

Project

Karthihaswar

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1 Project Objective

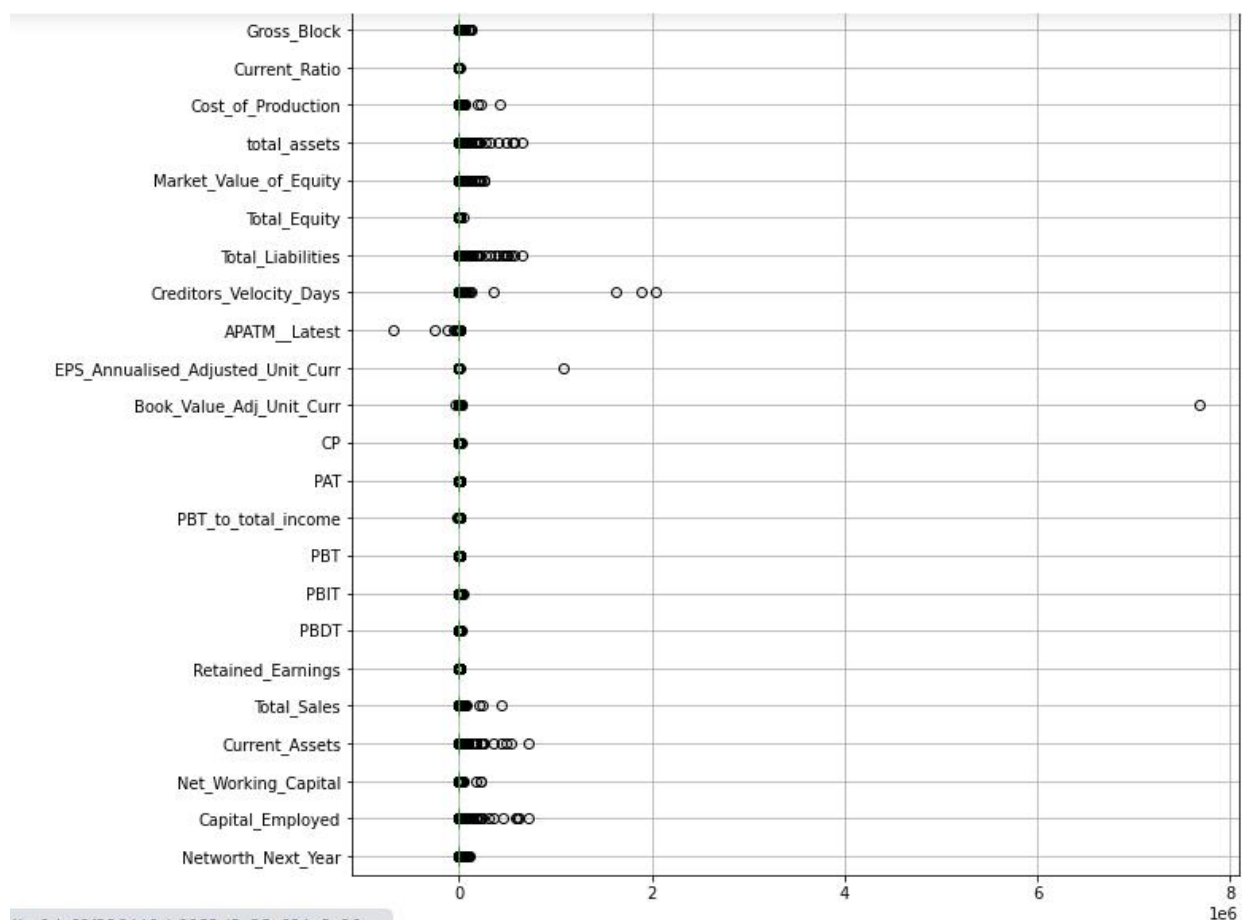
The objective of the report is to explore the data to create a Credit Risk Model, using the data provided and to calculate the mean and standard deviation on the stock returns and share insights on the dataset that contains 6 years of information(weekly stock information) on the stock prices of 10 different Indian Stocks. The project data sets are analyzed in Python to generate insights about the data sets. This exploration report will consist of the following:

- Importing the dataset in Python
- Understanding the structure of dataset
- Checking null values
- Univariate and Bivariate Analysis
- Outlier and Missing values Treatment
- Logistic Regression Model and Altzman's score
- Market risk and Analyze the returns
- Insights from the dataset

2 Credit Risk of Companies in India

2.1 Outlier Treatment

Boxplot visualization of all variables



The lower and upper whisker values of all variables

- The lower and upper whisker value of Networth_Next_Year is -175.74125, 303.52875000000006
- The lower and upper whisker value of Capital_Employed is -320.90125, 555.1087500000001
- The lower and upper whisker value of Net_Working_Capital is -89.40625, 151.52375
- The lower and upper whisker value of Current_Assets is -192.735, 331.885
- The lower and upper whisker value of Total_Sales is -348.06000000000006, 583.94
- The lower and upper whisker value of Retained_Earnings is -5.4025, 9.0575
- The lower and upper whisker value of PBDT is -19.4175, 32.3625
- The lower and upper whisker value of PBIT is -25.03875, 41.73125
- The lower and upper whisker value of PBT is -11.28375, 18.64625
- The lower and upper whisker value of PBT_to_total_income is -6.0, 10.0
- The lower and upper whisker value of PAT is -8.459999999999999, 13.939999999999998
- The lower and upper whisker value of CP is -16.365000000000002, 27.275000000000002
- The lower and upper whisker value of Book_Value_Adj_Unit_Curr is -72.325, 139.555
- The lower and upper whisker value of EPS_Annualised_Adjusted_Unit_Curr is -6.19125, 10.31875
- The lower and upper whisker value of APATM_Latest is -11.115, 18.525
- The lower and upper whisker value of Creditors_Velocity_Days is -113.5, 210.5
- The lower and upper whisker value of Total_Liabilities is -173.68499999999997, 299.715
- The lower and upper whisker value of Total_Equity is -19.93875, 43.23125
- The lower and upper whisker value of Market_Value_of_Equity is -167.18625, 278.64375
- The lower and upper whisker value of total_assets is -135.08375, 242.48625
- The lower and upper whisker value of Cost_of_Production is -281.97499, 472.46499
- The lower and upper whisker value of Current_Ratio is -1.955, 5.605
- The lower and upper whisker value of Gross_Block is -196.4175, 328.8825

