CALCULATING EFFICIENT BANK USING R AND PYTHON ML MODEL

by

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A project report submitted to

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VIT BUSINESS SCHOOL (VIT BS)

in partial fulfilment of the requirements for the course of

MGT1042 INVESTMENT ANALYSIS AND PORTFOLIO MANAGEMENT

in

B. Tech. COMPUTER SCIENCE AND ENGINEERING



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INTRODUCTION

Banks' technical efficiency is defined as the difference between observed. quantity of input and output variables with respect to optimal quantity of input and output variables. An efficient bank can achieve a maximum value of one in comparison to an inefficient bank, which can reduce to the level of zero.

DEAR MODEL USING R

4 Description

To bootstrap efficiency scores, deaR uses the algorithm proposed by Simar and Wilson (1998). For now, the function bootstrap_basic can only be used with basic DEA models (input- and outputoriented under constant and variable returns-to-scale).

♣ R CODE

library(deaR) library(readxl)

Bank_Data_2020 <- read_excel("D:\\SEM 4\\MGT1042-IAAPM PROJECT\\Bankdata2020.xlsx")

View(Bank_Data_2020)

Bank Data 2020

##Converting cells if the value is negative or zero because negative and zero value can not be considered in DEA

Bank_Data_2020\$Deposits[Bank_Data_2020\$Deposits == "-"] <- 0

Bank_Data_2020\$Borrowings[Bank_Data_2020\$Borrowings == "-"] <- 0

Bank_Data_2020\$Investments[Bank_Data_2020\$Investments == "-"] <- 0

##Converting character such as coma into numeric (1,000 to 1000)

Bank_Data_2020\$Deposits <- as.numeric(Bank_Data_2020\$Deposits)

Bank_Data_2020\$Capital <- as.numeric(Bank_Data_2020\$Capital)

Bank_Data_2020\$`Reserves and Surplus` <-

as.numeric(Bank_Data_2020\$`Reserves and Surplus`)

Bank_Data_2020\$Borrowings <- as.numeric(Bank_Data_2020\$Borrowings)

Bank_Data_2020\$Investments <- as.numeric(Bank_Data_2020\$Investments)

```
#view Bank Data 2020
View(Bank_Data_2020)
means = c(mean(Bank_Data_2020$Capital, na.rm =
TRUE),mean(Bank_Data_2020$`Reserves and Surplus`, na.rm =
TRUE),mean(Bank_Data_2020$Deposits, na.rm =
TRUE),mean(Bank_Data_2020$Borrowings, na.rm =
TRUE),mean(Bank_Data_2020$Investments, na.rm = TRUE))
#changing of negative values to the mean value of the column
for(j in 1:nrow(Bank_Data_2020))
 for(k in 2:ncol(Bank_Data_2020))
  if(Bank\_Data\_2020[j,k] \le 0)
   Bank_Data_2020[j,k] <- Bank_Data_2020[j,k] + means[k-2]
 }
}
View(Bank_Data_2020)
Bank Data 2020
# Define the input variables in the DEA model(first column will be treated as
DMU by default, ni is no. of input and no is no. of output)
data_input = read_data(Bank_Data_2020, ni = 4, no = 1)
data_input
#Final model
res<-model basic(data input,dmu eval = 1:97,dmu ref = 1:97,orientation =
"io",rts="crs")
res
efficiencies(res)
summary(res)
plot(res)
```

OUTPUT:

```
> library(deaR)
> library(readxl)
> Bank_Data_2020 <- read_excel("D:\\SEM 4\\MGT1042-IAAPM PROJECT\\Bankdata2020.xlsx")
> view(Bank_Data_2020)
```

	Banks	Capital	Reserves and Surplus	Deposits	Borrowings	Investments
1	ALLAHABAD BANK	4527.48	8135.29	228608.51	9102.57	80666.58
2	ANDHRA BANK	3095.54	9132.36	212609.38	14129.58	61331.17
3	BANK OF BARODA	925.37	70930.84	945984.43	93069.31	274614.61
4	BANK OF INDIA	3277.66	40538.65	555504.98	39752.47	158572.99
5	BANK OF MAHARASHTRA	5824.11	4931.17	150066.4	3670.03	57740.85
6	CANARA BANK	1030.23	38262.73	625351.17000000004	42761.77	176244.94
7	CENTRAL BANK OF INDIA	5709.76	15719.71	313763.15999999997	5787.2	142517.54
8	CORPORATION BANK	1198.84	12551.64	205354.78	2301.06	66432.44
9	INDIAN BANK	608.80	21480.47	260225.9	20830.310000000001	81241.69
10	INDIAN OVERSEAS BANK	16436.99	-282.01	222951.88	5419.73	79416.08
11	ORIENTAL BANK OF COMMERCE	1370.21	15168.88	230108.23	14121.39	72871.3
12	PUNJAB AND SIND BANK	701.05	4895.34	89667.55	3213.05	24552.1
13	PUNJAB NATIONAL BANK	1347.51	61009.97	703846.32	50225.43	240465.64
14	STATE BANK OF INDIA	892.46	231114.97	3241620.73	314655.65000000002	1046954.52
15	SYNDICATE BANK	2683.72	9802.34	281269.82	20278.86	74964.259999999995
16	UCO BANK	9918.34	9291.28	193203.44	15695.06	90998.81
17	UNION BANK OF INDIA	3422.82	30362.83	450668.45	52486.25	152413.9

