

Bankruptcy Prediction Using The Altman Z-Score Modification Model in India: A Case Study of Bharti Airtel Limited

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Abstract

Indian telecom sector is facing intense competition since Reliance Jio has entered the telecom market. Furthermore, the COVID-19 pandemic has further strained the sector. Considering these, evaluating a company's financial health is of paramount importance. Thus, Altman's Z-score modification model has been adopted to track Bharti Airtel's financial health in light of the aforementioned perspective. The study focuses on evaluating the financial standing of Bharti Airtel Limited & predicting bankruptcy using seven research hypotheses on the performance of the Z"-score model. The exploratory study is based on secondary data acquired from published sources for a period of ten years (2013 to 2022). The analysis based on Altman's Z-score modification model showed that the financial position of Bharti Airtel weakened as the financial scores moved from the grey zone to the distress zone towards the end of the study period. However, the net worth is positive, and revenue and market capitalization are also increasing, which underscores the need to reassess Altman's Z-score modification model within the service industry. This study fills a notable gap in the current literature by examining the model's limitations in evaluating financial health and considering additional parameters indicating financial stability. It highlights the dearth of studies in the literature and also proposes avenues for refining its coefficients to enhance its relevance in contemporary service industry contexts.

Keywords: Financial distress, Bankruptcy, Altman's Z-score modification model, Bankruptcy prediction, Bharti Airtel Limited, Indian Telecom sector

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1. Introduction

1.1 Financial Health

Financial health is of utmost concern for the survival of a business firm. Looking at the current business environment, the increasing uncertainty scenario reduces the certainty of existence for businesses. Perhaps the main concern for all business firms is ensuring the longevity of the business (Saini, 2018) and preventing bankruptcy. Bankruptcy occurs when a corporation lacks the finances to operate its business and to continue its operations (Winaya et al., 2020). While the balance sheet details the assets and liabilities of the company at any given time, the profit and loss account provides information about operating activities. Toit & Vermaak (2014) suggested that other sources should be considered in addition to the financial statements and that they may not be sufficient on their own.

Financial trouble that starts with uncertain income, inventory issues, uncollectible receivables, and asset turnover to diminished profitability typically precedes bankruptcy of a corporation (Santosa, 2010). To determine the financial health of any company, there are essentially two interested stakeholders. Users of accounting information are categorized as either internal or external. Shareholders, officers, managers, employees, and internal auditors are among the stakeholders with a stake in an organization's performance. External parties include banks, clients, creditors, and vendors.

Investors/shareholders (owners) utilize accounting data to decide whether to buy, sell, or hold onto shares, bonds, etc. They wonder if the company will be able to meet its desired rate of return. Accounting data is used by creditors (suppliers, banks) to make lending decisions, and they are curious about the firm's ability to pay for pricing and credit collection. Therefore, evaluating a company's financial strength can reveal a lot about it to the surrounding institutions and stakeholders. Their choices are influenced by the financial stability of the business organization.

There are many methods available that have been devised by financial management experts for determining a commercial firm's financial stability. However, Altman's Z score has been widely acknowledged as a popular and trustworthy instrument. There is proof that it predicts the bankruptcy of the underlying sample with a 76.9% accuracy rate (Begley et al., 1996).

1.2 Altman's Z-Score Model of Bankruptcy Prediction

Altman propounded three alternative models for predicting corporate bankruptcy labeled as the Altman Z-Score model, the Altman Z'-Score model, and the Altman Z''-Score model which are detailed in the research paper. The first Z-score model utilizes multi-factor variables and financial ratios to anticipate financial distress within manufacturing firms.

1.2.1 The Original Altman Z-Score model

Altman (1968) proposed the first multivariate bankruptcy prediction Z-Score model using multiple discriminant analyses (MDA) to combine the effects of all ratios, serving as a financial turnaround roadmap for the management of failing enterprises. The study focused on studying bankruptcy prediction of manufacturing companies in the public sector. Five anticipated factors were listed by Altman (1968) that can be used to assess the reliability of the multivariate model. Financial ratios are the model's foundation and can be up to 90% accurate in predicting bankruptcy (Chen & Shemer, 1981). The original Z-score model includes the following ratios:

Original Z-score model for Public Manufacturing Companies:

$$Z = 1.2X_1 + 1.4X_2 + 3.3X_3 + 0.6X_4 + 0.999X_5$$

Where,

X₁= Working capital / Total Assets

X₂= Retained earnings / Total Assets

X₃= Earnings before interest & taxes (EBIT) / Total Assets

$X4 = \text{Market value of equity} / \text{Book value of total liabilities}$

$X5 = \text{Sales} / \text{Total Assets}$

$Z = \text{Overall Index}$

X1= Working Capital/Total Assets Ratio (WC/TA)

The working capital/total assets ratio is a measurement of the firm's net liquid assets about its total capitalization and is frequently found in studies of corporate difficulties. The difference between current assets and current liabilities is known as working capital. Size and liquidity features are specifically taken into account. A company that consistently experiences operational losses will typically see a decline in current assets relative to total assets. This liquidity ratio turned out to be the most useful of the three that were examined. The current ratio and the quick ratio were two additional liquidity ratios that were examined. Some failing businesses were discovered to be less helpful and more susceptible to unfavorable trends.

X2= Retained Earnings/Total Assets Ratio (RE/TA)

The account for reporting a company's total reinvested profits and/or losses throughout its existence is called retained earnings. The balance is also known as earned surplus. The RE/TA ratio also calculates a company's leverage. Companies with high RE to TA have financed their assets using retained profits rather than a lot of debt. Most analysts and investors favor a greater Retained Earnings to Total Assets ratio since it shows that the company can keep more earnings. The ideal ratio for retained earnings to total assets is 1:1, or 100%.

X3= Earnings before interest and Taxes / Total Assets Ratio (EBIT/TA)

This ratio is a measurement of the actual asset productivity of the company, unaffected by taxes or leverage. This ratio seems to be particularly suitable for research dealing with corporate failure because a firm's ultimate viability depends on the earning capacity of its assets.

X4= Market value of equity / Book value of total liabilities Ratio (MVE/TL)

Liabilities comprise both present and long-term obligations, whereas equity is calculated as the market value of all outstanding shares of stock, preferred and common. The indicator displays how much the firm's assets can depreciate before the liabilities outweigh the assets and the company goes bankrupt (measured by the market value of stock + debt). This is the opposite of the widely used debt-to-equity ratio, often known as the total debt-to-total equity market value ratio or the total liabilities-to-market capitalization ratio.

