# IS NIFTY INDIA DIGITAL A GOOD INDEX TO INVEST IN?

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## LITERATURE REVIEW

- Liquidity-profitability analysis, prediction of bankruptcy - A study of select telecom companies ~ Dr. Bhavna Raj
- Determinants of equity share prices in India: A panel data approach ~ P. Srinivasan
- Panel data analysis Fixed and Random Effects using Stata ~ Oscar Torres-Reyna
- Panel data modelling for Indian food grain production ~ Ramji Madhaiyan and Subh S S
- Financial sector Development, Openness and Entrepreneurship: Panel regression analysis ~ Yilmaz Bayar and Zeki Ucar
- The Underlying Effect of Risk Management On Banks' Financial Performance:An Analytical Study On Commercial and Investment Banking in Bahrain ~ Mohammad Salem Oudat and Basel. J Ali
- Macroeconomic, Institutional and Bank-Specific Determinants of Non-Performing Loans in Emerging Market Economies: A Dynamic Panel Regression Analysis ~ Bayar, Yilmaz
- A Panel Data Analysis on Sustainable Economic Growth in India, Brazil, and Romania ~ Rathnaswamy Malar Kumaran
- Does Financial Crisis Give Impacts on Bahrain Islamic Banking Performance? A Panel Regression Analysis ~ Muhamad Abduh
- Estimation model and selection method of panel data regression : an overview of common effect, fixed effect, and random effect model ~ Rizka Zulfikar
- Evaluating factors of profitability for Indian banking sector: A panel regression ~ Rohit Bansal and Arun Singh
- Foreign Direct Investment In Latin America: A Panel Regression Study ~ Rahim M. Quazi
- Interest Rate, Exchange Rate, and Stock Prices of Islamic Banks: A Panel Data Analysis ~ Ayub, Aishahton and Masih, Mansur
- Practical Regression: Fixed Effects Models ~ David Dranove
- Panel Data Analysis for Sabah Construction Industries: Choosing the Best Model ~Anwar Fitrianto
- Regression with panel data: An Introduction ~ Prof. Bernard Fingleton
- Quality of governance, public spending on health and health status in Sub Saharan Africa: a panel data regression analysis ~ Bernadette O'Hare
- Regression Analysis and Panel Data ~ Joachim Landstrom, Uppsala University

## PROBLEM STATEMENT

- India is moving with full speed towards digitalization and with the aim of capturing companies pertaining to the Digital theme, an index called Nifty India Digital was formed.
- It comprises of companies from various industries like software, e-commerce, IT enabled services, industrial electronics and telecom services companies.
- So, it is difficult to understand if one should invest in this index or not since it is a mixture of 30 different companies with different financial positions.
- Hence, keeping Altman Z Scores of individual companies as the main parameter under study, we aim to understand if Nifty India Digital is a good fit for investment.

**OBJECTIVES**

1. To calculate the probability of bankruptcy of companies using Altman Z Scores.
2. To categorize the companies into Danger Zone, Grey Zone and Safe Zone depending on their average position of the past 5 years.
3. To study the effect of various liquidity and profitability ratios on the Altman Z Scores of the companies.
4. To understand the probable causes of the companies positions in the various zones.
5. To conclude whether the index is a good fit for investment.
6. To suggest how the index can become better.

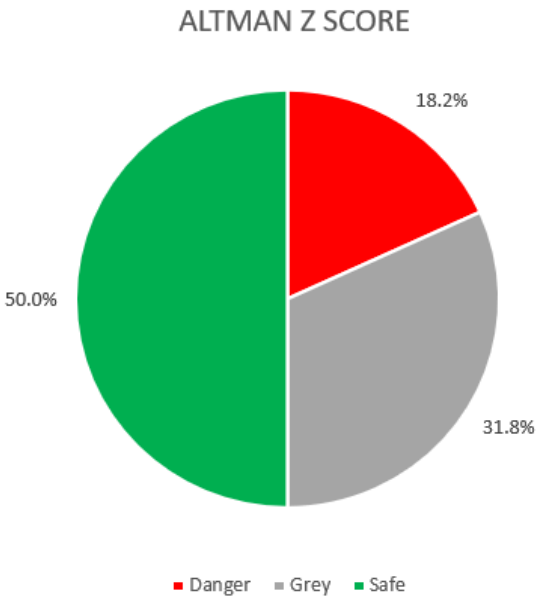
**NIFTY INDIA DIGITAL INDEX**

- The Nifty India Digital Index aims to track the performance of portfolio of stocks that broadly represent the Digital theme within basic industries like software, e-commerce, IT enabled services, industrial electronics and telecom services companies.
- The index is expected to act as a benchmark for asset managers and be a reference index tracked by passive funds in the form of ETFs, index funds and structured products.
- Digitalization is happening rapidly and is touching every aspect of our lives. Thus, we have chosen to study this index as it aims to capture the performance of companies exposed to the Digital theme, which will likely continue to increase in importance in the future.
- The largest 30 stocks from eligible basic industries are chosen based on their six-month average free-float market capitalization as on the cutoff dates at the end of January and July, it said.
- The base date for the index is April 01, 2005 and base value is 1000. Index reconstitution will be done on a semi-annual basis, it added.

**METHODOLOGY**

- **Altman Z Score**
  - Altman's Z-score Model is a numerical measurement that is used to predict the chances of bankruptcy.
  - In its initial test, the Altman Z-Score was found to be 72% accurate in predicting bankruptcy two years prior to the event. In subsequent tests over 31 years up until 1999, the model was found to be 80-90% accurate in predicting bankruptcy one year prior to the event.
  - Altman's Z-score model combines five financial ratios to predict the probability of a company becoming insolvent in the next two years.
  - Altman Z-Score = 1.2A + 1.4B + 3.3C + 0.6D + 1.0E
  - Where:
    - A = working capital / total assets
    - B = retained earnings / total assets
    - C = earnings before interest and tax / total assets

- D = market value of equity / total liabilities
- E = sales / total assets




- This chart shows the percentage of companies lying in each of the zones in accordance to the average of their Altman Z-scores.
- We can clearly see that half of the companies studied lie in the safe zone, 31.8% in the grey zone and the rest 18.2% in the danger zone.

**Panel Data Regression**

- Panel data regression is a powerful way to control dependencies of unobserved, independent variables on a dependent variable, which can lead to biased estimators in traditional linear regression models.
- Cross-sectional data analysis is when you analyse a data set at a fixed point in time.
- Time-series data only observes one object recurrently over time.
- Panel data comprises characteristics of both into one model by collecting data from multiple, same objects over time.
- There are 3 types of regression for panel data:
  - Pooled OLS: It can be described as simple Ordinary Least Squared model that is performed on panel data. It ignores time and individual characteristics and focuses only on dependencies between the individuals.
  - Fixed-Effects Model: This determines individual effects of unobserved, independent variables as constant over time.
  - Random-Effects Model: This determines individual effects of unobserved, independent variables as random variables over time. They are able to "switch" between OLS and Fixed-Effects and hence, can focus on both, dependencies between and within individuals.

