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Chapter 7 and Chapter 11 Bankruptcy Factors

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ABSTRACT

In light of the Financial Accounting Standards Board's August 2014 Accounting Standard Update on management *Going Concern Statements*, research using financial ratios to predict bankruptcy is more relevant than ever. Even though numerous research articles examine factors that predict bankruptcy, few make the distinction between the factors that affect Chapter 7 versus Chapter 11 bankruptcy. This work examines the factors that affect these two bankruptcy types (7 and 11) using the Securities and Exchange Commission data on 425 firms that filed for Chapter 7 or Chapter 11 bankruptcy. We tested our data using *t*-test, ordinary least squares (OLS), and logistic regression. Our results indicate that the asset turnover ratio and going concern statement are significant predictors of Chapter 7 versus Chapter 11 bankruptcy. We note the implications for auditors, corporate management, corporate creditors and investors, and the Financial Accounting Standards Board.

KEY WORDS Chapter 7 Bankruptcy; Chapter 11 Bankruptcy; Financial Ratios; Going Concern Statement

Identifying factors reflective of corporate success or failure has been the subject of much research and discussion for decades. The topic has taken on a renewed emphasis with the U.S. Financial Accounting Standards Board's August 2014 pronouncement (FASB 2014) requiring corporate management to address corporate continuity starting with reporting periods ending after December 15, 2016. Numerous studies have compared bankrupt and viable firms, developed predictive models of bankruptcy, and examined financial ratios that

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are predictive of bankruptcy. In previous bankruptcy studies, researchers have examined Chapter 7 and Chapter 11 bankruptcies as the same. They are not the same, however.

U.S. Federal bankruptcy law (U.S. Code Title 11) identifies six types of bankruptcy. The two bankruptcy filing types most commonly associated with businesses are Chapter 7 and Chapter 11. With a Chapter 7 filing, corporate management plans to "close up shop." Corporate assets are liquidated and distributions are made to creditors in a liquidation plan; the business ends operations. With a Chapter 11 filing, corporate management anticipates that the corporation has the ability to continue operating after a financial reorganization of the corporation. The corporation will undergo a financial reorganization but will continue operations during this reorganization period.

This article examines these two bankruptcy types (7 and 11) as two of three (including viable corporations) possible outcomes. It identifies factors predictive of Chapter 7 versus Chapter 11 bankruptcy using *t*-tests, correlations, OLS regression, and logistic regression. The study also examines the predictive ability (ability to predict Chapter 7 versus Chapter 11 bankruptcy) of the resulting OLS and logit models. In addition, this study splits the bankrupt-firm set into more refined data sets: firms filing for Chapter 7 bankruptcy and firms filing for Chapter 11 bankruptcy. Because the expected differences between Chapter 7 firms and Chapter 11 firms are finer than the expected differences between bankrupt firms and viable firms, we hypothesize that this study will identify fewer explanatory variables with less discriminatory power than do traditional bankruptcy studies. In addition, we hypothesize that the predictive model will have less explanatory power (lower *R*-square) than traditional bankruptcy-prediction studies because of the similarity of Chapter 7 firms and Chapter 11 firms when compared with viable firms. The results of this research will help auditors, corporate management, corporate creditors and investors, and the FASB.

LITERATURE REVIEW

A plethora of research articles address bankruptcy prediction, starting with seminal works such as Beaver's 1966 ratio analysis and Altman's development of a Z-score in 1968. These previous works and the work conducted here are even more important in light of the FASB's August 2014 accounting standards update (ASU) on going concern statements. This ASU requires corporate management to include in the financial statements (annual and interim) a statement about continuity-indicated concerns, beginning with reporting periods ending after December 15, 2016.

Business managers and financial analysts have long used accounting information to make various decisions, including lending decisions. Practitioners used and recognized financial ratios as effective indicators of financial well-being decades before academicians systematically explored their usefulness. Articles about the value of financial data for failure prediction existed in the first half of the 20th century (e.g., Merwin 1942). More recently, however, Beaver and Altman wrote seminal research articles about using financial data for predictive purposes.