18	UNITED BANK OF INDIA	9069.30	-2160.70	137614.64000000001	2279.949999999998	58636.92
19	AXIS BANK LIMITED	564.34	84383.51	640104.93999999994	147954.13	156734.32
20	BANDHAN BANK LIMITED	1610.25	13585.21	57081.5	16379.18	15351.77
21	CITY UNION BANK LIMITED	73.73	5222.34	40832.49	2032.4	9116.7900000000000
22	CSB BANK LIMITED	173.51	1787.16	15790.68	794	5359.84
23	DCB BANK LIMITED	310.42	3111.74	30369.93	3407.95	7741.5
24	FEDERAL BANK LTD	398.53	14119.08	152290.07999999999	10372.43	35892.68
25	HDFC BANK LTD.	548.33	170437.70	1147502.29	144628.54	391826.66
26	ICICI BANK LIMITED	1294.76	115209.64	770968.99	162896.76	249531.48
27	IDBI BANK LIMITED	10380.59	23643.77	222424.13	36748.86	81780.42
28	IDFC FIRST BANK LIMITED	4809.90	10532.70	65107.97	57397.19	45404.58
29	INDUSIND BANK LTD	693.54	33339.14	202039.81	60753.55	59979.94
30	JAMMU & KASHMIR BANK LTD	71.36	6322.12	97788.23	2019.58	23052.240000000000
31	KARNATAKA BANK LTD	310.88	5659.56	71785.149999999994	4065.12	17545.34
32	KARUR VYSYA BANK LTD	159.86	6440.41	59075.08	1184.18	15762.45
33	KOTAK MAHINDRA BANK LTD.	1456.52	47558.78	262820.52	37993.31	75051.55
34	LAKSHMI VILAS BANK LTD	336.71	893.09	21443.19	755.7	5383.83

35	NAINITAL BANK LTD	77.50	504.80	7679.43	0.01	1676.22
36	RBL BANK LIMITED	508.70	10074.25	57812.22	17006.73	18149.740000000002
37	SOUTH INDIAN BANK LTD	180.97	5296.38	83033.89	6893.23	20625.27
38	TAMILNAD MERCANTILE BANK LTD	142.51	3837.13	36825.03	324	9467.33
39	THE DHANALAKSHMI BANK LTD	253.01	573.90	10904.07	177.5	3682.4
40	YES BANK LTD.	2510.09	19216.20	105363.94	113790.5	43914.83
41	AB BANK LIMITED	36.98	56.36	105.82	-	39.58
42	ABU DHABI COMMERCIAL BANK PJSC	217.02	86.66	-	-	-
43	AMERICAN EXPRESS BANKING CORP.	1760.33	48.75	2128.989999999998	2059.61	3340.99
44	AUSTRALIA AND NEW ZEALAND BANKING GROUP LIMITED	1131.11	342.10	4548.4799999999996	834.97	3561.89
45	BANK OF AMERICA , NATIONAL ASSOCIATION	3188.26	9046.08	39638.19	5892.21	25656.52
46	BANK OF BAHRAIN & KUWAIT B.S.C.	292.89	138.52	2640.72	101	744.6
47	BANK OF CEYLON	135.00	111.88	243.07	-	55.18
48	BANK OF CHINA LIMITED	352.54	-36,30	20.5	-	-
49	BANK OF NOVA SCOTIA	839.41	1007.71	3381.41	649.1	3351.47
50	BARCLAYS BANK PLC	5249.52	1405.72	14439.22	1185.08	8624.86

