TITLE

Name:

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Course title:

Date of submission:

**Data and Methodology**

**Business failure forecasting: Relevant financial ratios**

**Data Interpretation**

The research obtained data from 192 firms, among these firms 91 had failed and the remaining 101 were a success. A descriptive analysis providing the summary of the data was done, leading to the following results.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable | Obs | Mean | Std. Dev. | Min | Max |
|  |  |  |  |  |  |
| cat | 192 | 1.526042 | .5006268 | 1 | 2 |
| roa | 192 | 7.23852 | 7.372248 | -26.0201 | 41.5163 |
| current | 192 | 1.633089 | 1.440978 | 0 | 13.6174 |
| roce | 192 | 2.028258 | 1.290552 | .692 | 9.6479 |
| debtr | 192 | 94.89836 | 140.8403 | 0 | 1350.611 |
|  |  |  |  |  |  |
| roe | 192 | 8.077871 | 1.295559 | 5.689003 | 11.65351 |

ROA- on examining the return on assets ratio it discovered that the mean was 7.2385% and the standard deviation was highly significant, having a huge value which was more than the mean, 7.3722%. This can be explained by the wide range between the firms, the data range for ROA was -26.0201% - 41.5163%.

Current Asset Ratio. The mean for all the firms stood at 1.6331, this value falls under the industry’s threshold ratio of 2:1, the current asset ratio had a standard deviation of 1.440978. The range for the current ratio of all these firms was 0 – 13.62:1

ROCE. Return on capital employed had a mean value of 2.0283. The standard deviation of these ratio was 1.2906, the range was 0.692 - 9.6479.

Debt ratio. The mean for the debt ratio is 94.8984%. This high value implies that most of the firms’ financials were highly geared

ROE. Return on equity of the firms had a mean of 8.0779% and a standard deviation of 1.2956. The range for the ROE was 5.689% - 11.6531%

**Analysis of Variances (ANOVA)**

Among the results of AOVA is the descriptive analysis, the objective is to show various statistics of the financial ratios of the firms from which the data was retrieved. These statistics are distinctly analyzed as failed and non-failed. These statistics are summarized below:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Category | N | Mean | Std. Deviation | Minimum | Maximum |
| ROA | Failed | 91 | 3.3538 | 3.35770 | -4.18 | 15.43 |
|  | Non-Failed | 101 | 7.5729 | 8.92753 | -26.02 | 32.51 |
| CURRENT | Failed | 91 | 1.8653 | 1.89846 | .04 | 13.62 |
|  | Non-Failed | 101 | 1.4238 | .79304 | 0.00 | 4.06 |
| ROCE | Failed | 91 | 1.6861 | .67658 | .69 | 3.43 |
|  | Non-Failed | 101 | 2.3366 | 1.60206 | .80 | 9.65 |
| DEBTR | Failed | 91 | 109.0203 | 182.72337 | 0.00 | 1350.61 |
|  | Non-Failed | 101 | 82.1746 | 86.56052 | 0.00 | 495.23 |
| ROE | Failed | 91 | 5.9758 | 6.26863 | -11.65 | 11.65 |
|  | Non-Failed | 101 | 5.2456 | 5.73032 | -9.69 | 10.14 |
|  | Total | 192 | 8.0779 | 1.29556 | 5.69 | 11.65 |

ROA, from the ANOVA, the average ROA for failed firms is 3.35838, this is much lower as compared to the non-failed firm’s ratio of 7.5729%. Similarly the standard deviation of non-failed is higher as compared to those of failed firms. The range of the ROA is 26.02% - 32.51%, with non-failed firms having the highest ROA and failed firms having the minimum value in the range.

Current ratio. The average current ratio for failed firms is higher at 1.8653:1 as compared to non-failed firms standing at 1.4238, this is also the case for the standard deviation. The volatility of failed firms is seen to be higher than that of non-failed firms. The range of this ratio is 0.4:1 – 13.62:1 for the failed firms, the maximum ratio supersedes that of non-failed firms.

ROCE. The average return on capital employed ratio of non-failed firms, 2.3366%, is much more than that of failed firms, 1.6861%. The latter is true for the standard deviation. The range value of the ROCE ratio in non-failed firms, were also higher than the range in failed firms.

Debt Ratio. The average ratio show how much firms were geared financially, for failed firms this value was at 109.0203% whereas non-failed firms had a value of 82.1746%, this implies failed firms were more geared than non-failed firms. Results on the standard deviation are significantly higher in failed firms in comparison to non-failed firms. The return on assets ratio is higher in failed firms in contrast to non-failed firms. In failed firms the average was 5.9758%, and in non-failed the mean is 5.2456%.

