FAILURE IN THE RETAIL INDUSTRY USING FINANCIAL DISTRESS PREDICTION MODELS

by

Sherika N. Miller

ANDREW BORCHERS, DBA, Faculty Mentor and Chair

JUDY BLANDO, DM, Committee Member

ELAINE M. GREGORY, DBA, Committee Member

Todd C. Wilson, PhD, Dean, School of Business and Technology

A Dissertation Presented in Partial Fulfillment

Of the Requirements for the Degree

Doctor of Business Administration

Capella University

August 2020

Abstract

Financial loss and bankruptcy can occur in any company regardless of the industry. Scholars have introduced financial distress prediction models to help managers and shareholders predict the possibility of bankruptcy. The general problem in this study was when a business struggles to generate profits and maximize shareholders wealth, the result can lead to a state of financial distress. The specific problem addressed bankruptcy filings in the retail industry. The purpose of this quantitative study was to test and investigate the efficacy of financial distress prediction using the original Altman Z-score and Bhandari and Iyer models to predict the possibility of financial failure in publicly traded retail companies. A consensus is lacking relating to the performance of various proposed financial distress predication models in varying economic circumstances. To address this gap in knowledge, two models were examined with different variables and economic conditions. The study was guided by the liquidity, profitability, and wealth theory coupled with the cash flow theory. Three research questions were investigated. "To what extent does the original Altman Z-score equation accurately predict corporate financial distress for retail firms that filed for bankruptcy during 2012 – 2018?" "To what extent does the Bhandari and Iyer equation accurately predict corporate financial distress for retail firms that filed for bankruptcy during 2012 – 2018?", and "To what extent do the original Altman Z-score and Bhandari and Iyer models perform relative to each?" The questions were tested for one, two, and three years prior to bankruptcy. Secondary data was gathered from the Electronic Data Gathering, Analysis and Retrieval database for 38 U.S. publicly traded retail firms (19 bankrupt and 19 non-bankrupt). The chi-square test of independence was used to answer the research questions. Study results do support a statistically significant relationship between the Altman Z-score model, Bhandari and Iyer model and corporate financial distress one and two years prior to

bankruptcy. Study results do not support a statistically significant relationship between the Altman Z-score model, Bhandari and Iyer model and corporate financial distress three years prior to bankruptcy. The results showed the Bhandari and Iyer cash model performed better than the Altman Z-score in predicting corporate financial distress in U.S. publicly traded retail firms. The study contributed to the body of knowledge in business by showing financial distress prediction models are important to practice and can reveal financial trouble one and two years prior to failure.

Dedication

Thank you to my Lord and Savior, Jesus Christ. It was my faith in Christ that keep me going and helped me complete this dissertation journey. A special thank you to my mom for always encouraging me to follow my dreams and giving nuggets of advice. Your Angel is a Doctor now! I dedicate this dissertation to my husband, Brian Miller, and son, Sean Stubbs. Brian, you are my rock, my cheerleader, my support system. I appreciate you giving me the space to complete this journey but always close enough to encourage me. Thank you for those kisses on the forehead as I sat at the computer working on my dissertation. Special powers were in every kiss because I gained the strength to write the next paragraph. You believed in me when I did not believe in myself, you celebrated me when I did not celebrate myself and you comforted me when I did not think I could read another article, write another paragraph or do another Google search. I love you and appreciate you.

I thank my extended family, aunts, and cousins I appreciate the calls and texts of affirmation and encouragement, telling me how proud you are that I was first in the family to become a Doctor. I want to thank my weekly prayer partners, Monique McFadden and Teresa Lampkin you ladies encouraged me every Thursday at 6 am from the start of this journey. Your prayers were unwavering and got me through. Lastly, a special thank you to my DNT fitness family, you guys ROCK! I appreciate the encouraging words and the "Hey Dr. Miller" even before I finished the journey. DNT is truly my extended family. Thank you to the founder, David Tinsley, for the vision of a fitness group that is not just exercise but a circle of people who encourage each other in all aspects of life.

Acknowledgments

I acknowledge my scholar cohort, the friends I have met along this journey who encouraged and supported me to finish my doctorate while they were doing the same. A special thank you to Dr. Patricia Green-Douglas, a true inspiration and example of determination to finish the doctoral journey. I especially want to thank my mentor, Dr. Borchers, for his consistent availability and the timely feedback during the dissertation journey. Thank you for your patience through the changing of my dissertation. A special thank you to Dr. Granberry for helping navigate the topic change, and Dr. Preiksaitis for her guidance and feedback. Thank you to my committee members, Dr. Blando and Dr. Gregory, for your feedback.

I must acknowledge Dr. Bhandari, the author of the cash flow model used in this dissertation. Thank you so much for your availability via email and your willingness to provide a better understanding of your published work. I could not have succeeded in this journey without my employer, Clark Enterprises, Inc. (CEI). I appreciate the financial investment in my dream to teach Accounting someday. Thank you to my CEI colleagues for the emotional support.

Table of Contents

List of Tables

List of Figures

CHAPTER 1. INTRODUCTION

Introduction

Corporate failure most often occurs when a company encounters significant financial losses and becomes indebted with liabilities in excess of its assets. Business losses can occur as a result of a change in the economic climate, such as a decrease in the total level of demand or by management failure. According to Korol and Korodi (2010), a company can experience financial losses as a result of rising market interest rates causing the cost of borrowed funds to increase or changes in government regulation. Macroeconomics, which are out of the control of a company can lead to financial anxiety with an outcome of bankruptcy (Bhunia & Sarkar, 2011). While the topic of business failure remains current, financial distress has been researched often and over an extended time period dating back many decades. Oz and Simga-Mugan (2018) posited that a consensus is lacking relating to the performance of various proposed financial distress predication (FDP) models in varying economic circumstances. In an effort to address this gap in knowledge, this research examined the results from two models that used different variables.

Sun, Li, Huang, and He (2014) noted early warnings of corporate failure, financial distress, and bankruptcy are fruitful research topics for corporate finance because at the core is FDP. Models using accrual basis financial statements to calculate financial ratios, which helps forecast a company's financial hardship, have been the most popular (Almamy, Aston, & Ngwa, 2016; Altman, 1968; Bhandari & Iyer, 2013). The use of FDP models can provide valuable

insight to interested stakeholders and business executives to predict the failure risk of a business. With this knowledge base, the appropriate corrective actions can be implemented to avoid unpleasant outcomes. FDP models are widely used in accounting, finance, and regulatory contexts to produce results that provide insight for an array of businesses purposes. Jones and Hensher (2004) posited such purposes include overseeing the solvency of banks or financial institutions by regulators, going concern estimations by corporate auditors, and the assessment of loan security.

The retail industry has been of significant concern to the financial markets. According to Keener (2013), research predicting the financial success of retailers is an important topic because once successful retailers such as Sears, JCPenney, and Kmart, have experienced declining sales. Evans and Mathur (2014) researched financial ratio analysis trends of U.S. retail companies over a 25-year period leading up to the great recession of 2008. The authors suggested investors and management analyze fundamental liquidity and efficiency financial ratio measures to help determine the retail company's performance level. With a detailed review of a company's financial ratio measures, such principles as the firm's going concern or asset impairment might be exposed. In concert with these findings, the current research examined financial distress of selected retail companies using two different models that required different variables. The original Altman (1968) model used accrual-based financial statement measures and the Bhandari and Iyer (2013) model used cash flow statement measures as predictor variables.

The objective of Chapter 1, consisting of 11 sections, is to introduce the dissertation topic explaining the importance of corporate financial distress. The background provides a brief

synopsis of the foundational research, followed by the business problem describing the issue organizations are confronted with when predicting corporate failure in the retail industry. The research purpose particularizes the research design flowing into the research questions, which guided the process of the study. The rationale section explained the importance of the research, followed by the theoretical framework that described the structure of the theories used to explore the research. The significance of the study section provide insight into the association of knowledge sharing, while the definition of terms established a uniform understanding throughout the research. The final sections of Chapter 1, assumptions and limitations, and organization for remainder of the study described the elements that can impact the research and detail the remaining chapters of the study, respectively.

Background

FDP models such as discriminant analysis, logistic regression (Du Jardin, 2012), and neural networks (Koh & Tan, 1999) have been researched and found to predict business failure within a few years before bankruptcy accurately. According to Al-Hroot (2015), what these researchers failed to discuss was the influence of selected ratios and the sample size of the same statistical method on distress prediction model accuracy. Dating back to the 1930s, a wealth of knowledge can be found in the literature relating to predicting corporate failure, that includes a wide range of variables. Fitzpatrick (1934), suggested that business failures usually occur over time, in stages, and are of no surprise to management. With the creation of new FDP models, scholars echo Fitzpatrick's findings and insert early signs of trouble must be properly addressed in an effort to avoid financial problems or business failure.

Beaver (1966) was the first study to implement a statistical technique for predicting business failure and bankruptcy. The model was univariate, meaning each ratio was examined separately (Rezende, Montezano, Oliveira, & Lameira, 2017). Beaver's model tended to correctly predict financial deterioration years before failure, however, there was an overlap between the outcome of each ratio. Batchelor (2018) surmised Beaver's analysis could cause confusion. For example, the profit margin ratio (net income/net sales) produced positive results indicating the firm was healthy. However, in contrast, the working capital to total assets ratio (current assets – current liabilities/total assets) might produce results leaning more toward failure. The body of work produced by Beaver developed a trajectory for FDP models and laid the foundation for financial failure and bankruptcy forecasting.

Following the suggestion of Beaver (1966), Altman (1968) included a set of financial metrics combined with a multivariate discriminant analysis (MDA) approach that aimed to provide a higher statistical significance. The result was a Z-score model with the ability to predict bankruptcy at least one year before entry into bankruptcy (95% accuracy). The Altman study was comprised of 66 manufacturing corporations selected on a stratified random basis which was divided into two groups, bankrupt and non-bankrupt. Accrual basis balance sheets and income statements were gathered for the 66 selected firms to calculate the variables (ratios). Altman started with 22 potential variables but concluded that only five would be used in the new model. These five were chosen based on relevancy to the new model and popularity in prior literature. Altman's (1968) discriminant function is $Z_A = 0.012X_1 + 0.14X_2 + 0.033X_3 + 0.06X_4 + 0.999X_5$.

Altman (1968) tested the success of the model by dividing the Z-values into three categories. Altman determined if a company had a Z-score below 1.81, they were considered bankrupt and found to be in a distressed zone. Meanwhile, if a company had a Z-score above 2.99, they were non-bankrupt and in a safe zone. The Z-score range of 1.81 and 2.99 was considered the "zone of ignorance" or the "gray area" (Altman, 1968, p. 606). Altman formulated what was known as a cut-off point, called the optimum Z-value. The need for a cut-off point was because potential users did not have access to the needed computer software to perform MDA analyses. This limitation led to users of the Z-score model drawing their own conclusions. Altman found the optimum Z-score value that discriminated between failed and non-failed firms was 2.675.

Bhandari and Iyer (2013) used predictor variables (financial ratios) derived mostly from the cash flow statement to build a new model that would predict business failure. Using a similar discriminant technique analysis as Altman (1968), the research consisted of 100 firms (50 failed firms and 50 non-failed firms). These firms were categorized using business activities codes known as the Standard Industrial Classification (SIC). Bhandari and Iyer was different from Altman because the model included a sample of companies that were classified as doing business in more than 20 different industries using multiple SIC codes. The model was comprised of seven ratios that were logically selected as compared to Altman, which selected ratios using statistical measures. Bhandari's and Iyer (2013) seven variable discriminant function including intercept term is written as $Z_B = -.531 + .675\ X_1 + .001\ X_2 - .028\ X_3 + .637\ X_4 + .096\ X_5 + .165\ X_6 + .006\ X_7$.

Similar to Altman (1968), Bhandari and Iyer (2013) tested the success of the model using the discriminant score's proximity to group centroid values to classify firms into a failed or non-failed category. Firms with a Z-score in the vicinity of - 0.718 where classified as failing while firms closer to +0.756 where non-failing. Bhandari and Iyer found the optimum Z-score value discriminated between failed and non-failed firms was 0.019.

The Altman (1968) and Bhandari and Iyer (2013) models are considered to be highly regarded tools in FDP for the business arena and researchers (Altman, Iwanicz-Drozdowska, Laitinen, & Suvas, 2017; Husein & Pambekti, 2014; Orabi, 2014; Oz & Yelkenci, 2017; Unegbu & Adefila, 2013). An array of research efforts followed using the Z-score model because, based on the macroeconomic conditions or industry changes, the same predictive models can yield different results. Researchers continue to use Altman and Bhandari and Iyer as well as many other models applying them to different industries and countries. For example, Darmawan and Supriyanto (2018) investigated financially distressed mining companies listed on the Indonesian Stock Exchange during 2011-2014 using the Altman Z-score model. They found when using the Z-score model to predict financial distress, the results accurately showed the financial state of the firm.

To investigate the efficacy of the Bhandari and Iyer Z-score, Kartikaningdyah and Handal (2018) examined the cash flow statement of Nigerian companies and found the model worked well but needed to be further tested. Hayes, Hodge, and Hughes (2010) outlined the development and evaluation of the Altman Z-score applying the model to several pairs of firms from an array of specialty retail industries covering two years. The study found the Z-score, 94%

of the time, consistently predicted bankruptcy filing, while 90% of the time, the model correctly predicted financial distress. Darmawan and Supriyanto (2018) recommended further research be conducted comparing the Altman Z-score to models with different predicative variables in sectors other than mining. The current sought to fill this gap and provide more insight into the model with the best FDP ability for managers, investors, and shareholders to use in the business decision-making process.

Business Problem

A stable economy relies on financially healthy businesses. The general business problem is when a company struggles to generate profits and maximize shareholders wealth, the result can lead to a state of financial distress. Financial analysis of a company's financial statements can be helpful to avoid the high cost of bankruptcy. During the 2008 economic recession, Pindado, Rodrigues, and de la Torre (2008) suggested there was widespread frustration with credit rating agencies because their analyses did not focus on the probability of financial distress. The study explained reporting on FDP would uncover financial aspects of a firm that would reveal the financial position. With the knowledge of a firm's true financial situation before the whispers of bankruptcy, corrective actions could be implemented, particularly across different industries.

Financial distress in the retail industry is of concern and is not a new phenomenon. Shaked and Orelowitz (2017) explained that distressed retail companies were at an all-time high. The U.S. Commerce Department reported that department store sales experienced 23 consecutive months of declines. The U.S. Census Bureau (2017) explained, a 7.2% decline was realized in

December 2016 compared to December 2015. Even before these statistics, the retail industry was collapsing and experiencing financial hardship. At the height of the 2008 recession, retail companies experienced falling stock prices, store vacancies, and went out of business (Evans & Mathur, 2014). Retail giants such as Walmart were not exempt from this downturn as the company failed to attain its financial goals during this period of recession.

Retailing is a segment of the economy which constitutes the purchase of finished products by consumers from individuals or companies. According to Shaked and Orelowitz (2017), retail gives way to an openly competitive environment that cultivates strong business operations and sparks innovations that increase efficiency and reliability. The study of financial failure in the retail industry is important because, during economic downturns, retailers experience more hardship as compared to other industries (Archana, 2018; Bhargava, Dubelaar, & Scott, 1998; Evans & Mathur, 2014; Keener, 2013). According to Sun et al. (2014), early warning signs of financial distress, corporate failure, and potential bankruptcy is an extensive ongoing research topic inclusive of various models. The specific business problem addressed in the current study is that retailers are continuously facing financial distress, which is often leading to failure and bankruptcy for companies. Knowing a firm's likelihood of failing is pivotal for management and individuals when confronted with making business investment decisions.

Financial distress and company bankruptcies appear to unveil rapidly, and news about the failing firm seems to come unexpectedly, but a financial downturn is of no surprise to management. Hayes et al. (2010) concurred and stated signs of financial distress are evident years before a bankruptcy filing takes place. According to the U.S. Census Bureau (2017),

bankruptcy filings by publicly traded companies continues to rise, therefore accurate and reliable FDP methods with consistent predictive power are helpful in a multitude of business arenas. When evaluating the health and wealth of a company, FDP models can be informative and helpful tools to the banking industry, rating agencies, investors, and even distressed firms themselves (Altman et al., 2017).

Research Purpose

The purpose of this quantitative study was to test and investigate the efficacy of FDP using the original Altman Z-score (1968) and Bhandari and Iyer (2013) models to predict the possibility of financial failure in publicly traded retail companies. Quantitative research methods are appropriate for this research because FDP models encompass numeric variables and prior research is quantitative. Comparing the performance of models to assess their efficacy has been common among prior researchers such as Ali and Abdulhassan Abbas (2015), Ashraf, G. S. Félix, and Serrasqueiro (2019), Roomi, Ahmad, Ramzan, and Zia-ur-Rehman (2015), Unegbu and Adefila (2013). The current study sought to extend the research of Archana (2018), which examined selected retail companies using the Altman Z-score to predict default. The study suggested future research be conducted that compares other bankruptcy and financial default prediction models with the Altman Z-score. Among recent research, Darmawan and Supriyanto (2018) suggested further research be conducted that compares the Altman Z-score model with FDP models using different ratios in sectors other than mining. Following this recommendation, the current study included the cash flow prediction model as outlined in Bhandari and Iyer

(2013) in conjunction with Altman (1968) to predict financial distress in selected bankrupt U.S. retail firms between 2012 and 2018.

The health of the U.S. economy can be tied to the prediction of business failure in an accurate and timely manner. Knowledge of financial distress can potentially prevent financial loss to interested parties such as shareholders, lending institutions and financial markets (Altman, 1968; Husein & Pambekti, 2014; Sun et al., 2014). The careful use of selected financial ratios and FDP models by accounting and audit specialist has been found to be helpful in determining the going concern of a business and, signaling early detection of financial distress (Oz & Simga-Mugan, 2018). Many scholars found that financial ratios are helpful identifiers of financial distress and can signal early signs of corporate failure. Altman et al. (2017) provided evidence that the Z-score model worked reasonably well, offering a prediction accuracy of approximately 75% for most countries but could be improved further above 90% by using country-specific estimation that incorporates additional variables. According to Andrijasevic and Pasic (2014), the Altman Z-score model has certain disadvantages, of most importance is the fact the model neglects cash flow indicators. Based on these findings, a clearer picture of corporate financial distress can be achieved when examining profitability ratios through the Altman Z-score model in connection with Bhandari and Iyer's cash flow model.

Research Questions

The research questions formulated for this study addressed the extent to which the application of FDP models can assist in foreseeing a financial downturn in retail companies. According to Creswell (2014), research questions help to keep a study aligned as well as focused

and are sources of reference for the reader. The current quantitative study answered the research questions which were expressed in hypotheses using corporate financial distress as the dependent variable. The binary dependent variable is represented by two values; 0 = non-failed and 1 = failed. The independent variables are 12 ratios associated with the original Altman Z-Score and the Bhandari and Iyer FDP models. Statistical techniques help to define the relationships between 12 independent variables and to inform the predictive ability of corporate financial distress in the retail industry. The independent variables are ratios of profitability, liquidity, productivity, and solvency, as outlined by Altman (1968) and ratios of cash flows from Bhandari's and Iyer (2013).

This study investigated the following research questions:

RQ1: To what extent does the original Altman Z-score equation accurately predict corporate financial distress for retail firms that filed for bankruptcy during 2012 – 2018?

RQ2: To what extent does the Bhandari and Iyer equation accurately predict corporate financial distress for retail firms that filed for bankruptcy during 2012 – 2018?

RQ3: To what extent do the original Altman Z-score and Bhandari and Iyer models perform relative to each?

Rationale

The rationale for this quantitative research was the opportunity to expand the existing knowledge of predicting financial failure in the retail industry. Ashraf et al. (2019) explained the topic of predicting business failure has developed into a major research space within corporate finance, accounting and audit. The study of corporate financial distress remains prevalent

because dependent upon macroeconomic conditions, the financial status of a company can change quickly. After the global economic downturn in 2008, the retail industry experienced major financial losses (Evans & Mathur, 2014).

Corporate failure distress is a topic that has produced many academic studies aimed at finding the best failure prediction model. A variety of modeling techniques with varying assumptions and specific computational intricacies have been formulated by academic researchers to potentially classify a company's financial health with a level of accuracy. With the use of logistic regressions, Keener (2013) sought to predict which companies were likely to fail in the retail industry using a sample of publicly traded companies collected from the COMPUSTAT database during the period 2005-2012. The results from this research contributed strong evidence that companies with low cash to current liability ratios, low cash flow margins, and high debt to equity ratios were at risk for bankruptcy. In a systematic review of 83 articles reporting 137 prediction failure models, Appiah, Chizema, and Arthur (2015) concluded while there is a compelling body of previous literature, a theoretically sound corporate failure prediction model has yet to be developed. Tomczak and Radosiński (2017) concluded the use of one prediction model was not helpful in assessing the financial standing of corporations. The predictive ability of financial distress increases when two or more models are used in comparison.

Statistical FDP models can reduce losses for users of financial statements by sending an accurate alert signal before distress or bankruptcy occurs. Samkin, Low, and Adams (2012) encouraged financial statement preparers to include financial ratio analysis geared toward

corporate failure prediction in their annual reporting. The appropriateness and predictive power of a model make a significant difference for those who use this information, such as corporate executives, lenders, investors, and other stakeholders. Corporate failures can impose high economic costs on society, causing downturns and recessions (Jones, Johnstone, & Wilson, 2017). The results produced by this research will help corporate financial executives, accounting professionals, and interested parties identify problems using the appropriate model.

Theoretical Framework

The development of financial distress theory was first attempted by Gordon (1971), who suggested a framework be centered around a decrease in the earnings capacity of a firm. Taffler (1983) and Agarwal and Taffler (2007) concluded the lack of a true theory linked to the use of financial ratio analysis constituted a gap in the accounting literature. Lim, Yun, Gan, and Jiang (2012) agreed and found bankruptcy prediction studies lacked a strong theoretical framework and suggested previous studies have been driven by empirical testing and the application of mathematical techniques. Agarwal and Taffler (2007), Gordon (1971), Lim et al. (2012), and Taffler (1983) agreed the benefit of a robust theoretical framework is that it focuses on explaining the corporate failure observation rather than repeating the process with different tools. The current study was guided by the liquidity, profitability, and wealth (leverage) theory coupled with cash flow theory proposed by Lim et al. and are applicable to the Altman (1968) and Bhandari and Iyer (2013) FDP models respectively.