50	INDIAN BANK	608.80	21480.47	260225.9	20830.310000000001	81241.69
51	INDIA POST PAYMENTS BANK LIMITED	1035.00	-460.99	855.03	-	694.25
52	IDFC FIRST BANK LIMITED	4809.90	10532.70	65107.97	57397.19	45404.58
53	IDBI BANK LIMITED	10380.59	23643.77	222424.13	36748.86	81780.42
54	ICICI BANK LIMITED	1294.76	115209.64	770968.99	162896.76	249531.48
55	HONGKONG AND SHANGHAI BANKING CORPN.LTD.	4499.17	21362.72	124852.98	24441.74	71622.009999999995
56	HDFC BANK LTD.	548.33	170437.70	1147502.29	144628.54	391826.66
57	FIRSTRAND BANK LTD	661.71	-339.18	318.77999999999997	1356.01	1208.8699999999999
58	FIRST ABU DHABI BANK PJSC	2012.59	179.91	374.64	2652.98	3626.02
59	FINCARE SMALL FINANCE BANK LIMITED	63.61	840.16	4653.93	1368.16	1006.96
60	FEDERAL BANK LTD	398.53	14119.08	152290.07999999999	10372.43	35892.68
61	ESAF SMALL FINANCE BANK LIMITED	427.80	656.29	7028.38	1203.32	1733.63
62	EQUITAS SMALL FINANCE BANK LIMITED	1053.40	1690.75	10788.41	5134.87	2342.5100000000002
63	EMIRATES NBD BANK (P.J.S.C.)	1397.74	8.31	801.98	619.16999999999996	1003.98
64	DOHA BANK Q.P.S.C	304.20	16.58	1319.32	6.5	259.06
65	DEUTSCHE BANK AG	7588.11	9401.49	59909.56	13973.69	33179.97
66	DCB BANK LIMITED	310.42	3111.74	30369.93	3407.95	7741.5

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67	DBS BANK INDIA LTD.	5037.65	997.81	35652.11	9086.69	23426.92
68	CTBC BANK CO., LTD.	553.55	-27.11	1373.91	125.25	513.830000000000004
69	CSB BANK LIMITED	173.51	1787.16	15790.68	794	5359.84
70	CREDIT SUISSE AG	1775.00	878.63	2831.74	4029.49	7534.66
71	CREDIT AGRICOLE CORPORATE AND INVESTMENT BANK	1097.17	830.83	6550.64	852.49	3501.03
72	CORPORATION BANK	1198.84	12551.64	205354.78	2301.06	66432.44
73	COOPERATIEVE RABOBANK U.A.	1220.08	-241.17	4637.24	467.65	1753.14
74	CITY UNION BANK LIMITED	73.73	5222.34	40832.49	2032.4	9116.7900000000000
75	CITIBANK N.A	3743.84	22790.02	157869.34	10149.799999999999	101480.47
76	CENTRAL BANK OF INDIA	5709.76	15719.71	313763.15999999997	5787.2	142517.54
77	CAPITAL SMALL FINANCE BANK LIMITED	33.81	372.97	4446.62	420.92	1051.8699999999999
78	CANARA BANK	1030.23	38262.73	625351.17000000004	42761.77	176244.94
79	BNP PARIBAS	4481.29	3383.24	21255.59	4082.22	13622.38
80	BARCLAYS BANK PLC	5249.52	1405.72	14439.22	1185.08	8624.86
81	BANK OF NOVA SCOTIA	839.41	1007.71	3381.41	649.1	3351.47

