Z-SCORE AS PREDICTOR OF FINANCIAL DISTRESS IN NSE AUTO INDEX COMPANIES, INDIA

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DECLARATION

I hereby declare that this is thesis is my own work and effort and it is not been submitted by anywhere from any other award. Where the other sources of information have been used, they have been duly acknowledged.

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ABSTRACT

The impact of Brexit in Indian auto mobile industry during the year 2015-2018 dilute auto industry profitability and sustainability. 16 automobile companies are listed in Indian NSE auto Index.

Financial distress of automobile companies affects India GDP and hence the study aims to probe the financial health among these companies.

Altman Z-score multiple discriminant analysis (MDA) model is used to investigate potential default on the auto sector companies listed in NSE auto index, India within 2015 to 2018.

Companies under study will be dividing into safe, grey and distress zone. The 5 financial ratios from Z"-score will be review and analyze as to how it will impact the company financial health.

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CHAPTER 1 – INTRODUCTION

1.0 Overview

The topic of this whole study is research is implementing the Altman Z-Score model in the public listed companies of the Indian Stock Exchange and determine the effectiveness of the Altman Z-Score model for the Indian stock market listed companies to predict bankruptcy risk in the recent timeframe. The underlying the main purpose of the study is to measure whether there is a difference in the accuracy of predicting bankruptcy risk in different sectors.

1.1 Background of Study

There are currently 23 stock markets in India, and in some major cities even there are other exchange located as well but all of them the major 3 stock exchange are, National Stock Exchange (NSE), The Bombay Stock Exchange (BSE), and also the Calcutta Stock Exchange (Yadav and Huria, 2017).

The Indian stock market is also known as the oldest stock exchange in Asia, as old as near the era of east India company around 18th century was applied transaction debt securities service in 1830s, exchange on shares of corporate and share of the bank and cotton press had started in Mumbai, although the trade business was broad broker was barely half a dozen during 1840 and 1850 (Hiremath, 2013). India also known as leading auto-vehicles supplier and is expecting high profit in its exports in the near future (Ray and Miglani, 2018). In Apr-Jan 2016, the growth of commercial vehicles recorded an increase of 18.36 percent in April-January 2015(Hiremath, 2013). Apart from this, many initiatives have been taken by major automobile players in the Indian government and the Indian market and by 2020 India is expected to make two-wheeler (2W) and Four-wheeler (4W) market leader (businessline, 2019). On the other hand, Europe specially UK is the largest market for auto industry of India, but after the Brexit referendum Indian automobile industry hit major decline between Brexit period (Speth, 2018). Currently the major automobile companies in India are Maruti Suzuki, Mahindra &Mahindra, Tata motors, SML Isuzu etc, these sectors develop often unexpectedly the environment dynamic, and changing economic circumstances, business features have a main impact on financial strategies of automobile industry (Naughton, 2012).

In Nifty Indian Auto Index is made measure and understand the behavior and all-time performance of the listed automobile industry, including cars and two-wheeler makers., heavy vehicles, auto accessories, etc. the Nifty automobile exchange index contain 16 auto sector companies which are listed in NSE index (Nseindia.com, 2019). The CNX Auto Index shows and indicate the behavior and performance of auto listed Auto manufacture of cars (four-wheeler) and Bikes (Two wheelers), and other variety of vehicles (Naughton, 2012). There are always ups and downs in the stock market and a stock price that changes quickly and much more "unstable", it also considered as the stock market is risky (Yadav and Huria, 2017). Edward Altman's Z score theory is an important tool that predicts volatility since 1985.

There is a high impact on financial strategies, it's a multicultural method used to measure company financial health, this is received wide acceptance with numerous stakeholders, such as investor or stockholders, financial analysts, Counsellors, Auditors, Bankers, Management Accountants, Courts, and Database systems (Lęgowik and Swiącik, 2017). Because it provides a outstanding take find to evaluate the proposed businesses financial health, it clearly measures relative longevity, liquidity, operating profitability, leverage, salvage, and a firm's efficiency and approx. every aspects of company performance, causes obvious findings, avoid decision reliability bias, and Altman Z- score is a broadly used solution that an procedure is applied which is likely to have useful predictive value a business is going bankrupt (Dave and Parikh, 2013).

1.2 Problem statement

The Study has focusing on the Altman Z-score model's effectiveness to be installed in the NSE Auto Index listed companies in India. With the intensity of competitiveness among enterprises, the management and financial risks of enterprises are increasing and may have to fall in a financial dilemma with the business quality and management experience of managers, business crisis and the financial crisis in enterprises (Saji, 2018).

The importance of Z Score is highlighted by many studies such as a study showed by Coopers (2002), Around 1998 to 2001 1200 public listed manufacturing businesses determined the Z-Score model as practical measurement tool of financial solvency. To predict the possibility, it has been used in many areas like Telecommunication, Wood Industry, Pharmaceuticals (Saji, 2018).

In all these cases, it was found that related the industry was in a crisis, which proved to be true later. Hence, studies demonstrated that the Z score model can provide the exact prediction of Financial crisis (Grybauskas and Pilinkiene, 2018).

Saji (2018), said that establishment of long-term financial initial warning could reduce the company's bankruptcy prospects.

Z-Score delivers a brilliant solution to evaluate the financial health of a firm - as low scores give a higher coincidental of disappointment and score the one which combines the unique ratios in a group, support to address the shortcomings of personal financial ratio analysis (Grybauskas and Pilinkiene, 2018).

Using the study done thru Altman (2003), before bankruptcy, For one-year financial score measure as 94% for one as accurate prediction year for one year and around 72% from their real events two years before. In a study of Lawrence, Pongsatat and Ramage (2004), on the other hand, 90.48% of bankruptcy for the big capital companies, and for next two consecutive year it had100% accuracy rate, accuracy rate for small property insolvent firms has same rate for two years and three year 94.87%,

Odipo and Sitati (2011), examined that this model can be the one of the strongest and useful diagnostic models to deal and predict business ability to enter bankruptcy in the next two years and found that eight of the 10 analyzed companies using Z-score model for coming 2 years,

Hence, while showing a successful measurement rate of 80%. Using the model, it established 99% effective cataloging dependent on the figures of 92 businesses and almost all the above research measuring the efficiency have indicate the effectiveness of this model relishes the complete steadiness of 70 to 80% (Tuffler and Tisho, 1977).

1.3 Research Objective

For this study, the main purpose is to determine the validity of the "Z-Score" model when used on the Auto index listed companies in the National Stock exchange (NSE) of India to estimate the bank's bankruptcy risk rate during the year 2015 to 2018 and 2013-2014 to compare the impact of Brexit and before Brexit respectively. The paper also discusses whether there are differences in the accuracy of bankruptcy risk forecasts between state-owned enterprises and non-state-owned enterprises.
The detailed research objectives are:

RO1: To determine whether Altman Z-score model is effective in forecasting bankruptcy risk in Auto Index listed companies of NSE India for three-year period.

RO2: To determine the difference in Altman Z-score's accuracy of predicting bankruptcy risk before the given year,2013-2014.

1.4 Research Questions

Based on the above information, research can find the following issues:

RQ1: Is Altman Z-score model effective in forecasting bankruptcy risk in Auto Index listed companies of NSE India for the year 2015-2018?

RQ2: Is there any difference in Altman Z-score's accuracy of predicting bankruptcy risk before the given year,2013-2014?

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CHAPTER 2 - LITERATURE REVIEW

2.0 Overview

The following Literature review provides a general background on significant previous research which addresses the prediction of financial distress. Specifically, this includes literature on financial distress definition (Section 2.1), financial distress definition and Altman Z-score (Section 2.2), Brief of definitions of financial distress (Section 2.3), gap in literature and limitation (Section 2.4) theoretical foundation for the model, fundamental theory used in Z-score model (Section 2.5) framework in Z score model India, These all led to the elaboration on the research and hypothesis formation (Section 2.6) and summary of some past studies which have been conducted (Section 2.7) followed with some conclusion.

2.1 Financial Distress

The stage before bankruptcy is called as financial distress, financial distress is the stage where the firm finds itself in difficult situations to pay its creditors and other stakeholders (Ray, 2011). If no attention is given or such situation is not relieved, the result will be bankruptcy and could causes of different financial problems, for example, the weakness of the industry, the selection of the wrong location, Firm performance of the firm, inadequate capital projection, along with improper capital structure Bad phase of business cycle etc. (Shahwan, 2015). All these factors can cause long-term survival problems. The region of crisis prediction is of high economic importance, because it affects a large part of society (Ray, 2011). Given the scams of big companies and the ups and downs of financial markets have created awareness about stakeholders and under pressure from managers to get an initial warning signal about companies' liquidity positions (Gul, 2018).

A study by Shilpa and Amulya (2017) enhances the failure prediction model for Indian companies explained, in India particularly competitive environment, the financial crisis in financial sector is of critical importance. Overhaul of the bad credit banking system is another complete crisis in India that prevents development and does not show signs of initial resolution and popularly known as non-executed assets or NPA, they are actually loans for which borrowers have stopped paying interest and principal or are unable to pay (Hussain, Rigoni and Orij, 2018).

Failure is not an impractical result and it grows in constant stages, if the company is expected to move forward in the direction of possible bankruptcy then a comfortable protective effort can be adjusted and it can help all the investors reduce the financial crisis and reduce the cost of bankruptcy (Shahwan, 2015).

Since these bankruptcy cases are the matter of talking for most stakeholders and seeing the scam of big companies and the ups and downs of financial markets have created awareness about stakeholders and the managers get an initial warning signal about liquidity, the position of the companies is under pressure (Hiremath, 2013). According to Altman (1968), Based on the historical financial statement data collection related companies using Altman's Z-Score model, there is research focus on the financial position of selected corporations of the any industry. Some companies are found in the zone of bankruptcy, these financially disable companies are forced to take corrective steps towards financial reforming, while some companies are under healthy areas and some have gone bankrupt by applying Altman model and keeping this concept in mind, the Altman Z score model can highlights the financial crisis position of Indian public listed companies (Bae 2012).