X5= Sales/Total Assets Ratio (S/TA)

This ratio often known as an asset turnover ratio, calculates how much revenue a company generates using its assets. This ratio focuses on the assets' and management's ability to generate sales, hence the larger the ratio, the better the performance. A private non-manufacturing company's Z-Score does not take this ratio into account.

Ranges/Zone of Discriminations

According to Altman (1968), the threshold values for the Z score measurement of public manufacturing companies are given as follows:

Table 1: Public Manufacturing companies		
$Z > 2.99$	Safe Zone	The lower the Z value, the Higher the chances of bankruptcy.
$1.81 < Z < 2.99$	Grey Zone	
$Z < 1.81$	Distress Zone	

1.2.2 The Altman Z'-Score model (A Revised Z-Score Model)

Altman (1983) developed a revised model of Z-score calculation for bankruptcy prediction of private manufacturing companies. The model replaces the market value of equity with the book value in X4 as compared to the original model, keeping the rest of the ratios the same.

Revised Z'-score model for Private Manufacturing Companies:

$$Z' = 0.717X_1 + 0.847X_2 + 3.107X_3 + 0.420X_4 + 0.998X_5$$

Where,

X1= Working capital / Total Assets

X2= Retained earnings / Total Assets

X3= Earnings before interest & taxes (EBIT) / Total Assets

X4= Book value of equity / Book value of total liabilities

X5= Sales / Total Assets

Z'= Overall Index

Ranges/Zone of Discriminations

According to Altman (1983), the threshold values for the Z score measurement of private manufacturing companies are given as follows:

Table 2: Private Manufacturing companies		
$Z' > 2.99$	Safe Zone	The lower the Z value, the Higher the chances of bankruptcy.
$1.23 < Z' < 2.99$	Grey Zone	
$Z' < 1.23$	Distress Zone	

1.2.3 The Altman Z''-Score model (A modified Z-Score Model)

Altman (1983) further revised the Z'- score model for non-manufacturing/service companies and analyzed the characteristics and accuracy of a model without X5 - sales/total assets. A four-variable Z''-Score Model excluding the Sales/Total assets ratio X5 from the revised model, because of a potential industry effect. Thus, to minimize the potential industry effect, Altman (1983) estimated the following four-variable Z''-Score model for non-manufacturing/service companies.

Modified Z''-score model for non-manufacturing/service companies:

$$Z'' = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$$

Where,

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'' = Overall Index

Ranges/Zone of Discriminations

According to Altman (1983), the threshold values for the Z score measurement of non-manufacturing/service companies are given as follows:

Table 3: Non-Manufacturing/ Service companies

$Z'' > 2.6$	Safe Zone	The lower the Z'' value, the Higher the chances of bankruptcy.
$1.1 < Z'' < 2.6$	Grey Zone	
$Z'' < 1.1$	Distress Zone	

1.2.4 The Altman Z'' -Score model (A variation adopted for Emerging markets)

Altman et al. (1995) utilized an upgraded version of the Z'' Score model in their analysis of corporate entities in emerging markets. They have modified the original Altman Z-Score model to create the emerging market scoring (EMS) model, where a constant term of +3.25 was added to standardize the scores.

Modified Z'' -score model for emerging markets:

$$Z'' = 3.25 + 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$$

Where,

X_1 = Working capital/Total assets

X_2 = Retained Earnings/Total assets

X_3 = Earnings before interest and taxes/Total assets

X_4 = Book value of equity/Book value of total liabilities

Z'' = Overall Index

Ranges/Zone of Discriminations

According to Altman et al., (1995), the threshold values for the Z score measurement of emerging non-manufacturing/service companies are given as follows:

Table 4: Non-Manufacturing Emerging Companies

$Z'' > 2.6$	Safe Zone	The lower the Z'' value, the Higher the chances of bankruptcy.
$1.1 < Z'' < 2.6$	Grey Zone	
$Z'' < 1.1$	Distress Zone	

1.3 Research Objectives of the Study

The research paper outlines the two-fold perspective of evaluating the financial health of Bharti Airtel using Altman's Z-score modification model and viability of the Altman's Z-score modification model in the present-day context for the service industry. The following are the research objectives of the study:

- To evaluate Bharti Airtel's overall financial performance/health using Altman's Z- score modification model.
- To understand the effect of various financial parameters on the financial health of Bharti Airtel.
- To forecast Bharti Airtel's financial stability and predict bankruptcy using Altman's Z-score modification model.
- To check the rationality of Altman's Z-score modification model in assessing the bankruptcy of Bharti Airtel.

1.4 Problem under study

Financial difficulty can develop when a company's operating cash flows are insufficient to cover its present obligations. To fulfill its obligations, a company in financial trouble may potentially file for bankruptcy or be liquidated. Financial stability depends on the company's solvency, which must be managed in the most effective way possible to ensure the organization's continuous existence and steady growth. The most crucial element in determining an organization's financial stability is its firm's liquidity. In the overall strategy towards the detection and correction of the possible problem, proactive instruments are required as opposed to reactive ones. To evaluate the firm's financial health, we will examine Altman's Z-score modification model in this paper and assess the rationality of Altman's Z-score modification model in predicting the bankruptcy of Bharti Airtel.

The paper is divided into five sections. The first section details the introduction followed by a literature review in the second section. The third section describes the research methodology that is used in gathering data and how the data was analyzed. The data analysis results are discussed in section four while the conclusion and suggestions are included in section five.

2. Review of Literature

The majority of the literature review was completed from the databases that the researcher had access to. Banking areas, manufacturing industries, non-manufacturing industries/service sector, and telecommunication industries were the subject areas of the literature search using the keywords Altman's Z-score model, bankruptcy, financial distress, and financial health. Out of these, additional shortlisting was done based on the relevancy of the topic. Research papers from the current electronic databases were also included during the research.

After Altman's (1968) groundbreaking work, academics in banking, finance, and credit risk began to use the multivariate method of failure prediction. For several of these internal-rate-based models, the Z-Score model which is based on multiple discriminant analysis (MDA) has evolved into a prototype for researchers and continues to be the most sought method to forecast the bankruptcy of firms (Perez, 2006; Agarwal & Taffler, 2007; Foo & Pathak, 2019). In the past, it has been applied to predict the bankruptcy of firms in the USA, Greece, China, Pakistan, Indonesia, Bangladesh, Malaysia, Serbia and India. The selected applications of Altman's Z score are briefed in Table 5 and reviewed in subsequent sections.

