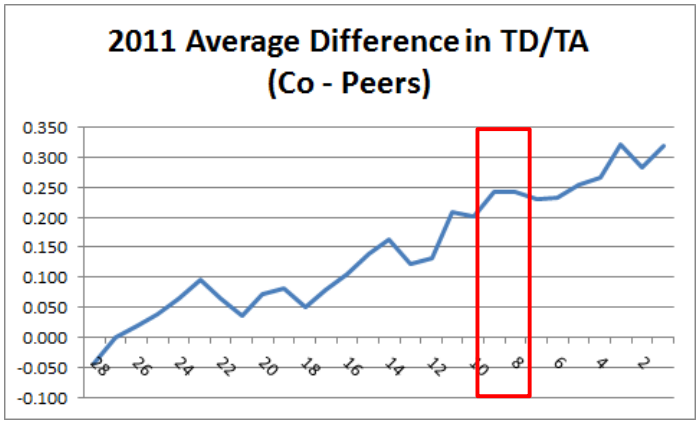
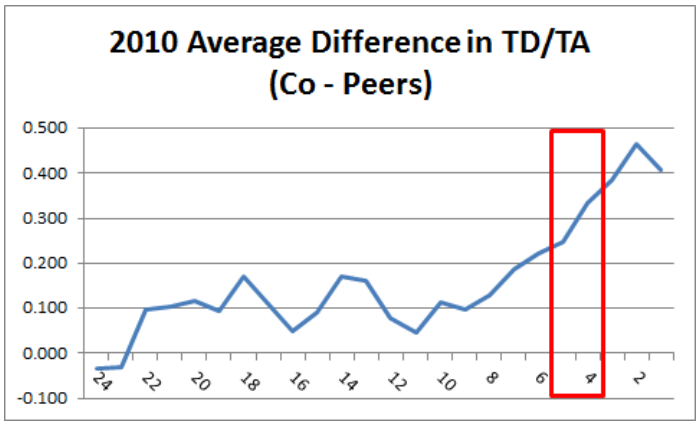


Exhibit 3.21





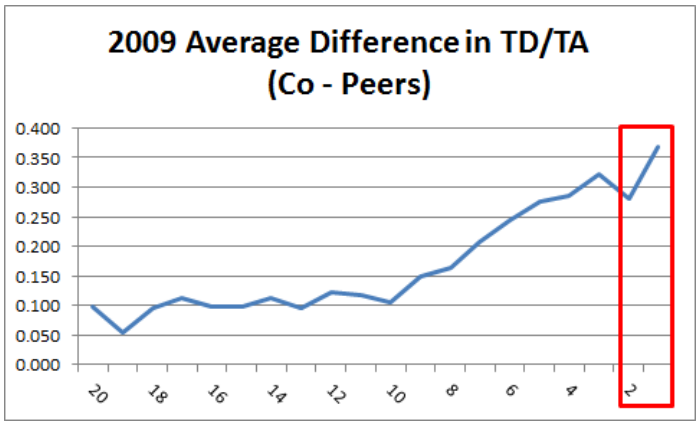
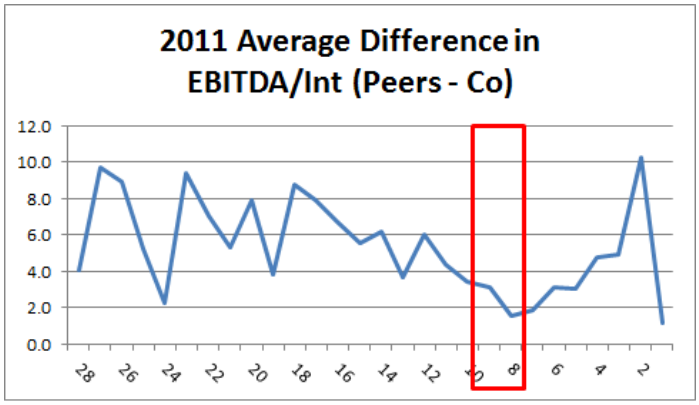
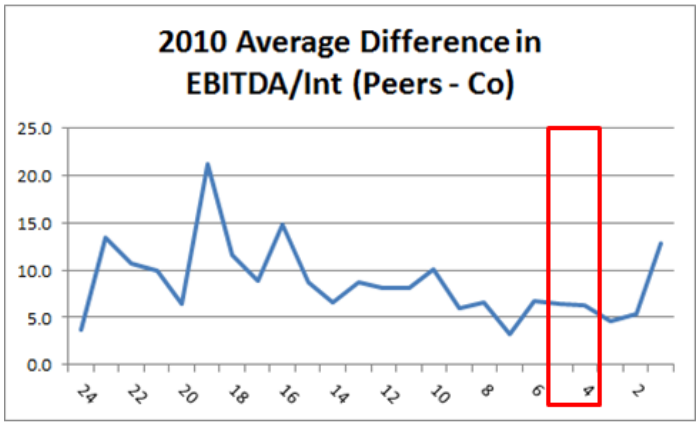