In a 1966 study, Beaver examined the usefulness of ratios as predictors of corporate financial well-being. Beaver tested the usefulness of financial ratios with regard

to a specific purpose: failure prediction. Beaver defined failure as the inability to make scheduled debt payments. He adopted three criteria for selecting ratios: popularity, ratio performance in previous studies, and ratios defined by cash flow. Popular ratios were those commonly found in the practical literature. Because corporate management knew that these ratios are common ones on which to judge corporate performance, Beaver expected corporations to "window dress" these ratios, which would result in the reduced utility of popular ratios. Beaver's list of possible explanatory ratios numbered 30. He grouped these ratios into six "common element" categories and compared common element ratios by their ability to predict failure or non-failure. Beaver used the ratio in each category that predicted with the least error to represent the group. Beaver's model included six ratios: cash flow to total debt, net income to total assets, debt to assets, working capital to total assets, current ratio, and quick assets less current liabilities (1966:78). He predicted that all the ratios would be greater for non-failed firms than for failed firms, with the exception of debt to assets, which should be greater for failed firms.

Beaver used a univariate, dichotomous classification to test the predictive abilities of the six ratios. He arrayed the ratios in ascending order and selected a cutoff point that optimally classified the failed and non-failed firms. Stated another way, he selected a value for the ratio that best divided the firms into failed and non-failed groups. The optimal cutoff point minimized the misclassifications. Beaver calculated this optimal cutoff point for each of the six ratios; he did this 30 times: for each of the six ratios in each of the five years.

Overall, Beaver's ratios were quite predictive of failure. Cash flow to total debt was most accurate at 87 percent one year before failure. This declined to 78 percent five years before failure. Beaver noted that this level of accuracy is still much better than random prediction (50 percent). The order of accuracy (descending) of other factors was return on assets, debt to assets, working capital to total assets, and current ratio. Beaver tested for but did not find any conclusive evidence that either industry or asset size had any significant predictive ability.

Altman developed his Z-score in 1968 as a bankruptcy-prediction model. Although researchers before Altman examined bankruptcy and provided evidence of financial predictability of bankruptcy, Altman's work is often cited as the seminal work using statistical methods to evaluate and predict bankruptcy. Numerous researchers have since refined his model and developed specialized bankruptcy-prediction models. Altman examined 66 bankrupt and non-bankrupt firms using a multiple discriminant analysis (MDA) method. Whereas Beaver examined the predictive ability of the ratios one at a time, MDA provided Altman the opportunity to examine the predictive power of the ratios in unison.

Altman's sample included 33 failed and 33 non-failed firms. The bankrupt firms filed for bankruptcy between January 1946 and December 1965. Non-failed firms were those still in existence in 1966. Altman's group of non-failed firms "consisted of a paired sample of manufacturing firms chosen on a stratified random basis. The firms are stratified by industry and by size, with the asset size range restricted to between $1–$25 million" (Altman 1968:594).

Altman's variable selection began with an exposition of the 22 ratios reported to be significant in previous studies and several that Altman cited as possibly useful in his study. He grouped these ratios into five commonly used categories of "liquidity, profitability, leverage, solvency, and activity" (1968: 594). Altman's final selection of five variables from among the 22 resulted from a four-step process: (1) determination of the contributions made by each variable independently, (2) examination of intercorrelations, (3) consideration of accuracy of various combinations of variables, and (4) "judgment of the analyst." Altman performed many computer runs using different linear combinations of ratio profiles (combinations of ratios) and found that earnings before interest and taxes/total assets, market value equity/book value of total debt, and sales/total assets were most significant.

Altman used three methods to test the results of his analysis. First, he used an *F*-test. The model should divide the total sample into two groups—failed and successful firms—maximizing the distance between the means of the two groups and minimizing the variance of observations within each group. The *F*-test is a measure of how well the resulting model achieves this objective. Altman's *F*-score was significant at the .01 level.

In a second test of the model, Altman calculated the misclassifications of sample individual observations from data one year before failure. He multiplied individual data from sample firms by model coefficients to produce a Z-score. (The Z-score measures standardized deviation from the mean.) Altman classified the firms by comparing each firm's Z-score with a benchmark Z-score. The accuracy in this test was quite high at 95 percent.

Altman further analyzed predictive ability three to five years prior to failure. His results indicated that predictive accuracy falls considerably after the second year before failure. In fact, predictive accuracy dropped to 48 percent, 29 percent, and 36 percent for the third, fourth, and fifth years before failure, respectively.