Table 5: Global applicability of Altman's Z-score Model

S.No.	Title	Author	Year	Country
1	A Multicriteria Discrimination Method for the Prediction of Financial Distress: The Case of Greece.	Doumpos & Zopounidis	1999	Greece
2	Alternative Models for Assessing the Financial Condition of Business in Greece.	Theodossiou	1991	Greece
3	Investigation of Financial Distress with a Dynamic Logit Based on the Linkage Between Liquidity and Profitability Status of Listed Firms.	Christopoulos et al.	2018	Greece
4	The Success of Bankruptcy Prediction Models in Greece.	Gloubos & Grammatikos	1988	Greece

5	Efficiency, Taxation, and Solvency Issues for SMEs: The Case of Greece, Italy, and Spain.	Floros et al.	2023	Greece
6	Using Ants to Detect Fraudulent Financial Statements.	Katsis et al.	2012	Greece
7	Prediction of Corporate Failures for Small and Medium-Sized Enterprises in Europe: A Comparison of Statistical and Machine Learning Approaches.	Eskantar et al.	2021	Greece
8	Modeling Bankruptcy Prediction for Non-Financial Firms: The Case of Pakistan.	Abbas & Ahmad	2012	Pakistan
9	Business Failure Prediction for Publicly Listed Companies in China.	Wang & Campbell	2010	China
10	An Implementation of Soft Set Theory in the Variables Selection Process for Corporate Failure Prediction Models. Evidence from NASDAQ Listed Firms.	Christopoulos et al.	2019	USA
11	Hospitality bankruptcy in the United States of America: A multiple discriminants analysis-logit model comparison.	Barreda et al.	2017	USA
12	Analysis of Altman Z-Score and Zmijewski Bankruptcy Prediction in Telecommunication Sub-Sectors Registered in Indonesia Stock Exchange in 2016–2018.	Winaya et al.	2020	Indonesia
13	The Effect of Financial Ratios to Financial Distress Using Altman Z-score Method in Real Estate Companies Listed in Indonesia Stock Exchange Period.	Desiyanti et al.	2019	Indonesia
14	Financial performance analysis of construction company before and during the COVID-19 pandemic in Indonesia.	Daryanto & Rizki	2021	Indonesia
15	Bankruptcy analysis using the Altman Z-score model and Springate model in a retail trading company listed in the Indonesia Stock Exchange.	Prasetiyani & Sofyan	2020	Indonesia
16	Analysis of the prediction of bankruptcy of cigarette companies listed in the Indonesia Stock Exchange using the Altman (z-score) model and Zmijewski (x-score) model.	Prabowo	2019	Indonesia

17	Corporate Bankruptcy Prediction Using Altman's Z-Score Model: The Effect of Time and Methodology on Accuracy of the Model.	Singh & Singla	2019	India
18	An Empirical Analysis of Default Risk for Listed Companies in India: A Comparison of Two Prediction Models.	Gupta	2014	India
19	Application of Altman Z Score Model on Selected Indian Companies to Predict Bankruptcy	Apoorva et al.	2019	India
20	Prediction of Financial Health of Banking Industry in Bangladesh Using Altman's Z Score: A Comparison Between State-Owned Commercial Banks and Private Commercial Banks.	Parvin et al.	2013	Bangladesh
21	Financial Soundness of Cement Industry of Bangladesh: An Empirical Investigation Using Z-score.	Mizan & Hossain	2014	Bangladesh
22	Using Altman's Z-Score model to predict the financial hardship of companies listed in the trading services sector of the Malaysian Stock Exchange.	Soon et al.	2014	Malaysia
23	Bankruptcy forecasting of hotel companies in the Republic of Serbia using Altman's Z-score model.	Milašinović et al.	2019	Serbia
24	Understanding the Connection of Performance and Z-Scores for Manufacturing Firms in South Korea	Foo & Pathak	2019	South Korea

According to Altman (1983, 1993), management of troubled enterprises might use the Z-Score model as a roadmap for a financial turnaround. Mohammed (2016) discussed several methods for evaluating a company's financial health, but the Altman Z score stands out as a trustworthy measure. The article discussed research done at the Raysut Cement Company, for which financial data from the previous 8 years was used. The analysis showed that the company and its subsidiary companies are financially sound because their z score is greater than the benchmark (2.99). The article concluded that managers and stockholders both can use the Altman Z score to form their financial decisions. Moreover, Anjum (2012) discussed the business failure, ongoing alterations to the Altman Z score model between 1968 and 1993, and a comparison of several bankruptcy modeling approaches. According to the statement, the model is frequently used as a "predictor of bankruptcy." It claimed that the Altman Z score model could be used to predict insolvency in the modern economy two to three years before the bankruptcy case was made public.

Hussain et al., (2014) indicated that the Altman Z score model offers reliable outcomes for the Pakistani textile industry and suggests using it as a tool for financial decision-making. Bal (2015)

evaluated the Altman Z score model's applicability to five FMCG companies chosen between 2011 and 2015. The liquidity analysis is explained in great detail in the paper. It also concluded that the Z score model is useful for predicting FMCG companies' insolvency and suggested that financial investors might adopt it. The report also advised businesses to estimate Z-score frequently while formulating plans to strengthen their financial condition.

Further Al-Rawi et al., (2008) utilized the Altman z-score analysis to forecast the insolvency of a company. They have noted that the company's debt has escalated and that bankruptcy will likely occur soon. Bal et al., (2013) also analyzed the management of profits and methods for predicting solvency conditions using Z-score. Their analysis employed the Z-score to forecast IOCL's financial hardship and concluded that the company's financial position is not very strong based on the original Z-score. Although there have been many studies done in this area, there may have been very few done in the Indian context, particularly when it comes to FMCG companies.

Another investigation conducted by Panigrahi (2019) investigated the credibility of Altman's Z-Score model, analyzing financial data from 2012 to 2017 across different companies. The findings revealed an average Z-Score of 5.9, suggesting the pharmaceutical sector was within a secure range. Narendra and Rajendar (2016) used the Z-Score model to reveal that private enterprises outperformed public telecom companies. Zainuddin et al., (2016) showed that Malaysian telecommunications businesses have a strong financial standing and that 70% of them rely more on debt financing than equity in their capital structure. AlAli (2018) used the Altman Z-Score model to assess the financial standing of Kuwait Stock Exchange companies in the mobile communication industry. According to the report, the companies' demise was caused by a shortage of working capital. The Altman Z-Score approach was also utilized by Ramachandran and Kelkar (2019) to assess the financial stability of both public and private telecommunication providers operating in Oman. The study suggested using the right techniques to attract clients to increase revenue. Among the range of techniques available, this multivariate statistical model has long been recognized as the primary method utilized by scholars and practitioners globally for detecting signs of financial distress within firms at an early stage (Khan et al., 2020).