2.1.1 Altman Z score as a financial distress predictor Globally

Altman's Z- score theory and model of the capital structure and strategic management has successfully been applied in many studies around the world (Allayannis, 2017). Globally many recession and big financial corporate failure have been also predicted by Z score by using in some important in investment decisions (Anjum, 2012). Therefore, many researchers have applied successfully in many other areas of financial failure of the public traded company (Sonu, Choi and Ahn, 2017). Asset and credit risk estimation are an essential part for economy measurement through z-score (Schmitt, Schäfer and Guhr, 2015). Distressed securities analysis by author (Marchesini, Perdue and Bryan, 2014). And financial failure of publicly traded companies by analytic philosopher (Rezende et al., 2017). And distressed securities (Gerantonis, Vergos, and Christopoulos, 2009). Financial crisis and prediction for the banking sector, (Chatzi, Diakomihalis and Sagka, 2016).

According to Lopez (2015), Altman Z-Score theory positive impact on stock returns, but the systematic risk is not a significant effect on stock returns.

Examining the exactness of the models which published in a paper from 1965 to 2007, it reflects that 38% of studies used multivariate discriminatory analysis, stating that the multiple-choice discriminating analysis and neural network bankruptcy forecast model are the most promising ways (Bhattacharya and Subramanyam, 2014). In all cases, techniques used to develop predictive models are considered as tools of analysis, whose purpose is not to intentionally replace individual evaluation on the basis of experience and information and Being used appropriately, each model is filtered for the localization of enterprises which requires the presentation of many years of investigation or solid tendency, so with the following trends, it is possible to find out the urgent ventures of the problem-prone enterprises and PEX works under the Palestinian capital market supervision's Authority (Hadi and Suryanto, 2017).

On a research of the year 2015 of Palestine stock market, it has around 48 public listed companies on The Palestine exchange (PEX), which is established in the year 1995 and market capitalization is about $ 2,993 billion 5 major economic areas; like Banking and financial services, insurance, investment, industries, and services (Marchesini, Perdue, and Bryan, 2004).

Among the all listed companies, Jordan Dinar is profitable and trading, while others do business in US Dollars (Hadi and Suryanto, 2017). in the year 2005, in Palestine legal structure development, especially for the release 2004 Securities Law No. 12 and the 2004 Capital Markets Authority Law Number 13, Palestine Capital Market Authorities (CMAs) took over the responsibility of monitoring PEX and issuing securities to the public stockholding companies (Sahem-inv.com, 2018).

Recent valuable reviews on the efficacy of the model are distributed by Agarwal (2015), keeping in mind these three types of models are popular in finance literature, displaying accounting-based models, market-based models and model of threat.

Altman Z-Score was calculated for Z-Score developing market and non-manufacturing models are as follows the model given is applied by Altman's statistical method terrible analysis for publicly organized datasets the makers, the guess was basically based on these data has been estimated again on the basis of the second datasets for private manufacturing, non-manufacturing and datasets Service companies (Agarwal and Taffler 2008).

Altman was able to develop a model with five financial ratios, which he had to go through several tests to exclude the financial ratio achieved, in which the minimum contribution is the overall power in predicting the financial crisis, (Altman, 1968).

The formula used is to follow;

Z = 1.2 X1 + 3.3 X2 + 3.3 X3 + 0.06 X4+0.999X5 (Equation 1)

Where; X1 = working capital (current assets (CA) – current liabilities (CL)) / total assets (TA)

X2 = retained earnings (RE) / total assets (TA)

X3 = earnings before interest and tax (EBIT) / total assets (TA)

X4 = total book equity (TE) / total liabilities (TL)

X5= sales/total assets

The results found from the model are related to a benchmark which is built to determine the company's financial strength. The lower any company's Z value is high chances the company will reach into the financial breakdown. The criteria used to explain the Z-score model are;

-Safe Zone if Z-score > 2.99 (risk free).

- Grey Zone if 1.81 < Z-score < 2.99 (at risk)

The Z value between 1.89 and 2.99 also known as the grey area

- Distress Zone if Z-score < 1.81 (bankruptcy)

Swadia and Shah (2016), studied that Altman's Z Score does not show the probability prediction but it is a probability that any Company may face bankruptcy, but proper managerial Decision can be successful in improving managers the result.

The Z-score model, which was tested in Agarwal and Taffler (2008), and a contingent claim-based model approach by also noted danger models were better in UK data Conditions: bankruptcy forecast accuracy (their default possibilities were observed Default rate), ROC analysis, and information content (Popov,2018).

Affes and Kaffel (2018), stated that despite a huge failure forecast research, the real Z-score model presented by Altman in 1968 has been the leading model implemented throughout the

global. Even though, the Z-score model has existed for the past many years, it is still used as a major or auxiliary equipment bankruptcy or financial crisis forecast or analysis in both studies and present globally (Apan, Öztel, and İslamoğlu, 2018).

2.1.2 Z-Score as predictor in Indian Automobile companies

Now a day's auto sector industries of India have 7.1 percent of contribution in the total nation's Gross domestic product (GDP) and employed more than 3 crore people in India by the year 2018 end (businessline, 2019). India Automotive Market 2020 (2011), has published a data which reported after the economic liberalization in the 1990s, the auto companies of India have seen an enormous market growth (Ray and Miglani, 2018). The Indian government has tried many steps to uphold the high growth rate and to maintain the charm of the Indian market, industry has registered an incremental employment of 19 million since 2006 (Gopalakrishnan, 2012).

India is one of the most profitable markets for emerging economies for foreign investors and has been attracting a lot of attention globally in recent times (Madhavi and Reddy 2018). Article, Brexit effect on Indian auto industry (2016), also mentioned, any major change in the world will definitely affect the Indian economy and the Indian stock market because it is more global.

Platt (2002), described the automotive supplier industry and came up with conclusion that early warning models effectively categorized between the distress and stable companies and demanded that the method should take in all the industries inside the population; Or else this option may result in sample bias.

The calculation of the CNX auto index Nifty is measure through method of free float market capitalization with the base price of 1000 with the base date of January 1, 2004, in which the index level Indicates the total float value of market of all the shares in the index base to market capitalization value (Ray and Miglani, 2018). considering component changes in the law index, and prominently, without affecting business functions such as new issue of share (IPO), Right issue, stock split, etc index value.

The ability to predict bankruptcy is dependent on models whose variables require other models or more Complex formula to find out (Verma and Sachdeva, 2014). Diakomihalis

(2012), believes that working with these models has difficulty reduces their popularity but goes to accept the role that technology has played into making it accessible.

The main motive was to predict and differentiate the financial solvency of two the companies those are using Altman's Z-Score model, which include many financial ratios and Its too to check long due bankruptcy of nominated firms by applying the similar statistical techniques Z-score model enabled researchers admitted that equally companies were at danger of insolvency with instruction for group businesses studied to make serious assessments of their salvage positions (Nayak and Nahak, 2011).

As per the Singhal and Zhu, (2013), Checks the connection between insolvency or default strategy of bankruptcy and model Altman Z-score is used to signify the possibility of insolvency which is very connected with leverage and examined that it is more possible to be insolvent than the concentrated the companies to diversified firms.

In the construction industry, Altman investigates the application of bankruptcy model, the original set of five variable has been extended into 14 set variables which It has been concluded that Altman's model is valid as well as operative in terms of liquidation forecast for some selective model (Danilov, 2014).

Celli (2015), analyse the Altman Z-score grade of reliability is comparatively high and still works a lot in the prediction of some Italy exchange-listed company's failure. And it concludes to be a valuable part in the company's detection 3 years ago for handling the financial problem and default (Muthukumar, 2014).

According to Vadivu, Arumuganathan and Kumar, (2015), Focusing on a Study on the fiscal fitness of selected Indian healthcare companies. In India, the pharmaceutical business is the third major company of the world in comparison with volume.

On research by Pharmaceuticals Department of Indian Chemicals and article by Wu and Ezell (2016), the total business of India's pharmaceutical sector grows,2008 to September 2009, it was the US $ 21.04 billion, while the local business market was the US $ 12.26 billion. $14 billion of market share in the United States, alone Indian industry holds (Nayak and Nahak, 2011). According to India Brand Equity Foundation. Indian drug market is expecting to rise CAGR of 14-17 per cent between 2012-16 India is now one of the top five World's pharmaceutical emerging markets (Panda and Behera, 2015).

Another view on Indian public-listed banks by, Pradhan (2014), Z-Score estimates from traditional to Indian banking sector at the time of Z-Score values Both are creditors and investors whose yields are based on wealth an estimate (Muthukumar, 2014). Using back-propagation neural networks to predict the internal parameters of the Z-Score which is used as the tool to the major credibility of the firm and then use these internal standards to estimate the Z-Score value by 2020. Like this Paper emphasizes the use of BPNN for public sector banks to predict bankruptcy in India (Muthukumar and S. 2014).

In response to Altman Z score model, Petrushnko et al., (2017) argue, using the data from different countries, the original version of the Z-Score model has been re-examined, using a more statistical method to estimate the effect of classification performance on the data being weird again goes to evidence reflect that the original Z-score model does so far in an international context.

2.1.3 Impact of Brexit on Automobile Companies

Following the global financial crisis of 2008 and Brexit 2016, it can be seen various element of business failure in each organization and auto subsidiaries are no exception. many studies have been inspired on the subject of financial crisis, as an interest in knowing which company had the ability to survive in the immediate future has been rose in recent year (Sternberg, 2016).

In India, financial crisis prediction has become an important part of modern enterprise financial management and establishing an important pre signal system for the financial disaster can improve the business's funding, investment, audit, operations and financial position (Muthukumar, 2014). Therefore, many enterprises in India use the Z-Score Financial Initial Warning Model for the applicability of listed companies in India (Nayak, and Nahak 2011).

Brexit came with a plan to achieve tariff free trade and non-tariff free costume in automotive priority, the government should show how it wants to secure a future trade agreement with the European Union, which gives benefit to the automotive industry, which Currently enjoying as a member of the Single Market (SMMT, 2019).

