

**THE EFFICACY OF LIQUIDATION
AND BANKRUPTCY PREDICTION
MODELS FOR ASSESSING
GOING CONCERN**

*Nirosh Kuruppu
Fawzi Laswad
Peter Oyelere*

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Centre of Accounting Education and Research
PO Box 84
Lincoln University
CANTERBURY

Telephone No: (64) (3) 325 3627
Fax No: (64) (3) 325 3847
E-Mail: laswad@lincoln.ac.nz

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Abstract

Although previous research generally find bankruptcy prediction models to outperform auditors' going concern opinion accuracy in identifying failing companies, recent research questions whether bankruptcy is the best proxy for assessing going concern since filing for bankruptcy is not synonymous with the invalidity of the going concern assumption. Furthermore, in contrast to debtor-oriented countries such as the US, liquidation is the most likely outcome of corporate insolvency in creditor-oriented countries such as the UK, Germany, Australia and New Zealand. This suggests that bankruptcy prediction models have limited use for assessing going concern in creditor-oriented countries. Previous research has not recognised this distinction between corporate bankruptcy and liquidation in developing statistical models as an audit tool for assessing going concern. This study examines the efficacy of a corporate liquidation model and a benchmark bankruptcy prediction model for assessing company liquidation. It finds that the liquidation model is more accurate in predicting company liquidations in comparison with the benchmark bankruptcy prediction model. Most importantly, Type 1 errors for the liquidation prediction model is significantly lower than for the bankruptcy prediction model, which indicates its greater efficacy as an analytical tool for assessing going concern. The results also suggest that bankruptcy prediction models may not be appropriate for assessing going concern in countries where the insolvency code is creditor-oriented.

Keywords: Going concern, Auditors' opinions, Analytical techniques, Corporate liquidation prediction, Corporate bankruptcy prediction, Insolvency frameworks.

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1. Introduction

The purpose of this article is to examine the efficacy of statistical corporate liquidation prediction models for assessing client going concern status. Previous research shows that statistical bankruptcy prediction models consistently outperform auditors' going concern judgement in discriminating between bankrupt and non-bankrupt companies (Levitan and Knoblett, 1985; Cormier et al., 1995; Grant et al., 1998). However, research also questions whether corporate bankruptcy is the best proxy for the assessment of going concern since filing for bankruptcy is not synonymous with the invalidity of the going concern assumption (Shultz, 1995; Casterella et al., 2000).

Indeed, in countries such as the US where the insolvency laws are debtor oriented, corporate bankruptcy procedures encourage companies in financial difficulty to continue as going concerns (Franks et al., 1996). Therefore it is possible for companies that file for bankruptcy to reorganise and emerge from bankruptcy, or to merge with another entity as a going concern (Shultz, 1995). This is in contrast to the insolvency procedures in creditor oriented countries such as the UK, Germany, Australia and New Zealand where liquidation is the most common outcome of corporate insolvency (Kaiser, 1996; Franks et al., 1996). The costs of corporate liquidation also exceed the cost of bankruptcy to shareholders and to other stakeholders (Alderson and Betker, 1996; Alderson and Betker, 1999). Moreover, companies in debtor oriented countries may also choose to file for bankruptcy for strategic reasons other than financial distress, such as to avoid an unprofitable contract (Kennedy and Shaw, 1991; Chatterjee et al., 1996; Franks et al., 1996). These arguments suggest that a bankruptcy prediction model might not be the best proxy for assessing going concern.

This study examines the efficacy of a statistical model to predict company liquidation, which is a better proxy for assessing the validity of the going concern assumption than bankruptcy prediction models used in previous research. Given the differences in debtor and creditor-oriented insolvency frameworks, the results can assist auditors in choosing appropriate business failure prediction models as an analytical technique for assessing going concern.

The study develops a liquidation prediction model from a sample of 135 NZSE listed companies and analyses its classification accuracy in terms of Type 1 and Type 2 errors, and compares it to a benchmark bankruptcy prediction model which has been used to benchmark the performance of newly developed corporate failure models. The results indicate that the

Type 1 errors for the liquidation prediction model are significantly lower than for the bankruptcy prediction model. Given the high costs associated with misclassifying failing companies, it suggests that the liquidation prediction model can be used as a valuable audit tool for assessing going concern. The high accuracy of the liquidation prediction model also raises the implications of using bankruptcy prediction models in countries where the insolvency framework is creditor-oriented.