There are also a lot of thorough research papers that offer several ways to recognize failing corporations and use data from American companies. This research is therefore focused on studying the dynamics of financial distress in the Indian telecom sector in the context of limited literature discussing the financial distress of firms in developing countries like India using Altman's Z- score model. The extensive use of Altman's Z-score model across economic and financial research as a measure of financial strength indicates its widespread acknowledgment as a logical, simple, and reliable means of assessing financial distress among firms.

In contrast to that, some research studies indicated that the accuracy of Altman's Z-score model declined in the case of non-manufacturing companies. Grice et al., (2001) indicated that the model's coefficients should be re-estimated as the model's ability to accurately classify the firms as being financially distressed is likely to differ. Kacer et al., (2019) also suggested that the re-estimated coefficients will provide better accuracy in the results. However, there is a dearth of studies in the existing literature which raises the need to study the rationality of the model.

Moreover, prior studies focus primarily on manufacturing firms where tangible assets significantly influence financial health. Whereas service-sector firms, particularly in telecom operate under distinct financial dynamics which raises concerns about the model's applicability in this context.

3. Research Methodology

3.1 The Context

The research study is exploratory cum descriptive in nature based on the financial data of Bharti Airtel Limited which is a global leader in the telecommunications industry, the most reputable ICT service provider with a global network spanning over USA, Europe, Africa, the Middle East, Asia-Pacific, India, and SAARC areas, headquartered in New India. As per subscribers, Airtel Telecommunications is one of the top 3 global providers of mobile services (<https://www.airtel.in/>). The ratios calculated were based on the secondary data collected from financial statements. All the financial statements are presented in rupees (in crores) and US\$ (in millions) (₹/\$).

3.2 Data & its sources

This study is based on secondary data that was acquired from published sources i.e. financial statements available on moneycontrol.com. The data collected consists of the financial statements of the last ten years (2013-2022) and is accumulated from the balance sheets, P&L A/c, and annual reports of the company. Other documents such as the director's report, articles, and documents from websites have also been referred to. In the Annexure the main points of the financial statement are presented along with the calculations done by the authors.

3.3 Analysis & Presentation

The financial health of the companies cannot be determined by looking at the absolute numbers in the financial accounts. To determine the strengths and weaknesses of the companies, the financial analyst must therefore analyze the financial data. Although financial analysts have access to a variety of analytical tools, ratio analysis is the most effective method for determining the financial health of a company, therefore ratio analysis was used to analyze the collected data. However, the accounting ratios that are used to forecast a company's financial performance only provide an alert when it is too late to take corrective action. As a result, it is required to aggregate the various ratios to provide a single indicator of the likelihood of illness or failure. In these circumstances, multiple discrimination analysis is a helpful tool. MDA is used to combine the effects of all ratios.

So, Altman's Z"-score analysis has been adopted to track the company's financial health in light of the aforementioned perspective. The data analysis is carried out in MS Excel and the data analyzed was presented in the form of tables and charts in the subsequent section.

3.4 Bankruptcy prediction of selected telecom company using Altman's Z"-score Model

Altman (1983) created Altman's Bankruptcy Prediction Model using information gathered from major US corporations to forecast the likelihood that a business would fail. This model creates a single number by combining four financial ratios in a specified way. The Z" score refers to this figure. It is a general indicator of the stability of corporate finances. This number serves as the overall business financial health indicator. Altman's Z"- score modification model is used for non-manufacturing organizations as well as public and private companies in both the United States and other countries (Joshi, 2019). The study utilized Altman's Z"- score modification model for the non-manufacturing/ service sector which includes four ratios and uses the following formula:

$$Z'' = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$$

Where the ratios are as follows:

Variables	Formulae
X_1	Working Capital / Total Assets
X_2	Retained earnings / Total Assets
X_3	Earnings before interest & taxes (EBIT) / Total Assets

X_4	The market value of equity/book value of total liabilities
Z''	Overall Index

Note: The symbol “\” means division

Ranges/Zone of Discriminations

If the Z'' score is less than 1.1 then it indicates bad financial performance which may lead to bankruptcy. It indicates poor financial performance if the Z'' Score is > 1.1 and < 2.6 . If the Z'' score value is greater than 2.6 then it indicates good financial performance.

Table 6: Non- Manufacturing companies/ Service sector		
$Z'' > 2.6$	Safe Zone	The lower the Z'' value, the Higher the chances of bankruptcy.
$1.1 < Z'' < 2.6$	Grey Zone	
$Z'' < 1.1$	Distress Zone	

The modified or new Z'' -Score model is more appropriate for non-manufacturing/Service sector companies. Therefore, the Altman Z'' -score model has been applied to the selected company from the Indian Telecommunication sector.

4. Results & Discussion

When utilized for non-manufacturing organizations, the original Z-score model, which was designed generally for manufacturing enterprises, may generate some ambiguous findings, due to the fifth factor, "Sales/Total assets," in the first Z-score model. Due to the aforesaid constraint, Altman changed the earlier (1968) model. The new model employed different weights and only the first four variables (ratios) from the original multivariate formula were used. This variable varies widely among non-manufacturing enterprises.

As stated above, the modified Z- score model (Z'' – Score) is used for this study as Bharti Airtel Limited is a non-manufacturing firm.

Modified Z'' -score model for non-manufacturing/ Service Companies:

$$Z'' = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$$

Where,

- X_1 = Working Capital/Total Assets Ratio;
- X_2 = Retained Earnings/Total Assets;
- X_3 = Earnings before Interest and Taxes/Total Assets;
- X_4 = Book Value of Equity / Total Liabilities.