Exhibit 3.22





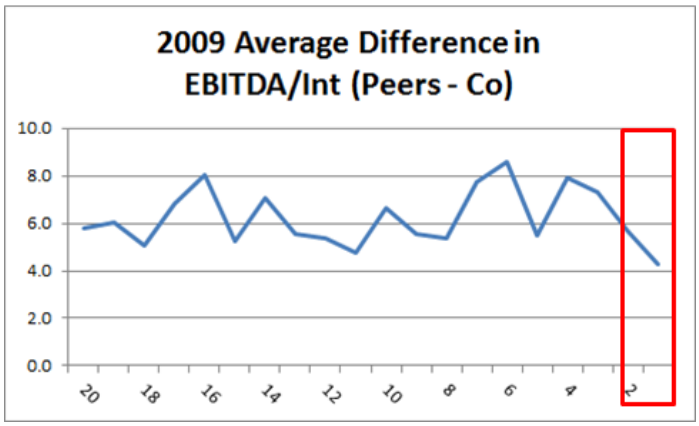


Exhibit 3.23

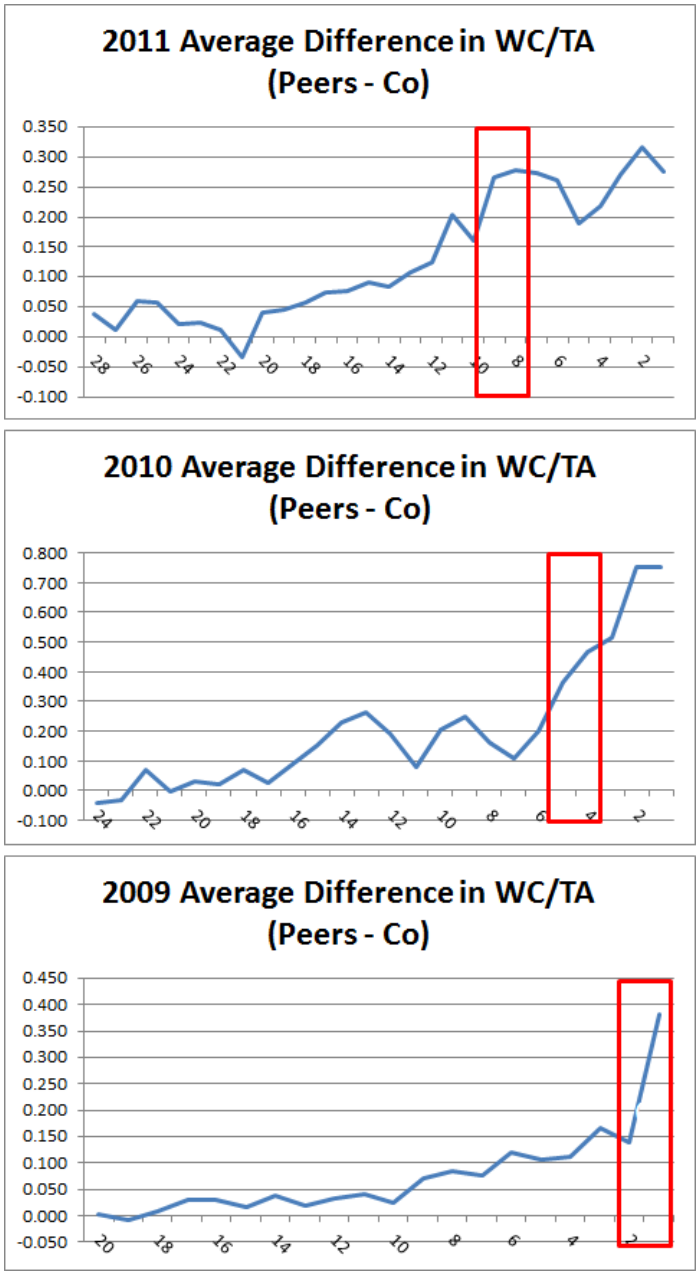
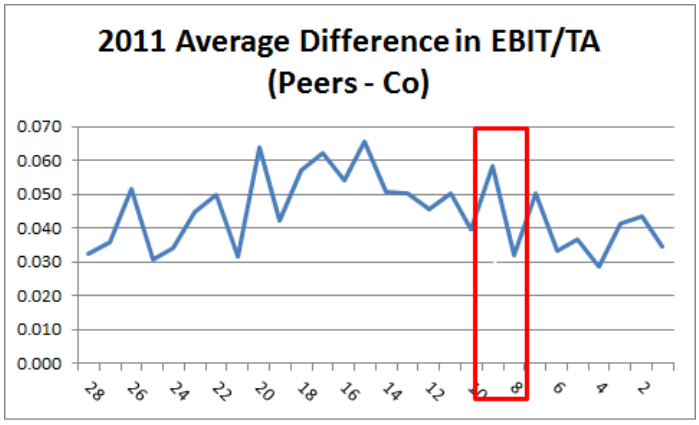
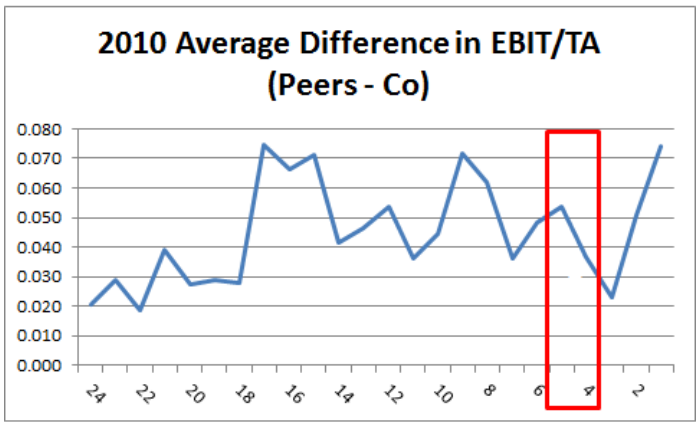