Ohlson (1980) used the logit model to analyze factors related to business failure: size and measures of financial structure, performance, and current liquidity. Ohlson matched failed and non-failed firms of similar size and industry, although uncertain what advantage matching provides. In fact, Ohlson found it more useful to use these factors as input variables rather than as selection variables. Ohlson collected data from industrial firms' balance sheets, income statements, funds statements, and accountants' reports for the three years before the firms' failures. His listing of failed firms began with the Wall Street Journal Index. Size, debt to assets, return on assets, cash from operations/total debt, a dichotomous variable representing net loss (0/1), and a dichotomous variable representing negative solvency (0/1) were significant predictors of failure. The current study uses all these variables as input factors.

Zavgren (1985) cited seven categories theoretically related to firm failure or non-failure: return on investment, capital turnover, inventory turnover, financial leverage, receivables turnover, short-term liquidity, and cash position. Zavgren found that each of the variables tested showed some degree of significance in explaining failure, although cash position and short-term liquidity were most significant in the short term. Return on investment was the least significant of the explanatory variables.

Zmijewski (1984) identified two methodological problems with failure-prediction studies. These are the data-collection problems of choice-based sample biases and sample

selection biases. Choice-based sample biases result when researchers select observations based on the dependent variable. Many researchers do this when one form of the dependent variable (i.e., failure) seldom occurs in the population sampled. Researchers use sample data sets with 50 percent failures and 50 percent successes even when failures in the population are less than 2 percent of observations. The study reported here includes all Chapter 7 and Chapter 11 firms in the time period studied for which data were available. Deleting observations with missing data may cause sample selection bias, if missing data is correlated with the dependent variable. Zmijewski's results "do not indicate significant changes in overall classification and prediction rates, nor do they indicate different qualitative results (statistical inferences) for the financial distress model tested" (Zmijewski 1984:63). Neither of the issues that Zmijewski addressed are problems for the logistic regression method used in this study.

In their 1999 study, Barney, Graves, and Johnson examined the predictive ability of 14 ratios on the ability of borrowers to make scheduled debt payments. The factors for the prediction model included twelve financial factors and two dichotomous variables representing previous debt trouble. The researchers examined ratios in the categories of liquidity (e.g., current ratio), solvency (e.g., asset turnover), profitability (e.g., return on assets), repayment capacity (e.g., cash debt coverage), and financial efficiency (e.g., asset turnover). The researchers found that nine ratios were correlated ($p < .10$) with making scheduled debt payments and that six of those nine ratios were highly correlated ($p < .01$) with making scheduled debt payments.

Researchers have addressed the importance of differentiating Type I and Type II errors. Type I error, as applied to bankruptcy studies, is the error of predicting bankruptcy for a successful firm. Type II error, generally considered the more costly of the two, is the error of identifying as successful a firm that subsequently files for bankruptcy. Because this study does not include a study of successful firms, only bankrupt firms, Type I error would be the prediction that a Chapter 11 firm files for Chapter 7. Type II error would be the error of predicting that a Chapter 7 firm filed for Chapter 11. Although this study does not address Type I and Type II errors, it is interesting to note that such errors still apply.

We anticipate that, when compared with traditional bankruptcy studies comparing bankrupt and viable firms, this study will identify fewer discriminatory factors of less significance in weaker predictive models. Still, identifying significant Chapter 7 versus Chapter 11 discriminatory factors will contribute to the relevant literature.

GOING CONCERN

U.S. (and international) auditing standards require auditors to provide a going concern qualification with the audit report if auditors have doubts about a corporation's ability to continue functioning in its current form for the coming year. In other words, if the auditors expect the corporation to go out of business (Chapter 7) or undergo restructuring through bankruptcy proceedings (Chapter 11), the auditors should render a going concern opinion in their audit letter. The time frame for the auditors' going concern decision is one year from the date of the financial statement.

Prior to the passage of Sarbanes–Oxley Act, auditors—theoretically, at least—were more reluctant to issue going concern opinions. Issuance of such opinions could cost an auditor not only the auditing business of a particular client but also the much more lucrative consulting business. The Sarbanes–Oxley Act theoretically reduced (but did not eliminate) the conflict inherent in the auditor's decision. According to section 201 of the act, auditors may not also engage in certain other work (notably some forms of consulting) with their publicly traded audit clients.

METHODOLOGY

This study examined two sets of corporations: those that filed for Chapter 7 bankruptcy and those that filed for Chapter 11 bankruptcy as reported by the Securities and Exchange Commission (SEC). The data were analyzed using correlation analysis, *t*-test of means, OLS, and logistic regression.