Summary of dataset before outlier treatment

	count	mean	std	min	25%	50%	75%	max
Company_Code	3586.0	16065.388734	19776.817379	4.00000	3029.2500	6077.500000	24269.5000	72493.00
Networth_Next_Year	3586.0	725.045251	4769.681004	-8021.60000	3.9850	19.015000	123.8025	111729.10
Capital_Employed	3586.0	2799.611054	26975.135385	-1824.75000	7.6025	39.090000	226.6050	714001.25
Net_Working_Capital	3586.0	410.809665	6301.218546	-13162.42000	0.9425	10.145000	61.1750	223257.56
Current_Assets	3576.0	1964.679298	22608.950227	-0.91000	3.9975	24.540000	135.1525	721166.00
Total_Sales	3586.0	1079.702579	9996.574173	-62.59000	1.4400	30.440000	234.4400	443775.16
Retained_Earnings	3586.0	48.729824	426.040665	-448.72000	0.0200	0.450000	3.6350	14143.40
PBDT	3586.0	116.268795	956.199566	-5874.53000	0.0000	0.795000	12.9450	23215.00
PBIT	3574.0	218.167440	1854.025961	-4812.95000	0.0000	1.150000	16.6925	41402.96
PBT	3586.0	85.752909	799.925768	-6032.34000	-0.0600	0.310000	7.4225	16798.00
PBT_to_total_income	3586.0	6.035648	464.867049	-13521.66667	0.0000	0.407407	4.0000	15370.00
PAT	3586.0	61.218313	620.298432	-6032.34000	-0.0600	0.255000	5.5400	13383.39
CP	3586.0	91.734200	780.790561	-5874.53000	0.0000	0.740000	10.9100	20760.20
Book_Value_Adj_Unit_Curr	3569.0	2251.122718	128517.147958	-33715.70000	7.1300	18.980000	60.1000	7677600.29
EPS_Annualised_Adjusted_Unit_Curr	3582.0	312.752518	18068.617234	0.00000	0.0000	0.360000	4.1275	1081400.02
APATM_Latest	3585.0	-365.056187	12500.051387	-688600.00000	0.0000	1.590000	7.4100	15266.67
Creditors_Velocity_Days	3578.0	2062.170486	54229.943466	0.00000	8.0000	39.000000	89.0000	2034145.00
Total_Liabilities	3527.0	2673.822492	27361.365936	-0.72000	3.8400	16.640000	122.1900	652823.81
Total_Equity	3586.0	62.979690	778.761080	0.01000	3.7500	8.295000	19.5425	42263.46
Market_Value_of_Equity	3586.0	1664.092387	12805.173084	0.00000	0.0000	8.370000	111.4575	260865.08
total_assets	3586.0	2058.032973	23726.460101	0.01000	6.5050	20.650000	100.8975	653267.37
Cost_of_Production	3586.0	798.544621	9076.702982	-22.65000	0.9400	25.990000	189.5500	419913.50
Current_Ratio	3585.0	12.056603	108.410131	0.00000	0.8800	1.360000	2.7700	4813.00
Gross_Block	3586.0	594.178829	4871.547802	-41.19000	0.5700	15.870000	131.8950	128477.59

Summary of dataset after outlier treatment

The values which are lower than the lower whisker value are equated to lower whisker value and the values greater than upper whisker value are replaced with the median values, as dropping those values leads to very less amount of population compared to original data.

	count	mean	std	min	25%	50%	75%	max
Company_Code	3586.0	16065.388734	19776.817379	4.00000	3029.2500	6077.5000	24269.50000	72493.00
Networth_Next_Year	3586.0	29.557756	64.788068	-175.74125	3.9850	18.9975	32.67750	301.35
Capital_Employed	3586.0	67.445760	106.637217	-320.90125	7.6025	39.0650	69.45750	551.45
Net_Working_Capital	3586.0	15.707747	34.913948	-89.40625	0.9425	10.1425	20.28750	148.75
Current_Assets	3576.0	41.835187	61.832819	-0.91000	3.9975	24.5300	43.36750	331.58
Total_Sales	3586.0	68.302699	115.380833	-62.59000	1.4400	30.4300	66.74000	581.83
Retained_Earnings	3586.0	0.989793	1.745919	-5.40250	0.0200	0.4500	0.91000	9.05
PBDT	3586.0	1.405876	7.961626	-19.41750	0.0000	0.7925	1.88000	32.17
PBIT	3574.0	2.589657	9.718026	-25.03875	0.0000	1.1500	2.96750	41.50
PBT	3586.0	0.181434	5.029348	-11.28375	-0.0600	0.3100	0.79000	18.58
PBT_to_total_income	3586.0	0.358696	3.200961	-6.00000	0.0000	0.4070	1.27994	10.00
PAT	3586.0	0.094827	3.795848	-8.46000	-0.0600	0.2525	0.60000	13.93
CP	3586.0	1.199969	6.650235	-16.36500	0.0000	0.7400	1.67750	27.25
Book_Value_Adj_Unit_Curr	3569.0	24.125220	33.973840	-72.32500	7.1300	18.9800	33.95000	138.79
EPS_Annualised_Adjusted_Unit_Curr	3582.0	1.187903	2.118018	0.00000	0.0000	0.3600	1.12000	10.30
APATM_Latest	3585.0	0.875287	6.652305	-11.11500	0.0000	1.5900	4.04000	18.52
Creditors_Velocity_Days	3578.0	43.372834	44.353608	0.00000	8.0000	36.0000	60.00000	210.00
Total_Liabilities	3527.0	34.215359	55.725597	-0.72000	3.8400	16.6400	31.37500	298.18
Total_Equity	3586.0	9.640177	8.644441	0.01000	3.7500	8.2925	12.00750	43.11
Market_Value_of_Equity	3586.0	24.209495	48.497559	0.00000	0.0000	8.3550	16.97750	277.03
total_assets	3586.0	33.535594	45.614728	0.01000	6.5050	20.6300	34.29250	242.35
Cost_of_Production	3586.0	54.872981	91.403975	-22.65000	0.9400	25.9750	54.13750	471.55
Current_Ratio	3585.0	1.415269	0.971894	0.00000	0.8800	1.3600	1.62000	5.57
Gross_Block	3586.0	37.964685	65.150008	-41.19000	0.5700	15.8700	34.40250	328.09

2.2 Missing value Treatment

Checking the missing values

```

Company_Code          0
Networth_Next_Year    0
Capital_Employed      0
Net_Working_Capital   0
Current_Assets        10
Total_Sales           0
Retained_Earnings     0
PBDT                  0
PBIT                  12
PBT                   0
PBT_to_total_income   0
PAT                   0
CP                    0
Book_Value_Adj_Unit_Curr 17
EPS_Annualised_Adjusted_Unit_Curr 4
APATM_Latest          1
Creditors_Velocity_Days 8
Total_Liabilities     59
Total_Equity          0
Market_Value_of_Equity 0
total_assets          0
Cost_of_Production    0
Current_Ratio         1
Gross_Block           0
dtype: int64