The remainder of the article is structured as follows. Section 2 examines the importance of the going concern concept in auditing and the requirements of the current auditing standards on going concern. Section 3 examines the usefulness of corporate distress models as an analytical procedure for assessing going concern, and discusses prior research in the area. Section 4 describes the research objective and hypotheses, followed by a description of the research design in Section 5. The data analysis and results are presented in Section 6, while Section 7 concludes the paper with the main findings and opportunities for further research.

2. The Going Concern Concept in Auditing

The going concern assumption has been recognised as one of the main concepts underlying financial reporting, which justifies accounting practices such as period reporting, accrual accounting and asset valuation (Boritz and Kralitz, 1987; Barnes and Huan, 1993; IAS 570). The going concern concept assumes that the reporting entity will continue in operation for the foreseeable future, and that it will be able to realise assets and discharge financial obligations in the normal course of operations. If the going concern assumption were to become invalid, both the period reporting and accrual concepts will also lose their relevance since defining assets as future economic benefits then becomes erroneous (Boritz and Kralitz, 1987). The traditional valuation of assets also loses its relevance since the realisation of assets at their reported value in the balance sheet becomes uncertain (Boritz and Kralitz, 1987). Furthermore, the classification of assets and liabilities into current and non-current categories in the balance sheet would also become meaningless.

Even though the going concern assumption is a fundamental concept in financial reporting, there has been little professional guidance on assessing going concern prior to the issuance of SAS 34 in the United States in 1981 (Johnson and Khurana, 1993; Guy and Carmichael, 2000). The dissatisfaction with auditors over the many company failures that occurred soon

after the issuance of a clean audit report motivated the development of SAS 34. The aim of this auditing standard was to bridge the public's expectation gap that auditors should be held responsible for disclosing going concern uncertainties (Guy and Carmichael, 2000). Other countries have since then followed suit to issue their own auditing standards on going concern such as SAS 130 in the UK, AUS 708 in Australia and AS 520 in New Zealand (Loftus and Miller, 2000).

Auditing standards on going concern including SAS 34 only require a passive approach to assessing going concern (Asare, 1990). For instance, it was only when matters indicating going concern issues were detected during the course of an audit that the auditor was required to search for more evidence supporting or refuting the going concern assumption. Subsequent revisions of auditing standards on going concern have increased in scope to minimise the 'expectations gap' between the financial statement users and auditors (Geiger et al., 1998). Current auditing standards on going concern now require the auditor to actively seek out circumstances that may negate the validity of the going concern assumption. Table 1 summarises the main requirements of auditing standards on going concern in the US, UK, Australia, New Zealand and international auditing standards.

Table 1
Evaluation Required by Auditing Standards on Going Concern

Country	Standard	Evaluation required	Audit period
US	SAS 59 (SAS 34 was superseded by SAS 59)	Specifically form an opinion on the going concern assumption from the results of usual audit procedures.	Not to exceed one year from the date of the financial statements being audited
UK	SAS 130	Plan and perform procedures specifically designed to identify going concern uncertainties (s21)	Not specifically defined or elaborated (s9), but likely to be the period that management has considered in assessing going concern s21(ii).
Australia	AUS 708	Auditor must obtain evidence that the going concern assumption is appropriate (s10) Must specifically assess going concern problems as part of the audit planning process (s.17)	One year (s4)
New Zealand	AS 520	Obtain audit evidence that the going concern assumption is appropriate (s27). Plan and perform specific procedures to identify going concern uncertainties (s8a, 30)	One year (s25)
IAS (IFAC)	ISA 570	Auditor should consider the appropriateness of the going concern assumption when planning and performing audit procedures and in evaluating their results (s2, s11, s12, s17)	One year (s18, s19)

Table 1 shows that auditors are required to perform procedures designed specifically to identify going concern uncertainties. Furthermore, since the use of analytical procedures is mandatory in all the countries referred to above, for example SAS 56, AUS 512 and AS 504, auditing standards are already in place to accommodate statistical models as an integral part of the review process.