Variables

This study uses the variables identified conceptually by the Public Company Accounting Oversight Board (PCAOB), which were used in previous bankruptcy-prediction studies and are publicly available. According to the PCAOB, the auditors, when examining a client for possible bankruptcy, should consider "recurring operating losses, working capital deficiencies, negative cash flows from operating activities, [and] adverse key financial ratios" (PCAOB 1989). While the PCAOB statement on appropriate factors to consider is more recent than the works cited in the literature review, those seminal works are still relevant today and provide the foundation for variable selection in current bankruptcy studies. As expected, the PCAOB recommendations emulate factor selection from those previous studies. Table 1 lists the factors used in this study.

It is anticipated that Chapter 11 firms will be in stronger financial positions than will Chapter 7 firms, albeit in weaker financial positions than will be viable firms; therefore, it is anticipated that all input factors except going concern and debt to assets will be higher on average for Chapter 11 firms than for Chapter 7 firms.

Data

The SEC lists financial (and other) data for all publicly traded companies. New Generation Research provides selected financial data for companies filing for bankruptcy. Data fields for the New Generation Research data list whether corporations filed for Chapter 7 or Chapter 11 bankruptcy, as well as dates of filing. SEC filings (Forms 10-K and 10-Q) include all the financial data and auditors' letters needed for this study. The data collected for each corporation were from the last financial statements submitted to the SEC on form 10-K immediately prior to the bankruptcy filing date, but not more than two years prior to the bankruptcy filing date. The data set includes all publicly traded companies filing for bankruptcy from January 1, 2009, to February 1, 2013. Of the original 500 publicly traded firms filing for bankruptcy during this period, 75 did not provide a 10-K to the SEC for the

two years prior to their bankruptcy filing dates. This study includes the remaining 425 firms, which consist of 75 U.S. firms that filed for Chapter 7 bakruptcy and 350 that filed for Chapter 11 bankruptcy. Following are a few idiosyncratic financial facts about these companies from the final 10-K before the bankruptcy filings.

Largest sales	Lyondell Chemical	Chemical	$22,674,000,000
Greatest Loss	Nortel Networks	Telephone	$5,799,000,000
Greatest Profit	Idearc	Advertising	$183,000,000
Most Assets	CIT Group	Finance	$80,448,900,000
Most Debt	CIT Group	Finance	$72,279,800,000
Greatest Retained Earnings	Eastman Kodak	Photographic	$4,071,000,000
Greatest Retained Deficit	Nortel Networks	Telephone	$42,362,000,000

Table 1. Factors Included in This Study

Liquidity	
CR	current ratio = current assets / current liabilities
CCDC	current cash debt coverage = cash from operations / current liabilities
Activity	
ARTO	accounts receivable turnover = net sales / average trade receivables
INTTO	inventory turnover = cost of goods sold / average inventory
ATO	asset turnover = net sales / average total assets
Profitability	
PM	profit margin = net income / sales
ROA	return on assets = net income / total assets
CFOA	cash flows on assets = cash from operations / total assets
Coverage	
DA	debt to assets = total debt / total assets
CDC	cash debt coverage = cash from operations / total debt
Financial History	
PP	past performance = retained earnings / total assets
RE01	retained earnings / deficit (0 = deficit, 1 = no deficit)
PNI01	previous year income (0 = NOL, 1 = NI)
Other Factors	
Total Assets at year end, stated in hundreds of millions of dollars	
GCAR	auditor report (0 = unqualified, 1 = going concern)
Dependent Variable	Bankruptcy (0 = Chapter 7, 1 = Chapter 11)

Note: NI=net income; NOL=net operating loss.

Of the 425 firms, 252 received going concern statements from auditors, although the period examined was a two-year window and auditors are required to consider only a one-year window.

Table 2 provides summary averages of all ratios. Not all ratios (e.g., inventory turnover) are applicable to all firms and were therefore not used in the calculation.

Table 2. Summary of Data Characteristics

Factor	*N*	Mean	Median
CR	418	2.02	0.68
CCDC	420	0.21	–0.06
ARTO	337	22.97	8.71
INTTO	193	23.63	6.24
ATO	393	0.91	0.66
PM	395	–12.23	–0.34
ROA	423	–6.23	–0.22
CFOA	423	–1.67	–0.22
DA	423	2.63	0.96
CDC	425	–0.17	–0.02
PP	423	–138.10	–0.78
RE01	425	15% of firms had positive retained earnings	
PNI01	425	24% of firms had a prior year net income instead of loss	
Total Assets	425	16.62 (in hundreds of $millions)	
GCAR	425	59% of firms received going concern statements	
Bankruptcy	425	83% filed Chapter 11; 17% filed Chapter 7	