```


Summary of dataset after missing value treatment

All the missing values are treated with its median values

	count	mean	std	min	25%	50%	75%	max
Company_Code	3586.0	16065.388734	19776.817379	4.00000	3029.2500	6077.5000	24269.50000	72493.00
Networth_Next_Year	3586.0	29.557756	64.788068	-175.74125	3.9850	18.9975	32.67750	301.35
Capital_Employed	3586.0	67.445760	106.637217	-320.90125	7.6025	39.0650	69.45750	551.45
Net_Working_Capital	3586.0	15.707747	34.913948	-89.40625	0.9425	10.1425	20.28750	148.75
Current_Assets	3586.0	41.786930	61.753265	-0.91000	4.0150	24.5300	43.19250	331.58
Total_Sales	3586.0	68.302699	115.380833	-62.59000	1.4400	30.4300	66.74000	581.83
Retained_Earnings	3586.0	0.989793	1.745919	-5.40250	0.0200	0.4500	0.91000	9.05
PBDT	3586.0	1.405876	7.961626	-19.41750	0.0000	0.7925	1.88000	32.17
PBIT	3586.0	2.584839	9.702104	-25.03875	0.0000	1.1500	2.94500	41.50
PBT	3586.0	0.181434	5.029348	-11.28375	-0.0600	0.3100	0.79000	18.58
PBT_to_total_income	3586.0	0.358696	3.200961	-6.00000	0.0000	0.4070	1.27994	10.00
PAT	3586.0	0.094827	3.795848	-8.46000	-0.0600	0.2525	0.60000	13.93
CP	3586.0	1.199969	6.650235	-16.36500	0.0000	0.7400	1.67750	27.25
Book_Value_Adj_Unit_Curr	3586.0	24.100828	33.895036	-72.32500	7.1925	18.9800	33.84500	138.79
EPS_Annualised_Adjusted_Unit_Curr	3586.0	1.186980	2.117016	0.00000	0.0000	0.3600	1.12000	10.30
APATM__Latest	3586.0	0.875487	6.651388	-11.11500	0.0000	1.5900	4.04000	18.52
Creditors_Velocity_Days	3586.0	43.356386	44.305458	0.00000	8.0000	36.0000	60.00000	210.00
Total_Liabilities	3586.0	33.926194	55.310361	-0.72000	3.9750	16.6400	30.55500	298.18
Total_Equity	3586.0	9.640177	8.644441	0.01000	3.7500	8.2925	12.00750	43.11
Market_Value_of_Equity	3586.0	24.209495	48.497559	0.00000	0.0000	8.3550	16.97750	277.03
total_assets	3586.0	33.535594	45.614728	0.01000	6.5050	20.6300	34.29250	242.35
Cost_of_Production	3586.0	54.872981	91.403975	-22.65000	0.9400	25.9750	54.13750	471.55
Current_Ratio	3586.0	1.415254	0.971759	0.00000	0.8800	1.3600	1.62000	5.57
Gross_Block	3586.0	37.964685	65.150008	-41.19000	0.5700	15.8700	34.40250	328.09

2.3 New Variables Creation

New variables are created respectively and infinite values in those new variables are treated as zero

	count	mean	std	min	25%	50%	75%	max
Company_Code	3586.0	16065.388734	19776.817379	4.000000	3029.250000	6077.500000	24269.500000	72493.000000
Networth_Next_Year	3586.0	29.557756	64.788068	-175.741250	3.985000	18.997500	32.677500	301.350000
Capital_Employed	3586.0	67.445760	106.637217	-320.901250	7.602500	39.065000	69.457500	551.450000
Net_Working_Capital	3586.0	15.707747	34.913948	-89.406250	0.942500	10.142500	20.287500	148.750000
Current_Assets	3586.0	41.786930	61.753265	-0.910000	4.015000	24.530000	43.192500	331.580000
Total_Sales	3586.0	68.302699	115.380833	-62.590000	1.440000	30.430000	66.740000	581.830000
Retained_Earnings	3586.0	0.989793	1.745919	-5.402500	0.020000	0.450000	0.910000	9.050000
PBDT	3586.0	1.405876	7.961626	-19.417500	0.000000	0.792500	1.880000	32.170000
PBIT	3586.0	2.584839	9.702104	-25.038750	0.000000	1.150000	2.945000	41.500000
PBT	3586.0	0.181434	5.029348	-11.283750	-0.060000	0.310000	0.790000	18.580000
PBT_to_total_income	3586.0	0.358696	3.200961	-6.000000	0.000000	0.407000	1.279940	10.000000
PAT	3586.0	0.094827	3.795848	-8.460000	-0.060000	0.252500	0.600000	13.930000
CP	3586.0	1.199969	6.650235	-16.365000	0.000000	0.740000	1.677500	27.250000
Book_Value_Adj_Unit_Curr	3586.0	24.100828	33.895036	-72.325000	7.192500	18.980000	33.845000	138.790000
EPS_Annualised_Adjusted_Unit_Curr	3586.0	1.186980	2.117016	0.000000	0.000000	0.360000	1.120000	10.300000
APATM__Latest	3586.0	0.875487	6.651388	-11.115000	0.000000	1.590000	4.040000	18.520000
Creditors_Velocity_Days	3586.0	43.356386	44.305458	0.000000	8.000000	36.000000	60.000000	210.000000
Total_Liabilities	3586.0	33.926194	55.310361	-0.720000	3.975000	16.640000	30.555000	298.180000
Total_Equity	3586.0	9.640177	8.644441	0.010000	3.750000	8.292500	12.007500	43.110000
Market_Value_of_Equity	3586.0	24.209495	48.497559	0.000000	0.000000	8.355000	16.977500	277.030000
total_assets	3586.0	33.535594	45.614728	0.010000	6.506000	20.630000	34.292500	242.350000
Cost_of_Production	3586.0	54.872981	91.403975	-22.650000	0.940000	25.975000	54.137500	471.550000
Current_Ratio	3586.0	1.415254	0.971759	0.000000	0.880000	1.360000	1.620000	5.570000
Gross_Block	3586.0	37.964685	65.150008	-41.190000	0.570000	15.870000	34.402500	328.090000
Return_on_Total_Asset	3586.0	0.090320	2.926560	-79.000000	-0.008225	0.013391	0.058018	88.333333
Profit_Margin	3586.0	-0.426094	7.137316	-285.000000	0.000000	0.010184	0.046512	31.333333
Debt_to_Equity_Ratio	3586.0	8.735187	90.736825	-0.070866	0.674082	2.006028	5.544921	4993.400000

