Project FRA

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```
library(tidyverse)

## -- Attaching packages -------------------------------- tidyverse 1.2.1 -
-

## v ggplot2 3.2.1      v purrr   0.3.2
## v tibble  2.1.3      v dplyr   0.8.3
## v tidyr   0.8.3      v stringr 1.4.0
## v readr   1.3.1      v forcats 0.4.0

## -- Conflicts --------------------------------- tidyverse_conflicts() -
-
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()

library(ggplot2)
library(caret)

## Loading required package: lattice

##
## Attaching package: 'caret'

## The following object is masked from 'package:purrr':
##
##     lift

library(caretEnsemble)

##
## Attaching package: 'caretEnsemble'

## The following object is masked from 'package:ggplot2':
##
##     autoplot

library(psych)

##
## Attaching package: 'psych'

## The following objects are masked from 'package:ggplot2':
##
##     %+%, alpha
```

```
library(Amelia)

## Loading required package: Rcpp

## ##
## ## Amelia II: Multiple Imputation
## ## (Version 1.7.5, built: 2018-05-07)
## ## Copyright (C) 2005-2019 James Honaker, Gary King and Matthew Blackwell
## ## Refer to http://gking.harvard.edu/amelia/ for more information
## ##

library(mice)

##
## Attaching package: 'mice'

## The following object is masked from 'package:tidyr':
##
##     complete

## The following objects are masked from 'package:base':
##
##     cbind, rbind

library(GGally)

## Registered S3 method overwritten by 'GGally':
##   method from
##   +.gg   ggplot2

##
## Attaching package: 'GGally'

## The following object is masked from 'package:dplyr':
##
##     nasa

library(gutenbergr)
library(tidytext)
library(dplyr)
library(janeaustenr)
library(stringi)
library(tidyr)
library(rpart)
library(dplyr)
library(randomForest)

## randomForest 4.6-14

## Type rfNews() to see new features/changes/bug fixes.

##
## Attaching package: 'randomForest'
```

```
## The following object is masked from 'package:psych':
##
##     outlier

## The following object is masked from 'package:dplyr':
##
##     combine

## The following object is masked from 'package:ggplot2':
##
##     margin
```

1. Project Objective and Scope

To create an India credit risk(default) model, using the data provided in the spreadsheet raw-data, and validate it on validation data . We will be used logistic regression framework to develop the credit default model.

2. Project Approach

A typical Development Lifecycle can be adopted for this assignment, as follows:

1. Data Preparation
2. EDA
3. Model Building
4. Communicating Results.

Importing Data set into R

```r
library(readxl)
#Library(XLConnect)
#Importing Data set
setwd("C:/Users/SuprasannaPradhan/Documents/My Files/Great Lakes
Projects/Project -7 FRA")
raw_data=read_excel("raw-data.xlsx")
str(raw_data)
```

```
## Classes 'tbl_df', 'tbl' and 'data.frame':    3541 obs. of  52 variables:
##  $ Num                         : num  1 2 3 4 5 6 7 8 9 10
...
##  $ Networth Next Year          : num  8890.6 394.3 92.2 2.7
109 ...
##  $ Total assets                : num  17512.3 941 232.8 2.7
478.5 ...
##  $ Net worth                   : num  7093.2 351.5 100.6
2.7 107.6 ...
```

```
##  $ Total income                                 : num   24965 1527 477 NA
1580 ...
##  $ Change in stock                              : num   235.8 42.7 -5.2 NA -
17 ...
##  $ Total expenses                               : num   23658 1455 479 NA
1558 ...
##  $ Profit after tax                             : num   1543.2 115.2 -6.6 NA
5.5 ...
##  $ PBDITA                                       : num   2860.2 283 5.8 NA 31
...
##  $ PBT                                          : num   2417.2 188.4 -6.6 NA
6.3 ...
##  $ Cash profit                                  : num   1872.8 158.6 0.3 NA
11.9 ...
##  $ PBDITA as % of total income                  : num   11.46 18.53 1.22 0
1.96 ...
##  $ PBT as % of total income                     : num   9.68 12.33 -1.38 0
0.4 ...
##  $ PAT as % of total income                     : num   6.18 7.54 -1.38 0
0.35 2.81 0 0.72 8.29 -2.88 ...
##  $ Cash profit as % of total income             : num   7.5 10.38 0.06 0 0.75
...
##  $ PAT as % of net worth                        : num   23.78 38.08 -6.35 0
5.25 ...
##  $ Sales                                        : num   24458 1504 476 NA
1575 ...
##  $ Income from financial services               : num   158 4 1.5 NA 3.9 6.4
NA NA 7.3 NA ...
##  $ Other income                                 : num   297.2 15.9 0.2 NA 0.9
...
##  $ Total capital                                : num   423.8 115.5 81.4 0.5
6.2 ...
##  $ Reserves and funds                           : num   6822.8 257.8 19.2 2.2
161.8 ...
##  $ Deposits (accepted by commercial banks)      : logi  NA NA NA NA NA NA
...
##  $ Borrowings                                   : num   14.9 272.5 35.4 NA
193.1 ...
##  $ Current liabilities & provisions             : num   9965.9 210 96.8 NA
112.8 ...
##  $ Deferred tax liability                       : num   284.9 85.2 NA NA 4.6
...
##  $ Shareholders funds                           : num   7093.2 351.5 100.6
2.7 107.6 ...
##  $ Cumulative retained profits                  : num   6263.3 247.4 32.4 2.2
82.7 ...
##  $ Capital employed                             : num   7108.1 624 136 2.7
300.7 ...
##  $ TOL/TNW                                      : num   1.33 1.23 1.44 0 2.83
1.8 0.03 5.17 1.05 3.25 ...
```

```
##  $ Total term liabilities / tangible net worth: num  0 0.34 0.29 0 1.59
0.37 0.03 0.94 0.3 0.54 ...
##  $ Contingent liabilities / Net worth (%)    : num  14.8 19.2 45.8 0 34.9
...
##  $ Contingent liabilities                    : num  1049.7 67.6 46.1 NA
37.6 ...
##  $ Net fixed assets                          : num  1900.2 286.4 38.7 2.5
94.8 ...
##  $ Investments                               : num  1069.6 2.2 4.3 NA 7.4
...
##  $ Current assets                            : num  13277.5 563.9 167.5
0.2 349.7 ...
##  $ Net working capital                       : num  3588.5 203.5 59.6 0.2
215.8 ...
##  $ Quick ratio (times)                       : num  1.18 0.95 1.11 NA
1.41 0.48 NA 0.54 0.59 0.39 ...
##  $ Current ratio (times)                     : num  1.37 1.56 1.55 NA
2.54 1.27 NA 1.15 1.58 0.5 ...
##  $ Debt to equity ratio (times)              : num  0 0.78 0.35 0 1.79
1.09 0.32 2.31 0.94 3.13 ...
##  $ Cash to current liabilities (times)       : num  0.43 0.06 0.21 NA 0
0.11 NA 0.04 0.19 0 ...
##  $ Cash to average cost of sales per day     : num  68.21 5.96 17.07 NA 0
...
##  $ Creditors turnover                        : chr  "3.62"
"9.8000000000000007" "5.28" "0" ...
##  $ Debtors turnover                          : chr  "3.85" "5.7" "5.07"
"0" ...
##  $ Finished goods turnover                   : chr  "200.55" "14.21"
"9.24" NA ...
##  $ WIP turnover                              : chr  "21.78" "7.49" "0.23"
NA ...
##  $ Raw material turnover                     : chr  "7.71" "11.46" NA "0"
...
##  $ Shares outstanding                        : chr  "42381675" "11550000"
"8149090" "52404" ...
##  $ Equity face value                         : chr  "10" "10" "10" "10"
...
##  $ EPS                                       : num  35.52 9.97 -0.5 0
7.91 ...
##  $ Adjusted EPS                              : num  7.1 9.97 -0.5 0 7.91
...
##  $ Total liabilities                         : num  17512.3 941 232.8 2.7
478.5 ...
##  $ PE on BSE                                 : chr  "27.31" "8.17" "-
5.76" "NA" ...
```

The data is consisted of 3541 observation with 52 variables: All variabels are numerical,
Networth Next Year varibale we will make it categorial for further anlysiss

Ranameing these colomuns to analyize conviently further

```r
colnames(raw_data)[colnames(raw_data)=="Networth Next Year"]<-"Networth_NY"
colnames(raw_data)[colnames(raw_data)=="Total assets"]<-"Total_asts"
colnames(raw_data)[colnames(raw_data)=="Net worth"]<-"Net_worth"
colnames(raw_data)[colnames(raw_data)=="Total income"]<-"Total_income"
colnames(raw_data)[colnames(raw_data)=="Change in stock"]<-"Change_instock"
colnames(raw_data)[colnames(raw_data)=="Total expenses"]<-"Total_expenses"
colnames(raw_data)[colnames(raw_data)=="Profit after tax"]<-"PAT"
colnames(raw_data)[colnames(raw_data)=="PBDITA"]<-"PBDITA"
colnames(raw_data)[colnames(raw_data)=="PBT"]<-"PBT"
colnames(raw_data)[colnames(raw_data)=="Cash profit"]<-"Cash_profit"
colnames(raw_data)[colnames(raw_data)=="PBDITA as % of total income"]<-
"PBDITA_total income"
colnames(raw_data)[colnames(raw_data)=="PBT as % of total income"]<-
"PBT_total income"
colnames(raw_data)[colnames(raw_data)=="PAT as % of total income"]<-
"PAT_total income"
colnames(raw_data)[colnames(raw_data)=="Cash profit as % of total income"]<-
"Cashprofit _totalincome"
colnames(raw_data)[colnames(raw_data)=="PAT as % of net worth"]<-
"PAT_net_worth"
colnames(raw_data)[colnames(raw_data)=="Sales"]<-"Sales"
colnames(raw_data)[colnames(raw_data)=="Income from financial services"]<-
"Income_financial_services"
colnames(raw_data)[colnames(raw_data)=="Other income"]<-"Other_income"
colnames(raw_data)[colnames(raw_data)=="Total capital"]<-"Total_capital"
colnames(raw_data)[colnames(raw_data)=="Reserves and funds"]<-
"Reserves_funds"
colnames(raw_data)[colnames(raw_data)=="Deposits (accepted by commercial
banks)"]<-"Deposits_com_bank"
colnames(raw_data)[colnames(raw_data)=="Borrowings"]<-"Borrowings"
colnames(raw_data)[colnames(raw_data)=="Current liabilities & provisions"]<-
"Current liabilities_provisions"
colnames(raw_data)[colnames(raw_data)=="Deferred tax liability"]<-
"Deferred_taxliability"
colnames(raw_data)[colnames(raw_data)=="Shareholders funds"]<-
"Shareholders_funds"
colnames(raw_data)[colnames(raw_data)=="Cumulative retained profits"]<-
"Cumulative_retained_profits"
colnames(raw_data)[colnames(raw_data)=="Capital employed"]<-
"Capital_employed"
colnames(raw_data)[colnames(raw_data)=="TOL/TNW"]<-"TOL_TNW"
colnames(raw_data)[colnames(raw_data)=="Total term liabilities / tangible net
worth"]<-" Liabilities_tangible_networth"
colnames(raw_data)[colnames(raw_data)=="Contingent liabilities / Net worth
(%)"]<-"Contingent_liabilities_networth "
colnames(raw_data)[colnames(raw_data)=="Contingent liabilities"]<-
"Contingent_liabilities"
colnames(raw_data)[colnames(raw_data)=="Net fixed assets"]<-"Netfixed_assets"
```

```r
colnames(raw_data)[colnames(raw_data)=="Investments"]<-"Investments"
colnames(raw_data)[colnames(raw_data)=="Current assets"]<-"Current_assets"
colnames(raw_data)[colnames(raw_data)=="Net working capital"]<-
"Networking_capital"
colnames(raw_data)[colnames(raw_data)=="Quick ratio (times)"]<-"Quick_ratio "
colnames(raw_data)[colnames(raw_data)=="Current ratio (times)"]<-
"Current_ratio "
colnames(raw_data)[colnames(raw_data)=="Debt to equity ratio (times)"]<-
"Debt_equity_ratio"
colnames(raw_data)[colnames(raw_data)=="Cash to current liabilities
(times)"]<-"Cash_current_liabilities "
colnames(raw_data)[colnames(raw_data)=="Cash to average cost of sales per
day"]<-"DY_salescost"
colnames(raw_data)[colnames(raw_data)=="Creditors turnover"]<-
"Creditors_turnover"
colnames(raw_data)[colnames(raw_data)=="Debtors turnover"]<-
"Debtors_turnover"
colnames(raw_data)[colnames(raw_data)=="Finished goods turnover"]<-
"Finished_goods_turnover"
colnames(raw_data)[colnames(raw_data)=="WIP turnover"]<-"WIP_turnover"
colnames(raw_data)[colnames(raw_data)=="Raw material turnover"]<-
"Raw_material_turnover"
colnames(raw_data)[colnames(raw_data)=="Shares outstanding"]<-
"Shares_outstanding"
colnames(raw_data)[colnames(raw_data)=="Equity face value"]<-
"Equity_face_value"
colnames(raw_data)[colnames(raw_data)=="EPS"]<-"EPS"
colnames(raw_data)[colnames(raw_data)=="Adjusted EPS"]<-"Adjusted_EPS"
colnames(raw_data)[colnames(raw_data)=="Total liabilities"]<-
"Total_liabilities"
colnames(raw_data)[colnames(raw_data)=="PE on BSE"]<-"PE_BSE"
describe(raw_data)

## Warning in describe(raw_data): NAs introduced by coercion

## Warning in describe(raw_data): NAs introduced by coercion

## Warning in describe(raw_data): NAs introduced by coercion

## Warning in describe(raw_data): NAs introduced by coercion

## Warning in describe(raw_data): NAs introduced by coercion

## Warning in describe(raw_data): NAs introduced by coercion

## Warning in describe(raw_data): NAs introduced by coercion

## Warning in describe(raw_data): NAs introduced by coercion
```

```
## Warning in FUN(newX[, i], ...): no non-missing arguments to min; returning
## Inf

## Warning in FUN(newX[, i], ...): no non-missing arguments to max; returning
## -Inf

##                                  vars    n      mean        sd
## Num                                 1 3541   1772.45   1023.73
## Networth_NY                         2 3541   1616.26  17459.64
## Total_asts                          3 3541   3443.38  30970.89
## Net_worth                           4 3541   1295.86  13387.89
## Total_income                        5 3343   4582.82  55681.24
## Change_instock                      6 3083     41.49    440.57
## Total_expenses                      7 3402   4262.93  53028.69
## PAT                                 8 3410    277.36   3064.41
## PBDITA                              9 3410    578.06   5653.77
## PBT                                10 3410    383.81   4117.07
## Cash_profit                        11 3410    392.07   4226.64
## PBDITA_total income                12 3473      4.57    147.12
## PBT_total income                   13 3473    -17.28    425.43
## PAT_total income                   14 3473    -19.20    429.81
## Cashprofit _totalincome            15 3473     -8.23    304.57
## PAT_net_worth                      16 3541     10.27     65.15
## Sales                              17 3282   4549.52  54964.65
## Income_financial_services          18 2606     80.84   1115.17
## Other_income                       19 2246     41.36    917.29
## Total_capital                      20 3537    216.61   1682.59
## Reserves_funds                     21 3456   1163.81  13372.68
## Deposits_com_bank                  22    0       NaN        NA
## Borrowings                         23 3175   1122.28   8681.92
## Current liabilities_provisions     24 3445    940.63   9546.09
## Deferred_taxliability              25 2401    227.22   2170.21
## Shareholders_funds                 26 3541   1322.07  13445.29
## Cumulative_retained_profits        27 3503    890.51  10112.38
## Capital_employed                   28 3541   2328.35  21069.01
## TOL_TNW                            29 3541      3.99     19.40
##  Liabilities_tangible_networth     30 3541      1.84     14.77
## Contingent_liabilities_networth    31 3541     53.94    378.84
## Contingent_liabilities             32 2353    932.92  12973.32
## Netfixed_assets                    33 3423   1189.68  13291.91
## Investments                        34 2106    694.73   6895.54
## Current_assets                     35 3475   1293.36  10131.77
## Networking_capital                 36 3509    138.57   2945.48
## Quick_ratio                        37 3448      1.40      7.73
## Current_ratio                      38 3448      2.13     10.11
## Debt_equity_ratio                  39 3541      2.78     14.97
## Cash_current_liabilities           40 3448      0.49      4.20
## DY_salescost                       41 3456    158.44   2746.90
## Creditors_turnover*                42 3494     15.45     68.21
## Debtors_turnover*                  43 3499     17.04     83.94
```

```
## Finished_goods_turnover*              44 3087        87.08        598.55
## WIP_turnover*                         45 3187        27.93        151.04
## Raw_material_turnover*                46 3466        19.09        376.34
## Shares_outstanding*                   47 3541 22067387.54 165519303.66
## Equity_face_value*                    48 3541     -1333.70      37500.73
## EPS                                   49 3541      -220.32      14261.95
## Adjusted_EPS                          50 3541      -221.51      14261.92
## Total_liabilities                     51 3541      3443.38      30970.89
## PE_BSE*                               52 3518        63.91       1433.81
##                                          median      trimmed          mad
## Num                                     1773.00      1772.31      1313.58
## Networth_NY                              116.30       265.91       159.53
## Total_asts                               309.70       643.26       402.08
## Net_worth                                102.30       220.77       134.03
## Total_income                             444.90       827.39       605.49
## Change_instock                             1.60         7.93        10.82
## Total_expenses                           407.70       774.78       562.50
## PAT                                        8.80        30.25        15.42
## PBDITA                                    35.40        86.81        51.00
## PBT                                       12.40        41.89        20.90
## Cash_profit                               18.85        52.48        27.95
## PBDITA_total income                        9.66        10.51         8.07
## PBT_total income                           3.31         4.47         4.91
## PAT_total income                           2.34         3.22         3.47
## Cashprofit _totalincome                    5.64         6.33         6.08
## PAT_net_worth                              7.92        10.21        11.74
## Sales                                    453.10       829.84       609.94
## Income_financial_services                  1.80         6.34         2.52
## Other_income                               1.40         3.50         1.93
## Total_capital                             42.10        61.40        49.82
## Reserves_funds                            54.80       160.31        90.51
## Deposits_com_bank                           NA          NaN           NA
## Borrowings                                99.20       205.91       135.36
## Current liabilities_provisions            69.40       152.13        94.59
## Deferred_taxliability                     13.40        29.36        18.09
## Shareholders_funds                       105.60       228.96       138.77
## Cumulative_retained_profits               37.10       116.20        71.76
## Capital_employed                         214.70       440.77       278.28
## TOL_TNW                                    1.43         1.74         1.48
##  Liabilities_tangible_networth            0.34         0.53         0.50
## Contingent_liabilities_networth            5.33        15.04         7.90
## Contingent_liabilities                    38.00       107.04        54.41
## Netfixed_assets                           93.50       198.87       123.65
## Investments                                8.35        43.85        12.08
## Current_assets                           145.10       286.21       196.74
## Networking_capital                        16.20        42.49        46.11
## Quick_ratio                                0.67         0.74         0.46
## Current_ratio                              1.23         1.33         0.53
## Debt_equity_ratio                          0.79         1.00         1.02
## Cash_current_liabilities                   0.07         0.12         0.09
```

```
## DY_salescost                         8.02       13.78       9.63
## Creditors_turnover*                  6.09        7.78       4.75
## Debtors_turnover*                    6.32        7.81       4.98
## Finished_goods_turnover*            17.27       25.14      16.69
## WIP_turnover*                        9.76       12.94       8.70
## Raw_material_turnover*               6.40        7.52       5.92
## Shares_outstanding*           4672063.00 6865618.23 5740720.60
## Equity_face_value*                  10.00       10.17       0.00
## EPS                                  1.43        4.93       2.95
## Adjusted_EPS                         1.18        4.02       2.46
## Total_liabilities                  309.70      643.26     402.08
## PE_BSE*                              9.10       10.46      10.33
##                                        min         max        range
## Num                             1.000000e+00 3.545000e+03 3.544000e+03
## Networth_NY                    -7.426560e+04 8.057734e+05 8.800390e+05
## Total_asts                      1.000000e-01 1.176509e+06 1.176509e+06
## Net_worth                       0.000000e+00 6.131516e+05 6.131516e+05
## Total_income                    0.000000e+00 2.442828e+06 2.442828e+06
## Change_instock                 -3.029400e+03 1.418550e+04 1.721490e+04
## Total_expenses                 -1.000000e-01 2.366035e+06 2.366035e+06
## PAT                            -3.908300e+03 1.194391e+05 1.233474e+05
## PBDITA                         -4.407000e+02 2.085765e+05 2.090172e+05
## PBT                            -3.894800e+03 1.452926e+05 1.491874e+05
## Cash_profit                    -2.245700e+03 1.769118e+05 1.791575e+05
## PBDITA_total income            -6.400000e+03 1.000000e+02 6.500000e+03
## PBT_total income               -2.134000e+04 1.000000e+02 2.144000e+04
## PAT_total income               -2.134000e+04 1.500000e+02 2.149000e+04
## Cashprofit _totalincome        -1.502000e+04 1.000000e+02 1.512000e+04
## PAT_net_worth                  -7.487200e+02 2.466670e+03 3.215390e+03
## Sales                           1.000000e-01 2.384984e+06 2.384984e+06
## Income_financial_services       0.000000e+00 5.193820e+04 5.193820e+04
## Other_income                    0.000000e+00 4.285670e+04 4.285670e+04
## Total_capital                   1.000000e-01 7.827320e+04 7.827310e+04
## Reserves_funds                 -6.525900e+03 6.251378e+05 6.316637e+05
## Deposits_com_bank                        Inf        -Inf         -Inf
## Borrowings                      1.000000e-01 2.782573e+05 2.782572e+05
## Current liabilities_provisions  1.000000e-01 3.522403e+05 3.522402e+05
## Deferred_taxliability           1.000000e-01 7.279660e+04 7.279650e+04
## Shareholders_funds              0.000000e+00 6.131516e+05 6.131516e+05
## Cumulative_retained_profits    -6.534300e+03 3.901338e+05 3.966681e+05
## Capital_employed                0.000000e+00 8.914089e+05 8.914089e+05
## TOL_TNW                        -3.504800e+02 4.730000e+02 8.234800e+02
##  Liabilities_tangible_networth -3.256000e+02 4.560000e+02 7.816000e+02
## Contingent_liabilities_networth 0.000000e+00 1.470427e+04 1.470427e+04
## Contingent_liabilities          1.000000e-01 5.595068e+05 5.595067e+05
## Netfixed_assets                 0.000000e+00 6.366046e+05 6.366046e+05
## Investments                     0.000000e+00 1.999786e+05 1.999786e+05
## Current_assets                  1.000000e-01 3.548152e+05 3.548151e+05
## Networking_capital             -6.383900e+04 8.578280e+04 1.496218e+05
## Quick_ratio                     0.000000e+00 3.410000e+02 3.410000e+02
```

```
## Current_ratio                          0.000000e+00 5.050000e+02 5.050000e+02
## Debt_equity_ratio                      0.000000e+00 4.560000e+02 4.560000e+02
## Cash_current_liabilities               0.000000e+00 1.650000e+02 1.650000e+02
## DY_salescost                           0.000000e+00 1.280408e+05 1.280408e+05
## Creditors_turnover*                    0.000000e+00 2.401000e+03 2.401000e+03
## Debtors_turnover*                      0.000000e+00 3.135200e+03 3.135200e+03
## Finished_goods_turnover*              -9.000000e-02 1.794760e+04 1.794769e+04
## WIP_turnover*                         -1.800000e-01 5.651400e+03 5.651580e+03
## Raw_material_turnover*                -2.000000e+00 2.109200e+04 2.109400e+04
## Shares_outstanding*                   -2.147484e+09 4.130401e+09 6.277884e+09
## Equity_face_value*                    -9.999989e+05 1.000000e+05 1.099999e+06
## EPS                                   -8.431818e+05 3.452253e+04 8.777043e+05
## Adjusted_EPS                          -8.431818e+05 3.452253e+04 8.777043e+05
## Total_liabilities                      1.000000e-01 1.176509e+06 1.176509e+06
## PE_BSE*                               -1.116640e+03 5.100274e+04 5.211938e+04
##                                        skew kurtosis          se
## Num                                    0.00    -1.20       17.20
## Networth_NY                           33.18  1373.06      293.41
## Total_asts                            27.86   939.63      520.46
## Net_worth                             33.50  1370.66      224.98
## Total_income                          32.35  1235.99      963.03
## Change_instock                        18.92   479.11        7.93
## Total_expenses                        33.09  1290.22      909.17
## PAT                                   26.28   847.39       52.48
## PBDITA                                25.90   806.51       96.82
## PBT                                   24.04   686.19       70.50
## Cash_profit                           29.33  1058.73       72.38
## PBDITA_total income                  -30.67  1148.62        2.50
## PBT_total income                     -40.35  1895.70        7.22
## PAT_total income                     -39.37  1821.62        7.29
## Cashprofit _totalincome              -38.40  1762.39        5.17
## PAT_net_worth                         17.91   645.38        1.09
## Sales                                 32.02  1208.80      959.43
## Income_financial_services             39.57  1798.02       21.85
## Other_income                          45.37  2110.70       19.36
## Total_capital                         33.73  1418.53       28.29
## Reserves_funds                        35.23  1493.59      227.47
## Deposits_com_bank                       NA       NA          NA
## Borrowings                            22.67   646.42      154.08
## Current liabilities_provisions        27.04   858.81      162.64
## Deferred_taxliability                 24.86   732.38       44.29
## Shareholders_funds                    33.13  1347.64      225.95
## Cumulative_retained_profits           29.50  1020.07      170.86
## Capital_employed                      30.07  1114.06      354.06
## TOL_TNW                               10.57   249.36        0.33
##  Liabilities_tangible_networth        12.59   433.85        0.25
## Contingent_liabilities_networth       25.76   849.70        6.37
## Contingent_liabilities                36.52  1499.07      267.45
## Netfixed_assets                       37.29  1642.50      227.19
## Investments                           20.62   504.13      150.26
```