A study of Verma and Sachdeva, (2014), which was organized on two major steel production industry of India, in which one belongs to public listed firm and second one personal which is also one the largest private company of nation.

According to Fowler, (2018) British car manufacturers have faced an uncertain future in market and most likely many big auto makers are looking to move out from the country. If UK penetration is considered insufficient in the single market, then some UK factories may be closed because they are uncompetitive and as per the research, plants run by Honda and Toyota are the most prone to stop after breakage (Wade, 2017).

As per the report, it's been predicting a decline of more than 200,000 in worldwide vehicle delivery this year, a fully triggered event by Brexit alone. In the next year, the drop is expected to increase to 1.25 million, and 2018 to 1.38 million (Excell, 2018).

2.2 Specific Concepts

Generally, any institution has to face two types of danger which determines its longevity, one is an internal threat from its management and the other is the external threat fully Economy (Boda and Uradnicek, 2016). The macroeconomic factor has a major influence in Altman Z-score theory, a financial crisis is a situation in which a company is unable to repay financial obligations to a creditor, or is usually unable to pay due to high fixed costs, non-current assets or sensitive recession towards income (Henzel and Rengel, 2016). The financial crisis occurs when an organization is unable to repay its creditors and lenders and this happens when a firm is highly leveraged, with a low-profit level per unit, a high break-even point, or its sale (Edwards and Lomax, 2017).

On current scenario, bankruptcy is a major problem for the any business and a because many companies are struggling for management, arguably, the prediction of the financial crisis is often interpreted as a way of estimating whether a company is in a financial crisis or not, the company may have to face bankruptcy (Boda and Uradnicek, 2016). A company is in financial trouble if it is unable to fulfil its obligations or its liabilities exceed its asset value (Omelka, Beranováand Tabas, 2013).

After, Altman (1968), the paper uses multilateral linear discrimination models to study the company's bankruptcy problem, and 5 variables, such as asset working capital rate, asset

return rate returns, asset return rates, debt-equity Market rate determines and, as a total asset business ratio, discrimination variables, a general probability value decreases in the financial position of an enterprise. Is determined by (Rahmadini, 2017).

It is predictable that financial crisis and consequential corporate failure are often a very expensive and destructive event, and the financial crisis predicts the prediction model companies whether or not to face financial difficulties in the future (Gepp and Kumar, 2015).

2.3 Gap In the literature

Altman is not the source of the Z Score, especially suitable for many industries, finance sector companies lets go, taking as an example of sales, what does "sale" describe for a bank? financially excessive tampering and they are not operational risks and exposures well disclosed. Economic globalization has become a trend, although India's research on the bankruptcy prediction of the listed companies is not very high, the listed companies need to establish a financial crisis forecasting system.

In the study of the Z-score model, many countries are still in the search field and there are possibilities Indian market performance could be different from other countries, also there is not enough evidence to prove the consistency of the Z-Score model in different industries. This letter will be a more systematic study of the application of Z-score model in Indian public listed companies under this background.

2.4 Fundamental Theory

2.4.1 Working Capital to total asset Ratio

Altman employed the working capital to total assets ratio because this ratio measures liquid assets in relation to the size of the company, which is found typically linked to financial distress (Berkman, 2012).

A positive working capital indicates a company's ability to pay its debts (Abousamak, 2018). However, as a company's working capital dwindles down to negative, then it is very likely to experience difficulty in paying off its short-term debts (Choul, 2016).

Altman (2018), established a theory and measure that working capital to total asset ratio is the highest contributing variable in predicting finance distress in his study.

Brighi and Venturelli, (2014), found a direct positive relationship between working capital to total asset ratio and financial health in US companies in past years found a direct positive relationship between working capital to total asset ratio with respect to financial health in India's construction companies.

2.4.2 Retained earnings to total asset ratio (RE/TA Ratio)

Retained earnings represent the sum of last year's profits of a company that its management decide not to pay back to its shareholders (Bircea 2012). Usually, this payback is in the form of dividends (Abousamak, 2018). Retained earnings to total assets ratio measure a company's earning power, low retained earnings may indicate a poor business year (Basargekar, 2012).

Bircea (2012), found this ratio have discriminating power in classifying financially distressed and non-distressed companies in Iran's company.

2.4.3 Profit before interest and tax to total assets ratio-

Earnings before interest and tax to total assets ratio are also called return on assets (ROA ratio), which represents a company's productivity of assets by measuring how much return is earning on the assets. also, one of the most popular profitability measurements, ROA is found to have a direct relationship with financial health in many countries or areas, such as Taiwan, Iran and Malaysia, (Sembiring and Rambe, 2017).

2.4.4 Market value of equity to book value of debts ratio -

This ratio consists of two financial components, first, the market value of equity, this component is used to identify the total market value of all outstanding shares of a company and the book value of debts is the second component, which includes both short and long-term liabilities (Rieg and Vanini, 2015). The market value of equity to book value of debts ratio measures the difference between what the market values the company and the company liability (Beaver, 1966). The reciprocal of this ratio would be the debt to equity ratio, which

presents the leverage level (Zarandi and Mozdabadi, 2012). Companies with a smaller market value to liability ratio is potentially riskier than a company with a bigger ratio (Clout and Willett, 2015).

2.4.5 Sales to total assets ratio

Sales to total assets ratio, known by investors as asset turnover, provides information on how efficiently a company can generate revenue from the company's assets by year or quarter, in the literature, asset turnover was a useful ratio to predict a company's financial condition and predict company profit and on future. (Beaver, 1966 and Wu, 2004).

2.5 Zindia-Score Model

Zindia Score Model The Z-Score model was introduced into India in the 1990, because there are very distinct differences in the accounting procedure between the companies in India and other countries (Altman, 2012), many researchers found the model developed in the USA does not perform well among Indian's companies (Clout and Willett, 2015).

Sulphey and Nisha (2013), research and analyses the financial distress through use of Altman Z-score into the 220 public listed companies of India includes some small-cap NSE index company and found that out of these 220 only 79 companies were in safe zone and 11 companies were in grey and rest 24 were in the distress zone.

Kumari (2013), came with an analysis MMTC using the z-score model from the year 2007-08 to 2011-12, the research comes with the conclusion that the profit earning and short-term investing of MMTC is good so far, the year and there is no sign of grey zone in the MMTC.

Hayes, Hodge and Hughes (2012), has analysed the creation of the Z-Score model by implementing it in a sample of 17 firms and the retail industry study showed that the model predicts the exact location of bankruptcy at the level of 94%.

The new purpose-built model, known as the Zindia-Score Model used the sample of companies went into financial distress during 1998-1999, Altman et al. (2012), initially chose 30 financially distressed companies during 1998 and 1999 and 30 non-distressed companies in the same time period to build the model (Beaver, 1966).

Similar to Altman when he first developed the original Z-Score Model, they chose the financial ratios based on popularity in literature as input and developed a final model to diagnose the distress risk of India's companies (Saji, 2018). Different from Altman's original US model, the Z India Score Model consists of just four variables (SHANMUGAM and MAHALAKSHMI, 2011).

The model is as follows:

Zindia Score 0.517-0.460X1+9.3202 0.388xs + 1.158 X Where X1: Debt Ratio total liability/total assets; X2: ROA Ratio net profit/total assets X3: WCITA Ratio working capital /total assets; X4: RE/TA Ratio retained earnings / total assets For Zindia-Score Model, Altman et al, (2018) set the cut-off point of 0.9 for financially healthy companies and 0.5 for financially distressed companies. A company with Z value higher than 0.9 is likely to be financially healthy companies, while a Z value lower than 0.5 indicates the company is likely to experience financial distress. Z value between 0.5 and 0.9 represent the so-called grey area, which distress may or may not be impending. Altman's research shows that the accuracy rate of this model one year prior to financial distress is as high as 87 %- and two-years prior is 70 % (Altman, 2018).

Cut-off points of Zindia-Score Model (Altman,2018)

Zindia score range	Financial situation
Z < 0.5	Financial Distress
0.5 < Z < 0.9	Gray Area
Z > 0.9	Non- distress

Noted that three variables (WC/TA Ratio, ROA Ratio and RE/TA Ratio) are same as Altman's original model in 1968. Debt Ratio is found to have discriminating power in predicting financial distress among India's companies

C (2016), While analysis and explanation Nifty we are estimating the following things from the Z-scores results table of 50 companies.

Nifty 50 companies' prominence, i.e. 26 companies' safe zone 9 companies are in the grey zone, companies that need special attention, there is enough potential for financial embarrassment (Nayak and Nahak, 2011). In this area, the possibility of low Z Score

technology, FMCG, Healthcare report is low, poor areas of poor artisans are power generation, distribution, metals and oils and gas sector variables (Shanmugam and Mahalakshmi, 2011).

The Fisher's primary method for development of the Z-Score Model was the Multiple Discriminant Analysis (MDA) method. MDA is essentially a two-phase" classification method (Pawar, 2017). First, it transforms high-dimensional data onto a lower dimensional data in terms of a line. Next, within this one-dimensional space, MDA performs necessary classification (Bouveyron and Brunet, 2012). A similar approach, not only maximizes the distance between the means of the two groups but at the same time minimizes the variance with each group which is being classified (Saji, 2018). Hence, MDA provides the best distinction between two groups by providing a linear combination of variables (Balcaen and Ooghe, 2006). In this manner, financially distressed group and non- distressed group are classified, at its core, the classification method of MDA is conceptually similar to the prediction method employed by multiple linear regression (Bouveyron and Brunet, 2012).

In multiple linear regression, its dependent variable is an interval variable. However, as for MDA, its dependent variable is categorical (Bhunia and Bengal, 2011), it is natural to apply MDA for classification of financially distressed companies and non-distressed companies. In addition, according to Bell, (2013), its primary advantage lies within its capability of analysing all the financial ratios associated with a company simultaneously rather than sequentially examining these variables. Specifically, this enables combinations of ratios to be analysed together. This approach ensures the removal of possible ambiguities as well as misclassifications which were not being recognized in previous traditional ratio researches.