2.4 Transform target variable into 0 and 1

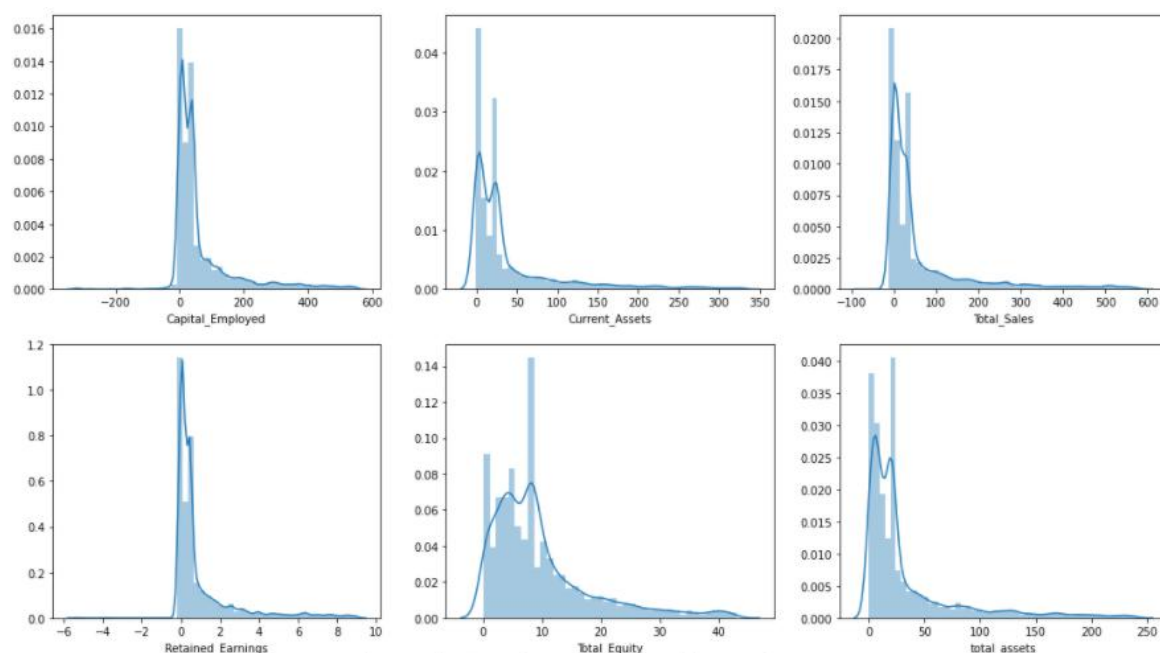
	0	1	2	3	4
Company_Code	16974.000000	21214.000000	14852.000000	2439.000000	23505.000000
Networth_Next_Year	-175.741250	-175.741250	-175.741250	-175.741250	-175.741250
Capital_Employed	-320.901250	39.090000	39.090000	39.090000	39.090000
Net_Working_Capital	-89.406250	-89.406250	10.145000	-89.406250	10.145000
Current_Assets	40.500000	24.540000	24.540000	24.540000	24.540000
Total_Sales	0.000000	30.440000	392.130000	30.440000	38.720000
Retained_Earnings	7.600000	0.450000	0.450000	0.450000	0.450000
PBDT	-19.417500	-4.320000	-19.417500	-19.417500	-19.417500
PBIT	-25.038750	35.530000	-25.038750	-25.038750	-25.038750
PBT	-11.283750	-11.283750	-11.283750	-11.283750	-11.283750
PBT_to_total_income	-8.000000	-8.000000	-8.000000	-3.579585	-8.000000
PAT	-8.480000	-8.480000	-8.480000	-8.480000	-8.480000
CP	-16.385000	-4.320000	-16.385000	-16.385000	-16.385000
Book_Value_Adj_Unit_Curr	-72.325000	-15.180000	94.140000	-39.840000	-72.325000
EPS_Annualised_Adjusted_Unit_Curr	0.000000	0.000000	0.000000	0.000000	0.000000
APATM_Latest	0.000000	-11.115000	-11.115000	-11.115000	1.590000
Creditors_Velocity_Days	0.000000	101.000000	36.000000	63.000000	36.000000
Total_Liabilities	16.640000	16.640000	16.640000	16.640000	16.640000
Total_Equity	8.295000	8.295000	8.295000	8.295000	8.295000
Market_Value_of_Equity	0.000000	8.370000	8.370000	194.270000	113.680000
total_assets	20.650000	20.650000	20.650000	20.650000	20.650000
Cost_of_Production	137.870000	25.990000	406.510000	25.990000	186.290000
Current_Ratio	0.020000	0.080000	1.080000	0.090000	0.500000
Gross_Block	15.870000	15.870000	15.870000	15.870000	15.870000
Return_on_Total_Asset	-0.546429	-0.546429	-0.546429	-0.546429	-0.546429
Profit_Margin	0.000000	-0.370688	-0.028776	-0.370688	-0.291419
Debt_to_Equity_Ratio	2.008028	2.008028	2.008028	2.008028	2.008028
default	1.000000	1.000000	1.000000	1.000000	1.000000

The default values are determined as 0 and 1 by Networth_Next_Year values as positives and negatives

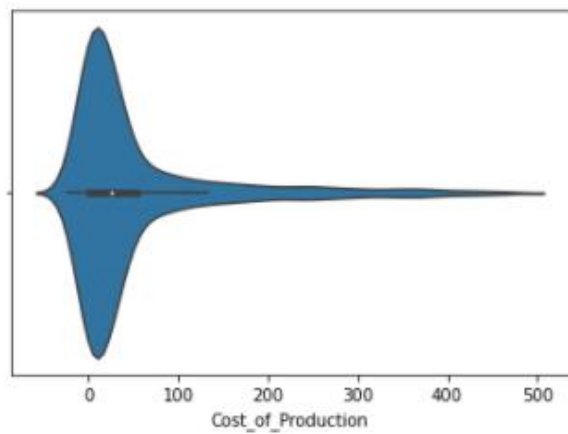
2.4 Perform Univariate & bivariate analysis (including Heatmap)

Univariate analysis

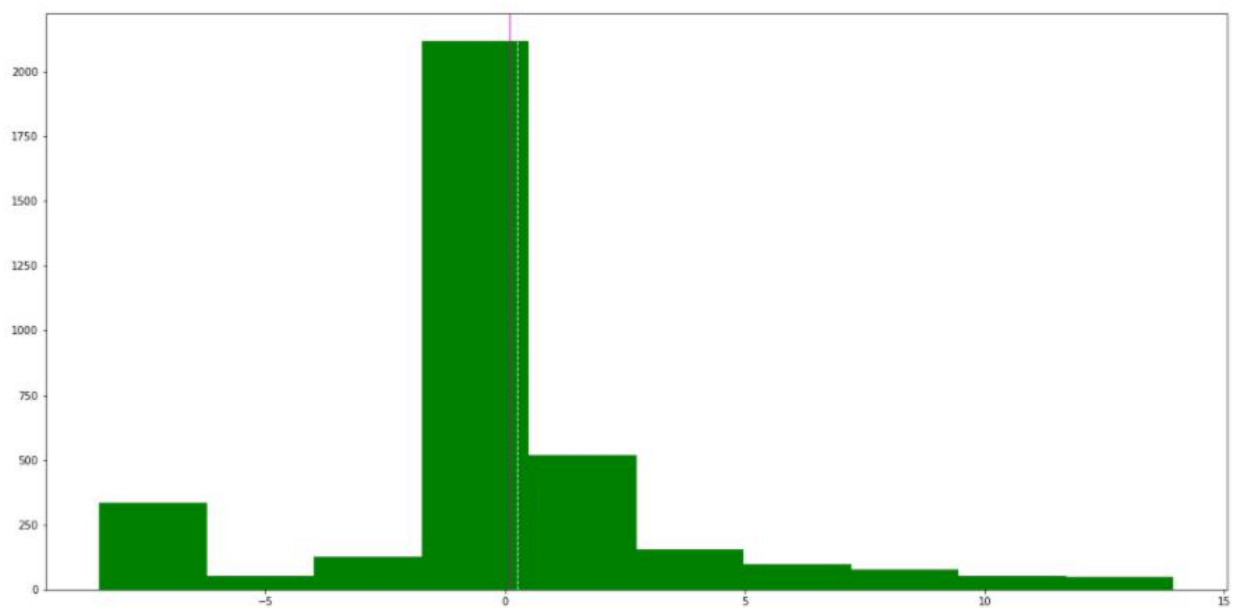
Histogram of Capital_Employed, Current_Assets, Total_Sales, Retained_Earnings, Total_Equity, Total_assets