```
## Current_assets                       22.93    646.58     171.87
## Networking_capital                     6.40    409.05      49.72
## Quick_ratio                           30.24   1172.12       0.13
## Current_ratio                         38.26   1805.46       0.17
## Debt_equity_ratio                     16.99    380.57       0.25
## Cash_current_liabilities              28.23    956.67       0.07
## DY_salescost                          36.04   1498.57      46.73
## Creditors_turnover*                   23.22    690.98       1.15
## Debtors_turnover*                     25.48    830.72       1.42
## Finished_goods_turnover*              20.41    491.96      10.77
## WIP_turnover*                         25.76    820.13       2.68
## Raw_material_turnover*                55.24   3088.44       6.39
## Shares_outstanding*                    8.94    288.31 2781542.42
## Equity_face_value*                   -26.51    703.15     630.20
## EPS                                  -58.35   3443.81     239.67
## Adjusted_EPS                         -58.35   3443.81     239.67
## Total_liabilities                     27.86    939.63     520.46
## PE_BSE*                               33.79   1184.09      24.17
```

Observed there is lot of NA are exited in the dataset and outlieres

Summary of some of important vairbales

```
raw_data1 <-  subset(raw_data,select =
c(2,3,4,5,7,17,19,20,24,30,34,35,42,43,47,51))
summary(raw_data1)

##    Networth_NY          Total_asts             Net_worth
##  Min.   :-74265.6   Min.   :      0.1   Min.   :      0.0
##  1st Qu.:    31.7   1st Qu.:     91.3   1st Qu.:     31.3
##  Median :   116.3   Median :    309.7   Median :    102.3
##  Mean   :  1616.3   Mean   :   3443.4   Mean   :   1295.9
##  3rd Qu.:   456.1   3rd Qu.:   1098.7   3rd Qu.:    377.3
##  Max.   :805773.4   Max.   :1176509.2   Max.   :613151.6
##
##    Total_income        Total_expenses          Sales
##  Min.   :     0.0   Min.   :     -0.1   Min.   :     0.1
##  1st Qu.:   106.5   1st Qu.:     95.8   1st Qu.:   112.7
##  Median :   444.9   Median :    407.7   Median :   453.1
##  Mean   :  4582.8   Mean   :   4262.9   Mean   :  4549.5
##  3rd Qu.:  1440.9   3rd Qu.:   1359.8   3rd Qu.:  1433.5
##  Max.   :2442828.2  Max.   :2366035.3   Max.   :2384984.4
##  NA's   :198        NA's   :139         NA's   :259
##    Other_income       Total_capital     Current liabilities_provisions
##  Min.   :    0.00   Min.   :    0.1   Min.   :     0.1
##  1st Qu.:    0.40   1st Qu.:   13.1   1st Qu.:    17.8
##  Median :    1.40   Median :   42.1   Median :    69.4
##  Mean   :   41.36   Mean   :  216.6   Mean   :   940.6
##  3rd Qu.:    5.97   3rd Qu.:  100.3   3rd Qu.:   261.7
##  Max.   :42856.70   Max.   :78273.2   Max.   :352240.3
```

```
##   NA's   :1295         NA's   :4          NA's   :96
##    Liabilities_tangible_networth  Investments       Current_assets
##   Min.   :-325.600                Min.   :    0.00   Min.   :     0.1
##   1st Qu.:   0.050                1st Qu.:    1.00   1st Qu.:    36.2
##   Median :   0.340                Median :    8.35   Median :   145.1
##   Mean   :   1.844                Mean   :  694.73   Mean   :  1293.4
##   3rd Qu.:   1.000                3rd Qu.:   64.30   3rd Qu.:   502.2
##   Max.   : 456.000                Max.   :199978.60  Max.   :354815.2
##                                   NA's   :1435       NA's   :66
##   Creditors_turnover Debtors_turnover  Shares_outstanding
##   Length:3541        Length:3541       Length:3541
##   Class :character   Class :character  Class :character
##   Mode  :character   Mode  :character  Mode  :character
##
##
##
##
##   Total_liabilities
##   Min.   :     0.1
##   1st Qu.:    91.3
##   Median :   309.7
##   Mean   :  3443.4
##   3rd Qu.:  1098.7
##   Max.   :1176509.2
##
```

Variable othere income is having 1295 Na, there is outlier in total income ,total expence and sale

Check NA values

```
##Checking Data ##
colSums(is.na(raw_data))
```

```
##                          Num                   Networth_NY
##                            0                             0
##                    Total_asts                     Net_worth
##                            0                             0
##                  Total_income                Change_instock
##                          198                           458
##                Total_expenses                           PAT
##                          139                           131
##                        PBDITA                           PBT
##                          131                           131
##                   Cash_profit            PBDITA_total income
##                          131                            68
##            PBT_total income              PAT_total income
##                           68                            68
##        Cashprofit _totalincome               PAT_net_worth
##                           68                             0
```

```
##                                  Sales               Income_financial_services
##                                    259                                     935
##                           Other_income                           Total_capital
##                                   1295                                       4
##                         Reserves_funds                       Deposits_com_bank
##                                     85                                    3541
##                             Borrowings          Current liabilities_provisions
##                                    366                                      96
##                  Deferred_taxliability                       Shareholders_funds
##                                   1140                                       0
##            Cumulative_retained_profits                         Capital_employed
##                                     38                                       0
##                                TOL_TNW          Liabilities_tangible_networth
##                                      0                                       0
## Contingent_liabilities_networth                       Contingent_liabilities
##                                      0                                    1188
##                         Netfixed_assets                             Investments
##                                    118                                    1435
##                         Current_assets                       Networking_capital
##                                     66                                      32
##                            Quick_ratio                           Current_ratio
##                                     93                                      93
##                       Debt_equity_ratio              Cash_current_liabilities
##                                      0                                      93
##                           DY_salescost                       Creditors_turnover
##                                     85                                      47
##                        Debtors_turnover              Finished_goods_turnover
##                                     42                                     454
##                           WIP_turnover                   Raw_material_turnover
##                                    354                                      75
##                      Shares_outstanding                       Equity_face_value
##                                      0                                       0
##                                    EPS                            Adjusted_EPS
##                                      0                                       0
##                      Total_liabilities                                  PE_BSE
##                                      0                                      23
```

Deposits (accepted by commercial banks) variable does not have any data,other income is aslo having 1295 NA values.So we may not be repaled it with mean let us proceed with making it zero.

Removing NA values
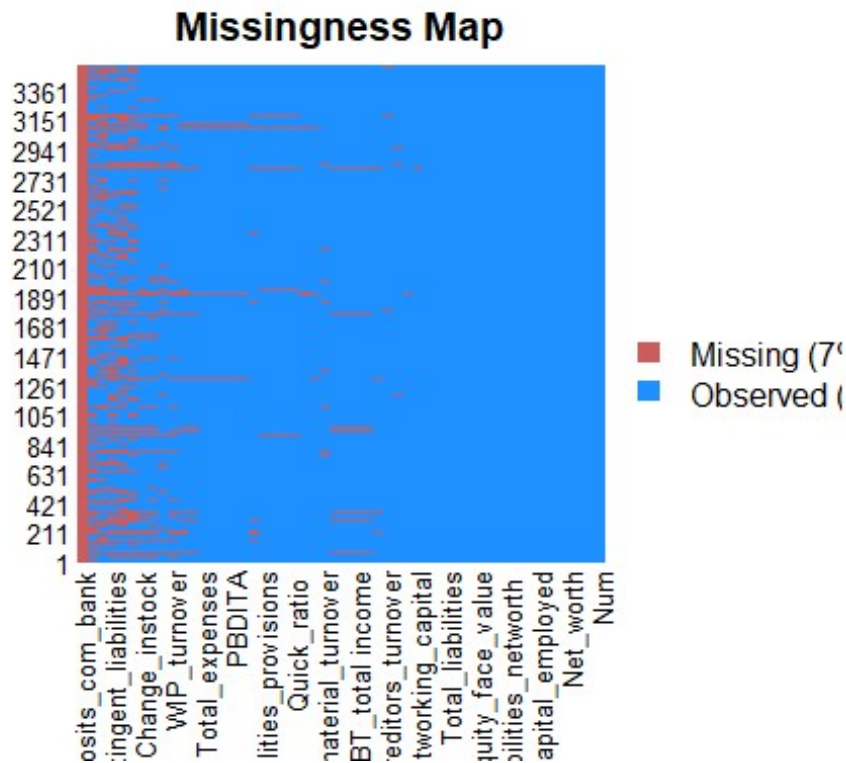
```
#visualize the missing data
missmap(raw_data)

## Warning in if (class(obj) == "amelia") {: the condition has length > 1 and
## only the first element will be used
```

```
## Warning: Unknown or uninitialised column: 'arguments'.

## Warning: Unknown or uninitialised column: 'arguments'.

## Warning: Unknown or uninitialised column: 'imputations'.
```


Missingness Map

```
sum(is.na(raw_data))

## [1] 13548

raw_data[is.na(raw_data)] <- 0
sum(is.na(raw_data))

## [1] 0
```

We have removed here all NA value from teh data set Observed some of variable are not into numberic values so we have to convert thease are not numberic value

Convert charactar to number values

```
#Convert charactar  to number values #
def_data<- subset(raw_data, select = -c(1,22))
def_data <- as.data.frame(def_data)
def_data$Creditors_turnover <- as.numeric(def_data$Creditors_turnover)

## Warning: NAs introduced by coercion

def_data$Debtors_turnover <- as.numeric(def_data$Debtors_turnover)
```

```
## Warning: NAs introduced by coercion

def_data$Finished_goods_turnover <-
as.numeric(def_data$Finished_goods_turnover)

## Warning: NAs introduced by coercion

def_data$WIP_turnover <- as.numeric(def_data$WIP_turnover)

## Warning: NAs introduced by coercion

def_data$Raw_material_turnover  <- as.numeric(def_data$Raw_material_turnover
)

## Warning: NAs introduced by coercion

def_data$Shares_outstanding  <- as.numeric(def_data$Shares_outstanding )

## Warning: NAs introduced by coercion

def_data$Equity_face_value  <- as.numeric(def_data$Equity_face_value )

## Warning: NAs introduced by coercion

def_data$PE_BSE   <- as.numeric(def_data$PE_BSE )

## Warning: NAs introduced by coercion

def_data[is.na(def_data)] <- 0
sum(is.na(def_data))

## [1] 0
```

Outliers Checking with Total Income

```
boxplot(def_data$Total_income)
```
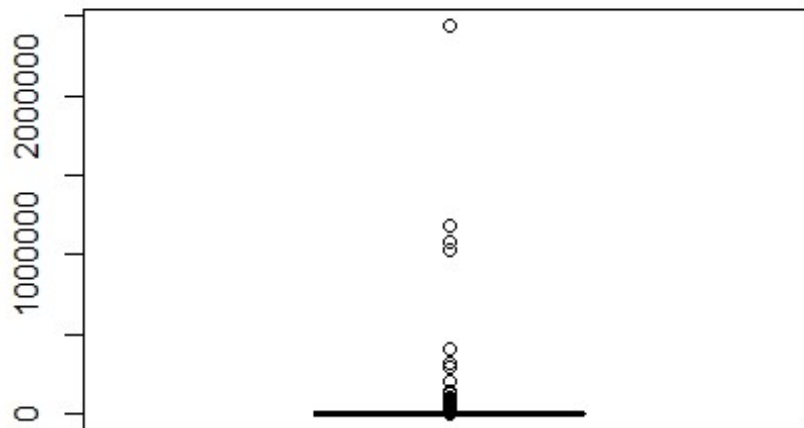
```
total_income_with_outlaier <- (def_data$Total_income)
```

Capping the outliers

```
# Capping outlier for total income
capOutlier <- function(x){
    qnt <- quantile(x, probs=c(.25, .75), na.rm = T)
    caps <- quantile(x, probs=c(.05, .95), na.rm = T)
    H <- 1.5 * IQR(x, na.rm = T)
    x[x < (qnt[1] - H)] <- caps[1]
    x[x > (qnt[2] + H)] <- caps[2]
    return(x)
}
def_data$Total_income=capOutlier(def_data$Total_income)
total_income_without_outlaier <- (def_data$Total_income)
```

Cheking outlier capping

```
par(mfrow=c(1, 2))
plot(total_income_with_outlaier)
plot(total_income_without_outlaier)
```
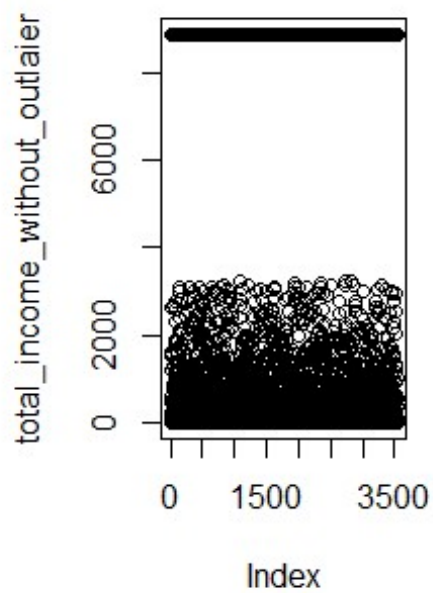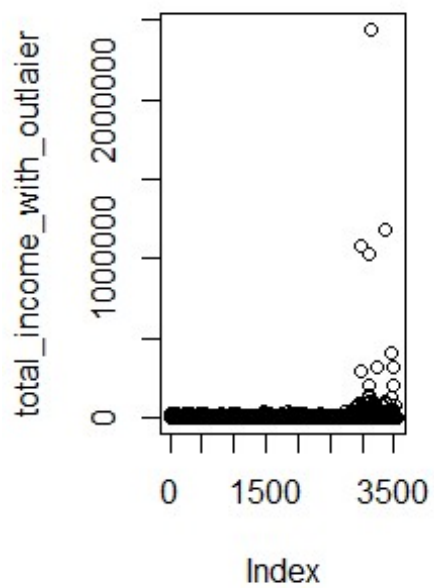
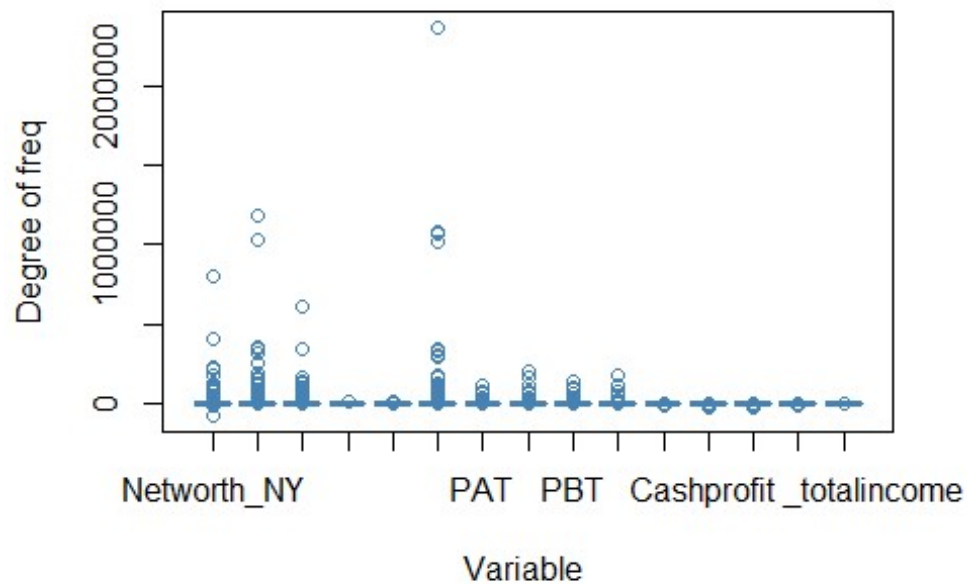# Find out outlier for other varibales

```r
# Outlier 1
boxplot(def_data[1:15],
main="Find outlaier ",
xlab="Variable ",
ylab="Degree of freq",
col="red",
border="steelblue" )
```

Find outlaier

Total assest ,Total Expence ,Net worth are having outliers

```
# Outlier 2
boxplot(def_data[16:35],
main="Find outlaier ",
xlab="Variable ",
ylab="Degree of freq",
col="blue",
border="red" )
```

Find outlaier
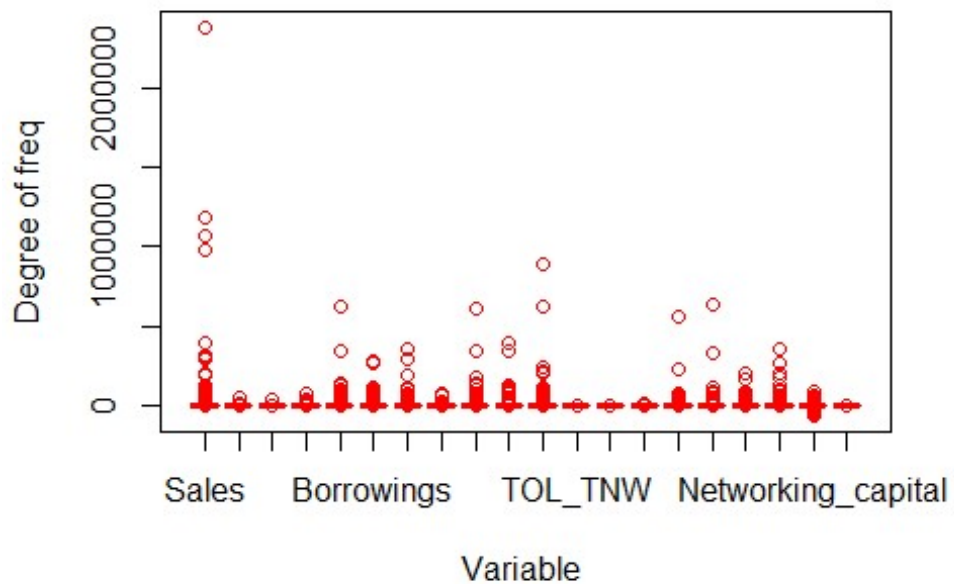
Sales , total capital and capitl employed ,Reversev fund are haivng outliers

```r
# Outlier 3
boxplot(def_data[36:43],
main="Find outlaier ",
xlab="Variable ",
ylab="Degree of freq",
col="blue",
border="brown" )
```

Find outlaier
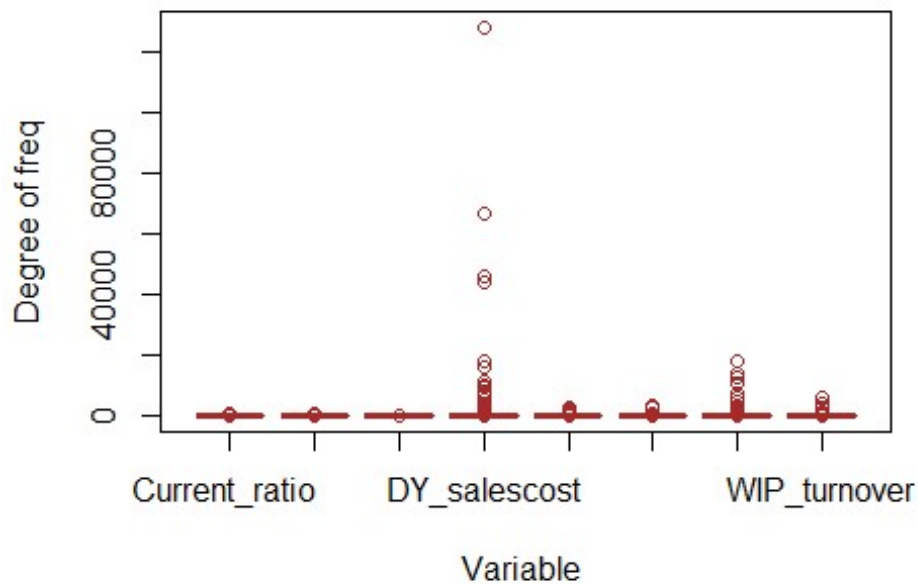
#Convert the variable data type

```
def_data$default=ifelse(def_data$Networth_NY>0,0,1)
def_data$default= as.factor(def_data$default)
def_data <- (def_data[-1])
```

Here we have converted the Netwoth of next year variable into categorical variabe

Ploted Total income with defaults

```
#Change box plot colors by groups
p<-ggplot(def_data, aes(x=default, y=Total_income, fill=default)) +
  geom_boxplot()
p
```

Cappinbg some more vairbale outlieres

```r
# Capping outlier sor some othervariables
capOutlier <- function(x){
   qnt <- quantile(x, probs=c(.25, .75), na.rm = T)
   caps <- quantile(x, probs=c(.05, .95), na.rm = T)
   H <- 1.5 * IQR(x, na.rm = T)
   x[x < (qnt[1] - H)] <- caps[1]
   x[x > (qnt[2] + H)] <- caps[2]
   return(x)
}
def_data$Total_asts=capOutlier(def_data$Total_asts)
def_data$Change_instock=capOutlier(def_data$Change_instock)
def_data$Total_expenses=capOutlier(def_data$Total_expenses)
def_data$Sales=capOutlier(def_data$Sales)
def_data$Other_income=capOutlier(def_data$Other_income)
def_data$Total_capital=capOutlier(def_data$Total_capital)
def_data$Capital_employed=capOutlier(def_data$Capital_employed)
def_data$Reserves_funds=capOutlier(def_data$Reserves_funds)
def_data$Shares_outstanding=capOutlier(def_data$Shares_outstanding)
def_data$Total_liabilities=capOutlier(def_data$Total_liabilities)
```

We have capped all these above variables outliers

Check the proportion of default

```
# printing counts of defaulters
comp_defaults<- table(def_data$default)
comp_defaults

##
##    0    1
## 3298  243
```

proportion of defaulters

```
#proportion of defaulters
defaulters <- prop.table(comp_defaults)
# Percentages of defaulters
round(defaulters*100,2)

##
##     0     1
## 93.14  6.86

nrow(subset(def_data,default==0))/nrow(def_data)

## [1] 0.9313753

# percentage of defaulters
library(psych)
tab1 <- round(prop.table(table(def_data$default))*100,2)
# bar-plot
bp <- barplot(tab1,
         xlab = "Defaulters(Yes/No)", ylab = "Percent (%)",
         main = "Percentage of Defaulters",
         col = c("red","blue"),
         legend = rownames(tab1),
         beside = TRUE,
         ylim = c(0, 90))
text(bp, 0, round(tab1, 1),cex=1,pos=3)
```

Percentage of Defaulters
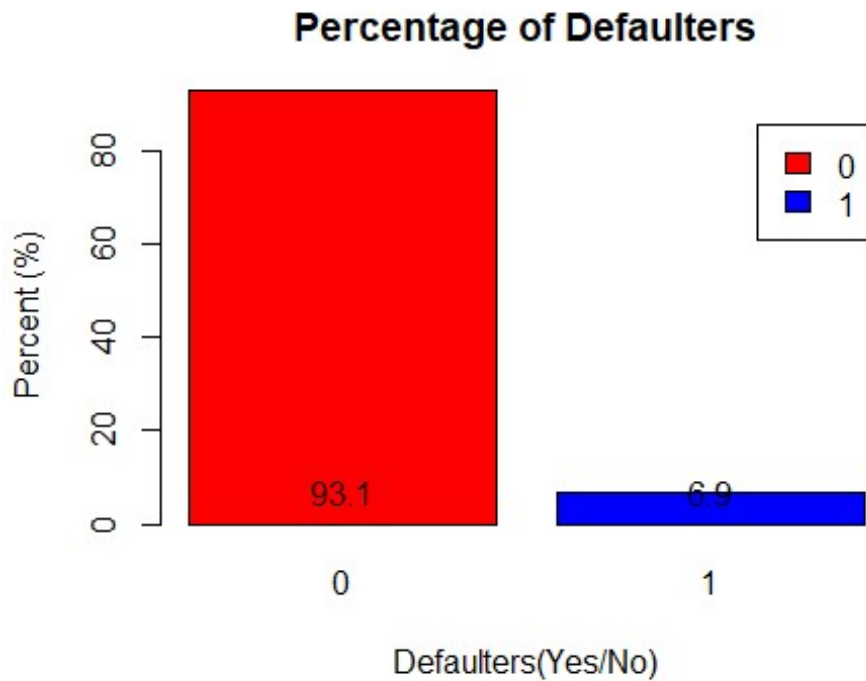
We got 93.14% of nagative cases and 6.86 % are not into default category

Total Income bydefaults