The discriminant function is as follows:

$$Z=V1X1+V2X2+V3X3\ldots. VnXn$$

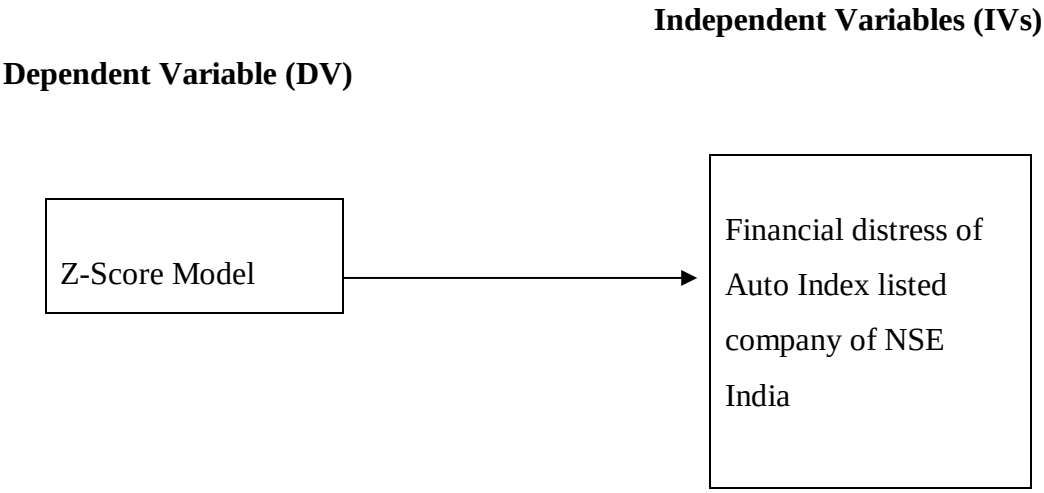
Where V1, V2, V3... Vn are discriminant coefficients

X1, X2, X3…. Xn are independent variables

The equation above is a discriminant function, this function converts the respective individual variable values into one discriminant Score (Z-Score). Based on this Z-Score, which ranges between and financially troubled companies and non-distressed companies are classified (Lachenbruch, 1975).

Hence, according to the discriminant function shown above, the Z-Score Model is essentially a linear analysis, which consists of five individual variable values that are weighted and added up to produce a Z-score. In turn, this Z-score becomes the standard reference for classification of companies into one of the groups (in this case distressed and non-distressed).

2.6 Theoretical framework



2.7 Hypotheses

The hypotheses for the study are as follows:

H1: Altman Z-score model is effective in forecasting bankruptcy risk in Auto Index companies of NSE India.

H2: There is a difference in the accuracy of predicting bankruptcy risk in two diverse manufacturing company (Two-wheeler and four-wheeler) over a three-year period.

2.8 Conclusion

The purpose of the study is to use Altman Z-score as a predictor to examine the financial soundness of public listed companies of India. The result obtained from this study is that Indian economy has great impact on India's public listed company and stock market of India, and many companies from different sector positioned in non-distress area which indicates that they are in safe zone, studies come from the use of the Altman's Z-score model performance of each category and sector individually through previous years data. Results show that for financial and pharma sector are performing well in the market and high demand from medium income group. Automobile sector faces major fluctuation have formed their strategies to compete. In this chapter, the Z-Score model is summarized shortly and the model is introduced in India, and the applicability of the Z-Score model is further verified by the literature. Apart from this, what are the risk management and financial crisis prediction in this paper, which is also the basis of the Z-score

CHAPTER 3 - RESEARCH METHODOLOGY

3.1 Chapter overview

In this part, we mainly describe the specific research methods. The sample population and sampling methods needed by the Institute were determined to ensure the reliability of the study. And at the end of the data collection, processing and statistics

3.2 Research Design

This study mainly uses Z-score model to analyse the financial situation of SOE and non-SOE in Indian Stock Market, and to predict whether there are any similarities between the two sector's bankruptcy risk. Using the way of quantitative studies, we know that the research methods and processes that will be used to analyse, test or understand the problems and phenomena, and thus to obtain meaning, are known as quantitative studies (Mitchell, 2014). Through analysis of the financial data of the companies, further forecast their financial risk

Figure 3.2.1 shows the research design which consists of a research strategy based on prior research and grounded theory. The are no interference nor manipulation of the data collected from Indian stock exchanges as the data is taken from the audited annual financial report.

Figure 3.2.1 (Research Design)

3.3 Sampling Design

Due to the limitation of access to financial data from all stock exchange the sampling is limited to 16 automobile Index listed companies of National stock exchange (NSE), between the year 2013-2018.

The study has National stock exchange (NSE) automobile Index listed companies as research samples, from Indian stock market. This paper forecasts the difference of bankruptcy risk by analysing the financial statements and data analysis of selected companies in the five years of 2013-2018. Here, we mainly adopt the non-probability sampling method, the researcher chooses the research object according to the need of the research goal and the researcher's subjective judgment.

3.4 Measurement

A panel data approach will be applied in this study which is also known as longitudinal study or cross-sectional time series data (Jager, 2008). Unlike cross sectional or time-series data sets, many cases are recorded And at least two are studied, the period of time and two different types of information are available i.e. cross-sectional information and time-series information (Jena, 2018).

The formers provide information about the difference between prior topics and later explains the difference in the subject on a particular period (DSS princeton.edu, 2015).

Hurlin (2013), stated that there are two types of panel data, i.e. a balanced panel where the same time period is for each cross-section observation; and an unbalanced panel where time dimensions are specific to each observation.

3.4.1 Preliminary analysis

There are few preliminary analyses has done to check the data quality of the sample used for this study

Descriptive analysis.

For Z-score analysis, there are 5 financial ratios has been collected and these are analyzed with descriptive analysis to obtain the mean, median, Kurtosis, S. deviation and skewedness and measured to understand the data distribution.

One Way Anova

This method is used to describe the mean difference between two or more groups (Sekaran and Bougie, 2013). The symmetry of the variance test is organized to check the similarity of the variance with a notion if the P-value is less than 0.05, then the hypothesis can be rejected for supporting the hypothesis option, which means that Variance does not equal according to French et al. (2015). Many researchers such as Niedermeier et al, (2003).

5 Based on the combined financial ratio, hypothesis null and hypothesis options are given below.

Ho: $\mu1 = \mu2 = \mu3 = \mu4 = \mu5$

Ha: $\mu1 \neq \mu2 \neq \mu3 \neq \mu4 \neq \mu5$

3.4.2 Demographic information

The demographics of the study cover Automobile sector companies Listed in NSE Auto Index for the time frame of 4 years between 2015 to 2018 as “Data set A” and “Data set B” for 2 year between 2013-2013. There are total of 16 automobile companies selected for the analysis. The method consists two set of data two Compare the Altman Z score value before the Brexit effect and during the Brexit in automobile companies in India (Table 3.4)

No.	company name	Stock Code	No.	company name	Stock Code
1	TVS	532343	9	Mahindra & Mahindra	500520
2	TATA Motors	500570	10	Bosch Ltd.	500530
3	Motherson Sumi Systems	517334	11	MRF Ltd.	50290
4	Maruti Suzuki India Ltd.	532500	12	Exide Industries Ltd.	500086
5	Eicher Motors Ltd.	505200	13	Apollo Tyres Ltd.	500877
6	Bharat Forge Ltd.	500493	14	Amara Raja Batteries.	500008
7	Hero MotoCorp Ltd.	500182	15	Ashok Leyland Ltd.	500477
8	Bajaj Auto Ltd.	500034	16	TATAMTRDVR	570001

Table 3.4.1 (16 auto index companies, Source - NSE.COM)

3.4.2 Hypothesis Test

Z-score can be described as a linear combination of 4-5 common business proportions. These ratios are loaded by coefficients, which they estimate that they have declared bankruptcy by searching a group of companies. After this, a matching sample of firms is collected for living firms that match industry and estimated asset (Altman, 1968).

The formula used is to follow;

Z = 1.2 X1 + 3.3 X2 + 3.3 X3 + 0.06 X4+0.999X5 (Equation 1)

Where; X1 = working capital (current assets (CA) – current liabilities (CL)) / total assets (TA)

X2 = retained earnings (RE) / total assets (TA)

X3 = earnings before interest and tax (EBIT) / total assets (TA)

X4 = total book equity (TE) / total liabilities (TL)

X5= sales/total assets

The results found from the model are related to a benchmark which is built to determine the company's financial strength. The lower any company's Z value is high chances the company will reach into the financial breakdown. The criteria used to explain the Z-score model are;

-Safe Zone if Z-score > 2.99 (risk free),

- Grey Zone if 1.81 < Z-score < 2.99 (at risk),

The Z value between 1.89 and 2.99 also known as the grey area,

- Distress Zone if Z-score < 1.81 (bankruptcy).

3.5 Data Collection

In this study the 16 automobiles company's financial data from NSE India were collected and analysed and the data is between the year of 2013 to 2018. The main source of data is annual financial report of the companies

3.6 Statistics treatment

The statistical methods included in the study include planning, designing, collecting data, analysing and explaining meaningful explanations and report conclusions. And using only the proper statistical methods, the results and estimates are accurate. After collecting data of 21 companies and calculating the data through the Z-Score model, the data is analysed by Smart-PSL, and the Chi-Square Test and Cross Analysis method is used to analyse it.

3.7 Chapter Summery

This chapter mainly deals with the methodology used to check the factors affecting the financial crisis 21 automobile company listed in NSE India between 2013-2018. It includes the introduction of sample and source of the data. An analysis of the secondary data received from the available annual financial report will be analysed with various statistical instruments to prove the above-mentioned hypothesis in chapter 2.

CHAPTER 4: FINDING AND DISCUSSION

4.1 Chapter Overview

. This chapter covers all descriptive analysis of sample data and statistical analysis, as mentioned in Chapter 1, to meet research objectives. This sample structure and financial ratio starts with discussion of the descriptive analysis of section 4.1; This is followed by the classification approach for the prediction and pilot test of the financial crisis with atman Z score (Section 4.2). Next, the prediction accuracy of the Zindia-score model will be discussed and compared (Section 4.3). After this, the prediction accuracy will be discussed and compared between Data set A "2015-2018 and DATA set B (2013-2014) (Section 4.4). In the end, the discussion of the result will be provided (Section 4.5)

4.2 Pilot Test

The Result of Pilot test from Altman Z-score model is listed in below table (4.2.1)

The results are as – "Yellow" Highlighted area are financially doing good, "Grey" highlighted area represent low risk and "Red" highlighted indicating financial distress.