**Ratios**

- The ratios used in our study are Current Ratio, Quick Ratio, Return on Assets, Return on Equity, Return on Capital Employed and Debt-Equity Ratio.

| | Current Ratio | Quick Ratio | Return on Assets Ratio | Return on Equity Ratio | Return on Capital Employed Ratio | Debt – Equity Ratio |
|---|---|---|---|---|---|---|
| **Definition** | An efficient current ratio shows good liquidity of the company. | Quick Ratio measures a company's capacity to pay it's current liabilities without needing to sell it's inventory. | Return on Assets is a ratio which shows the profitability of a company with respect to it's assets. | ROE is a measure of profitability of a company with respect to it's equity. | ROCE is a measure of the profitability as well as capital efficiency of a company. | The debt-equity ratio is a measure of the total long term debt and equity capital in the business |
| **Range** | 1.2 - 2 | > 1 | 5% - 20% | 15% - 20% | ≥ 20% | 1 – 1.5 |
| **Calculation** | $\frac{Current\ As}{Current\ Liab}$ | $\frac{Current\ Assets - Inventor}{Current\ Liabilities}$ | $\frac{Net\ Profit}{Total\ Assets}$ | $\frac{Net\ Income}{Shareholder's\ Eq}$ | $\frac{EBIT}{Capital\ Employ}$ | $\frac{Total\ Liabilitie}{Shareholder's\ Eq}$ |

**DATA DESCRIPTION**

- The companies lying under NIFTY INDIA DIGITAL index are studied.
- The regressand (that is, the dependent variable) is Altman Z score which was calculated using the five financial ratios whose calculation was mentioned above.
- The regressors (that is, the independent variables) are the liquidity and profitability ratios just mentioned, that is Current Ratio, Quick Ratio, Return on Asset, Return on Equity, Return on Capital Employed and Debt-Equity Ratio.
- All the data for these calculations have been collected from Moneycontrol for the past 5 years.
- The datasets are:

| *Years* | *ID* | *Company* | *Altman Z Score* | *Debt-Equity Ratio* | *Current Ratio* | *Quick Ratio* | *ROA* | *ROE* | *ROCE* |
|---|---|---|---|---|---|---|---|---|---|
| 2018 | 1 | BHARTIARTL | 0.89 | 0.61 | 0.49 | 0.49 | 0.03 | 0.07 | 3.09 |
| 2019 | 1 | BHARTIARTL | 0.65 | 0.85 | 0.32 | 0.32 | -0.83 | -1.90 | -0.12 |
| 2020 | 1 | BHARTIARTL | 0.07 | 0.81 | 0.63 | 0.63 | -12.01 | -35.70 | 0.95 |
| 2021 | 1 | BHARTIARTL | 0.39 | 1.22 | 0.56 | 0.56 | -9.07 | -32.57 | 4.05 |
| 2022 | 1 | BHARTIARTL | 0.58 | 1.31 | 0.51 | 0.51 | -1.27 | -4.59 | 5.66 |
| 2018 | 2 | IDEA | 0.55 | 1.86 | 0.91 | 0.90 | -4.37 | -14.56 | -2.26 |
| 2019 | 2 | IDEA | 0.19 | 1.71 | 0.36 | 0.36 | -6.03 | -22.13 | -5.27 |
| 2020 | 2 | IDEA | -0.99 | 10.71 | 0.23 | 0.23 | -31.95 | -812.45 | -6.11 |
| 2021 | 2 | IDEA | -0.99 | -4.18 | 0.29 | 0.29 | -22.79 | 0.00 | -4.53 |
| 2022 | 2 | IDEA | 0.50 | -3.11 | 0.35 | 0.35 | -14.56 | 0.00 | -5.50 |
| 2018 | 3 | INTELLECT | 2.08 | 0.18 | 1.95 | 1.95 | 3.06 | 4.69 | 6.17 |
| 2019 | 3 | INTELLECT | 1.71 | 0.11 | 1.96 | 1.96 | 9.99 | 14.73 | 15.47 |
| 2020 | 3 | INTELLECT | 1.31 | 0.25 | 1.49 | 1.49 | -2.05 | -3.50 | -0.94 |
| 2021 | 3 | INTELLECT | 1.82 | 0.01 | 1.87 | 1.87 | 11.93 | 17.47 | 19.17 |
| 2022 | 3 | INTELLECT | 1.80 | 0.00 | 1.98 | 1.98 | 9.35 | 13.88 | 18.32 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2018 | 4 | TATACOMM | 1.44 | 0.06 | 0.70 | 0.69 | 2.06 | 3.02 | 2.76 |
| 2019 | 4 | TATACOMM | 1.19 | 0.04 | 0.64 | 0.62 | -3.50 | -5.39 | 4.80 |
| 2020 | 4 | TATACOMM | 1.25 | 0.07 | 0.65 | 0.63 | 1.54 | 2.53 | 8.28 |
| 2021 | 4 | TATACOMM | 1.69 | 0.06 | 0.87 | 0.87 | 6.78 | 10.61 | 12.03 |
| 2022 | 4 | TATACOMM | 1.85 | 0.05 | 1.03 | 1.03 | 7.92 | 11.90 | 14.01 |