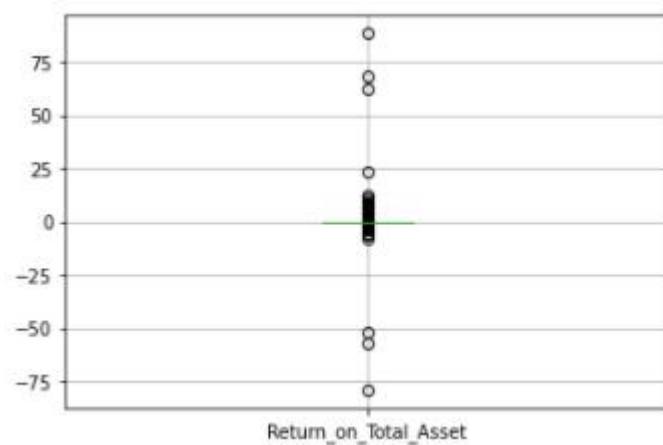
Violin plot of Cost_of_Production



Histogram of PAT

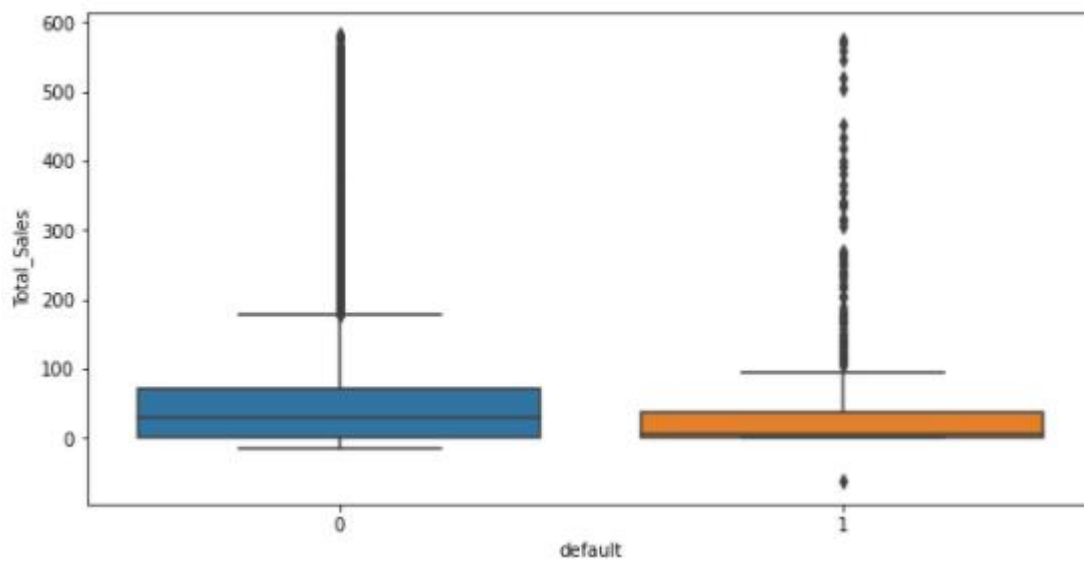


Box plot of Return_on_Total_Asset

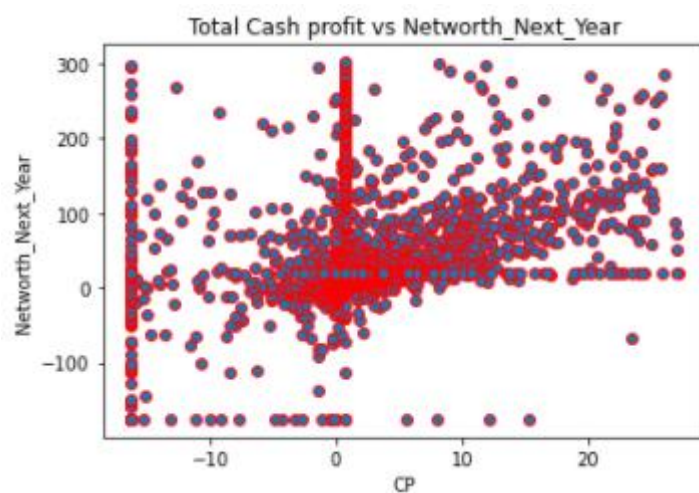


Bivariate analysis

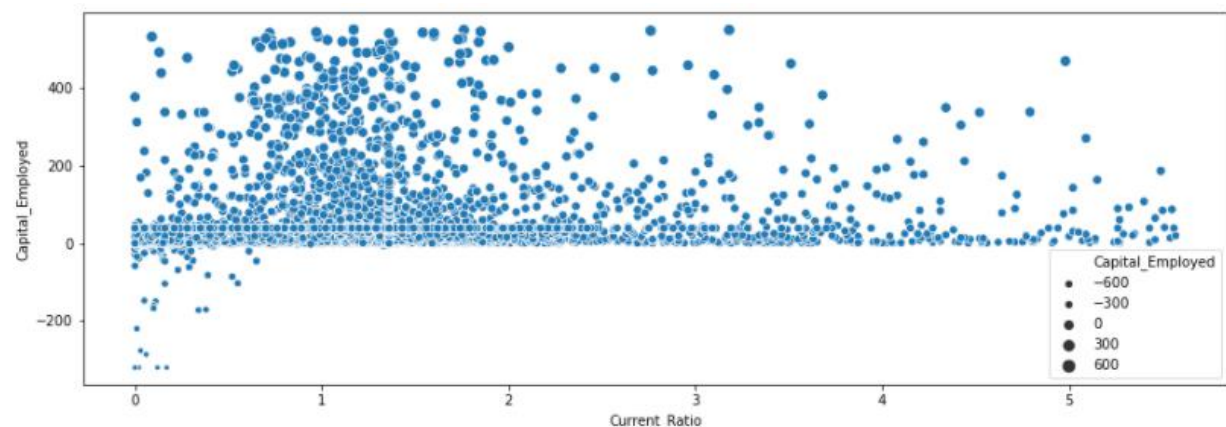
Boxplot of Total_Sales vs Default



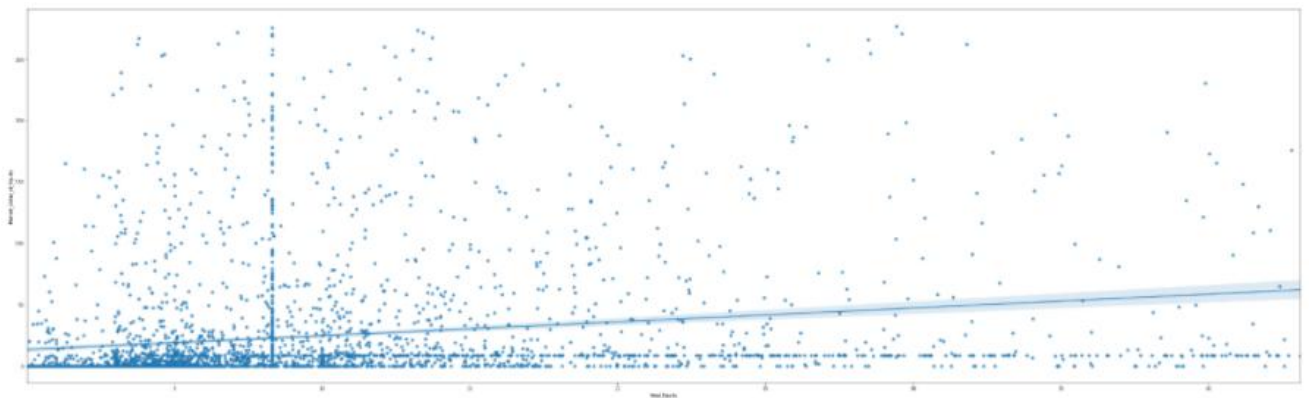
Scatter plot of Networth_Next_Year vs CP