```r
#visual 1
library(ggplot2)
library(dplyr)
colnames(def_data) <- make.unique(names(def_data))
ggplot(raw_data,aes(x=def_data$Total_income, colour = def_data$default )) +
  geom_freqpoly(binwidth =10000)+ labs(title="Total Income  Distribution by
defaults")
```

Total Income Distribution by defaults
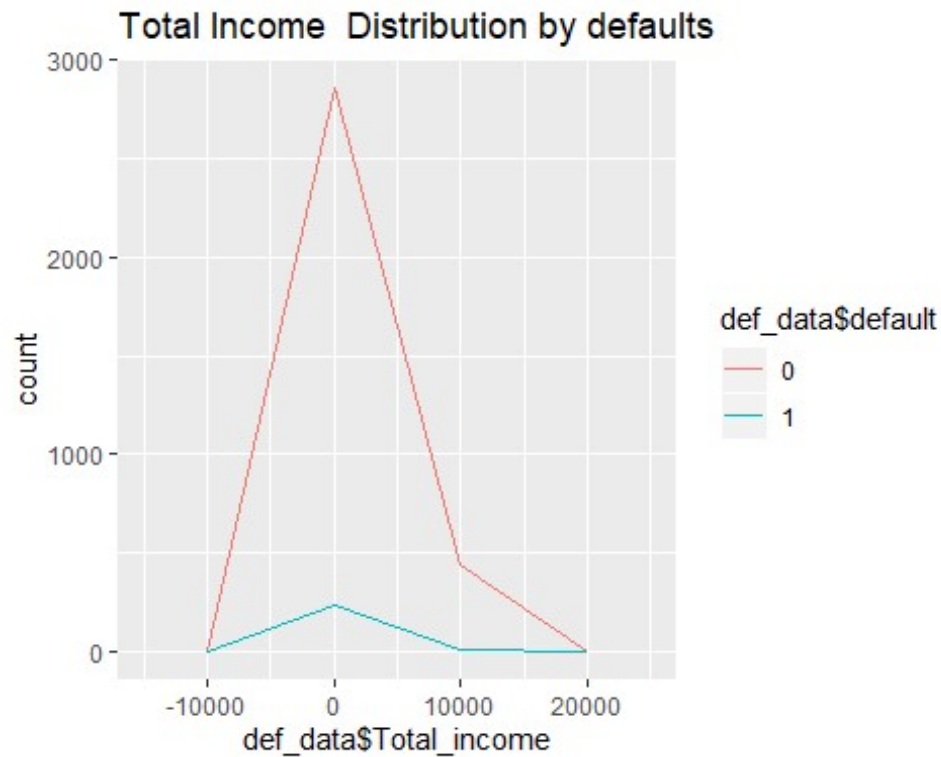
#Total asstest
Distribution by defaults

```
#visual 2
a <- ggplot(def_data, aes(x=Total_asts, fill=default, color=default)) +
  geom_histogram(binwidth =1000) + labs(title="Total Assets Distribution by
defaults")
a + theme_bw()
```

Total Assets Distribution by defaults
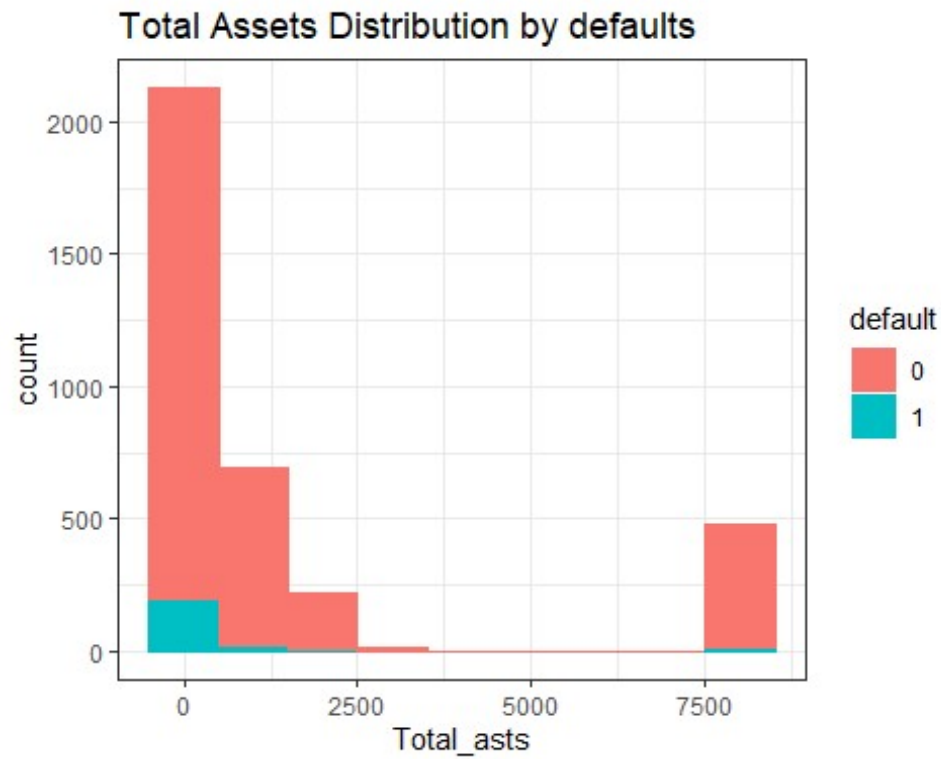
Total capital Distribution by defaults

```r
#visual 3
c <- ggplot(def_data, aes(x=Total_capital, fill=default, color=default)) +
  geom_histogram(binwidth =100) + labs(title="Total Capital Distribution by
defaults")
c + theme_bw()
```

Total Capital Distribution by defaults
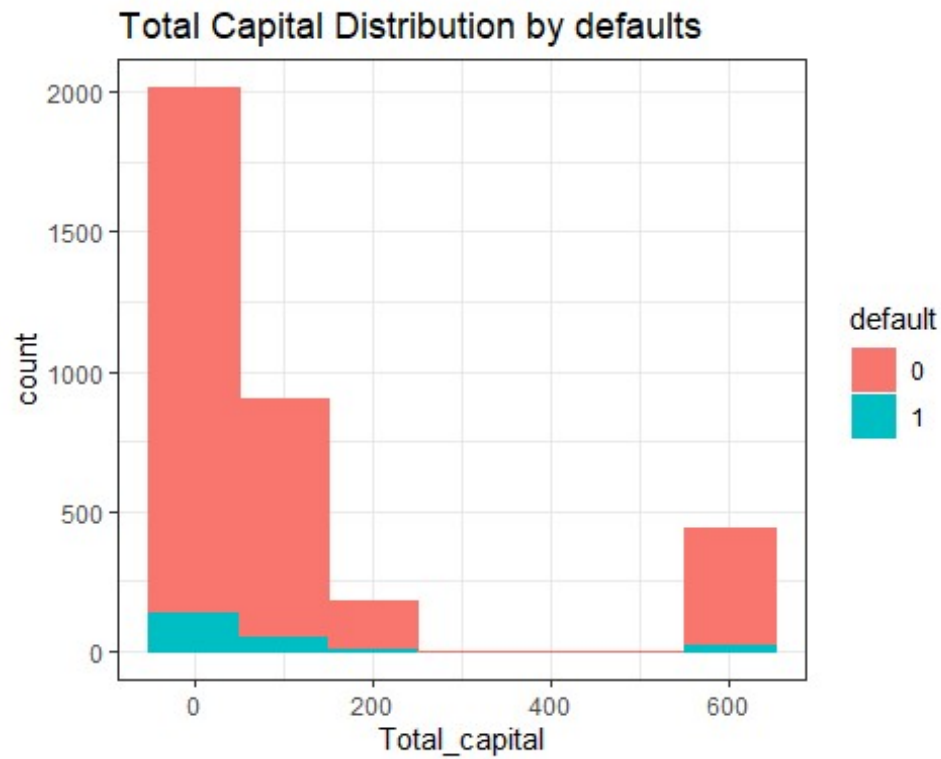
#Change in Stock by defaults

```
#visual 4
library(ggplot2)
library(dplyr)
ggplot(def_data,aes(x=Total_liabilities, colour = default )) +
  geom_freqpoly(binwidth =100)+ labs(title="Change in Stock Distribution by
defaults")
```

Change in Stock Distribution by defaults
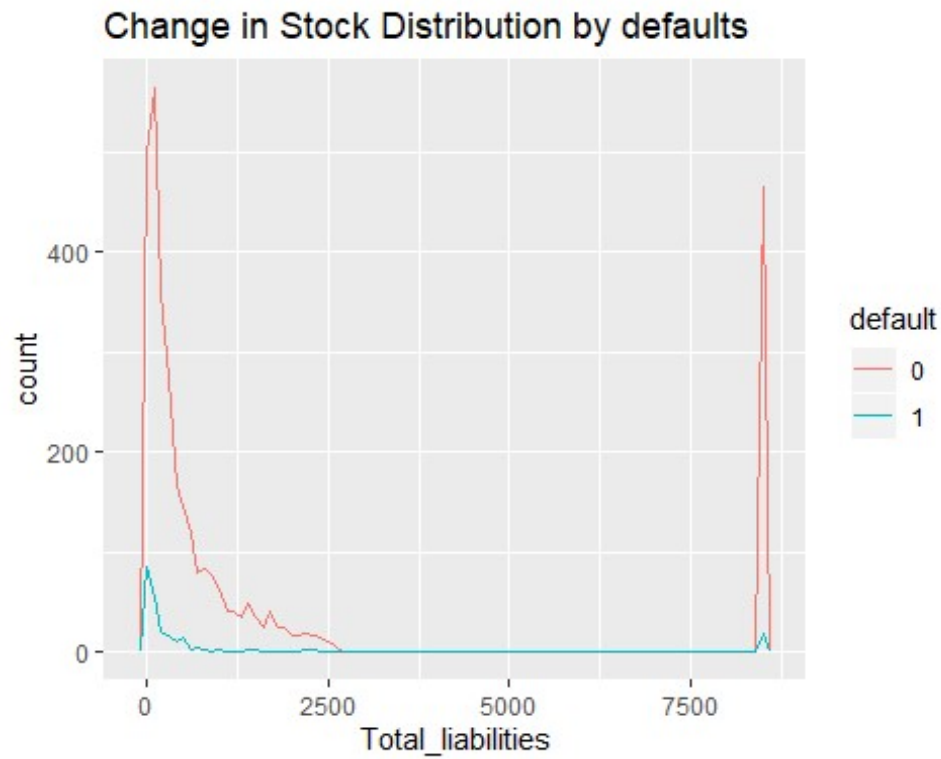
Total liabilities by defaults

```
#visual 5
l <- ggplot(def_data, aes(x=Total_liabilities, fill=default, color=default))
+
  geom_histogram(binwidth =100) + labs(title="Total liabilities Distribution
by defaults")
l + theme_bw()
```

Total liabilities Distribution by defaults
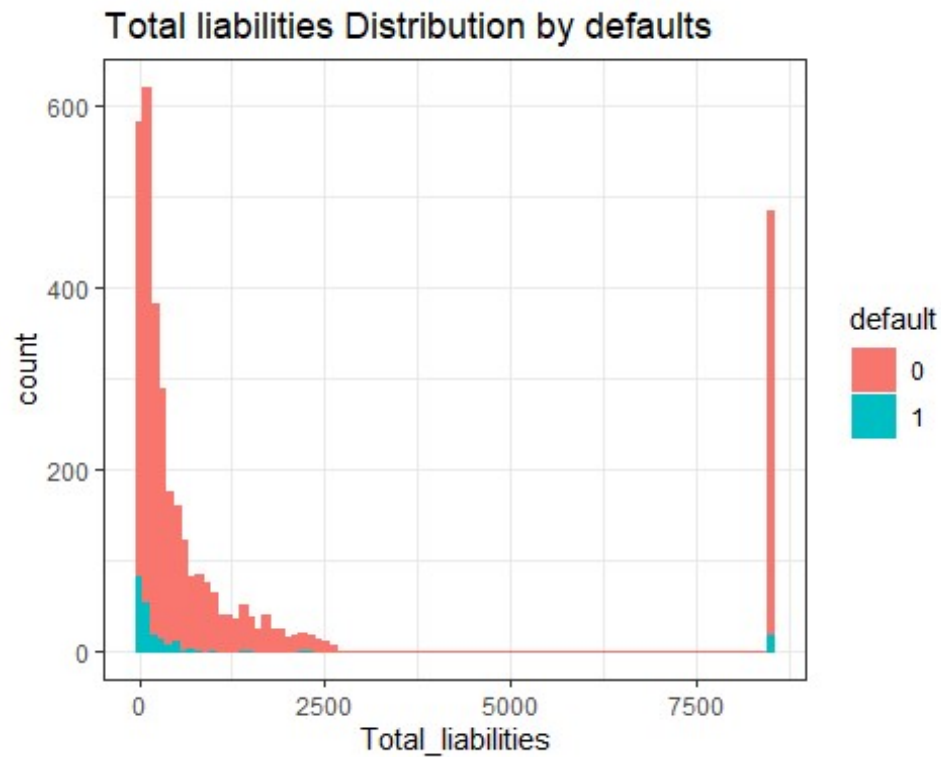
Scatter plots-Total income Vs Total expenses

```r
# plotting scatter plot
inc <- ggplot(def_data, aes(x = Total_income, y = Total_expenses,linetype =
default)) + ylab("Totalexpenses ") + geom_point() +
scale_linetype_manual(values=c("dashed", "solid")) +
  geom_smooth(method=lm, se=FALSE, color= "red")
inc + labs(x="Total income") +
labs(title="Scatter plot Total income Vs Total expenses")
```

Scatter plot Total income Vs Total expenses
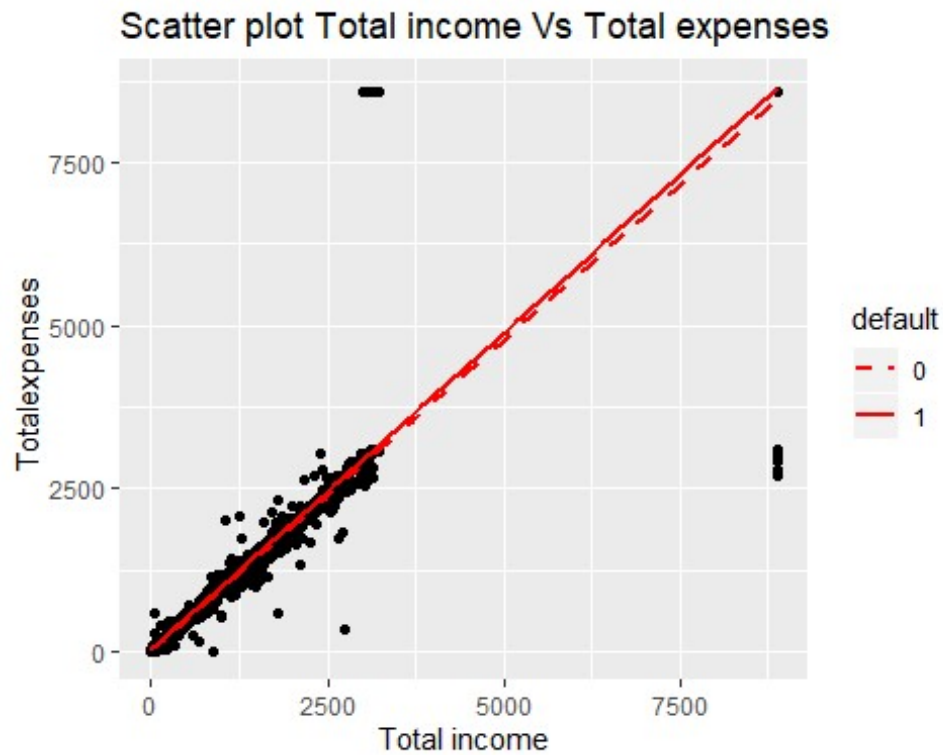
Found total expense and total income both factors are moved very closely and constantlyt trhought time

Total income Vs Total liabilities

```
# plotting scatter plot
inc <- ggplot(def_data, aes(x = Total_income, y =Total_liabilities ,linetype
= default)) + ylab("Total liabilites") + geom_point() +
scale_linetype_manual(values=c("dashed", "solid")) +
  geom_smooth(method=lm, se=FALSE, color= "red")
inc + labs(x="Total income") +
labs(title="Scatter plot Total income Vs Total_liabilities")
```

Scatter plot Total income Vs Total_liabilities
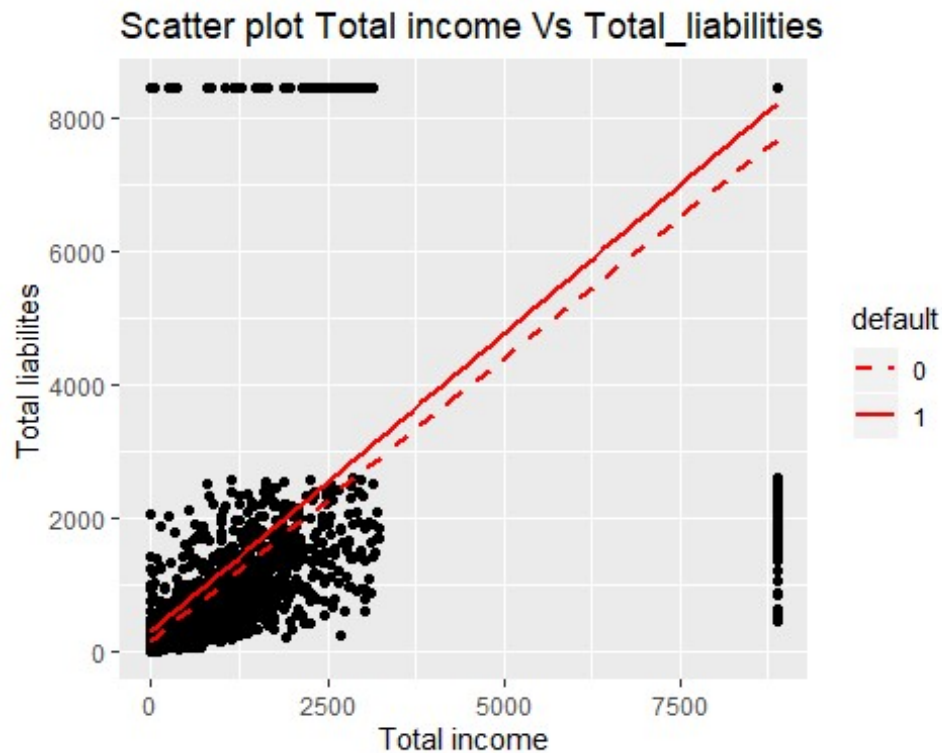
Adding variables for profitability, leverage, liquidity and company's size each

```
#Return on Equity = Profit After tax / Net worth,
def_data$Profitability   <- (def_data$PAT/def_data$Net_worth)

#Levearge = Total debt / Shareholders Equity
def_data$Levearge   <-
(def_data$Total_liabilities/def_data$Shares_outstanding)

#Return on Capital Employed =Earnings Before Interest, Taxes, Depreciation
and Amortization/Capital Employed
def_data$Roc   <- (def_data$PBDITA/def_data$Capital_employed)

#Liqudity = current assest /curent libilites
def_data$Liqudity   <- (def_data$Current_assets/def_data$Total_liabilities)
def_data$default <- as.numeric(def_data$default)
```

Added New variables creation for profitability, leverage, liquidity and company's size each

Correlation between Variable

```
#Checking umeric values
numeric.list <- sapply(def_data, is.numeric)
numeric.list
```

```
##                 Total_asts                      Net_worth
##                       TRUE                           TRUE
##               Total_income                   Change_instock
##                       TRUE                           TRUE
##             Total_expenses                            PAT
##                       TRUE                           TRUE
##                     PBDITA                            PBT
##                       TRUE                           TRUE
##                Cash_profit             PBDITA_total income
##                       TRUE                           TRUE
##           PBT_total income                PAT_total income
##                       TRUE                           TRUE
##       Cashprofit _totalincome               PAT_net_worth
##                       TRUE                           TRUE
##                      Sales      Income_financial_services
##                       TRUE                           TRUE
##               Other_income                  Total_capital
##                       TRUE                           TRUE
##             Reserves_funds                     Borrowings
##                       TRUE                           TRUE
## Current liabilities_provisions        Deferred_taxliability
##                       TRUE                           TRUE
##          Shareholders_funds  Cumulative_retained_profits
##                       TRUE                           TRUE
##            Capital_employed                        TOL_TNW
##                       TRUE                           TRUE
## Liabilities_tangible_networth Contingent_liabilities_networth
##                       TRUE                           TRUE
##       Contingent_liabilities                Netfixed_assets
##                       TRUE                           TRUE
##                Investments                  Current_assets
##                       TRUE                           TRUE
##          Networking_capital                     Quick_ratio
##                       TRUE                           TRUE
##              Current_ratio              Debt_equity_ratio
##                       TRUE                           TRUE
##     Cash_current_liabilities                     DY_salescost
##                       TRUE                           TRUE
##         Creditors_turnover               Debtors_turnover
##                       TRUE                           TRUE
##      Finished_goods_turnover                   WIP_turnover
##                       TRUE                           TRUE
##        Raw_material_turnover              Shares_outstanding
##                       TRUE                           TRUE
##            Equity_face_value                            EPS
##                       TRUE                           TRUE
##                Adjusted_EPS              Total_liabilities
##                       TRUE                           TRUE
##                     PE_BSE                        default
##                       TRUE                           TRUE
```

```
##                      Profitability                      Levearge
##                              TRUE                          TRUE
##                               Roc                      Liqudity
##                              TRUE                          TRUE

sum(numeric.list)

## [1] 54

numeric.df <- def_data[, numeric.list]
```

Check Corralation

```
#Check corralation #
cor.mat <- cor(numeric.df)
cor.mat

##                                   Total_asts    Net_worth Total_income
## Total_asts                       1.000000000  0.209930813  0.863030510
## Net_worth                        0.209930813  1.000000000  0.209706651
## Total_income                     0.863030510  0.209706651  1.000000000
## Change_instock                   0.413189795  0.117637668  0.413324734
## Total_expenses                   0.860026848  0.210025849  0.987839782
## PAT                              0.200656463  0.959392964  0.208261538
## PBDITA                           0.221268428  0.966598085  0.227584176
## PBT                              0.206691483  0.939738975  0.214373045
## Cash_profit                      0.203470577  0.981264323  0.209513748
## PBDITA_total income              0.031690044  0.009104482  0.035505912
## PBT_total income                 0.021268990  0.006457327  0.033424653
## PAT_total income                 0.020936528  0.006052976  0.032759353
## Cashprofit _totalincome          0.020115386  0.006308180  0.031362060
## PAT_net_worth                    0.045068408  0.019491296  0.078088211
## Sales                            0.852832321  0.208869056  0.992280210
## Income_financial_services        0.144326461  0.585308206  0.144021088
## Other_income                     0.609173653  0.169041309  0.596568384
## Total_capital                    0.651616793  0.200117745  0.594229924
## Reserves_funds                   0.812703147  0.200920319  0.756201987
## Borrowings                       0.261607033  0.885104863  0.253024701
## Current liabilities_provisions   0.212388489  0.726133748  0.215888669
## Deferred_taxliability            0.194414333  0.963749712  0.197339125
## Shareholders_funds               0.213143343  0.999261142  0.212290569
## Cumulative_retained_profits      0.196561986  0.975219747  0.200266738
## Capital_employed                 0.952223009  0.211619277  0.832256645
## TOL_TNW                         -0.023107239 -0.013434460 -0.019593765
##  Liabilities_tangible_networth  -0.022956346 -0.008892308 -0.016843455
## Contingent_liabilities_networth  0.011922875 -0.001558792  0.010098043
## Contingent_liabilities           0.133052973  0.947595165  0.134443013
## Netfixed_assets                  0.190978801  0.972781633  0.190519744
## Investments                      0.182578441  0.880569330  0.179870737
## Current_assets                   0.263703744  0.747249447  0.267426505
```