Exhibit 3.24





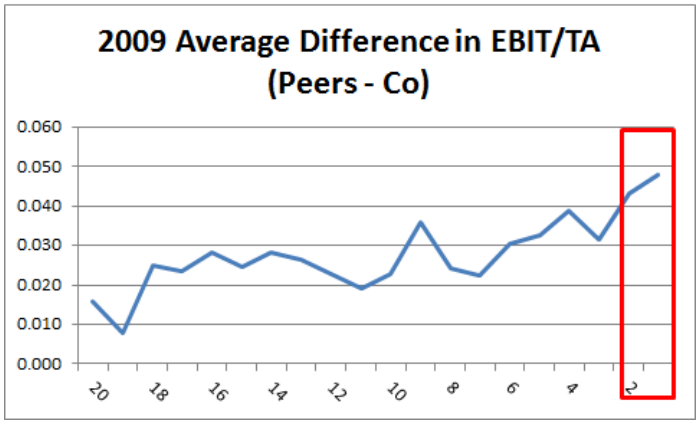
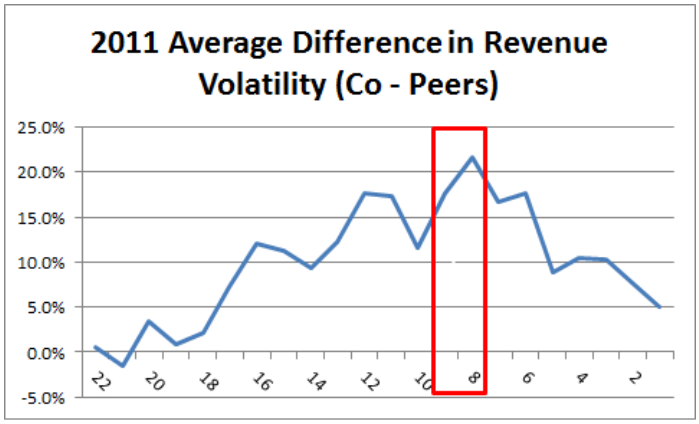
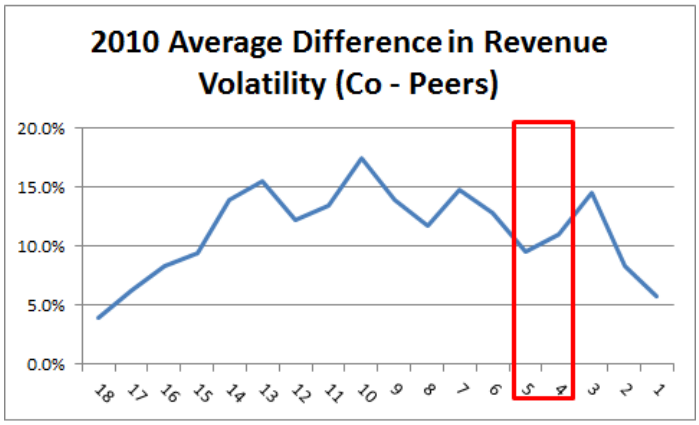
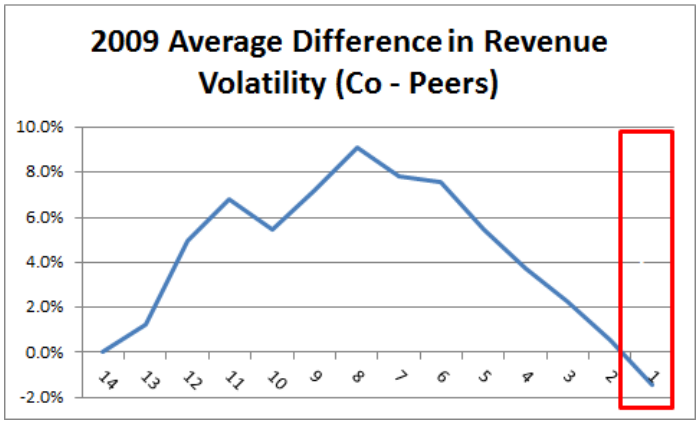