The Z'' of Bharti Airtel Limited is computed and compared with the cut-off and the results are presented in the following tables:

Table 7: Net Working Capital to Total Assets Ratio (X_1) (₹ in Crores/ US Million \$)

Years	Working Capital (WC)	Total Assets (TA)	$X_1=WC/TA$	Exchange rate
2012-2013 (in ₹)	(13,221.90)	87,883.20	(0.1504)	53.06
2012-2013 (in \$)	(2,491.88)	16,562.99		
2013-2014 (in ₹)	(12,369.20)	98,204.10	(0.1260)	54.78
2013-2014 (in \$)	(2,257.98)	17,927.00		
2014-2015 (in ₹)	(8,295.10)	126,423.70	(0.0656)	60.95
2014-2015 (in \$)	(1,360.97)	20,742.20		
2015-2016 (in ₹)	(16,425.80)	185,028.00	(0.0888)	66.79

2015-2016 (in \$)	(2,459.32)	27,702.95		
2016-2017 (in ₹)	(20,506.30)	191,637.60	(0.1070)	67.63
2016-2017 (in \$)	(3,032.13)	28,336.18		
2017-2018 (in ₹)	(22,144.50)	204,937.30	(0.1081)	64.94
2017-2018 (in \$)	(3,409.99)	31,557.95		
2018-2019 (in ₹)	(41,186.30)	222,907.50	(0.1848)	70.64
2018-2019 (in \$)	(5,830.45)	31,555.42		
2019-2020 (in ₹)	(34,429.90)	300,372.80	(0.1146)	72.15
2019-2020 (in \$)	(4,771.99)	41,631.71		
2020-2021 (in ₹)	(31,367.50)	277,747.10	(0.1129)	74.31
2020-2021 (in \$)	(4,221.17)	37,376.81		
2021-2022 (in ₹)	(36,666.40)	284,854.50	(0.1287)	75.45
2021-2022 (in \$)	(4,859.70)	37,754.08		

Source: X1 computed by researcher based on values extracted from audited financial statements 2013-2022. (INR/(US\$))

Inference: It may be observed from the following Table 7 that the working capital to total assets ratio of Bharti Airtel Limited had been around -0.1848 to -0.0656. The ratio of the company is very fluctuating. The company had negative working capital since its current obligations exceeded its current assets. Negative working capital is a sign of the company's unsound state. This ultimately pushes the business in the direction of bankruptcy.

Table 8: Retained Earnings to Total Assets Ratio (X2) (₹ in Crores/ US Million \$)

Years	Retained Earnings (RE)	Total Assets (TA)	X2=RE/TA	Exchange rate
2012-2013 (in ₹)	52,245.30	87,883.20	0.5945	53.06
2012-2013 (in \$)	9,846.45	16,562.99		
2013-2014 (in ₹)	64,727.20	98,204.10	0.6591	54.78
2013-2014 (in \$)	11,815.85	17,927.00		
2014-2015 (in ₹)	76,272.10	126,423.70	0.6033	60.95
2014-2015 (in \$)	12,513.88	20,742.20		
2015-2016 (in ₹)	1,09,730.40	185,028.00	0.5930	66.79
2015-2016 (in \$)	16,429.17	27,702.95		
2016-2017 (in ₹)	99,208.60	191,637.60	0.5177	67.63
2016-2017 (in \$)	14,669.32	28,336.18		
2017-2018 (in ₹)	1,00,862.20	204,937.30	0.4922	64.94
2017-2018 (in \$)	15,531.60	31,557.95		
2018-2019 (in ₹)	96,307.20	222,907.50	0.4321	70.64
2018-2019 (in \$)	13,633.52	31,555.42		
2019-2020 (in ₹)	98,347.20	300,372.80	0.3274	72.15
2019-2020 (in \$)	13,630.94	41,631.71		
2020-2021 (in ₹)	74,614.10	277,747.10	0.2686	74.31
2020-2021 (in \$)	10,040.92	37,376.81		
2021-2022 (in ₹)	76,134.80	284,854.50	0.2673	75.45
2021-2022 (in \$)	10,090.76	37,754.08		

Source: X2 computed by researcher based on values extracted from audited financial statements 2013-2022. (INR/(US\$))

Inference: Table 8 shows the trends in retained earnings to total assets of Bharti Airtel Limited. Retained profits as a percentage of total assets show how much of total assets have been financed by

retained earnings. The greater the ratio, the more stable the company's finances will be throughout periods of low profitability. Additionally, it shows that the business is using its earnings as a less expensive form of financing rather than borrowed financing. Here, the ratio kept on decreasing except in the years 2013-2014 & 2014-2015, demonstrating the company's inability to utilize its resources properly and pushing the ratio even lower than 0.5. A low ratio would imply growth, that comes from growing indebtedness rather than from reinvesting the profits, which may not be sustainable.

Table 9: EBIT (earnings before interest & taxes) to Total Assets Ratio (X3) (₹ in Crores/ US Million \$)

Years	Earnings before interest & taxes (EBIT)	Total Assets (TA)	X3=EBIT/TA	Exchange rate
2012-2013 (in ₹)	6,454.80	87,883.20	0.0734	53.06
2012-2013 (in \$)	1,216.51	16,562.99		
2013-2014 (in ₹)	8,584.50	98,204.10	0.0874	54.78
2013-2014 (in \$)	1,567.08	17,927.00		
2014-2015 (in ₹)	15,655.30	126,423.70	0.1238	60.95
2014-2015 (in \$)	2,568.54	20,742.20		
2015-2016 (in ₹)	10,934.30	185,028.00	0.0591	66.79
2015-2016 (in \$)	1,637.11	27,702.95		
2016-2017 (in ₹)	8,761.30	191,637.60	0.0457	67.63
2016-2017 (in \$)	1,295.47	28,336.18		
2017-2018 (in ₹)	(77.10)	204,937.30	(0.0004)	64.94
2017-2018 (in \$)	(11.87)	31,557.95		
2018-2019 (in ₹)	(8,048.80)	222,907.50	(0.0361)	70.64
2018-2019 (in \$)	(1,139.41)	31,555.42		
2019-2020 (in ₹)	(9,479.10)	300,372.80	(0.0316)	72.15
2019-2020 (in \$)	(1,313.80)	41,631.71		
2020-2021 (in ₹)	(3,442.20)	277,747.10	(0.0124)	74.31
2020-2021 (in \$)	(463.22)	37,376.81		
2021-2022 (in ₹)	(2,224.60)	284,854.50	(0.0078)	75.45
2021-2022 (in \$)	(294.84)	37,754.08		

Source: X3 computed by researcher based on values extracted from audited financial statements 2013- 2022. (INR/(US\$))

Inference: Earnings before interest & taxes to Total assets provide access to operational performance and earnings, which determine the success or failure of an organization (Table 9). The earnings before interest and taxes were negative from 2017 – 2018 onwards showing the company's inability to turn a profit from its activities, therefore causing the EBIT/TA ratio to decrease.