82	BANK OF MAHARASHTRA	5824.11	4931.17	150066.4	3670.03	57740.85
83	BANK OF INDIA	3277.66	40538.65	555504.98	39752.47	158572.99
84	BANK OF CHINA LIMITED	352.54	-36.30	20.5	-	-
85	BANK OF CEYLON	135.00	111.88	243.07	-	55.18
86	BANK OF BARODA	925.37	70930.84	945984.43	93069.31	274614.61
87	BANK OF BAHRAIN & KUWAIT B.S.C.	292.89	138,52	2640.72	101	744.6
88	BANK OF AMERICA , NATIONAL ASSOCIATION	3188.26	9046.08	39638.19	5892.21	25656.52
89	BANDHAN BANK LIMITED	1610.25	13585.21	57081.5	16379.18	15351.77
90	AXIS BANK LIMITED	564.34	84383.51	640104.93999999994	147954.13	156734.32
91	AUSTRALIA AND NEW ZEALAND BANKING GROUP LIMITED	1131.11	342.10	4548.4799999999996	834.97	3561.89
92	AU SMALL FINANCE BANK LIMITED	304.12	4072.69	26163.93	10335.32	10668.22
93	ANDHRA BANK	3095.54	9132.36	212609.38	14129.58	61331.17
94	AMERICAN EXPRESS BANKING CORP.	1760.33	48.75	2128,989999999998	2059.61	3340.99
95	ALLAHABAD BANK	4527.48	8135.29	228608.51	9102.57	80666.58
96	ABU DHABI COMMERCIAL BANK PJSC	217.02	86.66	-	-	-
97	AB BANK LIMITED	36.98	56.36	105.82	-	39.58

```
# A tibble: 97 \times 6
                             Capital `Reserves and Surplus` Deposits
                                                                                      Borrowings
                                                                                                               Investments
                                4527.
                                                                                         9102.57
                                                                                                               80666.58
 1 ALLAHABAD BANK
                                                           <u>8</u>135. 228608.51
 2 ANDHRA BANK
                                <u>3</u>096.
                                                           <u>9</u>132. 212609.38
                                                                                         14129.58
                                                                                                               61331.17
   BANK OF BARODA
                                 925.
                                                          <u>70</u>931. 945984.43
                                                                                         93069.31
                                                                                                                274614.61
4 BANK OF INDIA
5 BANK OF MAHARASHTRA
                                3278.
                                                         <u>40</u>539. 555504.98
                                                                                         39752.47
                                                                                                               158572.99
                                                          4931. 150066.4 3670.03
38263. 625351.17000000004 42761.77
                                5824.
                                                                                                               57740.85
 6 CANARA BANK
                                <u>1</u>030.
                                                                                                               176244.94
 7 CENTRAL BANK OF INDIA 5710.
                                                          <u>15</u>720. 313763.1599999999 5787.2
                                                                                                               142517.54
                                                                                  2301.06
 8 CORPORATION BANK
                              <u>1</u>199.
                                                          <u>12</u>552. 205354.78
                                                                                                               66432.44
                                                                                         20830.310000000001 81241.69
5419.73 79416 08
                                                          21480. 260225.9
-282. 222951.88
 9 INDIAN BANK
                                 609.
10 INDIAN OVERSEAS BANK 16437.
# ... with 87 more rows
```

```
> ##Converting cells if the value is negative or zero because negative and zero value can not be considered in DEA
> Bank_Data_2020Speposits[Bank_Data_2020Speposits == "-"] <- 0
> Bank_Data_2020Speposits[Bank_Data_2020Sperrowings] == "-"] <- 0
> Bank_Data_2020Sperrowings[Bank_Data_2020Sperrowings] == "-"] <- 0
> ##Converting character such as coma into numeric (1,000 to 1000)
> Bank_Data_2020Speposits <- as.numeric(Bank_Data_2020Speposits)
> Bank_Data_2020Speposits <- as.numeric(Bank_Data_2020Speposits)
> Bank_Data_2020Sperrowings <- as.numeric(Bank_Data_2020Sperrowings)
> Bank_Data_2020Sperrowings <- as.numeric(Bank_Data_2020Sperrowings)
> Bank_Data_2020Sperrowings <- as.numeric(Bank_Data_2020Sperrowings)
> Bank_Data_2020Sperrowings <- as.numeric(Bank_Data_2020Sperrowings)
> Wiew Bank_Data_2020O
> Wiew Bank_Data_2020O
> Wiew Bank_Data_2020O
> Wiew Bank_Data_2020O
> Means = c(mean(Bank_Data_2020Scapital, na.rm = TRUE), mean(Bank_Data_2020Sperrowings, na.rm = TRUE), mean(Bank_Data_2020Sperist, n
```