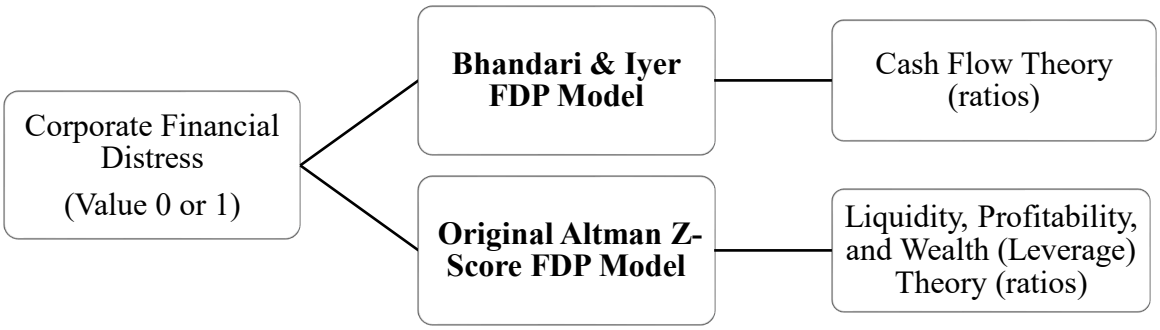

Figure 1. Theoretical framework.

The present study was guided in part by Evans and Mathur (2014), who recommended future research of financial ratio trends by firm size and industry. The study, which did not apply a theoretical framework used various financial ratios and concluded retailers around the world should systematically study various types of FDP models and their impact on profitability. Going a few steps further, this research examined financial failure, bankruptcy prediction models, and how ratio analysis can help predict financial failure for publicly listed retail companies in the United States. Comparing the Altman Z-score and the Bhandari and Iyer models provided a baseline to help shed insight on which model is the better indicator of corporate financial distress.

Significance

The importance of the current study was to alert business leaders, shareholders, financial analyst, accountants, and auditors in the retail industry to a company's subpar financial performance and potential financial distress one to three years prior to bankruptcy or failure with the help of FDP models. According to Evans and Mathur (2014), the retail industry was one of

the most impacted in the recession of 2008, which caused stores to close their operations. Performing financial statement analysis with FDP models can help shed light and provide knowledge of a firm's financial performance prior to failure. Implementing FDP metrics is important because business failure can have a devastating effect on firm owners, partners, society, and the country's economy by and large (Sun et al., 2014). In an effort to mitigate this potential financial devastation, Alaka et al. (2018) explained bankruptcy and FDP models continue to be a justified area of study. This study contributed to the body of knowledge about corporate financial distress by examining the predictive ability of two FDP models when applied to the financial statements of U.S. publicly traded retail firms.

Definition of Terms

The following terminology and definitions were used throughout the study.

Altman Z-score. Altman Z-Score is a formula that aids in determining the potential for financial distress in a company by considering profitability, leverage, and liquidity ratios (Altman, 1968; Altman et al., 2017; Archana, 2018).

Bankrupt. The failure of an organization to defray its obligations and falling under a specific legal framework where business operations are terminated (Farooq, Jibran Qamar, & Haque, 2018).

Cash flow. A company's cash flow is net income plus non-cash changes or cash inflows and outflows from operations, financing activities, and investing activities (Kamaluddin, Ishak, & Mohammed, 2019).

Failed/Non-failed. Dichotomous classification of Z-Score outcome. (Altman, 1968; Bhandari & Iyer, 2013).

Financial distress prediction (FDP). FDP is the process of determining if a company will experience a financial hardship through the examination of a company's financial data using statistical, mathematical, or intelligent models (Fallahpour, Lakvan, & Zadeh, 2017; Sun et al., 2014).

Financial ratios. Financial ratios are the relative magnitude of two selected numerical values taken from a firm's financial statements. (Andrijasevic & Pasic, 2014; Beaver, 1966; Heidari, 2012).

Financial ratio analysis. Financial ratio analysis is the process of examining historical financial statements to quantify data based on factors such as competitive position, financial strength and profitability which allows investors to arrive at an understanding of a company's stability (Beaver, 1966; Darmawan & Supriyanto, 2018).

Multiple discriminate analysis (MDA). MDA is a multivariate technique. A single weighted composite score is derived from multiple measurements and can be differentiated from two of more groups (Alaka et al., 2018; Altman, 1968; Bhandari, 2014).

Assumptions and Limitations

Assumptions are concepts that are accepted as true or possible in the context of scholarly research (Leedy & Ormrod, 2013). This study focused on FDP models using secondary data which in part requires financial ratio analysis. Heidari (2012) posited that financial ratios are derived from a firm's financial statements, so a key assumption to this research is that the

examined financial statements are in accordance with General Accepted Accounting Principles (GAAP). The primary responsibility of the U.S. Financial Accounting Standards Board (FASB) is to oversee the development of accounting principles, and ensure financial accountants follow GAAP in the preparation of financial statements (Jiang, Wang, & Wangerin, 2018). Another assumption is that the examined financial statements are audited, include no material misstatements and are in accordance with the standards set forth by the U.S. Public Company Accounting Oversight Board (PCOAB). The data for this study was gathered from the U.S. Securities and Exchange Commission (SEC) Electronic Data Gathering Analysis and Retrieval (EDGAR) website which is assumed to be reliable.

The nature of financial statement creation has inherent assumptions and limitations. For example, Andrijasevic and Pasic (2014) explained FDP models and financial ratio analysis requires the income statement, balance sheet, and cash flow statement to be complete, accurate and link together. Financial statements are directly linked to the flow or articulation of information between them which displays the overall financial status of a firm. Casey, Gao, Kirschenheiter, Li, and Pandit (2016) explained articulation is a key attribute of financial statement preparation. For example, the stock documents and the balance sheet totals must connect to each other through the three flow statements: cash flow, income, and changes in owners' equity. The financial statements in the EDGAR database are assumed to flow and link through articulation.

The FDP models in this research are accrual and cash flow based which inherently has limitations. Hassan, Zainuddin, and Nordinto (2017) explained accrual and cash based financial

statements includes historical data that might not provide enough information for predicting future performance. The historical cost and conservatism concepts indicate that the true value of a firms' asset may vary from the book values included in the financial statements. Another limitation is that a firm's management can manipulate accounting numbers to display a successful financial performance. Limitations exist with the use of secondary data because of the possibility of incomplete datasets (Johnston, 2014). Narrowing the focus to the retail industry consisting of publicly traded companies is a limitation of this research because the sample size is smaller.

Organization for Remainder of Study

This study is organized into five chapters. Chapter 1, the introduction, described the study's problem statement, the background of the study, the purpose of the study, the research questions, the significance of the study, the rationale for the research, the definitions of terms, the nature of the study or theoretical framework, and the assumptions and limitations of the research. Chapter 2 is the literature review, which covers the existing research from the dissertation topic area. Chapter 3 presents the research methodology that was used to answer the research questions and prove or disprove the hypotheses. This chapter consists of research design, the sample used in the research, the setting in which the study was conducted, the instruments and measures used, data collection and treatment, data analysis, validity and reliability, and ethical considerations. Chapter 4 presents the findings of the study, which includes hypotheses testing and comparative analyses. Chapter 5 presents an evaluation of the

research results relating to the business problem, research purpose and implications, and closes with recommendations for future research and overall conclusions.

CHAPTER 2. LITERATURE REVIEW

Introduction

Investors are more watchful of the potential danger associated with engaging in the debts and liabilities of companies, especially after the demise of many corporate giants (Ali & Abdulhassan Abbas, 2015). Particularly in the retail industry, these corporate giants included formerly successful companies such as Hollywood Video, Sears and Borders Books. While these retailers had to close several locations, other large companies like JC Penny, Macys and Barnes and Noble are searching for ways to lower costs and increase profits (Keener, 2013). When a business is financially distressed there is an effect on multiple stakeholders including employees and investors. For this reason, there continues to be a need to research the financial warning signs which can potentially alert business managers, executives, and investors when the financial stability of a company is in question. The current research study tested and investigated the efficacy of FDP using the original Altman Z-score (1968) and the Bhandari and Iyer (2013) models to predict the possibility of financial failure in publicly traded retail companies.

Chapter 2 includes an analysis of peer-reviewed articles from the literature addressing FDP in corporate failure and bankruptcy modeling. Appiah et al. (2015) systematic literature review found corporate FDP articles revealed that authors used bankruptcy, insolvency, liquidation, failure and dissolution as synonyms for corporate financial distress. These topics have been found to be closely interchangeable in the literature. This literature review was guided

in part by the business problem and more specifically by the research questions, which focused on FDP models applied to companies classified as doing business in the retail industry. The following research questions guided the literature review:

RQ1: To what extent does the original Altman Z-score equation accurately predict corporate financial distress for retail firms that filed for bankruptcy during 2012 – 2018?

RQ2: To what extent does the Bhandari and Iyer equation accurately predict corporate financial distress for retail firms that filed for bankruptcy during 2012 – 2018?

RQ3: To what extent do the original Altman Z-score and Bhandari and Iyer models perform relative to each other?

The literature review commenced with a reintroduction of the topic and restatement of the research purpose and questions. Laying the foundation for FDP, was a discussion of corporate financial distress coupled with an examination of the causes leading to failure in the retail industry. The different stages of corporate financial distress as identified by previous researchers was discussed, followed by a synthesis of the research on FDP models. Financial ratio analysis which is the underpinning of the FDP models examined in this study was discussed. The two FDP models which guided the research were presented in the theoretical orientation of the study section along with a review of the theories associated with each model. The literature on FDP in the retail industry was viewed, followed by the chapter summary.

Corporate Financial Distress

Understanding the concept of financial distress is important for a study directed at predicting the probability of failure in companies. This first section focused on understanding

what financial distress is and defining the term in an effort to put the current research in perspective. Gordon (1971) laid the foundation for the development of financial distress theory. Gordon denoted financial distress is only one state of the process, followed by failure, possible restructuring, and could be defined by financial structure and security valuation. When a corporation's ability to generate earnings weakens and the amount of debt exceeds the value of the company's total assets, a state of corporate financial distress is on the horizon (Gordon).

The early literature of corporate failure and bankruptcy (Altman, 1968; Ohlson, 1980) was focused on forecasting failure after the legal event of bankruptcy occurred. As research in this area developed these seminal works were found to need further exploration which would help provide early warning signs of failure (Farooq et al., 2018). Pindado et al. (2008) contributed an ex-ante model for estimating financial distress likelihood (FDL). The model defined FDL as a component of three variables – profitability, financial expenses and retained earnings. Probability, the first explanatory variable calculated by dividing total assets by earnings before interest and taxes helped to understand the firm's capacity to manage its assets and produce enough funds to satisfy its financial obligations. Profitability ratios were used by Altman (1968) to measure a firm's performance. The second variable, financial expenses, calculated by dividing total assets by the firm's financial expenses replaced debt to stock ratios. Financial expenses were a better variable because debt to stock ratios tend to lose explanatory power (Pindado et al.) The revision of the Z-score as outlined by Altman, Haldeman and Narayanan (1977) agreed that financial expense variables were more efficient in explaining financial distress than debt variables. Retained earnings, the last variable of the FDL model and is considered the

most critical indictor of financial distress (Pindado et al.). The measure is calculated by dividing total assets by retained earnings and tracks cumulative profitability over time. The FDL model made an important contribution to the literature on financial distress because the findings revealed that the ex-ante approach was useful to predict financial distress conditions when applied to different periods and sectors.

The literature regarding financial distress provides many different approaches to the definition of the term and shows how versatile, complex, and sometimes even controversial the economic category can be. Previous scholars defined and explained financial distress in multiple ways. Most definitions were centered around the stages a company passes through when experiencing financial instability. Emphasizing the initial period of the process, Pindado and Rodrigues (2005) explained financial distress occurred during a time when it would be feasible to allow a company to reflect, react, and recover without incurring exorbitant direct costs. Another definition of financial distress offered by Farooq, Nazir, and Nawaz (2012) is the failure to meet financial burdens which sequentially leads to the inability to generate required returns from investing activities to cover external obligations.

Focusing on the distinction between financial distress and solvency, Purnanandam (2008) argued financial distress was a state in which a company could remain solvent while generating lower than expected cash flow. Poor operating decisions and external macroeconomic factors can lead to financial distress in a company (Platt & Platt, 2006). Scholars contend financial distress is the precursor to bankruptcy and the intent of management is the difference between the two (Purnanandam; Platt & Platt). Bankruptcy is the decision management makes to protect their

assets from creditors, whereas financial distress arises as a direct result of poor operating decisions producing less than satisfactory results (Platt & Platt). If financial distress in a company is pinpointed, stakeholders, management and all other interested parties could move expeditiously to remedy a financial downturn before bankruptcy became a reality.

The idea of financial distress can be viewed as a separate economic category. Platt and Platt (2002) explored corporate financial distress by obtaining a dataset of financially distressed but not yet bankrupt companies in the auto manufacturer industry and demonstrated that early identification of financial distress was possible through financial ratio analysis. As research continued, Campbell, Hilscher, and Szilagyi (2011) identified the need for awareness of financial distress and sought to address this gap by developing models that would help pinpoint financially troubled companies using financial ratio analysis. The research produced from these studies contribute to the current research because they focused on ratio analysis while in a state of financial distress.

Financial distress as explained by Turetsky and McEwen (2001) is a comprehensive process that connects single states of corporate financial decline. Turetsky and McEwen further explained financial distress as a set of consecutive stages characterized by adverse financial issues which is caused by a volatile decrease from a positive to negative cash flow. In this study, the term financial distress was highlighted and classified as a middle ground between financial stability and bankruptcy.

Causes of Financial Distress

Causes of financial distress which may lead to a firm's untimely demise can be attributable to both internal and external factors. Factors can be identified and predicted in advance to allow management an opportunity to shift or implement business practices to avoid the loss and embarrassment of bankruptcy (Xu & Wang, 2009). Contributing factors and leading causes of a firm experiencing financial distress or failure is centered around poor management, inappropriate allocation of resources, and asymmetric information where important knowledge is not disclosed to all parties (Whitaker, 1999). The most insidious reason for a firm's distress and possible failure is managerial incompetence (Chang, Yan & Chou, 2013). Poor management can single handedly cause financial distress and economic failure which leads to declining profits resulting in excessive debt. Whitaker (1999) offered management's corrective actions are a significant factor which can affect both recovery from financial distress and improvement of a firm's market value relative to its industry.

The profitability of retailers has continued to decline. At the height of the 2008 recession, retail companies experienced falling stock prices, store vacancies and went out of business (Evans & Mathur, 2014). The reason for financial distress in the retail industry can be attributable to the shift in shopping patterns and the overwhelming amount of overhead and fixed commitment cost incurred (Shaked & Orelowitz, 2017). Management, shareholders, employees and all other parties with a vested interest may find financial ratio analysis and FDP models useful in determining the financial status of a retailer. Working knowledge of FDP models or at the very least an early warning system is essential to prevent total financial failure (Kim, 2011).

In an effort to mitigate risk and losses, investors, creditors, and corporate executives can apply FDP models to gauge a firm's financial status before making investment, lending, or financial strategic decisions.

Corporate Financial Distress Stages

The stages of financial distress are interwoven in a firm's corporate lifecycle. Koh, Durand, Dai, and Chang (2015) examined how firms at different stages of the corporate lifecycle encounter financial distress and found firms in earlier stages of the lifecycle tend to reduce the number of employees while mature firms are more likely to engage in asset restructuring. Different stages of the corporate lifestyle will have varying levels of resources and financial stability will differ systematically over the firm's life span (Akbar, Akbar, Tang, & Qureshi, 2019). Using non-financial Pakistan companies, Akbar et al. any level of financial distress risk is possible at all stages of the lifecycle. However, financial instability tends to be higher in the birth stage as compared to the maturity stage.

Financial distress for a company does not occur quickly but instead can evolve through several stages. The phenomenon of corporate financial failure and distress can be characterized as a unified process consisting of different stages or cycles ranging from healthy to bankruptcy with the potential of recovery (Fitzpatrick, 1934). The effects of financial distress can be detected in early stages when management notices a sharp decline in a firm's value well in advance of default occurring (Whitaker, 1999). The corporate lifecycle and how each stage can contribute differently to corporate failure has been well documented in the literature.

Fitzpatrick's Five Stages

The five stages a company will experience prior to financial failure are; unfavorable business conditions, financially embarrassed, financial insolvency, total insolvency, and confirmed insolvency (Fitzpatrick, 1934). Stage 1, unfavorable business conditions which can be difficult for experienced and high-level executives to detect. If resolution steps are not activated in Stage 1, the firm will move to a Stage of financially embarrassed where short-term obligations such as payroll and accounts payable are difficult to satisfy. In the next Stage a firm can continue daily operations with the extension of credit, and in time regain a position of solvency. If management is unable to secure a credit extension, Stage 3, financial insolvency is inevitable. In this Stage, access to borrowed funds to meet operational needs are restricted or completely denied. Business restricting is needed along with new financial policies which may require outside consultants to help the business regain profitability. Stage 4, total financial insolvency is most often the point at which the firm's liabilities exceed its assets and at this time the public is informed of the firm's failure. The last Stage, as identified by Fitzpatrick (1934), confirmed insolvency is where steps are taken to file for bankruptcy.

Lau's Five States

Lau (1987) suggested a firm would pass through five financial states. State 0 gauges financial stability, where firms experienced no financial stress or financial loss. State 1 occurred when dividends were reduced or altogether omitted by the firm. State 2 emerged when a firm defaulted on loan obligations. State 3 resulted when a firm filed for protection under the Bankruptcy Act, and State 4 the final step was complete liquidation and bankruptcy status.

Sormunen and Laitinen's three Stages

Sormunen and Laitinen (2012) encapsulated financial distress into three stages. In the e*arly stage a* company's financial statements indicated a decreased profitability, followed by the *late stage.* During this Stage, the company's profitability fell coupled with an increase in leverage or debt. The *final stage* encompassed the previous two stages, decrease in profits, an increase in debt and added a decrease in liquidity. This research zeroed in on the effectiveness of financial ratios if calculated in the final stages of the failure or distress process. Important to the research questions in the current study, Sormunen and Laitinen aligned with prior research which generated a knowledge base to help identify if financial ratios and financial prediction models were affected by different stages. The researchers found, depending on the stage of financial distress, the use of several different financial ratios or FDP models could be highly effective at foreseeing a firm's untimely demise.

Farooq's Three Stages

The three stages of financial distress as identified by Farooq et al. (2018) are; profit reduction (PR), mild liquidity (ML) and severe liquidity (SL). PR which included decreased profits and financial losses were assumed to be the first hurdle for healthy firms. If PR was not addressed, the company would fall into the next stage, ML where cash flow is slightly decreased, and only operational expenses are paid. If continuous losses and liquidity problems persist in a manner where assets could no longer meet the operational obligations, SL was the result. In the stage of SL, liquidation of the company occurred to fulfill creditor's claims which led to the wind down of the business followed by bankruptcy. Farooq et al. concluded companies could

regain a healthy status following every stage of financial distress however a shift in financial strategies would need to occur.

Fitzpatrick (1934) likened business failure to that of an individual suffering from a minor illness which if not addressed may develop into a disease. Figure 2 offers a graphic representation showing the dynamic nature of corporate financial distress stages according to Fitzpatrick (1934), Lau (1987), Sormunen and Laitinen (2012), and Farooq et al. (2018). Corporate financial distress is a three-dimensional process consisting of a time frame, financial state, and process stage (Ufo, 2015). Ufo further explained financial distress was time-varying meaning each stage has specific attributes, which contribute differently to corporate financial distress. While each researcher shown in Figure 2 labeled the financial distress stages differently with three or four stages, the underlying concept was the same. When experiencing financial trouble, a company's financial situation progressively gets worse overtime ending in a stage where full financial corporate failure is realized.

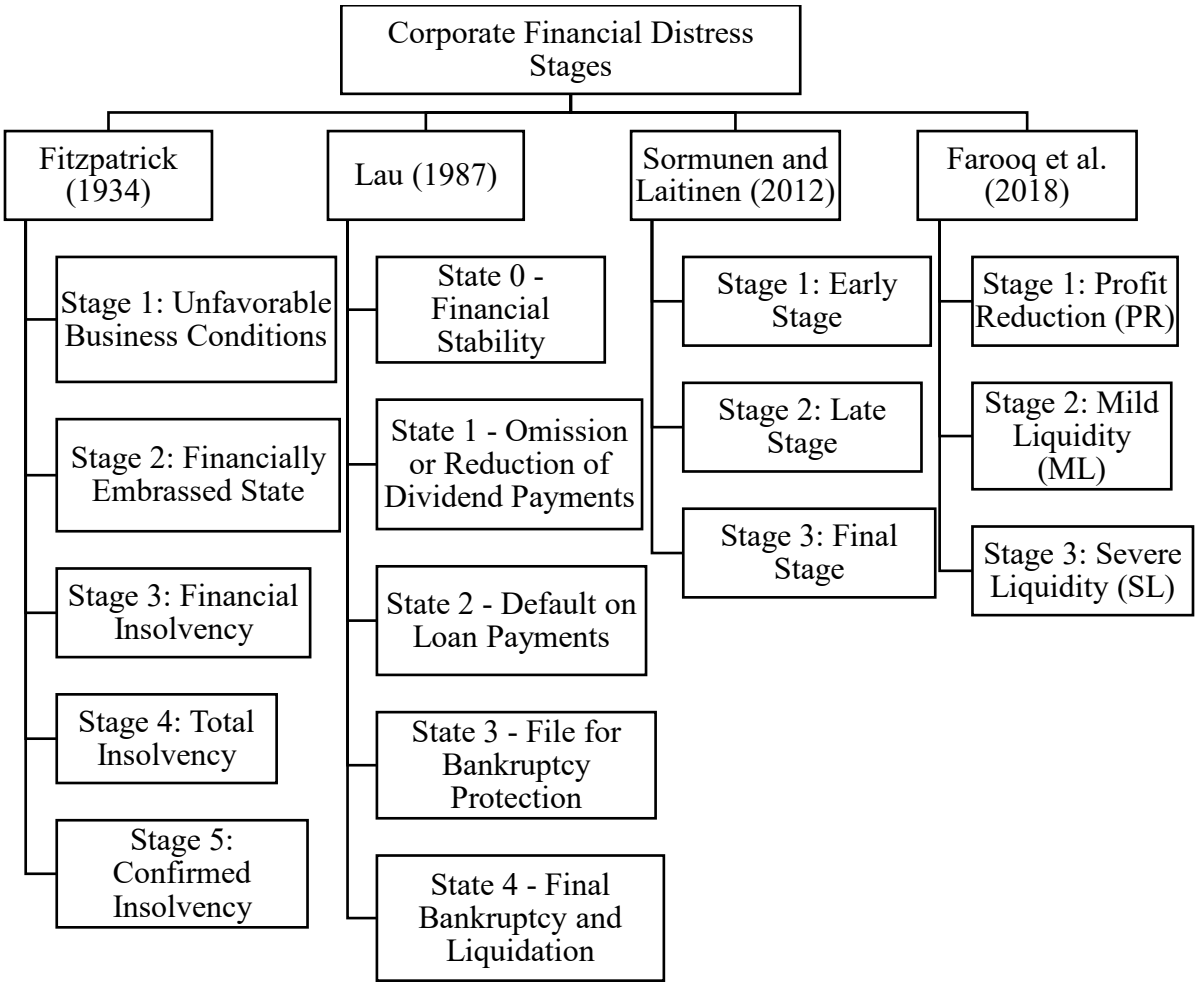

Figure 2. Stages of corporate financial distress.