Table 10: Market Value of Equity to Total Liabilities Ratio (X4) (₹ in Crores/ US Million \$)

Years	Market value of Equity (MVE)	Total Liabilities (TL)	X4=MVE/TL	Exchange rate
2012-2013 (in ₹)	1,898.80	33,737.00	0.0563	53.06
2012-2013 (in \$)	357.85	6,358.27		
2013-2014 (in ₹)	1,998.70	31,476.10	0.0635	54.78
2013-2014 (in \$)	364.85	5,745.91		
2014-2015 (in ₹)	1,998.70	48,150.80	0.0415	60.95
2014-2015 (in \$)	327.92	7,900.04		
2015-2016 (in ₹)	1,998.70	73,298.90	0.0273	66.79
2015-2016 (in \$)	299.25	10,974.53		
2016-2017 (in ₹)	1,998.70	90,430.30	0.0221	67.63

2016-2017 (in \$)	295.53	13,371.33		
2017-2018 (in ₹)	1,998.70	1,02,076.40	0.0196	64.94
2017-2018 (in \$)	307.77	15,718.57		
2018-2019 (in ₹)	1,998.70	1,24,601.60	0.0160	70.64
2018-2019 (in \$)	282.94	17,638.96		
2019-2020 (in ₹)	2,727.80	1,98,943.60	0.0137	72.15
2019-2020 (in \$)	378.07	27,573.61		
2020-2021 (in ₹)	2,746.00	2,00,387.00	0.0137	74.31
2020-2021 (in \$)	369.53	26,966.36		
2021-2022 (in ₹)	2,795.00	2,05,924.70	0.0136	75.45
2021-2022 (in \$)	370.44	27,292.87		

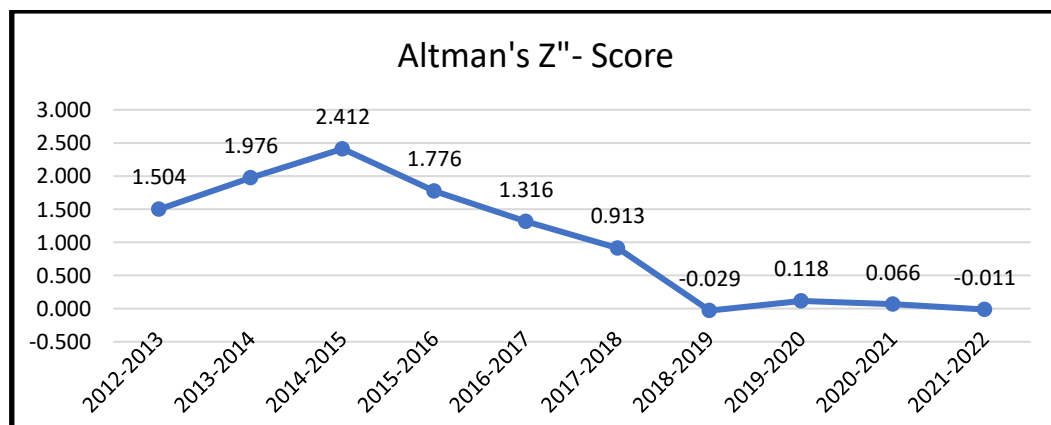
Source: X4 computed by researcher based on values extracted from audited financial statements 2013- 2022. (INR/(US\$))

Inference: Table 10 demonstrates that the market value of equity and total liabilities increased every year, although not in the same ratio. The equity-to-debt ratio shows how much of the owner's capital is invested in long-term debt. The corporation must pay interest to its creditors when it has a higher level of debt, which may raise shareholders' risk. The declining trend of this ratio is not good for Bharti Airtel Limited.

Table 11: Altman's Z'' Score ($6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$)

Year	X1=WC/TA	X2=RE/TA	X3=EBIT/TA	X4=MVE/TL	Z'' - Score	Zone
2012-2013	(0.1504)	0.5945	0.0734	0.0563	1.504	Grey
2013-2014	(0.1260)	0.6591	0.0874	0.0635	1.976	Grey
2014-2015	(0.0656)	0.6033	0.1238	0.0415	2.412	Grey
2015-2016	(0.0888)	0.5930	0.0591	0.0273	1.776	Grey
2016-2017	(0.1070)	0.5177	0.0457	0.0221	1.316	Grey
2017-2018	(0.1081)	0.4922	(0.0004)	0.0196	0.913	Distress
2018-2019	(0.1848)	0.4321	(0.0361)	0.0160	(0.029)	Distress
2019-2020	(0.1146)	0.3274	(0.0316)	0.0137	0.118	Distress
2020-2021	(0.1129)	0.2686	(0.0124)	0.0137	0.066	Distress
2021-2022	(0.1287)	0.2673	(0.0078)	0.0136	(0.011)	Distress

*Calculation is done in Microsoft Excel.



*Chart made in Microsoft Excel.

Fig.1. Altman's Z''-Score of Bharti Airtel

Inference: It is evident from Table 11's findings and the above Figure 1 that Bharti Airtel Limited's Z"-Score substantially dropped from 1.316 in 2016–2017 to 0.913 in 2017–2018, and it continued to drop, indicating the likelihood that the company was experiencing financial trouble and was on the verge of declaring bankruptcy. In actuality, according to the Z"-score model's discrimination zones, the corporation was in the grey zone from 2012-2013.

5. Conclusion

5.1 Results of Altman Z"-score Model

Every single stakeholder of the company needs to assess the company's financial standing to recognize financial distress in its initial phases for implementation of pertinent measures and strategies for resolution. Predictions related to corporate bankruptcy bear important practical implications for the organization of financial markets. As per the literature review, Altman's Z"-score is a key factor in determining how financially sound, a company is when evaluating its financial accuracy. The present study investigated the application of Altman's Z"-score model in predicting the corporate financial distress of Bharti Airtel Limited and concluded that the financial position of Bharti Airtel weakened as the financial scores moved from the grey zone to the distress zone towards the end of the study period.

5.2 Additional parameters incorporated by the authors

Apart from this, some additional parameters were incorporated by the authors to evaluate the financial performance of Bharti Airtel. The following parameters of financial health were taken into consideration:

i. Net Worth

Net worth also known as shareholders' equity is indeed a key parameter used to assess the financial position of a company. It measures the difference between a company's total assets and liabilities. The net worth of Bharti Airtel is calculated below during the study period:

Table 12: Net worth from 2013-2022 (₹ in Crores/ US Million \$)