Financial ratios for firms undergoing financial stress can be quite different from ratios for viable firms. Financial stress may significantly affect the current ratio, for example. Of 418 observations, only 155 firms had current ratios above 1. Fifty-six (56) firms had current ratios less than 0.1. Of 420 observations, 245 firms reported negative current cash debt coverage, due to negative cash from operations. Similarly, 246 of 423 observations for cash flow on assets were negative. Most of these observations (200) were between 0 and –1. Accounts receivable turnover varied dramatically. Firms with minimal sales and accounts receivable balances had account receivable turnover near 0; one hundred ninety-two (192) firms had accounts receivable turnover less than 1. Firms nearing bankruptcy or contemplating bankruptcy may let inventory levels approach zero, even if they are retailers, resulting in large inventory turnover ratios. One-third of the 193 observations for inventory turnover were ratios in excess of 10.

Asset turnover ratio may be a strong indicator of financial distress. Asset turnover and profit margin were missing 30 observations because 30 firms had no sales. With the firms having no sales for the last 10-K before filing bankruptcy, one might expect that most or all of these firms would file for Chapter 7 bankruptcy. Actually, however, only 12 of these 30 firms (40 percent) filed Chapter 7. The other 18 (60 percent) firms without sales filed for Chapter 11, in anticipation of continuing operations. Of the 393 observations for asset turnover, 144 exceeded 1, and 50 exceeded 2.

The highest return on assets was 2.67. Four firms had return on assets greater than 1, and only 40 firms had a positive return on assets. Financially distressed firms do not make efficient use their assets. Too much debt gets firms into trouble, from which they cannot recover. Of 423 observations for debt to assets, 244 had debt-to-asset ratios less than 1, but 75 of these had debt-to-asset ratios between .9 and 1.0. Having a respectable debt-to-asset ratio did not guarantee that a firm would avoid bankruptcy. Seventy-nine (79) bankrupt firms had debt-to-asset ratios of less than .4 in the last 10-K filed before filing for bankruptcy. These firms often had at least two consecutive loss years.

A retained deficit was common among the firms. Of 423 observations, 358 had retained deficits. Of 395 reporting firms, 40 (10 percent) had positive net income in the last 10-K before filing bankruptcy. This compares with 24 percent filing positive net income the previous year. Apparently, some firms that had the potential to continue without bankruptcy were pushed over the edge by one (or more) bad years.

Data Analysis and Results

To test our hypotheses, we have used several quantitative methods.

t-Test. The Pearson two-tailed correlation shows the level of correlation between the two examined variables, the direction of the correlation, and the significance of the relationship. The *t*-test, with assumed unequal variances, examines for significance the differences in means for each variable between Chapter 7 and Chapter 11 firms.

Results, displayed in Table 3, indicate that Chapter 11 firms look stronger than the Chapter 7 firms, and means are in the anticipated direction. Both sets of firms, especially the Chapter 11 firms, have respectable current ratio averages. While the current cash debt coverage ratio is negative for Chapter 7 firms, this ratio is positive for Chapter 11 firms, with a significant difference. Both sets of firms have very large accounts-receivable and inventory-turnover ratios immediately prior to filing for bankruptcy. The financial statements show that firms tend to have low levels of inventory and accounts receivable compared with what might be expected in their industries. Asset turnover varied significantly between the two sets of firms, and for neither set did this ratio average breach 1. Profit margin averaged negative for both sets of firms and did not differ significantly between Chapter 7 and Chapter 11 firms.

Return on assets and cash flows on assets were, on average, negative for both Chapter 7 and Chapter 11 firms. Debt to assets was at distressing levels for both Chapter 7 and Chapter 11 firms. With debt-to-asset ratios of 3.21 and 2.51 for Chapter

7 and Chapter 11 firms, respectively, it is not surprising that these firms are applying for bankruptcy.

Cash debt coverage varied significantly between Chapter 7 and Chapter 11 firms but averaged negative for both. Financial history of the firm (in the form of past performance, retained-earnings dichotomous variable, or previous-year income) did not vary significantly between Chapter 7 and Chapter 11 firms. Assets were significantly larger for Chapter 11 firms than for Chapter 7 firms. This may be due to Chapter 11 firms being larger initially than Chapter 7 firms or, as was seen in numerous cases, due to Chapter 7 firms selling off assets in efforts to save the businesses. Chapter 7 firms were significantly more likely to receive going concern statements from auditors than were Chapter 11 firms, with 76 percent of Chapter 7 firms receiving going concern statements and 56 percent of Chapter 11 firms receiving going concern statements.