3. The Relevance of Statistical Models for Assessing Going Concern

3.1 Introduction

The interest in statistical models for assessing going concern is largely motivated by the perceived expectations gap between auditors and financial statement users that place greater responsibility on the auditor for disclosing going concern uncertainties (Asare, 1990). The potential usefulness of statistical models for assessing going concern is recognised in the expectations gap literature since the late 1970s, when the Cohen commission's report (1978) on auditor responsibilities first suggested their use as a means toward reducing the expectations gap (Altman, 1983; Levitan and Knoblett, 1985; Asare, 1990). More recently, the AICPA (1993) in the US has also recognised the public's demand for an early warning system of corporate failure (Loftus and Miller, 2000). Given the success of statistical models in discriminating between failed and non-failed companies, they are seen as a tool that could assist auditors in making more accurate going concern judgements (Levitan and Knoblett, 1985; Louwers, 1998).

Previous research show objective statistical models to outperform auditors in assessing company failure (Cormier et al., 1995; Grant et al., 1998). One of the best known is Altman's ZETA bankruptcy prediction model which is used by over 80 commercial clients (Loftus and Miller, 2000). Such models can help auditors in forming more accurate assessments of clients' going concern status, and thereby help reduce the costs associated with inappropriate audit opinions such as litigation from shareholders, loss of clients and the loss of professional reputation (Koh, 1991; Carcello and Palmrose, 1994, Grant et al., 1995).

Koh and Brown (1991) assert that an accurate corporate distress model can help the auditor identify high-risk companies in the planning stages of the audit. This helps the auditor in

planning specific audit procedures aimed at assessing the appropriateness of the going concern assumption (Koh and Brown, 1991). Statistical models developed from Probit and Logit analyses, which are types of conditional probability model, also provide an objective assessment of the *probability* of the client failing. A high probability of failure alerts the auditor to the need to apply a more rigorous audit assessment than he or she might have in the absence of this information.

In the final stages of the audit, a corporate distress model can be used to verify that the overall audit opinion in relation to going concern is appropriate for the client's financial statements (Chen and Church, 1992). In the event that an adverse or qualified opinion is rendered, an objective statistical model can more readily help the auditor in justifying the decision to interested parties (Koh and Oliga, 1990; Chen and Church, 1992).

Furthermore, statistical evidence is accepted as evidence in court (Evidence Amendment Act No.2 1980, NZ). This allows an objective model to be used as a defence in court cases claiming audit failure (Wallace, 1983). A model that can assist auditors in minimising the risk of client misclassification can lessen the risks of litigation, which might subsequently filter down to clients in the form of lower audit fees. In the United States, for example, approximately 9% of auditor revenues are spent on defending lawsuits (Grant et al., 1998).

Due to the usefulness of statistical corporate failure models described above, auditing standards such as in Australia already recognise statistical models. The Australian standard on analytical procedures (AUS 512) with reference to AUS 708 on Going Concern draws the auditors' attention to financial models developed from Probit and Discriminant Analysis for assessing going concern. The Proceedings of the Expectations Gap Roundtable in the United States (1993) has also called for continued research into the effectiveness of analytical procedures, and it has identified the use of bankruptcy prediction models for assessing the validity of the going concern assumption (Blocher and Loebbecke, 1993). The ability of corporate failure models to provide objective evidence for making a going concern judgement is also recognised by accounting practitioners (Constable and Woodliff, 1994).

3.2 Review of Empirical Findings

Considerable empirical research compares the accuracy of bankruptcy prediction models to auditors' going concern qualifications. The seminal work by Altman and McGough (1974) investigates the usefulness of bankruptcy prediction models for assessing company going concern status, and follows the pioneering work of Beaver (1966) and Altman (1968). Altman and McGough (1974) find that their model was 82 percent successful in predicting bankruptcy filings when compared with auditors' going concern assessment of 46 percent accuracy. These results were re-affirmed in a later study by Altman (1983) where the models' average success in predicting bankruptcy was 86 percent compared to auditors' 48 percent.

Table 2 provides a summary of empirical studies. Most of the studies that followed the early work of Altman and McGough (1974) are similar in design, except that they were applied to different samples and sample periods, and examined bankrupt companies. These include Levitan and Knoblett (1985), Mutchler (1985), Koh and Killough (1990), Koh and Brown (1991) and Cormier et al., (1995) who developed bankruptcy prediction models to predict company failure.¹ The developed models were found to be more accurate when compared with auditors' prior audit opinions.