> Bank_Data_2020

```
> Bank_Data_2020
  # A tibble: 97 \times 6
                                                                Capital `Reserves and Surplus` Deposits Borrowings Investments
         Banks
          <chr>
                                                                      < dh7 >
                                                                                                                              <db7>
                                                                                                                                                    <db7> <db7>
                                                                                                                                                                                                            <dh1>
                                                                                                                                               228609.
212609.
                                                                     4527.
                                                                                                                              8135.
                                                                                                                                                                               9103.
     1 ALLAHABAD BANK
                                                                                                                                                                                                          80667.
    2 ANDHRA BANK
                                                                     <u>3</u>096.
                                                                                                                                                                            14130.
                                                                                                                                                                                                          61331.
                                                                                                                              9132.
         BANK OF BARODA
                                                                      925.
                                                                                                                           70931.
                                                                                                                                               945984.
                                                                                                                                                                            93069.
                                                                                                                                                                                                       274615.
         BANK OF INDIA
                                                                     <u>3</u>278.
                                                                                                                           <u>40</u>539.
                                                                                                                                               <u>555</u>505.
                                                                                                                                                                            <u>39</u>752.
                                                                                                                                                                                                       158573.
                                                                     <u>5</u>824.
                                                                                                                                                                                                          <u>57</u>741.
         BANK OF MAHARASHTRA
                                                                                                                              <u>4</u>931.
                                                                                                                                               150066.
                                                                                                                                                                               <u>3</u>670.
                                                                                                                                              <u>625</u>351.
                                                                    <u>1</u>030.
                                                                                                                                                                            <u>42</u>762.
                                                                                                                                                                                                       <u>176</u>245.
         CANARA BANK
                                                                                                                           <u>38</u>263.
                                                                                                                           <u>15</u>720.
         CENTRAL BANK OF INDIA
                                                                     <u>5</u>710.
                                                                                                                                               <u>313</u>763.
                                                                                                                                                                               <u>5</u>787.
                                                                                                                                                                                                       142518.
                                                                                                                           <u>12</u>552.
                                                                                                                                              <u>205</u>355.
                                                                                                                                                                                                          <u>66</u>432.
    8 CORPORATION BANK <u>1</u>199.
                                                                                                                                                                               <u>2</u>301.
                                                                      609.
                                                                                                                                                                                                          <u>81</u>242.
    9 INDIAN BANK
                                                                                                                           <u>21</u>480.
                                                                                                                                               <u>260</u>226.
                                                                                                                                                                            <u>20</u>830.
                                                                                                                                                                                                         79416.