***DANGER ZONE***

***GREY ZONE***

| *Years* | *ID* | *Company* | *Altman Z Score* | *Debt-Equity Ratio* | *Current Ratio* | *Quick Ratio* | *ROA* | *ROE* | *ROCE* |
|---|---|---|---|---|---|---|---|---|---|
| 2018 | 1 | BSOFT | 2.28 | 0.17 | 1.89 | 1.89 | 8.44 | 11.80 | 11.08 |
| 2019 | 1 | BSOFT | 2.26 | 0.03 | 2.17 | 2.17 | 10.07 | 14.15 | 12.33 |
| 2020 | 1 | BSOFT | 2.73 | 0.00 | 2.75 | 2.75 | 8.41 | 11.61 | 17.39 |
| 2021 | 1 | BSOFT | 3.07 | 0.00 | 3.64 | 3.64 | 10.55 | 13.89 | 19.51 |
| 2022 | 1 | BSOFT | 3.47 | 0.00 | 4.36 | 4.36 | 14.74 | 18.63 | 23.72 |
| 2018 | 2 | CYIENT | 3.25 | 0.00 | 5.56 | 5.56 | 16.73 | 19.49 | 24.22 |
| 2019 | 2 | CYIENT | 3.24 | 0.00 | 6.07 | 6.07 | 17.08 | 19.70 | 23.34 |
| 2020 | 2 | CYIENT | 2.59 | 0.00 | 3.68 | 3.68 | 9.27 | 11.81 | 15.29 |
| 2021 | 2 | CYIENT | 2.61 | 0.00 | 4.06 | 4.06 | 9.15 | 11.60 | 14.23 |
| 2022 | 2 | CYIENT | 3.06 | 0.00 | 4.45 | 4.45 | 17.86 | 21.89 | 24.75 |
| 2018 | 3 | HCLTECH | 3.16 | 0.00 | 3.29 | 3.28 | 22.43 | 26.70 | 32.52 |
| 2019 | 3 | HCLTECH | 3.10 | 0.00 | 2.93 | 2.93 | 21.85 | 26.88 | 32.00 |
| 2020 | 3 | HCLTECH | 2.49 | 0.00 | 1.69 | 1.69 | 16.75 | 24.04 | 28.84 |
| 2021 | 3 | HCLTECH | 2.88 | 0.00 | 2.77 | 2.76 | 15.79 | 20.07 | 27.76 |
| 2022 | 3 | HCLTECH | 3.10 | 0.01 | 2.97 | 2.97 | 20.35 | 25.53 | 30.14 |
| 2018 | 4 | NAUKRI | 2.47 | 0.00 | 2.84 | 2.84 | 6.93 | 8.65 | 8.63 |
| 2019 | 4 | NAUKRI | 2.62 | 0.00 | 2.54 | 2.54 | 9.57 | 12.12 | 18.55 |
| 2020 | 4 | NAUKRI | 2.43 | 0.00 | 2.10 | 2.10 | 6.61 | 8.45 | 18.04 |
| 2021 | 4 | NAUKRI | 2.60 | 0.00 | 4.30 | 4.30 | 5.10 | 5.93 | 7.65 |
| 2022 | 4 | NAUKRI | 3.67 | 0.00 | 2.86 | 2.86 | 55.18 | 63.85 | 3.93 |
| 2018 | 5 | TANLA | 2.34 | 0.00 | 1.68 | 1.68 | 1.44 | 1.97 | 0.95 |
| 2019 | 5 | TANLA | 2.37 | 0.07 | 1.87 | 1.87 | 1.62 | 2.44 | 3.02 |
| 2020 | 5 | TANLA | 1.95 | 0.00 | 2.29 | 2.29 | -22.41 | -29.73 | -27.67 |
| 2021 | 5 | TANLA | 3.39 | 0.00 | 1.78 | 1.78 | 15.96 | 23.79 | 24.54 |
| 2022 | 5 | TANLA | 3.52 | 0.00 | 1.71 | 1.71 | 10.60 | 16.94 | 21.94 |
| 2018 | 6 | TECHM | 2.94 | 0.01 | 2.85 | 2.85 | 14.92 | 20.46 | 22.85 |
| 2019 | 6 | TECHM | 2.86 | 0.00 | 2.28 | 2.28 | 14.43 | 21.21 | 24.31 |
| 2020 | 6 | TECHM | 3.05 | 0.00 | 3.16 | 3.16 | 14.95 | 20.35 | 21.93 |
| 2021 | 6 | TECHM | 3.02 | 0.00 | 3.36 | 3.36 | 12.70 | 16.94 | 20.39 |
| 2022 | 6 | TECHM | 3.03 | 0.00 | 2.56 | 2.56 | 14.03 | 19.00 | 22.37 |
| 2018 | 7 | WIPRO | 2.91 | 0.11 | 2.86 | 2.84 | 13.16 | 18.27 | 23.87 |
| 2019 | 7 | WIPRO | 2.81 | 1.00 | 2.96 | 2.94 | 11.36 | 15.41 | 20.44 |
| 2020 | 7 | WIPRO | 2.87 | 0.11 | 2.78 | 2.77 | 13.29 | 18.68 | 23.62 |
| 2021 | 7 | WIPRO | 2.87 | 0.13 | 2.50 | 2.50 | 15.30 | 22.23 | 27.49 |
| 2022 | 7 | WIPRO | 2.75 | 0.14 | 2.23 | 2.23 | 15.09 | 22.32 | 27.32 |