Corporate Financial Distress Prediction (FDP) Models

FDP models have been developed by academic researchers and practitioners throughout history to help predict financial distress for private and public firms using accounting and market information. Lesáková, Gundová, and Vinczeová (2020) explained while the literature is plentiful on FDP models, most companies fail to use them in financial reporting. Failure to incorporate FDP models is primarily the result of ignorance, company size or the use of firm

specific models (Lesáková et al.). Lesáková et al. suggested managers with a working knowledge of the history and importance of FDP models were better equipped at implementing the models as an integral part of annual financial reporting.

Seminal works of Beaver (1966) and Altman (1968) laid the foundation for several studies which were driven by accounting ratios to predict corporate failure and bankruptcy. These seminal works, along with others such as Deakin (1972), Altman et al. (1977), Ohlson (1980), and Zmijewski (1984), found the most critical signals about financial distress could be gathered from the analysis of a company's accounting financial ratios. Traditionally financial ratio analysis has been the preferred method and most popular as a selection criterion.

Many scholars including Almamy et al. (2016), Altman et al. (2017), Batchelor (2018), Darmawan and Supriyanto (2018), Hayes et al. (2010), Keener (2013), Wang and Campbell (2010), continue to apply financial ratio analysis to help determine the going concern of a company. Hillegeist, Keating, Cram, and Lundstedt (2004) contradicted these studies and concluded that financial ratios are past-oriented and cannot capture the future dynamics and prospects of the company as a going concern. Despite Hillegeist et al. conclusions, financial ratio analysis continues to be the preferred FDP method and performs well in predicting financial distress and probability of default (Batchelor, 2018).

Seminal Prediction Models

Early FDP models were based on simple univariate financial ratio analysis. Beaver (1966) explored the predictive ability of each variable separately in a data set. Following a paired sample method, 79 failed and 79 non-failed publicly traded firms in the United States during the

period from 1954 to 1964 were selected. Beaver suggested the motivation for using a paired sample method was to control the factors of asset size and industry on financial ratio and failure. The study included 30 selected ratios with the following criteria; popularity and frequency of the appearance of the ratios in the literature, performance of the ratios in previous studies, and use of the ratios within the framework of a cash flow theory applied to financial statements for five years prior to failure. The ratios selected were classified into six groups; net income ratios, debt to total assets, current assets to total assets, current assets to current liabilities, turnover ratios, and cash flow ratios. Beaver applied the cash flow theory as a baseline for the study and suggested within a company, there exist a repository of liquid assets, which could be defined as an accumulation of inflows reduced by the depletion of outflows. This research concluded the solvency of a firm could be identified by the level of its liquid assets, mainly cash. A firm was at a point of failure and unable to pay its obligations as they became due if the cash account was exhausted to nothing. Beaver (1966) is aligned with RQ2 as this work focused on cash flow to predict financial distress and business failure, which is followed up by Bhandari and Iyer (2013).

As research in the area of corporate financial distress continued, many scholars agreed with the work of Beaver (1966) that financial distress was centered on cash flow. Whitaker (1999) defined the early or entry stage of financial distress as the first year in which the firm's available resources (cash flow) was shown to be less than the current portion of its long-term debt. Beaver (1966) showed that financial ratios were able to expose signs of deterioration years before failure, however, the flaw in Beaver's research was an overlap between ratio outcomes, which was the underpinnings of the univariate model. For example, net-income to sales ratio

could show signs of a healthy firm, while working capital to total assets ratio might lean toward a failing firm, producing inconsistent results for different ratios used on the same company.

The univariate model approach was simplistic and appealing but was contradictory because ratios were considered one at a time. With the inherent limitations associated with this approach, scholars sought to develop more advanced statistical methods in an effort to predict corporate financial failure (Moscalu & Vintila, 2012). Beaver concluded the univariate model had limitations and recommended a multi ratio analysis approach be explored in future studies. This recommendation led scholars to explore the use of several ratios at one time as opposed to single ratio analysis.

Altman (1968) addressed the Beaver (1966) single ratio analysis limitation by proposing the MDA approach in an attempt to develop a linear combination of ratios that best classified a firm as failing or non-failing. Error types can exist when classifying firms as failing or non-failing. According to Sormunen and Laitinen (2012), two types of errors exist when predicting corporate financial distress or failure, Type I, and Type II. Type I, the misclassification of failed firms as non-failed and Type II, the misclassification of non-failed firms as failed. Sormunen and Laitinen found different costs were associated with each error, but Type I costs carried a significantly higher burden than that of Type II errors. Altman's (1968) results returned a Type I error of 6% and a Type II error at 3%. While these error percentages were good, Altman explained further prediction models should produce even lower error Type I and II percentages.

The MDA model included several ratios combined into a single discriminant score called a *Z-score.* The financial ratios were constructed using account balances reported in the firms'

financial statements or computed from available market data. Altman's (1968) model is known as the original Z-score and was developed for manufacturing firms with publicly traded shares. Building on the original model, Altman (1983) formulated two additional models, one for use with privately held manufacturing firms not listed on the capital market, *Z'-score* and one for nonmanufacturing firms, *Z"-score*. The original Z-score included the ratio, market value of equity, which was equal to the market capitalization of a firm's shares, not readily available in financial statements. Altman's revised or re-estimated model still included five financial indicators; however, the market value of equity/book value of total debt was changed to book value of equity/ book value of total debt, eliminating the need for market data.

Altman (1983) also provided a model for non-manufacturing firms and those who operated in emerging markets. Instead of five financial ratios, this model excluded the sales/total assets ratio, because of a potential industry effect that was more likely to occur with industry sensitive variables or ratios such as asset turnover. Table 1 shows the three Z-score iterations, including the business type, accounting ratios, or determinants, the formulas, and the zones of discrimination. The original model developed continues to be the superior model and the one of choice worldwide (Altman et al., 2017).

Table 1. Altman Z-score Iterations

Altman Z-Score Iterations	Type of Business	Determinants	Formula	Zone of Discrimination
Altman (1968)	Public (market data required)	X1= working capital/total assets X2= retained earnings/total assets X3= earnings before interest and taxes/total assets X4= market value of equity/book value of total liabilities X5= sales/total assets	$Z = 0.012X1 + 0.014X2 + 0.033X3 + 0.006X4 + 0.999X5$	$Z > 2.99$ - "Safe" Zone $1.8 < Z < 2.99$ - "Grey" Zone $Z < 1.8$ - "Distress" Zone
Altman (1983)	Private firms	X1= working capital/total assets X2= retained earnings/total assets X3= earnings before interest and taxes/total assets X4= book value of equity/book value of total liabilities X5= sales/total assets	$Z' = 0.717X1 + 0.847X2 + 3.107X3 + 0.420X4 + 0.998X5$	$Z > 2.9$ - "Safe" Zone $1.23 < Z < 2.9$ - "Grey" Zone $Z < 1.23$ - "Distress" Zone
Altman (1983)	Non-Manufacturing Firms and Emerging Markets	X1 = working capital/total Assets X2 = retained earnings/total assets X3 = earnings before interest and taxes/total assets X4 = book value of equity/book value of total liabilities	$Z'' = 6.56X1 + 3.26X2 + 6.72X3 + 1.05X4$	$Z > 2.6$ - "Safe" Zone $1.1 < Z < 2.6$ - "Grey" Zone $Z < 1.1$ - "Distress" Zone

As researchers began to apply the Z-score models to help predict corporate financial distress, the results showed the models were best suited for use two years prior to a firm's financial decline. Moyer (1977) found the best results were realized in the first two years prior to bankruptcy when applying the original Z-score. Altman et al. (1977) constructed a second-generation model known as ZETA with several enhancements to the original Z-score to help predict failure beyond two years. The study tested the ability to classify firms as financially distressed up to five years prior to complete failure. Unfortunately, the ZETA model was a proprietary effort and the market parameters were not disclosed.

The original Altman Z-score model is used by auditors, management accountants, and investors. The model is known to be the best statistically derived predictive model used to forecast a firm's impending bankruptcy by determining financial distress (Hayes et al., 2010). The first seminal work on FDP modeling introduced by Beaver (1966) did not gain the popularity of Altman (1968) because the model was not multidimensional.

Deakin (1972) sought to expand the seminal works of Beaver (1966) and Altman (1968) and proposed an alternative FDP model that was a cross between the two. The model formulated by Deakin included the MDA equation from Altman and the ratios from the Beaver. The analysis was able to predict failure three years prior to the event with relatively high accuracy as compared to two years using the Altman model. Deakin concluded three years was enough lead time where management could take preemptive steps to avoid financial ruins. Beaver and Altman laid the foundation for bankruptcy prediction modeling. These models had compelling strengths

and limitations as outlined in Table 2, which lead to the onset of an array of additional traditional prediction models developed by scholars who followed.

Table 2. Seminal Prediction Models

Seminal Work	Findings	Major Strength	Major limitation
Univariate, Beaver (1966)	Model showed cash flow/total debt ratio was found to be the optimum predictor of financial distress	Simple and easy to apply Can be used at least five years prior to failure	Multidimensional nature of financial failure was ignored
MDA, Altman (1968)	Model showed 94% accuracy for bankrupt firms and 97% for non-bankrupt firms	Constructs a discriminant function by maximizing the ratio of between-group and within-group variances	Uses dichotomous dependent variables Restrictive to the assumptions of multivariate normality and misclassification costs

Traditional Prediction Models

The literature on FDP models includes a wide variety of explanatory variables and methodological techniques. Altman (1968) used in the current study for RQ1 is an important FDP seminal work; however, other extensive studies performed in the pursuit of developing an FDP model are well documented in the literature. Bellovary, Giacomino, and Akers (2007), Appiah et al. (2015), Hassan et al. (2017), and Alaka et al. (2018) generated systematic reviews or comparative studies discussing previous research performed in the field of financial distress and bankruptcy prediction models. The research produced from these studies revealed scholars

should continue to construct MDA models from the work of Altman (1968) as well as create new tools such as logistic regression, neural network, and probit.

For many decades, the Altman FDP model has been widely used and is well documented in the literature, but the model has been criticized. Ohlson (1980) surmised MDA was restrictive in its assumptions about multivariate normality and the independence of explanatory variables. To overcome these limitations, Ohlson proposed a new model based on logit analysis with a set of nine accounting ratios. The logit linear probability model used the logistic function to alter the dependent financial distress variable into a continuous one that was applicable to linear regression. Following Ohlson (1980), Zmijewski (1984) employed probit analysis and developed a three-variable distress prediction model including return on assets, leverage, and liquidity ratios. Husein and Pambekti (2014) conducted a study to analyze the efficacy of several popular models as indicators of financial distress. The study found Zmijewski (1984) was better at predicting when a firm entered financial distress because the model focused on the amount of debt a firm carried on its balance sheet. Firms with large volumes of debt tend to have leverage problems leading to financial distress (Husein & Pambekti).

Shumway (2001) also disagreed with Altman (1968) and suggested the model was not worthy of being used to predict the financial downturn of a firm because the model was static and ignored time-varying covariates. In an effort to address the static problem, Shumway formulated a simple hazard model that used three market-driven variables coupled with standard accounting ratios to determine if a firm was entering a stage of financial distress. Shumway argued the hazard model explicitly accounted for time, and since firms changed throughout time,

the model was a better indicator of financial distress than static models. Wu, Gaunt, and Gray (2010) formulated a comprehensive model by comparing the studies of Altman (1968), Ohlson (1980), Zmijewski (1984) and Shumway (2001) and found each study lacked firm characteristic variables, such as, size and corporate diversification. Wu et al. concluded the models were satisfactory FDP tools, however, a comprehensive model that included market data, accounting variables, and firm characteristics would outperform the existing models.

FDP studies including seminal and traditional models have been applied to different industries and environments. Altman, Danovi, and Falini (2013) applied the methodology of the *Z"-score* for non-manufacturing firms and emerging markets to Italian companies facing financial hardship and found the application informative but had some limitations. Mselmi, Lahiani, and Hamza (2017) and Jones et al. (2017) reported the logit analysis was the most accurate predictor for French markets. Ashraf et al. (2019) concluded in emerging markets, both Altman (1968) and Zmijewski (1984) were most accurate in predicting corporate financial distress.

Focusing on a single industry, Diakomihalis (2012) applied the three iterations of the Z-score model to the hotel industry. Diakomihalis found the original Altman Z-score to be most accurate in predicting financial distress in the Greek hotel industry. Shome and Verma (2020) examined the Indian airline industry applying four FDP models. The study found the existence of severe financial distress using all four, however, Altman Z-score was most accurate. Other single industry studies that applied Altman Z-score with success include; Taffler (1983) in manufacturing and construction, Keener (2013) in retail, and Hayes et al. (2010) in retail and

service. Mixed results are well documented in the literature regarding FDP models predictive ability under accrual ratio analysis MDA applied to different economies.

The use of cash flow analysis in predicting corporate financial distress has not been as widespread in the literature as accrual ratio analysis. Literature reviews tend to ignore studies about cash flow as a means of predicting a financial downturn (Shamsudin & Kamaluddin, 2015; Sharma, 2001). Accrual ratio analysis can potentially fail to identify a firm's liquidity problems (Arlov, Rankov, & Kotlica, 2013). The balance sheet displays data at a single point in time and measures the ability of a firm's reserves to meet unexpected setbacks. The income statement relates to the operations and includes non-cash transactions such as depreciation. The cash flow statement records the changes in the other financial statements over a period of time. The information for the cash flow statement flows from the balance sheet and income statement making the cash flow statement more dynamic and useful in signaling early warning signs of financial distress (Arlov et al.).

Shamsudin and Kamaluddin (2015) suggested FDP studies have shown when measuring a company's performance, earnings (or income statement) information is less effective. The research suggested the use of cash flow information to analyze the financial health of a firm was simpler and more convenient. Shamsudin and Kamaluddin proposed eight cash flow patterns as independent variables derived from the positive and negative signs of the operating, investing, and financing activities on the cash flow statement as an alternative tool to accurately predict financial distress. The dependent variable was financial distress that used dichotomous categorical outcomes (1=distressed company, 0=healthy company). The sample included three

years of data from 124 Malaysian publicly listed companies (62 bankrupt and 62 non-bankrupt) spanning from 2006 to 2013. The study applied the chi-square test of statistics at a significance level of .05 and found there was a significant difference between non-bankrupt or healthy and bankrupt or distressed companies when using different cash flow patterns. Shamsudin and Kamaluddin research aligned with the statistical testing for RQ1 and RQ2 in the current study.

Cash flow ratios used in conjunction with the traditional balance sheet and income statement ratios has greater explanatory power. (Almamy et al., 2016; Barua & Saha, 2015; Gentry, Newbold, & Whitford, 1985). The combination of traditional and cash flow ratio analysis can be a better indicator of the financial strength and weaknesses of a firm. Ratio analysis was the underpinnings of the two prediction models used in the current study. An in-depth review of the literature about the effectiveness of signaling early warning signs of financial distress and bankruptcy for both traditional and cash flow ratios is important to this research.

Financial Ratio Analysis

Financial ratios are good indicators to use when examining the health of a company. Ratio analysis, dating back to the early 19th century, has been used in previous studies to help determine the probability of corporate financial distress or failure (Lim et al., 2012). Fitzpatrick (1934), one of the first researchers to apply financial ratio analysis compared 13 ratios of failed and non-failed firms. Fitzpatrick found, in most cases, non-failed or successful firms displayed favorable ratios while the failed firms had unfavorable ratios when compared with ratio trends. Prior to Fitzpatrick, the Bureau of Business Research (BBR) in 1930 published a bulletin that summarized the results of a study that analyzed 24 ratios (Bellovary et al., 2007). The ratios were

formulated from 29 firms to determine the common characteristics of failing industrial firms. Of the 24 ratios analyzed, eight were found to be good indicators that aided in signaling financial distress (Bellovary et al.). Many years after the BBR study, five of the eight ratios were used in Altman (1968) and Bhandari and Iyer (2013) FDP models.

The importance of financial ratio analysis when predicting financial distress at least up to five years prior to complete financial failure or bankruptcy is well documented in the literature (Beaver, McNichols, & Rhie, 2005). Bellovary et al. (2007), in a systematic review, found the use of simple ratio analysis to be the most popular. Gentry et al. (1985), Abdullah (2015), and Al-Hroot (2015) agreed financial ratios helped to pin-point areas of concern and often served as the baseline for financial performance. Adnan Aziz and Dar (2006), in a meta-analysis study, inferred financial ratio analysis continues to be a widely used approach to predict financial distress when using profitability, liquidity, leverage, and cash flow ratios. The research questions in the current study continues financial ratio analysis with the application of the Altman (1968) and Bhandari and Iyer (2013) FDP models in the retail industry.

The accounting specialization often uses ratio analysis to evaluate the financial condition of a firm. A financial ratio is a relative magnitude of two selected numerical values taken from a firms' financial statements (Heidari, 2012). Financial ratio analysis was developed for evaluating the financial position and performance of a firm, when examining multiple ratios at one time (Darmawan & Supriyanto, 2018). Financial ratio analysis was historically used by credit suppliers to assess the creditworthiness of borrowers (Beaver, Correla, & McNichols, 2010). The need for financial ratio analysis has grown and is currently employed by a wide variety of users,

including banks, trade suppliers, credit-rating agencies, investors, and management (Beaver et al.).

Financial ratio analysis, according to Andrijasevic and Pasic (2014), is one of the simplest techniques and is most often the first step in signaling financial problems in a firm. Chen and Shimerda (1981) examined the effectiveness of financial ratios to predict a firms' financial strength, and Zohra et al., (2015) confirmed that financial ratio analysis was functional when predicting financial distress. Charitou, Neophytou, and Charalambous (2004) examined the predictability of corporate financial distress using cash flow and accrual basis variables in UK public industrial firms. The study found FDP models that included cash flow, profitability, and financial leverage variables yielded an overall correct classification accuracy of 83% one year prior to the failure. Charitou et al. (2004) is aligned with RQ3 because the FDP models applied in the present study include cash flow, profitability and financial leverage. Charitou et al. population included UK public industrial firms while the present study examined US public retail firms.

The selection of financial ratios should be based on demonstrated empirical evidence. Chen and Shimerda (1981) found when using a large number of financial ratios (41 ratios), evaluating the financial performance of a firm was difficult. Taffler (1983) posited out of 80 potential ratios, only four were useful in evaluating a firms' financial condition. Bhunia and Sarkar (2011) selected 16 ratios to assess profitability, liquidity, efficiency, and solvency based on how frequent the variable was used by scholars in the prior literature. The present study used

12 independent predictive ratios found in Altman (1968) and Bhandari and Iyer (2013) studies as shown in Table 3.

Table 3. Independent Predictor Variables (Ratios)

Prediction Model	Category	Independent Predictor Variable (Ratio)	Calculation Abbreviation
Altman Z-score Model	Liquidity	Working capital to Total Assets	WC/TA
Altman Z-score Model	Profitability	Retained Earnings to Total Assets	RE/TA
Altman Z-score Model	Profitability	Earnings Before Interest and Tax to Total Assets	EBIT/TA
Altman Z-score Model	Leverage	Market Value of Equity to book value of total debt	MV of Eq/Debt
Altman Z-score Model	Profitability	Sales to Total assets	Sales/TA
Bhandari & Iyer Model	Cash Flow	Operating cash flow divided by current liabilities	OCF/CL
Bhandari & Iyer Model	Cash Flow	Cash flow coverage of interest	OCF+INT+TAX/INT
Bhandari & Iyer Model	Cash Flow	Operating cash flow margin	OCF/Sales
Bhandari & Iyer Model	Cash Flow	Operating cash flow return on total assets	OCF/Assets
Bhandari & Iyer Model	Cash Flow	Earning Quality	EBIT/OCF
Bhandari & Iyer Model	Cash Flow	Quick Ratio or Acid-test ratio	CA-INV/CL
Bhandari & Iyer Model	Cash Flow	3-year sales growth	Sales 3 Year CAGR

Theoretical Orientation of the Study

The theoretical orientation of the present study was structured using the liquidity, profitability and wealth (leverage) theory coupled with the cash flow theory. Evans and Mathur

(2014) analyzed the financial performance of U.S. retail firms using a univariate single ratio approach and noted the lack of a theory associated with financial distress. Previous scholars Agarwal and Taffler (2007), Alaminos, Del Castillo and Fernández (2016), Appiah et al. (2015), Rezende et al. (2017), and Taffler (1983) highlighted the nonexistence of a single well-defined theory in the accounting and corporate financial distress literature.

Oz and Yelkenci (2017) inferred previous studies such as Grice and Ingram (2001), which tested the generalizability of notable prediction models failed because a theoretical base was lacking. The lack of an underlying theory is common in studies aimed at predicting financial distress because the results of studies are most often depended upon current macroeconomics (Gruszczyński, 2015). Previous researchers chose to identify potential variables based on the predictive success of preceding similar studies because an underlying theory was undocumented (Charitou et al., 2004). The FDP models tested in the current study follow a similar approach and include variables that have been well documented in previous literature.

Gordon (1971) made the first attempt to develop a theory of financial distress. Several scholars followed including Altman (1968), Beaver (1966), Chen and Shimerda (1981), Deakin (1972), Ohlson (1980), Zmijewski (1984); and more recently Bhandari and Iyer (2013) conducted studies in the development of statistical models but were unsuccessful in formulating an underlying theory of financial distress. The prediction models developed by these researchers contributed mostly to the practical issues surrounding forecasting financial distress without a discussion on the process of ratio selection (Oz & Yelkenci, 2017). To address this gap, Oz and Yelkenci built a common base to predict financial distress by examining the earnings

components found in prior literature. The study measured the significance of cash flow and accrual basis financial data on the earning as the basis for developing a new mixed prediction model. Oz and Yelkenci found when seeking to determine corporate failure and financial distress, the inclusion of both accrual and cash flow ratios produced the most comprehensive and complete results as compared to the use of one set of ratios. The present study encompassed these findings as applicable to the retail industry using accrual and cash flow ratios, as outlined by Altman (1968) and Bhandari and Iyer (2013).