The analysis of variances are used to contrast returns of the two classes of firms, this analysis determines how significant the difference between the ratios in the firms is. This differences are illustrated in the table below.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | Sum of Squares | df | Mean Square | F | Sig. |
| ROA | Between Groups | 852.111 | 1 | 852.111 | 18.020 | .000 |
|  | Within Groups | 8984.754 | 190 | 47.288 |  |  |
| CURRENT | Between Groups | 9.330 | 1 | 9.330 | 4.577 | .034 |
|  | Within Groups | 387.266 | 190 | 2.038 |  |  |
| ROCE | Between Groups | 20.258 | 1 | 20.258 | 12.922 | .000 |
|  | Within Groups | 297.857 | 190 | 1.568 |  |  |
| DEBTR | Between Groups | 34499.197 | 1 | 34499.197 | 1.746 | .188 |
|  | Within Groups | 3754176.891 | 190 | 19758.826 |  |  |
| ROE | Between Groups | 25.522 | 1 | 25.522 | .711 | .400 |
|  | Within Groups | 6820.270 | 190 | 35.896 |  |  |
|  | Total | 320.589 | 191 |  |  |  |

Hypothesis of the analysis of variances; the mean difference between the ratios vary. The null hypothesis and alternative hypothesis for the analysis were as follows.

H0: Mean difference = 0

H1: Mean difference ≠ 0

The confidence interval was 0.05

Using the f-statistics obtained from the analysis, we fail to reject the null hypothesis for the ROE ratio and debt ratio of the firms. For the ROA, Current ratio and ROCE ratio we reject the null hypothesis, this is due to the fact that the difference in average of the later ratios are significantly different.

ROA, mean difference of the ROA is more than zero, this implies that the ROA ratios of the non-failed firms is significantly higher as compared to the ROA of the failed firms.

Current ratio, similarly this ratio has a more than zero mean difference, this means that the difference in average of failed firms is much more when compared to non-failed firms.

ROCE. Contrary to other ratios in the ROCE the non-failed firms have a much higher result in contrast to failed firms. The difference between these two categories is highly significant.

Debt ratio and ROE. There is no significant difference between the ratios of the ROE and debt for the failed and non-failed firms. The insignificant difference in debt ratio between these categories implies that the firms had a similar high level of financial gearing. The ROE varied between the failed and the non-failed firms, the failed firms had a greater difference, this was however not significant as compared to the non-failed firms.

**Predicting Bankruptcy: Altman z-score**

**Data description**

The focus in this analysis is to compare the Altman z-score for 40 firms (20 failed and 20 non-failed), this analysis is done over a period of 4 years, 2015 -2018. The table below illustrates the descriptive statistics of the 40firms before being categorized over the four years.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable | Obs | Mean | Std. Dev. | Min | Max |
|  |  |  |  |  |  |
| cat | 160 | 1.5 | .5015699 | 1 | 2 |
| year | 160 | 2016.5 | 1.121544 | 2015 | 2018 |
| zscore | 160 | 2.837592 | 1.57909 | .0732 | 9.0368 |

The data analyzed was for 40 firms collected over the four years. The total amount of data observation is therefore 1160. The average z-score of the firms is 2.838. This implies that on combining all firms together, over a period of four years, and using their performance on the z-score then the firms fall in the safe region. The value of their mean is above the threshold, hence no significant risk of bankruptcy.

**Z-score: Comparison of differences between failed and non-failed firms**

The table below represents the mean coefficient of the z-score, grouped into failed and non-failed categories

|  |  |  |  |
| --- | --- | --- | --- |
| CAT | Mean | Std. Dev. | Freq. |
|  |  |  |  |
| 1 - Failed | 2.055685 | 1.2450339 | 80 |
| 2 – Non-Failed | 3.6194988 | 1.4934081 | 80 |
|  |  |  |  |
| Total | 2.8375919 | 1.5790896 | 160 |

From the results above the coefficient on z-score for non-failed firms is 3.619 and the value for failed firms is 2.055. This implies for the two categories of firms that there is a difference in the means of the –scores. To determine the significance of mean difference an ANOVA analysis is use. Below is an analysis of variance table illustrating significance of mean difference across the firms:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source | SS | df | MS | F | Prob > F |
|  |  |  |  |  |  |
| Between groups | 97.8205404 | 1 | 97.8205404 | 51.75 | 0.0000 |
| Within groups | 298.64979 | 158 | 1.89018854 |  |  |
|  |  |  |  |  |  |
| Total | 396.470331 | 159 | 2.49352409 |  |  |

The hypothesis used in the analysis was: there is no change in the mean difference. The null and alternative hypothesis are

H0: mean difference = 0

H1: mean difference ≠ 0, this analysis was done at 99.5% confidence interval.

The results showed the f-statistics coefficients are significant, however the p-value from the analysis is insignificant. We therefore reject the null hypothesis. The results sufficiently show that the mean difference according to the z-statistics of the failed and non-failed firms is significant.