***SAFE ZONE***

| *Years* | *ID* | *Company* | *Altman Z Score* | *Debt-Equity Ratio* | *Current Ratio* | *Quick Ratio* | *ROA* | *ROE* | *ROCE* |
|---|---|---|---|---|---|---|---|---|---|
| 2018 | 1 | COFORGE | 3.18 | 0.01 | 3.41 | 3.41 | 12.67 | 15.34 | 18.08 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2019 | 1 | COFORGE | 3.55 | 0.01 | 3.94 | 3.94 | 15.05 | 17.54 | 21.27 |
| 2020 | 1 | COFORGE | 3.41 | 0.00 | 3.27 | 3.27 | 18.00 | 21.39 | 24.11 |
| 2021 | 1 | COFORGE | 3.57 | 0.00 | 2.33 | 2.33 | 10.66 | 13.29 | 15.28 |
| 2022 | 1 | COFORGE | 3.51 | 0.15 | 1.04 | 1.04 | 19.88 | 29.21 | 28.25 |
| 2018 | 2 | HONAUT | 7.16 | 0.00 | 2.08 | 2.00 | 10.26 | 17.60 | 17.43 |
| 2019 | 2 | HONAUT | 7.73 | 0.00 | 2.27 | 2.18 | 12.41 | 20.53 | 31.28 |
| 2020 | 2 | HONAUT | 7.58 | 0.00 | 2.53 | 2.42 | 14.21 | 22.56 | 30.30 |
| 2021 | 2 | HONAUT | 9.97 | 0.00 | 2.75 | 2.68 | 11.63 | 17.83 | 23.31 |
| 2022 | 2 | HONAUT | 8.77 | 0.00 | 3.23 | 3.14 | 8.45 | 11.95 | 15.96 |
| 2018 | 3 | INFY | 3.35 | 0.00 | 3.78 | 3.78 | 21.29 | 30.63 | 31.00 |
| 2019 | 3 | INFY | 3.31 | 0.00 | 3.00 | 3.00 | 18.62 | 25.23 | 31.38 |
| 2020 | 3 | INFY | 3.28 | 0.00 | 2.88 | 2.88 | 19.17 | 24.97 | 31.28 |
| 2021 | 3 | INFY | 3.21 | 0.00 | 2.74 | 2.74 | 19.21 | 23.44 | 32.23 |
| 2022 | 3 | INFY | 3.28 | 0.00 | 2.10 | 2.10 | 21.36 | 25.44 | 38.46 |
| 2018 | 4 | LTI | 4.16 | 0.00 | 3.10 | 3.10 | 22.96 | 31.19 | 30.79 |
| 2019 | 4 | LTI | 4.24 | 0.00 | 3.27 | 3.27 | 23.69 | 31.29 | 41.38 |
| 2020 | 4 | LTI | 3.57 | 0.00 | 2.87 | 2.87 | 18.66 | 29.68 | 33.35 |
| 2021 | 4 | LTI | 3.80 | 0.00 | 3.27 | 3.27 | 17.90 | 25.76 | 32.13 |
| 2022 | 4 | LTI | 4.00 | 0.00 | 3.19 | 3.19 | 19.31 | 26.90 | 33.88 |
| 2018 | 5 | LTTS | 4.09 | 0.00 | 2.89 | 2.89 | 18.87 | 24.90 | 24.87 |
| 2019 | 5 | LTTS | 4.30 | 0.02 | 2.90 | 2.90 | 21.70 | 28.74 | 38.59 |
| 2020 | 5 | LTTS | 3.73 | 0.01 | 2.83 | 2.83 | 19.35 | 30.15 | 35.15 |
| 2021 | 5 | LTTS | 3.53 | 0.00 | 3.28 | 3.28 | 13.96 | 20.15 | 24.63 |
| 2022 | 5 | LTTS | 3.86 | 0.00 | 3.27 | 3.27 | 16.09 | 23.06 | 28.81 |
| 2018 | 6 | MPHASIS | 2.98 | 0.03 | 3.29 | 3.29 | 15.85 | 18.93 | 23.91 |
| 2019 | 6 | MPHASIS | 2.98 | 0.07 | 2.11 | 2.11 | 17.98 | 23.57 | 29.19 |
| 2020 | 6 | MPHASIS | 2.90 | 0.06 | 2.11 | 2.11 | 21.86 | 32.77 | 33.78 |
| 2021 | 6 | MPHASIS | 3.30 | 0.04 | 2.72 | 2.72 | 18.68 | 25.76 | 31.07 |
| 2022 | 6 | MPHASIS | 3.35 | 0.08 | 2.01 | 2.01 | 17.85 | 27.77 | 33.77 |
| 2018 | 7 | OFSS | 3.96 | 0.00 | 3.85 | 3.85 | 21.63 | 26.42 | 38.00 |
| 2019 | 7 | OFSS | 4.38 | 0.00 | 5.57 | 5.57 | 28.84 | 33.05 | 49.79 |
| 2020 | 7 | OFSS | 3.77 | 0.00 | 9.61 | 9.61 | 26.08 | 28.73 | 35.68 |
| 2021 | 7 | OFSS | 4.00 | 0.00 | 10.56 | 10.56 | 26.49 | 29.03 | 37.82 |
| 2022 | 7 | OFSS | 4.08 | 0.00 | 9.85 | 9.85 | 28.11 | 31.21 | 39.62 |
| 2018 | 8 | PERSISTENT | 3.70 | 0.00 | 6.55 | 6.55 | 15.01 | 16.66 | 16.53 |
| 2019 | 8 | PERSISTENT | 3.53 | 0.00 | 5.74 | 5.74 | 12.65 | 14.18 | 19.58 |
| 2020 | 8 | PERSISTENT | 2.39 | 0.00 | 4.48 | 4.48 | 15.31 | 17.73 | 22.99 |
| 2021 | 8 | PERSISTENT | 4.11 | 0.00 | 4.70 | 4.70 | 15.42 | 18.26 | 23.81 |
| 2022 | 8 | PERSISTENT | 5.17 | 0.00 | 3.79 | 3.79 | 17.38 | 20.66 | 26.98 |
| 2018 | 9 | SONATSOFTW | 4.06 | 0.00 | 4.00 | 4.00 | 24.83 | 30.78 | 30.30 |
| 2019 | 9 | SONATSOFTW | 4.03 | 0.00 | 5.02 | 5.02 | 26.24 | 32.34 | 43.37 |
| 2020 | 9 | SONATSOFTW | 4.07 | 0.00 | 2.06 | 2.06 | 32.38 | 56.59 | 62.54 |
| 2021 | 9 | SONATSOFTW | 4.06 | 0.00 | 2.98 | 2.98 | 22.87 | 33.80 | 43.79 |
| 2022 | 9 | SONATSOFTW | 4.08 | 0.00 | 3.27 | 3.27 | 29.27 | 41.13 | 46.27 |
| 2018 | 10 | TATAELXSI | 7.44 | 0.00 | 4.23 | 4.23 | 25.30 | 32.50 | 31.70 |
| 2019 | 10 | TATAELXSI | 6.09 | 0.00 | 5.39 | 5.39 | 25.36 | 30.75 | 45.30 |
| 2020 | 10 | TATAELXSI | 4.60 | 0.00 | 5.53 | 5.53 | 18.43 | 23.49 | 30.55 |
| 2021 | 10 | TATAELXSI | 6.22 | 0.00 | 5.26 | 5.26 | 21.44 | 27.22 | 35.65 |
| 2022 | 10 | TATAELXSI | 9.88 | 0.00 | 4.13 | 4.13 | 25.34 | 34.33 | 42.91 |
| 2018 | 11 | TCS | 4.13 | 0.00 | 4.85 | 4.85 | 27.72 | 33.27 | 41.50 |
| 2019 | 11 | TCS | 3.73 | 0.00 | 4.18 | 4.18 | 30.21 | 38.10 | 50.71 |

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|---|---|---|---|---|---|---|---|---|---|
| 2020 | 11 | TCS | 4.24 | 0.00 | 3.30 | 3.30 | 31.68 | 44.72 | 52.79 |
| 2021 | 11 | TCS | 4.09 | 0.00 | 2.92 | 2.92 | 2.30 | 41.39 | 52.75 |
| 2022 | 11 | TCS | 4.18 | 0.00 | 2.49 | 2.48 | 31.49 | 49.48 | 60.23 |