  10 INDIAN OVERSEAS BANK 16437.
                                                                                                                              1685.
                                                                                                                                               222952.
                                                                                                                                                                               <u>5</u>420.
 # ... with 87 more rows
> data_input
$input
                                         ALLAHABAD BANK ANDHRA BANK BANK OF BARODA BANK OF INDIA BANK OF MAHARASHTRA CANARA BANK 4527.48 3095.54 925.37 3277.66 5824.11 1030.23 8135.29 9132.36 70930.84 40538.65 4931.17 38262.73
Capital
                                          8135.29 9132.30 7.555.04.98 228608.51 212609.38 945984.43 555504.98 9102.57 14129.58 93069.31 39752.47 3670.03 42761.77

CENTRAL BANK OF INDIA CORPORATION BANK INDIAN BANK INDIAN OVERSEAS BANK ORIENTAL BANK OF COMMERCE 5709.76 1198.84 608.80 16436.990 1370.21 15719.71 12551.64 21480.47 1685.018 15168.88 230108.23 22951.880 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 230108.23 2
Reserves and Surplus
Deposits
Reserves and Surplus
                                         Borrowings
Capital
Reserves and Surplus
Deposits
Borrowings
Capital
Reserves and Surplus
                                                                                                     137614.6400
Deposits
                                                                450668.45
                                                                                                                                                 640104.94
                                                                                                                                                                                                57081.50
                                        52486.25 2279.9500 147954.13 16379.18
CITY UNION BANK LIMITED CSB BANK LIMITED DCB BANK LIMITED FEDERAL BANK LTD HDFC BANK LTD.
                                          T3.73

73.73

5222.34

1787.16

40832.49

15790.68

30369.93

10372.43

ICICI BANK LIMITED IDFC FIRST BANK LIMITED INDUSIND BANK LTD

1294.76

10380.59

115209.64

23643.77

10532.70

33339.14

770068.99

222424.13

65107.97

202039.81

76748.86

57397.19

60753.55
                                                                                                                                310.42 398.53 548.33
3111.74 14119.08 170437.70
30369.93 152290.08 1147502.29
3407.95 10372.43 144628.54
Capital
Reserves and Surplus
Borrowings
Reserves and Surplus
Deposits
Borrowings
                                          JAMMU & KASHMIR BANK LTD KARNATAKA BANK LTD KARUR VYSYA BANK LTD KOTAK MAHINDRA BANK LTD.
71.36 310.88 159.86 1456.57
6322.12 5659.56 6440.41 47558.78
                                                                                                    310.88 159.86
5659.56 6440.41
71785.15 59075.08
Capital
                                                                                                                                                                                                                    1456.52
Reserves and Surplus
Deposits
                                                                            97788.23
                                                                                                                                                                                                                  262820.52
                                          2019.58 4065.12 1184.18

LAKSHMI VILAS BANK LTD NAINITAL BANK LTD RBL BANK LIMITED SOUTH INDIAN BANK LTD
336.71 77.50 508.70 180.97
893.09 504.80 10074.25 5296.38
Borrowings
Reserves and Surplus
Deposits
                                                                        21443.19
                                                                                                               7679.43
                                                                                                                                                 57812.22
17006.73
                                                                                                                                                                                              83033.89
                                                                             755.70
                                                                                                                      0.01
                                                                                                                                                                                                 6893.23
                                          TAMILNAD MERCANTILE BANK LTD THE DHANALAKSHMI BANK LTD YES BANK LTD. AB BANK LIMITED 142.51 253.01 2510.09 36.98 3837.13 573.90 19216.20 56.36
Reserves and Surplus
                                                                                     36825.03
                                                                                                                                          10904.07
177.50
                                                                                                                                                                      105363.94
                                                                                                                                                                                               144072.63
                                                                                        324.00
Borrowings
                                                                                                                                                                      113790.50
                                          ABU DHABI COMMERCIAL BANK PJSC AMERICAN EXPRESS BANKING CORP. 217.02 1760.33
Capital
Reserves and Surplus
Deposits
                                                                                               86.66
                                                                                                                                                                48.75
                                                                                         13218.64
                                                                                                                                                            2128.99
Borrowings
                                                                                       144072.63
                                                                                                                                                            2059.61
                                          AUSTRALIA AND NEW ZEALAND BANKING GROUP LIMITED BANK OF AMERICA , NATIONAL ASSOCIATION
Capital
                                                                                                                            1131.11
342.10
                                                                                                                                                                                                                3188.26
Reserves and Surplus
                                                                                                                                                                                                                9046.08
Deposits
                                                                                                                               4548.48