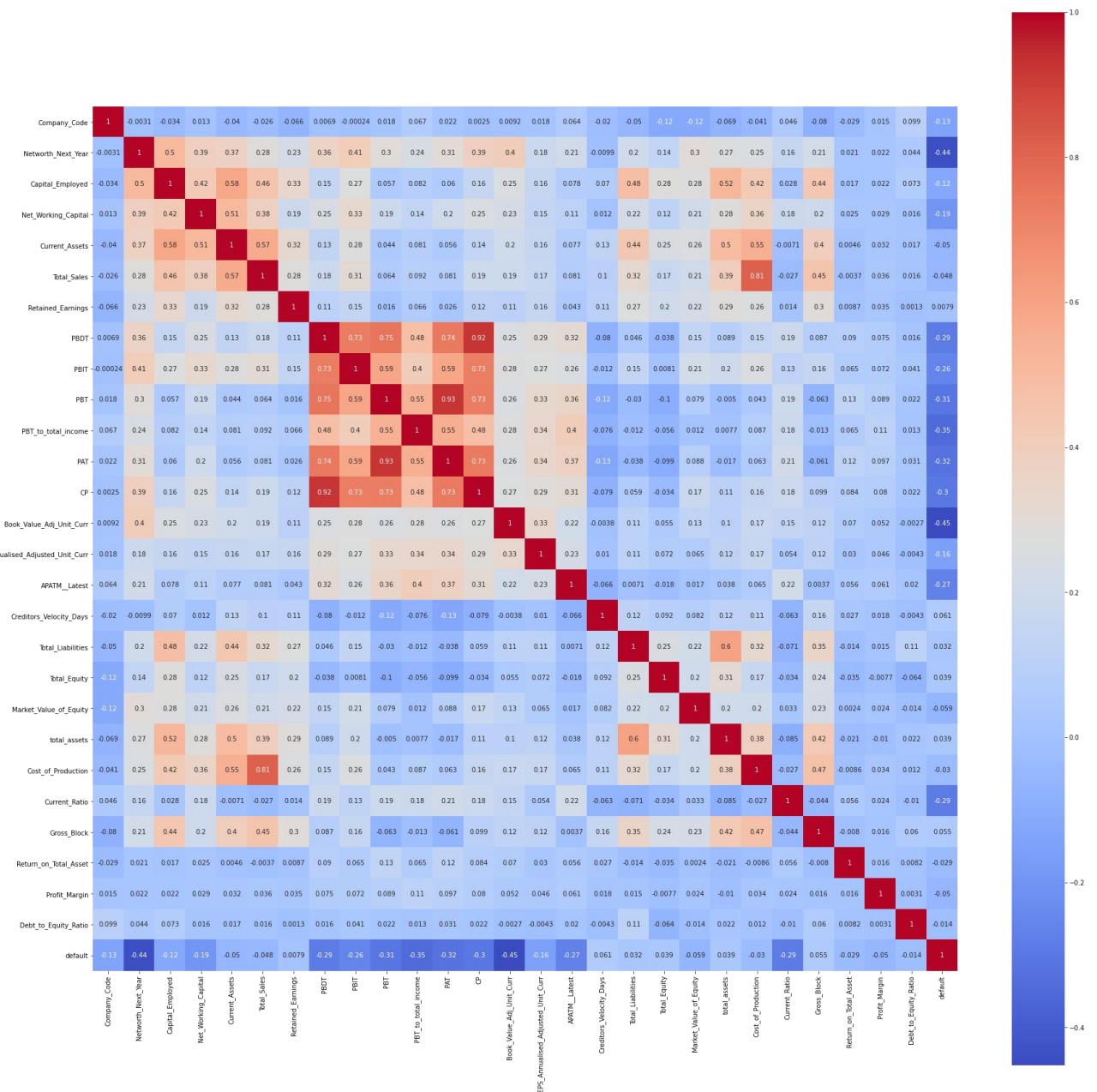
Scatter plot of Capital_Employed vs Current_Ratio



Scatter plot with regression line of Market_Value_of_Equity vs Total_Equity



Heatmap



2.5 Perform Train Test Split

Train data

	842	1057	1595	100	1191
Capital_Employed	3.540000	5.390000	13.500000	-58.300000	20.620000
Net_Working_Capital	2.940000	3.560000	13.470000	-84.100000	7.380000
Current_Assets	2.980000	3.620000	13.620000	7.690000	22.220000
Total_Sales	0.420000	1.880000	0.120000	0.760000	142.800000
Retained_Earnings	0.000000	0.720000	0.750000	0.340000	2.640000
PBDT	0.140000	0.500000	0.230000	-19.417500	1.700000
PBIT	0.030000	0.420000	0.230000	-25.038750	3.020000
PBT	0.020000	0.410000	0.230000	-11.283750	1.090000
PBT_to_total_income	0.000000	0.569444	0.306667	-8.000000	0.412879
PAT	0.010000	0.410000	0.160000	-8.460000	0.730000
CP	0.130000	0.500000	0.160000	-16.365000	1.340000
Book_Value_Adj_Unit_Curr	10.740000	11.140000	1.030000	-8.370000	1.490000
EPS_Annualised_Adjusted_Unit_Curr	0.030000	0.860000	0.010000	0.000000	0.180000
APATM_Latest	1.590000	-7.650000	1.060000	-11.115000	1.790000
Creditors_Velocity_Days	0.000000	13.000000	0.000000	15.000000	28.000000
Total_Liabilities	0.050000	0.020000	16.640000	2.460000	14.330000
Total_Equity	3.250000	4.750000	13.060000	8.295000	4.000000
Market_Value_of_Equity	0.000000	0.000000	257.280000	6.320000	0.000000
total_assets	3.300000	4.770000	13.060000	75.100000	18.330000
Cost_of_Production	0.250000	1.350000	0.080000	0.830000	138.750000
Current_Ratio	1.360000	1.360000	1.360000	0.000000	1.020000
Gross_Block	1.530000	0.750000	0.000000	18.660000	7.760000
Return_on_Total_Asset	0.006061	0.085954	0.017611	-0.150250	0.059465
Profit_Margin	0.047619	0.218085	1.916667	-14.847039	0.007633
Debt_to_Equity_Ratio	0.015385	0.004211	1.274119	0.296564	3.582500
default	0.000000	0.000000	0.000000	1.000000	0.000000