## *CALCULATION OF ALTMAN Z-SCORE*

| *Years* | *ID* | *Company* | *Working Capital* | *Total Assets* | *Retained Earnings* | *EBIT* | *MV of Equity* | *Total Liabilities* | *Sales* | *Altman Z Score* |
|---|---|---|---|---|---|---|---|---|---|---|
| *2018* | 1 | BHARTIARTL | -22145 | 204937 | 100862 | 4387 | 354.7 | 204937 | 53663 | 0.8929 |
| *2019* | 1 | BHARTIARTL | -41187 | 222907 | 96307 | 2603 | 310.44 | 222907 | 49606 | 0.6451 |
| *2020* | 1 | BHARTIARTL | -34430 | 300372 | 98347 | -39557 | 437.41 | 300372 | 54317 | 0.0680 |
| *2021* | 1 | BHARTIARTL | -31368 | 277747 | 74614 | -6648 | 515.01 | 277747 | 64325 | 0.3943 |
| *2022* | 1 | BHARTIARTL | -36667 | 284854 | 76134 | 9911 | 751.61 | 284854 | 70641 | 0.5841 |
| *2018* | 2 | BSOFT | 445 | 2101 | 1466 | 205 | 127.98 | 2101 | 1442 | 2.2759 |
| *2019* | 2 | BSOFT | 522 | 1663 | 1129 | 150 | 96.01 | 1663 | 1001 | 2.2613 |
| *2020* | 2 | BSOFT | 560 | 1672 | 1156 | 235 | 59.13 | 1672 | 1462 | 2.7293 |
| *2021* | 2 | BSOFT | 816 | 1833 | 1337 | 297 | 248.34 | 1833 | 1640 | 3.0661 |
| *2022* | 2 | BSOFT | 974 | 2008 | 1533 | 407 | 451 | 2008 | 2049 | 3.4750 |
| *2018* | 3 | COFORGE | 529 | 1784 | 1393 | 283 | 838.65 | 1784 | 1645 | 3.1766 |
| *2019* | 3 | COFORGE | 645 | 1986 | 1624 | 375 | 1283.9 | 1986 | 1999 | 3.5521 |
| *2020* | 3 | COFORGE | 666 | 2346 | 1904 | 495 | 1117.7 | 2346 | 2231 | 3.4100 |
| *2021* | 3 | COFORGE | 475 | 2249 | 1692 | 289 | 2872.5 | 2249 | 2412 | 3.5696 |
| *2022* | 3 | COFORGE | 23 | 3240 | 2087 | 743 | 4427.1 | 3240 | 3313 | 3.5094 |
| *2018* | 4 | CYIENT | 1228 | 2401 | 2005 | 526 | 593.82 | 2401 | 1439 | 3.2535 |
| *2019* | 4 | CYIENT | 1304 | 2580 | 2181 | 542 | 569.51 | 2580 | 1614 | 3.2413 |
| *2020* | 4 | CYIENT | 1045 | 2672 | 2043 | 349 | 214.53 | 2672 | 1523 | 2.5889 |
| *2021* | 4 | CYIENT | 1417 | 3038 | 2342 | 366 | 605.75 | 3038 | 1379 | 2.6101 |
| *2022* | 4 | CYIENT | 1357 | 3186 | 2543 | 691 | 894.78 | 3186 | 1750 | 3.0621 |
| *2018* | 5 | HCLTECH | 10755 | 32818 | 27285 | 9148 | 446.42 | 32818 | 22073 | 3.1578 |
| *2019* | 5 | HCLTECH | 12328 | 37456 | 30168 | 9947 | 510.4 | 37456 | 26012 | 3.1016 |
| *2020* | 5 | HCLTECH | 9589 | 53515 | 36753 | 11415 | 404.61 | 53515 | 32606 | 2.4942 |
| *2021* | 5 | HCLTECH | 17695 | 55361 | 43010 | 12587 | 924.36 | 55361 | 35673 | 2.8759 |
| *2022* | 5 | HCLTECH | 17844 | 53423 | 42048 | 13377 | 1131.9 | 53423 | 40638 | 3.1024 |
| *2018* | 6 | HONAUT | 1075 | 2431 | 1409 | 381 | 17013 | 2431 | 2689 | 7.1645 |
| *2019* | 6 | HONAUT | 1409 | 2890 | 1738 | 558 | 21987 | 2890 | 3174 | 7.7271 |
| *2020* | 6 | HONAUT | 1786 | 3457 | 2169 | 693 | 25717 | 3457 | 3290 | 7.5750 |
| *2021* | 6 | HONAUT | 2235 | 3952 | 2570 | 524 | 47276 | 3952 | 3042 | 9.9739 |
| *2022* | 6 | HONAUT | 2472 | 4010 | 2827 | 463 | 39589 | 4010 | 2948 | 8.7664 |
| *2018* | 7 | IDEA | -987 | 101950 | 26161 | -2064 | 46.91 | 101950 | 27828 | 0.5541 |
| *2019* | 7 | IDEA | -34492 | 233053 | 54702 | -8220 | 17.75 | 233053 | 36858 | 0.1928 |
| *2020* | 7 | IDEA | -73276 | 228886 | -19799 | -46909 | 3.1 | 228886 | 44715 | -0.9862 |
| *2021* | 7 | IDEA | -46957 | 203131 | -66479 | -28322 | 9.25 | 203131 | 41672 | -0.9905 |
| *2022* | 7 | IDEA | -39584 | 193931 | 93560 | -7263 | 9.65 | 193931 | 38220 | 0.5040 |
| *2018* | 8 | INFY | 32428 | 75877 | 62410 | 19908 | 506.56 | 75877 | 61941 | 3.3505 |
| *2019* | 8 | INFY | 30793 | 78930 | 60533 | 19927 | 689.21 | 78930 | 73107 | 3.3064 |
| *2020* | 8 | INFY | 28600 | 81041 | 59808 | 20591 | 607.6 | 81041 | 79047 | 3.2750 |
| *2021* | 8 | INFY | 30660 | 93939 | 69029 | 24603 | 1367 | 93939 | 85912 | 3.2080 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *2022* | 8 | INFY | 27461 | 99387 | 66597 | 28623 | 1886.9 | 99387 | 103940 | 3.2773 |
| *2018* | 9 | INTELLECT | 271 | 1,077 | 639 | 72 | 166.04 | 1,077 | 681 | 2.0780 |
| *2019* | 9 | INTELLECT | 362 | 1,371 | 864 | 77 | 215.46 | 1,371 | 313 | 1.7071 |
| *2020* | 9 | INTELLECT | 276 | 1,522 | 826 | 50 | 54.201 | 1,522 | 314 | 1.3135 |
| *2021* | 9 | INTELLECT | 470 | 1,737 | 1,119 | 72 | 737.3 | 1,737 | 349 | 1.8190 |
| *2022* | 9 | INTELLECT | 688 | 2,161 | 1,388 | 61 | 942.3 | 2,161 | 362 | 1.8036 |
| *2018* | 10 | LTI | 2,699 | 5,051 | 3,701 | 1,482 | 1328.2 | 5,051 | 6,906 | 4.1603 |
| *2019* | 10 | LTI | 2,860 | 6,226 | 4,696 | 1,964 | 1635 | 6,226 | 8,907 | 4.2364 |
| *2020* | 10 | LTI | 3,902 | 8,316 | 5,105 | 2,079 | 1385.8 | 8,316 | 10,184 | 3.5721 |
| *2021* | 10 | LTI | 5,260 | 9,988 | 6,844 | 2,464 | 3982.1 | 9,988 | 11,566 | 3.8026 |
| *2022* | 10 | LTI | 5,722 | 11,703 | 8,327 | 3,078 | 6110.2 | 11,703 | 14,406 | 3.9950 |
| *2018* | 11 | LTTS | 1,186 | 2,592 | 1,944 | 681 | 1176.8 | 2,592 | 3,506 | 4.0911 |
| *2019* | 11 | LTTS | 1,488 | 3,225 | 2,380 | 942 | 1545.8 | 3,225 | 4,712 | 4.2994 |
| *2020* | 11 | LTTS | 1,799 | 4,081 | 2,563 | 1,090 | 1128.4 | 4,081 | 5,181 | 3.7251 |
| *2021* | 11 | LTTS | 2,303 | 4,820 | 3,289 | 938 | 2616.1 | 4,820 | 4,964 | 3.5264 |