**Periodic data comparison: Failed and non-failed firms (2015-2018)**

The following test is for comparison of the z-score performance over the four year period. The analysis for failed and non-failed firms are tabulated separately. The aim is to determine whether the z-score ratio changes significantly for either the failed or non-failed firms hence serving as a signal for bankruptcy. The table below shows results of the failed firm

|  |  |  |  |
| --- | --- | --- | --- |
| YEAR | Mean | Std. Dev. | Freq. |
|  |  |  |  |
| 2015 | 1.9917 | 1.0534364 | 20 |
| 2016 | 1.97075 | 1.269381 | 20 |
| 2017 | 1.82054 | .87848808 | 20 |
| 2018 | 2.43975 | 1.6513685 | 20 |
|  |  |  |  |
| Total | 2.055685 | 1.2450339 | 80 |

In the period of 2015-2018 the mean coefficient z-score is 2.055, this therefore implies that the failed firm were initially in the same category as non-failed firms. In 2018 the mean was 2.440, this was the year the firms failed. In 2017 these firm showed the least bankruptcy of all the years, 1.821, for the firms this was the lower end of the grey region. In 2015 and 2016 the ratios of the firms were much more, 1.992 and 1.971 respectively. These were average ratios, hence implying that the companies were at a higher risk of bankruptcy. A further analysis of variance was carried out to further assess the significance of change in z-score over the four years.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source | SS | df | MS | F | Prob > F |
|  |  |  |  |  |  |
| Between groups | 4.28214322 | 3 | 1.42738107 | 0.92 | 0.4364 |
| Within groups | 118.1765 | 76 | 1.55495394 |  |  |
|  |  |  |  |  |  |
| Total | 122.458643 | 79 | 1.5501094 |  |  |

This hypothesis is, there are changes in mean difference. At a 99% level of significance, the null and alternative hypotheses were;

H0: mean difference = 0

H1: mean difference ≠ 0

From the results of ANOVA, the f-statistic is of no significance while the p-value is significant. Therefore we fail to reject the null hypothesis, leading to the conclusion that there was no significant change in the low z-score over the period of 2015-2018.

The test below is for the z-score over the period of 4 years for the non-failed firms.

|  |  |  |  |
| --- | --- | --- | --- |
| YEAR | Mean | Std. Dev. | Freq. |
|  |  |  |  |
| 2015 | 3.398915 | 1.5827613 | 20 |
| 2016 | 3.585555 | 1.1970066 | 20 |
| 2017 | 3.9397451 | 1.5979195 | 20 |
| 2018 | 3.55378 | 1.6177085 | 20 |
|  |  |  |  |
| Total | 3.6194988 | 1.4934081 | 80 |

The mean score for the non-failed firms was 3.619, which is a value in the secure region. From the distribution of the z-score this values ascertains that this non-failed firms were in the secure zone from bankruptcy. The ranking of the z- score starts with 2017 with the highest followed by 2016, 2015 then 2015. To determine the significance of these scores over the years an analysis of variances was performed, the results are as follows.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Source | SS | df | MS | F | Prob > F |
|  |  |  |  |  |  |
| Between groups | 3.13372011 | 3 | 1.04457337 | 0.46 | 0.7119 |
| Within groups | 173.057427 | 76 | 2.27707141 |  |  |
|  |  |  |  |  |  |
| Total | 176.191147 | 79 | 2.23026769 |  |  |

The null and alternative hypotheses under 5% confidence interval were as follows:

H0: Mean difference = 0

H1: Mean difference ≠ 0.

The f-statistics coefficients had no significance. The p-value on the other hand was significant. Therefore we fail to reject the null hypothesis. This leads to the conclusion that the evidence suggesting the mean coefficient of the z-statistics for firms that didn’t fail had a significant change (value was greater than zero) is insufficient.

**Discussion**

**Test business failure: financial ratios**

Analysis done using financial ratios are ambiguous. This is because the results generated are mixed, some show significance, while others are insignificant. The ambiguity of these results makes unclear the determination of failure or not in business. Evidence suggests that firms that experienced failure had a higher level of liquidity as compared to the industrial market threshold. This could be as a result of firms enhancing their liquidity since they are experiencing low liquidity, highly profitable firms are usually assured and don’t seek to improve liquidity. A contrary point van be made on the same since the current ratio of nan-failing firms is lee than the threshold of 2:1. The ROE variation between the two categories was insignificant, however the failing firms had a higher return on equity than non-failing firms. Due to the alternating results of the financial ratios one could conclude that the financial ratios are not sufficient forecasting the success or failure of a business. Through this method we are unable to pinpoint a ratio that has more relevance as compared to another distorts the decision making process on the business position of firm. Hence financial ratios are insufficient in predicting the risk of failure of a business in the market.

**Test business failure risk: Altman z-score**

From the analysis above, the mean z-score for non-failed firms is 2.05, while the mean z-score for failed firms is 2.05. The difference in findings correspond to Altman z-score provisions with regards to the risk of bankruptcy a business entity faces. The results continue to show a significant variation between failed and non-failed firms. This results prove sufficiency of the Altman z–score in determining the firms that are close to bankruptcy and firms that can be considered to be in the safe region from bankruptcy.

A significantly huge difference is also seen between the z- statistics of the failed and non-failed firms, from the results used to demonstrate consistency of the z-score over the years. The Altman z-score model has provisions for testing bankruptcy. The scores between 1.8 and 2.9 are considered to be in the grey area and t a risk of facing bankruptcy. A score more than 3 implies the firm is in the safe region. The analysis revealed that firms that failed had a lesser coefficient, and these results were consistent through the four years, this would explain why the firms failed in 2019. Their counter parts, also HAD a consistent coefficient of more than 3.0 hence would be expected to not fail, as they did in 2019.