FDP models continue to be of interest to academic and business practitioners because they help to mitigate financial ruin. Lim et al. (2012) inferred with the application of prediction models growing, a theoretical framework is needed. Lim et al. suggested liquidity, profitability and wealth (leverage) theory, coupled with cash flow theory were suitable underpinnings for the future development of a theory in the area of finance and more specifically financial distress.

Liquidity, Profitability, and Wealth (Leverage) Theory

The financial ratios associated with the liquidity, profitability, and wealth (leverage) theory have predictive power when determining the financial health of a firm (Lim et al., 2012). Lim et al. suggested positive ratios associated with the three major categories, liquidity, profitability and wealth (leverage) indicates financial stability. Liquidity refers to a firm's ability to meet short-term maturing obligations within one year and is kept in various forms such as cash in a locked safe, cash in the bank, or the ability to access cash reserves (Akinleye & Ogunleye, 2019). A firm can also maintain liquidity through holding assets that can be converted to cash with low transaction cost and loss in value. Olang (2017) explained the profitability category

includes the ability to make a profit from all business activities and indicates management's ability to generate profits from all available resources in the market. A firm that is financially leveraged incorporates a combination of shareholders' wealth and debt to fund daily operations which can be an indication of financial distress (Olang). Altman (1968) combined these measures in a multivariate function that was helpful in providing foresight into a firms' financial distress position.

Altman Z-score Model. Altman (1968) developed the first multivariate ratio analysis using MDA over the multiple regression analysis, which included a statistical technique. This technique was best suited because the dependent variable, non-bankrupt and bankrupt were in qualitative form. In the present study, the dependent variable of financial distress or non-financial distress was similar. On a stratified random basis, Altman selected two groups; Group 1 consisted of 33 bankrupt manufacturing firms that had filed for bankruptcy and 33 financially stable, non-bankrupt manufacturing firms during the years 1946-1965. Choosing 22 financial ratios according to their popularity in the literature and potential relevance to the analysis, Altman (1968) grouped them into five standard ratio categories: liquidity, profitability, leverage, solvency, and activity. From the 22 financial ratios, five were selected as overall collectively performing the best in the prediction of corporate failure or bankrupt.

The five ratios or variables have been previously discussed, however, an in-depth discussion on the ratio inputs is needed. The original Z-score formula is:

$$Z_A = 0.012X_1 + 0.14X_2 + 0.033X_3 + 0.06X_4 + 0.999X_5.$$

X1 = working capital/total assets. This ratio (variable) is a measure of net liquid assets of a firm (Altman, 1968). Working Capital (WC) is calculated as the current assets minus current liabilities showing on a company's balance sheet at a point in time. WC is divided by the total assets listed on the balance sheet.

X2 = retained earnings/total assets. This ratio (variable) is a measure of a firm's cumulative profitability over time (Altman, 1968). Retained earnings is the summation of the firm's annual net income since inception which is then divided by total assets.

X3 = earnings before interest and taxes/total assets. This ratio (variable) is a measure of a firm's productivity of its assets before the consideration of interest requirements and taxes due (Altman, 1968).

X4 = market value of equity/book value of total debt. Altman (1968) explained this ratio (variable) is useful in determining how far the firm's market value of equity (total value of preferred and common stock outstanding) would drop before liabilities eclipse the firm's assets. The ratio is different from the other four because it requires access to stock market data which is a component of publicly traded companies.

X5 = sales/total assets. This ratio (variable) measures how well a firm uses its assets to generate sales (Altman, 1968).

Applying these ratios along with discriminant coefficients, Altman (1968) found that companies with a discriminant Z-score below 1.81 were all financially distressed or bankrupt and companies with a Z-score above 2.99 were all not financially distressed or non-bankrupt. To test the validity of the model, Altman used a split and secondary sample approach. The strength of

the MDA equation is driven by its high-caliber predictive ability and is still considered to be one of the most highly regarded tools by scholars including Altman et al. (2017), Husein and Pambekti (2014), Orabi (2014), Oz and Yelkenci (2017), Unegbu and Adefila (2013) for predicting corporate distress and failure.

Do Prado et al. (2016) evaluated previous studies of credit risk, bankruptcy, and FDP using the Reuters Web of Science database from 1968-2015. The study found out of the ten most-cited articles in the field of FDP, the Altman research registered 1,483, the highest of all the literature examined. Prior to Do Prado et al., Bellovary et al. (2007) found over the span of five decades, Altman's MDA model using an array of variables had been replicated 63 times in different countries, industries and under several macroeconomic conditions.

Cash Flow Theory

The cash flow theory supports RQ2 in the present study. Beaver (1966) found ratio analysis could best be illustrated within the framework of a cash flow model using the cash flow to total debt ratio but lacked the underpinnings of a theoretical framework. Decades later, Wruck (1990) found when using a cash flow theory approach, predicting the probability of financial distress was extremely high and suggested cash flow from daily operations was the driving indicator of financial instability. Lim et al. (2012) approached cash flow theory differently than Wruck (1990), suggesting a firm was financially distressed if its liquid assets were not sufficient to pay its obligations. Cash flow ratio analysis is not well documented in the literature when compared to accrual financial ratio analysis; thus, the present study sought to address this gap in research.

Bhandari and Iyer Model. The importance of cash flow models in predicting financial distress has been minimally highlighted in the literature. Bhandari and Iyer (2013) built a cash flow model from the work of Beaver (1966) and Wruck (1990) that was constructed using variables based on the cash flow statement. Taking the MDA technique first used by Altman (1968), Bhandari and Iyer (2013) inserted seven cash flow variables to build a new FDP model. The cash flow model used a matched pair sampling technique of failed and non-failed firms from various industries, which was different from Altman (1968), who studied the manufacturing industry exclusively.

Bhandari and Iyer (2013) used COMPUSTAT's list of inactive firms from 2008 to 2010 to identify failed firms, which was then matched to active firms with the same SIC code and size for the non-failed sample. Using SPSS-19 software to perform discriminant analysis (DA), the model classified 83.3 percent of the firms correctly (Bhandari & Iyer). These results were based on firms that were taken from more than 20 different industries. The present study applied the Bhandari and Iyer model to one industry, retail, to examine if the results were compatible when tested using one industry.

The seven ratios or variables have been discussed previously in Chapter 1, however, an in-depth discussion on the predictor variable inputs is needed. Bhandari and Iyer (2013) stated the cash flow-based variables were selected because they had been cited in previous literature. Bhandari and Iyer (2013) discriminant formula:

$$Z_B = -.531 + .675\ X_1 + .001\ X_2 - .028\ X_3 + .637\ X_4 + .096\ X_5 + .165\ X_6 + .006\ X_7,$$

X1 = Operating cash flow divided by current liabilities (OCF/CL). This ratio measures the sufficiency of the cash generated from daily operations to pay the firm's short-term obligations or current liabilities (Bhandari & Iyer, 2013). Operating cash flow is comprised of a firm's cash inflows and outflows related to the day to day business activities.

X2 = Cash flow coverage of interest (OCF + INT +Tax/INT). This ratio measures the firm's ability to pay the interest portion its debt obligation (Bhandari & Iyer, 2013).

X3 = Operating cash flow margin (OCF/Sales). This ratio measures the firm's ability to generate cash from sales (Bhandari & Iyer, 2013).

X4 = Operating cash flow return on total assets (OCF/Asset). This ratio measures the firm's ability to generate cash from all assets (Bhandari & Iyer, 2013).

X5 = Quality of earning (EBIT/OCF). This ratio is intended to measure the firm's earnings quality. Bhandari and Iyer (2013) inferred using an accrual-based earnings figure which is then divided by a cash flow figure is reflective of the firm's future performance.

X6 = Quick ratio (acid-test ratio). This ratio measures the short-term liquidity of a firm. The numerator of this variable includes the firm's most liquid assets or those assets that can be converted to cash within 90 days such as cash, marketable securities, accounts receivable and prepaids (Bhandari & Iyer, 2013). This figure is then divided by the firm's current liabilities to get a clear indication of the firm's ability to use current assets to fulfill liabilities maturing within a year. The quick ratio is also commonly referred to as current assets minus inventory divided by current liabilities.

X7 = Three-year sales growth - 3 Year compound annual growth rate (CAGR). This ratio examines the growth or decline in sales over three years to determine a firm's potential for future financial distress. The variable is the only one in model that is not derived from cash flow statements. Bhandari and Iyer (2013) explained the metric is included in the model because a trend in declining sales is most often the precursor to corporate financial distress leading to bankruptcy.

Applying these ratios along with discriminant coefficients Bhandari and Iyer (2013) found that companies with a discriminant Z-score below -0.718 were all financially distressed or bankrupt and companies with a Z-score above 0.756 were all not financially distressed or non-bankrupt. The Lachenbruch leave-one-out method was used to test the validity of the model. Although Bhandari and Iyer (2013) is fairly new and has not been duplicated by researchers to date to, many studies are documented in the literature which indicates successful results from the use of cash flow statement-based models. Scholars such as Andrijasevic and Pasic (2014), Arlov et al. (2013), Barua and Saha (2015), Fawzi, Kamaluddin, and Sanusi (2015) investigated the use of cash flow-based models and found they outperformed accrual basis models in predicting corporate financial distress. Almamy et al. (2016) attempted to formulate a model using only cash flow variables but found the use of variables from both cash flow and accrual financial statements was better at predicting corporate financial distress.

Bhandari (2014) provided a comparison between the Altman (1968) and Bhandari and Iyer (2013) FDP models as, shown in Table 4. The studies were similar in that they both used a discriminant analysis technique on matched samples; however, the two papers differ in all other

respects. Altman used data from publicly traded manufacturers with only accrual-based variables. Conversely, Bhandari and Iyer used data published by firms representing over 20 industries with variables derived from all three financial statements, mostly the cash flow statement. Another significant difference was that Altman selected his variables post-facto by first assessing 22 variables, then pairing down to the five that worked best. In contrast, Bhandari and Iyer variables were selected a-prior by logically justifying the seven selected variables. Table 4 provides additional comparisons.

Table 4. Comparison of Altman (1968) and Bhandari and Iyer (2013) Failure Prediction Models

	Altman's 1968 Paper	Bhandari and Iyer 2013 Paper
Title	Financial Ratios, Discriminant Analysis and Prediction of Corporate Bankruptcy	Predicting Business Failure Using Cash Flow Statement Based Measures
Authors/Affiliation	Edward I. Altman New York University	Shyam B. Bhandari and Rajesh Iyer, Bradley University
Journal	Journal of Finance	Managerial Finance
Year	1968, September	2013, June
Pages	21 (589-609)	10 (667-676)
Dependent Variable	Bankrupt/Non-bankrupt firm	Inactive/Active firms
Independent Variable	Five out of 22, post-facto pick	Seven, a-prior selection
Sample size	66 paired (33 each)	100 paired (50 each), 78 in test sample
Sample drawn from	1946-1965 period	2008-2010 period
Industry	One, manufacturing	Twenty different industries
Data source	Income statement and Balance sheet	Cash flow statement, Income statement and Balance sheet
Financial Ratios used as Independent variables	WC/TA, RE/TA, EBIT/TA, MV OF Eq/DEBT, SALES/TA	OCF/CL, OCF/SALES, QR EBTI/OCF, OCF/ASSETS, 3-YR SALES GROWTH, (OCF+INT+TAX)/INT
Classification accuracy	95%	83.3%
Group centroids and	-0.29 and +5.02	-0.718 and +0.756
Midpoint	2.675	0.019
Order of relative contribution	EBIT/TA, SALES/TA, MV 0f EQUITY/DEBT	OCF/CL, OCF/TA EBIT/OCF
Financial statement Items needed	CA, CL, DEBT, TA, RE, MV of Eq, Sales, No. of shares	CA, CL, INV, TA, SALES, INT, EBIT, TAX, OCF
Validation Techniques	Split and secondary sample	Lachenbruch's leave-one-out method
Application	Publicly held manufacturing firms	Any firm with audited financial statements

Note. Reprinted from "Two Discriminant Analysis Models of Predicting Business Failure: A Contrast of the Most Recent with the First Model" by Bhandari, S., 2014, *American Journal of Management, 14,* p. 16. Copyright 2014 by North American Business Press. Reprinted with permission.

Retail Industry

Single industry failure prediction studies are well documented in the literature, including the railroad, oil and gas, education, banking, brokerage, and insurance industries (Zmijewski, 1984). Evans and Mathur (2014) analyzed the financial performance of U.S. retail firms from 1982 through 2007 using a univariate single ratio approach derived from Dun & Bradstreet's annual Industry Norms & Key Business Ratios. They found when using popular ratios such as current ratio, return on sales, return on assets, and financial leverage, retailers in the U.S. showed a steady decline for decades. The present study sought to extend the research conducted by Evans and Mathur (2014) by applying the MDA equations and associated variables outlined in Altman (1968) and Bhandari and Iyer (2013) to a sample of retail firms in a different timeframe. Evans and Mathur (2014) suggested the use of a different model that was inclusive of ratio analysis for retail firms in a future time period would extend their research.

The manufacturing industry was the focus in Altman (1968), however researchers have had success in predicting distress in other industries using the model. For example, Guffey and Moore (1991) examined trucking; Platt, Platt, and Pedersen (1994) considered the oil and gas industry; Pantalone and Platt (1987) modeled failure of commercial banks and Schipper (1977) predicted the financial condition of private colleges. Platt and Platt (2002) postulated single-industry studies avoid issues arising in multi-industry studies such as different accounting treatment of variables, cost, and capital structures as well as econometric concerns regarding data normality and stability over time. The current research applied Altman (1968) and Bhandari and

Iyer (2013) FDP models to the retail industry to examine how well the models performed in one industry.

The retail industry continues to experience financial ups and downs and has been an area for corporate financial distress research. According to Shaked and Orelowitz (2017), financial media outlets, newspapers, and websites have been inundated with discussions surrounding financial distress in retail companies. The uptick in store closures and employee layoffs seems to be a never-ending cycle, which makes it crucial for investors, management, and all interested parties to recognize and understand the onset of financial distress in the retail industry.

Studies focused on the retail industry using an array of methods and variables are documented in the literature. Altman et al. (1977) extended the work of Altman (1968) which analyzed the retail industry same as manufactures and found using MDA, financial distress was foreseeable with 78 percent accuracy four years prior to failure. Altman et al. concluded the inclusion of retailers alongside manufacturers did not negatively affect the results. Bhargava et al. (1998) focus was solely on predicting financial hardship in the retail industry, comparing the financial distress predictive ability of Altman (1968) with the single performance measures of cash flow and inventory turnover. The study used the logit model that produced overall results which indicated the Altman (1968) Z-score had a better predictive ability in comparison to the single predictors of cash flow and inventory turnover.

Pang and Kogel (2013) followed the MDA technique in Altman (1968) to formulate three new discriminant functions using 40 publicly traded retail firms (18 bankrupt and 22 non-bankrupt). The study concluded the newly formulated discriminant functions predicted

bankruptcy for retail firms better than Altman's original Z-score. Out of the 40 firms, the original Altman Z-score had three misclassifications, making it 92.5% accurate, two of the newly formulated discriminant functions were 100% accurate and the third model was 97.5% accurate. from various and Archana (2018) performed a study aimed at predicting the financial distress probability of five retail firms outside of the U.S. for the period 2012 to 2017 using Altman (1983) four variable multiple discriminant model. The results showed three of the five retail firms were in financial distress. The study did not include matched pairs as part of the sample as found in Altman (1983) thus it is unclear if the study can be relied upon.

Summary

This literature review was, in part, guided by the research questions, as outlined in Chapter 1. Definitions and examples of corporate financial distress can be found in the literature dating back to Fitzpatrick (1934), who was one of the first scholars to study the area of corporate financial distress and bankruptcy and found the downtown of a company occurred in gradual stages. Scholars Lau (1987); Sormunen and Laitinen (2012); Farooq et al. (2018) also suggested corporate financial distress occurred in stages, as shown in Figure 2.

Gordon (1971) extended Fitzpatrick's research by laying the foundation for a baseline theory aimed at understanding the concept of corporate financial distress. In an effort to expand the knowledge of financial distress, Beaver (1966) applied a statistical technique aimed at finding a way to predict the economic downturn of a firm. Extending Beaver (1966), Altman bought about change to the prediction of financial distress by introducing the MDA formula. The seminal works of Beaver (1966) and Altman (1968) laid the trajectory for many models to

follow, Table 2 outlines the strengths and limitations of these works. According to Altman et al., (2017), Altman (1968) is still the most used corporate financial distress and bankruptcy prediction model worldwide.

The MDA formula derived by Altman (1968) was rooted in financial ratio analysis. Along with corporate financial distress situations, this literature review also closely examined the literature relating to financial ratios and its inputs. Altman included five financial ratios in the MDA formula focused in the manufacturing industry. Archana (2018) recommended further research comparing Altman and other models, which used the MDA methodology but with different financial ratio inputs. Thus, the current research compared the cash flow prediction model as outlined in Bhandari and Iyer (2013) with Altman to predict financial distress in selected U.S. retail firms that filed for bankruptcy from 2012 through 2018.

CHAPTER 3. METHODOLOGY

Introduction

Accurately pinpointing when a company is experiencing financial distress is extremely important to shareholders, management, and the overall health of the economy (Hayes et al., 2010). Financial distress in the retail industry continues to be a great concern with stores rapidly going out of business (Shaked & Orelowitz, 2017). The purpose of this quantitative study was to test and investigate the efficacy of FDP using the original Altman Z-score (1968) and Bhandari and Iyer (2013) models to predict the possibility of financial distress in publicly traded retail companies. Investigating financial distress was accomplished using a linear combination of ratios that fall into the categories of profitability, leverage, liquidity, and cash flow. The ratios were calculated using published financial statements for three years prior to actual bankruptcy. FDP models have been formulated and published by an array of scholars, however, the Z-score linear equation continues to be most popular and highly regarded by many scholars including Altman et al. (2017), Orabi (2014), Oz and Yelkenci (2017), Husein and Pambekti (2014), Unegbu and Adefila (2013).

Creswell (2014) explained methodology is a fundamental step in the process of quantitative research that defines how data is collected and analyzed. Chapter 3 includes the research methodology for this quantitative study. In addition to methodology, this chapter offers the approach for the research design along with the population and sampling strategies. The data

collection and analysis process, which aided in answering the research questions is thoroughly explored. The chapter concludes with an examination of the validity and reliability of the data and ethical considerations.

Design and Methodology

This nonexperimental quantitative study was built on the research conducted by Darmawan and Supriyanto (2018) to test the predictive ability of the original Z-score of mining companies listed on the Indonesian Stock Exchange during 2011-2014. Following their research recommendations, the current study sought to examine the predictive ability of financial distress in the retail industry using Altman Z-score (1968) and Bhandari and Iyer (2013) FDP models, and answering the question of which model performed better. Bhandari (2014) provided a comparison, contrast, and critique of Altman (1968) and Bhandari and Iyer (2013) studies, which were published 45 years apart. Both studies used secondary data consisting of the income statement, balance sheet and cash flow statements found in publicly open databases.

The nature of secondary data is the information has been collected by someone else and readily available from public sources (Johnston, 2014). The data in the present study was gathered using publicly available financial statements (income statements, balance sheets, and cash flow statements) of listed retail companies. From these financial statements, the 12 variables (ratios), as shown in Table 3, was calculated without manipulation. Financial statements represent numeric expressions that allow the predictive independent variables to be examined using the nonexperimental quantitative approach (Khaldi, 2017). Standard statistical

techniques within Microsoft Excel was used to explore the research questions, and associated hypotheses.

Population and Sampling

U.S. retail companies were the target population for this study. A list of distressed, downgraded, or fully delisted retail companies that had filed for bankruptcy protection from January 1, 2012, to December 31, 2018, was obtained from Bankruptcydata.com. Distressed and downgraded is determined based on audit options, discounted debt, or some form of negative data published about the company. Using the matched pairs technique, bankrupt firms were selected and paired with a non-bankrupt firm. Altman (1968) and Bhandari and Iyer (2013) both used the discriminant analysis technique with matched pairs based on asset size and industry or SIC code. Deakin (1972) inferred that matched pairs according to size and industry help to avoid potential bias in certain ratios. Li (2012) also found selecting non-distressed firms with the same industry and comparable asset size as the distressed firms was a suitable sampling technique. The current research followed the MDA analysis method along with the matched pair sampling technique as done by Altman (1968) and Bhandari and Iyer (2013).

Past research helped to define the sample method and size for the current study. Munteanu, Zamfir, and Florea (2018) stated statistical sampling should be based on probability, where every unit in a total population has an equal opportunity for inclusion in the sample. Creswell (2014) inferred determining statistical sample size can depend on the tolerable margin of error, the confidence level, and the estimated response rate. Munteanu et al. further explained,

non-statistical sampling can be determined by professional reasoning or past research, which was the approach taken in the current research to determine a suitable sample size.

BankruptcyData.com listed 126 retail companies classified as doing business under SIC codes ranging from 5200-5999 with a distressed, downgraded, or bankruptcy date between January 1, 2012, and December 31, 2018. To determine the probability of financial distress, the focus of the current study was on financial data three years prior to a company filing for bankruptcy protection. From the 126 companies listed, 71 were eliminated because they had not filed for bankruptcy during the six-year window under review, 26 were eliminated because they were not publicly traded, and seven were eliminated because their annual financial reports were not available in the SEC database for the three years immediately prior to bankruptcy. For each bankrupt firm in the sample, a creditworthy and solvent retail firm was matched, having the same SIC code and closet asset value. The asset value reported on the balance sheet prior to bankruptcy is matched with a firm that has a similar asset value for that same year when determining matched pairs (Shamsudin & Kamaluddin, 2015; Wang & Campbell, 2010). The final sample size for the current study was 22 bankrupt retail companies and 22 non-bankrupt retail companies with three years of observation preceding bankruptcy. Therefore, the total number of observations was 132 (22 bankrupt companies plus 22 non-bankrupt companies multiplied by 3 years).

The sample size determined for the present study is suitable for research aimed at forecasting financial distress based on previous scholars. Al-Hroot (2015) emphasized the importance of determining the proper sample size for a study aimed at financial ratio analysis.

Al-Hroot found the accuracy of predicting corporate failure decreased when the sample size was large. The original Z-score was developed using a sample of 33 failed and 33 non-failed firms over a period of 20 years in one industry (Altman, 1968). Altman stated since average ratios have a tendency to shift, a 20-year timeframe can skew the results. Bhandari and Iyer (2013) original sample included 50 failed and 50 non-failed firms spanning two years but included 20 different industries, however, due to missing data, the final test sample was a total of 78 companies (40 failed and 38 non-failed).