| *2022* | 11 | LTTS | 2,790 | 5,708 | 3,941 | 1,290 | 5080.1 | 5,708 | 5,873 | 3.8619 |
| *2018* | 12 | MPHASIS | 1,596 | 4,665 | 3,714 | 935 | 737.63 | 4,665 | 3,274 | 2.9833 |
| *2019* | 12 | MPHASIS | 1,027 | 4,277 | 3,077 | 979 | 874.42 | 4,277 | 3,434 | 2.9763 |
| *2020* | 12 | MPHASIS | 1,348 | 5,512 | 3,490 | 1,450 | 606.15 | 5,512 | 4,347 | 2.9026 |
| *2021* | 12 | MPHASIS | 1,929 | 5,944 | 4,123 | 1,497 | 1687.6 | 5,944 | 5,561 | 3.2976 |
| *2022* | 12 | MPHASIS | 1,962 | 6,918 | 4,259 | 1,678 | 3237 | 6,918 | 7,389 | 3.3515 |
| *2018* | 13 | NAUKRI | 951 | 2,627 | 1,985 | 281 | 1191.3 | 2,627 | 915 | 2.4657 |
| *2019* | 13 | NAUKRI | 944 | 2,940 | 2,184 | 398 | 1820.9 | 2,940 | 1,098 | 2.6171 |
| *2020* | 13 | NAUKRI | 682 | 3,111 | 2,269 | 325 | 2026.7 | 3,111 | 1,272 | 2.4286 |
| *2021* | 13 | NAUKRI | 2,297 | 5,305 | 4,435 | 349 | 4262.9 | 5,305 | 1,098 | 2.5962 |
| *2022* | 13 | NAUKRI | 2,018 | 16,169 | 13,843 | 10,105 | 4504.4 | 16,169 | 1,562 | 3.6745 |
| *2018* | 14 | OFSS | 2,106 | 4,650 | 3,764 | 1,486 | 3065 | 4,650 | 3,861 | 3.9571 |
| *2019* | 14 | OFSS | 2,082 | 4,445 | 3,672 | 1,986 | 2821.4 | 4,445 | 3,580 | 4.3793 |
| *2020* | 14 | OFSS | 3,572 | 6,066 | 5,292 | 2,016 | 1684.1 | 6,066 | 3,525 | 3.7724 |
| *2021* | 14 | OFSS | 3,743 | 6,187 | 5,451 | 2,192 | 2861.5 | 6,187 | 3,645 | 3.9952 |
| *2022* | 14 | OFSS | 3,867 | 6,441 | 5,603 | 2,379 | 3393 | 6,441 | 3,896 | 4.0781 |
| *2018* | 15 | PERSISTENT | 1166 | 2279 | 1973 | 455 | 648.91 | 2279 | 1732 | 3.6996 |
| *2019* | 15 | PERSISTENT | 1189 | 2488 | 2142 | 438 | 603.72 | 2488 | 1959 | 3.5346 |
| *2020* | 15 | PERSISTENT | 1131 | 2661 | 192 | 537 | 541.03 | 2661 | 2108 | 2.3937 |
| *2021* | 15 | PERSISTENT | 1682 | 3275 | 2641 | 671 | 1902.5 | 3275 | 2479 | 4.1070 |
| *2022* | 15 | PERSISTENT | 1506 | 3944 | 3127 | 918 | 4749.9 | 3944 | 3575 | 5.1688 |
| *2018* | 16 | SONATSOFTW | 405 | 1233 | 642 | 265 | 187.05 | 1233 | 2453 | 4.0626 |
| *2019* | 16 | SONATSOFTW | 530 | 1528 | 757 | 352 | 215.34 | 1528 | 2960 | 4.0307 |
| *2020* | 16 | SONATSOFTW | 358 | 1616 | 656 | 394 | 116.83 | 1616 | 3743 | 4.0683 |
| *2021* | 16 | SONATSOFTW | 530 | 1946 | 892 | 367 | 366.54 | 1946 | 4228 | 4.0628 |
| *2022* | 16 | SONATSOFTW | 651 | 2555 | 1086 | 518 | 544.02 | 2555 | 5553 | 4.0818 |
| *2018* | 17 | TANLA | 163 | 904 | 652 | 6 | 187.05 | 904 | 691 | 2.3427 |
| *2019* | 17 | TANLA | 265 | 1057 | 688 | 22 | 215.34 | 1057 | 809 | 2.3714 |
| *2020* | 17 | TANLA | 280 | 887 | 654 | -234 | 116.83 | 887 | 1060 | 1.9451 |
| *2021* | 17 | TANLA | 254 | 993 | 652 | 203 | 366.54 | 993 | 891 | 3.3878 |
| *2022* | 17 | TANLA | 296 | 1118 | 686 | 154 | 544.02 | 1118 | 1246 | 3.5232 |
| *2018* | 18 | TATACOMM | -983 | 12902 | 8518 | 529 | 603.98 | 12902 | 5120 | 1.4395 |
| *2019* | 18 | TATACOMM | -1354 | 12613 | 7913 | -239 | 582.66 | 12613 | 5389 | 1.1877 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| *2020* | 18 | TATACOMM | -1446 | 13489 | 7935 | 428 | 224.66 | 13489 | 5750 | 1.2521 |
| *2021* | 18 | TATACOMM | -449 | 14197 | 8781 | 1336 | 1028.7 | 14197 | 6225 | 1.6925 |
| *2022* | 18 | TATACOMM | 110 | 14720 | 9517 | 1608 | 1202.1 | 14720 | 6587 | 1.8523 |
| *2018* | 19 | TATAELXSI | 617 | 948 | 676 | 754 | 935.92 | 948 | 1386 | 7.4442 |
| *2019* | 19 | TATAELXSI | 822 | 1143 | 880 | 517 | 904.3 | 1143 | 1596 | 6.0943 |
| *2020* | 19 | TATAELXSI | 984 | 1388 | 1027 | 358 | 610.88 | 1388 | 1609 | 4.6000 |
| *2021* | 19 | TATAELXSI | 1127 | 1716 | 1289 | 433 | 2662.2 | 1716 | 1826 | 6.2177 |
| *2022* | 19 | TATAELXSI | 1285 | 2169 | 1538 | 363 | 8795.2 | 2169 | 2470 | 9.8815 |
| *2018* | 20 | TCS | 54164 | 91056 | 75675 | 31961 | 1335.4 | 91056 | 97356 | 4.1272 |
| *2019* | 20 | TCS | 509 | 99500 | 78523 | 40875 | 1892.2 | 99500 | 123170 | 3.7337 |
| *2020* | 20 | TCS | 55168 | 104975 | 73993 | 42734 | 1769.6 | 104975 | 131306 | 4.2374 |
| *2021* | 20 | TCS | 54635 | 109381 | 74424 | 41439 | 3114.7 | 109381 | 135963 | 4.0895 |
| *2022* | 20 | TCS | 56291 | 121263 | 76807 | 50209 | 3705.2 | 121263 | 160341 | 4.1800 |
| *2018* | 21 | TECHM | 9315 | 26798 | 19049 | 4977 | 559.34 | 26798 | 23661 | 2.9406 |
| *2019* | 21 | TECHM | 10072 | 30339 | 20153 | 5470 | 701.74 | 30339 | 27219 | 2.8566 |
| *2020* | 21 | TECHM | 12330 | 30322 | 21377 | 5398 | 523.17 | 30322 | 29225 | 3.0529 |
| *2021* | 21 | TECHM | 14059 | 33374 | 24526 | 5589 | 942.29 | 33374 | 29640 | 3.0194 |
| *2022* | 21 | TECHM | 10329 | 35004 | 25359 | 6348 | 1477.9 | 35004 | 34726 | 3.0254 |
| *2018* | 22 | WIPRO | 27932 | 58671 | 41357 | 10418 | 213.15 | 58671 | 44710 | 2.9112 |
| *2019* | 22 | WIPRO | 31586 | 66998 | 48185 | 10395 | 257.45 | 66998 | 48123 | 2.8083 |
| *2020* | 22 | WIPRO | 29270 | 65306 | 45311 | 11542 | 194.32 | 65306 | 50407 | 2.8683 |
| *2021* | 22 | WIPRO | 27247 | 65736 | 44145 | 13087 | 410.06 | 65736 | 50299 | 2.8689 |
| *2022* | 22 | WIPRO | 28599 | 80382 | 53254 | 15631 | 587.01 | 80382 | 59574 | 2.7483 |