Table 3. *t*-test Results for Chapter 7 and Chapter 11 Bankruptcies

Factor	Chapter 7 Mean	Chapter 11 Mean	*t*-value
CR	1.21	2.20	–.92
CCDC	–1.34	.53	–1.68^{+}
ARTO	33.47	21.51	.50
INTTO	27.60	23.24	.23
ATO	.69	.96	–1.73^{+}
PM	–25.97	–9.74	–1.66
ROA	–28.57	–1.47	–1.00
CFOA	–7.46	–.56	–1.03
DA	3.21	2.51	1.00
CDC	–.68	–.06	–1.83^{+}
PP	–751.31	–9.91	–1.01
RE01	.14	.16	–.43
PNI01	.219	.25	–.57
Assets	6.14	18.83	–2.94**
GCAR	.76	.56	3.49**

$^{**}p < .01$ $^{+}p < .10$

Although none of the correlations (Table 4) were greater than .2, this was expected, as it is difficult to discriminate between Chapter 7 and Chapter 11 bankruptcies. Still, the results are impressive because they show that although difficult, it is possible to identify some distinctions between Chapter 7 and Chapter 11 bankruptcy filings using financial data.

All significant correlations were in the anticipated direction. Of the significant correlations, asset turnover is the least correlated (.094) with type of bankruptcy, but the correlation is significant ($p < .10$). As asset turnover increases,so does the likelihood that

a firm will file for Chapter 11 versus Chapter 7 bankruptcy. Likewise, return on assets and cash flow on assets positively correlated ($p < .05$) with bankruptcy type. Like asset turnover, a better return on assets or cash flow on assets indicates greater likelihood that a firm will plan to continue operations after bankruptcy proceedings.

Debt to assets is negatively correlated with bankruptcy type, as expected. As the debt-to-asset ratio increases, a firm becomes more likely to select Chapter 7 bankruptcy and cease operations.

Past performance of the firm is a significant ($p < .05$) correlate of the type of bankruptcy filing, but the correlation is perhaps not as strong as anticipated. Current performance, in contrast, did not provide a significant relationship. Going concern explanation by the external auditors was the most significant ($p < .01$) predictor of bankruptcy filing and provided the most explanatory power. The negative correlation indicates that a firm filing for Chapter 7 bankruptcy is more likely to receive a going concern explanation in its auditor letter. This is rational, as firms filing Chapter 7 a priori would have worse ratios and would therefore garner more auditor attention.

Table 4. Correlations of Factors Used

Factor	Correlation with Bankruptcy Type
CR	.02
CCDC	.04
ARTO	–.06
INTTO	–.01
ATO	.10^{+}
PM	.08
ROA	.11*
CFOA	.11*
DA	–.11*
CDC	.05
PP	.11*
RE01	.02
PNI01	.03
Assets	.08
GCAR	–.15**

$^{+}p < .10$ $^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$

Ordinary Least Square Regression. We used the OLS model (Aldrich and Nelson 1984:10) to predict the factors affecting Chapter 7 or Chapter 11 bankruptcy filings. The objective of the OLS model is to select coefficients (b_k) to minimize the sum of the

squared differences between the observed outcomes and the predicted outcomes. The OLS model is

$$Y_i = \Sigma b_k X_{ik} + u_i$$

where b_k is a vector of unknown coefficients, X is the observed independent variable, and u is the error term. In this context (Y_i is either 0 or 1), the model is a "linear probability model." The observed outcomes are either 0 or 1: Chapter 7 or Chapter 11 bankruptcy. Because the methodology does not place bounds on the predicted outcomes, the resulting OLS model may yield probabilities greater than 1 or less than 0. The logit model, which we will discuss next, theoretically improves on OLS by restricting the predicted probabilities from 0 to 1.

We ran two different OLS models (Table 5). First, using all the input variables above, we identified two variables as significant components in the model: asset turnover and going concern. Model 1 provided an adjusted R-square of .037 ($p < .10$). Although the model was significant at predicting bankruptcy type, the overall model did not have much explanatory power. This result is consistent throughout the statistical methods used above and was anticipated.