Exhibit 3.25



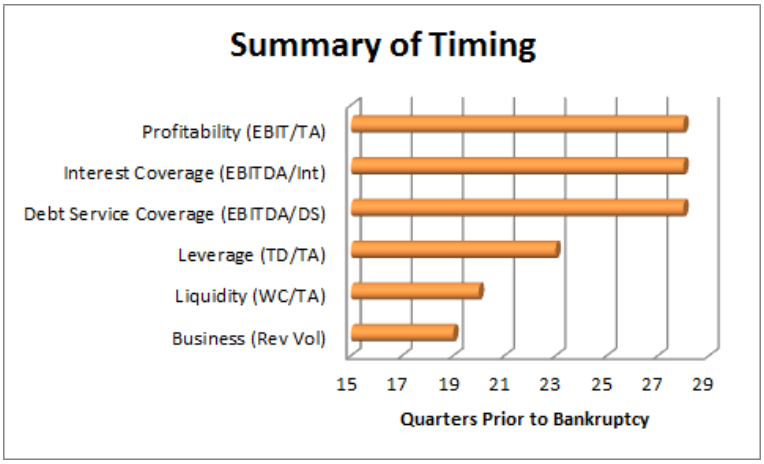




3.5 Indications of Potential Causes

Exhibit 3.26 summarizes the data presented earlier displaying the proportion of companies that exhibit a difference relative to peers in a specified metric. Once again using the 50% measure as a threshold (i.e. the point in time when over 50% of the failed companies show a difference in the specified metric relative to their peers), the chart shows that profitability, and debt service and interest coverage issues appear in the sample of failed companies prior to the point when leverage, liquidity and revenue volatility issues become evident. However, while this provides a good description of the timing characteristics of the sample as a whole, it offers little information regarding the experience of the individual companies.

Exhibit 3.26



Variable Deterioration Timing Evaluation

The final part of the analysis attempts to identify whether there is any difference in the timing and incidence of the various failure metrics at the company-specific level. Differences in the timing between failed companies may provide clues about the relative frequency distribution of the various initial causes of failure. This portion of the study was performed by analyzing the time series data of each failed company's EBIT/TA, WC/TA, TD/TA and EBITDA/Interest Coverage peer-relative metrics (revenue