```
## Networking_capital                0.081011887 -0.070146130  0.081288406
## Quick_ratio                       -0.038173008 -0.006546016 -0.039937138
## Current_ratio                     -0.036772740 -0.006580232 -0.038514447
## Debt_equity_ratio                 -0.009071905 -0.012824829 -0.023754851
## Cash_current_liabilities          -0.030888975 -0.002222785 -0.034461840
## DY_salescost                       0.019963589  0.025851163  0.014945293
## Creditors_turnover                -0.017736286 -0.005568928  0.006332912
## Debtors_turnover                   0.013905230  0.009936766  0.027760811
## Finished_goods_turnover            0.003428926 -0.005345291 -0.003449140
## WIP_turnover                      -0.001324043 -0.006015666  0.006170532
## Raw_material_turnover             -0.008929691 -0.001849723 -0.001203441
## Shares_outstanding                 0.643479744  0.196302250  0.591547044
## Equity_face_value                  0.017076002  0.004671160  0.018723553
## EPS                               -0.036266925  0.003353852  0.001640670
## Adjusted_EPS                      -0.036371106  0.003270890  0.001537759
## Total_liabilities                  1.000000000  0.209930813  0.863030510
## PE_BSE                            -0.004276486 -0.001194960 -0.006090544
## default                           -0.064149485 -0.021610324 -0.092635203
## Profitability                               NA           NA           NA
## Levearge                                   NaN          NaN          NaN
## Roc                                         NA           NA           NA
## Liqudity                           0.141842380  0.727559797  0.172494571
##                                   Change_instock Total_expenses
## Total_asts                           0.413189795    0.8600268481
## Net_worth                            0.117637668    0.2100258490
## Total_income                         0.413324734    0.9878397825
## Change_instock                       1.000000000    0.4246878954
## Total_expenses                       0.424687895    1.0000000000
## PAT                                  0.117964056    0.2075614462
## PBDITA                               0.123007704    0.2277353707
## PBT                                  0.121446424    0.2139425193
## Cash_profit                          0.117107613    0.2096784314
## PBDITA_total income                  0.012415126    0.0335551572
## PBT_total income                     0.017437990    0.0318752762
## PAT_total income                     0.016983804    0.0312761247
## Cashprofit _totalincome              0.015079784    0.0299236449
## PAT_net_worth                        0.067644429    0.0668111291
## Sales                                0.418513448    0.9875306359
## Income_financial_services            0.040026465    0.1436027927
## Other_income                         0.314096014    0.5953393902
## Total_capital                        0.279552793    0.5937119474
## Reserves_funds                       0.375373985    0.7448490505
## Borrowings                           0.132674467    0.2546918649
## Current liabilities_provisions       0.112377510    0.2167584796
## Deferred_taxliability                0.101755142    0.1982296607
## Shareholders_funds                   0.117515424    0.2126848310
## Cumulative_retained_profits          0.111141443    0.2001373794
## Capital_employed                     0.410735959    0.8289550710
## TOL_TNW                              0.012000366   -0.0169098681
##  Liabilities_tangible_networth       0.019386578   -0.0152169074
```

```
## Contingent_liabilities_networth       0.015155177    0.0121485252
## Contingent_liabilities                 0.075530601    0.1350814311
## Netfixed_assets                        0.103887162    0.1915506342
## Investments                            0.097867974    0.1799930692
## Current_assets                         0.143902186    0.2683810202
## Networking_capital                     0.028857115    0.0808225643
## Quick_ratio                           -0.021717667   -0.0399426213
## Current_ratio                         -0.014010054   -0.0384674848
## Debt_equity_ratio                      0.013473253   -0.0212867733
## Cash_current_liabilities              -0.025927493   -0.0348907547
## DY_salescost                          -0.018241530    0.0150039730
## Creditors_turnover                     0.002056269    0.0064170264
## Debtors_turnover                      -0.006019444    0.0269087838
## Finished_goods_turnover               -0.005718738   -0.0030136347
## WIP_turnover                          -0.034363336    0.0067006725
## Raw_material_turnover                  0.040859437   -0.0007362348
## Shares_outstanding                     0.306051644    0.5860477188
## Equity_face_value                      0.015093860    0.0186311851
## EPS                                   -0.034727383   -0.0012907904
## Adjusted_EPS                          -0.034795061   -0.0013926371
## Total_liabilities                      0.413189795    0.8600268481
## PE_BSE                                 0.003954794   -0.0049602126
## default                               -0.053657296   -0.0891414632
## Profitability                                   NA              NA
## Levearge                                       NaN             NaN
## Roc                                             NA              NA
## Liqudity                               0.110608760    0.1742876109
##                                               PAT         PBDITA            PBT
## Total_asts                             0.200656463    0.2212684283    0.206691483
## Net_worth                              0.959392964    0.9665980846    0.939738975
## Total_income                           0.208261538    0.2275841761    0.214373045
## Change_instock                         0.117964056    0.1230077038    0.121446424
## Total_expenses                         0.207561446    0.2277353707    0.213942519
## PAT                                    1.000000000    0.9895236477    0.995314308
## PBDITA                                 0.989523648    1.0000000000    0.988978542
## PBT                                    0.995314308    0.9889785421    1.000000000
## Cash_profit                            0.991053563    0.9917372735    0.980036467
## PBDITA_total income                    0.011861867    0.0114640196    0.011947922
## PBT_total income                       0.008358148    0.0077538336    0.008324174
## PAT_total income                       0.007680723    0.0071466725    0.007572688
## Cashprofit _totalincome                0.008075586    0.0075256405    0.008000453
## PAT_net_worth                          0.040246981    0.0314991196    0.038889738
## Sales                                  0.209210006    0.2275610372    0.215480132
## Income_financial_services              0.593073747    0.6700380649    0.615855751
## Other_income                           0.165292369    0.1808455994    0.169738497
## Total_capital                          0.191750207    0.2116378804    0.197673689
## Reserves_funds                         0.199823290    0.2116119473    0.204574427
## Borrowings                             0.798573899    0.8541495650    0.786930945
## Current liabilities_provisions         0.729959875    0.7854006408    0.742638202
## Deferred_taxliability                  0.928284155    0.9600922532    0.918299268
```

```
## Shareholders_funds              0.958454186  0.9659715817  0.939406624
## Cumulative_retained_profits     0.954278847  0.9732447223  0.945668527
## Capital_employed                0.201576289  0.2222372043  0.207415126
## TOL_TNW                        -0.013448205 -0.0111193591 -0.013453700
##  Liabilities_tangible_networth -0.008601602 -0.0075531620 -0.008835817
## Contingent_liabilities_networth -0.002226139 -0.0003517327 -0.002171704
## Contingent_liabilities          0.868417939  0.8714788365  0.829029344
## Netfixed_assets                 0.904005623  0.9233824699  0.875213351
## Investments                     0.833969258  0.8684921766  0.825289144
## Current_assets                  0.759434192  0.8139793327  0.781897349
## Networking_capital              0.020523806  0.0235198570  0.074031744
## Quick_ratio                    -0.006808854 -0.0081901042 -0.006916949
## Current_ratio                  -0.007131397 -0.0083677444 -0.007324479
## Debt_equity_ratio              -0.014278752 -0.0118049603 -0.014291639
## Cash_current_liabilities       -0.001736881 -0.0030301452 -0.001596644
## DY_salescost                   -0.003562047  0.0136422512 -0.003501829
## Creditors_turnover             -0.006251377 -0.0063626464 -0.006349440
## Debtors_turnover                0.011357620  0.0123455361  0.011919584
## Finished_goods_turnover        -0.005434288 -0.0057713662 -0.005593288
## WIP_turnover                   -0.006509194 -0.0062744968 -0.006538228
## Raw_material_turnover          -0.001837728 -0.0020121176 -0.001899165
## Shares_outstanding              0.197138444  0.2124083190  0.202396066
## Equity_face_value               0.003471192  0.0037919179  0.003616151
## EPS                             0.003496799  0.0026162227  0.003309125
## Adjusted_EPS                    0.003397516  0.0025203973  0.003210975
## Total_liabilities               0.200656463  0.2212684283  0.206691483
## PE_BSE                         -0.001293597 -0.0013948253 -0.001358525
## default                        -0.030109979 -0.0245814950 -0.029375383
## Profitability                            NA            NA           NA
## Levearge                                NaN           NaN          NaN
## Roc                                      NA            NA           NA
## Liqudity                        0.741106517  0.7935426290  0.763044874
##                                 Cash_profit PBDITA_total income
## Total_asts                     0.2034705772        3.169004e-02
## Net_worth                      0.9812643232        9.104482e-03
## Total_income                   0.2095137477        3.550591e-02
## Change_instock                 0.1171076127        1.241513e-02
## Total_expenses                 0.2096784314        3.355516e-02
## PAT                            0.9910535634        1.186187e-02
## PBDITA                         0.9917372735        1.146402e-02
## PBT                            0.9800364667        1.194792e-02
## Cash_profit                    1.0000000000        1.060259e-02
## PBDITA_total income            0.0106025877        1.000000e+00
## PBT_total income               0.0075335361        6.807279e-01
## PAT_total income               0.0069548725        6.890365e-01
## Cashprofit _totalincome        0.0075002683        6.911129e-01
## PAT_net_worth                  0.0315761753        9.243729e-02
## Sales                          0.2109973900        3.396613e-02
## Income_financial_services      0.6059842125        6.243117e-03
## Other_income                   0.1673491492        3.162605e-02
```

```
## Total_capital                        0.1942639916         2.155757e-02
## Reserves_funds                       0.1984786469         3.989270e-02
## Borrowings                           0.8420892322         9.319235e-03
## Current liabilities_provisions       0.7521206609         7.007154e-03
## Deferred_taxliability                0.9614910267         7.374106e-03
## Shareholders_funds                   0.9801779078         9.183085e-03
## Cumulative_retained_profits          0.9698515217         8.898302e-03
## Capital_employed                     0.2047613245         3.239953e-02
## TOL_TNW                             -0.0120727607        -9.898601e-02
##  Liabilities_tangible_networth      -0.0078950262        -5.683148e-02
## Contingent_liabilities_networth     -0.0008749481        -2.416397e-02
## Contingent_liabilities               0.9133995376         5.004476e-03
## Netfixed_assets                      0.9493915577         7.082749e-03
## Investments                          0.8525526653         7.545004e-03
## Current_assets                       0.7684784555         1.024550e-02
## Networking_capital                  -0.0417303917         9.312774e-03
## Quick_ratio                         -0.0074776700        -7.083622e-04
## Current_ratio                       -0.0075798440         1.427535e-03
## Debt_equity_ratio                   -0.0126294281        -9.155734e-02
## Cash_current_liabilities            -0.0026359115         5.933128e-03
## DY_salescost                        -0.0036861396         1.164269e-02
## Creditors_turnover                  -0.0058279071         8.765922e-03
## Debtors_turnover                     0.0115673157         1.046451e-02
## Finished_goods_turnover             -0.0054017411         4.735966e-03
## WIP_turnover                        -0.0058902463         5.325119e-03
## Raw_material_turnover               -0.0017873303         1.170963e-03
## Shares_outstanding                   0.1977489733         2.982472e-02
## Equity_face_value                    0.0034712032         1.331208e-05
## EPS                                  0.0025592862         1.542799e-03
## Adjusted_EPS                         0.0024625415         1.534891e-03
## Total_liabilities                    0.2034705772         3.169004e-02
## PE_BSE                              -0.0012564252         8.851869e-04
## default                             -0.0273758586        -9.504554e-02
## Profitability                                  NA                   NA
## Levearge                                      NaN                  NaN
## Roc                                            NA                   NA
## Liqudity                             0.7498434989         1.336723e-02
##                              PBT_total income PAT_total income
## Total_asts                           2.126899e-02         2.093653e-02
## Net_worth                            6.457327e-03         6.052976e-03
## Total_income                         3.342465e-02         3.275935e-02
## Change_instock                       1.743799e-02         1.698380e-02
## Total_expenses                       3.187528e-02         3.127612e-02
## PAT                                  8.358148e-03         7.680723e-03
## PBDITA                               7.753834e-03         7.146673e-03
## PBT                                  8.324174e-03         7.572688e-03
## Cash_profit                          7.533536e-03         6.954873e-03
## PBDITA_total income                  6.807279e-01         6.890365e-01
## PBT_total income                     1.000000e+00         9.954588e-01
## PAT_total income                     9.954588e-01         1.000000e+00
```

```
## Cashprofit _totalincome                 9.850363e-01        9.803941e-01
## PAT_net_worth                            9.334134e-02        9.416813e-02
## Sales                                    3.305170e-02        3.239814e-02
## Income_financial_services               4.100340e-03        3.915754e-03
## Other_income                             2.731372e-02        2.706346e-02
## Total_capital                            1.020705e-02        1.015882e-02
## Reserves_funds                           2.881060e-02        2.890546e-02
## Borrowings                               5.190973e-03        5.074128e-03
## Current liabilities_provisions           5.653006e-03        5.306744e-03
## Deferred_taxliability                    5.205742e-03        4.899422e-03
## Shareholders_funds                       6.412255e-03        6.001846e-03
## Cumulative_retained_profits              6.933879e-03        6.479603e-03
## Capital_employed                         2.112322e-02        2.068552e-02
## TOL_TNW                                 -1.870240e-01       -1.847014e-01
##  Liabilities_tangible_networth          -1.004067e-01       -9.890922e-02
## Contingent_liabilities_networth         -1.297485e-02       -1.351131e-02
## Contingent_liabilities                   3.867448e-03        3.662604e-03
## Netfixed_assets                          4.963424e-03        4.767637e-03
## Investments                              4.614191e-03        4.314022e-03
## Current_assets                           7.461105e-03        7.045973e-03
## Networking_capital                       5.486536e-03        5.127418e-03
## Quick_ratio                              8.529302e-04        1.087245e-03
## Current_ratio                            3.326926e-03        3.500032e-03
## Debt_equity_ratio                       -1.962748e-01       -1.935497e-01
## Cash_current_liabilities                 1.274781e-03        1.475353e-03
## DY_salescost                            -1.587467e-03       -1.383432e-03
## Creditors_turnover                       1.081474e-02        1.093888e-02
## Debtors_turnover                         1.026546e-02        1.021380e-02
## Finished_goods_turnover                  3.407491e-03        3.469259e-03
## WIP_turnover                             1.376989e-03        1.731907e-03
## Raw_material_turnover                    2.341944e-03        2.401006e-03
## Shares_outstanding                       1.832532e-02        1.797957e-02
## Equity_face_value                       -1.256115e-03       -1.394660e-03
## EPS                                      7.739379e-05       -3.591980e-06
## Adjusted_EPS                             7.156312e-05       -9.040193e-06
## Total_liabilities                        2.126899e-02        2.093653e-02
## PE_BSE                                   1.429087e-03        1.479740e-03
## default                                 -1.140289e-01       -1.176217e-01
## Profitability                                     NA                  NA
## Levearge                                         NaN                 NaN
## Roc                                               NA                  NA
## Liqudity                                 1.562814e-02        1.491518e-02
##                            Cashprofit _totalincome PAT_net_worth
## Total_asts                             0.0201153863   0.045068408
## Net_worth                              0.0063081805   0.019491296
## Total_income                           0.0313620596   0.078088211
## Change_instock                         0.0150797837   0.067644429
## Total_expenses                         0.0299236449   0.066811129
## PAT                                    0.0080755859   0.040246981
## PBDITA                                 0.0075256405   0.031499120
```

```
## PBT                                              0.0080004531    0.038889738
## Cash_profit                                       0.0075002683    0.031576175
## PBDITA_total income                               0.6911129431    0.092437285
## PBT_total income                                  0.9850363047    0.093341343
## PAT_total income                                  0.9803941060    0.094168126
## Cashprofit _totalincome                           1.0000000000    0.094419179
## PAT_net_worth                                     0.0944191794    1.000000000
## Sales                                             0.0311630414    0.074237616
## Income_financial_services                         0.0038245956    0.014147375
## Other_income                                      0.0261385011    0.057615051
## Total_capital                                     0.0108053260    0.027120479
## Reserves_funds                                    0.0264629513    0.077627178
## Borrowings                                        0.0050936352    0.009580132
## Current liabilities_provisions                    0.0052739119    0.022587585
## Deferred_taxliability                             0.0052095203    0.018303865
## Shareholders_funds                                0.0062541527    0.019543088
## Cumulative_retained_profits                       0.0067112812    0.022998743
## Capital_employed                                  0.0205095770    0.042541665
## TOL_TNW                                          -0.1904666274   -0.098957951
##  Liabilities_tangible_networth                   -0.1024372568   -0.073353765
## Contingent_liabilities_networth                  -0.0166746441   -0.179694707
## Contingent_liabilities                            0.0038613752    0.010789713
## Netfixed_assets                                   0.0050605717    0.012764788
## Investments                                       0.0042355420    0.013487712
## Current_assets                                    0.0070246522    0.025550964
## Networking_capital                                0.0053020800    0.010571267
## Quick_ratio                                       0.0035856443   -0.010252377
## Current_ratio                                     0.0053286259   -0.009890993
## Debt_equity_ratio                                -0.1969701316   -0.105671590
## Cash_current_liabilities                          0.0054791822   -0.008394853
## DY_salescost                                     -0.0020001286   -0.008842419
## Creditors_turnover                                0.0104167052    0.004064276
## Debtors_turnover                                  0.0099417120    0.018929635
## Finished_goods_turnover                           0.0026715159    0.022219431
## WIP_turnover                                      0.0009899097    0.003167870
## Raw_material_turnover                             0.0020437630    0.003893355
## Shares_outstanding                                0.0196372430    0.043509567
## Equity_face_value                                -0.0009844263    0.007672571
## EPS                                               0.0001981282    0.047958782
## Adjusted_EPS                                      0.0001923170    0.047936511
## Total_liabilities                                 0.0201153863    0.045068408
## PE_BSE                                            0.0011759690   -0.002140726
## default                                          -0.1184647415   -0.231049048
## Profitability                                               NA             NA
## Levearge                                                   NaN            NaN
## Roc                                                         NA             NA
## Liqudity                                          0.0137246118    0.026710358
##                                                  Sales Income_financial_services
## Total_asts                                0.8528323207              1.443265e-01
## Net_worth                                 0.2088690562              5.853082e-01
```

```
## Total_income                      0.9922802104              1.440211e-01
## Change_instock                    0.4185134478              4.002646e-02
## Total_expenses                     0.9875306359              1.436028e-01
## PAT                                0.2092100064              5.930737e-01
## PBDITA                             0.2275610372              6.700381e-01
## PBT                                0.2154801319              6.158558e-01
## Cash_profit                        0.2109973900              6.059842e-01
## PBDITA_total income                0.0339661338              6.243117e-03
## PBT_total income                   0.0330517039              4.100340e-03
## PAT_total income                   0.0323981388              3.915754e-03
## Cashprofit _totalincome            0.0311630414              3.824596e-03
## PAT_net_worth                      0.0742376162              1.414737e-02
## Sales                              1.0000000000              1.373806e-01
## Income_financial_services          0.1373806497              1.000000e+00
## Other_income                       0.5884199052              1.211560e-01
## Total_capital                      0.5896841750              1.364473e-01
## Reserves_funds                     0.7511237113              1.321325e-01
## Borrowings                         0.2459355943              6.821187e-01
## Current liabilities_provisions     0.2170957407              8.039332e-01
## Deferred_taxliability              0.1984815935              6.749844e-01
## Shareholders_funds                 0.2114861854              5.865240e-01
## Cumulative_retained_profits        0.2013414584              7.001890e-01
## Capital_employed                   0.8217566711              1.451894e-01
## TOL_TNW                           -0.0189782331             -4.123648e-03
##  Liabilities_tangible_networth    -0.0164904163             -4.043499e-03
## Contingent_liabilities_networth    0.0106140627             -6.612817e-05
## Contingent_liabilities             0.1354110999              4.642454e-01
## Netfixed_assets                    0.1917360829              5.401070e-01
## Investments                        0.1757740333              7.427840e-01
## Current_assets                     0.2646124692              8.017869e-01
## Networking_capital                 0.0666834436              1.486648e-01
## Quick_ratio                       -0.0398326153             -4.099425e-03
## Current_ratio                     -0.0382422676             -4.540454e-03
## Debt_equity_ratio                 -0.0232178003             -6.089148e-03
## Cash_current_liabilities          -0.0348175232              1.682766e-05
## DY_salescost                      -0.0264420346              9.863403e-02
## Creditors_turnover                 0.0072737790             -3.457631e-03
## Debtors_turnover                   0.0278817218              7.443537e-03
## Finished_goods_turnover           -0.0029931341             -4.858866e-03
## WIP_turnover                       0.0060915500             -5.074964e-03
## Raw_material_turnover             -0.0009228073             -1.311219e-03
## Shares_outstanding                 0.5866314303              1.312127e-01
## Equity_face_value                  0.0187868577              3.291357e-03
## EPS                                0.0015918392              1.925040e-03
## Adjusted_EPS                       0.0014879336              1.865217e-03
## Total_liabilities                  0.8528323207              1.443265e-01
## PE_BSE                            -0.0060097996             -1.020904e-03
## default                           -0.0963379593             -7.046923e-03
## Profitability                               NA                        NA
## Levearge                                   NaN                       NaN
```

```
## Roc                                      NA              NA
## Liqudity                          0.1712560380    7.907887e-01
##                             Other_income Total_capital Reserves_funds
## Total_asts                     0.609173653  0.6516167934     0.812703147
## Net_worth                      0.169041309  0.2001177448     0.200920319
## Total_income                   0.596568384  0.5942299235     0.756201987
## Change_instock                 0.314096014  0.2795527928     0.375373985
## Total_expenses                 0.595339390  0.5937119474     0.744849051
## PAT                            0.165292369  0.1917502067     0.199823290
## PBDITA                         0.180845599  0.2116378804     0.211611947
## PBT                            0.169738497  0.1976736890     0.204574427
## Cash_profit                    0.167349149  0.1942639916     0.198478647
## PBDITA_total income            0.031626055  0.0215575718     0.039892696
## PBT_total income               0.027313724  0.0102070479     0.028810603
## PAT_total income               0.027063458  0.0101588211     0.028905458
## Cashprofit _totalincome        0.026138501  0.0108053260     0.026462951
## PAT_net_worth                  0.057615051  0.0271204793     0.077627178
## Sales                          0.588419905  0.5896841750     0.751123711
## Income_financial_services      0.121155965  0.1364473176     0.132132487
## Other_income                   1.000000000  0.4590070910     0.552827552
## Total_capital                  0.459007091  1.0000000000     0.475430140
## Reserves_funds                 0.552827552  0.4754301399     1.000000000
## Borrowings                     0.190512781  0.2443504710     0.224927210
## Current liabilities_provisions 0.176674919  0.2005010475     0.195364492
## Deferred_taxliability          0.159059354  0.1896158339     0.185105477
## Shareholders_funds             0.171082522  0.2038999711     0.202803299
## Cumulative_retained_profits    0.161976194  0.1792617049     0.197645768
## Capital_employed               0.596358708  0.6527434282     0.815230262
## TOL_TNW                       -0.028795046 -0.0254917101    -0.080145498
##  Liabilities_tangible_networth -0.026574042 -0.0227543772    -0.062117574
## Contingent_liabilities_networth 0.008362497  0.0202255374    -0.028381259
## Contingent_liabilities         0.111379939  0.1287636642     0.125260751
## Netfixed_assets                0.153985429  0.1848406896     0.176197227
## Investments                    0.150922506  0.1783810284     0.171383701
## Current_assets                 0.204904037  0.2409387615     0.240384464
## Networking_capital             0.036121146  0.0683747197     0.070492903
## Quick_ratio                   -0.040546725 -0.0265961985    -0.021545148
## Current_ratio                 -0.038325031 -0.0258381181    -0.020355785
## Debt_equity_ratio             -0.014500872  0.0007599448    -0.064310206
## Cash_current_liabilities      -0.031592052 -0.0153227276    -0.021843680
## DY_salescost                   0.015161625  0.0243925284    -0.020200002
## Creditors_turnover            -0.017608821 -0.0191150756    -0.001882753
## Debtors_turnover               0.060693897  0.0412665293     0.026544232
## Finished_goods_turnover       -0.019221069 -0.0155594473     0.012596014
## WIP_turnover                   0.001738883 -0.0070739169    -0.017677922
## Raw_material_turnover         -0.007810858 -0.0121575946    -0.007941489
## Shares_outstanding             0.449320214  0.8070502169     0.535105657
## Equity_face_value              0.017081255  0.0217318377     0.015207657
## EPS                           -0.034658956  0.0130105952     0.015288779
## Adjusted_EPS                  -0.034735788  0.0129652861     0.015182100
```

```
## Total_liabilities                      0.609173653  0.6516167934    0.812703147
## PE_BSE                                 -0.006684518 -0.0034531973   -0.004648339
## default                               -0.056659741 -0.0208516825    -0.125600624
## Profitability                                   NA            NA             NA
## Levearge                                       NaN           NaN            NaN
## Roc                                             NA            NA             NA
## Liqudity                               0.133552426  0.1532743071    0.140997926
##                                         Borrowings
## Total_asts                            0.2616070334
## Net_worth                             0.8851048629
## Total_income                          0.2530247012
## Change_instock                        0.1326744668
## Total_expenses                        0.2546918649
## PAT                                   0.7985738992
## PBDITA                                0.8541495650
## PBT                                   0.7869309452
## Cash_profit                           0.8420892322
## PBDITA_total income                   0.0093192350
## PBT_total income                      0.0051909731
## PAT_total income                      0.0050741279
## Cashprofit _totalincome               0.0050936352
## PAT_net_worth                         0.0095801322
## Sales                                 0.2459355943
## Income_financial_services             0.6821186589
## Other_income                          0.1905127806
## Total_capital                         0.2443504710
## Reserves_funds                        0.2249272101
## Borrowings                            1.0000000000
## Current liabilities_provisions        0.7437239934
## Deferred_taxliability                 0.8990784050
## Shareholders_funds                    0.8832708619
## Cumulative_retained_profits           0.8848649675
## Capital_employed                      0.2644919828
## TOL_TNW                              -0.0038986041
##  Liabilities_tangible_networth       -0.0029661517
## Contingent_liabilities_networth       0.0060830560
## Contingent_liabilities                0.8314274326
## Netfixed_assets                       0.8886131569
## Investments                           0.8933489867
## Current_assets                        0.7747598165
## Networking_capital                   -0.0557838521
## Quick_ratio                          -0.0106666803
## Current_ratio                        -0.0103833234
## Debt_equity_ratio                     0.0005264462
## Cash_current_liabilities             -0.0050478042
## DY_salescost                          0.1297709448
## Creditors_turnover                   -0.0057401792
## Debtors_turnover                      0.0096163378
## Finished_goods_turnover              -0.0056886228
## WIP_turnover                         -0.0070348669
```