**INCONSISTENCIES IN THE DATA**

- It is hard to meet all the assumptions accurately.
- Multicollinearity is very high between Quick and Current ratio because the values are same for both the ratios for most of the companies.
- Debt-Equity ratio for most of the companies are 0.

*Why are the debt-equity ratios of most companies that lie in the grey and safe zone 0?*

The debt-to-equity ratio compares an organization's liabilities to its shareholders' equity and is used to gauge how much debt or leverage the organization is using.

It's calculated by dividing a firm's total liabilities by total shareholders' equity.

Tech companies that deliver all its products online and who do not have to worry about storing physical products or maintaining a customer-facing physical space generally have a low debt-to-equity ratio. As our index comprises of industries in the Digital field, thus it can be observed that the companies in the grey and safe zone that have very low risk of bankruptcy have a debt-to-equity ratio of nearly 0.

A steadily rising D/E ratio may make it harder for a company to obtain financing in the future. The growing reliance on debt could eventually lead to difficulties in servicing the company's current loan obligations. Very high D/E ratios may eventually result in a loan default or bankruptcy. (Can be seen in the case of BhartiAirtel)

A negative debt to equity ratio occurs when a company has interest rates on its debts that are greater than the return on investment. Companies that experience a negative debt to equity ratio may be seen as risky to investors because this debt is a sign of financial instability. (Seen in Idea Company)

*Why are current and Quick ratios equal?*

Both the current ratio and quick ratio measure a company's short-term liquidity, or its ability to generate enough cash to pay off all debts should they become due at once.

**ANALYSIS AND RESULTS**

*DANGER ZONE*

- Z-score less than 1.81 means the danger zone; i.e. Imminent bankruptcy.
- BhartiAirtel , Idea, Intellect and TATACOMM are the 4 companies lie in the danger zone based on the average of their last 5 years data calculations.

Aim

Our motive is to check which ratios among the liquidity and profitability ratios affects the Altman Z score the most in the danger zone.

Hypothesis

H0: Ratios are not significant to Altman Z scores.

H1: Ratios are significant to Altman Z scores.

Best Model Determination

Using panel data regression in R, we tested the three models (fixed effect model, random effect model and Ordinary least squares model) for each zone. To determine the model that best fits our data, we used the three tests:

1. Chow test: Chow Test examines whether parameters of one group of the data are equal to those of other groups. Simply put, the test checks whether the data can be pooled. If only intercepts are different across groups, this is a fixed effect model, which is simple to handle. Our null hypothesis is that data can be pooled. The alternative hypothesis is to use the fixed effect model.

2. Hausman test: The Hausman test can be used to differentiate between fixed effects model and random effects model in panel analysis. In this case, Random effects (RE) is preferred under the null hypothesis due to higher efficiency, while under the alternative Fixed effects (FE) is at least as consistent and thus preferred.
3. Lagrange Multiplier test: The LM test helps you decide between a random effects regression and a simple OLS regression. The null hypothesis in the LM test is that variances across entities is zero. This is, no significant difference across units (i.e. no panel effect).

| **Test** | **P-value** | **Decision Criteria** |
|---|---|---|
| Chow Test | 0.02916 | Reject H0 (use fixed effect model) |
| Hausman Test | 0.0008014 | Reject H0 (use fixed effect model) |
| Lagrange Multiplier Test | 0.7667 | Accept H0 (use OLS) |

Hence, we selected the Fixed Effect model.

Assumption Checking

1. Test for autocorrelation
   - We used the Durbin Watson Test for autocorrelation**.**
   - The Durbin-Watson statistic will always have a value ranging between 0 and 4.
   - A value of 2.0 indicates there is no autocorrelation detected in the sample.
   - Values from 0 to less than 2 points to positive autocorrelation and values from 2 to 4 means negative autocorrelation.
   - The DW value we obtained is 2.5225 which is close to 2.
   - Hence, there is no autocorrelation in the data.

2. Test for Homoscedasticity
   - We used the Bruesh-Pagan test for homoscedasticity.
   - It tests whether the variance of the errors from a regression is dependent on the values of the independent variables.
   - In that case, heteroscedasticity is present.
   - If the test statistic has a p-value below an appropriate threshold then the null hypothesis of homoscedasticity is rejected and heteroscedasticity assumed.
   - The BP value is 5.682.
   - The p-value is 31.93% which is greater than 5%.
   - Hence, there is no homoscedasticity in the danger zone.

| Ratios | Coefficients | P – value |
|---|---|---|
| Debt-Equity Ratio | -0.1400568 | 0.117914 |
| Current Ratio | 1.0385089 | 0.044984 |
| Return on Assets (ROA) | 0.0852980 | 0.001982 |
| Return on Equity (ROE) | -0.0030559 | 0.102981 |
| Return on Capital Employed (ROCE) | -0.0554521 | 0.024236 |

Output Table

| ***Output Table*** | ***Value*** |
|---|---|
| R- squared | 0.8178 |
| Adjusted R – squared | 0.68528 |
| F – statistic | 9.87438 |

| P – value | 0.00087841 |
|---|---|
| Total Sum of Squares | 3.4555 |
| Residual Sum of squares | 0.62961 |

Conclusion

- Current Ratio, ROA and ROCE are significant to the model.
- The average current ratio is 2.97 which is almost equal to 3.
- Such a high current ratio means the company might not be using it's assets correctly.
- The average ROA ratio is -2.79.
- A negative ROA implies that the business is generating losses and not making the expected profits.
- The average ROCE is 4.5.
- The ratio is very low which tells us that the company is not generating high returns on investment.

*GREY ZONE*

- This zone comprises of 7 companies.
- The Altman Z Scores of all these companies lies between $1.81 < Z < 2.99$.

Aim

Our motive is to check which ratios among the liquidity and profitability ratios affects the Altman Z score the most in the danger zone.

Hypothesis

H0: Ratios are not significant to Altman Z scores.