¹ The most common definition of company failure used in prior accounting research is filing for bankruptcy. Other definitions of corporate failure used in accounting research include large losses disproportionate to assets, stock exchange delisting, companies in the process of liquidation or receivership, an arrangement with creditors, failure to pay annual listing fees, negative stock returns and the receipt of a going concern qualification (Mutchler, 1985; Cormier et al., 1995; Zhang and Harrold, 1997; Nasir et al., 2000).

Table 2
Studies Applying Bankruptcy Prediction Models for Assessing Going Concern

Study	Place	Sample	Definition of Company Failure	Method	Findings	Conclusions
Altman and McGough (1974)	US	33 bankrupt; 33 non-bankrupt companies	Bankruptcy	MDA	Model accuracy 82% compared to auditors 46% accuracy.	Bankruptcy predictions models can be useful to auditors.
Altman (1983)	US	40 failed companies	Bankruptcy	MDA	Average bankruptcy model accuracy 86.2% compared to auditors' 48.1% accuracy.	Auditors should examine analytical methods which can assist in the going concern context.
Levitan and Knoblett (1985)	US	32 failed; 32 non-failed companies	Bankruptcy	MDA	One year prior to bankruptcy, model 84% accurate compared to auditors' 66% accuracy. Three year model average is 67% compared to auditors' 33%.	Model accuracy is a better predictor of bankruptcy when compared to auditors' opinion.
Mutchler (1985)	US	119 going concern qualified; 119 non-going concern modified companies	Receipt of going concern qualification	MDA	Model was able to predict the GC opinion 83% of the time.	Urges more studies into the overall function of the audit opinion since the majority of these opinions could be predicted by publicly available information.
Koh and Killough (1990)	US	35 failed; 35 non-failed companies	Companies reported as "failed" by the Wall Street Journal Index. No further details are provided	MDA	Model and auditors have similar accuracy for non-failed companies (88.6% and 88.86% respectively). Model accuracy strongly outperforms auditors for failed companies (78.57% to only 21.43% by auditors).	Asserts that future research could provide auditors with more sophisticated and accurate models for assessing going concern problems.
Koh and Brown (1991)	US	40 failed; 40 non-failed companies	Bankruptcy	Probit	Model predicted 82.50% of non-going concerns and 100% of going concerns yielding an average success rate of 91.25%. Auditors' average success rate was 68.75%, with a 40% success rate for failed companies.	Suggests the model as a useful audit tool.
Cormier et al., (1995)	Canada	138 failed; 112 non-failed companies	Annual stock return less than -50%	Logit, MDA and Recursive Partitioning (RP)	Classification rates for failed companies using Logit, MDA and RP respectively: 76.08%, 81.88%, 70.3% Auditors' accuracy was not compared in this study.	Models developed in this study can be compared with current practice in accounting firms. From this exercise, better specified models can be developed.

The findings of the empirical studies summarised in Table 2 indicate that statistical models could assist auditors in forming more accurate going concern judgements. This would assist the accounting profession in reducing the public's expectations gap of the profession, and in increasing the public's confidence in the audit function.

However, even though prior research have found bankruptcy prediction models to be useful for assessing going concern, other research indicate that a bankrupt company can be regarded as a going concern until the resolution of bankruptcy, and that company bankruptcy is less costly compared to company liquidation (Shultz, 1995; Alderson and Betker, 1996; Franks et al., 1996; Casterella et al., 2000). Indeed, Alderson and Betker (1996) show that the loss of going concern value forms the largest component of liquidation cost at 32 percent of corporate value. Furthermore, more than 50 percent of companies that re-emerge from bankruptcy generate a return that exceeds the return available on benchmark portfolios, indicating that corporate bankruptcy is not as costly as liquidation to shareholders and to other stakeholders (Alderson and Betker, 1996; Alderson and Betker, 1999).

These findings suggests that inappropriate audit opinions issued to liquidated companies are more costly than inappropriate opinions issued to companies which emerge from bankruptcy as going concerns. This distinction between bankrupt and liquidated companies suggests that company liquidation is a better proxy for assessing client's going concern status in statistical business continuity models.