```
## Raw_material_turnover                     -0.0024279488
## Shares_outstanding                          0.2331165981
## Equity_face_value                           0.0043956200
## EPS                                        -0.0024181102
## Adjusted_EPS                               -0.0024958802
## Total_liabilities                           0.2616070334
## PE_BSE                                     -0.0017978487
## default                                    -0.0060755418
## Profitability                                        NA
## Levearge                                            NaN
## Roc                                                  NA
## Liqudity                                    0.7487953900
##                               Current liabilities_provisions
## Total_asts                                   0.2123884885
## Net_worth                                    0.7261337485
## Total_income                                 0.2158886693
## Change_instock                               0.1123775104
## Total_expenses                               0.2167584796
## PAT                                          0.7299598748
## PBDITA                                       0.7854006408
## PBT                                          0.7426382020
## Cash_profit                                  0.7521206609
## PBDITA_total income                          0.0070071544
## PBT_total income                             0.0056530064
## PAT_total income                             0.0053067443
## Cashprofit _totalincome                      0.0052739119
## PAT_net_worth                                0.0225875848
## Sales                                        0.2170957407
## Income_financial_services                    0.8039332401
## Other_income                                 0.1766749193
## Total_capital                                0.2005010475
## Reserves_funds                               0.1953644917
## Borrowings                                   0.7437239934
## Current liabilities_provisions               1.0000000000
## Deferred_taxliability                        0.8207779045
## Shareholders_funds                           0.7248467145
## Cumulative_retained_profits                  0.7852861971
## Capital_employed                             0.2098351346
## TOL_TNW                                     -0.0006609979
##  Liabilities_tangible_networth             -0.0065613955
## Contingent_liabilities_networth              0.0021186342
## Contingent_liabilities                       0.6405158936
## Netfixed_assets                              0.7108023519
## Investments                                  0.7506588776
## Current_assets                               0.9607565775
## Networking_capital                          -0.0895187708
## Quick_ratio                                 -0.0095259859
## Current_ratio                               -0.0096652230
## Debt_equity_ratio                           -0.0087915340
## Cash_current_liabilities                    -0.0044914418
```

```
## DY_salescost                             0.0020548920
## Creditors_turnover                       -0.0074535352
## Debtors_turnover                          0.0085103023
## Finished_goods_turnover                  -0.0054281694
## WIP_turnover                             -0.0062699646
## Raw_material_turnover                    -0.0021031380
## Shares_outstanding                        0.1981674745
## Equity_face_value                         0.0031250140
## EPS                                       0.0005671075
## Adjusted_EPS                              0.0005119208
## Total_liabilities                         0.2123884885
## PE_BSE                                   -0.0016501525
## default                                  -0.0174941108
## Profitability                                      NA
## Levearge                                          NaN
## Roc                                                NA
## Liqudity                                  0.9431108612
##                             Deferred_taxliability Shareholders_funds
## Total_asts                            0.194414333        0.213143343
## Net_worth                             0.963749712        0.999261142
## Total_income                          0.197339125        0.212290569
## Change_instock                        0.101755142        0.117515424
## Total_expenses                        0.198229661        0.212684831
## PAT                                   0.928284155        0.958454186
## PBDITA                                0.960092253        0.965971582
## PBT                                   0.918299268        0.939406624
## Cash_profit                           0.961491027        0.980177908
## PBDITA_total income                   0.007374106        0.009183085
## PBT_total income                      0.005205742        0.006412255
## PAT_total income                      0.004899422        0.006001846
## Cashprofit _totalincome               0.005209520        0.006254153
## PAT_net_worth                         0.018303865        0.019543088
## Sales                                 0.198481594        0.211486185
## Income_financial_services             0.674984428        0.586524034
## Other_income                          0.159059354        0.171082522
## Total_capital                         0.189615834        0.203899971
## Reserves_funds                        0.185105477        0.202803299
## Borrowings                            0.899078405        0.883270862
## Current liabilities_provisions        0.820777904        0.724846714
## Deferred_taxliability                 1.000000000        0.961783135
## Shareholders_funds                    0.961783135        1.000000000
## Cumulative_retained_profits           0.965449963        0.972372425
## Capital_employed                      0.196024136        0.214912532
## TOL_TNW                              -0.007138928       -0.013361265
##  Liabilities_tangible_networth       -0.004683977       -0.008783990
## Contingent_liabilities_networth       0.002188569       -0.001364560
## Contingent_liabilities                0.914428019        0.946132560
## Netfixed_assets                       0.967207570        0.970586627
## Investments                           0.868902974        0.876942456
## Current_assets                        0.822099154        0.750090426
```

```
## Networking_capital                    -0.093614403    -0.056579942
## Quick_ratio                           -0.008559732    -0.006501196
## Current_ratio                         -0.008237377    -0.006594568
## Debt_equity_ratio                     -0.007843341    -0.012499368
## Cash_current_liabilities              -0.004443155    -0.001935489
## DY_salescost                          -0.003378705     0.025729642
## Creditors_turnover                    -0.004838622    -0.005644495
## Debtors_turnover                       0.010527658     0.010061333
## Finished_goods_turnover               -0.006321577    -0.005449335
## WIP_turnover                          -0.005285320    -0.006127037
## Raw_material_turnover                 -0.001719488    -0.001899486
## Shares_outstanding                     0.189006846     0.199284339
## Equity_face_value                      0.003231809     0.004733191
## EPS                                    0.002052100     0.003384498
## Adjusted_EPS                           0.001976593     0.003301831
## Total_liabilities                      0.194414333     0.213143343
## PE_BSE                                -0.001205587    -0.001227288
## default                               -0.020573454    -0.021227621
## Profitability                                   NA              NA
## Levearge                                       NaN             NaN
## Roc                                             NA              NA
## Liqudity                               0.804779489     0.730008975
##                         Cumulative_retained_profits
## Total_asts                             0.196561986
## Net_worth                              0.975219747
## Total_income                           0.200266738
## Change_instock                         0.111141443
## Total_expenses                         0.200137379
## PAT                                    0.954278847
## PBDITA                                 0.973244722
## PBT                                    0.945668527
## Cash_profit                            0.969851522
## PBDITA_total income                    0.008898302
## PBT_total income                       0.006933879
## PAT_total income                       0.006479603
## Cashprofit _totalincome                0.006711281
## PAT_net_worth                          0.022998743
## Sales                                  0.201341458
## Income_financial_services             0.700189039
## Other_income                           0.161976194
## Total_capital                          0.179261705
## Reserves_funds                         0.197645768
## Borrowings                             0.884864967
## Current liabilities_provisions        0.785286197
## Deferred_taxliability                  0.965449963
## Shareholders_funds                     0.972372425
## Cumulative_retained_profits            1.000000000
## Capital_employed                       0.198100398
## TOL_TNW                               -0.013831858
##  Liabilities_tangible_networth        -0.009070121
```

```
## Contingent_liabilities_networth                    -0.002615380
## Contingent_liabilities                               0.893475871
## Netfixed_assets                                      0.940114756
## Investments                                          0.927577096
## Current_assets                                       0.795097809
## Networking_capital                                  -0.052078927
## Quick_ratio                                         -0.007098770
## Current_ratio                                       -0.006935242
## Debt_equity_ratio                                   -0.013847932
## Cash_current_liabilities                            -0.003121749
## DY_salescost                                        -0.005371104
## Creditors_turnover                                  -0.004930093
## Debtors_turnover                                     0.010037197
## Finished_goods_turnover                             -0.006132366
## WIP_turnover                                        -0.006396257
## Raw_material_turnover                               -0.001550026
## Shares_outstanding                                   0.181824417
## Equity_face_value                                    0.004475072
## EPS                                                  0.004294974
## Adjusted_EPS                                         0.004209330
## Total_liabilities                                    0.196561986
## PE_BSE                                              -0.001187952
## default                                             -0.026882879
## Profitability                                                 NA
## Levearge                                                     NaN
## Roc                                                          NA
## Liqudity                                             0.777714609
##                              Capital_employed        TOL_TNW
## Total_asts                        0.952223009 -2.310724e-02
## Net_worth                         0.211619277 -1.343446e-02
## Total_income                      0.832256645 -1.959377e-02
## Change_instock                    0.410735959  1.200037e-02
## Total_expenses                    0.828955071 -1.690987e-02
## PAT                               0.201576289 -1.344820e-02
## PBDITA                            0.222237204 -1.111936e-02
## PBT                               0.207415126 -1.345370e-02
## Cash_profit                       0.204761325 -1.207276e-02
## PBDITA_total income               0.032399530 -9.898601e-02
## PBT_total income                  0.021123223 -1.870240e-01
## PAT_total income                  0.020685520 -1.847014e-01
## Cashprofit _totalincome           0.020509577 -1.904666e-01
## PAT_net_worth                     0.042541665 -9.895795e-02
## Sales                             0.821756671 -1.897823e-02
## Income_financial_services         0.145189385 -4.123648e-03
## Other_income                      0.596358708 -2.879505e-02
## Total_capital                     0.652743428 -2.549171e-02
## Reserves_funds                    0.815230262 -8.014550e-02
## Borrowings                        0.264491983 -3.898604e-03
## Current liabilities_provisions    0.209835135 -6.609979e-04
## Deferred_taxliability             0.196024136 -7.138928e-03
```

```
## Shareholders_funds                  0.214912532 -1.336127e-02
## Cumulative_retained_profits         0.198100398 -1.383186e-02
## Capital_employed                    1.000000000 -2.709991e-02
## TOL_TNW                            -0.027099906  1.000000e+00
##  Liabilities_tangible_networth     -0.022389573  9.443464e-01
## Contingent_liabilities_networth     0.011931610  2.603505e-01
## Contingent_liabilities              0.134120083 -6.071114e-03
## Netfixed_assets                     0.192458123 -8.513727e-03
## Investments                         0.184154543 -9.937685e-03
## Current_assets                      0.262695409 -3.081362e-03
## Networking_capital                  0.083552856 -8.840930e-03
## Quick_ratio                        -0.035197238  2.055566e-03
## Current_ratio                      -0.032711207  1.541741e-02
## Debt_equity_ratio                  -0.003034858  8.956864e-01
## Cash_current_liabilities           -0.028907450  2.528615e-02
## DY_salescost                        0.018840189  2.512921e-02
## Creditors_turnover                 -0.015183935 -1.750817e-02
## Debtors_turnover                    0.015349789 -6.083970e-03
## Finished_goods_turnover             0.001987368 -7.123098e-03
## WIP_turnover                       -0.005584521 -9.016015e-03
## Raw_material_turnover              -0.008083489 -3.435130e-03
## Shares_outstanding                  0.643625900 -3.735239e-02
## Equity_face_value                   0.018740569 -2.062708e-04
## EPS                                -0.036591415 -1.040772e-01
## Adjusted_EPS                       -0.036695914 -1.040708e-01
## Total_liabilities                   0.952223009 -2.310724e-02
## PE_BSE                             -0.003782191 -4.213181e-03
## default                            -0.071242587  2.737075e-01
## Profitability                                NA           NA
## Levearge                                    NaN          NaN
## Roc                                          NA           NA
## Liqudity                            0.145028857  9.528899e-05
##                             Liabilities_tangible_networth
## Total_asts                                   -0.0229563461
## Net_worth                                    -0.0088923076
## Total_income                                 -0.0168434547
## Change_instock                                0.0193865781
## Total_expenses                               -0.0152169074
## PAT                                          -0.0086016022
## PBDITA                                       -0.0075531620
## PBT                                          -0.0088358166
## Cash_profit                                  -0.0078950262
## PBDITA_total income                          -0.0568314776
## PBT_total income                             -0.1004066965
## PAT_total income                             -0.0989092232
## Cashprofit _totalincome                      -0.1024372568
## PAT_net_worth                                -0.0733537646
## Sales                                        -0.0164904163
## Income_financial_services                    -0.0040434988
## Other_income                                 -0.0265740420
```

```
## Total_capital                              -0.0227543772
## Reserves_funds                             -0.0621175742
## Borrowings                                 -0.0029661517
## Current liabilities_provisions            -0.0065613955
## Deferred_taxliability                      -0.0046839769
## Shareholders_funds                         -0.0087839898
## Cumulative_retained_profits                -0.0090701205
## Capital_employed                           -0.0223895735
## TOL_TNW                                     0.9443464202
##  Liabilities_tangible_networth             1.0000000000
## Contingent_liabilities_networth            0.1927938002
## Contingent_liabilities                     -0.0038559351
## Netfixed_assets                            -0.0062843224
## Investments                                -0.0061857974
## Current_assets                             -0.0076692071
## Networking_capital                         -0.0026890492
## Quick_ratio                                 0.0181066065
## Current_ratio                               0.0351132973
## Debt_equity_ratio                           0.8777679833
## Cash_current_liabilities                    0.0462814552
## DY_salescost                                0.0298308145
## Creditors_turnover                         -0.0100049098
## Debtors_turnover                           -0.0085530250
## Finished_goods_turnover                    -0.0068634503
## WIP_turnover                               -0.0083184820
## Raw_material_turnover                      -0.0034733852
## Shares_outstanding                         -0.0341957606
## Equity_face_value                          -0.0001960092
## EPS                                        -0.0888708768
## Adjusted_EPS                               -0.0888671753
## Total_liabilities                          -0.0229563461
## PE_BSE                                     -0.0027486813
## default                                     0.2144024915
## Profitability                                         NA
## Levearge                                             NaN
## Roc                                                   NA
## Liqudity                                   -0.0070255161
##                          Contingent_liabilities_networth
## Total_asts                                    1.192288e-02
## Net_worth                                    -1.558792e-03
## Total_income                                  1.009804e-02
## Change_instock                                1.515518e-02
## Total_expenses                                1.214853e-02
## PAT                                          -2.226139e-03
## PBDITA                                       -3.517327e-04
## PBT                                          -2.171704e-03
## Cash_profit                                  -8.749481e-04
## PBDITA_total income                          -2.416397e-02
## PBT_total income                             -1.297485e-02
## PAT_total income                             -1.351131e-02
```

```
## Cashprofit _totalincome                                    -1.667464e-02
## PAT_net_worth                                               -1.796947e-01
## Sales                                                        1.061406e-02
## Income_financial_services                                   -6.612817e-05
## Other_income                                                 8.362497e-03
## Total_capital                                                2.022554e-02
## Reserves_funds                                              -2.838126e-02
## Borrowings                                                   6.083056e-03
## Current liabilities_provisions                               2.118634e-03
## Deferred_taxliability                                        2.188569e-03
## Shareholders_funds                                          -1.364560e-03
## Cumulative_retained_profits                                 -2.615380e-03
## Capital_employed                                             1.193161e-02
## TOL_TNW                                                      2.603505e-01
##  Liabilities_tangible_networth                               1.927938e-01
## Contingent_liabilities_networth                              1.000000e+00
## Contingent_liabilities                                       9.386672e-03
## Netfixed_assets                                              2.801893e-03
## Investments                                                 -1.131511e-03
## Current_assets                                               6.645414e-04
## Networking_capital                                          -6.232313e-03
## Quick_ratio                                                 -8.481453e-03
## Current_ratio                                               -7.199396e-03
## Debt_equity_ratio                                            2.542228e-01
## Cash_current_liabilities                                    -1.089332e-02
## DY_salescost                                                -6.185060e-03
## Creditors_turnover                                           8.600759e-03
## Debtors_turnover                                             1.258610e-03
## Finished_goods_turnover                                     -3.672772e-03
## WIP_turnover                                                -2.198497e-03
## Raw_material_turnover                                       -2.036315e-03
## Shares_outstanding                                           5.600166e-03
## Equity_face_value                                            3.789735e-03
## EPS                                                         -1.480561e-01
## Adjusted_EPS                                                -1.480561e-01
## Total_liabilities                                            1.192288e-02
## PE_BSE                                                      -3.537090e-03
## default                                                      1.557404e-01
## Profitability                                                          NA
## Levearge                                                              NaN
## Roc                                                                    NA
## Liqudity                                                    -5.823191e-03
##                              Contingent_liabilities Netfixed_assets
## Total_asts                              0.1330529731     0.190978801
## Net_worth                               0.9475951652     0.972781633
## Total_income                            0.1344430134     0.190519744
## Change_instock                          0.0755306011     0.103887162
## Total_expenses                          0.1350814311     0.191550634
## PAT                                     0.8684179393     0.904005623
## PBDITA                                  0.8714788365     0.923382470
```

```
## PBT                                          0.8290293436     0.875213351
## Cash_profit                                  0.9133995376     0.949391558
## PBDITA_total income                          0.0050044764     0.007082749
## PBT_total income                             0.0038674477     0.004963424
## PAT_total income                             0.0036626036     0.004767637
## Cashprofit _totalincome                      0.0038613752     0.005060572
## PAT_net_worth                                0.0107897135     0.012764788
## Sales                                        0.1354110999     0.191736083
## Income_financial_services                    0.4642454326     0.540106998
## Other_income                                 0.1113799386     0.153985429
## Total_capital                                0.1287636642     0.184840690
## Reserves_funds                               0.1252607513     0.176197227
## Borrowings                                   0.8314274326     0.888613157
## Current liabilities_provisions              0.6405158936     0.710802352
## Deferred_taxliability                        0.9144280193     0.967207570
## Shareholders_funds                           0.9461325598     0.970586627
## Cumulative_retained_profits                  0.8934758706     0.940114756
## Capital_employed                             0.1341200825     0.192458123
## TOL_TNW                                     -0.0060711144    -0.008513727
##  Liabilities_tangible_networth              -0.0038559351    -0.006284322
## Contingent_liabilities_networth              0.0093866718     0.002801893
## Contingent_liabilities                       1.0000000000     0.967940374
## Netfixed_assets                              0.9679403739     1.000000000
## Investments                                  0.7812035841     0.836785338
## Current_assets                               0.6183170785     0.703015429
## Networking_capital                          -0.2505698754    -0.191629921
## Quick_ratio                                 -0.0052236825    -0.008817700
## Current_ratio                               -0.0052453939    -0.008360425
## Debt_equity_ratio                           -0.0061080106    -0.005891821
## Cash_current_liabilities                    -0.0026815390    -0.005009447
## DY_salescost                                -0.0018293047    -0.003749132
## Creditors_turnover                          -0.0039271765    -0.004876157
## Debtors_turnover                             0.0079621483     0.010968568
## Finished_goods_turnover                     -0.0043683011    -0.005313044
## WIP_turnover                                -0.0039798380    -0.004165188
## Raw_material_turnover                       -0.0010520103    -0.001617071
## Shares_outstanding                           0.1299678640     0.182181579
## Equity_face_value                            0.0030612882     0.003024455
## EPS                                          0.0006247375    -0.001082371
## Adjusted_EPS                                 0.0005337506    -0.001160491
## Total_liabilities                            0.1330529731     0.190978801
## PE_BSE                                      -0.0008569050    -0.001175506
## default                                     -0.0135988211    -0.014490777
## Profitability                                          NA              NA
## Levearge                                              NaN             NaN
## Roc                                                    NA              NA
## Liqudity                                     0.6071088795     0.684874751
##                                 Investments Current_assets
## Total_asts                      0.1825784407     0.2637037439
## Net_worth                       0.8805693296     0.7472494472
```

```
## Total_income                        0.1798707371   0.2674265054
## Change_instock                       0.0978679735   0.1439021861
## Total_expenses                       0.1799930692   0.2683810202
## PAT                                  0.8339692583   0.7594341921
## PBDITA                               0.8684921766   0.8139793327
## PBT                                  0.8252891441   0.7818973492
## Cash_profit                          0.8525526653   0.7684784555
## PBDITA_total income                  0.0075450041   0.0102455031
## PBT_total income                     0.0046141907   0.0074611051
## PAT_total income                     0.0043140220   0.0070459728
## Cashprofit _totalincome              0.0042355420   0.0070246522
## PAT_net_worth                        0.0134877118   0.0255509637
## Sales                                0.1757740333   0.2646124692
## Income_financial_services           0.7427839780   0.8017869444
## Other_income                         0.1509225061   0.2049040371
## Total_capital                        0.1783810284   0.2409387615
## Reserves_funds                       0.1713837011   0.2403844641
## Borrowings                           0.8933489867   0.7747598165
## Current liabilities_provisions       0.7506588776   0.9607565775
## Deferred_taxliability                0.8689029738   0.8220991538
## Shareholders_funds                   0.8769424557   0.7500904256
## Cumulative_retained_profits          0.9275770958   0.7950978086
## Capital_employed                     0.1841545430   0.2626954092
## TOL_TNW                             -0.0099376854  -0.0030813625
##  Liabilities_tangible_networth      -0.0061857974  -0.0076692071
## Contingent_liabilities_networth     -0.0011315111   0.0006645414
## Contingent_liabilities               0.7812035841   0.6183170785
## Netfixed_assets                      0.8367853375   0.7030154288
## Investments                          1.0000000000   0.7460017599
## Current_assets                       0.7460017599   1.0000000000
## Networking_capital                  -0.0963206827   0.1454430588
## Quick_ratio                         -0.0067381902  -0.0081432684
## Current_ratio                       -0.0064818164  -0.0088374165
## Debt_equity_ratio                   -0.0094642658  -0.0098563365
## Cash_current_liabilities            -0.0036967685  -0.0016706607
## DY_salescost                         0.0718624333   0.0665201929
## Creditors_turnover                  -0.0046779403  -0.0065298034
## Debtors_turnover                     0.0115796228   0.0059232681
## Finished_goods_turnover             -0.0046980140  -0.0051965712
## WIP_turnover                        -0.0048282601  -0.0090435308
## Raw_material_turnover               -0.0014585821  -0.0025895356
## Shares_outstanding                   0.1728170007   0.2317653964
## Equity_face_value                    0.0040115275   0.0052715295
## EPS                                  0.0028799219   0.0022175957
## Adjusted_EPS                         0.0028086324   0.0021619405
## Total_liabilities                    0.1825784407   0.2637037439
## PE_BSE                              -0.0009051739  -0.0018978656
## default                             -0.0113292664  -0.0201512362
## Profitability                                 NA             NA
## Levearge                                     NaN            NaN
```

```
## Roc                                          NA           NA
## Liqudity                         0.7293864589    0.9771006387
##                                  Networking_capital  Quick_ratio
## Total_asts                          0.0810118866 -0.0381730080
## Net_worth                          -0.0701461303 -0.0065460157
## Total_income                        0.0812884056 -0.0399371384
## Change_instock                      0.0288571149 -0.0217176665
## Total_expenses                      0.0808225643 -0.0399426213
## PAT                                 0.0205238065 -0.0068088536
## PBDITA                              0.0235198570 -0.0081901042
## PBT                                 0.0740317441 -0.0069169487
## Cash_profit                        -0.0417303917 -0.0074776700
## PBDITA_total income                 0.0093127745 -0.0007083622
## PBT_total income                    0.0054865359  0.0008529302
## PAT_total income                    0.0051274180  0.0010872452
## Cashprofit _totalincome             0.0053020800  0.0035856443
## PAT_net_worth                       0.0105712665 -0.0102523770
## Sales                               0.0666834436 -0.0398326153
## Income_financial_services           0.1486648345 -0.0040994251
## Other_income                        0.0361211458 -0.0405467248
## Total_capital                       0.0683747197 -0.0265961985
## Reserves_funds                      0.0704929030 -0.0215451482
## Borrowings                         -0.0557838521 -0.0106666803
## Current liabilities_provisions     -0.0895187708 -0.0095259859
## Deferred_taxliability              -0.0936144026 -0.0085597319
## Shareholders_funds                 -0.0565799424 -0.0065011959
## Cumulative_retained_profits        -0.0520789269 -0.0070987698
## Capital_employed                    0.0835528561 -0.0351972375
## TOL_TNW                            -0.0088409300  0.0020555665
##  Liabilities_tangible_networth     -0.0026890492  0.0181066065
## Contingent_liabilities_networth    -0.0062323129 -0.0084814533
## Contingent_liabilities             -0.2505698754 -0.0052236825
## Netfixed_assets                    -0.1916299212 -0.0088176996
## Investments                        -0.0963206827 -0.0067381902
## Current_assets                      0.1454430588 -0.0081432684
## Networking_capital                  1.0000000000  0.0106231104
## Quick_ratio                         0.0106231104  1.0000000000
## Current_ratio                       0.0084262491  0.9741810837
## Debt_equity_ratio                  -0.0053524688  0.0104267138
## Cash_current_liabilities            0.0149130937  0.5599232189
## DY_salescost                        0.2251443087  0.0896630477
## Creditors_turnover                  0.0023424014  0.0238991635
## Debtors_turnover                   -0.0099662244 -0.0138651439
## Finished_goods_turnover             0.0027598674 -0.0054260303
## WIP_turnover                       -0.0062914679 -0.0059410848
## Raw_material_turnover              -0.0016594074 -0.0018395614
## Shares_outstanding                  0.0488925036 -0.0304863451
## Equity_face_value                   0.0048804626 -0.0007168671
## EPS                                 0.0048872248  0.0030747671
## Adjusted_EPS                        0.0049031942  0.0030820788
```