Table 5. OLS Results

Dependent Variable: Bankruptcy Type				
	Model 1		Model 2	
Independent Variables	B	*t*	B	*t*
CR	–.08	–1.08	–.05	–.69
CCDC	.03	.34	.08	1.01
ARTO	–.10	–1.48	–.09	–1.38
INTTO	–.01	–.19	–.02	–.29
ATO	–.13	–1.88^{+}	–.13	–1.89^{+}
PM	.07	.93	.05	.68
ROA	–.05	–.32	–.06	–.15
CFOA	–.04	–.33	–.004	–.04
DA	–.04	–.28	.19	.48
CDC	.11	1.27	.10	1.19
PP	.18	1.61	.31	1.94^{+}
RE	.07	.98	.10	1.40
PNI	–.01	–.08	.01	.08
Assets	.05	.77	.05	.80
GC	–.13	–1.66^{+}		

$^{+}p < .10$ $^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$

Because the auditors develop the going concern audit report after examining the other financial factors, it is useful to examine the significance of other factors without going concern audit report as an input factor; we therefore ran a second OLS model without going concern (Model 2). The removal of the going concern audit report resulted in the significance of past performance as an input factor. The overall fit of the model, however, dropped to an adjusted *R*-square of .035 (with a significance of .293), which means the model has no explanatory power without going concern audit report.

Logistic Regression. Researchers cite the advantages of logistic regression models in studies with dichotomous dependent variables because logistics regression does not assume linearity between the dependent and independent variables (Stone and Rasp 1997). Accounting researcher studies show that OLS can perform as well as logistic regression (Gessner et al. 1988). OLS assumes that the relationship between the dependent and independent variables is linear. OLS also identifies the regression line fitting the data as the line that minimizes the sum of the squares of the errors of the predictions from the observations.

On the other hand, researchers use logit in many dichotomous output models, including failure-prediction models. Stone and Rasp (1997) noted a preference for logit over OLS in accounting-choice studies, even in studies using small sample sizes. Articles in the accounting research literature provide results of comparisons of OLS and logistic regression (logit and probit).

Noreen (1988) compared probit and OLS using samples of 50 and 100 observations—sizes he describes as average for accounting classification studies—with several ratios and at least one dummy variable as independent variables. Stone and Rasp identified and researched the tradeoffs between OLS and logit, stating that researchers can expect logit "to be more powerful whenever the relationship being modeled is nonlinear" (1997:184).

The logit model assumes a logistic relationship between the inputs and output. This model is

$$P(Y = 1 \mid X) = exp(\Sigma b_k X_k) / [1 + exp(\Sigma b_k X_k)]$$

where b represents the coefficient estimates of the model and X represents the observed values (Aldrich and Nelson 1984).

The objective of logistic regression is to select coefficients (b_k) that maximize the likelihood of predicting the observed outcome (0/1). Maximum likelihood estimation seeks to maximize the logit likelihood function (Aldrich and Nelson 1984):

$$L(Y \mid X, b) = \prod_{i=1}^{N} \left[\frac{\exp(\Sigma b_k X_{ik})}{1+\exp(\Sigma b_k X_{ik})} \right]^{Yi} \left[\frac{1}{1+\exp(\Sigma b_k X_{ik})} \right]^{1-Yi}$$

The logit model provides probabilities of success or failure but, unlike the OLS model, limits the output from 0 to 1.

We ran stepwise logistic regression using input variables in a forward integration logit model with .09/.10 probabilities and 411 observations. The results of the analysis, shown in Table 6, indicate that the model had a Cox and Snell *R*-square of .057.

Table 6. Results of Logistic Regression

		B	SE (B)	Wald	Sig.	OR
Step 1	GC	–1.39	.57	5.84	< .05	.25
	Constant	3.18	.51	38.78	< .001	24.00
Step 2	ATO	–0.36	.19	3.67	< .10	.70
	GC	–1.55	.59	6.92	< .01	.22
	Constant	3.77	.63	35.83	< .001	43.42
Step 3	ATO	–0.38	.19	4.15	< .05	68
	PP	0.02	.01	2.61	.11	1.02
	GC	–1.37	.61	5.08	< .05	.25
	Constant	3.83	.64	36.16	< .001	46.26

The above models show that going concern audit report is the strongest determinant of bankruptcy type. This is logical, given that the auditors will incorporate the other factor information (e.g., debt to assets, return on assets, past performance) in their going concern audit report decisions. Because the auditors develop the going concern audit report after examining the other financial factors, it is useful to examine the significance of other factors without going concern audit report as an input factor.