H1: Ratios are significant to Altman Z scores.

Best Model Determination

| **Test** | **P-value** | **Decision Criteria** |
|---|---|---|
| Chow Test | 5.157e-05 | Reject H0 (use fixed effect model) |
| Hausman Test | 2.2e-16 | Reject H0 (use fixed effect model) |
| Lagrange Multiplier Test | 0.2969 | Accept H0 (use OLS) |

Hence, Fixed Effect Model is the best fit for the analysis of this zone.

Assumption Checking

1. Test for Autocorrelation
    - Durbin Watson test was conducted to check autocorrelation in the data.
    - The DW value turned out to be $2.11 \approx 2$.
    - Hence, there is no autocorrelation in the data.
2. Test for Homoscedasticity
    - Bruesh-Pagan test was conducted to check the equality of variances.
    - The BP value was 8.559.
    - The p-value is 12.8% which is greater than 5%.
    - Hence, there is no homoscedasticity.

| ***Ratios*** | ***Coefficients*** | ***p-value*** |
|---|---|---|
| Debt – Equity Ratio | -0.1400568 | 0.117914 |
| Current Ratio | 1.0385089 | 0.044984 |

| | | |
|---|---|---|
| Return on Assets (ROA) | 0.0852980 | 0.001982 |
| Return on Equity (ROE) | -0.0030559 | 0.102981 |
| Return on Capital Employed (ROCE) | -0.0554521 | 0.024236 |

Output Table

| ***Output Table*** | ***Value*** |
|---|---|
| R- squared | 0.88641 |
| Adjusted R – squared | 0.83209 |
| F – statistic | 35.8972 |
| P – value | 3.9706e-10 |
| Total Sum of Squares | 4.9039 |
| Residual Sum of squares | 0.55703 |

Conclusion

- Current Ratio and ROCE are significant to the model.
- The average current ratio is 0.89 which is very less.
- This implies that the company's debts are due in a year or less are greater than their assets.
- The average ROCE ratio is 18.61 which is less than 20%.
- This implies that the company is not using it's capital efficiently because of which high returns on investment are not generated.
- So, companies are not liquid and slightly less profitable.
- Thus, in addition to Altman Z Score, the current ratio and ROCE support the fact that the companies are somewhat likely to become bankrupt if necessary actions are not taken at the right time to be more efficient.

*SAFE ZONE*

- This zone comprises of 11 companies.
- The Altman Z Scores of all these companies are $Z > 2.99$.

Hypothesis

H0: Ratios are not significant to Altman Z scores.

H1: Ratios are significant to Altman Z scores.

Best Model Determination

| Test | P-value | Decision Criteria |
|---|---|---|
| Chow Test | 5.147e-12 | Reject H0 (use fixed effect model) |
| Hausman Test | 0.551 | Accept H0 (use random effect model) |
| Lagrange Multiplier Test | 5.227e-13 | Reject H0 (use random effect model) |

Hence, Random Effect Model is the best fit for the analysis of this zone.

Assumption Checking

1. Test for Autocorrelation
    - Durbin Watson test was conducted to check autocorrelation in the data.
    - The DW value turned out to be 1.5349 ≈ 2.
    - Hence, there is slight negative autocorrelation in the data.
2. Test for Homoscedasticity
    - Bruesh-Pagan test was conducted to check the equality of variances.
    - The BP value was 3.7945.
    - The p-value is 57.94% which is greater than 5%.
    - Hence, there is no homoscedasticity.
3. Test for Multicollinearity
    - VIF test was conducted to check for multicollinearity between variables.
    - The VIF values turned out to be:
        i. Debt-Equity Ratio: 1.182884
        ii. Current Ratio: 1.271605
        iii. ROA: 1.519094
        iv. ROE: 4.027903
        v. ROCE: 3.482264
    - Since all VIF values are less than 5, it can be concluded that there is not multicollinearity between variables.

Output Table

| ***Output Table*** | ***Value*** |
|---|---|
| R- squared | 0.035183 |
| Adjusted R – squared | -0.063267 |
| F – statistic | 1.78685 |
| P – value | 0.87778 |
| Total Sum of Squares | 36.746 |
| Residual Sum of squares | 35.746 |

| ***Ratios*** | ***Coefficients*** | ***p-value*** |
|---|---|---|
| Debt – Equity Ratio | -4.504656 | 0.4867 |
| Current Ratio | -0.095353 | 0.4038 |
| Return on Assets (ROA) | 0.012607 | 0.6977 |
| Return on Equity (ROE) | 0.016767 | 0.7107 |
| Return on Capital Employed (ROCE) | -0.003814 | 0.9126 |

Conclusion

- None of the ratios are significant to the model.

- The average of ROE ratio is 27.33, Debt – Equity Ratio is 0.01, Current Ratio is 3.80, ROCE is 33.57 and ROA is 19.99.
- All these ratios are high and lie in their efficient ranges.
- These companies are highly liquid and profitable.
- This ensures efficient working of these companies.
- Thus, this supports the fact that these companies are very less likely to go bankrupt.

## CONCLUSION

- Half of the companies lie in the safe zone which have sound financials and are in no risk of bankruptcy at the moment.
- The companies in the grey zone have a mediocre performance currently. These companies with proper measures can change their standings and place themselves in the safe zone.
- The 4 companies lying in the danger zone have to be monitored from time-to-time. BHARTIARTL and IDEA have the worst financials among these 4. Therefore these 2 companies are highly vulnerable and thus have to bring strict reforms and policies to improve their financial stability.
- Thus, overall this index can be considered as a good place to invest passively.

## LIMITATIONS

- Only the data of past 5 years was taken into account.
- Eight companies were eliminated from the study because their past 5 years data was not available.
- Only Liquidity, Return and Debt-Equity ratios were considered.
- There is no intercept in fixed effect model. Hence, VIF test for multicollinearity failed.
- Financial data is sensitive and is not shared. We relied on company accounts which can be manipulated by auditors.

## FUTURE SCOPE

NIFTY INDIA DIGITAL INDEX

| Index Returns(%) | QTD | YTD | 1 Year | 5 Years | Since Inception |
|---|---|---|---|---|---|
| Price Return | -2.6 | 44.13 | 59.24 | 17.32 | 12.08 |
| Total Return | -2.38 | 45.85 | **61.15** | **19.14** | 13.54 |

NIFTY 50

| Index Returns(%) | QTD | YTD | 1 Year | 5 Years | Since Inception |
|---|---|---|---|---|---|
| Price Return | -3.6 | 21.47 | 30.95 | 15.61 | 11.47 |
| Total Return | -3.43 | 22.87 | **32.49** | **17.05** | |

- Backtesting was performed on the NIFTY INDIA DIGITAL Index to find out the returns for the last 5 years.
- It can be observed that the total return of NIFTY INDIA DIGITAL Index over the period of 5 years and over the last year exceed that of NIFTY 50.
- Some companies don't have 5 year data, but in another few years we will be able to analyse them as well.