```
## Total_liabilities                      0.0810118866 -0.0381730080
## PE_BSE                                 -0.0004805224 -0.0038352925
## default                                -0.0006843192 -0.0058570623
## Profitability                                     NA           NA
## Levearge                                         NaN          NaN
## Roc                                               NA           NA
## Liqudity                               0.1385799536 -0.0028962865
##                                        Current_ratio Debt_equity_ratio
## Total_asts                             -0.0367727405      -9.071905e-03
## Net_worth                              -0.0065802318      -1.282483e-02
## Total_income                           -0.0385144473      -2.375485e-02
## Change_instock                         -0.0140100536       1.347325e-02
## Total_expenses                         -0.0384674848      -2.128677e-02
## PAT                                    -0.0071313974      -1.427875e-02
## PBDITA                                 -0.0083677444      -1.180496e-02
## PBT                                    -0.0073244787      -1.429164e-02
## Cash_profit                            -0.0075798440      -1.262943e-02
## PBDITA_total income                     0.0014275346      -9.155734e-02
## PBT_total income                        0.0033269261      -1.962748e-01
## PAT_total income                        0.0035000321      -1.935497e-01
## Cashprofit _totalincome                 0.0053286259      -1.969701e-01
## PAT_net_worth                          -0.0098909929      -1.056716e-01
## Sales                                  -0.0382422676      -2.321780e-02
## Income_financial_services              -0.0045404544      -6.089148e-03
## Other_income                           -0.0383250313      -1.450087e-02
## Total_capital                          -0.0258381181       7.599448e-04
## Reserves_funds                         -0.0203557849      -6.431021e-02
## Borrowings                             -0.0103833234       5.264462e-04
## Current liabilities_provisions         -0.0096652230      -8.791534e-03
## Deferred_taxliability                  -0.0082373773      -7.843341e-03
## Shareholders_funds                     -0.0065945676      -1.249937e-02
## Cumulative_retained_profits            -0.0069352425      -1.384793e-02
## Capital_employed                       -0.0327112070      -3.034858e-03
## TOL_TNW                                 0.0154174130       8.956864e-01
##  Liabilities_tangible_networth          0.0351132973       8.777680e-01
## Contingent_liabilities_networth        -0.0071993959       2.542228e-01
## Contingent_liabilities                 -0.0052453939      -6.108011e-03
## Netfixed_assets                        -0.0083604247      -5.891821e-03
## Investments                            -0.0064818164      -9.464266e-03
## Current_assets                         -0.0088374165      -9.856336e-03
## Networking_capital                      0.0084262491      -5.352469e-03
## Quick_ratio                             0.9741810837       1.042671e-02
## Current_ratio                           1.0000000000       2.702021e-02
## Debt_equity_ratio                       0.0270202128       1.000000e+00
## Cash_current_liabilities                0.4340718941       3.943228e-02
## DY_salescost                            0.0662238548       2.756834e-02
## Creditors_turnover                      0.0352384546      -1.323038e-02
## Debtors_turnover                       -0.0064638671      -7.224376e-03
## Finished_goods_turnover                -0.0074747398      -6.952382e-03
## WIP_turnover                           -0.0092533889      -1.017069e-02
```

```
## Raw_material_turnover           -0.0018850445    -3.151431e-03
## Shares_outstanding              -0.0312546112    -1.417414e-02
## Equity_face_value               -0.0053346326    -9.703828e-05
## EPS                              0.0025598121    -1.005928e-01
## Adjusted_EPS                     0.0025666145    -1.005866e-01
## Total_liabilities               -0.0367727405    -9.071905e-03
## PE_BSE                           -0.0004434924    -3.588453e-03
## default                         -0.0068735506     2.900387e-01
## Profitability                             NA               NA
## Levearge                                 NaN              NaN
## Roc                                       NA               NA
## Liqudity                        -0.0027309424    -1.167692e-02
##                                 Cash_current_liabilities   DY_salescost
## Total_asts                                 -3.088898e-02   0.0199635886
## Net_worth                                  -2.222785e-03   0.0258511631
## Total_income                               -3.446184e-02   0.0149452927
## Change_instock                             -2.592749e-02  -0.0182415295
## Total_expenses                             -3.489075e-02   0.0150039730
## PAT                                        -1.736881e-03  -0.0035620470
## PBDITA                                     -3.030145e-03   0.0136422512
## PBT                                        -1.596644e-03  -0.0035018288
## Cash_profit                                -2.635911e-03  -0.0036861396
## PBDITA_total income                         5.933128e-03   0.0116426897
## PBT_total income                            1.274781e-03  -0.0015874674
## PAT_total income                            1.475353e-03  -0.0013834317
## Cashprofit _totalincome                     5.479182e-03  -0.0020001286
## PAT_net_worth                              -8.394853e-03  -0.0088424185
## Sales                                      -3.481752e-02  -0.0264420346
## Income_financial_services                   1.682766e-05   0.0986340277
## Other_income                               -3.159205e-02   0.0151616255
## Total_capital                              -1.532273e-02   0.0243925284
## Reserves_funds                             -2.184368e-02  -0.0202000022
## Borrowings                                 -5.047804e-03   0.1297709448
## Current liabilities_provisions             -4.491442e-03   0.0020548920
## Deferred_taxliability                      -4.443155e-03  -0.0033787047
## Shareholders_funds                         -1.935489e-03   0.0257296415
## Cumulative_retained_profits                -3.121749e-03  -0.0053711045
## Capital_employed                           -2.890745e-02   0.0188401895
## TOL_TNW                                     2.528615e-02   0.0251292107
##  Liabilities_tangible_networth              4.628146e-02   0.0298308145
## Contingent_liabilities_networth            -1.089332e-02  -0.0061850604
## Contingent_liabilities                     -2.681539e-03  -0.0018293047
## Netfixed_assets                            -5.009447e-03  -0.0037491322
## Investments                                -3.696769e-03   0.0718624333
## Current_assets                             -1.670661e-03   0.0665201929
## Networking_capital                          1.491309e-02   0.2251443087
## Quick_ratio                                 5.599232e-01   0.0896630477
## Current_ratio                               4.340719e-01   0.0662238548
## Debt_equity_ratio                           3.943228e-02   0.0275683434
## Cash_current_liabilities                    1.000000e+00   0.1697777310
```

```
## DY_salescost                            1.697777e-01  1.0000000000
## Creditors_turnover                      2.752076e-02 -0.0061012981
## Debtors_turnover                       -1.150900e-03 -0.0038467946
## Finished_goods_turnover                -7.469207e-03 -0.0061614064
## WIP_turnover                           -8.044859e-03 -0.0082091346
## Raw_material_turnover                  -2.472039e-03 -0.0024046889
## Shares_outstanding                     -1.400255e-02 -0.0165909804
## Equity_face_value                       3.549721e-03  0.0020613780
## EPS                                     2.297988e-03  0.0008578538
## Adjusted_EPS                            2.304705e-03  0.0008620765
## Total_liabilities                      -3.088898e-02  0.0199635886
## PE_BSE                                 -2.572041e-03 -0.0018248993
## default                                 1.714860e-02  0.1048596495
## Profitability                                    NA            NA
## Levearge                                        NaN           NaN
## Roc                                              NA            NA
## Liqudity                               -1.413906e-03  0.0657109013
##                              Creditors_turnover Debtors_turnover
## Total_asts                          -0.017736286      0.013905230
## Net_worth                           -0.005568928      0.009936766
## Total_income                         0.006332912      0.027760811
## Change_instock                       0.002056269     -0.006019444
## Total_expenses                       0.006417026      0.026908784
## PAT                                 -0.006251377      0.011357620
## PBDITA                              -0.006362646      0.012345536
## PBT                                 -0.006349440      0.011919584
## Cash_profit                         -0.005827907      0.011567316
## PBDITA_total income                  0.008765922      0.010464508
## PBT_total income                     0.010814741      0.010265459
## PAT_total income                     0.010938875      0.010213798
## Cashprofit _totalincome              0.010416705      0.009941712
## PAT_net_worth                        0.004064276      0.018929635
## Sales                                0.007273779      0.027881722
## Income_financial_services           -0.003457631      0.007443537
## Other_income                        -0.017608821      0.060693897
## Total_capital                       -0.019115076      0.041266529
## Reserves_funds                      -0.001882753      0.026544232
## Borrowings                          -0.005740179      0.009616338
## Current liabilities_provisions      -0.007453535      0.008510302
## Deferred_taxliability               -0.004838622      0.010527658
## Shareholders_funds                  -0.005644495      0.010061333
## Cumulative_retained_profits         -0.004930093      0.010037197
## Capital_employed                    -0.015183935      0.015349789
## TOL_TNW                             -0.017508174     -0.006083970
##  Liabilities_tangible_networth      -0.010004910     -0.008553025
## Contingent_liabilities_networth      0.008600759      0.001258610
## Contingent_liabilities              -0.003927177      0.007962148
## Netfixed_assets                     -0.004876157      0.010968568
## Investments                         -0.004677940      0.011579623
## Current_assets                      -0.006529803      0.005923268
```

```
## Networking_capital                    0.002342401      -0.009966224
## Quick_ratio                           0.023899163      -0.013865144
## Current_ratio                         0.035238455      -0.006463867
## Debt_equity_ratio                     -0.013230376     -0.007224376
## Cash_current_liabilities              0.027520763      -0.001150900
## DY_salescost                          -0.006101298     -0.003846795
## Creditors_turnover                    1.000000000       0.030688147
## Debtors_turnover                      0.030688147       1.000000000
## Finished_goods_turnover               0.003112629       0.006658820
## WIP_turnover                          0.034829469       0.028663645
## Raw_material_turnover                 0.010660887       0.002614329
## Shares_outstanding                    -0.011892863      0.042256047
## Equity_face_value                     0.002764218       0.004831341
## EPS                                   0.002459976       0.001411801
## Adjusted_EPS                          0.002462025       0.001414618
## Total_liabilities                     -0.017736286      0.013905230
## PE_BSE                                0.022138311       0.048817461
## default                              -0.032830409      -0.005082347
## Profitability                                 NA                NA
## Levearge                                     NaN               NaN
## Roc                                           NA                NA
## Liqudity                              0.002705215      -0.002984632
##                           Finished_goods_turnover  WIP_turnover
## Total_asts                             0.0034289265 -0.0013240432
## Net_worth                             -0.0053452911 -0.0060156659
## Total_income                          -0.0034491400  0.0061705322
## Change_instock                        -0.0057187382 -0.0343633364
## Total_expenses                        -0.0030136347  0.0067006725
## PAT                                   -0.0054342877 -0.0065091944
## PBDITA                                -0.0057713662 -0.0062744968
## PBT                                   -0.0055932877 -0.0065382279
## Cash_profit                           -0.0054017411 -0.0058902463
## PBDITA_total income                    0.0047359662  0.0053251187
## PBT_total income                       0.0034074911  0.0013769894
## PAT_total income                       0.0034692590  0.0017319068
## Cashprofit _totalincome                0.0026715159  0.0009899097
## PAT_net_worth                          0.0222194313  0.0031678702
## Sales                                 -0.0029931341  0.0060915500
## Income_financial_services             -0.0048588665 -0.0050749636
## Other_income                          -0.0192210686  0.0017388831
## Total_capital                         -0.0155594473 -0.0070739169
## Reserves_funds                         0.0125960139 -0.0176779216
## Borrowings                            -0.0056886228 -0.0070348669
## Current liabilities_provisions        -0.0054281694 -0.0062699646
## Deferred_taxliability                 -0.0063215774 -0.0052853204
## Shareholders_funds                    -0.0054493349 -0.0061270367
## Cumulative_retained_profits           -0.0061323659 -0.0063962566
## Capital_employed                       0.0019873678 -0.0055845206
## TOL_TNW                               -0.0071230977 -0.0090160145
##  Liabilities_tangible_networth        -0.0068634503 -0.0083184820
```

```
## Contingent_liabilities_networth            -0.0036727724 -0.0021984969
## Contingent_liabilities                      -0.0043683011 -0.0039798380
## Netfixed_assets                             -0.0053130443 -0.0041651883
## Investments                                 -0.0046980140 -0.0048282601
## Current_assets                              -0.0051965712 -0.0090435308
## Networking_capital                           0.0027598674 -0.0062914679
## Quick_ratio                                 -0.0054260303 -0.0059410848
## Current_ratio                               -0.0074747398 -0.0092533889
## Debt_equity_ratio                           -0.0069523825 -0.0101706921
## Cash_current_liabilities                    -0.0074692072 -0.0080448586
## DY_salescost                                -0.0061614064 -0.0082091346
## Creditors_turnover                           0.0031126290  0.0348294687
## Debtors_turnover                             0.0066588195  0.0286636448
## Finished_goods_turnover                      1.0000000000  0.2785637375
## WIP_turnover                                 0.2785637375  1.0000000000
## Raw_material_turnover                       -0.0007289303  0.0012618846
## Shares_outstanding                          -0.0130940313 -0.0140758450
## Equity_face_value                            0.0003913630 -0.0037142173
## EPS                                          0.0021293136  0.0017798343
## Adjusted_EPS                                 0.0021279068  0.0017847520
## Total_liabilities                            0.0034289265 -0.0013240432
## PE_BSE                                      -0.0028532242 -0.0036273746
## default                                      0.0103509202 -0.0206146695
## Profitability                                          NA            NA
## Levearge                                              NaN           NaN
## Roc                                                    NA            NA
## Liqudity                                     0.0026695739 -0.0076292473
##                                Raw_material_turnover Shares_outstanding
## Total_asts                              -0.0089296913        0.643479744
## Net_worth                               -0.0018497229        0.196302250
## Total_income                            -0.0012034406        0.591547044
## Change_instock                           0.0408594370        0.306051644
## Total_expenses                          -0.0007362348        0.586047719
## PAT                                     -0.0018377279        0.197138444
## PBDITA                                  -0.0020121176        0.212408319
## PBT                                     -0.0018991652        0.202396066
## Cash_profit                             -0.0017873303        0.197748973
## PBDITA_total income                      0.0011709629        0.029824724
## PBT_total income                         0.0023419444        0.018325321
## PAT_total income                         0.0024010063        0.017979568
## Cashprofit _totalincome                  0.0020437630        0.019637243
## PAT_net_worth                            0.0038933554        0.043509567
## Sales                                   -0.0009228073        0.586631430
## Income_financial_services               -0.0013112189        0.131212716
## Other_income                            -0.0078108579        0.449320214
## Total_capital                           -0.0121575946        0.807050217
## Reserves_funds                          -0.0079414892        0.535105657
## Borrowings                              -0.0024279488        0.233116598
## Current liabilities_provisions          -0.0021031380        0.198167474
## Deferred_taxliability                   -0.0017194877        0.189006846
```

```
## Shareholders_funds                      -0.0018994856      0.199284339
## Cumulative_retained_profits             -0.0015500264      0.181824417
## Capital_employed                        -0.0080834889      0.643625900
## TOL_TNW                                 -0.0034351300     -0.037352387
##  Liabilities_tangible_networth          -0.0034733852     -0.034195761
## Contingent_liabilities_networth         -0.0020363146      0.005600166
## Contingent_liabilities                  -0.0010520103      0.129967864
## Netfixed_assets                         -0.0016170714      0.182181579
## Investments                             -0.0014585821      0.172817001
## Current_assets                          -0.0025895356      0.231765396
## Networking_capital                      -0.0016594074      0.048892504
## Quick_ratio                             -0.0018395614     -0.030486345
## Current_ratio                           -0.0018850445     -0.031254611
## Debt_equity_ratio                       -0.0031514310     -0.014174135
## Cash_current_liabilities                -0.0024720394     -0.014002546
## DY_salescost                            -0.0024046889     -0.016590980
## Creditors_turnover                       0.0106608873     -0.011892863
## Debtors_turnover                         0.0026143287      0.042256047
## Finished_goods_turnover                 -0.0007289303     -0.013094031
## WIP_turnover                             0.0012618846     -0.014075845
## Raw_material_turnover                    1.0000000000     -0.011606351
## Shares_outstanding                      -0.0116063513      1.000000000
## Equity_face_value                        0.0001768380      0.017977526
## EPS                                      0.0007552292      0.009012411
## Adjusted_EPS                             0.0007568948      0.008955855
## Total_liabilities                       -0.0089296913      0.643479744
## PE_BSE                                  -0.0010136671     -0.001841557
## default                                 -0.0081644042     -0.043173187
## Profitability                                      NA                NA
## Levearge                                          NaN               NaN
## Roc                                                NA                NA
## Liqudity                                 0.0015584322      0.145257811
##                                 Equity_face_value           EPS
## Total_asts                           1.707600e-02 -3.626693e-02
## Net_worth                            4.671160e-03  3.353852e-03
## Total_income                         1.872355e-02  1.640670e-03
## Change_instock                       1.509386e-02 -3.472738e-02
## Total_expenses                       1.863119e-02 -1.290790e-03
## PAT                                  3.471192e-03  3.496799e-03
## PBDITA                               3.791918e-03  2.616223e-03
## PBT                                  3.616151e-03  3.309125e-03
## Cash_profit                          3.471203e-03  2.559286e-03
## PBDITA_total income                  1.331208e-05  1.542799e-03
## PBT_total income                    -1.256115e-03  7.739379e-05
## PAT_total income                    -1.394660e-03 -3.591980e-06
## Cashprofit _totalincome             -9.844263e-04  1.981282e-04
## PAT_net_worth                        7.672571e-03  4.795878e-02
## Sales                                1.878686e-02  1.591839e-03
## Income_financial_services            3.291357e-03  1.925040e-03
## Other_income                         1.708126e-02 -3.465896e-02
```

```
## Total_capital                        2.173184e-02  1.301060e-02
## Reserves_funds                        1.520766e-02  1.528878e-02
## Borrowings                            4.395620e-03 -2.418110e-03
## Current liabilities_provisions        3.125014e-03  5.671075e-04
## Deferred_taxliability                 3.231809e-03  2.052100e-03
## Shareholders_funds                    4.733191e-03  3.384498e-03
## Cumulative_retained_profits           4.475072e-03  4.294974e-03
## Capital_employed                      1.874057e-02 -3.659141e-02
## TOL_TNW                              -2.062708e-04 -1.040772e-01
##  Liabilities_tangible_networth       -1.960092e-04 -8.887088e-02
## Contingent_liabilities_networth       3.789735e-03 -1.480561e-01
## Contingent_liabilities                3.061288e-03  6.247375e-04
## Netfixed_assets                       3.024455e-03 -1.082371e-03
## Investments                           4.011527e-03  2.879922e-03
## Current_assets                        5.271530e-03  2.217596e-03
## Networking_capital                    4.880463e-03  4.887225e-03
## Quick_ratio                          -7.168671e-04  3.074767e-03
## Current_ratio                        -5.334633e-03  2.559812e-03
## Debt_equity_ratio                    -9.703828e-05 -1.005928e-01
## Cash_current_liabilities              3.549721e-03  2.297988e-03
## DY_salescost                          2.061378e-03  8.578538e-04
## Creditors_turnover                    2.764218e-03  2.459976e-03
## Debtors_turnover                      4.831341e-03  1.411801e-03
## Finished_goods_turnover               3.913630e-04  2.129314e-03
## WIP_turnover                         -3.714217e-03  1.779834e-03
## Raw_material_turnover                 1.768380e-04  7.552292e-04
## Shares_outstanding                    1.797753e-02  9.012411e-03
## Equity_face_value                     1.000000e+00  1.532657e-03
## EPS                                   1.532657e-03  1.000000e+00
## Adjusted_EPS                          1.529934e-03  9.999997e-01
## Total_liabilities                     1.707600e-02 -3.626693e-02
## PE_BSE                                8.799717e-04  4.285944e-04
## default                              -2.421969e-02 -6.704850e-02
## Profitability                                  NA            NA
## Levearge                                      NaN           NaN
## Roc                                            NA            NA
## Liqudity                             -1.392127e-03  7.170651e-03
##                                Adjusted_EPS Total_liabilities
## Total_asts                     -3.637111e-02       1.000000000
## Net_worth                       3.270890e-03       0.209930813
## Total_income                    1.537759e-03       0.863030510
## Change_instock                 -3.479506e-02       0.413189795
## Total_expenses                 -1.392637e-03       0.860026848
## PAT                             3.397516e-03       0.200656463
## PBDITA                          2.520397e-03       0.221268428
## PBT                             3.210975e-03       0.206691483
## Cash_profit                     2.462542e-03       0.203470577
## PBDITA_total income             1.534891e-03       0.031690044
## PBT_total income                7.156312e-05       0.021268990
## PAT_total income               -9.040193e-06       0.020936528
```

```
## Cashprofit _totalincome           1.923170e-04        0.020115386
## PAT_net_worth                      4.793651e-02        0.045068408
## Sales                              1.487934e-03        0.852832321
## Income_financial_services          1.865217e-03        0.144326461
## Other_income                      -3.473579e-02        0.609173653
## Total_capital                      1.296529e-02        0.651616793
## Reserves_funds                     1.518210e-02        0.812703147
## Borrowings                        -2.495880e-03        0.261607033
## Current liabilities_provisions     5.119208e-04        0.212388489
## Deferred_taxliability              1.976593e-03        0.194414333
## Shareholders_funds                 3.301831e-03        0.213143343
## Cumulative_retained_profits        4.209330e-03        0.196561986
## Capital_employed                  -3.669591e-02        0.952223009
## TOL_TNW                           -1.040708e-01       -0.023107239
##  Liabilities_tangible_networth    -8.886718e-02       -0.022956346
## Contingent_liabilities_networth   -1.480561e-01        0.011922875
## Contingent_liabilities             5.337506e-04        0.133052973
## Netfixed_assets                   -1.160491e-03        0.190978801
## Investments                        2.808632e-03        0.182578441
## Current_assets                     2.161941e-03        0.263703744
## Networking_capital                 4.903194e-03        0.081011887
## Quick_ratio                        3.082079e-03       -0.038173008
## Current_ratio                      2.566615e-03       -0.036772740
## Debt_equity_ratio                 -1.005866e-01       -0.009071905
## Cash_current_liabilities           2.304705e-03       -0.030888975
## DY_salescost                       8.620765e-04        0.019963589
## Creditors_turnover                 2.462025e-03       -0.017736286
## Debtors_turnover                   1.414618e-03        0.013905230
## Finished_goods_turnover            2.127907e-03        0.003428926
## WIP_turnover                       1.784752e-03       -0.001324043
## Raw_material_turnover              7.568948e-04       -0.008929691
## Shares_outstanding                 8.955855e-03        0.643479744
## Equity_face_value                  1.529934e-03        0.017076002
## EPS                                9.999997e-01       -0.036266925
## Adjusted_EPS                       1.000000e+00       -0.036371106
## Total_liabilities                 -3.637111e-02        1.000000000
## PE_BSE                             4.296604e-04       -0.004276486
## default                           -6.703962e-02       -0.064149485
## Profitability                               NA                 NA
## Levearge                                   NaN                NaN
## Roc                                         NA                 NA
## Liqudity                           7.129215e-03        0.141842380
##                                         PE_BSE        default Profitability
## Total_asts                         -0.0042764860 -0.0641494854           NA
## Net_worth                          -0.0011949601 -0.0216103237           NA
## Total_income                       -0.0060905438 -0.0926352034           NA
## Change_instock                      0.0039547945 -0.0536572961           NA
## Total_expenses                     -0.0049602126 -0.0891414632           NA
## PAT                                -0.0012935972 -0.0301099785           NA
## PBDITA                             -0.0013948253 -0.0245814950           NA
```

```
## PBT                                -0.0013585246 -0.0293753831        NA
## Cash_profit                         -0.0012564252 -0.0273758586        NA
## PBDITA_total income                  0.0008851869 -0.0950455353        NA
## PBT_total income                     0.0014290874 -0.1140288591        NA
## PAT_total income                     0.0014797396 -0.1176216518        NA
## Cashprofit _totalincome              0.0011759690 -0.1184647415        NA
## PAT_net_worth                       -0.0021407263 -0.2310490484        NA
## Sales                               -0.0060097996 -0.0963379593        NA
## Income_financial_services           -0.0010209045 -0.0070469227        NA
## Other_income                        -0.0066845178 -0.0566597415        NA
## Total_capital                       -0.0034531973 -0.0208516825        NA
## Reserves_funds                      -0.0046483395 -0.1256006239        NA
## Borrowings                          -0.0017978487 -0.0060755418        NA
## Current liabilities_provisions      -0.0016501525 -0.0174941108        NA
## Deferred_taxliability               -0.0012055874 -0.0205734536        NA
## Shareholders_funds                  -0.0012272883 -0.0212276210        NA
## Cumulative_retained_profits         -0.0011879523 -0.0268828792        NA
## Capital_employed                    -0.0037821911 -0.0712425874        NA
## TOL_TNW                             -0.0042131808  0.2737074668        NA
##  Liabilities_tangible_networth      -0.0027486813  0.2144024915        NA
## Contingent_liabilities_networth     -0.0035370900  0.1557403618        NA
## Contingent_liabilities              -0.0008569050 -0.0135988211        NA
## Netfixed_assets                     -0.0011755065 -0.0144907766        NA
## Investments                         -0.0009051739 -0.0113292664        NA
## Current_assets                      -0.0018978656 -0.0201512362        NA
## Networking_capital                  -0.0004805224 -0.0006843192        NA
## Quick_ratio                         -0.0038352925 -0.0058570623        NA
## Current_ratio                       -0.0004434924 -0.0068735506        NA
## Debt_equity_ratio                   -0.0035884533  0.2900387287        NA
## Cash_current_liabilities            -0.0025720413  0.0171485998        NA
## DY_salescost                        -0.0018248993  0.1048596495        NA
## Creditors_turnover                   0.0221383106 -0.0328304090        NA
## Debtors_turnover                     0.0488174606 -0.0050823470        NA
## Finished_goods_turnover             -0.0028532242  0.0103509202        NA
## WIP_turnover                        -0.0036273746 -0.0206146695        NA
## Raw_material_turnover               -0.0010136671 -0.0081644042        NA
## Shares_outstanding                  -0.0018415569 -0.0431731872        NA
## Equity_face_value                    0.0008799717 -0.0242196881        NA
## EPS                                  0.0004285944 -0.0670484959        NA
## Adjusted_EPS                         0.0004296604 -0.0670396186        NA
## Total_liabilities                   -0.0042764860 -0.0641494854        NA
## PE_BSE                               1.0000000000 -0.0080234157        NA
## default                             -0.0080234157  1.0000000000        NA
## Profitability                                 NA            NA         1
## Levearge                                     NaN           NaN        NA
## Roc                                           NA            NA        NA
## Liqudity                             0.0044145463 -0.0294335069        NA
##                                    Levearge Roc      Liqudity
## Total_asts                              NaN  NA  1.418424e-01
## Net_worth                               NaN  NA  7.275598e-01
```