Years	Total Liabilities (TL)	Total Assets (TA)	Net Worth (TA- TL)	Exchange rate
2012-2013 (in ₹)	87,883.20	33,737.00	54,146.20	53.06
2012-2013 (in \$)	1,656.29	635.82	1,020.47	
2013-2014 (in ₹)	98,204.10	31,476.10	66,728.00	54.78
2013-2014 (in \$)	1,792.70	574.59	1,218.10	
2014-2015 (in ₹)	1,26,423.70	48,150.80	78,272.90	60.95
2014-2015 (in \$)	2,074.22	790.00	1,284.21	
2015-2016 (in ₹)	1,85,028.00	73,298.90	1,11,729.1	66.79
2015-2016 (in \$)	2,770.29	1,097.45	1,672.84	
2016-2017 (in ₹)	1,91,637.60	90,430.30	1,01,207.30	67.63
2016-2017 (in \$)	2,833.61	1,337.13	1,496.48	
2017-2018 (in ₹)	2,04,937.30	1,02,076.40	1,02,860.90	64.94
2017-2018 (in \$)	3,155.79	1,571.85	1,583.93	
2018-2019 (in ₹)	2,22,907.50	1,24,601.60	98,305.90	70.64
2018-2019 (in \$)	3,155.54	1,763.89	1,391.64	
2019-2020 (in ₹)	3,00,372.80	1,98,943.60	1,01,429.20	72.15
2019-2020 (in \$)	4,163.17	2,757.36	1,405.81	

2020-2021 (in ₹)	2,77,747.10	2,00,387.00	77,360.10	74.31
2020-2021 (in \$)	3,737.68	2,696.63	1,041.04	
2021-2022 (in ₹)	2,84,854.50	2,05,924.70	78,929.80	75.45
2021-2022 (in \$)	3,775.40	2,729.28	1,046.12	

Source: Net worth computed by researcher based on values extracted from audited financial statements 2013-2022. (INR/(US\$))

Interpretation: The above table shows the net worth of the company which is positive from the year 2013 to 2022 highlighting the financial stability and soundness of the company.

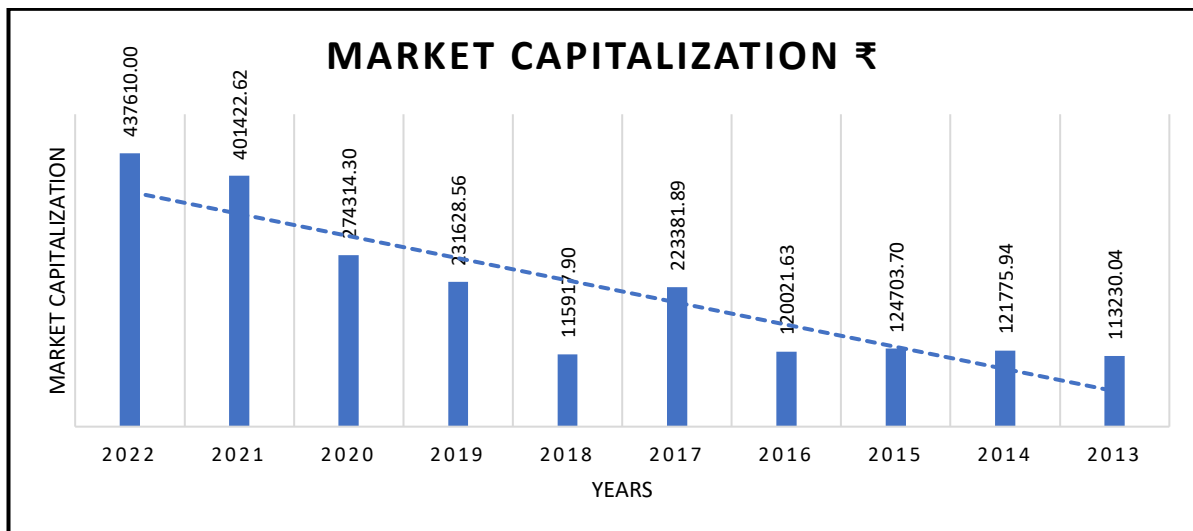
ii. Market Capitalization

Market capitalization, commonly known as "market cap," is a metric representing the total value of a firm determined by the stock market. It is computed by multiplying the market value of each outstanding share of the company's stock by its current share price. It is one of the most effective and widely considered ways of evaluating the value of a company. The market capitalization of Bharti Airtel is calculated in Table 13.

Table 13: Market Capitalization from 2013-2022 (₹ in Crores/ US Million \$)

Years	Market Capitalization	% Change	Exchange rate
2012-2013 (in ₹)	1,13,230.04	(2.94)	53.06
2012-2013 (in \$)	21,340.00		
2013-2014 (in ₹)	1,21,775.94	4.15	54.78
2013-2014 (in \$)	22,230.00		
2014-2015 (in ₹)	1,24,703.70	(7.93)	60.95
2014-2015 (in \$)	20,460.00		
2015-2016 (in ₹)	1,20,021.63	(12.17)	66.79
2015-2016 (in \$)	17,970.00		
2016-2017 (in ₹)	2,23,381.89	(83.78)	67.63
2016-2017 (in \$)	33,030.00		
2017-2018 (in ₹)	1,15,917.90	(45.95)	64.94
2017-2018 (in \$)	17,850.00		
2018-2019 (in ₹)	2,31,628.56	83.63	70.64
2018-2019 (in \$)	32,790.00		
2019-2020 (in ₹)	2,74,314.30	15.95	72.15
2019-2020 (in \$)	38,020.00		
2020-2021 (in ₹)	4,01,422.62	42.10	74.31
2020-2021 (in \$)	54,020.00		
2021-2022 (in ₹)	4,37,610.00	7.36	75.45
2021-2022 (in \$)	58,000.00		

Source: Market Capitalization computed by researcher based on values extracted from audited financial statements 2013- 2022. (INR/(US\$))



*Chart made in Microsoft Excel.

Fig.2. Market cap history of Bharti Airtel from 2013 to 2022

Interpretation: The Market capitalization of Bharti Airtel is calculated above in Table 13. It is evident from the above table that the Market capitalization is continuously increasing since 2013, as the trend line in the figure also shows an increasing trend from 2013 to 2022.

iii. Total Revenue

Total revenue is a crucial financial metric that provides insights into a company's financial health, reflecting its potential to generate income, compete effectively in the market, and promote long-term growth and profitability. The total revenue of Bharti Airtel is calculated and the results are presented in the form of a table and figure given below.