When testing the efficacy of the Z-score, past researchers have had success with an array of sample sizes. For example, Hayes et al. (2010) sample frame was seventeen (8 failed and 9 non-failed) over a two-year bankruptcy period in one industry. Wang and Campbell (2010) data set was a total of 84 firms (42 bankrupt/delisted and 42 non-bankrupt/non-delisted) within an 8-year bankruptcy window in more than one industry. Pang and Kogel data set consisted of 40 firms (18 bankrupt and 22 non-bankrupt) focused in one industry. Hence, the sample size of 44 (22 bankrupt and 22 non-bankrupt) over a 6-year bankrupt window focused in one industry was a sufficient data set.

Setting

The number of retail companies filing for bankruptcy have substantially increased, which is currently at an all-time high (Shaked & Orelowitz, 2017). There was no unique setting required for this research. Retail firms that filed for bankruptcy during the time period 2012 to 2018 was selected for review. The current study was completed with secondary data (financial statements) collected from publicly available databases. The financial statements were available

online and easily accessible. Each statement was downloaded from the U.S. SEC website and exported by company and year into Microsoft Excel. The present study did not require human participant contact. According to Johnston (2014), the use of secondary data in research studies can be cost-effective and highly convenient as compared to alternative methods of data gathering.

Data Collection

The data needed for this study was collected from open and publicly accessible sources. Table 5 displays the financial statement accounts needed as inputs to calculate the Altman Z-score and the Bhandari and Iyer cash flow equation. The annual 10-K reports of the 44 retail firms in the sample for three years prior to bankruptcy will be accessed using the Internet via the EDGAR database. These reports consisted of the balance sheets, income statements, cash flow statements, and any other pertinent public data needed to calculate the company's distress zone. The online database houses information submitted by public entities or companies required by law to file and make data available to the investing community. Microsoft Excel statistical analysis was used to calculate the financial ratios, analysis the data, and store the results.

Table 5. Data Collection Components

Prediction Model	Independent Predictor Variable	Data Collected	Prediction Model	Independent Predictor Variable	Data Collected
Altman Z-Score	X_1	Current Assets	Bhandari and Iyer Model	X_1	Operating Cash Flow
		Current Liabilities			Current Liabilities
		Total Assets			
	X_2	Retained Earnings		X_2	Operating Cash Flow
		Total Assets			Interest
					Taxes
	X_3	Earnings Before Interest and Taxes		X_3	Operating Cash Flow
		Total Assets			Sales
	X_4	Market Value of Preferred Stock		X_4	Operating Cash Flow
		Market Value of Common Stock			Total Assets
		Book Value of Current Debts		X_5	Earnings Before Interest and Taxes
		Book Value of Long-term Debts			Operating Cash Flow
	X_5	Sales		X_6	Current Assets
		Total Assets			Inventory
					Current Liabilities
				X_7	3 years of Sales Revenue

Instrumentation/Measures

A survey instrument was not required for the current study. Financial statements obtained from publicly available databases served as the data inputs for the study. The Z-score equation created by Altman (1968) and Bhandari and Iyer (2013) were used to determine if the retail company experienced financial distress three years prior to actual bankruptcy. Financial distress was measured using the financial data for firms doing business in the retail industry that filed for bankruptcy protection from 2012 – 2018 in each equation. The financial data needed to calculate the formulas (instruments) was manually collected for each company in the sample. Figures 3 and Figures 4 displays the complete Z-score equation and the optimum cut-off for both FDP models in the study.

Z_A = 0.12(working capital/total assets) + .014(retained earnings/total assets) + .033(earnings before interest and taxes/total assets) + .006(market value of equity/book value of total debt) + .999(sales/total assets)

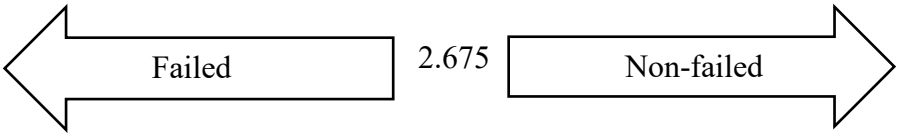

Figure 3. Altman (1968) final discriminant function.

Z_B = - 0.531+ 0.675(operating cash flow/current liabilities) + 0.001(operating cash flow + interest + taxes/interest) – 0.028(operating cash flow/sales) + 0.637(operating cash flow/total assets) + 0.096(earnings before interest and taxes/operating cash flow) + 0.165(current assets – inventory/current liabilities) + 0.006(sales 3-year CAGR)

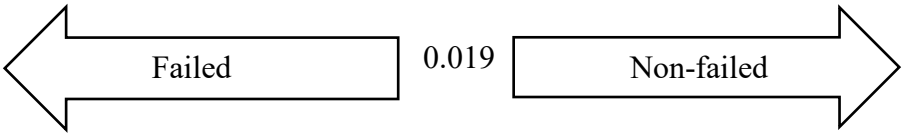

Figure 4. Bhandari and Iyer (2013) final discriminant function.

Hypotheses

Hypotheses are formulated after the purpose statement and research questions are established in a quantitative research. Creswell (2014) noted hypotheses transform the research questions into predictions about the expected outcomes of relationships among variables. Hypothesis testing includes statistical procedures where the researcher draws inferences about the population from a sample. In quantitative research, the potential relationship between variables are described in null and alternative hypotheses statements. A null hypothesis is the statement in which the proposed cause known as an independent variable or the predictor variable has no effect on the dependent variable being measured (Smith, 2003). The alternative hypothesis is the opposite of the null. In the current study, the hypotheses were tested and the efficacy of corporate financial distress prediction using the original Altman Z-score (1968) and Bhandari and Iyer (2013) models to predict the possibility of financial failure in publicly traded retail companies was investigated.

RQ1: To what extent does the original Altman Z-score equation accurately predict corporate financial distress for retail firms that filed for bankruptcy during 2012 – 2018?

$H1_0$: There is no relationship between the original Altman Z-score equation and corporate financial distress for retail firms that filed for bankruptcy during 2012 – 2018?

$H1_a$: There is a relationship between the original Altman Z- score equation and corporate financial distress for retail firms that filed for bankruptcy during 2012 – 2018?

RQ2: To what extent does the Bhandari and Iyer equation accurately predict corporate financial distress for retail firms that filed for bankruptcy during 2012 – 2018?

$H2_0$: There is no relationship between the Bhandari and Iyer equation and corporate financial distress for retail firms that filed for bankruptcy during 2012 - 2018?

$H2_a$: There is a relationship between the Bhandari and Iyer equation and corporate financial distress for retail firms that filed for bankruptcy during 2012 – 2018?

RQ3: To what extent do the original Altman Z-score and Bhandari and Iyer models perform relative to each other?

Research Question 3 was evaluated using a comparative analysis method. The accuracy of the predictive ability of the Altman (1968) Z-score based on accrual financial statements and Bhandari and Iyer (2013) Z-score based on cash flow statements were ranked by the percentage of accurate and inaccurate predictions for each prior to failure. The question was answered by the best performing model which returned the highest accuracy percentage and the lowest inaccuracy percentage. This methodology was in-line with studies performed by Almamy et al. (2016), Agarwal and Taffler (2007), and Li (2012) who used the comparative method analysis.

Data Analysis

Data analysis can be conducted using statistical software programs. According to Creswell (2014), descriptive numbers are standardized in hypothesis testing, which allows for easy comparisons to fixed values found in computer programs. The data for this study was analyzed using Microsoft Excel. The use of Microsoft Excel in statistical data analysis is

common for education researchers and students. Abbott (2011) explained the software can hold a variety of data sets and has specific menus for data management, descriptive statistical analysis, and hypothesis testing. The descriptive statistics in this study included mean, median, standard deviation, minimum, and maximum.

The data analysis required the calculation of all twelve ratios (variables) shown in Table 3 using Microsoft Excel. Five ratios were used in the Altman Z-Score model and seven in the Bhandari and Iyer model. The financial statements for the 22 bankrupt firms and the 22 matched non-bankrupt firms was needed to calculate each ratio. The results of the ratio analysis were inserted in the equations shown in Figure 3 and Figure 4 to calculate the Z-score and determine fail or non-fail for three years prior to bankruptcy.

The hypotheses associated with RQ1 and RQ2 were tested using the chi-square test of independence at a 0.05 level of significance ($p < .05$) as done by Shamsudin and Kamaluddin (2015). As discussed in Chapter 2, two types of errors exist to predict corporate financial distress or failure, Type I, and Type II. Type I, the misclassification of failed firms as non-failed and Type II, the misclassification of non-failed firms as failed. After calculating the Z-scores for the bankrupt and non-bankrupt firms using both models, the overall accuracy rate, Type I and Type II errors were calculated to answer RQ3. The results were presented in a comparative analysis chart for the one, two and, three years preceding bankruptcy in a similar manner, as did Wang and Campbell (2010).

Validity and Reliability

The quality of research investigations is grounded in the rigorous way the researcher designs and follows through with the intended research objectives. Heale and Twycross (2015) surmised, validity and reliability are the benchmarks by which the quality of quantitative research is measured. Validity is aimed at ensuring the research tools utilized met the stated objectives, while reliability is concerned with the accuracy and duplication of the tools. In the current study, the models used were validated by each researcher. Altman (1968) employed split and secondary sample, and Bhandari and Iyer (2013) used the Lachenbruch's leave-one-out method validation technique. The Altman and Bhandari and Iyer Z-scores have been validated and were suitable for use in the current research with no further validation.

Governing bodies have implemented rules, and regulations that can result in significant civil and criminal penalties levied against companies and their highest officers for omissions, errors, or violations in published financial statements (Gerdes, 2003). The statements filed with the SEC are publicly accessible via the EDGAR database and are deemed to be reliable. The EDGAR database automatically collects, validates, and catalogs financial data submissions of U.S. publicly traded companies (Gerdes). Nam, No, and Lee (2017) explained financial statement users obtain financial data from two popular sources: public data repositories and financial data aggregators.

The data for the current research was retrieved from public data repositories such as COMPUSTAT, bankruptcy.com and the EDGAR database. Data from proprietary databases provided by financial data aggregators such as Standard and Poors, MSN Money, and

Bloomberg are less reliable than public data repositories and include a number of errors (Nam et al., 2017). Al-Hroot (2015), Ashraf et al. (2019), Oz and Simga-Mugan (2018), Pang and Kogel (2013), Roomi et al. (2015) used EDGAR or its foreign equivalent to gather annual financial statements of listed corporations.

Ethical Considerations

Ethical considerations are important in research because there is inherent risk to subjects in the collection of data. Ethics in research should aim to cause no harm, adverse outcome, or suffering to human subjects (Greenwood, 2016). The *Belmont Report* provides ethical guidelines and principles which must be followed to protect human subjects in research. The report outlines three ethical principles that apply to studies involving human subjects; respect for persons, beneficence, and justice (U.S. Department of Health and Human Services, National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979). The research for this study did not require human subjects and was conducted through accessing public databases on the Internet. The secondary data consisted of the annual 10-K filed in compliance with SEC regulations by 44 U.S. publicly traded retail firms. The organization's name was displayed on the Form 10-K; however, Creswell (2014) recommended that the rights and privacy of corporations be respected. Although data is publicly displayed and freely accessed via the Internet, the names of the 44 firms in this study remained anonymous and only referred to by SIC code.

CHAPTER 4. RESULTS

Introduction

Chapter 4 is a detailed report of the results from data collection and analysis of the hypotheses. The purpose of this quantitative study was to test and investigate the efficacy of FDP using the original Altman Z-score (1968) and Bhandari and Iyer (2013) models to predict the possibility of financial failure in publicly traded retail companies. The current study was built on research conducted by Archana (2018) and Darmawan and Supriyanto (2018) in the area of corporate financial distress. These studies suggested future research be conducted that compares Altman Z-score with more recently published FDP models using different ratios. Following this recommendation, the present study included the cash flow prediction model as outlined in Bhandari and Iyer (2013) in conjunction with Altman (1968) to predict financial distress in selected U.S. retail firms that filed for bankruptcy between 2012 and 2018.

Prior to data collection and analysis, one null and one alternative hypothesis for RQ1 and RQ2 was identified in Chapter 3. The results of the data analysis required three null and three alternative hypotheses for RQ1 and RQ2, resulting in a modification from Chapter 3. The modification was needed because the Z-scores for both FDP models were calculated for one, two, and three years prior to the bankruptcy, which required separate statistical testing. The following research questions and hypotheses were investigated using a quantitative research design:

RQ1: To what extent does the original Altman Z-score equation accurately predict corporate financial distress for retail firms that filed for bankruptcy during 2012 – 2018?

$H1_0 1$: There is no relationship between the original Altman Z-score equation and corporate financial distress for one year prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

$H1_a 1$: There is a relationship between the original Altman Z-score equation and corporate financial distress for one year prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

$H1_0 2$: There is no relationship between the original Altman Z-score equation and corporate financial distress for two years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

$H1_a 2$: There is a relationship between the original Altman Z-score equation and corporate financial distress for two years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

$H1_0 3$: There is no relationship between the original Altman Z-score equation and corporate financial distress for three years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

$H1_a3$: There is a relationship between the original Altman Z-score equation and corporate financial distress for three years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

RQ2: To what extent does the Bhandari and Iyer equation accurately predict corporate financial distress for retail firms that filed for bankruptcy during 2012 – 2018?

$H2_01$: There is no relationship between the Bhandari and Iyer equation and corporate financial distress for one year prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

$H2_a1$: There is a relationship between the Bhandari and Iyer equation and corporate financial distress for one year prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

$H2_02$: There is no relationship between the Bhandari and Iyer equation and corporate financial distress for two years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

$H2_a2$: There is a relationship between the Bhandari and Iyer equation and corporate financial distress for two years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

$H2_03$: There is no relationship between the Bhandari and Iyer equation and corporate financial distress for three years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

$H2_a3$: There is a relationship between the Bhandari and Iyer equation and corporate financial distress for three years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

RQ3: To what extent do the original Altman Z-score and Bhandari and Iyer models perform relative to each other?

As described in the data collection section of Chapter 3, the data needed for this study would be collected from 44 firms (22 bankrupt and 22 non-bankrupt) annual 10-K financial reports available in the EDGAR database on the SEC website. The information needed to calculate certain ratios were not available reducing the sample size to 38 firms (19 bankrupt and 19 non-bankrupt), resulting in a modification from Chapter 3.

Creswell (2014) explained the research results are reported after data collection and analysis using tables and figures to interpret the results gathered from statistical testing. Chapter 4 is organized in five sections; introduction, data collection results, descriptive analysis, analysis of hypotheses, and the summary. The introduction reiterates the research topic, purpose, research questions, and hypotheses as well as describe any differences from the approved proposal. The data collection results section is a detailed analysis and evaluation of the actual data collection steps. The descriptive analysis section organizes the raw data gathered with visuals aids such as tables and figures. The analysis of hypotheses tests and evaluates the hypotheses using tables and

figures to report the statistical findings. Lastly, the chapter summary recaps the data analysis and transitions to Chapter 5, where the research findings are discussed in detail.

Data Collection Results

The EDGAR database was used to gather the financial data listed in Table 5 from each company's annual 10-K to calculate the Altman Z-score and the Bhandari & Iyer Z-score for three years. Data collection started on March 12, 2020, after receiving official approval from the IRB board and ended on April 1, 2020. The IRB board stated the current research did not require IRB oversight because the study does not meet the federal regulatory definition of Human Subjects. The original sample of 22 publicly traded retail companies that filed for bankruptcy between 2012 and 2018 was obtained from Bankruptcydata.com. The company's name, bankruptcy filing date, and SIC code was extracted from Bankruptcydata.com.

The annual 10-K for three years prior to bankruptcy was found in the EDGAR database by searching the name of each company. The EDGAR search displayed all filings published by the SEC. A filter search was performed to isolate the annual 10-K, and based on the bankruptcy filing date, the 10-K for three years prior to that date was downloaded into Microsoft Excel and saved on an external hard drive. The SIC codes for retail firms range from 5200-5999, and the companies in the sample represented 15 SIC codes, as shown in Table 6. For each bankrupt company, a non-bankrupt company with the same SIC code and similar asset value in the year prior to bankruptcy were selected from EDGAR. Three years of annual 10-Ks for each non-bankrupt company were downloaded and saved in Microsoft Excel.

Table 6. SIC Code, SIC Description and Number of Companies

SIC	SEC Description	Number of
5311	Retail- Department Stores	2
5331	Retail- Variety Stores	1
5400	Retail- Food Stores	1
5600	Retail- Apparel & Accessory Stores	3
5621	Retail- Women's Clothing Stores	3
5661	Retail-Shoe Stores	1
5712	Retail- Furniture Stores	1
5731	Retail- Radio TV & Consumer	2
5734	Retail -Computer & Computer	1
5900	Retail- Miscellaneous Retail	1
5912	Retail -Drug Stores and Proprietary	1
5940	Retail- Miscellaneous Shopping Goods	2
5945	Retail-Hobby, Toy & Game Shops	1
5960	Retail- Non-Store Retailers	1
5961	Retail- Catalog & Mail-Order Houses	1

Note. Data from U.S. Securities and Exchange Commission (2020).

The data collection components, as shown in Table 5, were extracted from the saved 10-Ks and loaded into a new Microsoft Excel spreadsheet. The companies represented by SIC codes 5734, 5912, and 5945 were eliminated from the sample due to missing data, such as 3 years of sales revenue or stock prices needed to calculate the market value of equity variable. The final sample size was 38 firms (19 bankrupt and 19 non-bankrupt). The reduced sample size is aligned with sample sizes presented in past research. As explained in Chapter 3, the original Altman Z-score was developed using a sample of 33 failed and 33 non-failed firms over a period of 20 years in one industry (Altman, 1968). Bhandari and Iyer (2013) original sample included 40

failed and 38 non-failed firms spanning two years but included 20 different industries. Wang and Campbell (2010) sample size included 84 firms (42 bankrupt/delisted and 42 non-bankrupt/non-delisted) over an 8-year bankruptcy window coming from multiple industries. Hence, the sample size of 38 (19 bankrupt and 19 non-bankrupt) over a 6-year bankrupt window focused in the retail industry was sufficient.

Descriptive Analysis

The descriptive phase of data analysis is the initial process of exploring data sets and understanding the characteristics of the variables (Abbott, 2011). The independent variables in this study were the 12 ratios associated with the two FDP models, and the dependent variable was corporate financial distress. According to Keener (2013), sales and total assets are important predictor variables when evaluating the reliability and validity of financial statement data. Sales figures provide insight into the profitability of a firm, and historical total asset cost is a display of how the firm uses available resources (Keener). The sales and total assets data components were used to calculate seven of the 12 continuous variables in this study. Therefore, the descriptive statistics analysis included the sales and total assets for one year prior to bankruptcy for the bankrupt and non-bankrupt companies in the sample.

Validating the data set using the balance of the total assets on the financial statement one year prior to bankruptcy aligns with Shamsudin and Kamaluddin (2015) and Wang and Campbell (2010). Each bankrupt company in the sample was matched to a solvent company with the same SIC code and closet total asset value in the year prior to bankruptcy. The mean, median,

standard deviation, coefficient of variation, minimum, and maximum for one year of sales and total assets from the 38 firms (19 bankrupt and 19 non-bankrupt) are shown in Table 7.

Table 7. Descriptive Statistics - Sales and Total Assets

	Bankrupt					
	M	*Mdn*	*SD*	CV	Minimum	Maximum
Sales	1778.59	530.13	3746.74	2.11	47.20	16702.00
Total Assets	779.35	235.09	1658.42	2.13	20.00	7262.00
	Non-bankrupt					
	M	*Mdn*	*SD*	CV	Minimum	Maximum
Sales	3681.279	939.16	9539.94	2.59	152.12	42410.00
Total Assets	1593.48	389.10	3181.31	2.00	207.98	14013.00

Note. Bankrupt (N= 19) and Non-bankrupt (N = 19). Data from U.S. Securities and Exchange Commission (2020).

The descriptive statistics show the mean, median, and standard deviation for bankrupt firms were smaller than non-bankrupt firms for sales and total assets as expected. The coefficient of variation statistics is similar for both sales and total assets, which indicates the bankrupt and non-bankrupt firms in the sample are comparable. The histograms in Figure 5 and Figure 6 provide visual presentations of sales for bankrupt and non-bankrupt, showing the comparability in the data sets. The histograms in Figure 7 and Figure 8 provide visual presentations for total assets confirming bankrupt firms were properly matched with non-bankrupt firms in this study.

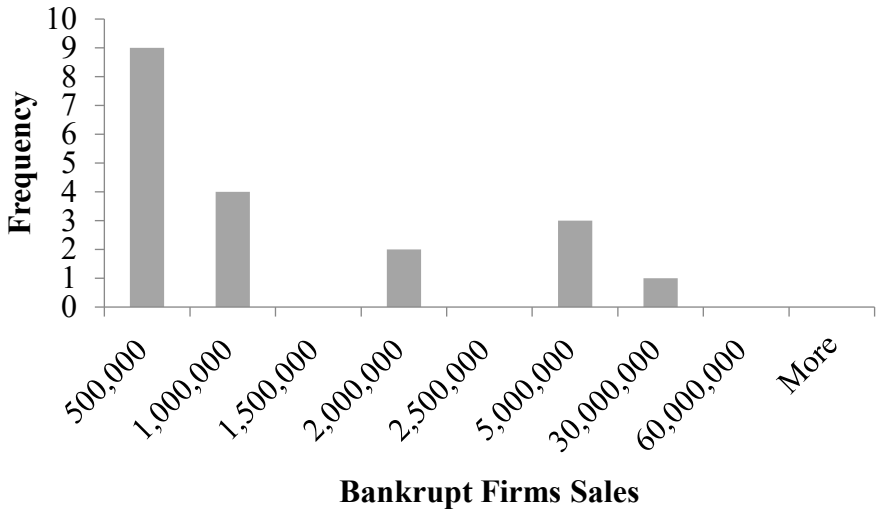

Figure 5. Histogram for bankrupt firms' sales. Data from U.S. Securities and Exchange Commission (2020). $N = 19$; $M = 1778.59$; $SD = 3746.74$.

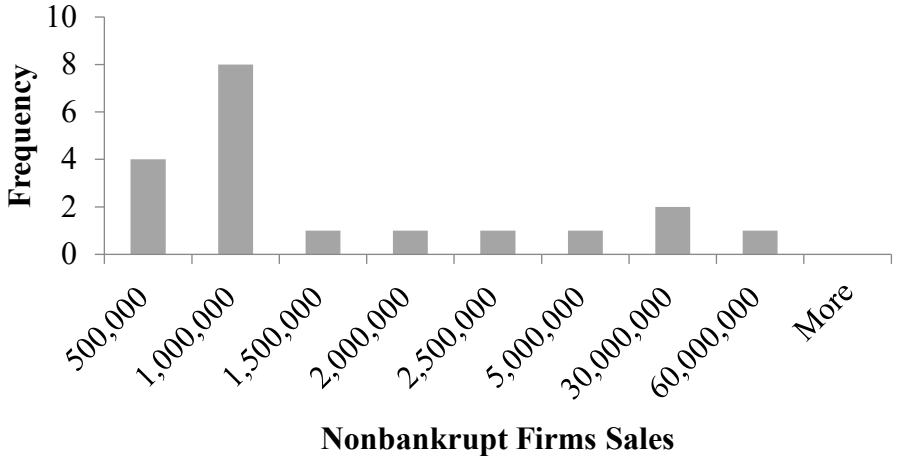

Figure 6. Histogram for non-bankrupt firms' sales. Data from U.S. Securities and Exchange Commission (2020). $N = 19$; $M = 3681.27$; $SD = 9539.94$.