                                                                                                                                                                                                               39638.19
```

```
Reserves and Surplus
                                                                                                342.10
                                                                                                                                                           9046.08
                                                                                             4548.48
834.97
Borrowings
                                                                                                                                                           5892.21
                               BANK OF BAHRAIN & KUWAIT B.S.C. BANK OF CEYLON BANK OF CHINA LIMITED BANK OF NOVA SCOTTAL
292.89 135.00 352.540 839.41
5 138.52 111.88 1930.728 1007.71
Reserves and Surplus
Deposits
                                                                     2640.72
101.00
                                                                                       243.07
144072.63
                                                                                                                                20.500
                                                                                                                                                              3381.41
                                                                                                                          144072.631
Borrowings
                                                                                                                                                               649.10
BARCLAYS BANK PLC BNP PARIBAS CITIBANK N.A COOPERATIEVE RABOBANK U.A. Capital 5249.52 4481.29 3743.84 1220.080 Reserves and Surplus 1405.72 3383.24 22790.02 1725.858
                                                                                                                              1220.080
                                                                                                                              1725.858
4637.240
467.650
                                                             21255.59 157869.34
4082.22 10149.80
                                             14439.72
Deposits
                               14439.22 21255.59 157869.34 4057.240

1185.08 4082.22 10149.80 467.650

CREDIT AGRICOLE CORPORATE AND INVESTMENT BANK CREDIT SUISSE AG CTBC BANK CO., LTD.

1097.17 1775.00 553.550

830.83 878.63 1939.918
Borrowings
                                                                                                                                                     553.550
                                                                                                                                                   1939.918
Reserves and Surplus
Deposits
                                                                                                                                                   1373.910
                                                                                           6550.64
                                                                                                                     2831 74
Borrowings
                                                                                             852.49
                                DBS BANK INDIA LTD. DEUTSCHE BANK AG DOHA BANK Q.P.S.C EMIRATES NBD BANK (P.J.S.C.)
                                  5037.65
997.81
35652.11
                                                                                          304.20
16.58
1319.32
                                                                7588.11
9401.49
59909.56
                                                                                                                                                      1397.74
Reserves and Surplus
                                                                                                                                                           8.31
                               35652.11 59909.56 1317.52

9086.69 13973.69 6.50 619.1/
FIRST ABU DHABI BANK PJSC FIRSTRAND BANK LTD HONGKONG AND SHANGHAI BANKING CORPN.LTD.
2012.59 661.710 4499.17
5 179.91 1627.848 21362.72
374.64 318.780 124852.98
Deposits
Capital
Reserves and Surplus
                               374.64 318.780
2652.98 1356.010
INDUSTRIAL AND COMMERCIAL BANK OF CHINA INDUSTRIAL BANK OF KOREA
455.45 392.60
210.93 47.52
2118.86 205.82
566.58 144072.63
Deposits
                                                                                                                                                      124852.98
                                                                                                                                                        24441.74
Capital
 .
Reserves and Surplus
Deposits
                               2118.86 205.82
566.58 144072.63

JPMORGAN CHASE BANK NATIONAL ASSOCIATION JSC VTB BANK KEB HANA BANK KOOKMIN BANK
                              JPMORGAN CHASE BANK NATIONAL ASSOCIATION JSC VTB BANK KEB HANA BANK KOOKMIN BANK 6570.34 110.570 643.46 355.86 
5 7982.24 1941.218 42.08 0.24 
28386.46 0.050 1151.53 290.21 
16836.96 144072.631 98.36 144072.63 
KRUNG THAI BANK PUBLIC COMPANY LIMITED MASHREQ BANK PSC MIZUHO BANK LTD MUFG BANK LTD 35.84 226.71 3044.34 2207.34 
5 26.13 197.42 2145.98 3452.25 458.08 267.44 14505.96 19585.00 
144072.63 264.21 1473.38 5994.93
Capital
Reserves and Surplus
Deposits
Borrowings
Capital
Reserves and Surplus
Deposits
                               436.08 207.44 14303.96 19363.00 194072.63 264.21 1473.38 5994.93 NATWEST MARKETS PLC PT BANK MAYBANK INDONESIA TBK QATAR NATIONAL BANK (Q.P.S.C.) SBERBANK 2802.820 208.88 321.65 273.21 5 1759.378 5.96 0.03 88.84 13218.635 50.08 717.73 24.15 1707.190 25.60 65.00 144072.63
Borrowings
Capital
Reserves and Surplus
Deposits
Borrowinas
208.88
5.96
50.08
                                2802.820
1759.378
                                                                                                                                                 321.65
Reserves and Surplus
                                                                                                                                                     0.03
                                                                                                                                                  717.73
Deposits
                                              13218.635
                                                                                                                                                                   24.15
                               13218.635 50.08 717.73 24.15
1707.190 25.60 65.00 144072.63

SBM BANK (INDIA) LTD. SHINHAN BANK SOCIETE GENERALE SONALI BANK STANDARD CHARTERED BANK
756.960 633.19 1449.37 0.61 7440.07
1791.088 679.86 300.70 14.26 21412.54
1830.040 7633.69 2745.13 101.98 100394.58
15.000 1542.75 303.77 144072.63 16725.58

SUMITOMO MITSUI BANKING CORPORATION UNITED OVERSEAS BANK LTD WESTPAC BANKING CORPORATION WOORI BANK
7947.53 752.55 808.73 696.33
941.46 86.50 183.55 128.71
14479.66 887.03 13218.64 3511.38
257.26 144072.63 144072.63 319.19
Reserves and Surplus
Deposits
Reserves and Surplus
Deposits
                                                                                                              144072.63
Borrowings
                                                                            257.26