4. Research Objective and Hypotheses

The objective of this study, therefore, is to examine the efficacy of a business continuity model to predict company liquidation. It is argued that liquidation is the better proxy for assessing the validity of the going concern assumption than bankruptcy prediction models used in previous research. To achieve this objective, three hypotheses are tested.

H₁: *A liquidation prediction model outperforms a bankruptcy prediction model in discriminating between liquidated and continuing companies.*

This hypothesis examines whether a liquidation prediction model is a better predictor of company liquidation than a benchmark bankruptcy prediction model. Altman's Z-score

bankruptcy prediction model is used for the comparison since it is frequently used to benchmark the performance of newly developed bankruptcy prediction models (Holmen, 1988; Eidleman, 1995). Furthermore, it is a tried and tested model that has been used in a number of different countries across various industry settings, and it has been even found to outperform country specific corporate failure models (Holmen, 1988; Eidleman, 1995).

H₂: Type 1 errors are lower for the liquidation prediction model compared to the bankruptcy prediction model in discriminating between liquidated and continuing companies.

A Type 1 error is misclassifying a failed company as non-failed. Prior research indicates that Type 1 errors are costliest to auditors, where it would lead to the possible loss of audit fee, professional reputation and litigation from shareholders (Koh, 1991; Carcello and Palmrose, 1994; Geiger et al., 1998). This indicates that for a corporate failure model to be an effective analytical technique for assessing going concern, it has to be highly accurate in predicting failing companies. This hypothesis identifies the errors of misclassifying a failed company as a non-failed company for the developed liquidation prediction model and the bankruptcy prediction model.

H₃: Type 2 errors are lower for the liquidation prediction model compared to the bankruptcy prediction model in discriminating between liquidated and continuing companies.

A Type 2 error is misclassifying a healthy company as failed, and the costs of Type 2 errors include the loss of professional reputation, loss of audit fee, and the client's demise due to the inappropriate audit opinion (Geiger et al., 1998; Louwers et al., 1999) This hypothesis assesses the difference in accuracy between the liquidation prediction model and the bankruptcy prediction model in misclassifying non-failed companies. The next section describes the research design followed to test the above hypotheses.

5.0 Research Design

5.1 Sample Selection and Variables

The first stage in testing the developed hypotheses requires the development of a liquidation prediction model for New Zealand companies. Most of prior studies on bankruptcy prediction were able to use online databases such as Compact Disclosure and NAARS to obtain the

required data for model development. New Zealand has no such online database of failed company financial data which make the data collection much more difficult.

However, a large number of listed companies failed in the years following the stock market crash of 1987 which enables the researcher to obtain a sufficiently large number of failed companies. Therefore, to enable the development of a liquidation prediction model for New Zealand, listed companies that were liquidated and struck off from the Companies Register from 1987-1993 were identified from the Companies Office database. This process identified 85 liquidated companies. A further group of 50 continuing companies that delisted during the same period were also selected to represent companies which are going concerns, but which are not in sound financial health (Zhang and Harrold, 1997; Nazir et al., 2000). Since auditors are more likely to issue a going concern qualification to companies in financial stress, a model that can discriminate between failed and other stressed companies is argued to be especially useful (Foster et al., 1998). Companies in the financial and property sectors were excluded from the sample due to significant industry differences (Grant et al., 1998). This resulted in a total sample size of 135 companies, which is a significantly large sample relative to the number of companies listed on the New Zealand Stock Exchange.

The financial statement data were then manually obtained from the various archives of New Zealand universities and national libraries. For each company, 174 individual pieces of data were entered, which resulted in over 23,000 entries.

The financial statement data collated from the sample companies were used to calculate 63 explanatory variables for the prediction model. This includes variables found to be useful used in prior studies and additional variables not used in prior corporate failure studies. The new variables were identified as potentially useful variables for corporate failure prediction by examining the literature on financial statement analysis (Ketz et al., 1990; Woelfel, 1994; Bertoneche and Knight, 2001). These new variables include ratios calculated from total tangible assets, interest coverage, working capital turnover, asset turnover ratios and the audit report lag, among others. The dependent variable was coded as a binary variable, where 1 is defined as a failure and 0 is defined as a non-failure.