Test data

	251	3493	3063	2384	1679
Capital_Employed	-1.550000	39.090000	350.020000	60.880000	14.270000
Net_Working_Capital	-2.180000	10.145000	3.720000	63.820000	1.470000
Current_Assets	2.220000	24.540000	6.710000	89.340000	2.290000
Total_Sales	0.690000	30.440000	2.180000	93.970000	3.340000
Retained_Earnings	0.000000	0.450000	0.030000	0.370000	0.000000
PBDT	-0.980000	0.795000	1.680000	-4.450000	2.000000
PBIT	-0.580000	1.150000	1.610000	-3.570000	1.280000
PBT	-0.980000	0.310000	1.610000	-5.920000	1.280000
PBT_to_total_income	0.000000	1.196298	0.407000	-6.000000	0.000000
PAT	-0.980000	0.255000	1.490000	-3.570000	1.000000
CP	-0.980000	0.740000	1.540000	-2.100000	1.720000
Book_Value_Adj_Unit_Curr	-25.400000	18.980000	108.270000	40.760000	19.190000
EPS_Annualised_Adjusted_Unit_Curr	0.000000	0.380000	0.480000	0.000000	1.350000
APATM_Latest	-4.680000	1.590000	1.590000	0.800000	1.590000
Creditors_Velocity_Days	83.000000	31.000000	4.000000	73.000000	0.000000
Total_Liabilities	4.030000	16.640000	233.420000	25.740000	107.140000
Total_Equity	2.190000	8.295000	32.330000	3.010000	7.440000
Market_Value_of_Equity	5.390000	8.370000	116.710000	99.630000	53.570000
total_assets	6.220000	20.650000	32.330000	28.750000	7.440000
Cost_of_Production	2.680000	25.990000	0.160000	99.830000	2.090000
Current_Ratio	0.730000	1.440000	4.340000	1.550000	1.380000
Gross_Block	1.070000	15.870000	5.490000	31.220000	13.870000
Return_on_Total_Asset	-0.154341	0.015012	0.049799	-0.205913	0.172043
Profit_Margin	-1.391304	0.010184	0.738532	-0.062999	0.383234
Debt_to_Equity_Ratio	1.840183	2.006028	7.219920	8.551495	14.406538
default	1.000000	0.000000	0.000000	0.000000	0.000000

The dataset is splitted as train and test data as per given constraints

2.6 Build a Logistic Regression Model on most important variables on Train Dataset

Initial model

Logit Regression Results

Dep. Variable:	default	No. Observations:	2402			
Model:	Logit	Df Residuals:	2388			
Method:	MLE	Df Model:	13			
Date:	Wed, 02 Sep 2020	Pseudo R-squ.:	0.6245			
Time:	14:01:59	Log-Likelihood:	-309.22			
converged:	True	LL-Null:	-823.47			
Covariance Type:	nonrobust	LLR p-value:	1.316e-211			
	coef	std err	z	P> z	[0.025	0.975]
Intercept	-0.2780	0.199	-1.387	0.165	-0.686	0.114
Capital_Employed	-0.0030	0.002	-1.548	0.122	-0.007	0.001
Retained_Earnings	0.1055	0.082	1.281	0.200	-0.056	0.267
PBT_to_total_income	-0.1952	0.043	-4.524	0.000	-0.280	-0.111
CP	-0.0622	0.023	-2.701	0.007	-0.107	-0.017
Book_Value_Adj_Unit_Curr	-0.1373	0.011	-12.725	0.000	-0.158	-0.116
EPS_Annualised_Adjusted_Unit_Curr	0.1033	0.104	0.991	0.322	-0.101	0.308
Market_Value_of_Equity	-0.0055	0.004	-1.542	0.123	-0.013	0.001
Cost_of_Production	0.0023	0.002	1.190	0.234	-0.002	0.006
Current_Ratio	-1.1821	0.159	-7.442	0.000	-1.493	-0.871
Gross_Block	0.0059	0.002	2.416	0.016	0.001	0.011
Return_on_Total_Asset	0.0941	0.023	4.122	0.000	0.049	0.139
Profit_Margin	0.0120	0.013	0.898	0.369	-0.014	0.038
Debt_to_Equity_Ratio	-0.0419	0.013	-3.138	0.002	-0.068	-0.016

Final model

Logit Regression Results

Dep. Variable:	default	No. Observations:	2402
Model:	Logit	Df Residuals:	2394
Method:	MLE	Df Model:	7
Date:	Wed, 02 Sep 2020	Pseudo R-squ.:	0.6187
Time:	14:04:50	Log-Likelihood:	-314.03
converged:	True	LL-Null:	-823.47
Covariance Type:	nonrobust	LLR p-value:	1.003e-215

	coef	std err	z	P> z	[0.025	0.975]
Intercept	-0.2439	0.192	-1.268	0.205	-0.621	0.133
PBT_to_total_income	-0.1811	0.041	-4.367	0.000	-0.262	-0.100
CP	-0.0517	0.022	-2.390	0.017	-0.094	-0.009
Book_Value_Adj_Unit_Curr	-0.1385	0.010	-13.079	0.000	-0.157	-0.116
Current_Ratio	-1.2129	0.155	-7.809	0.000	-1.517	-0.909
Gross_Block	0.0059	0.002	3.129	0.002	0.002	0.010
Return_on_Total_Asset	0.0889	0.022	4.132	0.000	0.047	0.131
Debt_to_Equity_Ratio	-0.0439	0.013	-3.399	0.001	-0.069	-0.019

Logistic regression is done by picking important variables and less correlated variables initially.

The variables in final model are the significant variables.

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2.7 State the accuracy, specificity, and sensitivity of the model based upon the optimized cutoff value

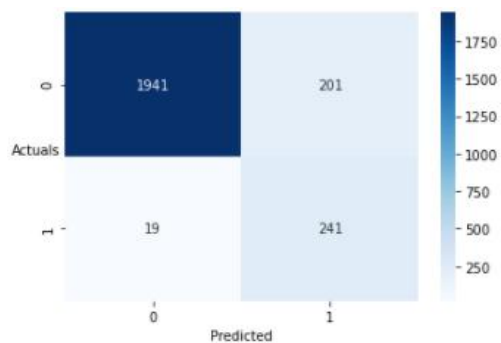
Optimized cutoff value

0.11415763529402564

Accuracy, Specificity and Sensitivity

	precision	recall	f1-score	support
0	0.990	0.906	0.946	2142
1	0.545	0.927	0.687	260
accuracy			0.908	2402
macro avg	0.768	0.917	0.816	2402
weighted avg	0.942	0.908	0.918	2402

Confusion matrix



2.8 Validate the Model on Test Dataset and state the performance matrices

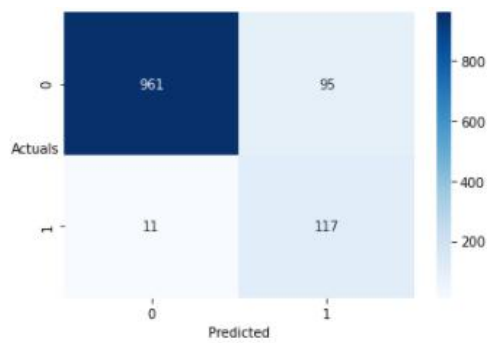
Predictions on test data

```
251      9.088190e-01
3493     7.934707e-03
3063     1.003487e-09
2384     1.228572e-03
1679     5.848031e-03
...
1321     3.239139e-08
2666     1.995532e-07
773      9.290209e-02
3488     6.238636e-08
2956     2.515418e-06
Length: 1184, dtype: float64
```

Classification report

	precision	recall	f1-score	support
0	0.989	0.910	0.948	1056
1	0.552	0.914	0.688	128
accuracy			0.910	1184
macro avg	0.770	0.912	0.818	1184
weighted avg	0.941	0.910	0.920	1184

Confusion matrix



2.9 Find out the Altzman Score on test and train dataset

Train data

842	1.336236
1057	1.846566
1595	13.205274
100	-2.130100
1191	8.773552
...	...
1815	0.883500
2852	5.259503
1505	0.661074
375	0.768319
3428	2.462908

Test data

251	-0.299146
3493	2.462908
3063	2.542153
2384	7.515514
1679	5.892831
...	...
1321	3.189736
2666	5.417415
773	0.218224
3488	2.462908
2956	4.967740