			Zscore Score					
		Finacial year	Data Set "B"		Data Set "A"			
Company name	**Company Code**	Ending	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
TVS	532343	31st march	4.41839	5.48392	4.968744003	5.4881611	5.70961	3.41839
TATA motors	500570	31st march	2.31525	1.37525	2.074928725	1.6886764	1.62373	1.31525
Motherson Sumi Ltd.	517334	31st march	3.37749	4.62749	5.013425203	4.1195235	3.4621	3.67749
Maruti Suzuki India Ltd.	532500	31st march	12.2076	11.5346	9.529316989	8.2653634	10.0503	11.2076
Eicher Motors Ltd's	505200	31st march	22.6331	23.7396	33.54111859	#DIV/0!	28.2039	21.6331
Bharat Forge Ltd.	500493	31st march	6.83402	7.39108	5.762920426	4.5067716	5.03271	5.83402
Hero MotoCorp Ltd.	500182	31st march	13.4746	14.1144	14.17619036	13.676848	12.329	12.4746
M & M Ltd.	500520	31st march	2.90697	1.97857	1.789661093	1.6794	1.89361	1.90697
Bosch Ltd.	500530	31st march	10.7289	11.7199	14.30155342	14.731635	15.3335	9.72892
MRF Ltd.	50290	31st march	18.0577	17.7075	#DIV/0!	12.518161	18.3546	17.0577
Exide Industries Ltd.	500086	31st march	3.06515	2.16715	2.210479692	1.9612664	2.22617	2.06515
Apollo Tyres Ltd.	500877	31st march	3.35436	4.30326	4.053434612	3.2129913	2.52422	2.35436
Amara Raja Batteries Ltd.	500008	31st march	10.8227	11.6629	17.97190911	14.313625	12.5044	9.8227
Ashok Leyland Ltd.	500477	31st march	3.41546	3.23456	1.906261834	2.558895	2.10323	2.41546
Bajaj Auto Ltd.	500034	31st march	13.9435	14.5394	14.11450907	16.23714	15.91	12.9435
TATAmtr Dvr	570001	31st march	2.18272	2.82372	1.829716351	1.5783447	1.44466	1.18272

Table (4.2.1 Z-score rating)

Z-Score was predicted that many companies fall under the default risk throughout the year however it has different result if it is compared with NSE Auto listed companies.

The result shows there are 16 automobile companies in which 1 company fall under distress mode in 2018 and whereas 7 companies are in grey zone continuously in both data Set A (2015-2018) and Data set B (2013-2014). And 8 companies have shown no impact of Brexit before and after time and highlighted as safe zone constantly. The Z-score default prediction for the all automobile companies has been same before and after Brexit period only TATA motor DVR has shown as Financial distress zone in the year 2018.which decrease the accuracy number only time in complete table (table 4.2.2)

	2015	2016	2017	2018	2013	2014
Total Company	16	16	16	16	16	16
Z Score None Distress	16	16	16	15	16	16
Z Score Distress	0	0	0	1	0	0
Z Score Accuracy, %	**100%**	**100%**	**100%**	**96%**	**100%**	**100%**

	Set A	Set B
Total Company	**64**	**32**
Z Score None Distress	**63**	**32**
Z Score Distress	**1**	**0**

(Table 4.2.2: Z-score accuracy in Set A and Set B)

Hypothesis

4.3 Descriptive Statistics

Table 4.2.1 highlighted the Z- score's descriptive analysis for the two Data set A and Set B.

To apply the Z score model for predicting the financial c distress, it requires independent variables from a unique company (X1 date ratio, X2 ROA ratio, X3 WC/TA ratio,X4 RE / TA ratio, X5- Efficiency ratio), because this paper offers advanced prediction Two forms (one-year forecast) and (full selected year prediction) between two Data, set A and Set B, the Essential input from the same company is collected from different time periods.

For One year's prediction, descriptive statistics of all input variables are in Table 4.3.2. For Final prediction between two data "set A" and "set B", descriptive statistics for all the input variables are tabulated in Table 4.3.1

Descriptive analysis of Independent variable (Set A- Set B)

X1- Debt Ratio, X2 – ROA Ratio, X3- WC/TA ratio, RE/TA ratio, X5 -Efficiency Ratio

Descriptive Statistics						
		N	**Mean**	**Std. Deviation**	Skewness	Kurtosis
year-2015-2018	X1	64	0.1073482	0.142886	0.684	-0.478
	X2	64	0.2889007	0.217621	0.386	-1.033
	X3	64	0.1344194	0.078717	1.197	0.897
	X4	64	8.0542167	10.22523	1.949	4.116
	X5	64	1.0413614	0.501351	0.631	0.586
	Valid N (listwise)	64				
		N	Mean	Std. Deviation	Skewness	Kurtosis
year=2013-2104	X1	32	0.1185379	0.163868	0.448	-1.44
	X2	32	0.2864234	0.233641	0.875	-0.702
	X3	32	0.139137	0.078342	1.602	2.669
	X4	32	9.5531776	14.29899	2.286	4.284
	X5	32	1.2828543	0.587579	0.832	-0.712
	Valid N (listwise)	32				

(4.3.1 Descriptive analysis for Set A and Set B)

Descriptive analysis of Independent variable (One-year Prediction)

		N	Std. Deviation	Skewness	Kurtosis	**Mean**
year=2015	X1	16	0.158245	0.677	-0.873	0.1350508
	X2	16	0.230204	0.547	-0.925	0.2790242
	X3	16	0.07025	0.767	-0.106	0.1386970
	X4	16	12.85232	2.118	4.859	9.5195537
	X5	16	0.623016	0.402	-0.319	1.2179590
year=2013	X1	16	0.163868	0.448	-1.44	0.1185379
	X2	16	0.233641	0.875	-0.702	0.2864234
	X3	16	0.078342	1.602	2.669	0.1391370
	X4	16	14.29899	2.286	4.284	9.5531776
	X5	16	0.587579	0.832	-0.712	1.2828543

(Table 4.3.2)

ANOVA							
			Sum of Squares	df	Mean Square	F	**P-value**.
X1	Between Groups	(Combined)	0.022	5	0.004	0.174	**0.972**
	Within Groups		2.261	90	0.025		
	Total		2.283	95			
X2	Between Groups	(Combined)	0.093	5	0.019	0.284	**0.921**
	Within Groups		5.882	90	0.065		
	Total		5.975	95			
X3	Between Groups	(Combined)	0.294	5	0.059	0.899	**0.485**
	Within Groups		5.894	90	0.065		
	Total		6.188	95			
X4	Between Groups	(Combined)	174.082	5	34.816	0.3	**0.912**
	Within Groups		10436.25	90	115.958		
	Total		10610.33	95			
X5	Between Groups	(Combined)	2.64	5	0.528	1.402	**0.231**
	Within Groups		33.891	90	0.377		
	Total		36.531	95			

Looking at the visual aspects of the two table indicates that, for both one year's and complete data set predictions, there are not much differences between The data Set A and data Set B throughout the year, in the context of all independent variables. The mean of the Debt ratio (X1) decrease little point only between Data set B to Set A, while the mean of other variables like the X2, X3, X4 and X5 has very minor changes. These changes are very mix and constant especially for the RE / TA ratio (Figure 4.2.1 and Figure 4.2.2).

4.4 One-way Anova

Anova: Single Factor				
SUMMARY				
Groups	Count	Sum	**Average**	Variance
2015	64	232.11	15.88	61.51
2016	64	255.72	11.01	32.36
2017	64	217.23	8.33	31.39
2018	64	197.55	9.33	39.42

(Table 4.4 .2)

The calculated P-value is more than 0.05 for all variables, Hence, is no significant difference between dismissing H1 and supporting H2. That is why, the hypothesis is accepted and the solution is that NSE India Automobile Index company Altman Z "is financially strong in the safe sector in 2015-2018 as per the score model."

4.4 Summary of finding

Based on the result, Altman Z "-score, which was an improvement from the initial Z-score model in 1968, has a better service as the default predictor with accuracy of 92%.

The descriptive analysis of Z "-score data shows that this is standard distribution and slipped from 0.11 to 0.10 in “Set B” to “Set A”, respectively.

One-way ANOVA analysis shows that there are no significant differences in rejecting the hypothesis, therefore it is safe to accept that the result is financially strong during the 5 years.

The total financial position of the oil and gas company has been deteriorating for many years. Nevertheless, the financial situation is safe for the oil and gas company's decline in most of the major financial crisis in the financial situation.

4.5 Conclusion

Indian NSE auto Index company are financially good during the year 2015-2018.

Hypotheses	Positive / Negative
H1Altman Z-score model is effective in forecasting bankruptcy risk in Auto Index companies of NSE India in the year 2015-2018. .	positive
H2: There is a difference in the accuracy of predicting bankruptcy risk before the 2015. .	Negative

CHAPTER 5: CONCLUSION AND RECOMMENDATION

5.0 Overview

This chapter summaries the result of complete report and improvement in study with suggestion for the result.

5.1 Finding

Altman Z score as financial distress predictor in 16 Nifty Auto Index company

Based on the result with the all the variables for Altman z score, we have seen there is no big distress factor for the any automobile company throughout the selected year from of Brexit and before the Brexit, Eventually, The only company Tata Motor Dvr who has shown some major impact of Brexit continuedly decrease the safe zone number and during the year 2018 it falls under the distress zone, whereas 8 companies has reached the level of grey zone but still consider as normal and good to grow (table4.1.1) . and it come with the result as the automobile company of Nifty index India are in safe zone and there is no financial distress pressure on them because of the influence of Brexit referendum and all the 16 traded companies are sound healthy. Hence the RQ of the study has proven right when it comes to Altman z score is mostly effective in forecasting the bankruptcy risk in Auto index listed companies of NSE India during the year 2015-2018.