```
## Total_income                         NaN   NA   1.724946e-01
## Change_instock                       NaN   NA   1.106088e-01
## Total_expenses                       NaN   NA   1.742876e-01
## PAT                                  NaN   NA   7.411065e-01
## PBDITA                               NaN   NA   7.935426e-01
## PBT                                  NaN   NA   7.630449e-01
## Cash_profit                          NaN   NA   7.498435e-01
## PBDITA_total income                  NaN   NA   1.336723e-02
## PBT_total income                     NaN   NA   1.562814e-02
## PAT_total income                     NaN   NA   1.491518e-02
## Cashprofit _totalincome              NaN   NA   1.372461e-02
## PAT_net_worth                        NaN   NA   2.671036e-02
## Sales                                NaN   NA   1.712560e-01
## Income_financial_services            NaN   NA   7.907887e-01
## Other_income                         NaN   NA   1.335524e-01
## Total_capital                        NaN   NA   1.532743e-01
## Reserves_funds                       NaN   NA   1.409979e-01
## Borrowings                           NaN   NA   7.487954e-01
## Current liabilities_provisions       NaN   NA   9.431109e-01
## Deferred_taxliability                NaN   NA   8.047795e-01
## Shareholders_funds                   NaN   NA   7.300090e-01
## Cumulative_retained_profits          NaN   NA   7.777146e-01
## Capital_employed                     NaN   NA   1.450289e-01
## TOL_TNW                              NaN   NA   9.528899e-05
##  Liabilities_tangible_networth       NaN   NA  -7.025516e-03
## Contingent_liabilities_networth      NaN   NA  -5.823191e-03
## Contingent_liabilities               NaN   NA   6.071089e-01
## Netfixed_assets                      NaN   NA   6.848748e-01
## Investments                          NaN   NA   7.293865e-01
## Current_assets                       NaN   NA   9.771006e-01
## Networking_capital                   NaN   NA   1.385800e-01
## Quick_ratio                          NaN   NA  -2.896287e-03
## Current_ratio                        NaN   NA  -2.730942e-03
## Debt_equity_ratio                    NaN   NA  -1.167692e-02
## Cash_current_liabilities             NaN   NA  -1.413906e-03
## DY_salescost                         NaN   NA   6.571090e-02
## Creditors_turnover                   NaN   NA   2.705215e-03
## Debtors_turnover                     NaN   NA  -2.984632e-03
## Finished_goods_turnover              NaN   NA   2.669574e-03
## WIP_turnover                         NaN   NA  -7.629247e-03
## Raw_material_turnover                NaN   NA   1.558432e-03
## Shares_outstanding                   NaN   NA   1.452578e-01
## Equity_face_value                    NaN   NA  -1.392127e-03
## EPS                                  NaN   NA   7.170651e-03
## Adjusted_EPS                         NaN   NA   7.129215e-03
## Total_liabilities                    NaN   NA   1.418424e-01
## PE_BSE                               NaN   NA   4.414546e-03
## default                              NaN   NA  -2.943351e-02
## Profitability                         NA   NA             NA
## Levearge                               1   NA            NaN
```

```
## Roc                                    NA    1            NA
## Liqudity                               NaN   NA   1.000000e+00
```

Check multicollinearity

```
library(corrplot)
```

```
## corrplot 0.84 loaded
```

```
corrplot(cor.mat, type = "lower")
```
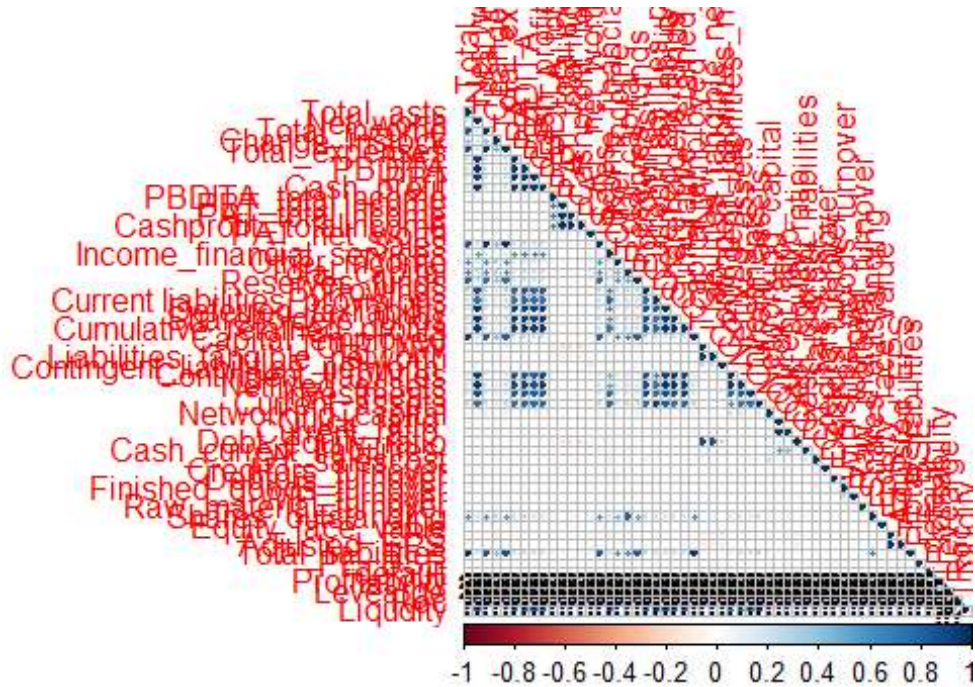


```
corrplot(cor.mat, type = "lower", method = "number")
```

```
ggcorr(def_data)
```
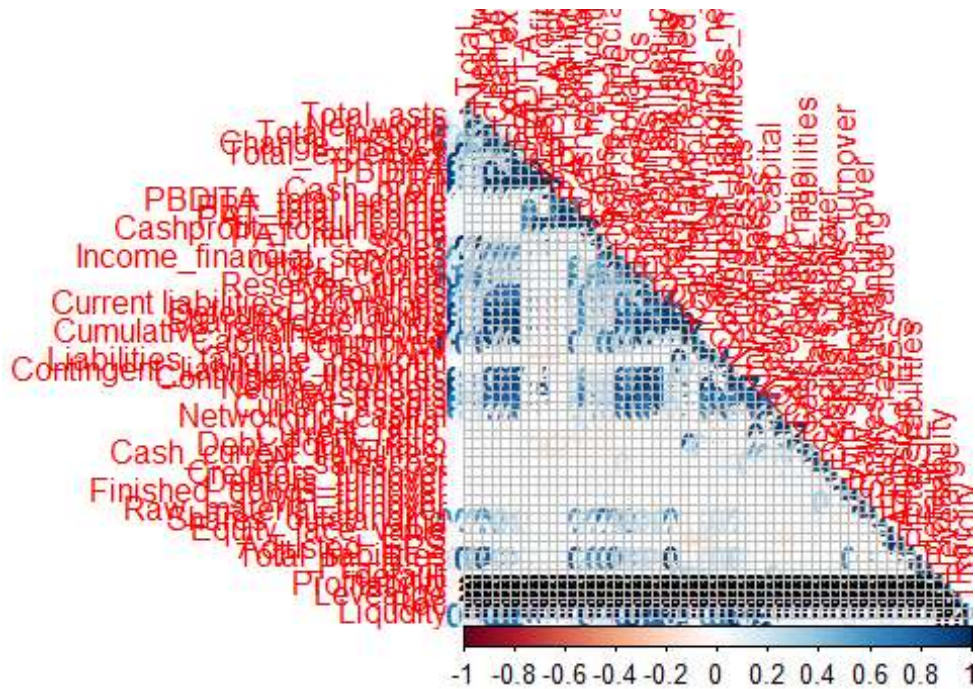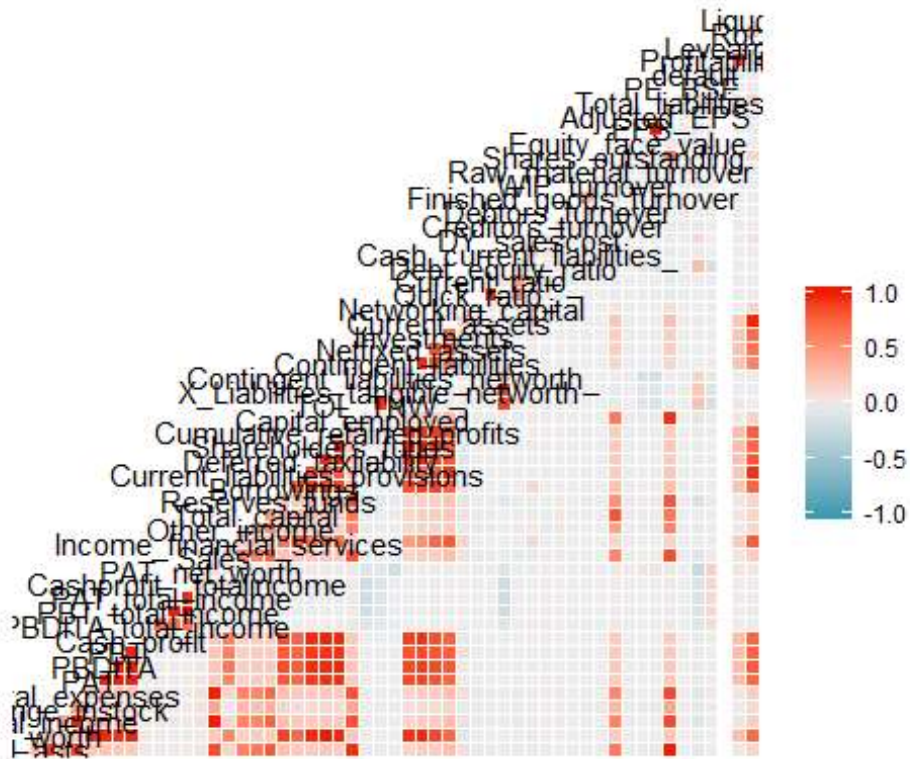

These independable variables are highly correlated

Here we assumed the null hypotheses (H0) is zero coefficient and alternatively hypotheses(H1) predicting the coefficient is not equal to zero, if the coefficient value is zero here then we understand that the variable is not participating in the regression we found these vairables are higly coefficiented.

Remmove any inf or na values

```
normalize<-function(x){ +return((x-min(x))/(max(x)-min(x)))}
def_data$Levearge <-normalize(def_data$Levearge)
def_data[is.na(def_data)] <- 0
sum(is.na(def_data))

## [1] 0

#def_data[Reduce(`&`, lapply(def_data, function(x) !is.na(x)  &
is.finite(x))),]
```

Checkin intinal regerssion

```
def_m1<-lm(default ~.,data=def_data)
summary(def_m1)

##
## Call:
## lm(formula = default ~ ., data = def_data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.48542 -0.07586 -0.05242 -0.02281  1.74098
##
## Coefficients: (2 not defined because of singularities)
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)               1.110e+00  9.898e-03 112.185  < 2e-16
## Total_asts                4.964e-06  5.168e-06   0.961 0.336859
## Net_worth                -2.946e-06  1.198e-05  -0.246 0.805792
## Total_income              3.046e-07  1.277e-05   0.024 0.980981
## Change_instock            8.358e-06  8.352e-05   0.100 0.920296
## Total_expenses           -3.713e-06  1.003e-05  -0.370 0.711271
## PAT                       1.345e-05  4.271e-05   0.315 0.752863
## PBDITA                    2.330e-05  2.414e-05   0.965 0.334657
## PBT                       2.209e-05  3.677e-05   0.601 0.548047
## Cash_profit              -8.236e-05  2.750e-05  -2.995 0.002763
## `PBDITA_total income`    -7.656e-05  3.720e-05  -2.058 0.039677
## `PBT_total income`        3.575e-04  1.105e-04   3.235 0.001226
## `PAT_total income`       -2.715e-04  9.584e-05  -2.832 0.004645
## `Cashprofit _totalincome` -8.850e-05  7.503e-05  -1.180 0.238245
## PAT_net_worth            -5.505e-04  6.295e-05  -8.745  < 2e-16
## Sales                    -5.590e-07  1.315e-05  -0.043 0.966091
## Income_financial_services 4.069e-06  1.817e-05   0.224 0.822846
```

```
## Other_income                          -3.588e-06  3.874e-04  -0.009 0.992610
## Total_capital                           1.989e-05  3.731e-05   0.533 0.593929
## Reserves_funds                         -2.521e-05  7.773e-06  -3.243 0.001194
## Borrowings                             -2.441e-06  2.153e-06  -1.134 0.257076
## `Current liabilities_provisions`        6.166e-06  4.345e-06   1.419 0.155956
## Deferred_taxliability                  -2.868e-05  1.944e-05  -1.475 0.140182
## Shareholders_funds                      6.579e-06  1.037e-05   0.634 0.525973
## Cumulative_retained_profits            -5.958e-06  4.394e-06  -1.356 0.175187
## Capital_employed                       -9.040e-06  6.702e-06  -1.349 0.177488
## TOL_TNW                                 2.938e-03  7.689e-04   3.821 0.000135
## ` Liabilities_tangible_networth`       -4.760e-03  9.344e-04  -5.094 3.68e-07
## `Contingent_liabilities_networth `      2.427e-05  1.100e-05   2.206 0.027443
## Contingent_liabilities                 -8.057e-07  2.299e-06  -0.351 0.725962
## Netfixed_assets                         1.114e-05  4.362e-06   2.554 0.010706
## Investments                             1.746e-06  3.420e-06   0.511 0.609630
## Current_assets                          6.973e-06  4.775e-06   1.460 0.144262
## Networking_capital                      1.573e-06  3.714e-06   0.424 0.671911
## `Quick_ratio `                         -2.281e-04  3.063e-03  -0.074 0.940632
## `Current_ratio `                       -1.933e-04  2.156e-03  -0.090 0.928561
## Debt_equity_ratio                       4.329e-03  6.077e-04   7.123 1.28e-12
## `Cash_current_liabilities `             2.153e-04  1.420e-03   0.152 0.879502
## DY_salescost                            9.189e-06  1.736e-06   5.294 1.27e-07
## Creditors_turnover                     -7.309e-05  5.925e-05  -1.234 0.217425
## Debtors_turnover                       -1.095e-06  4.818e-05  -0.023 0.981875
## Finished_goods_turnover                 1.397e-05  7.490e-06   1.866 0.062145
## WIP_turnover                           -4.692e-05  2.915e-05  -1.610 0.107587
## Raw_material_turnover                  -3.268e-06  1.074e-05  -0.304 0.761006
## Shares_outstanding                     -1.566e-11  3.499e-10  -0.045 0.964315
## Equity_face_value                      -1.817e-07  1.139e-07  -1.596 0.110621
## EPS                                     3.411e-04  3.905e-04   0.873 0.382506
## Adjusted_EPS                           -3.414e-04  3.905e-04  -0.874 0.382095
## Total_liabilities                             NA         NA      NA       NA
## PE_BSE                                 -1.052e-06  4.335e-06  -0.243 0.808254
## Profitability                          -2.053e-02  2.533e-03  -8.106 7.19e-16
## Levearge                                      NA         NA      NA       NA
## Roc                                     2.121e-02  2.770e-03   7.659 2.41e-14
## Liqudity                               -1.048e-01  1.902e-02  -5.511 3.82e-08
##
## (Intercept)                            ***
## Total_asts
## Net_worth
## Total_income
## Change_instock
## Total_expenses
## PAT
## PBDITA
## PBT
## Cash_profit                            **
## `PBDITA_total income`                  *
## `PBT_total income`                     **
```

```
## `PAT_total income`                     **
## `Cashprofit _totalincome`
## PAT_net_worth                          ***
## Sales
## Income_financial_services
## Other_income
## Total_capital
## Reserves_funds                         **
## Borrowings
## `Current liabilities_provisions`
## Deferred_taxliability
## Shareholders_funds
## Cumulative_retained_profits
## Capital_employed
## TOL_TNW                                ***
## ` Liabilities_tangible_networth`       ***
## `Contingent_liabilities_networth `     *
## Contingent_liabilities
## Netfixed_assets                        *
## Investments
## Current_assets
## Networking_capital
## `Quick_ratio `
## `Current_ratio `
## Debt_equity_ratio                      ***
## `Cash_current_liabilities `
## DY_salescost                           ***
## Creditors_turnover
## Debtors_turnover
## Finished_goods_turnover                .
## WIP_turnover
## Raw_material_turnover
## Shares_outstanding
## Equity_face_value
## EPS
## Adjusted_EPS
## Total_liabilities
## PE_BSE
## Profitability                          ***
## Levearge
## Roc                                    ***
## Liqudity                               ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2277 on 3489 degrees of freedom
## Multiple R-squared:  0.201,  Adjusted R-squared:  0.1894
## F-statistic: 17.21 on 51 and 3489 DF,  p-value: < 2.2e-16
```

Adjusted R Square is 0.17, indicating its not good model. Let's remove the insignificant Variables and refine the initial built model. We found these variable are having postive

importing validation data

```
val_data <-read_excel("C:/Users/SuprasannaPradhan/Documents/My Files/Great
Lakes Projects/Project -7 FRA/validation_data .xlsx")
```

Renaming colomuns - validation data

```
colnames(val_data)[colnames(val_data)=="Default - 1"]<-"default_1"
colnames(val_data)[colnames(val_data)=="Total assets"]<-"Total_asts"
colnames(val_data)[colnames(val_data)=="Net worth"]<-"Net_worth"
colnames(val_data)[colnames(val_data)=="Total income"]<-"Total_income"
colnames(val_data)[colnames(val_data)=="Change in stock"]<-"Change_instock"
colnames(val_data)[colnames(val_data)=="Total expenses"]<-"Total_expenses"
colnames(val_data)[colnames(val_data)=="Profit after tax"]<-"PAT"
colnames(val_data)[colnames(val_data)=="PBDITA"]<-"PBDITA"
colnames(val_data)[colnames(val_data)=="PBT"]<-"PBT"
colnames(val_data)[colnames(val_data)=="Cash profit"]<-"Cash_profit"
colnames(val_data)[colnames(val_data)=="PBDITA as % of total income"]<-
"PBDITA_total income"
colnames(val_data)[colnames(val_data)=="PBT as % of total income"]<-
"PBT_total income"
colnames(val_data)[colnames(val_data)=="PAT as % of total income"]<-
"PAT_total income"
colnames(val_data)[colnames(val_data)=="Cash profit as % of total income"]<-
"Cashprofit _totalincome"
colnames(val_data)[colnames(val_data)=="PAT as % of net worth"]<-
"PAT_net_worth"
colnames(val_data)[colnames(val_data)=="Sales"]<-"Sales"
colnames(val_data)[colnames(val_data)=="Income from financial services"]<-
"Income_financial_services"
colnames(val_data)[colnames(val_data)=="Other income"]<-"Other_income"
colnames(val_data)[colnames(val_data)=="Total capital"]<-"Total_capital"
colnames(val_data)[colnames(val_data)=="Reserves and funds"]<-
"Reserves_funds"
colnames(val_data)[colnames(val_data)=="Deposits (accepted by commercial
banks)"]<-"Deposits_com_bank"
colnames(val_data)[colnames(val_data)=="Borrowings"]<-"Borrowings"
colnames(val_data)[colnames(val_data)=="Current liabilities & provisions"]<-
"Current liabilities_provisions"
colnames(val_data)[colnames(val_data)=="Deferred tax liability"]<-
"Deferred_taxliability"
colnames(val_data)[colnames(val_data)=="Shareholders funds"]<-
"Shareholders_funds"
colnames(val_data)[colnames(val_data)=="Cumulative retained profits"]<-
"Cumulative_retained_profits"
colnames(val_data)[colnames(val_data)=="Capital employed"]<-
```

```r
"Capital_employed"
colnames(val_data)[colnames(val_data)=="TOL/TNW"]<-"TOL_TNW"
colnames(val_data)[colnames(val_data)=="Total term liabilities / tangible net
worth"]<-" Liabilities_tangible_networth"
colnames(val_data)[colnames(val_data)=="Contingent liabilities / Net worth
(%)"]<-"Contingent_liabilities_networth "
colnames(val_data)[colnames(val_data)=="Contingent liabilities"]<-
"Contingent_liabilities"
colnames(val_data)[colnames(val_data)=="Net fixed assets"]<-"Netfixed_assets"
colnames(val_data)[colnames(val_data)=="Investments"]<-"Investments"
colnames(val_data)[colnames(val_data)=="Current assets"]<-"Current_assets"
colnames(val_data)[colnames(val_data)=="Net working capital"]<-"Networking
_capital"
colnames(val_data)[colnames(val_data)=="Quick ratio (times)"]<-"Quick_ratio "
colnames(val_data)[colnames(val_data)=="Current ratio (times)"]<-
"Current_ratio "
colnames(val_data)[colnames(val_data)=="Debt to equity ratio (times)"]<-
"Debt_equity_ratio"
colnames(val_data)[colnames(val_data)=="Cash to current liabilities
(times)"]<-"Cash_current_liabilities "
colnames(val_data)[colnames(val_data)=="Cash to average cost of sales per
day"]<-"DY_salescost"
colnames(val_data)[colnames(val_data)=="Creditors turnover"]<-
"Creditors_turnover"
colnames(val_data)[colnames(val_data)=="Debtors turnover"]<-
"Debtors_turnover"
colnames(val_data)[colnames(val_data)=="Finished goods turnover"]<-
"Finished_goods_turnover"
colnames(val_data)[colnames(val_data)=="WIP turnover"]<-"WIP_turnover"
colnames(val_data)[colnames(val_data)=="Raw material turnover"]<-
"Raw_material_turnover"
colnames(val_data)[colnames(val_data)=="Shares outstanding"]<-
"Shares_outstanding"
colnames(val_data)[colnames(val_data)=="Equity face value"]<-
"Equity_face_value"
colnames(val_data)[colnames(val_data)=="EPS"]<-"EPS"
colnames(val_data)[colnames(val_data)=="Adjusted EPS"]<-"Adjusted_EPS"
colnames(val_data)[colnames(val_data)=="Total liabilities"]<-
"Total_liabilities"
colnames(val_data)[colnames(val_data)=="PE on BSE"]<-"PE_BSE"
#Convert charactar  to number values #
#vel_data<- subset(val_data, select = -c(1,22))
val_data <- as.data.frame(val_data)
val_data$Creditors_turnover <- as.numeric(val_data$Creditors_turnover)

## Warning: NAs introduced by coercion

val_data$Debtors_turnover <- as.numeric(val_data$Debtors_turnover)

## Warning: NAs introduced by coercion
```

```
val_data$Finished_goods_turnover <-
as.numeric(val_data$Finished_goods_turnover)

## Warning: NAs introduced by coercion

val_data$WIP_turnover <- as.numeric(val_data$WIP_turnover)

## Warning: NAs introduced by coercion

val_data$Raw_material_turnover <- as.numeric(val_data$Raw_material_turnover
)

## Warning: NAs introduced by coercion

val_data$Shares_outstanding <- as.numeric(val_data$Shares_outstanding )

## Warning: NAs introduced by coercion

val_data$Equity_face_value <- as.numeric(val_data$Equity_face_value )

## Warning: NAs introduced by coercion

val_data$PE_BSE <- as.numeric(val_data$PE_BSE )

## Warning: NAs introduced by coercion

str(val_data)