5.2 Statistical Modelling Approach

Multiple Discriminant Analysis (MDA) is used to develop the liquidation prediction model since it is proven to be robust in bankruptcy prediction and there is no significant difference in accuracy between MDA models and Logit/Probit Analyses (Collins and Green, 1982; Allen and Chung, 1998). Furthermore, preliminary data analysis using both these methods on the New Zealand sample identified the MDA model as having greater accuracy in predicting company liquidation when compared to a Logit model developed from the same data.

Prior studies using Multiple Discriminant Analysis (MDA) have often used a sample matching approach, for example, by matching failed and non-failed companies by industry. However, this approach is not necessary since discriminant analysis optimally classifies between the two given sample groups. Lau (1987) and Gilbert et al. (1990) have used this approach. Furthermore, due to the relatively small New Zealand sample size compared to overseas studies it is difficult to obtain a sufficiently large number of failed companies if sample matching is used.

Prior studies have also used equal group sizes when analysing the discriminant function that maximally discriminates between the two groups. However, discriminant analysis does not require equal group sizes since prior probabilities can be computed from the individual samples by weighing (George and Mallery, 2001). Hence in this study, prior probabilities of group membership are calculated from the failed and non-failed sample sizes.

The discriminant function is derived by the Wilks' lambda (λ) stepwise method. This procedure uses the 63 variables for the 135 companies in an iterative process to retain the most significant variables in a discriminant function that maximally discriminates between the two sample groups by minimising the Wilks' λ at each step of variable entry. The stepwise procedure is used in preference to a 'forced entry' approach because in practice, the stepwise discriminant procedure performs better than when all the variables are forced into the discriminant function (George and Mallery, 2001). This was confirmed during preliminary analysis on the New Zealand sample using both an Enter and Stepwise method.

5.3 Model Validation and Hypotheses Testing

There are two main methods available for model validation, using a holdout sample or the Lachenbruch procedure (Jones, 1987). The former method entails applying the developed model to a new sample of companies not used to derive the model. The Lachenbruch procedure develops a model from $n-1$ observations, and applies it to the observation not used in developing the model. This is repeated until all the firms in the sample are used to assess the model's accuracy. Most importantly, the Lachenbruch method provides an unbiased estimate of the misclassification rate (Jones, 1987). Since the entire sample can be used for cross-validation, this method is useful for use in the corporate failure setting due to the generally small² sample sizes available. Therefore, due to the suitability of the Lachenbruch method in this context, given the relatively small sample size that can be used in New Zealand, it is used to cross-validate the discriminant function.

The hypotheses are tested by comparing the developed models accuracy from the Lachenbruch cross-validation method to Altman's Z-score bankruptcy prediction model which is also applied to the sample of companies used to develop the New Zealand model. Due to the lack of market value information, Altman's modified Z-score model is used with adjusted coefficients (Eidleman, 1995).

6. Data Analysis

6.1 The Model

The summary discriminant analysis results are shown below in Table 3. The discriminant analysis on the sample of New Zealand companies using the sixty three independent variables with the stepwise methodology results in a twelve variable discriminant function. These twelve variables coincidentally form the optimum discriminant function that maximally discriminates between the failed and non-failed company groups. Out of the 12 variables found to be significant ($p < 0.05$), only three are common to prior studies. These are the Current Assets/Current Liabilities, Total Sales/Average Total Assets and Total

² For example Grant et al., (1998) developed their model using 17 bankrupt companies and validated it by using 15 companies. Lau (1987) also used a very small sample size of 15 companies.

Liabilities/Total Assets ratios. The remaining eight ratios have not been found to be significant in previous bankruptcy prediction research and are therefore unique to this study.

The tolerances for the model at the final step of variable entry are all above 0.001 indicating that the variables in the discriminant function are not highly dependent or correlated with other variables in the function. The canonical correlation is 54.5% and 100% of the variance is explained by the discriminant function. A high Chi-square value which is statistically significant at $p < 0.05$ indicates that the discriminant function classifies well.