And on the other hand, RQ2 has proven wrong because that there is no any significance difference in accuracy on predicting bankruptcy through Altman z score model during the year 2013-2014.

5.2 Recommendation for Future

The sample researched in this study were selected among listed companies of NSE auto index only of India and specially all companies came from auto sector so the future research can include the diverse sector and compare it with peer countries like china, U.K. or USA, who had the impact of Brexit

Secondly, for this research there is two data set during the Brexit time zone and before the Brexit time zone, in future after some final report on study, future study will be able to get the after effect for the study as well which will help to predict the robustness of company with high accuracy.

Thirdly, this study includes the robustness of Z score model in single market index companies and mostly are big companies. According to Negash, (2015), large company have stable profit than small companies and there are less chances of getting financial distress for such companies. In sense robustness of Altman z score will be more effective and accurate with small cap or mid cap companies. So, it will be good to test in future with different cap size companies.

5.3 Personal Reflection

Personally, I have encountered many difficulties during the research but on the other hand I learnt and experienced lot of benefits during the study. The main purpose of the study was to understand the purpose of Altman z score and understanding the calculation to predict the companies' financial distress, which is the best and important learning throughout the study.

Each stage of the whole research has to be conducted with proper manner and calculation for this project and with well time manner because our research time frame was very short of 10 weeks only, which help to learn the time management as well. Investigating this topic was a good challenge as I had very limited background knowledge and understanding on topic Altman Z score, and during research I had gained lot about company financial distress prediction and able to understand from company point of view that financial budgeting and planning for every institute is very important to tackle the volatility in business and company leader should examine the market risk and business potential to protect their company from solvency.

5.4 Limitation of study

This study took into the companies of automobile sector listed in NSE Auto index therefore there is only 16 companies because was very limited for the study, the lesser number of companies within the scope might be an influencing factor in measuring the accuracy and strength of Z score model.

Secondly, As discussed in chapter two as well there is the limitation of Altman score when it comes to finance company, because it cannot be applied on this sector

5.5 Conclusion

This study is set to perform the robustness of Altman Z score model in NSE India automobile Index listed companies as the financial distress predictor with two data set of year 2015-2018 and 2013-2014. In addition of the same secondary objective is to predict the financial distress of selected sector before and during the Brexit period. There were total 16 companies have been selected for this study for given selected time frame and Z score value has been calculated for each of the companies and statically measurement was used to answer the question of the study.

As for the question whether Z score model is effective in calculating and predicting the financial distress of the companies, statistics showed the Indian NSE auto index company are in safe Zone or in better position mostly and there is very less chances of financial distress in the company during the event of Brexit in the year 2015 to 2018.

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Appendix

Company with value of X1, X2, X3, X4, X5 from year 2013-2018

Company	Year	x1	xx2	x3	x4	x5
TVS	2013	-0.04394	0.12826	0.11258	2.93057	2.14545
TATA Motors	2013	-0.06594	0.13826	0.10258	3.95057	2.14546
Motherson Sumi Systems Ltd.	2013	0.00036	0	0.10678	1.00487	1.11921
Maruti Suzuki India Ltd.	2013	0.00392	0.13608	0.0526	0.45029	0.99619
Eicher Motors Ltd's	2013	0.06572	0.17608	0.12279	3.73612	2.04116
Bharat Forge Ltd.	2013	0.14413	0.14924	0.1028	2.38728	1.30858
Hero MotoCorp Ltd.	2013	0.00952	0.60178	0.14428	11.30781	1.41458
Mahindra & Mahindra Ltd.	2013	0.06346	0.05029	0.06937	0.99615	0.72069
Bosch Ltd.	2013	-0.08543	0.61513	0.19662	12.22073	1.31032
MRF Ltd.	2013	0.25638	0.69029	0.27823	48.22719	2.41257
Exide Industries Ltd.	2013	0.17155	0.11769	0.05235	1.51539	0.65555
Apollo Tyres Ltd.	2013	-0.02123	0.69886	0.34747	41.84085	0.99983
Amara Raja Batteries Ltd.	2013	0.33814	0.21964	0.15267	6.04751	0.91734
Ashok Leyland Ltd.	2013	0.36092	0.32075	0.1162	5.094	0.71069
Bajaj Auto Ltd.	2013	0.33814	0.21964	0.15267	6.04751	0.91734
TATAMTRDVR	2013	0.36092	0.32075	0.1162	5.094	0.71069
TVS	2014	0.51126	1.51126	2.51126	3.51126	4.51126
TATA Motors	2014	-0.11126	0.16564	0.12549	4.60803	2.21083
Motherson Sumi Systems Ltd.	2014	0.01212	0	0.06576	0.7126	1.02956
Maruti Suzuki India Ltd.	2014	-0.02013	0.16847	0.04701	0.26807	0.89092
Eicher Motors Ltd's	2014	0.06026	0.17847	0.12758	2.51865	1.86516
Bharat Forge Ltd.	2014	0.04709	0.15824	0.09252	2.65535	1.50091
Hero MotoCorp Ltd.	2014	-0.07239	0.60234	0.17943	9.28161	1.34788
Mahindra & Mahindra Ltd.	2014	0.06222	0	0.0732	4	0.59329
Bosch Ltd.	2014	-0.12479	0.61583	0.02511	15.14613	1.32467
MRF Ltd.	2014	0.0944	0	0.34399	2.51865	1.57519
Exide Industries Ltd.	2014	0.08088	0.20749	0.06933	1.03246	0.58947
Apollo Tyres Ltd.	2014	0.02833	0.6856	0.32758	31.03486	0.9373
Amara Raja Batteries Ltd.	2014	0.34597	0.25733	0.12874	4.16104	0.80989

Ashok Leyland Ltd.	2014	0.37477	0.33621	0.12878	6.10994	0.82265
Bajaj Auto Ltd.	2014	0.34597	0.25733	0.12874	4.16104	0.80989
TATAMTRDVR	2014	0.37477	0.33621	0.12878	6.10994	0.82265
TVS	2015	-0.06594	0.13826	0.10258	3.95057	2.14546
TATA Motors	2015	0.00036	0	0.10678	1.00487	1.11921
Motherson Sumi Systems Ltd.	2015	0.06572	0.17608	0.12279	3.73612	2.04116
Maruti Suzuki India Ltd.	2015	0.00952	0.60178	0.14428	11.30781	1.41458
Eicher Motors Ltd's	2015	0.25638	0.69029	0.27823	48.22719	2.41257
Bharat Forge Ltd.	2015	0.33814	0.21964	0.15267	6.04751	0.91734
Hero MotoCorp Ltd.	2015	0.33814	0.21964	0.15267	6.04751	0.91734
Mahindra & Mahindra Ltd.	2015	0.06346	0	0.08337	1.19615	0.72069
Bosch Ltd.	2015	0.03023	0.32484	0.13568	22.08238	0.11331
Exide Industries Ltd.	2015	0.11155	0.21769	0.06275	1.51539	0.65555
MRF Ltd.	2015	0.11155	0.21769	0.06275	1.51539	0.65555
Apollo Tyres Ltd.	2015	0.14642	0.39797	0.16509	2.30459	1.39304
Amara Raja Batteries Ltd.	2015	0.33998	0.61488	0.25529	23.49637	1.76284
Ashok Leyland Ltd.	2015	-0.02846	0.0881	0.03982	1.49137	0.79083
Bajaj Auto Ltd.	2015	0.44342	0.5575	0.24763	17.79346	1.30866
TATAMTRDVR	2015	0.00036	0	0.10678	0.59619	1.11921
TVS	2016	-0.11126	0.16564	0.12549	4.60803	2.21083
TATA Motors	2016	0.01212	0	0.06576	0.7126	1.02956
Motherson Sumi Systems Ltd.	2016	0.06026	0.17847	0.12758	2.51865	1.86516
Maruti Suzuki India Ltd.	2016	-0.07239	0.60234	0.17943	9.28161	1.34788
Eicher Motors Ltd.	2016	0.0944	0	0.34399	15.14613	1.57519
Bharat Forge Ltd.	2016	0.34597	0.25733	0.12874	4.16104	0.80989
Hero MotoCorp Ltd.	2016	0.34597	0.25733	0.12874	4.16104	0.80989
Mahindra & Mahindra Ltd.	2016	0.07222	0	0.0886	1.05176	0.66929
Bosch Ltd.	2016	0.02686	0.3898	0.16864	22.52372	0.08294
Exide Industries Ltd.	2016	0.12088	0.22749	0.06933	1.08246	0.61947
MRF Ltd.	2016	0.12088	0.22749	0.06933	1.08246	0.61947
Apollo Tyres Ltd.	2016	0.09909	0.39405	0.14439	1.76421	1.00739
Amara Raja Batteries Ltd.	2016	0.26106	0.59315	0.2449	17.9947	1.56494
Ashok Leyland Ltd.	2016	0.02825	0.10391	0.09612	1.87024	0.94018
Bajaj Auto Ltd.	2016	0.11321	0.53973	0.32946	21.62263	1.28487
TATAMTRDVR	2016	0.01212	0	0.06576	0.52871	1.02956
TVS	2017	-0.11515	0.20142	0.11693	5.2437	2.03372