volatility and EBITDA/Debt Service were excluded due to challenges with relative timing consistency). Starting from 20 quarters prior to bankruptcy – the earliest period for which data was available for the vast majority of failed companies – the analysis moved forwards in time to identify the *first incidence* of four consecutive quarters of peer-relative ratio deterioration experienced by a company; the specific ratio that was flagged first was noted as a potential "initial cause". For example, if the EBIT/TA ratio deteriorated before any of the other ratios, this can potentially be seen as a sign that falling profitability may have triggered the company's failure. While these ratios may serve only as inexact proxies for potential causes of failure, they may at least provide some rough approximation of the various way in which firms fail. Approximately 70% of the companies in the sample experienced the four-quarter deterioration for at least one of the ratios 4-5 years prior to failure. Exhibit 3.27 below shows the relative distribution of the major categories of potential "initial causes". About half of companies exhibited increasing financial leverage as the isolated primary trigger, while one third initially showed signs of deteriorating liquidity. Additionally, another 15% experienced the incidence of both liquidity and financial leverage issues concurrently. The least prevalent triggers appearing in isolation were low profitability (3%) and interest coverage (0%). Exhibits 3.28-3.29 below show a more detailed breakdown of the triggers appearing concurrently within the two major categories of financial leverage and liquidity. As mentioned above, the two triggers of leverage and liquidity issues most often appear together; for either category, a combination with low profitability is the next most frequently appearing combination of initial causes.

Exhibit 3.27

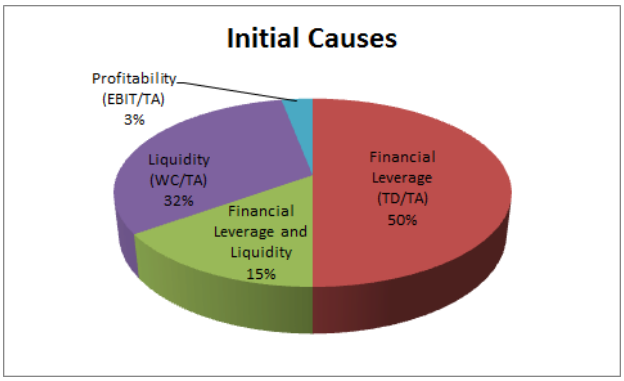


Exhibit 3.28

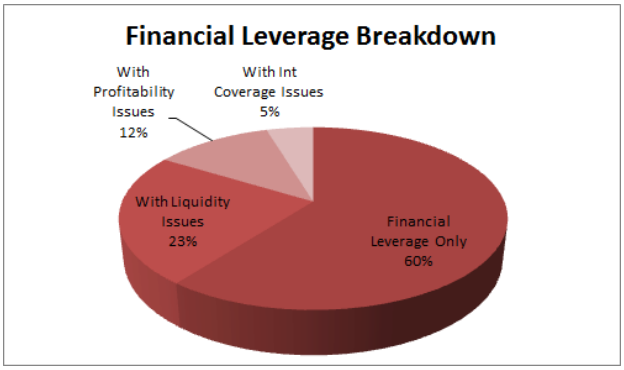
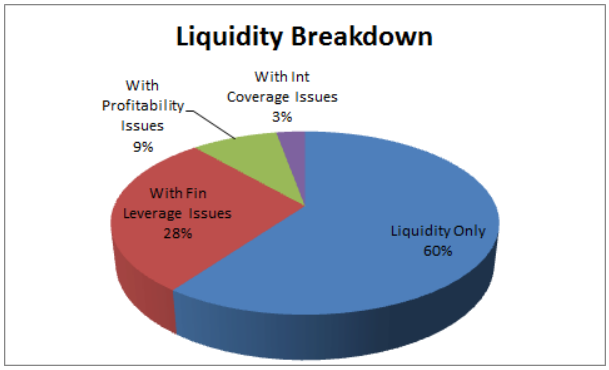


Exhibit 3.29



3.6 Results Summary

In aggregate, the failed companies in the study exhibit the relative characteristics that one would reasonably expect. Liquidity issues and overall leverage problems appear to intensify in magnitude as bankruptcy approaches, while revenue volatility peaks several years prior. Profitability problems and interest coverage deficiencies remain consistently elevated throughout the entire 5-7 year period leading up to bankruptcy. Notably, debt service coverage deficiencies decline over time, a likely result of negotiations with lenders as the (eventually) failed companies begin to struggle financially. Operating leverage appears to be elevated throughout the period, but it was difficult to separate true leverage effects from the impact of operating at near-breakeven levels. Using the ratios as proxies for initial causes, or potential triggers for eventual failure, it appears that the vast majority of failures are initiated by leverage,

liquidity issues or a combination of both. Based on this sample, a lack of profitability and interest coverage deficiencies do not appear to be major triggers of failure. While this initial research provides some key insights into how firms fail, further research is needed to substantiate these results and to determine the overall frequency distribution of the causes of corporate failure and bankruptcy.