Summary of Altzman train data

count	2402.000000
mean	8.294490
std	68.049937
min	-364.359000
25%	0.783634
50%	2.462908
75%	5.680021
max	2239.212333

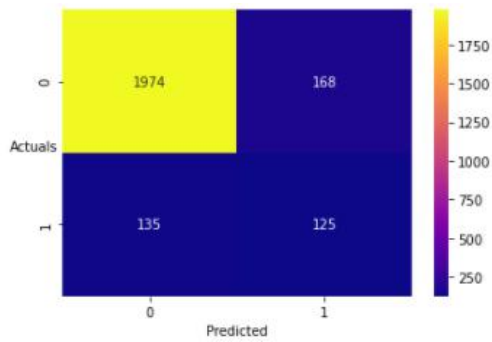
Summary of Altzman test data

count	1184.000000
mean	6.924922
std	33.193595
min	-11.121097
25%	0.823207
50%	2.464525
75%	5.739661
max	963.270515

Classification report on Altzman train data

	precision	recall	f1-score	support
0	0.936	0.922	0.929	2142
1	0.427	0.481	0.452	260
accuracy			0.874	2402
macro avg	0.681	0.701	0.690	2402
weighted avg	0.881	0.874	0.877	2402

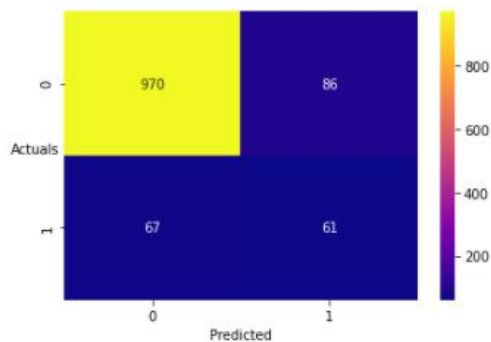
Confusion matrix on Altzman train data



Classification report on Altzman test data

	precision	recall	f1-score	support
0	0.935	0.919	0.927	1056
1	0.415	0.477	0.444	128
accuracy			0.871	1184
macro avg	0.675	0.698	0.685	1184
weighted avg	0.879	0.871	0.875	1184

Confusion matrix on Altzman test data



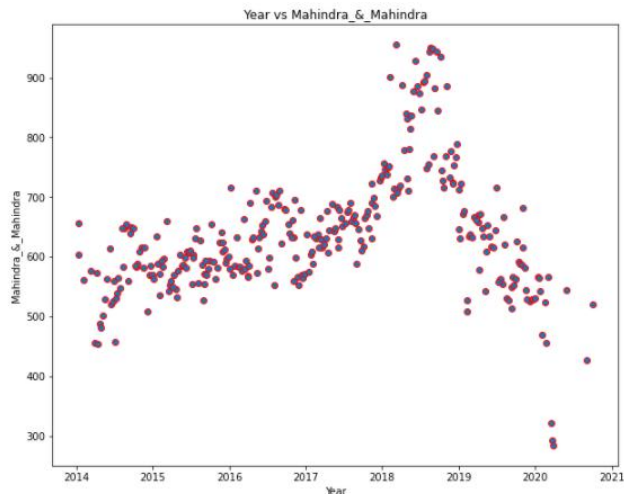
2.10 Compare the Altzman's Score with the Logistic Regression Model

- The accuracy of Logistic regression on train data is 0.908 and test data is 0.91.
- The accuracy of Altzman's score on train data is 0.874 and test data is 0.871.
- Also the Precision, Recall and F1-score value on Logistic regression model performs better than Altzman's score.
- So Logistic regression model performs better than Altzman's score in all aspects.

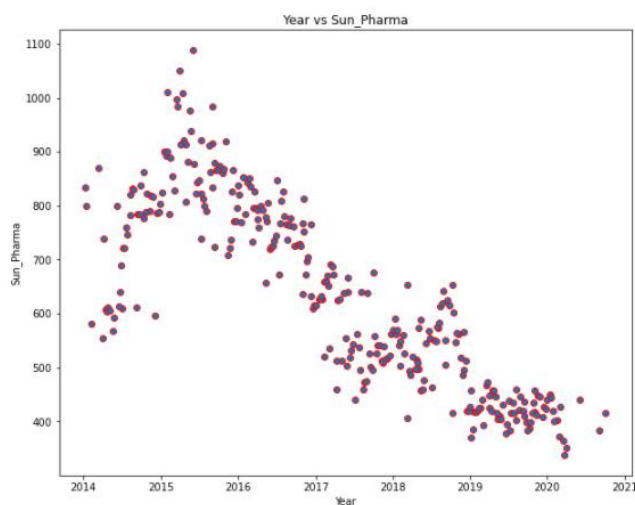
3 Market Risk on the Stock Prices of 10 different Indian Stocks

3.1 Draw Stock Price Chart for any 2 variables

Year vs Mahindra_&_Mahindra



Year vs Sun_Pharma



3.2 Calculate Returns

	Infosys	Indian_Hotel	Mahindra_&_Mahindra	Axis_Bank	SAIL	Shree_Cement	Sun_Pharma	Jindal_Steel	Idea_Vodafone	Jet_Airways
0	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN
1	-0.026873	-0.014599	0.006572	0.048247	0.028988	0.032831	0.094491	-0.065882	0.011976	0.086112
2	-0.011742	0.000000	-0.008772	-0.021979	-0.028988	-0.013888	-0.004930	0.000000	-0.011976	-0.078943
3	-0.003945	0.000000	0.072218	0.047025	0.000000	0.007583	-0.004955	-0.018084	0.000000	0.007117
4	0.011788	-0.045120	-0.012371	-0.003540	-0.076373	-0.019515	0.011523	-0.140857	-0.049393	-0.148846

3.3 Calculate Stock Means and Standard Deviation

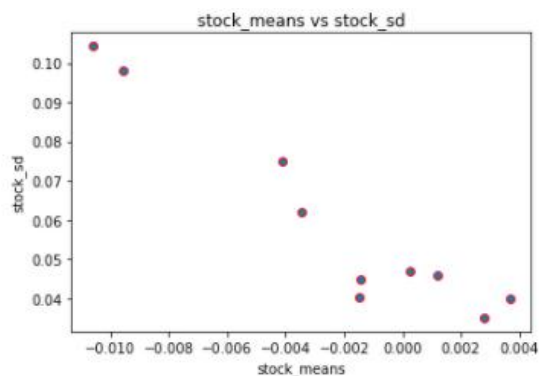
Stock means

Infosys	0.002794
Indian_Hotel	0.000266
Mahindra_&_Mahindra	-0.001506
Axis_Bank	0.001167
SAIL	-0.003463
Shree_Cement	0.003681
Sun_Pharma	-0.001455
Jindal_Steel	-0.004123
Idea_Vodafone	-0.010608
Jet_Airways	-0.009548

Stock standard deviation

Infosys	0.035070
Indian_Hotel	0.047131
Mahindra_&_Mahindra	0.040169
Axis_Bank	0.045828
SAIL	0.062188
Shree_Cement	0.039917
Sun_Pharma	0.045033
Jindal_Steel	0.075108
Idea_Vodafone	0.104315
Jet_Airways	0.097972

3.4 Draw a plot of Stock Means vs Standard Deviation and share insights



4 Appendix A – Source Code



Karthiyeswar_Fina
nce and Risk Analy