## 'data.frame':    715 obs. of  52 variables:
##  $ Num                       : num  1545 735 2605 1292 134 ...
##  $ default_1                 : num  0 0 1 0 0 0 0 0 0 0 ...
##  $ Total_asts                : num  971 675 532 858 823 ...
##  $ Net_worth                 : num  276 212 120 201 349 ...
##  $ Total_income              : num  2185 819 564 3576 1034 ...
##  $ Change_instock            : num  14.2 10.4 -28.1 -0.6 28.9 -0.5
NA -7.7 27.2 -0.2 ...
##  $ Total_expenses            : num  2099 810 578 3613 1042 ...
##  $ PAT                       : num  100.2 19.7 -42.4 -37.5 21.4 ...
##  $ PBDITA                    : num  285.6 116 -31 68.2 90.1 ...
##  $ PBT                       : num  152.1 33.7 -56 25.7 29.7 ...
##  $ Cash_profit               : num  182.3 50.5 -35.3 37.3 62.7 ...
##  $ PBDITA_total income       : num  13.07 14.16 -5.5 1.91 8.71 ...
##  $ PBT_total income          : num  6.96 4.11 -9.94 0.72 2.87 ...
##  $ PAT_total income          : num  4.59 2.4 -7.52 -1.05 2.07 ...
##  $ Cashprofit _totalincome   : num  8.34 6.16 -6.26 1.04 6.06 ...
##  $ PAT_net_worth             : num  42.11 10.66 -31.2 0 6.31 ...
##  $ Sales                     : num  2171 817 552 3573 1027 ...
##  $ Income_financial_services : num  2.3 0.8 9.1 1 0.7 ...
##  $ Other_income              : num  NA 0.2 2.1 1.5 2.3 0.1 NA NA 0.1
0.1 ...
##  $ Total_capital             : num  48 114 47.1 50.5 33 ...
##  $ Reserves_funds            : num  413.1 97.6 227.4 150.9 316.2 ...
##  $ Deposits_com_bank         : logi  NA NA NA NA NA NA ...
```

```
##  $ Borrowings                      : num  177.3 339.8 17.5 524.2 162.3 ...
##  $ Current liabilities_provisions  : num  328.5 100.5 240.1 75.2 299.6 ...
##  $ Deferred_taxliability           : num  3.7 23.1 NA 56.7 12.2 2.1 1.9
4.4 2.9 NA ...
##  $ Shareholders_funds              : num  276 212 120 201 349 ...
##  $ Cumulative_retained_profits     : num  227.8 97.6 69.9 150.9 316.2 ...
##  $ Capital_employed                : num  453 551 138 726 512 ...
##  $ TOL_TNW                         : num  1.8 2.01 1.73 2.94 1.02 0.86
0.06 1.92 0.37 1.96 ...
##  $ Liabilities_tangible_networth  : num  0.27 0.72 0.09 0.81 0.1 0.11
0.05 0.78 0 1.81 ...
##  $ Contingent_liabilities_networth : num  112.94 5.77 102.83 0.65 28.78
...
##  $ Contingent_liabilities          : num  311.5 12.2 123.6 1.3 100.5 ...
##  $ Netfixed_assets                 : num  332 199 270 263 191 ...
##  $ Investments                     : num  NA NA 0.7 NA NA NA 17.3 2.6 NA
NA ...
##  $ Current_assets                  : num  560 407 148 536 472 ...
##  $ Networking _capital             : num  134.2 123.6 -97.1 99.6 75.3 ...
##  $ Quick_ratio                     : num  0.92 0.48 0.32 0.51 0.58 0.97
166 0.52 0.88 0.6 ...
##  $ Current_ratio                   : num  1.31 1.39 0.6 1.23 1.19 1.86 166
1.56 1.19 0.55 ...
##  $ Debt_equity_ratio               : num  0.64 1.61 0.15 2.6 0.46 0.32
0.05 1.24 0 1.81 ...
##  $ Cash_current_liabilities        : num  0.09 0.03 0.04 0.08 0.08 0 165
0.03 0.35 0.23 ...
##  $ DY_salescost                    : num  7.56 3.88 4.63 3.71 11.15 ...
##  $ Creditors_turnover              : num  5.94 10.59 2.35 NA 5.48 ...
##  $ Debtors_turnover                : num  5.74 6.03 9.6 NA 4.78 ...
##  $ Finished_goods_turnover         : num  25.11 28.96 8.23 NA 6.28 ...
##  $ WIP_turnover                    : num  20 18.6 6.6 NA 6.7 ...
##  $ Raw_material_turnover           : num  17.58 2.67 3.77 NA 3.7 ...
##  $ Shares_outstanding              : num  4800000 11400000 471285 5050000
3205946 ...
##  $ Equity_face_value               : num  10 10 100 10 10 100 10 NA 10 10
...
##  $ EPS                             : num  18.6 1.65 -90.39 -7.09 5.9 ...
##  $ Adjusted_EPS                    : num  18.6 1.65 -90.39 -7.09 5.9 ...
##  $ Total_liabilities               : num  971 675 532 858 823 ...
##  $ PE_BSE                          : num  NA NA -15.5 -0.16 NA NA NA NA NA
NA ...
```

Adding variables in test data set profitability, leverage, liquidity and company'

```
#Return on Equity = Profit After tax / Net worth,
val_data$Profitability   <- (val_data$PAT/val_data$Net_worth)
```

```
#levearge = Total debt / Shareholders Equity
val_data$Levearge <- (val_data$Total_liabilities/val_data$Shares_outstanding)

#Return on Capital Employed =Earnings Before Interest, Taxes, Depreciation
and Amortization/Capital Employed
#val_data$Roc   <- (val_data$PBDITA/val_data$Capital_employed)

#Liqudity = current assest /curent libilites
val_data$Liqudity   <- (val_data$Current_assets/val_data$Total_liabilities)
```

Remove all na values from validataion data

```
val_data[is.na(val_data)] <- 0
sum(is.na(val_data))

## [1] 0

#val_data[Reduce(`&`, lapply(val_data, function(x) !is.na(x)  &
is.finite(x))),]
normalize<-function(x){ +return((x-min(x))/(max(x)-min(x)))}
val_data$Levearge <-normalize(val_data$Levearge)
val_data$PBDITA <-normalize(val_data$PBDITA)
```

Let us check with logistc regression model

Build Logistic Regression

```
def_data$default= as.factor(def_data$default)
def_lg <-glm(default ~ .,data = def_data, family=binomial(link="logit"))

## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred

summary(def_lg)

##
## Call:
## glm(formula = default ~ ., family = binomial(link = "logit"),
##     data = def_data)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -4.3449  -0.3429  -0.2075  -0.0218   6.3259
##
## Coefficients: (2 not defined because of singularities)
##                                 Estimate Std. Error z value Pr(>|z|)
## (Intercept)                    -1.892e+00  1.738e-01 -10.889  < 2e-16
## Total_asts                      1.886e-04  2.059e-04   0.916 0.359677
## Net_worth                      -3.038e-03  2.696e-03  -1.127 0.259775
## Total_income                    2.313e-03  6.968e-04   3.320 0.000902
## Change_instock                  4.904e-03  3.125e-03   1.569 0.116599
```

```
## Total_expenses                        -8.373e-04  3.202e-04  -2.615 0.008935
## PAT                                     9.163e-04  7.665e-03   0.120 0.904846
## PBDITA                                 -4.072e-03  2.528e-03  -1.611 0.107286
## PBT                                     2.841e-03  8.242e-03   0.345 0.730304
## Cash_profit                            -1.265e-02  2.821e-03  -4.482 7.38e-06
## `PBDITA_total income`                   7.015e-04  6.858e-04   1.023 0.306310
## `PBT_total income`                      2.582e-03  4.705e-03   0.549 0.583144
## `PAT_total income`                     -2.820e-03  4.661e-03  -0.605 0.545165
## `Cashprofit _totalincome`              -4.442e-04  8.645e-04  -0.514 0.607415
## PAT_net_worth                          -1.058e-02  2.666e-03  -3.970 7.20e-05
## Sales                                  -1.266e-03  6.231e-04  -2.032 0.042135
## Income_financial_services              1.162e-02  3.393e-03   3.426 0.000613
## Other_income                           7.521e-03  1.308e-02   0.575 0.565414
## Total_capital                         -2.657e-03  1.372e-03  -1.936 0.052851
## Reserves_funds                        -2.060e-04  4.866e-04  -0.423 0.672109
## Borrowings                             7.865e-06  1.847e-04   0.043 0.966029
## `Current liabilities_provisions`       8.458e-04  9.645e-04   0.877 0.380485
## Deferred_taxliability                  7.022e-04  1.743e-03   0.403 0.686996
## Shareholders_funds                     3.044e-03  2.585e-03   1.177 0.239029
## Cumulative_retained_profits           -5.632e-03  9.368e-04  -6.012 1.83e-09
## Capital_employed                      -9.390e-04  4.358e-04  -2.155 0.031192
## TOL_TNW                                1.115e-02  1.157e-02   0.963 0.335417
## ` Liabilities_tangible_networth`      -1.186e-02  1.361e-02  -0.872 0.383321
## `Contingent_liabilities_networth `     2.346e-04  2.058e-04   1.140 0.254177
## Contingent_liabilities                -1.477e-03  1.238e-03  -1.193 0.232822
## Netfixed_assets                        1.177e-03  3.781e-04   3.113 0.001854
## Investments                           -1.285e-03  8.727e-04  -1.472 0.140914
## Current_assets                        -1.759e-03  9.763e-04  -1.801 0.071635
## Networking_capital                     1.113e-03  1.038e-03   1.073 0.283406
## `Quick_ratio `                        -1.947e-01  1.413e-01  -1.378 0.168126
## `Current_ratio `                      -1.093e-02  6.096e-02  -0.179 0.857767
## Debt_equity_ratio                      2.097e-02  1.042e-02   2.014 0.044041
## `Cash_current_liabilities `            1.933e-01  1.272e-01   1.520 0.128535
## DY_salescost                           7.930e-05  3.509e-05   2.260 0.023829
## Creditors_turnover                    -5.965e-03  4.377e-03  -1.363 0.172934
## Debtors_turnover                       7.566e-04  7.462e-04   1.014 0.310569
## Finished_goods_turnover                2.311e-04  9.398e-05   2.459 0.013925
## WIP_turnover                          -7.616e-03  3.267e-03  -2.331 0.019748
## Raw_material_turnover                 -2.254e-03  4.254e-03  -0.530 0.596278
## Shares_outstanding                     8.293e-10  1.159e-08   0.072 0.942946
## Equity_face_value                     -1.985e-06  1.193e-06  -1.664 0.096210
## EPS                                    3.397e-03  2.592e-02   0.131 0.895723
## Adjusted_EPS                          -3.402e-03  2.592e-02  -0.131 0.895571
## Total_liabilities                            NA         NA      NA       NA
## PE_BSE                                -1.135e-03  1.378e-03  -0.824 0.410101
## Profitability                         -4.124e-01  1.299e-01  -3.174 0.001504
## Levearge                                     NA         NA      NA       NA
## Roc                                    4.003e-01  1.225e-01   3.268 0.001083
## Liqudity                              -5.845e-01  3.641e-01  -1.606 0.108375
##
```

```
## (Intercept)                            ***
## Total_asts
## Net_worth
## Total_income                           ***
## Change_instock
## Total_expenses                         **
## PAT
## PBDITA
## PBT
## Cash_profit                            ***
## `PBDITA_total income`
## `PBT_total income`
## `PAT_total income`
## `Cashprofit _totalincome`
## PAT_net_worth                          ***
## Sales                                  *
## Income_financial_services             ***
## Other_income
## Total_capital                          .
## Reserves_funds
## Borrowings
## `Current liabilities_provisions`
## Deferred_taxliability
## Shareholders_funds
## Cumulative_retained_profits            ***
## Capital_employed                       *
## TOL_TNW
## ` Liabilities_tangible_networth`
## `Contingent_liabilities_networth `
## Contingent_liabilities
## Netfixed_assets                        **
## Investments
## Current_assets                         .
## Networking_capital
## `Quick_ratio `
## `Current_ratio `
## Debt_equity_ratio                      *
## `Cash_current_liabilities `
## DY_salescost                           *
## Creditors_turnover
## Debtors_turnover
## Finished_goods_turnover                *
## WIP_turnover                           *
## Raw_material_turnover
## Shares_outstanding
## Equity_face_value                      .
## EPS
## Adjusted_EPS
## Total_liabilities
## PE_BSE
```

```
## Profitability                              **
## Levearge
## Roc                                        **
## Liqudity
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 1771  on 3540  degrees of freedom
## Residual deviance: 1119  on 3489  degrees of freedom
## AIC: 1223
##
## Number of Fisher Scoring iterations: 17
```

The refined Regression Model

```
def_data3 <- subset(def_data,select =
c(3,5,9,14,15,16,18,24,25,30,32,36,38,41,42,50,51,53))
def_lg2 <-glm(default ~ .,data = def_data3, family=binomial(link="logit"))
```

```
## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
```

```
summary(def_lg2)
```

```
##
## Call:
## glm(formula = default ~ ., family = binomial(link = "logit"),
##     data = def_data3)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -4.2342  -0.3687  -0.2365  -0.0296   6.5234
##
## Coefficients:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -2.315e+00  1.065e-01 -21.734  < 2e-16 ***
## Total_income                1.788e-03  4.477e-04   3.993 6.53e-05 ***
## Total_expenses             -6.809e-04  3.129e-04  -2.176 0.029542 *
## Cash_profit                -1.220e-02  2.159e-03  -5.651 1.59e-08 ***
## PAT_net_worth              -1.088e-02  2.572e-03  -4.232 2.32e-05 ***
## Sales                      -9.631e-04  3.934e-04  -2.448 0.014360 *
## Income_financial_services   5.294e-03  2.153e-03   2.459 0.013919 *
## Total_capital              -1.854e-03  9.267e-04  -2.000 0.045474 *
## Cumulative_retained_profits -4.947e-03  7.531e-04  -6.569 5.06e-11 ***
## Capital_employed           -1.023e-03  2.770e-04  -3.694 0.000221 ***
## Netfixed_assets             1.213e-03  2.808e-04   4.321 1.55e-05 ***
## Current_assets             -9.673e-04  3.353e-04  -2.885 0.003920 **
## Debt_equity_ratio           2.836e-02  4.855e-03   5.841 5.20e-09 ***
## DY_salescost                7.133e-05  3.169e-05   2.251 0.024390 *
```

```
## Finished_goods_turnover        2.116e-04  9.452e-05   2.239 0.025161 *
## WIP_turnover                  -7.388e-03  2.894e-03  -2.553 0.010679 *
## Profitability                 -4.530e-01  1.176e-01  -3.851 0.000118 ***
## Roc                            4.433e-01  1.107e-01   4.006 6.19e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##      Null deviance: 1771.0  on 3540  degrees of freedom
## Residual deviance: 1164.5  on 3523  degrees of freedom
## AIC: 1200.5
##
## Number of Fisher Scoring iterations: 14
```

Check Multi-Collinearity Effect:

```
# Check Multi collinearity effect.
# VIF = 1      - Not Correlated
# VIF > 1 < 5 - Moderately Correlated
# VIF > 5      - Highly Correlated
library(car)

## Loading required package: carData

## Registered S3 methods overwritten by 'car':
##   method                          from
##   influence.merMod                lme4
##   cooks.distance.influence.merMod lme4
##   dfbeta.influence.merMod         lme4
##   dfbetas.influence.merMod        lme4

##
## Attaching package: 'car'

## The following object is masked from 'package:psych':
##
##     logit

## The following object is masked from 'package:dplyr':
##
##     recode

## The following object is masked from 'package:purrr':
##
##     some

vif(def_lg2)

##          Total_income          Total_expenses
##             43.372914               19.641486
```

```
##                Cash_profit              PAT_net_worth
##                   1.951237                   1.689855
##                      Sales  Income_financial_services
##                  30.265956                   1.771936
##              Total_capital Cumulative_retained_profits
##                   2.419947                   2.620220
##           Capital_employed              Netfixed_assets
##                   7.359032                   4.321176
##             Current_assets           Debt_equity_ratio
##                   2.991278                   1.239726
##                DY_salescost      Finished_goods_turnover
##                   1.041560                   1.060957
##                WIP_turnover                Profitability
##                   1.104703                  55.027370
##                        Roc
##                  53.231501
```

Revised Logistic Regression Model

```r
def_data4 <- subset(def_data,select = c(9,14,16,18,24,30,32,36,38,41,42,50))
def_lg3 <-glm(default ~ .,data = def_data4, family=binomial(link="logit"))
```

```
## Warning: glm.fit: fitted probabilities numerically 0 or 1 occurred
```

```r
summary(def_lg3)
```

```
##
## Call:
## glm(formula = default ~ ., family = binomial(link = "logit"),
##     data = def_data4)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -2.8573  -0.3729  -0.2547  -0.0595   7.5153
##
## Coefficients:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                 -2.319e+00  1.060e-01 -21.876  < 2e-16 ***
## Cash_profit                 -9.832e-03  2.055e-03  -4.784 1.72e-06 ***
## PAT_net_worth               -1.779e-02  2.081e-03  -8.551  < 2e-16 ***
## Income_financial_services    4.330e-03  9.740e-04   4.446 8.74e-06 ***
## Total_capital               -2.011e-03  8.704e-04  -2.311   0.0208 *
## Cumulative_retained_profits -3.341e-03  7.182e-04  -4.652 3.29e-06 ***
## Netfixed_assets              3.114e-04  1.949e-04   1.598   0.1100
## Current_assets              -7.969e-04  1.753e-04  -4.546 5.47e-06 ***
## Debt_equity_ratio            2.932e-02  5.733e-03   5.114 3.16e-07 ***
## DY_salescost                 8.269e-05  3.556e-05   2.326   0.0200 *
## Finished_goods_turnover      1.813e-04  8.903e-05   2.036   0.0418 *
## WIP_turnover                -4.992e-03  2.680e-03  -1.863   0.0625 .
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 1771.0  on 3540  degrees of freedom
## Residual deviance: 1222.7  on 3529  degrees of freedom
## AIC: 1246.7
##
## Number of Fisher Scoring iterations: 12
```

Using the Revised Model for Making Predictions on the validation Data Set

```
#val_data$default_1= as.factor(val_data$default_1)
pred_def <- predict.glm(def_lg3, newdata=val_data[-1], type="response")
tab_def <- table(val_data$default_1,pred_def>0.5)
tab_def
```

```
##
##      FALSE TRUE
##   0   656    5
##   1    38   16
```

Measuring the accuracy of the model

```
accuracy.lg = sum(diag(tab_def))/sum(tab_def)
accuracy.lg
```

```
## [1] 0.9398601
```

Computing Accuracy of the Model

Accuracy = 656/(656+16)= 0.9761 Comparing basic Accucacy =3298/(3298+243)=0.931375318 he baseline accuracy is 0.931. Hence, we see that the Revised Model beats the baseline model comfortably.

Validate data with Area Under the Curve (AUC)

```
library(ROCR)
```

```
## Loading required package: gplots
```

```
##
## Attaching package: 'gplots'
```

```
## The following object is masked from 'package:stats':
##
##     lowess
```

```
ROCRpred = prediction(pred_def, val_data$default_1)
as.numeric(performance(ROCRpred, "auc")@y.values)

## [1] 0.9590407

perf = performance(ROCRpred, "tpr","fpr")
plot(perf)
```
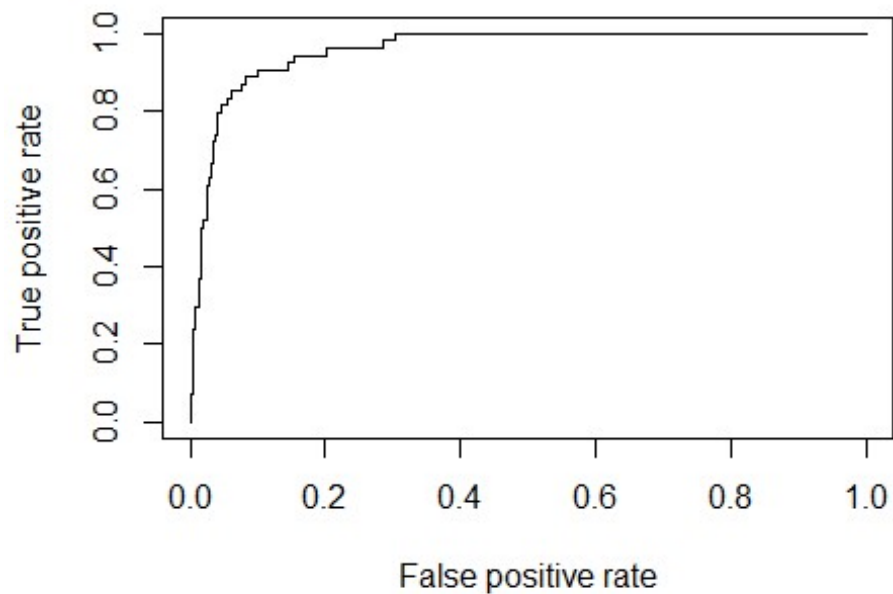

Add colors & Add threshold labels

```
plot(perf, colorize=TRUE, print.cutoffs.at=seq(0,1,by=0.1), text.adj=c(-0.2,1.7))
```
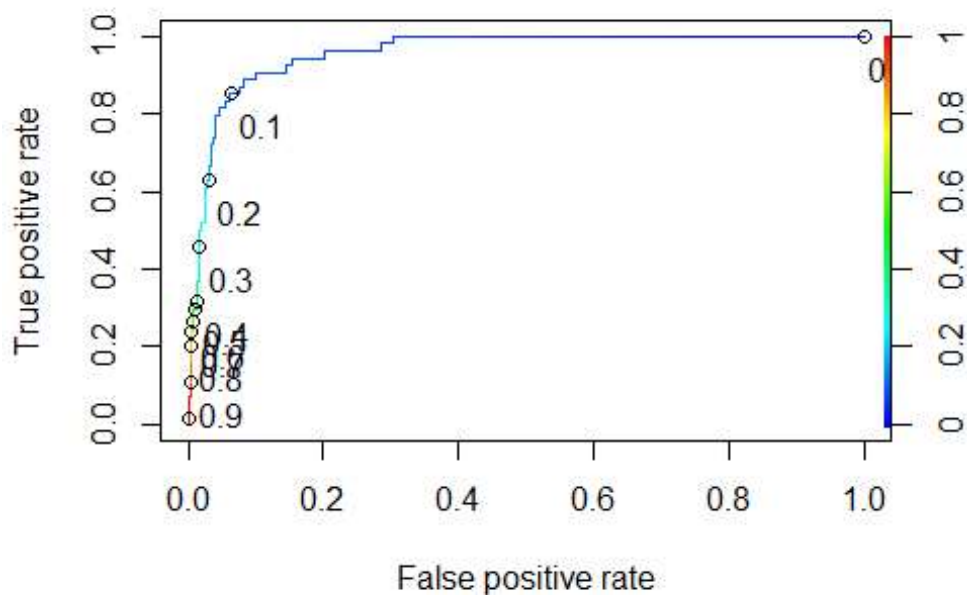
#Validate LG model on test data

```r
KS <- max(attr(perf, 'y.values')[[1]]-attr(perf, 'x.values')[[1]])
KS

## [1] 0.8075587

## Area Under Curve
auc <- performance(ROCRpred,"auc");
auc <- as.numeric(auc@y.values)
auc

## [1] 0.9590407

## Gini Coefficient
library(ineq)
gini = ineq(pred_def,val_data$default_1, type="Gini")
gini

## [1] 0.6780262
```

Create Random Forest Model

```r
library(randomForest)
def_data4$default = as.factor(def_data4$default)
val_data$default_1 = as.factor(val_data$default_1)
#Create Random Forest Model
RF_def = randomForest(default ~ ., data =def_data4, nodesize =7, ntree
```

```r
=201,importance = TRUE)
#mtry = 3, nodesize = 10, ntree = 501
```

Pass the Test data through RF model

```r
#Pass the Test data through RF model
predRF = predict(RF_def, newdata = val_data, type="class")
predRF1 = predict(RF_def, newdata = val_data, type="prob")
```

Preparing Decile

```r
## deciling code
decile <- function(x){
  deciles <- vector(length=10)
  for (i in seq(0.1,1,.1)){
    deciles[i*10] <- quantile(x, i, na.rm=T)
  }
  return (
    ifelse(x<deciles[1], 1,
          ifelse(x<deciles[2], 2,
                ifelse(x<deciles[3], 3,
                      ifelse(x<deciles[4], 4,
                            ifelse(x<deciles[5], 5,
                                  ifelse(x<deciles[6], 6,
                                        ifelse(x<deciles[7], 7,
                                              ifelse(x<deciles[8], 8,

ifelse(x<deciles[9], 9, 10

                                                  ))))))))))
}

## deciling
val_data$deciles <- decile(predRF1[,2])
#val_data$default_1<- as.numeric(val_data$default_1)
#val_data$default_1
```

Model Performance Measure - Rank Ordering

```{r}

library(data.table)

library(scales)

= data.table(val_data)

rank <- tmp_DT[, list( # cnt = length(default_1), # cnt_resp = sum(default_1), # cnt_non_resp = sum(default_1== 2)) , # by=deciles][order(-deciles)]

$rank$rrate <- round($rank$cnt_resp / rank$cnt,2); #rank$cum_resp <- cumsum(rank$cnt_resp) #rank$cum_non_resp <- cumsum(rank$cnt_non_resp) #rank$cum_rel_resp <- round($rank$cum_resp/sum($rank$cnt_resp),2);

$rank$cum_rel_non_resp <- round($rank$cum_non_resp / sum(rank$cnt_non_resp),2); #rank$ks <- abs($rank$cum_rel_resp - rank$cum_rel_non_resp);

library(scales)

$rank$rrate <- percent($rank$rrate)

$rank$cum_rel_resp <- percent($rank$cum_rel_resp)

$rank$cum_rel_non_resp <- percent($rank$cum_rel_non_resp)
```

View(rank)

```