TATA Motors	2017	0.00392	0	0.0526	0.74875	0.99619
Motherson Sumi Systems Ltd.	2017	0.14413	0.14924	0.1028	2.38728	1.30858
Maruti Suzuki India Ltd.	2017	-0.08543	0.61513	0.19662	12.22073	1.31032
Eicher Motors Ltd.	2017	-0.02123	0.69886	0.34747	41.84085	0.99983
Bharat Forge Ltd.	2017	0.36092	0.32075	0.1162	5.094	0.71069
Hero MotoCorp Ltd.	2017	0.36092	0.32075	0.1162	5.094	0.71069
Mahindra & Mahindra Ltd.	2017	0.07805	0.18598	0.08633	1.01629	0.64492
Bosch Ltd.	2017	0.02773	0.50681	0.17994	23.17188	0.09374
Exide Industries Ltd.	2017	0.12535	0.22828	0.06997	1.49607	0.62762
MRF Ltd.	2017	0.12535	0.22828	0.06997	1.49607	0.62762
Apollo Tyres Ltd.	2017	0.03693	0.35678	0.10014	1.32657	0.85401
Amara Raja Batteries Ltd.	2017	0.27869	0.60783	0.19591	15.31519	1.48334
Ashok Leyland Ltd.	2017	0.02402	0.10066	0.10807	1.22226	0.8435
Bajaj Auto Ltd.	2017	0.28911	0.58059	0.2583	21.48643	1.00596
TATAMTRDVR	2017	0.00392	0	0.0526	0.45029	0.99619
TVS	2018	-0.00803	0.12673	0.09474	2.8413	1.23317
TATA Motors	2018	-0.02013	0	0.04701	0.48895	0.89092
Motherson Sumi Systems Ltd.	2018	0.04709	0.15824	0.09252	2.65535	1.50091
Maruti Suzuki India Ltd.	2018	-0.12479	0.61583	0.02511	15.14613	1.32467
Eicher Motors Ltd's	2018	0.02833	0.6856	0.32758	31.03486	0.9373
Bharat Forge Ltd.	2018	0.37477	0.33621	0.12878	6.10994	0.82265
Hero MotoCorp Ltd.	2018	0.37477	0.33621	0.12878	6.10994	0.82265
Mahindra & Mahindra Ltd.	2018	0.07234	0.20278	0.10352	0.99646	0.59676
Bosch Ltd.	2018	0.02741	0.50528	0.14685	14.02728	0.08767
Exide Industries Ltd.	2018	0.10266	0.22704	0.05819	1.3124	0.64462
MRF Ltd.	2018	0.10266	0.22704	0.05819	1.3124	0.64462
Apollo Tyres Ltd.	2018	0.0962	0.29165	0.05804	1.51825	0.72812
Amara Raja Batteries Ltd.	2018	0.27811	0.59377	0.17136	11.06444	1.45354
Ashok Leyland Ltd.	2018	0.00686	0.11112	0.11365	1.68292	0.86685
Bajaj Auto Ltd.	2018	0.20442	0.56965	0.23606	16.86796	1.00095
TATAMTRDVR	2018	-0.02013	0	0.04701	0.26807	0.89092

Z score value of all company

				Zscore Score			
Company name	Company Code	2013	2014	2015	2016	2017	2018
TVS	532343	4.418392	5.483916	4.968744003	5.48816107	5.709612	3.418392
TATA motors	500570	2.315253	1.375253	2.074928725	1.68867645	1.623733	1.315253
Motherson Sumi Ltd.	517334	3.377494	4.627494	5.013425203	4.11952351	3.462096	3.677494
Maruti Suzuki India Ltd.	532500	12.20762	11.53462	9.529316989	8.26536338	10.05029	11.20762
Eicher Motors Ltd's	505200	22.63308	23.73964	33.54111859	#DIV/0!	28.2039	21.63308
Bharat Forge Ltd.	500493	6.834019	7.391084	5.762920426	4.50677158	5.03271	5.834019
Hero MotoCorp Ltd.	500182	13.47455	14.11435	14.17619036	13.6768479	12.32904	12.47455
M & M Ltd.	500520	2.906973	1.978573	1.789661093	1.6794	1.893606	1.906973
Bosch Ltd.	500530	10.72892	11.71988	14.30155342	14.7316352	15.33347	9.728918
MRF Ltd.	50290	18.05771	17.70751	#DIV/0!	12.5181613	18.35461	17.05771
Exide Industries Ltd.	500086	3.06515	2.16715	2.210479692	1.96126641	2.226174	2.06515
Apollo Tyres Ltd.	500877	3.354356	4.303256	4.053434612	3.21299131	2.524221	2.354356
Amara Raja Batteries Ltd.	500008	10.8227	11.6629	17.97190911	14.3136247	12.50435	9.822697
Ashok Leyland Ltd.	500477	3.415456	3.234556	1.906261834	2.55889503	2.103234	2.415456
Bajaj Auto Ltd.	500034	13.94354	14.53944	14.11450907	16.2371401	15.90996	12.94354
TATAmtr Dvr	570001	2.182722	2.823722	1.829716351	1.57834468	1.444659	1.182722

Descriptive

Case Processing Summary

	Cases					
	Included		Excluded		Total	
	N	Percent	N	Percent	N	Percent
year * X1	84	100.0%	0	0.0%	84	100.0%
year * X2	84	100.0%	0	0.0%	84	100.0%
year * X3	84	100.0%	0	0.0%	84	100.0%
year * X4	83	98.8%	1	1.2%	84	100.0%
year * X5	84	100.0%	0	0.0%	84	100.0%

Descriptives

	company			Statistic	Std. Error
X1	Amara Ra	Mean		.3069933	.01562246
		95% Confidence Interval for Mean	Lower Bound	.2668345	
			Upper Bound	.3471521	

	5% Trimmed Mean		.3073795	
	Median		.3084154	
	Variance		.001	
	Std. Deviation		.03826704	
	Minimum		.26106	
	Maximum		.34597	
	Range		.08491	
	Interquartile Range		.06763	
	Skewness		-.098	.845
	Kurtosis		-2.914	1.741
Apollo T	Mean		.0642902	.02471790
	95% Confidence Interval for Mean	Lower Bound	.0007508	
		Upper Bound	.1278295	
	5% Trimmed Mean		.0644788	
	Median		.0665642	
	Variance		.004	
	Std. Deviation		.06054624	
	Minimum		-.02123	
	Maximum		.14642	
	Range		.16765	
	Interquartile Range		.09498	
	Skewness		-.086	.845
	Kurtosis		-.847	1.741
Ashok Le	Mean		.1277264	.07639056
	95% Confidence Interval for Mean	Lower Bound	-.0686418	
		Upper Bound	.3240946	
	5% Trimmed Mean		.1226789	
	Median		.0261327	
	Variance		.035	
	Std. Deviation		.18711789	
	Minimum		-.02846	
	Maximum		.37477	
	Range		.40324	
	Interquartile Range		.36635	
	Skewness		.920	.845
	Kurtosis		-1.851	1.741
Bajaj Au	Mean		.2890461	.04745499
		Lower Bound	.1670592	

		95% Confidence Interval for Mean	Upper Bound	.4110331	
		5% Trimmed Mean		.2902383	
		Median		.3136240	
		Variance		.014	
		Std. Deviation		.11624050	
		Minimum		.11321	
		Maximum		.44342	
		Range		.33021	
		Interquartile Range		.18871	
		Skewness		-.394	.845
		Kurtosis		-.148	1.741
	Bharat F	Mean		.2685032	.05632528
		95% Confidence Interval for Mean	Lower Bound	.1237144	
			Upper Bound	.4132919	
		5% Trimmed Mean		.2748999	
		Median		.3420537	
		Variance		.019	
		Std. Deviation		.13796820	
		Minimum		.04709	
		Maximum		.37477	
		Range		.32768	
		Interquartile Range		.24452	
		Skewness		-1.141	.845
		Kurtosis		-.643	1.741
	Bosch Lt	Mean		-.0163302	.02853452
		95% Confidence Interval for Mean	Lower Bound	-.0896805	
			Upper Bound	.0570202	
		5% Trimmed Mean		-.0128913	
		Median		.0271381	
		Variance		.005	
		Std. Deviation		.06989502	
		Minimum		-.12479	
		Maximum		.03023	
		Range		.15502	
		Interquartile Range		.12362	
		Skewness		-1.103	.845
		Kurtosis		-1.065	1.741

Eicher M	Mean		.0806425	.03865390
	95% Confidence Interval for Mean	Lower Bound	-.0187205	
		Upper Bound	.1800056	
	5% Trimmed Mean		.0765393	
	Median		.0629900	
	Variance		.009	
	Std. Deviation		.09468234	
	Minimum		-.02123	
	Maximum		.25638	
	Range		.27761	
	Interquartile Range		.11895	
	Skewness		1.491	.845
	Kurtosis		3.062	1.741
Hero Mot	Mean		.2261547	.08230140
	95% Confidence Interval for Mean	Lower Bound	.0145922	
		Upper Bound	.4377171	
	5% Trimmed Mean		.2344841	
	Median		.3420537	
	Variance		.041	
	Std. Deviation		.20159643	
	Minimum		-.07239	
	Maximum		.37477	
	Range		.44716	
	Interquartile Range		.37534	
	Skewness		-1.022	.845
	Kurtosis		-1.449	1.741
Maruti S	Mean		-.0482166	.02211590
	95% Confidence Interval for Mean	Lower Bound	-.1050673	
		Upper Bound	.0086341	
	5% Trimmed Mean		-.0471701	
	Median		-.0462604	
	Variance		.003	
	Std. Deviation		.05417266	
	Minimum		-.12479	
	Maximum		.00952	
	Range		.13431	
	Interquartile Range		.10059	
	Skewness		-.299	.845

	Kurtosis		-1.717	1.741
Motherso	Mean		.0549458	.02079514
	95% Confidence Interval for Mean	Lower Bound	.0014902	
		Upper Bound	.1084014	
	5% Trimmed Mean		.0530241	
	Median		.0536764	
	Variance		.003	
	Std. Deviation		.05093749	
	Minimum		.00036	
	Maximum		.14413	
	Range		.14377	
	Interquartile Range		.07614	
	Skewness		1.064	.845
	Kurtosis		1.602	1.741
MRF Ltd.	Mean		.1352043	.02467663
	95% Confidence Interval for Mean	Lower Bound	.0717710	
		Upper Bound	.1986376	
	5% Trimmed Mean		.1307396	
	Median		.1162181	
	Variance		.004	
	Std. Deviation		.06044515	
	Minimum		.09440	
	Maximum		.25638	
	Range		.16198	
	Interquartile Range		.05751	
	Skewness		2.254	.845
	Kurtosis		5.278	1.741
TATA Mot	Mean		-.0301554	.01986459
	95% Confidence Interval for Mean	Lower Bound	-.0812189	
		Upper Bound	.0209082	
	5% Trimmed Mean		-.0279981	
	Median		-.0098858	
	Variance		.002	
	Std. Deviation		.04865811	
	Minimum		-.11126	
	Maximum		.01212	
	Range		.12338	
	Interquartile Range		.08324	