Table 7. Logit Stepwise Regression without GCAR

	Variable	Model Log Likelihood	Change in –2 Log Likelihood
Step 1	CCDC	–71.95	4.04*
Step 2	CCDC	–71.02	5.60*
	ATO	–69.97	3.51+
Step 3	CCDC	–67.84	4.59*
	ATO	–67.45	3.81+
	RE	–68.44	5.78*

$^{+}p < .10$ $^{*}p < .05$ $^{**}p < .01$ $^{***}p < .001$

Without going concern audit report, logit included three factors in the model: current cash debt coverage, asset turnover, and retained earnings (dichotomous variable). The model without going concern audit report had a Cox and Snell *R*-square of .055. As the results shows (Table 7), results were slightly different once we removed going concern from our model.

Table 8 outlines the factors determined with each method to have a significant relationship with bankruptcy type.

Table 8. Summary of Findings

Factor	*t*-test	Correlation	OLS with GCAR	OLS without GCAR	Logit with GCAR	Logit without GCAR
CR						
CCDC	X					X
ARTO						
INTTO						
ATO	X	X	X	X	X	X
PM						
ROA		X				
CFOA		X				
DA		X				
CDC	X					
PP		X		X	X	
RE01						X
PNI01						
Assets	X					
GCAR	X	X	X		X	

Asset turnover was a significant factor in every statistical method differentiating Chapter 7 and Chapter 11 firms. Apparently, efficiency of operations focusing on use of assets is a strong determining factor in planned corporate continuity. The going concern audit report was also a significant determining factor in all statistical methods in which it was available. This is not surprising, as the auditors have access to all the data analyzed here, and more.

Past performance in the form of retained earnings over assets was identified three times as significant. The three factors directly involving current assets—current ratio, accounts receivable turnover, and inventory turnover—did not differ between Chapter 7 and Chapter 11 firms and were not significant determining factors in any statistical

method. Firms nearing a bankruptcy decision see dramatic changes to their current-asset and current-liability positions. This may well cloud the picture for these firms.

Profit margin in the current year and whether the firm was profitable the prior year did not differ significantly between Chapter 7 and Chapter 11 firms, nor were these two factors identified in any statistical model as significant input factors. It is possible that the question of whether to file for Chapter 7 or Chapter 11 hinges more on the longer-term perspective than recent operations of results, based on the lack of significance of the ratios using current assets and current liabilities and the ratios of current and past-year profit performance.

CONCLUSION

Previous research has identified key factors separating bankrupt corporations from viable corporations, but this work has taken the previous research one step further, by differentiating between corporate bankruptcy types and examining factors explanatory of bankruptcy type (Chapter 7 or Chapter 11). Both Chapter 7 and Chapter 11 bankruptcy filings are indicators that firms have serious financial trouble. Although, based on prior studies, there is a distinct financial contrast between viable firms and firms filing for bankruptcy, the financial contrast between firms filing for Chapter 7 versus Chapter 11 bankruptcy is not as distinct. Still, there are significant financial differences between firms filing for the two types of bankruptcy. This study identified and discussed some of those financial differences, and the results of this research will help auditors, corporate management, corporate creditors and investors, and the FASB.

Corporate management and public auditors must make going-concern decisions about corporations' abilities to remain in business for the coming year. A model differentiating Chapter 7, Chapter 11, and viable firms can help corporate management make a decision or can help reinforce a decision already made. The model can also serve as an additional warning of impending bankruptcy. Such a warning can provide an impetus for management to make needed changes in time to save the corporation.

The FASB may well be the greatest beneficiary of this research. The FASB has issued an ASU requiring corporate management to render going concern letters. Such required letters could have more than one form of wording; they could include phrasing to indicate that the corporation plans to liquidate (Chapter 7) versus undertake financial restructuring (Chapter 11). Corporate management would therefore decide whether to issue a going concern letter, and, if so, whether that letter incorporates Chapter 7 or Chapter 11 wording.

Corporate creditors will also benefit from this research. Previous research has examined bankrupt corporations versus viable corporations. Chapter 11 financial reorganization changes the dynamics of creditor positions in the corporation yet may allow creditors to maintain a financial position, as opposed to the Chapter 7 bankruptcy.

There is a similar benefit for investors. Chapter 7 bankruptcy means the cessation of business and often means that investors receive little, if any, remuneration. Chapter 11 bankruptcy may provide the opportunity for investors to maintain some financial position in the corporation, depending on the terms of reorganization.

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