Table 3
Discriminant Function Summary Statistics

Step	Entered Variable	Unstandardised Canonical Discriminant Function Coefficients	Wilks' Lambda (λ)	Tolerance at Step 12	Sig
1	Total Sales/Total Tangible Assets	3.298	0.952	0.051	0.017
2	Quick Assets/Total Assets	-3.920	0.903	0.673	0.003
3	Current Assets/Current Liabilities	0.163	0.875	0.566	0.002
4	Total Sales /Average Total Assets	-2.671	0.847	0.051	0.001
5	Net income/Average Total Assets	5.030	0.801	0.232	0.000
6	Total Liabilities/Total Assets	3.654	0.775	0.167	0.000
7	Net Income/Shareholders Funds	-0.119	0.760	0.829	0.000
8	Working Capital/Total Sales	0.023	0.746	0.936	0.000
9	Sales/ Average Accounts Receivable	0.005	0.732	0.970	0.000
10	Sales/Average Working Capital	-0.002	0.722	0.968	0.000
11	Net Income/Total Liabilities	-0.425	0.713	0.263	0.000
12	Shareholders Funds/Total Assets	1.727	0.704	0.196	0.000
	Constant	-2.786			
Eigenvalues					
Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation	
1	.421(a)	100.0	100.0	.545	
Wilks' Lambda					
Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.	
1	.704	38.685	12	.000	

Table 4 shows the results of the Lachenbruch cross-validation procedure. Lachenbruch cross-validation involves developing a discriminant function from all companies in the sample except for one which used to validate the function. This procedure is repeated until all the companies in the sample have been used as a held-out company. The Lachenbruch classification results show that 36 percent of non-failed companies and 92 percent of failed companies are correctly identified. This is a robust performance given that the function correctly classified 38 percent and 92 percent respectively for the original cases. The model has a Type 1 error of only 8 percent and a Type 2 error of 64 percent. The very high accuracy

for predicting failed companies and lesser accuracy for non-failed companies is consistent with prior research (Mutchler 1985; Koh and Killough, 1990, Morris, 1997). Since Type 1 errors are agreed to be the most costly to auditors, the model's Type 1 error rate of only 8 percent shows its usefulness as an analytical technique for assessing going concern.

Table 4
Lachenbruch Classification Results

STATUS		Predicted Group Membership			Total
		.00	1.00		
Original	Count	.00	19	31	50
		1.00	7	78	85
	%	.00	38.0	62.0	100.0
		1.00	8.2	91.8	100.0
Cross-validated	Count	.00	18	32	50
		1.00	7	78	85
	%	.00	36.0	64.0	100.0
		1.00	8.2	91.8	100.0
Type 1 error: 8.2% Type 2 error: 64%					
71.9% of original grouped cases correctly classified. 71.1% of cross-validated grouped cases correctly classified.					

6.2 Altman's Z-score Model

Altman's model was applied to the same sample of companies used to develop the liquidation prediction model and comprises of five ratios, namely: Working Capital/Total Assets, Retained Earnings/Total Assets, EBIT/Total Assets, Book Value of Equity/Book Value of Debt and Sales/Total Assets. The results of Altman's Z-score model are shown below in Table 5. Altman's model correctly classifies company failures 41 percent of the time and correctly classifies non-failed companies 54 percent of the time. This results in a Type 1 error rate of 59 percent and a Type 2 error rate of 46 percent.

Table 5
Altman's Z-score Model Accuracy

Actual Membership	Predicted Membership		Total	% accuracy
	Failed	Non-failed		
Non-failed	23	27	50	54
Failed	35	50	85	41
Type 1 error: 59% Type 2 error: 46%				

6.3 Hypotheses Tests

The results support Hypothesis 1 that a liquidation prediction model outperforms a bankruptcy prediction model in discriminating between liquidated and continuing companies. The developed company failure model for New Zealand companies was 92 percent successful in predicting company failures compared to Altman's Z-score model accuracy of 41 percent.

Due to differences in debtor and creditor oriented insolvency frameworks among various countries, this finding has significant implications on the choice of corporate failure model that is more appropriate for assessing going concern. Essentially, a non-going concern in a debtor oriented insolvency framework has the opportunity to reorganise and continue operations when the same company would have been liquidated in a creditor oriented insolvency framework.