Table 14: Total Revenue from 2013-2022 (₹ in Crores/ US Million \$)

Years	Total Revenue (TR)	Exchange rate
2012-2013 (in ₹)	76,905.00	53.06
2012-2013 (in \$)	14,493.97	
2013-2014 (in ₹)	85,746.00	54.78
2013-2014 (in \$)	15,652.79	
2014-2015 (in ₹)	92,039.00	60.95
2014-2015 (in \$)	15,100.74	
2015-2016 (in ₹)	96,532.00	66.79
2015-2016 (in \$)	14,453.06	
2016-2017 (in ₹)	94,251.00	67.63
2016-2017 (in \$)	13,936.27	
2017-2018 (in ₹)	82,639.00	64.94
2017-2018 (in \$)	12,725.44	
2018-2019 (in ₹)	80,780.00	70.64
2018-2019 (in \$)	11,435.45	
2019-2020 (in ₹)	87,539.00	72.15
2019-2020 (in \$)	12,132.92	
2020-2021 (in ₹)	1,00,616.00	74.31
2020-2021 (in \$)	13,540.03	

2021-2022 (in ₹)	1,16,547.00	75.45
2021-2022 (in \$)	15,446.92	

Source: Total revenue computed by researcher based on values extracted from audited financial statements 2013- 2022. (INR/(US\$))

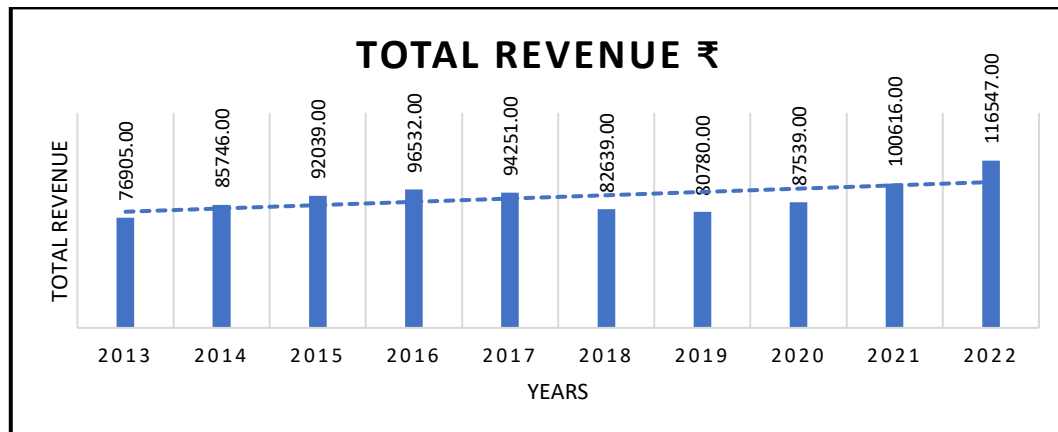


Fig.3. Total Revenue of Bharti Airtel from 2013 to 2022

Interpretation: As depicted by the table and figure, the results of Bharti Airtel's total revenue from 2013 to 2022 show an increasing trend, which is a sign of the healthy financial position of the company.

5.3 Concluding remarks

The results of Altman's Z"-score model contradict the current financial position of the company as measured by other parameters of financial health such as net worth, market capitalization & total revenue. The possible reasons for non-conformity could be the hypotheses given by (Altman et al., 2014).

Seven research hypotheses were considered and validated by (Altman et al., 2014) in their study, suggesting further improvisations to the existing model to boost the accuracy to a much higher level. The hypotheses were associated with the following effects on the classification performance of the Z"-Score Model:

H ₁ : Obsolescence of the coefficients (re-estimation of coefficients)
H ₂ : Method of estimation
H ₃ : Bankruptcy year
H ₄ : Size of the firm
H ₅ : Age of the firm
H ₆ : Industry of the firm
H ₇ : Country of origin
<i>Source: Altman et al., (2014)</i>

Thus, evidence indicates that the Z"-score model may be somewhat improved by considering the above-mentioned arguments, to make it a more efficient model to be utilized for bankruptcy prediction. It is recommended by the authors to consider the parameters stated above for bankruptcy prediction in future analysis. The present study of bankruptcy prediction also contributes to a better assessment of viable companies in the telecommunication sector and assists in corporate governance decisions of interested stakeholders on one hand, and the academic community on the other, opening the path for future research. However, more research could be done to assess the financial situation using various methods.

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Annexure

Financial data of Bharti Airtel Limited (all Figures in crores)

Years	2022	2021	2020	2019	2018	2017	2016	2015	2014	2013	Average
Total current assets	37,817.80	40,071.90	58,781.30	19,514.90	21,495.90	15,310.10	11,421.00	14,756.40	6,738.80	6,203.80	23,211.19
Total current liabilities	74,484.20	71,439.40	93,211.20	60,701.20	43,640.40	35,816.40	27,846.80	23,051.50	19,108.00	19,425.70	46,872.48
Net working capital	(36,666.40)	(31,367.50)	(34,429.90)	(41,186.30)	(22,144.50)	(20,506.30)	(16,425.80)	(8,295.10)	(12,369.2)	(13,221.9)	(23,661.29)
Total non-current assets	247,036.70	237,675.20	241,591.50	203,392.60	183,441.40	174,954.60	173,607.00	111,667.30	91,465.30	81,679.40	174,651.10
Total assets	284,854.50	277,747.10	300,372.80	222,907.50	204,937.30	191,637.60	185,028.00	126,423.70	98,204.10	87,883.20	197,999.58
Retained earnings	76,134.80	74,614.10	98,347.20	96,307.20	1,00,862.20	99,208.60	1,09,730.40	76,272.10	64,727.20	52,245.30	84,844.91
Total liabilities = total current liabilities + total non-current liabilities	2,05,924.70	2,00,387.00	1,98,943.60	1,24,601.60	1,02,076.40	90,430.30	73,298.90	48,150.80	31,476.10	33,737.00	1,10,902.64
Profit Before interest & Tax	(2,224.60)	(3,442.20)	(9,479.10)	(8,048.80)	(77.10)	8,761.30	10,934.30	15,655.30	8,584.50	6,454.80	2,711.84
Market value of Equity	2,795.00	2,746.00	2,727.80	1,998.70	1,998.70	1,998.70	1,998.70	1,998.70	1,998.70	1,898.80	2,215.98
Total non-current liabilities	131,440.50	128,947.60	105,732.40	63,900.40	58,436.00	54,613.90	45,452.10	25,099.30	12,368.10	14,311.30	64,030.16
Total current liabilities	74,484.20	71,439.40	93,211.20	60,701.20	43,640.40	35,816.40	27,846.80	23,051.50	19,108.00	19,425.70	46,872.48
Total liabilities = total current liabilities + total non-current liabilities	2,05,924.70	2,00,387.00	1,98,943.60	1,24,601.60	1,02,076.40	90,430.30	73,298.90	48,150.80	31,476.10	33,737.00	1,10,902.64

(Source: Annual reports of Bharti Airtel Limited Year 2013- 2022 from moneycontrol.com)