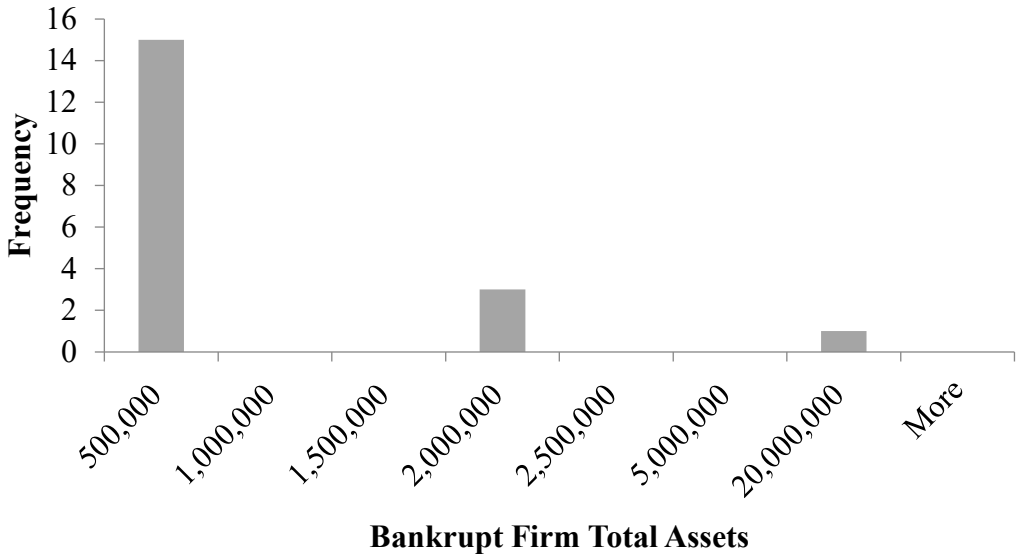

Figure 7. Histogram bankrupt firms' total assets. Data from U.S. Securities and Exchange Commission (2020). $N = 19$; $M = 779.35$; $SD = 1658.42$.

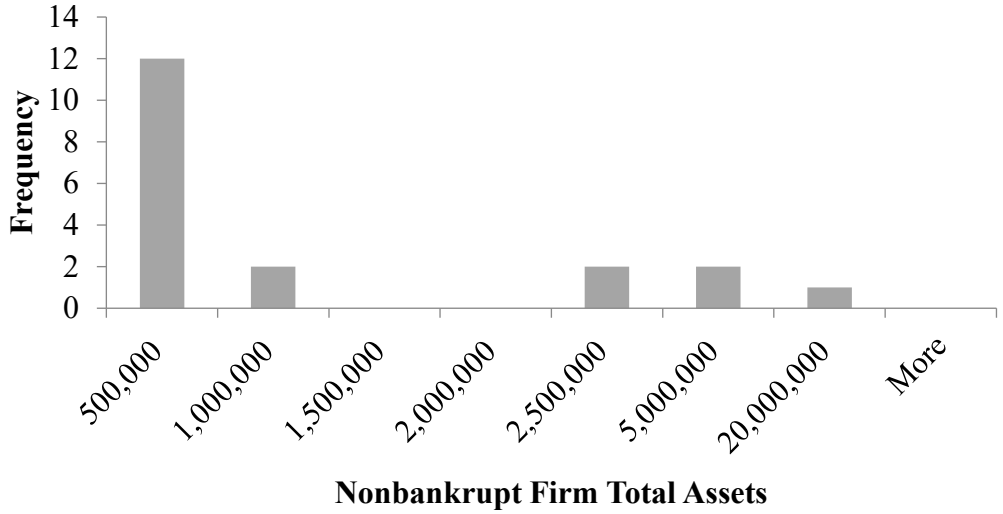

Figure 8. Non-bankrupt firms' total assets. Data from U.S. Securities and Exchange Commission (2020). $N = 19$; $M = 1593.48$; $SD = 3181.31$.

The original Altman and Bhandari and Iyer FDP Z-scores were the basis for testing the hypotheses. Twelve variables (ratios) were calculated as detailed in Table 3 for the sample (19 bankrupt firms and 19 non-bankrupt firms) using data from one, two, and three years prior to bankruptcy. Five ratios represented liquidity, profitability, and leverage as defined by the Altman Z-score FDP model, and seven ratios were cash flow as outlined by the Bhandari and Iyer FDP model. The results from the ratios were inserted into the equations, as shown in Figure 3 and Figure 4, for each FDP model to calculate the Z-score for each year. The calculated Z-scores for each company by year were labeled as failing or non-failing according to the optimum cut-off.

Altman Z-score and Bhandari and Iyer Z-score results were converted to a categorical (dichotomous) count for the purpose of chi-square statistical analysis, consistent with Shamsudin and Kamaluddin (2015). The total count of failing and non-failing companies for the Altman Z-score model is shown in Table 8.

Table 8. Altman Z-score FDP Model Results

Altman Z-score FDP Model Results			
Bankrupt Companies	Z < 2.675 Failed	Z > 2.675 Non-failed	Total
Number of companies 1 year prior to bankruptcy	10	9	19
Number of companies 2 years prior to bankruptcy	9	10	19
Number of companies 3 years prior to bankruptcy	7	12	19
Non-bankrupt Companies	Z < 2.675 Failed	Z > 2.675 Non-failed	Total
Number of companies 1 year prior to bankruptcy	3	16	19
Number of companies 2 years prior to bankruptcy	1	18	19
Number of companies 3 years prior to bankruptcy	2	17	19

The total count of failing and non-failing companies for the Bhandari and Iyer model is shown in Table 9 for the three years prior to bankruptcy. Table 8 and Table 9 are used to test the hypotheses in the following section.

Table 9. Bhandari and Iyer FDP Model Results

Bhandari and Iyer FDP Model Results			
Bankrupt Companies	Z < .0190 Failed	Z > .0190 Non-failed	Total
Number of companies 1 year prior to bankruptcy	18	1	19
Number of companies 2 years prior to bankruptcy	17	2	19
Number of companies 3 years prior to bankruptcy	13	6	19
Non-bankrupt Companies	Z < .0190 Failed	Z > .0190 Non-failed	Total
Number of companies 1 year prior to bankruptcy	5	14	19
Number of companies 2 years prior to bankruptcy	4	15	19
Number of companies 3 years prior to bankruptcy	8	11	19

Analysis of Hypotheses

Research Questions 1 and 2 were tested using the chi-square test of independence. Gorsuch and Lehmann (2017) explained chi-square statistical testing includes a dependent dichotomous variable and is used to measure the relationship among categorical variables. The chi-square statistical test is applicable when exploring the existence of a statistically significant relationship between two variables (Gaur & Gaur, 2009). McHugh (2013) explained six assumptions are associated with chi-square statistical testing (a) data is in the form of frequencies or counts of cases as opposed to percentages, (b) variable categories are mutually exclusive, (c) the subjects contribute single-cell data, (d) group independence, and (f) at least 80% of the cell

data is greater than 5 and not less than 1. The chi-square test was appropriate for this study because the data met these six assumptions.

The dependent variable in this study was corporate financial distress, a binary categorical variable with two possible outcomes; fail or non-fail. The chi-square analysis produces a *p* value, most often used in the statistical testing of hypotheses for inferential statistics (Gorsuch & Lehmann, 2017). The level of significance set by the researcher is required to determine if a statistical relationship exists among two variables which is typically set at 0.05 (Gorsuch & Lehmann). The significance level applied in this study was 0.05.

The calculated Z-scores from both FDP models were converted to failed or non-failed counts and presented in a two-way contingency table. Gorsuch and Lehmann (2017) explained a contingency table could be used to display data when the rows and columns represent categories for different variables. The observed (actual) count and the calculated expected count is displayed in the table. Microsoft Excel chi-square functions were used to calculate the *p* value and chi-square statistic value where degrees of freedom (df) = 1. If the *p* value was less than or equal to the level of significance (0.05), a statistically significant association between the two variables exists, meaning the null hypothesis was rejected, and the alternative hypothesis was accepted.

Analysis of Research Question 1 and Hypotheses

The hypotheses required a statistical test that measured the relationship between the original Altman Z-score equation and corporate financial distress in U.S. publicly traded retail firms using a two-way table for one, two, and three years prior to the bankruptcy. The chi-square

test was the basis for determining the relationship between the dependent variable, corporate financial distress, and the independent variable, the original Altman Z-score equation in retail firms that filed for bankruptcy during 2012 – 2018.

RQ1: To what extent does the original Altman Z-score equation accurately predict corporate financial distress for retail firms that filed for bankruptcy during 2012 – 2018?

$H1_0 1$: There is no relationship between the original Altman Z-score equation and corporate financial distress for one year prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

$H1_a 1$: There is a relationship between the original Altman Z-score equation and corporate financial distress for one year prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

Table 10 displays the results of the original Altman Z-score FDP equation for one year prior to bankruptcy in a two-way contingency table. A chi-square test of independence indicated there was a significant association between the original Altman Z-score FDP equation and corporate financial distress for one year prior to failure in retail firms that filed for bankruptcy during 2012 – 2018, $\chi 2$ (1, N = 38) = 5.729, p = .0167. The results supported the rejection of the null hypothesis (*$H1_0 1$)*, which indicated a statistically significant relationship between the original Altman Z-score FDP equation and corporate financial distress for one year prior to failure in retail firms that filed for bankruptcy during 2012 – 2018.

Table 10. Altman Chi-Square Test 1 Year Prior to Bankruptcy

Altman Z-score – 1 year prior			
Observed			
	Bankrupt	Non-bankrupt	Total
$Z < 2.675$	10	3	13
$Z > 2.675$	9	16	25
	19	19	38
Expected			
	Bankrupt	Non-bankrupt	Total
$Z < 2.675$	6.5	6.5	13
$Z > 2.675$	12.5	12.5	25
	19	19	38

Note. χ^2 (1, N = 38) = 5.729, p = .0167

$H1_02$: There is no relationship between the original Altman Z-score equation and corporate financial distress for two years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

$H1_a2$: There is a relationship between the original Altman Z-score equation and corporate financial distress for two years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

Table 11 displays the results of the original Altman Z-score FDP equation for two years prior to bankruptcy in a two-way contingency table. A chi-square test of independence indicated there was a significant association between the original Altman Z-score FDP equation and corporate financial distress for two years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018, χ^2 (1, N = 38) = 8.685, p = .0032. The results supported the rejection of the null hypothesis (*$H1_02$)*, which indicated a statistically significant relationship between the

original Altman Z-score FDP equation and corporate financial distress for two years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018.

Table 11. Altman Chi-Square Test 2 Years Prior to Bankruptcy

Altman Z-score – 2 years prior			
Observed			
	Bankrupt	Non-bankrupt	Total
$Z < 2.675$	9	1	10
$Z > 2.675$	10	18	28
	19	19	38
Expected			
	Bankrupt	Non-bankrupt	Total
$Z < 2.675$	5	5	10
$Z > 2.675$	14	14	28
	19	19	38

Note. χ^2 (1, N = 38) = 8.6585, p = .0032

$H1_0 3$: There is no relationship between the original Altman Z-score equation and corporate financial distress for three years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

$H1_a 3$: There is a relationship between the original Altman Z-score equation and corporate financial distress for three years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

Table 12 displays the results of the original Altman Z-score FDP equation for three years prior to bankruptcy in a two-way contingency table. A chi-square test of independence indicated

there was no significant association between the original Altman Z-score FDP equation and corporate financial distress for three years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018, χ^2 (1, N = 38) = 3.639, p = .0564. The results did not support the rejection of the null hypothesis (*$H1_03$)*, which indicated no statistically significant relationship between the original Altman Z-score FDP equation and corporate financial distress for three years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018.

Table 12. Altman Chi-Square Test 3 Years Prior to Bankruptcy

	Altman Z-score – 3 years prior		
Observed			
	Bankrupt	Non-bankrupt	Total
$Z < 2.675$	7	2	9
$Z > 2.675$	12	17	29
	19	19	38
Expected			
	Bankrupt	Non-bankrupt	Total
$Z < 2.675$	4.5	4.5	9
$Z > 2.675$	14.5	14.5	29
	19	19	38

Note. χ^2 (1, N = 38) = 3.639, p = .0564

Analysis of Research Question 2 and Hypotheses

The hypotheses required a statistical test that measured the relationship between the Bhandari and Iyer equation and corporate financial distress in U.S. publicly traded retail firms using a two-way table for one, two, and three years prior to bankruptcy. The chi-square test was the basis for determining the relationship between the dependent variable, corporate financial

distress, and the independent variable, the Bhandari and Iyer equation in retail firms that filed for bankruptcy during 2012 – 2018.

RQ2: To what extent does the Bhandari and Iyer equation accurately predict corporate financial distress for retail firms that filed for bankruptcy during 2012 – 2018?

$H2_0 1$: There is no relationship between the Bhandari and Iyer equation and corporate financial distress for one year prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

$H2_a 1$: There is a relationship between the Bhandari and Iyer equation and corporate financial distress for one year prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

Table 13 displays the results of the Bhandari and Iyer FDP equation for one year prior to bankruptcy in a two-way contingency table. A chi-square test of independence indicated there was a significant association between the Bhandari and Iyer FDP equation and corporate financial distress for one year prior to failure in retail firms that filed for bankruptcy during 2012 – 2018, $\chi^2 (1, N = 38) = 18.614$, $p < .001$. The results supported the rejection of the null hypothesis (*$H2_0 1$)*, which indicated a statistically significant relationship between the Bhandari and Iyer FDP equation and corporate financial distress for one year prior to failure in retail firms that filed for bankruptcy during 2012 – 2018.

Table 13. Bhandari and Iyer Chi-Square Test 1 Year Prior to Bankruptcy

Bhandari and Iyer Z-score – 1 year prior			
Observed			
	Bankrupt	Non-bankrupt	Total
$Z < .0190$	18	5	23
$Z > .0190$	1	14	15
	19	19	38
Expected			
	Bankrupt	Non-bankrupt	Total
$Z < .0190$	11.5	11.5	23
$Z > .0190$	7.5	7.5	15
	19	19	38

Note. χ^2 (1, N = 38) = 18.614, $p < .001$

$H2_02$: There is no relationship between the Bhandari and Iyer equation and corporate financial distress for two years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

$H2_a2$: There is a relationship between the Bhandari and Iyer equation and corporate financial distress for two years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

Table 14 displays the results of the Bhandari and Iyer FDP equation for two years prior to bankruptcy in a two-way contingency table. A chi-square test of independence indicated there was a significant association between the Bhandari and Iyer FDP equation and corporate financial distress for two years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018, χ^2 (1, N = 38) = 17.989, $p < .001$. The results supported the rejection of the null hypothesis (*$H2_02$)*, which indicated a statistically significant relationship between the Bhandari

and Iyer FDP equation and corporate financial distress for two years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018.

Table 14. Bhandari and Iyer Chi-Square Test 2 Years Prior to Bankruptcy

Bhandari and Iyer Z-score – 2 years prior			
Observed			
	Bankrupt	Non-bankrupt	Total
$Z < .0190$	17	4	21
$Z > .0190$	2	15	17
	19	19	38
Expected			
	Bankrupt	Non-bankrupt	Total
$Z < .0190$	10.5	10.5	21
$Z > .0190$	8.5	8.5	17
	19	19	38

Note. χ^2 (1, N = 38) = 17.989, $p < .001$

$H2_03$: There is no relationship between the Bhandari and Iyer equation and corporate financial distress for three years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

$H2_a3$: There is a relationship between the Bhandari and Iyer equation and corporate financial distress for three years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018?

Table 15 displays the results of the Bhandari and Iyer FDP equation for three years prior to bankruptcy in a two-way contingency table. A chi-square test of independence indicated there was no significant association between the Bhandari and Iyer FDP equation and corporate

financial distress for three years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018, χ^2 (1, N = 38) = 2.661, p = .1028. The results did not support the rejection of the null hypothesis (*$H2_03$)*, which indicated no statistically significant relationship between the Bhandari and Iyer FDP equation and corporate financial distress for three years prior to failure in retail firms that filed for bankruptcy during 2012 – 2018.

Table 15. Bhandari and Iyer Chi-Square Test 3 Years Prior to Bankruptcy

Bhandari and Iyer Z-score – 3 years prior			
Observed			
	Bankrupt	Non-bankrupt	Total
$Z < .0190$	13	8	21
$Z > .0190$	6	11	17
	19	19	38
Expected			
	Bankrupt	Non-bankrupt	Total
$Z < .0190$	10.5	10.5	21
$Z > .0190$	8.5	8.5	17
	19	19	38

Note. χ^2 (1, N = 38) = 2.661, p = .1028

Analysis of Research Question 3 and Comparative Analysis

Research Question 3 was examined using a comparative analysis. The question was answered by the best performing model with the highest accuracy percentage and the lowest inaccuracy percentage. This methodology is in line with studies performed by Almamy et al. (2016), Agarwal and Taffler (2007), and Li (2012).

RQ3: To what extent do the original Altman Z-score and Bhandari and Iyer models perform relative to each other?

The comparative analysis presented in Table 16 shows of the two models presented in this study, Bhandari and Iyer, had the highest accuracy percentages for year one and two prior to bankruptcy but tied with Altman in year 3. The Bhandari and Iyer model had the lowest Type 1 errors, while the Altman model had the lowest Type II errors.

Table 16. Comparative Analysis

Bankrupt Sample						
	Altman Z-score (2.675)			Bhandari & Iyer (0.019)		
	Y1	Y2	Y3	Y1	Y2	Y3
Sample Size	19	19	19	19	19	19
Failed (Z < 2.675)	10	9	7	18	17	13
Non-failed -Type I Error (Z > 2.675)	9	10	12	1	2	6
Failed %	52.63%	47.37%	36.84%	94.74%	89.47%	68.42%
Non-failed % - Type I Error	47.37%	52.63%	63.16%	5.26%	10.53%	31.58%
Total %	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Non-bankrupt Sample						
	Altman Z-score (2.675)			Bhandari & Iyer (0.019)		
	Y1	Y2	Y3	Y1	Y2	Y3
Sample Size	19	19	19	19	19	19
Failed (Z < 2.675) – Type II Error	3	1	2	5	4	8
Non-failed (Z > 2.675)	16	18	17	14	15	11
Failed % - Type II Error	15.79%	5.26%	10.53%	26.32%	21.05%	42.11%
Non-failed %	84.21%	94.74%	89.47%	73.68%	78.95%	57.89%
Total %	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Overall Accuracy						
	Altman Z-score (2.675)			Bhandari & Iyer (0.019)		
	Y1	Y2	Y3	Y1	Y2	Y3
Sample Size	38	38	38	38	38	38
Accurate Prediction	26	27	24	32	32	24
Accuracy %	68.42%	71.05%	63.16%	84.21%	84.21%	63.16%
Type I Error	23.68%	26.32%	31.58%	2.63%	5.26%	15.79%
Type II Error	7.89%	2.63%	5.26%	13.16%	10.53%	21.05%
Total %	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

Summary

The purpose of this quantitative study was to test and investigate the efficacy of FDP using the original Altman Z-score (1968) and Bhandari and Iyer (2013) models to predict the possibility of financial failure in publicly traded retail companies. Oz and Simga-Mugan (2018) stated that a consensus was lacking in the performance of various FDP models under difficult economic circumstances. The research questions in this study were designed to fill the gap, as suggested by Oz and Simga-Mugan, applying the Altman and Bhandari and Iyer equations to retail firms who had filed for bankruptcy from 2012 to 2018. The study followed the matched paired techniques, as done by Altman and Bhandari and Iyer. The hypotheses associated with RQ1 and RQ2 were tested using the chi-square test at .05 level of significance ($p < .05$), and RQ3 was examined using a comparative analysis method.

The results provided sufficient statistical evidence to reject the null hypotheses for RQ1 (Altman Z-score) and RQ2 (Bhandari and Iyer Z-score) for one and two years prior to bankruptcy. The null hypothesis testing year three prior to bankruptcy could not be rejected for RQ1 and RQ2, indicating no relationship between the Altman and Bhandari and Iyer equations and corporate financial distress in retail firms that filed for bankruptcy during 2012 – 2018. The comparative analysis indicated the Bhandari and Iyer model performed better predicting corporate financial distress in years one and two prior to bankruptcy but tied with Altman in year three. The results of this study are further discussed in Chapter 5.

CHAPTER 5. CONCLUSIONS

Introduction

The objective of this quantitative study was to test and investigate the efficacy of FDP using the original Altman Z-score (1968) and Bhandari and Iyer (2013) models to predict the possibility of financial failure in publicly traded retail companies. The use of selected financial ratios and FDP models by accounting and audit specialists has helped determine the going concern of business and signaling early detection of financial distress (Oz & Simga-Mugan, 2018). The current study's importance was to alert business leaders, shareholders, financial analysts, accountants, and auditors in the retail industry to a company's subpar financial performance and potential financial distress one to three years prior to failure with the help of FDP models.

In the process of completing the current research, scholars have started and completed similar studies. Bhandari, Showers, and Johnson-Snyder (2019) investigated the predictive ability of FDP models by applying six accrual accounting ratios and six cash flow ratios to 50 failed and 50 non-failed firms during the 2008-2010 recession. The study agreed with the findings of the current research that cash flow measures were better predictors than using only accrual accounting ratios. Bhandari et al. found a model that included two accrual accounting and two cash flow ratios performed best compared to other models. Bhandari and Johnson-Snyder (2018) took a different approach using the multivariate logit regression analysis

technique to focus on success rather than distress using variables obtained from the cash flow statement. The model accurately classified organizations' success 90.290% of the time using five of the seven predictor variables found in Bhandari and Iyer (2013).

The research performed in this quantitative study calculated the Z-scores for two FDP models for the three years prior to bankruptcy to determine if a company was failing or non-failing using the chi-square test for hypotheses testing. This chapter includes five sections: evaluation of the research questions, fulfillment of the research purpose, contribution to the business problem, recommendations for further research, and conclusions.