For debtor oriented countries such as the US where much of previous corporate failure research has taken place, bankruptcy prediction models might still be of value since the US bankruptcy code is designed to keep companies as going concerns (Franks et al., 1996). A liquidation prediction model would not be suitable in this context since bankrupt companies can emerge from bankruptcy as a going concern. However, for countries where the insolvency procedures are creditor oriented, such as in the UK, Germany, Australia and New Zealand, liquidation is the more likely outcome of insolvency (Kaiser, 1996; Franks et al., 1996). In the latter mentioned countries, creditors can obtain control of the company and has the legal right to recover their debt even though it results in the debtor companies' liquidation (Kaiser, 1996; Franks et al., 1996). This suggests that liquidation prediction models are better proxy for assessing going concern in countries where the insolvency laws are creditor oriented.

Hypothesis 2, that the Type 1 errors are lower for the liquidation prediction model compared to the bankruptcy prediction model, is also supported. It shows that the liquidation prediction model correctly classified a failing company 92 percent of the time compared to Altman's bankruptcy prediction model's accuracy of 41 percent. This result in a Type 1 error rate for the liquidation prediction model of only 8 percent compared to Altman's Type 1 error rate of 59 percent. Given that Type 1 errors are most expensive to auditors (Koh, 1991; Carcello and Palmrose, 1994; Geiger et al., 1998), it shows that the liquidation prediction model is a better analytical tool for the auditor for assessing going concern.

Hypothesis 3 is rejected since the developed model has a higher Type 2 error rate of 64 percent compared to Altman's Type 2 error rate of 46 percent. Prior bankruptcy research also show that corporate failure models generally have high Type 2 errors compared to Type 1 errors (Koh and Killough, 1990, Morris, 1997). The liquidation prediction model correctly classified non-failed companies 36 percent of the time compared to Altman's 54 percent accuracy. This indicates that Altman's model is better at predicting non-failures compared to the developed liquidation prediction model.

The above findings confirm the liquidation prediction model's accuracy over Altman's benchmark bankruptcy prediction model in classifying between liquidated and continuing companies. The liquidation prediction model is more accurate in predicting company liquidation with an accuracy of 92 percent. Given the high costs associated with misclassifying failing companies, this suggests that the developed model can be used as a valuable analytical tool to assist the auditor in forming the going concern judgment.

Furthermore, the findings of this study also raise the issue of the appropriateness of using bankruptcy prediction models in countries where the insolvency code is essentially creditor oriented. In countries such as the UK, Australia and New Zealand, a liquidation prediction model is likely to be more appropriate because the majority of insolvent companies are liquidated, and not given the opportunity of remaining as a going concern as encouraged by the US Chapter 11 insolvency procedures.

7. Summary and Conclusions

This study developed and tested the efficiency of a liquidation prediction model against Altman's benchmark bankruptcy prediction model based on the premise that company liquidation is a better proxy for assessing the validity of the going concern assumption than corporate bankruptcy. The developed corporate liquidation model was found to outperform Altman's bankruptcy prediction model in predicting company liquidation. This finding is significant given that Altman's model is a proven model and has been used to benchmark the performance of newly developed corporate failure models (Holmen, 1988; Eidleman, 1995). The Type 1 error of only 8 percent for the New Zealand model is very important given the large costs associated with not qualifying a failing company (Koh, 1991). Furthermore, the going concern status of a company is more likely to be called into question for companies in

financial distress rather than for healthy companies (Foster, et al., 1998). Hence, the New Zealand model's accuracy of 92 percent in classifying failed companies is especially significant given that the model was developed from failed and stressed companies rather than failed and healthy bankrupt companies as used in prior studies. Consistent with prior research, Type 2 errors remain relatively high compared to Type 1 errors (Mutchler 1985; Koh and Killough, 1990, Morris, 1997).

This research therefore shows that a company liquidation model can be used as a valuable audit tool in assessing going concern due to its very high accuracy with low Type 1 errors. Given the argument that company liquidation is a more appropriate proxy for a company's non-going concern status, this finding is especially important. As a result, future research should be directed at assessing the efficiency of corporate liquidation prediction models as an analytical tool for auditors. This line of research is useful given that bankruptcy prediction models developed in countries where the insolvency law is debtor oriented may not be appropriate for use in countries where the insolvency laws are essentially creditor oriented, such as in the UK, Australia and New Zealand.

Furthermore, previous research has made inferences between auditor accuracy and statistical models' accuracy based on prior audit opinions. Future research should more actively seek to address how useful are statistical corporate failure models for auditors in the actual decision-making environment and in different insolvency frameworks, which have not been addressed in prior accounting and auditing research.

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