		Skewness		-1.132	.845
		Kurtosis		.035	1.741
	TATAMTRD	Mean		.1219931	.07788695
		95% Confidence Interval for Mean	Lower Bound	-.0782217	
			Upper Bound	.3222078	
		5% Trimmed Mean		.1158454	
		Median		.0080188	
		Variance		.036	
		Std. Deviation		.19078329	
		Minimum		-.02013	
		Maximum		.37477	
		Range		.39490	
		Interquartile Range		.36915	
		Skewness		.957	.845
		Kurtosis		-1.860	1.741
	TVS	Mean		.0244917	.09864518
		95% Confidence Interval for Mean	Lower Bound	-.2290838	
			Upper Bound	.2780672	
		5% Trimmed Mean		.0052068	
		Median		-.0649381	
		Variance		.058	
		Std. Deviation		.24163035	
		Minimum		-.11515	
		Maximum		.51126	
		Range		.62641	
		Interquartile Range		.23403	
		Skewness		2.310	.845
		Kurtosis		5.453	1.741

Case Processing Summary

		Cases					
		Valid		Missing		Total	
	year	N	Percent	N	Percent	N	Percent
X1	31.03.2013	14	100.0%	0	0.0%	14	100.0%
	31.03.2014	14	100.0%	0	0.0%	14	100.0%
	31.03.2015	14	100.0%	0	0.0%	14	100.0%
	31.03.2016	14	100.0%	0	0.0%	14	100.0%

	31.03.2017	14	100.0%	0	0.0%	14	100.0%
	31.03.2018	14	100.0%	0	0.0%	14	100.0%

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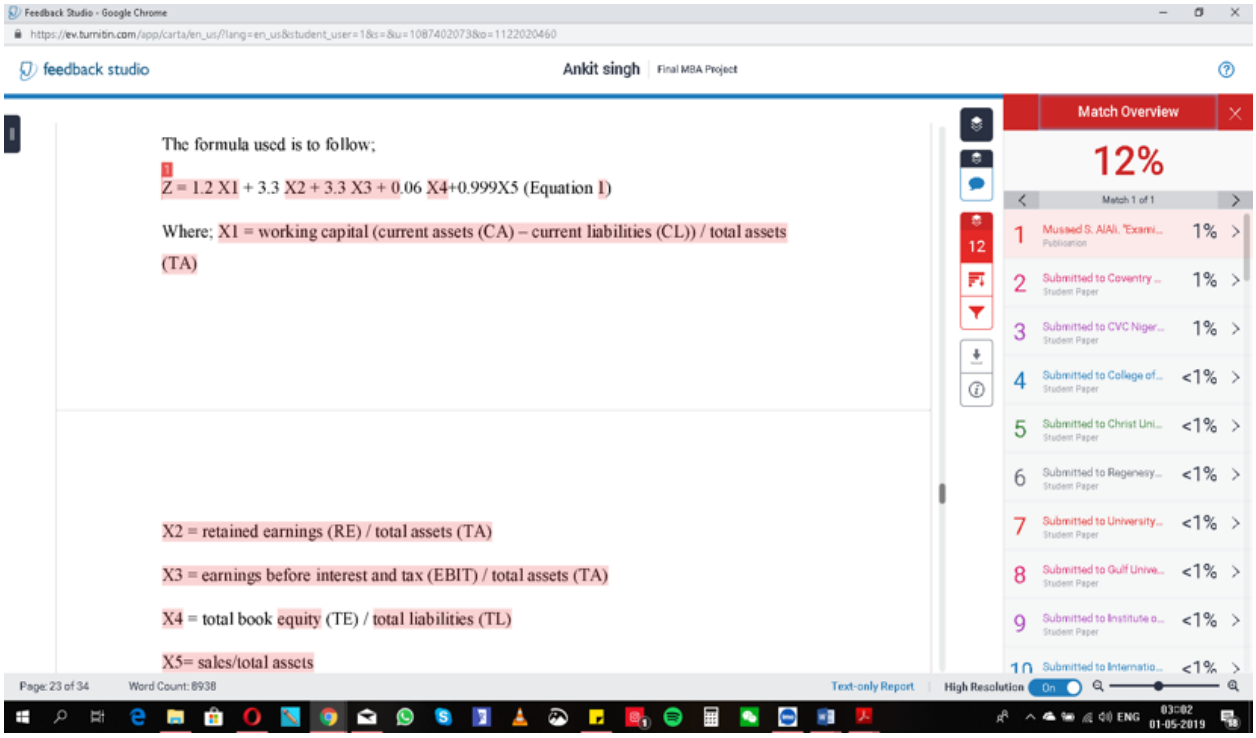

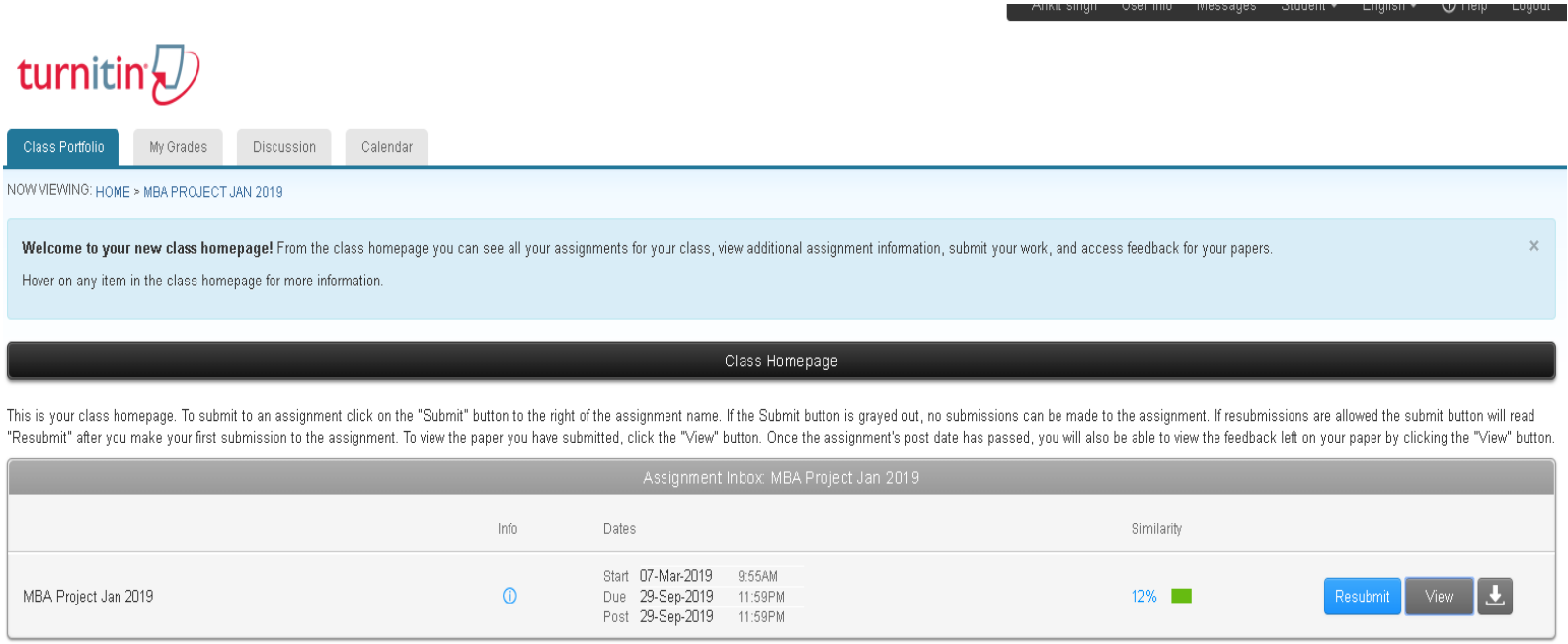
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Meeting 4

Date of Meeting	18 march 2019
Progress Made	
Agreed Action	Discussion of project work and IVs
Student Signature	
Supervisor's Signature	

Meeting 5

Date of Meeting	11 march 2019
Progress Made	
Agreed Action	Topic discussion, work Review
Student Signature	
Supervisor's Signature	

Meeting 6

Date of Meeting	1 march 2019
Progress Made	
Agreed Action	work Review
Student Signature	
Supervisor's Signature	

Meeting 7

Date of Meeting	15/04/2017
Progress Made	
Agreed Action	Discussion on Chapter and SPSS
Student Signature	
Supervisor's Signature	

Meeting 8

Date of Meeting	8/04/2017
Progress Made	
Agreed Action	Discussion on Chap 4 & SPSS
Student Signature	
Supervisor's Signature	

Meeting 9

Date of Meeting	01/04/2017
Progress Made	Discussion on IVs and DVs
Agreed Action	
Student Signature	
Supervisor's Signature	

Meeting 10

Date of Meeting	20 Apr 2019
Progress Made	MBA final project Submission
Agreed Action	
Student Signature	
Supervisor's Signature	

Meeting 11

Date of Meeting	25 Apr 2019
Progress Made	work and Discussion on Chapter 4
Agreed Action	
Student Signature	
Supervisor's Signature	

Meeting 12

Date of Meeting	22 Apr 2019
Progress Made	~~work~~ on Discussed for Chapter 4 and viva.
Agreed Action	
Student Signature	
Supervisor's Signature	

Meeting 13

Date of Meeting	29-Mar-2019
Progress Made	
Agreed Action	Enhanced
Student Signature	
Supervisor's Signature	

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Section D. Comments on Management of Project

(to be completed at the end of the dissertation process)

Student Comments

Want to thank my supervisor Mr. Sakaar to which under his ~~guidance~~ guidance this project was completed. Thank you sir.

Supervisor Comments

Signature of Student	Date 30-04-2019
Signature of Supervisor	Date 30-04-2019
Ethics Confirmed	Date

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