Evaluation of Research Questions

A quantitative methodology and nonexperimental research design were appropriate for the study because using the original Altman and Bhandari and Iyer Z-score equations required no manipulation of the independent variables. Multiple discriminate analysis (MDA), which reduces multiple measurements to a single weighted composite score was used in developing both models (Alaka et al., 2018; Altman, 1968; Bhandari, 2014). The current study sought to measure the efficacy of these two models. The annual 10-K reports for one, two, and three years prior to bankruptcy were gathered from the SEC's website for retail firms that filed for bankruptcy from 2012 to 2018. Examining the three years prior to bankruptcy was selected because prior scholars using FDP models revealed corporate financial distress was best determined a few years prior to bankruptcy (Altman, 1968; Archana, 2018; Darmawan & Supriyanto, 2018; Wang & Campbell, 2010). Altman (1968) examined manufacturing companies two years prior to bankruptcy and suggested that the percentage of accurately declines after the second year while Bhandari and

Iyer (2013) examined financial data for one year prior to bankruptcy. The results of this study revealed the financial data three years prior to bankruptcy could not accurately predict corporate financial distress. These results aligned with the research conducted by the models' authors. A detailed evaluation of each research question follows.

Research Question 1

Research Question 1 was, To what extent does the original Altman Z-score equation accurately predict corporate financial distress for retail firms that filed for bankruptcy during 2012 – 2018?

The chi-square test results showed using the financial data from the annual 10-K for one, and two years prior to bankruptcy, the Altman Z-score model accurately predicted corporate financial distress. The *p* value for one and two years prior to bankruptcy was the basis on which the null hypotheses *($H1_01$)* and *($H1_02$)* were rejected at a .05 level of significance. The results of the study reported in Chapter 4 supported a statistically significant relationship between corporate financial distress and the original Altman Z-score model in years one and two prior to bankruptcy for U.S. publicly traded retail firms. The study results also revealed when using financial data from the annual 10-K three years prior to bankruptcy, the null hypothesis *($H1_03$)* was not rejected at a .05 level of significance. The results of the study reported in Chapter 4 did not support a statistically significant relationship between corporate financial distress and the original Altman Z-score model in year three prior to bankruptcy for U.S. publicly traded retail firms.

The original Altman Z-score is based on financial ratio analysis and is studied in different macroeconomic conditions, industries, and countries. Altman (1968) selected 66 manufacturing firms (33 bankrupt and 33 non-bankrupt) that had filed for bankruptcy during the years 1946-1965 and found using the MDA model accurately predicted corporate financial distress at 95%. Altman claimed the power of the model to accurately predict failure declined after two years prior to bankruptcy, which is supported by the findings from RQ1 in this study. Altman tested the declining accuracy rate by calculating the Z-scores for firms using financial data from the third, fourth, and fifth years prior to bankruptcy and found the accuracy percentage dropped from 95% in year one to 36% in year five. Altman theorized that if financial ratios are examined within a multivariate framework, a high level of statistical significance would be achieved.

Altman (1968) is well established and continues to be used worldwide. The model's popularity is evidenced by scholars who produce successful studies to accurately predict corporate financial distress in different macroeconomic conditions. For example, Altman et al. (2017) sought to predict financial distress in firms using the original Altman Z-score during 2007 and 2008. The study found the model accurately predicted bankruptcy at 94%. Orabi (2014) conducted research using the original Altman Z-score to predict financial failure using a sample of ten Jordanian public companies (five bankrupt and five non-bankrupt). The study found Altman accurately predicted business failure at 91% one year prior to bankruptcy and at 77% two years prior to bankruptcy. The findings from RQ1 align with these studies.

Research Question 2

Research Question 2 was, To what extent does the Bhandari and Iyer equation accurately predict corporate financial distress for retail firms that filed for bankruptcy during 2012 – 2018?

The chi-square test results showed using the financial data from the annual 10-K for one, and two years prior to bankruptcy, the Bhandari and Iyer model accurately predicted corporate financial distress. The *p* value for one and two years prior to bankruptcy was the basis on which the null hypotheses *($H1_01$)* and *($H1_02$)* were rejected at a .05 level of significance. The results of the study reported in Chapter 4 supported a statistically significant relationship between corporate financial distress and the Bhandari and Iyer model in years one and two prior to bankruptcy for U.S. publicly traded retail firms. The study results also revealed when using financial data from the annual 10-K three years prior to bankruptcy, the null hypothesis *($H1_03$)* was not rejected at a .05 level of significance. The results of the study reported in Chapter 4 did not support a statistically significant relationship between corporate financial distress and the Bhandari and Iyer model in year three prior to bankruptcy for U.S. publicly traded retail firms.

Bhandari and Iyer (2013) MDA model used ratios based on operating cash flow to accurately predicate corporate financial distress at 83.3% using a sample of 78 companies (40 failed and 38 non-failed) from 20 different industries from 2008 to 2010. Bhandari and Iyer's research were based on financial data from one year prior to bankruptcy. RQ2 extends Bhandari and Iyer study to two and three years prior to bankruptcy, and the study results revealed the model could be relied on in year two but not in year three. The model, as designed by Bhandari and Iyer, has not been tested by scholars in the literature to date. Scholars have used the results in the development of new models that use cash flow ratios. For example, Shamsudin and

Kamaluddin (2015) proposed eight cash flow patterns as independent variables derived from the positive and negative signs of the operating, investing, and financing activities on the cash flow statement as an alternative tool to accurately predict financial distress. The findings of the current study were similar to the results of Shamsudin and Kamaluddin, in which a statistically significant relationship between cash flow patterns and corporate financial distress was supported. Cash flow FDP models to accurately predict corporate financial distress continue to evolve in the literature. However, the current study, as well as Shamsudin and Kamaluddin, provide helpful insights for potential and existing shareholders about the importance of FDP tools based on the statement of cash flows.

Research Question 3

Research Question 3 was, To what extent do the original Altman Z-score and Bhandari and Iyer models perform relative to each other?

A comparative analysis was performed to investigate RQ3. Figure 9, a chart view of Table 16 in Chapter 4, shows the Bhandari and Iyer model performed better than the Altman Z-score model and Type I and Type II errors were good indicators. The Bhandari and Iyer Type I error percentage for all three years was lower than Altman Z-score, indicating the model performed better at misclassifying failed firms as non-failed. Sormunen and Laitinen (2012) explained out of the two types of errors, Type I is the most dangerous and carries a higher burden than Type II errors. Type I errors are costly because managers, investors, and other interested stakeholders are given a false sense of sincerity, believing a firm is financially performing well.

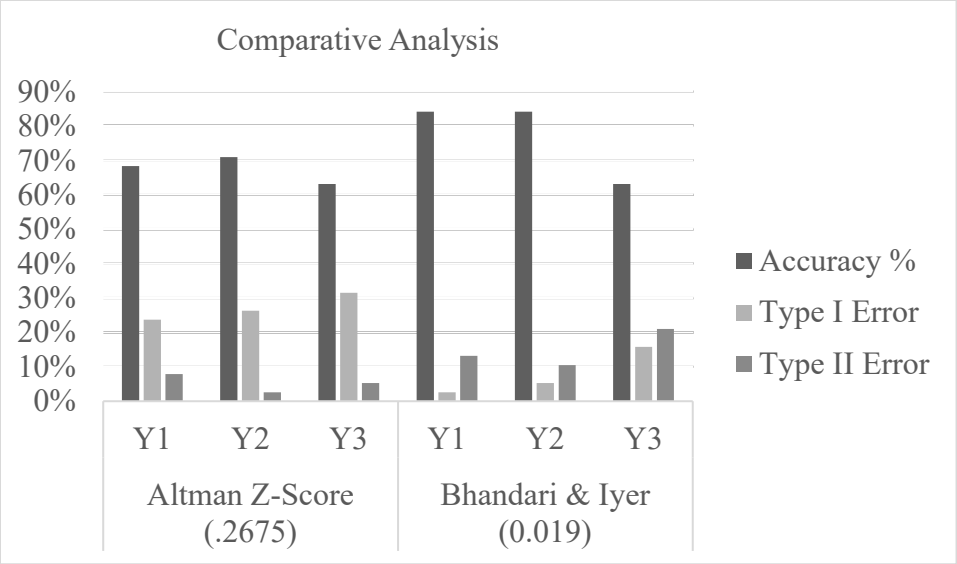

Figure 9. Comparative Analysis.

Fulfillment of Research Purpose

The purpose of this quantitative study was to test and investigate the efficacy of FDP using the original Altman Z-score (1968) and Bhandari and Iyer (2013) models to predict financial failure in publicly traded retail companies. As outlined in Chapter 1, the original Altman Z-score is driven by liquidity, profitability, and wealth (leverage) accrual ratios, and cash flow ratios are the underpinnings of the Bhandari and Iyer model. Scholars evidenced the careful use of selected financial ratios and FDP models by accounting and audit specialist helps detect early signs of financial distress (Oz & Simga-Mugan, 2018). The current research contributes to the body knowledge about the relationship between FDP models and their ability to predict corporate financial distress accurately and timely in U.S. retail companies. The original Altman Z-score and Bhandari and Iyer FDP models were used to fulfill the purpose of the study and to provide information to scholars and practitioners in the field of accounting and financial analysis.

The topics of business failure and financial distress are topics which have been relevant for several decades through the present day. In 2020, a pandemic related to Covid-19 has impacted the retail industry in unprecedented ways. Scholars continue to develop FDP models for practitioners to apply in the pursuit of detecting financial distress before failure in organizations. Appiah et al. (2015) concluded while there is a compelling body of previous literature, a theoretically sound corporate failure prediction model has yet to be developed. Tomczak and Radosiński (2017) inferred that the use of one prediction model was not helpful in assessing the financial standing of corporations, but when two or more models are used in comparison, the predictive ability increases.

The current research applied the Altman Z-score and Bhandari and Iyer FDP models to examine the possibility of accurately and timely predicting financial distress in selected retail firms. The research findings indicated a significant relationship existed between the calculated Z-scores for both models and corporate financial distress in retail firms for one and two years prior to bankruptcy. For the third year prior to bankruptcy, the findings revealed no significant relationship existed between the calculated Z-scores for both models and corporate financial distress in retail firms. The study provides valuable information to investors, managers, employees, and all interested parties on the importance of using financial ratio analysis with FDP models to recognize signs of financial distress in retail organizations.

Contribution to Business Problem

FDP studies can provide valuable insight and knowledge about the financial stability of an organization to management, stakeholders, employees, and other interested parties. There has

been widespread frustration in the investing community because annual financial reporting packages or 10-Ks lack ratio analysis, which may help determine the probability of financial distress (Pindado et al., 2008). The business problem in this study addressed the struggle a business face to sustain profits and maximize shareholders' wealth, which can lead to a state of financial distress. The specific business problem focused on financial distress in the retail industry, which has resulted in declining sales and numerous bankruptcies for retailers (Keener, 2013).

The literature review revealed a single well-defined theory in the accounting and corporate financial distress literature was lacking (Agarwal & Taffler, 2007; Alaminos et al., 2016; Appiah et al., 2015; Evans & Mathur, 2014; Rezende et al., 2017; Taffler, 1983). To address this gap, the current study relied on theories associated with the ratio inputs of each model; liquidity, profitability, and wealth (leverage) theory for Altman Z-score and cash flow theory for Bhandari and Iyer. Profitability ratios represent three of the five independent variables (ratios) in the Altman Z-score model; retained earnings to total assets, earnings before interest and taxes to total assets, and sales to total assets. Olang (2017) asserted profitability is the most important variable because it is an indicator of management's ability to generate profits from all business activities. The study results aligned with Olang's assertion that when the calculated profitability ratios were low, the Altman Z-score failed. Cash flow is presented in Bhandari and Iyer's seven independent variables (ratios). Wruck (1990) surmised a cash flow theory approach with cash flow from daily operations as the driving indicator would predict financial distress with a high degree of certainty. The study results agreed with Wruck and revealed Bhandari and

Iyer's cash flow was better than the Altman Z-score accrual model when predicting the probability of financial distress.

Corporate financial distress, in conjunction with cash flow and profitability variables, is fruitful areas of research. The theoretical framework employed in this study yielded empirical results that can be used by a boarder community of accounting or finance scholars, practitioners, financial managers, and investors. The independent variables (ratios) inputs in the FDP models can be computed for any firm with publicly available data. The retail industry, the focus of the research, has been hardest impacted and continues to recover from the economic recession of 2008 (Evans & Mathur, 2014).

The financial stability of retail firms is dependent on macroeconomics, thus when the economy takes a downturn, retail companies most often follow. During the writing of this dissertation, the COVID-19 pandemic occurred. COVID-19 is spread from person to person and as of August 2020 has caused severe illness and the death of approximately 170,00 people in the U.S. (Centers for Disease Control and Prevention [CDC], 2020). In response, government officials issued stay at home orders which led to decreased retail store shopping and travel. Companies, such as JC Penney, filed for bankruptcy protection, and Nordstorm closed a number of the stores' locations as a result of COVID-19 (Clifford & Wahba, 2020). Financial statement analysis with FDP models can be helpful to foresee financial failure. However, macroeconomic conditions such as pandemics are most often uncontrollable, and the impact on a company's financial statement may not be foreseeable.

Recommendations for Further Research

This study focused on predicting financial distress for companies in a single industry, retail. Publicly traded retail companies filed for bankruptcy starting January 1, 2012 – December 31, 2018, were included in the sample. During the data collection process, the sample size decreased due to incomplete or missing data. The data in this study were gathered from one publicly accessible source, the SEC EDGAR website. Nam et al. (2017) explained the public data repository, COMPUSTAT included reliable financial data; however, this database was not accessible for the current study. This limitation presents an opportunity for future research to include data from two reliable financial databases, which could offer a larger sample size.

Altman (1968) focused on bankrupt manufacturing companies over a 20-year time frame. Single industry failure prediction studies are well documented in the literature, including the railroad, oil and gas, education, banking, brokerage, and insurance industries (Zmijewski, 1984). Future research should include companies from multiple industries that would expand the sample size. Research questions should be added to investigate how industry-specific factors could affect each models' accuracy. Bhandari and Iyer (2013) sample size included companies from 20 different sectors but did not address how the macroeconomics associated with each industry affected the results.

Research Question 3 in this study investigated which model performed better. The results revealed the Bhandari and Iyer cash flow model predicted financial distress better than Altman Z-score. Future research could formulate a new MDA model that includes accrual and cash flow predictor variables (ratios) from Altman Z-score and Bhandari and Iyer models. As was done by

Altman (1968) and Bhandari and Iyer (2013), a discriminant analysis should be used to process the linear equation comprised of the predictor variables. Such a study would extend the current research and Bhandari et al. (2019) that found a mixture of two accrual and two cash flow ratios accurately predicted corporate financial distress. Bhandari et al. explained further research, including different financial ratio measures, was needed to support their findings.

FDP models have been formulated and published by an array of scholars. However, the Z-score linear equation has been more popular than other models (Altman et al., 2017). Further research should be conducted to compare the financial distress predictive ability to other models such as probit, logit, O-Score, D-Score, and hazard. Ashraf et al. (2019) conducted a similar study that compared the predictive ability of several traditional FDP models in Pakistan's emerging market and found the probit model had the highest overall predictive ability. Ashraf et al. recommended a replication study be conducted in developed markets such as the U.S.

Conclusions

Corporate financial distress in the retail industry is a topic of concern as companies continue to post annual financial losses (Shaked & Orelowitz, 2017). Researchers have concluded financial distress does not occur overnight, is no surprise to management, and occurs in dynamic stages (Farooq et al., 2018; Fitzpatrick, 1934; Lau, 1987; Sormunen & Laitinen, 2012). The financial instability of a company can be reasonably predicted using FDP models and financial ratio analysis within one and two years prior to bankruptcy. The purpose of this quantitative study was to test and investigate the efficacy of FDP using the original Altman Z-score (1968) and Bhandari and Iyer (2013) models to predict financial failure in publicly traded

retail companies. This study expands the research on the use of FPD models and financial ratio analysis in the pursuit of accurately predicting corporate financial distress. The results revealed a statistically significant relationship between corporate financial distress using the original Altman and the Bhandari and Iyer Z-score models in years one and two prior to bankruptcy for U.S. publicly traded retail firms.

The study used a comparative analysis approach to examine if one FDP model performed better than the other. Although the two models in this study were created approximately 50 years apart, the findings showed both models accurately revealed when a company was experiencing financial distress one and two years preceding a bankruptcy filing. The results for three years preceding bankruptcy revealed no statistically significant relationship exists between corporate financial distress and either model. The comparative analysis results were aligned with previous scholars and revealed FDP models inclusive of cash flow metrics are most efficient at predicting financial distress.

This study may enable corporate leaders in the retail industry to recognize signs of financial distress at least two years prior to bankruptcy. Corrective actions and adjustments can be made to avoid the costly and embarrassing act of bankruptcy. In practice, the study shows that financial ratios and several FDP models should be computed annually and used by retail companies in assessing financial performance. For scholars, this research may broaden the use of FDP models and reveal the importance of financial ratio analysis as instructional material in the learning process of predicting financial distress.

REFERENCES

Abbott, M. L. (2011). *Understanding educational statistics using Microsoft Excel® and SPSS*. Hoboken, NJ: Wiley.

Abdullah, M. (2015). An empirical analysis of liquidity, profitability and solvency of Bangladeshi banks. *Journal of Business & Financial Affairs, 4*(3), 1-12. doi:10.4172/2167-0234.1000157

Adnan Aziz, M., & Dar, H. A. (2006). Predicting corporate bankruptcy: Where we stand? *Corporate Governance: The International Journal of Business in Society, 6*(1), 18-33. doi:10.1108/14720700610649436

Agarwal, V., & Taffler, R. J. (2007). Twenty-five years of the Taffler Z-score model: Does it really have predictive ability? *Accounting and Business Research, 37*, 285-300. doi:10.1080/00014788.2007.9663313

Akbar, A., Akbar, M., Tang, W., & Qureshi, M. (2019). Is bankruptcy risk tied to corporate life-cycle? Evidence from Pakistan. *Sustainability, 11*(3), 1-22. doi:10.3390/su11030678

Akinleye, G. T., & Ogunleye, J. S. (2019). Liquidity and the profitability of manufacturing firms in Nigeria. *Applied Finance and Accounting, 5*(2), 68-73. doi:10.11114/afa.v5i2.4477

Alaka, H. A., Oyedele, L. O., Owolabi, H. A., Kumar, V., Ajayi, S. O., Akinade, O. O., & Bilal, M. (2018). Systematic review of bankruptcy prediction models: Towards a framework for tool selection. *Expert Systems with Applications, 94,* 164-184. doi:10.1016/j.eswa.2017.10.040

Alaminos, D., Del Castillo, A., & Fernández, M. Á. (2016). A global model for bankruptcy prediction. *PloS One, 11*(11), 1-18. doi:10.1371/journal.pone.0166693

Al-Hroot, Y. A. (2015). The influence of sample size and selection of financial ratios in bankruptcy model accuracy. *Economic Review: Journal of Economics & Business/ Ekonomska Revija: Casopis Za Ekonomiju i Biznis, 13*(1), 7–19. Retrieved from http://www.ef.untz.ba/images/Casopis/maj2015/yusuf.pdf

Ali, M. F. A., & Abdulhassan Abbas, A. (2015). Companies bankruptcy prediction by using Altman models and comparing them. *Research Journal of Finance and Accounting, 6*, 154-169. Retrieved from https://www.iiste.org/Journals/index.php/RJFA

Almamy, J., Aston, J., & Ngwa, L. N. (2016). An evaluation of Altman's Z-score using cash flow ratio to predict corporate failure amid the recent financial crisis: Evidence from the UK. *Journal of Corporate Finance, 36*, 278-285. doi:10.1016/j.jcorpfin.2015.12.009

Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *Journal of Finance, 23*, 589-609. doi:10.2307/2978933

Altman, E. I. (1983). *Corporate financial distress: A complete guide to predicting, avoiding, and dealing with bankruptcy*. New York, NY: Wiley.

Altman, E. I., Danovi, A., & Falini, A. (2013). Z-score models' application to Italian companies subject to extraordinary administration. *Journal of Applied Finance, 23*, 128-137. Retrieved from https://www.irjaf.com/

Altman, E. I., Haldeman, R. G., & Narayanan, P. (1977). ZETA Analysis: A new model to identify bankruptcy risk of corporations. *Journal of Banking and Finance, 1*(1), 29-54. doi:10.1016/0378-4266(77)90017-6

Altman, E. I., Iwanicz-Drozdowska, M., Laitinen, E. K., & Suvas, A. (2017). Financial distress prediction in an international context: A review and empirical analysis of Altman's Z-Score model. *Journal of International Financial Management & Accounting, 28*, 131-171. doi:10.1111/jifm.12053

Andrijasevic, M., & Pasic, V. (2014). A blueprint of ratio analysis as information basis of corporation financial management. *Problems of Management in the 21st Century, 9*, 117-123. Retrieved from http://www.scientiasocialis.lt/pmc/

Appiah, K. O., Chizema, A., & Arthur, J. (2015). Predicting corporate failure: A systematic literature review of methodological issues. *International Journal of Law and Management, 57*, 461-485. doi:10.1108/IJLMA-04-2014-0032

Archana, H. N. (2018). Default prediction using Altman Z Score model - A study of some select retail firms. *Sumedha Journal of Management, 7*(4), 60-75. doi:10.5958/2322-0449.2018.00006.6

Arlov, O., Rankov, S., & Kotlica, S. (2013). Cash flow in predicting financial distress and bankruptcy. In I. Corbi & N.E. Mastorakis (Eds.). *Advances in environmental science and energy planning* (pp. 88-93). Tenerife, Canary Islands, Spain: WSEAS Press.