Areas for Further Research

A much more detailed analysis of the causes of corporate failure can be performed by building on the overall approach used in this study and applying it to a larger dataset of failed companies across various time periods. The sequence of ratio deterioration can be analyzed in more detail by taking the magnitude of the peer-relative differences into account, as well as determining the optimal threshold for classifying a particular ratio as a trigger. For example, perhaps it is more appropriate to use six or eight, instead of four, consecutive quarters of deficiency to classify a ratio deficiency as a trigger. Also, identifying the second-order triggers (i.e. the measure that is violated after the initial trigger has been identified) may provide additional insight as well. Other ratios and measures, such as revenue volatility and operating leverage, can be better calibrated for inclusion in future studies and may shed additional light on the overall causes of failure.

Bibliography

Adler, B., Baird, D., & Jackson, T. (2007). *Bankruptcy: Cases, Problems and Materials* (4th ed., p. 797). New York, NY: Foundation Press.

Altman, E. I. (1983). *Corporate Financial Distress: A Complete Guide to Predicting, Avoiding, and Dealing with Bankruptcy*. New York, NY: John Wiley & Sons, Inc.

Altman, E. I., & Hotchkiss, E. (2005). *Corporate Financial Distress and Bankruptcy*. Hoboken, NJ, USA: John Wiley & Sons, Inc. doi:10.1002/9781118267806

Aziz, A., Emanuel, D., & Lawson, G. (1988). Bankruptcy prediction - an investigation of cash flow based models. *Journal of Management Studies1*, *25*(5), 419–437.

Bearly, R., Myers, S., & Allen, F. (2011). *Principles of Corporate Finance* (10th ed., pp. 440–466). New York, NY: McGraw-Hill/Irvin.

Beaver, W. H. (1966). Financial Ratios as Predictors of Failure. *Journal of Accounting Research*, *4*, 71–111.

Beaver, W. H., McNichols, M., & Rhie, J.-W. (2005). Have Financial Statements Become Less Informative ? Evidence from the Ability of Financial Ratios to Predict Bankruptcy. *Review of Accounting Studies*, *10*, 93–122.

Branch, B. (2002). The costs of bankruptcy a review. *International Review of Financial Analysis*, *11*, 39–57.

Drake, P., & Fabozzi, F. (2010). *Financial Ratio Analysis, in The Basics of Finance: An Introduction to Financial Markets, Business Finance, and Portfolio Management*. Hoboken, NJ, USA: John Wiley & Sons, Inc.

Ganguin, B., & Bilardello, J. (2005). *Fundamentals of Corporate Credit Analysis*. New York, NY: McGraw-Hill.

Jackson, R. H. G., & Wood, A. (2013). The performance of insolvency prediction and credit risk models in the UK : a comparative study. *The British Accounting Review*, *45*(3), 183–202.

Mossman, C. E., Bell, G. G., & Swartz, L. M. (1998). An empirical comparison of bankruptcy models. *The Financial Review*, *33*(2), 35–54.

Moyer, S. (2005). *Distressed Debt Analysis*. Boca Raton, FL: J. Ross Publishing.

Perry, C. (1995). *CS FIXED INCOME RESEARCH BULLETIN Implied Default Probabilities : A New Approach to Risky Debt*.

Platt, H. D. (1985). *Why Companies Fail: Strategies for Detecting, Avoiding, and Profiting from Bankruptcy* (p. 147). Lexington, MA: Lexington Books.

Rosenbaum, J., & Pearl, J. (2009). *Investment Banking: Valuation, Leveraged Buyouts, and M&A* (Vol. 2007, pp. 180–194). Hoboken, NJ, USA: John Wiley & Sons, Inc.

Seidman, K. F. (2002). Economic Development Finance. In *Economic Development Finance* (pp. 91–110). Thousand Oaks, CA: Sage Publications.

Shumway, T. (2001). Forecasting Bankruptcy More Accurately: A Simple Hazard Model. *Journal of Business*, *74*(No. 1).

Sull, D. (2009). *The Upside Of Turbulence*. HarperCollins.

Vernimmen, P. (2009). *Corporate Finance: Theory and Practice* (Second Edi., Vol. 92). Chichester, United Kingdom: John Wiley & Sons, Inc. doi:10.1111/j.1600-0404.1995.tb01704.x

Zmijewski, M. E. (1984). Methodological Issues Related to the Estimation of Financial Distress Prediction Models. *Journal of Accounting Research*, *22*(Supplement), 59–83.