Ashraf, S., G. S. Félix, E., & Serrasqueiro, Z. (2019). Do traditional financial distress prediction models predict the early warning signs of financial distress? *Journal of Risk and Financial Management, 12*(2), 1-17. doi:10.3390/jrfm12020055

Barua, S., & Saha, A. K. (2015). Traditional ratios vs. cash flow based ratios: Which one is better performance indicator? *Advances in Economics and Business, 3*, 232-251. doi:10.13189/aeb.2015.030605

Batchelor, T. (2018). Corporate bankruptcy: Testing the efficacy of the Altman Z-score. *International Research Journal of Applied Finance, 9*, 404-414. Retrieved from https://www.irjaf.com/

Beaver, W. H. (1966). Financial ratios as predictors of failure. *Journal of Accounting Research, 4*, 71-111. doi:10.2307/2490171

Beaver, W. H., Correla, M., & McNichols, M. F. (2010). Financial statement analysis and the prediction of financial distress. *Foundations and Trends in Accounting, 5*, 99–173. doi:10.1561/1400000018

Beaver, W. H., McNichols, M. F., & Rhie, J. (2005). Have financial statements become less informative? Evidence from the ability of financial ratios to predict bankruptcy. *Review of Accounting Studies, 10*, 93-122. doi:10.1007/s11142-004-6341-9

Bellovary, J., Giacomino, D., & Akers, M. (2007). A review of bankruptcy prediction studies: 1930 to present. *Journal of Financial Education, 33*(4), 1-42. Retrieved from http://www.jstor.org/stable/41948574

Bhandari, S., Showers, V., & Johnson-Snyder, A. J. (2019). A comparison: Accrual versus cash flow based financial measures' performance in predicting business failure. *Journal of Accounting and Finance, 19*(6), 11-25. doi:10.33423/jaf.v19i6.2313

Bhandari, S. B. (2014). Two discriminant analysis models of predicting business failure: A contrast of the most recent with the first model. *American Journal of Management, 14*(3), 11-19. Retrieved from http://www.na-businesspress.com/ajmopen.html

Bhandari, S. B., & Iyer, R. (2013). Predicting business failure using cash flow statement based measures. *Managerial Finance, 39*, 667-676. doi:10.1108/03074351311323455

Bhandari, S. B., & Johnson-Snyder, A. (2018). A generic model of predicting probability of success-distress of an organization: A logistic regression analysis. *Journal of Applied Business Research, 34*, 169-182. doi:10.19030/jabr.v34i1.10107

Bhargava, M., Dubelaar, C., & Scott, T. (1998). Predicting bankruptcy in the retail sector: An examination of the validity of key measures of performance. *Journal of Retailing and Consumer Services, 5*, 105-117. doi:10.1016/S0969-6989(97)00029-5

Bhunia, A., & Sarkar, R. (2011). A study of financial distress based on MDA. *Journal of Management Research, 3*(2), 1-11. doi:10.5296/jmr.v3i2.574

Campbell, J., Hilscher, J., & Szilagyi, J. (2011). Predicting financial distress and the performance of distressed stocks. *Journal of Investment Management, 9*(2), 14-34. Retrieved from https://www.joim.com/

Casey, R. J., Gao, F., Kirschenheiter, M. T., Li, S., & Pandit, S. (2016). Do Compustat financial statement data articulate? *Journal of Financial Reporting, 1*(1), 37-59. doi:10.2308/jfir-51329

Centers for Disease Control and Prevention. (2020). *Coronavirus disease 2019 (COVID-19)* [Cases, data & surveillance]. Retrieved from https://www.cdc.gov/coronavirus/2019-ncov/cases-updates/cases-in-us.html

Chang, T. C., Yan, Y. C., & Chou, L. C. (2013). Is default probability associated with corporate social responsibility? *Asia-Pacific Journal of Accounting & Economics*, *20*, 457-472. doi:10.1080/16081625.2013.825228

Charitou, A., Neophytou, E., & Charalambous, C. (2004). Predicting corporate failure: Empirical evidence for the UK. *European Accounting Review, 13*, 465-497. doi:10.1080/0963818042000216811

Chen, K. H., & Shimerda, T. A. (1981). An empirical analysis of useful financial ratios. *Financial Management, 10*(1), 51-60. doi:10.2307/3665113

Clifford, L. & Wahba, F. (2020, August). A running list of companies that have filed for bankruptcy during the coronavirus pandemic. *Fortune.* Retrieved from https://fortune.com/2020/08/04/companies-filing-bankruptcy-2020-due-to-covid-list-filed-chapter-11-coronavirus-pandemic/

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). Thousand Oaks, CA: Sage.

Darmawan, A., & Supriyanto, J. (2018). The effect of financial ratio on financial distress in predicting bankruptcy. *Journal of Applied Managerial Accounting, 2*, 110-120. doi:10.30871/jama.v2i1.727

Deakin, E. B. (1972). A discriminant analysis of predictors of business failure. *Journal of Accounting Research, 10*, 167-179. doi:10.2307/2490225

Diakomihalis, M. N. (2012). The accuracy of Altman's models in predicting hotel bankruptcy. *International Journal of Accounting and Financial Reporting, 2*, 96-113. doi:10.5296/ijafr.v2i2.2367

Do Prado, J. W., de Castro Alcântara, V., de Melo Carvalho, F., Vieira, K. C., Machado, L. K. C., & Tonelli, D. F. (2016). Multivariate analysis of credit risk and bankruptcy research data: A bibliometric study involving different knowledge fields (1968–2014). *Scientometrics, 106*, 1007–1029. doi:10.1007/s11192-015-1829-6

Du Jardin, P. (2012). The influence of variable selection methods on the accuracy of bankruptcy prediction models. *The Munich Personal RePEc Archive (MPRA), 116*(1), 20-39. Retrieved from https://mpra.ub.uni-muenchen.de/

Evans, J. R., & Mathur, A. (2014). Retailing and the period leading up to the great recession: A model and a 25-year financial ratio analysis of US retailing. *The International Review of Retail, Distribution and Consumer Research 24*(1), 30-58, doi:10.1080/09593969.2013.801360

Fallahpour, S., Lakvan, E. N., & Zadeh, M. H. (2017). Using an ensemble classifier based on sequential floating forward selection for financial distress prediction problem. *Journal of Retailing and Consumer Services, 34,* 159-167. doi:10.1016/j.jretconser.2016.10.002

Farooq, U., Jibran Qamar, M. A., & Haque, A. (2018). A three-stage dynamic model of financial distress. *Managerial Finance, 44*, 1101-1116. doi:10.1108/MF-07-2017-0244

Farooq, U., Nazir, M. S., & Nawaz, M. M. (2012). Operating or financial distress? how much costly these are? *American Journal of Scientific Research, 55*, 96-108. Retrieved from https://www.americanjournalofscientificresearch.com/

Fawzi, N. S., Kamaluddin, A., & Sanusi, Z. M. (2015). Monitoring distressed companies through cash flow analysis. *Procedia Economics and Finance, 28*, 136–144. doi:10.1016/s2212-5671(15)01092-8

Fitzpatrick, P. J. (1934). Transitional stages of a business failure. *The Accounting Review, 9*, 337-340. Retrieved from https://aaajournals.org/loi/accr

Gaur, A. S., & Gaur, S. S. (2009). *Statistical methods for practice and research: A guide to data analysis using SPSS* (2nd ed.). Thousand Oaks, CA: Sage.

Gentry, J. A., Newbold, P., & Whitford, D. T. (1985). Predicting bankruptcy: If cash flow's not the bottom line, what is? *Financial Analysts Journal, 41*(5), 47-56. doi:10.2469/faj.v41.n5.47

Gerdes, J. (2003). EDGAR-analyzer: Automating the analysis of corporate data contained in the SEC's EDGAR database. *Decision Support Systems, 35*(1), 7-29. doi:10.1016/S0167-9236(02)00096-9

Gordon, M. J. (1971). Towards a theory of financial distress. *Journal of Finance, 26*, 347-356. doi.:10.1111/j.1540-6261.1971.tb00902.x

Gorsuch, R. L., & Lehmann, C. (2017). Chi-square and F Ratio: Which should be used when? *Journal of Methods and Measurement in the Social Sciences, 8*(2), 58-71. doi:10.2458/v8i2.22990

Greenwood, M. (2016). Approving or improving research ethics in management journals. *Journal of Business Ethics, JBE, Dordrecht, 137*, 507-520. doi:10.1007/s10551-015-2564-x

Grice, J. S., & Ingram, R. W. (2001). Tests of the generalizability of Altman's bankruptcy prediction model. *Journal of Business Research, 54*(1), 53-61. doi:10.1016/S0148-2963(00)00126-0

Gruszczyński, M. (2015). Issues in modelling the financial distress and bankruptcy of companies. *Quantitative Methods in Economics, 16*(1), 96-107. Retrieved from http://qme.sggw.pl/en/

Guffey, D. M., & Moore, W. T. (1991). Direct bankruptcy costs: Evidence from the trucking industry. *The Financial Review, 26*, 223-235. doi:10.1111/j.1540-6288.1991.tb00378.x

Hassan, E., Zainuddin, Z., & Nordinto, N. (2017). A review of financial distress prediction models: Logistic regression and multivariate discriminant analysis. *Indian-Pacific Journal of Accounting and Finance, 1*(3). 13-23. Retrieved from http://ipjaf.omjpalpha.com/

Hayes, S. K., Hodge, K. A., & Hughes, L. W. (2010). A study of the efficacy of Altman's Z to predict bankruptcy of specialty retail firms doing business in contemporary times. *Economics & Business Journal: Inquiries & Perspectives, 3*, 130-134. Retrieved from https://nebeconandbus.org/journal/home.htm

Heale, R., & Twycross, A. (2015). Validity and reliability in quantitative studies. *Evidence Based Nursing, 18*(3), 66–67. doi:10.1136/eb-2015-102129

Heidari, I. (2012). Ratings of Iranian cement companies based on financial ratio analysis. *Life Science Journal, 9*, 540-544. Retrieved from http://www.lifesciencesite.com/

Hillegeist, S. A., Keating, E. K., Cram, D. P., & Lundstedt, K. G. (2004). Assessing the probability of bankruptcy. *Review of Accounting Studies, 9*(1), 5-34. doi:10.1023/B:RAST.0000013627.90884.b7

Husein, M. F., & Pambekti, G. T. (2014). Precision of the models of Altman, Springate, Zmijewski, and Grover for predicting the financial distress. *Journal of Economics, Business & Accountancy Ventura, 17*, 405-416. doi:10.14414/jebav.v17i3.362

Jiang, J. (Xuefeng), Wang, I. Y., & Wangerin, D. D. (2018). How does the FASB make decisions? A descriptive study of agenda-setting and the role of individual board members. *Accounting, Organizations and Society, 71*(1), 30–46. doi:10.1016/j.aos.2018.05.002

Johnston, M. (2014). Secondary data analysis: A method of which the time has come. *Qualitative and Quantitative Methods in Libraries, 3*, 619-626. Retrieved from http://www.qqml.net/index.html

Jones, S., & Hensher, D. A. (2004). Predicting firm financial distress: A mixed logit model. The *Accounting Review, 79*, 1011-1038. doi:10.2308/accr.2004.79.4.1011

Jones, S., Johnstone, D., & Wilson, R. (2017). Predicting corporate bankruptcy: An evaluation of alternative statistical frameworks. *Journal of Business Finance & Accounting, 44*(1-2), 3-34. doi:10.1111/jbfa.12218

Kamaluddin, A., Ishak, N., & Mohammed, N. F. (2019). Financial distress prediction through cash flow ratios analysis. *International Journal of Financial Research, 10*(3), 63-76. doi:10.5430/ijfr.v10n3p63

Kartikaningdyah, E., & Handal, B. (2018). Testing Bhandari Z-score model bankruptcy prediction using cash flow. *Journal of Applied Managerial Accounting, 2*, 121-128. doi:10.30871/jama.v2i1.728

Keener, M. H. (2013). Predicting the financial failure of retail companies in the United States. *Journal of Business & Economics Research (Online), 11*, 373-380. doi:10.19030/jber.v11i8.7982

Khaldi, K. (2017). Quantitative, qualitative or mixed research: Which research paradigm to use? *Journal of Educational and Social Research, 7*(2), 15-24. doi:10.5901/jesr.2017.v7n2p15

Kim, S. Y. (2011). Prediction of hotel bankruptcy using support vector machine, artificial neural network, logistic regression, and multivariate discriminant analysis. *Service Industries Journal, 31*, 441-468. doi:10.1080/02642060802712848

Koh, H. C., & Tan, S. S. (1999). A neural network approach to the prediction of going concern status. *Accounting and Business Research, 29*, 211-216. doi:10.1080/00014788.1999.9729581

Koh, S., Durand, R. B., Dai, L., & Chang, M. (2015). Financial distress: Lifecycle and corporate restructuring. *Journal of Corporate Finance, 33*(1), 19-33. doi:10.1016/j.jcorpfin.2015.04.004

Korol, T., & Korodi, A. (2010). Predicting bankruptcy with the use of macroeconomic variables. *Economic Computation & Economic Cybernetics Studies & Research, 44*, 201–219. Retrieved from http://www.ecocyb.ase.ro/

Lau, A. (1987). A five-state financial distress prediction model. *Journal of Accounting Research, 25*, 127-138. doi:10.2307/2491262

Leedy, P. D., & Ormrod, J. E. (2013). *Practical research: Planning and design.* Upper Saddle River, NJ: Merrill.

Lesáková, Ľ., Gundová, P., & Vinczeová, M. (2020). The practice of use of models predicting financial distress in Slovak companies. *Journal of Eastern European and Central Asian Research (JEECAR), 7*, 122–136. doi:10.15549/jeecar.v7i1.369

Li, J. (2012). Prediction of corporate bankruptcy from 2008 through 2011. *Journal of Accounting and Finance, 12*(1), 31-41. Retrieved from http://ipjaf.omjpalpha.com/

Lim, T. C., Yun, J. L. X., Gan, S., & Jiang, H. (2012). Bankruptcy prediction: Theoretical framework proposal. *International Journal of Management Sciences and Business Research, 1*(9), 69-74. Retrieved from http://www.ijmsbr.com/

McHugh, M. L. (2013). The chi-square test of independence. *Biochemia medica, 23*, 143–149. doi:10.11613/bm.2013.018

Moscalu, M., & Vintila, G. (2012). Business failure risk analysis using financial ratios. *Procedia - Social and Behavioral Sciences, 62*, 778-732. doi.org/10.1016/j.sbspro.2012.09.123

Moyer, R. C. (1977). Forecasting financial failure: A re-examination. *Financial Management, 6*(1), 11-17. doi:10.2307/3665489

Mselmi, N., Lahiani, A., & Hamza, T. (2017). Financial distress prediction: The case of French small and medium-sized firms. *International Review of Financial Analysis, 50*(1)*,* 67-80. doi:10.1016/j.irfa.2017.02.004

Munteanu, V., Zamfir, M. P., & Florea, C. F. (2018). Application of the sampling selection technique in approaching financial audit. *Academic Journal of Economic Studies, 4*, 123-132. Retrieved from http://www.ajes.ro/

Nam, H., No, W., & Lee, Y. (2017). Are commercial financial databases reliable? New evidence from Korea. *Sustainability, 9*(8), 1-23. doi:10.3390/su9081406

Ohlson, J. A. (1980). Financial ratios and the probabilistic prediction of bankruptcy. *Journal of Accounting Research, 18*, 109-131. doi:10.2307/2490395

Olang, M. (2017). Effect of financial leverage on profitability of firms listed in the Nairobi Securities Exchange. (2017). *International Journal of Science and Research (IJSR), 6*, 290–295. doi:10.21275/art20175033

Orabi, M. M. A. (2014). Empirical tests on financial failure prediction models. *Interdisciplinary Journal of Contemporary Research in Business, 5*(9), 29-43. Retrieved from https://ijcrb.webs.com/

Oz, I. O., & Simga-Mugan, C. (2018). Bankruptcy prediction models' generalizability: Evidence from emerging market economies. *Advances in Accounting, 41*, 114-125. doi:10.1016/j.adiac.2018.02.002

Oz, I. O., & Yelkenci, T. (2017). A theoretical approach to financial distress prediction modeling. *Managerial Finance, 43*, 212-230. doi:10.1108/MF-03-2016-0084

Pang, J., & Kogel, M. (2013). Retail bankruptcy prediction. *American Journal of Economics and Business Administration, 5*(1), 29–46. doi:10.3844/ajebasp.2013.29.46

Pantalone, C. C., & Platt, M. B. (1987). Predicting commercial bank failure since deregulation. *Federal Reserve Bank of Boston New England Economic Review*, (July), 37-47. Retrieved from https://www.bostonfed.org/publications-and-data.aspx#/

Pindado, J., & Rodrigues, L. (2005). Determinants of financial distress costs. *Financial Markets and Portfolio Management, 19*, 343-359. doi:10.1007/s11408-005-6456-4

Pindado, J., Rodrigues, L., & de la Torre, C. (2008). Estimating financial distress likelihood. *Journal of Business Research, 61*, 995-1003. doi:10.1016/j.jbusres.2007.10.006

Platt, H. D., & Platt, M. B. (2002). Predicting corporate financial distress: Reflections on choice-based sample bias. *Journal of Economics and Finance, 26*, 184-199. doi:10.1007/BF02755985

Platt, H. D., & Platt, M. B. (2006). Understanding differences between financial distress and bankruptcy. *Review of Applied Economics, 2*, 141-157. doi:10.22004/ag.econ.50146

Platt, H. D., Platt, M. B., & Pedersen, J. G. (1994). Bankruptcy discrimination with real variables. *Journal of Business Finance and Accounting, 21*, 491-510. doi:10.1111/j.1468-5957.1994.tb00332.x

Purnanandam, A. K. (2008). Financial distress and corporate risk management: Theory and evidence. *Journal of Financial Economics, 87*, 706-739. doi.org/10.1016/j.jfineco.2007.04.003.

Rezende, F. F., Montezano, R. M. d. S., Oliveira, F. N. d., & Lameira, V. d. J. (2017). Predicting financial distress in publicly-traded companies. *Revista Contabilidade & Finanças, 28*, 390-406. doi:10.1590/1808-057x201704460

Roomi, M. S., Ahmad, W., Ramzan, M., & Zia-ur-Rehman, M. (2015). Bankruptcy prediction for non-financial firms of Pakistan. *International Journal of Accounting and Financial Reporting, 5*(2), 26-37. doi:10.5296/ijafr.v5i2.7782

Samkin, G., Low, M., & Adams, T. (2012). The use of Z-scores to predict finance company collapses: A research note. *New Zealand Journal of Applied Business Research, 10*(2), 69-82. Retrieved from https://www.manukau.ac.nz/about/faculties-schools/business-and-information-technology/more-information-for-students/nzjabr

Schipper, K. (1977). Financial distress in private colleges. *Journal of Accounting Research, 15*(1), 1-40. doi:10.2307/2490628

Shaked, I., & Orelowitz, B. (2017). Understanding retail bankruptcy. *American Bankruptcy Institute Journal, 36*(11), 20-73. Retrieved from https://www.abi.org/abi-journal

Shamsudin, A., & Kamaluddin, A. (2015). Impending bankruptcy: Examining cash flow pattern of distress and healthy firms. *Procedia Economics and Finance, 31,* 766-774. doi:10.1016/S2212-5671(15)01166-1

Sharma, D. S. (2001). The role of cash flow information in predicting corporate failure: The state of the literature. *Managerial Finance, 27*(4), 3–28. doi:10.1108/03074350110767114

Shome, S., & Verma, S. (2020). Financial distress in Indian aviation industry: Investigation using bankruptcy prediction models. *Eurasian Journal of Business and Economics, 13*(25), 91–109. doi:10.17015/ejbe.2020.025.06

Shumway, T. (2001). Forecasting bankruptcy more accurately: a simple hazard model. *The Journal of Business, 74*, 101-124. doi:10.2139/ssrn.171436

Smith, M. (2003). *Research methods in accounting.* Thousand Oaks, CA: Sage.

Sormunen, N., & Laitinen, T. (2012). Late financial distress process stages and financial ratios: Evidence for auditors' going-concern evaluation. *Liiketaloudellinen Aikakauskirja, 61*(1), 41-69. Retrieved from http://lta.lib.aalto.fi/

Sun, J., Li, H., Huang, Q. H., & He, K. Y. (2014). Predicting financial distress and corporate failure: A review from the state-of-the-art definitions, modeling, sampling, and featuring approaches. *Knowledge-Based Systems, 57*(1), 41-56. doi:10.1016/j.knosys.2013.12.006

Taffler, R. J. (1983). The assessment of company solvency and performance using a statistical model. *Accounting and Business Research, 13*, 295-308. doi:10.1080/00014788.1983.9729767

Tomczak, S. K., & Radosiński, E. (2017). The effectiveness of discriminant models based on the example of the manufacturing sector. *Operations Research and Decisions, 27*(3), 81-97. doi:10.5277/ord170306

Turetsky, H. F., & McEwen, R. A. (2001). An empirical investigation of firm longevity: A model of the ex ante predictors of financial distress. *Review of Quantitative Finance and Accounting, 16*, 323-343. doi:10.1023/A:1011291425075

Ufo, A. (2015). Impact of financial distress on the leverage of selected manufacturing firms of Ethiopia. *Industrial Engineering Letters, 5*(10), 6-11. Retrieved from https://iiste.org/Journals/index.php/IEL

Unegbu, A., & Adefila, J. (2013). Efficacy assessments of Z-score and operating cash flow insolvency predictive models. *Open Journal of Accounting, 2*(3), 53-78. doi:10.4236/ojacct.2013.23009

U.S. Census Bureau (2017). Quarterly retail e-commerce sales 3rd quarter 2016. Retrieved from https://www2.census.gov/retail/releases/historical/ecomm/16q4.pdf

U.S. Department of Health and Human Services, National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research. (1979). *The Belmont report: Ethical principles and guidelines for the protection of human subjects of research (45 CFR 46).* Retrieved from http://www.hhs.gov/ohrp/regulations-and-policy/belmontreport/

U.S. Securities and Exchange Commission. (2020). EDGAR [Data file]. Available from https://www.sec.gov/edgar/searchedgar/companysearch.html

Wang, Y., & Campbell, M. (2010). Business failure prediction for publicly listed companies in china. *Journal of Business and Management, 16*(1), 75-88. Retrieved from http://jbm.nccu.edu.tw/

Whitaker, R. B. (1999). The early stages of financial distress. *Journal of Economics and Finance, 23*, 123-132. doi:10.1007/BF02745946

Wruck, K. H. (1990). Financial distress, reorganization, and organizational efficiency. *Journal of Financial Economics, 27*, 419-444. doi:10.1016/0304-405X(90)90063-6

Wu, Y., Gaunt, C., & Gray, S. (2010). A comparison of alternative bankruptcy prediction models. *Journal of Contemporary Accounting & Economics, 6*(1), 34-45. doi:10.1016/j.jcae.2010.04.002

Xu, X., & Wang, Y. (2009). Financial failure prediction using efficiency as a predictor. *Expert Systems with Applications, 36*, 366-373. doi:10.1016/j.eswa.2007.09.040

Zmijewski, M. (1984). Methodological issues related to the estimation of financial distress prediction models. *Journal of Accounting Research, 22*(2), 59-82. doi:10.2307/2490859

Zohra, K. F., Mohamed, B., Elhamoud, T., Garaibeh, M., Ilhem, A., & Naimi, H. (2015). Using financial ratios to predict financial distress of Jordanian industrial firms, empirical study using logistic regression. *Academic Journal of Interdisciplinary Studies, 4*, 137-142. doi:10.5901/ajis.2015.v4n2p137