                                                                                                                                                         144072.63
                                                                                                                                                                               319.19
                               AU SMALL FINANCE BANK LIMITED CAPITAL SMALL FINANCE BANK LIMITED EQUITAS SMALL FINANCE BANK LIMITED
                                                                                                                       33.81
372.97
4446.62
                                                                   304.12
                                                                                                                                                                              1053.40
Reserves and Surplus
                                                              4072.69
                                                                                                                                                                              1690.75
Deposits
                                ESAF SMALL FINANCE BANK LIMITED FINCARE SMALL FINANCE BANK LIMITED JANA SMALL FINANCE BANK LIMITED 427.80 63.61 200.72
Borrowinas
                                                                                                                                                                              5134.87
.
Reserves and Surplus
Borrowings
                                                                     1203.32
                                                                                                                           1368.16
                                                                                                                                                                            2898.73
                                NORTH EAST SMALL FINANCE BANK LIMITED SURYODAY SMALL FINANCE BANK LIMITED
                                                                                                      86.59
979.64
                                                                               293.38
Reserves and Surplus
                                                                                 71.89
                                                                                890.14
                                                                                749.99
Borrowings
                                                                                                                                      1264.62
                               UJJIVAN SMALL FINANCE BANK LIMITED UTKARSH SMALL FINANCE BANK LIMITED
                                                                                                                                 759.27
260.23
                                                                          1928.22
Reserves and Surplus
                                                                          1259.50
Deposits
                                                                        10780.48
                                                                                                                                5235.21
Borrowings
                               INDIA POST PAYMENTS BANK LIMITED
                                                                     1035.000
                                                                  1506.038
Reserves and Surplus
Deposits
                                                                       855.030
                                                                 144072.631
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ALLAHABAD BANK ANDHRA BANK BANK OF BARODA BANK OF INDIA BANK OF MAHARASHTRA CANARA BANK 80666.58 61331.17 274614.6 158573 57740.85 176244.9

CENTRAL BANK OF INDIA CORPORATION BANK INDIAN BANK INDIAN OVERSEAS BANK ORIENTAL BANK OF COMMERCE 142517.5 66432.44 81241.69 79416.08 72871.3

PUNJAB AND SIND BANK PUNJAB NATIONAL BANK STATE BANK OF INDIA SYNDICATE BANK UCO BANK UNION BANK OF INDIA 24552.1 240465.6 1046955 74964.26 90998.81 152413.9

UNITED BANK OF INDIA AXIS BANK LIMITED BANDHAN BANK LIMITED CITY UNION BANK LIMITED CSB BANK LIMITED S8636.92 156734.3 15351.77 9116.79 5359.84
$output
Investments
                                               UNITED BANK OF INDIA AXIS BANK LIMITED BANDHAN BANK LIMITED CALL SEGMENT STATES SEARCH STATES SEARCH STATES SEARCH STATES SEARCH STATES SEARCH SEARCH STATES SEARCH STATES
Investments
Investments
Investments
                                                 9467.33 3682.4 4
ABU DHABI COMMERCIAL BANK PJSC AMERICAN EXPRESS BANKING CORP.
17485.77 3340.99
Investments
                                                                                                                                                                                                                                                                                    3340.99
                                                  AUSTRALIA AND NEW ZEALAND BANKING GROUP LIMITED BANK OF AMERICA , NATIONAL ASSOCIATION
Investments
                                                                                                                                                                                                                         3561.89
                                                                                                                                                                                                                                                                                                                                                                                         25656.52
                                                 BANK OF BAHRAIN & KUWAIT B.S.C. BANK OF CEYLON BANK OF CHINA LIMITED BANK OF NOVA SCOTIA BARCLAYS BANK PLC
744.6 55.18 17485.77 3351.47 8624.86
                                                 744.6 55.18 17485.77 3351.47 8624.86
BNP PARIBAS CITIBANK N.A COOPERATIEVE RABOBANK U.A. CREDIT AGRICOLE CORPORATE AND INVESTMENT BANK
13622.38 101480.5 1753.14
CREDIT SUISSE AG CTBC BANK CO., LTD. DBS BANK INDIA LTD. DEUTSCHE BANK AG DOHA BANK Q.P.S.C
7534.66 513.83 23426.92 33179.97 259.06
Investments
Investments
Investments
                                                7534.66 513.83 23426.92 33179.97 259.06

EMIRATES NBD BANK (P.J.S.C.) FIRST ABU DHABI BANK PJSC FIRSTRAND BANK LTD
1003.98 3626.02 1208.87

HONGKONG AND SHANGHAI BANKING CORPN.LTD. INDUSTRIAL AND COMMERCIAL BANK OF CHINA INDUSTRIAL BANK OF KOREA
71622.01 2688.69 37.07

JPMORGAN CHASE BANK NATIONAL ASSOCIATION JSC VTB BANK KBB HANA BANK KOOKMIN BANK
34460.52 17485.77 121.93 56.5

KRUNG THAI BANK PUBLIC COMPANY LIMITED MASHREQ BANK PSC MIZUHO BANK LTD MUFG BANK LTD NATWEST MARKETS PLC
414.02 356.27 5220.96 11960.14 4181.11
Investments
                                                 PT BANK MAYBANK INDONESIA TBK QATAR NATIONAL BANK (Q.P.S.C.) SBERBANK SBM BANK (INDIA) LTD. SHINHAN BANK 121.98 207.97 99.7 567.8 2601.34
                                               121.98 207.97 99.7 567.8 2601.34

SOCIETE GENERALE SONALI BANK STANDARD CHARTERED BANK SUMITOMO MITSUI BANKING CORPORATION 3061.51 12.28 48503.34

UNITED OVERSEAS BANK LTD WESTPAC BANKING CORPORATION WOORI BANK AU SMALL FINANCE BANK LIMITED 365.84 17485.77 1204.87 10668.22

CAPITAL SMALL FINANCE BANK LIMITED EQUITAS SMALL FINANCE BANK LIMITED ESAF SMALL FINANCE BANK LIMITED 1051.87 1733.63

FINCARE SMALL FINANCE BANK LIMITED JANA SMALL FINANCE BANK LIMITED NORTH EAST SMALL FINANCE BANK LIMITED 1006.96 2650.03 353.15

SURYODAY SMALL FINANCE BANK LIMITED UJIVAN SMALL FINANCE BANK LIMITED UTKARSH SMALL FINANCE BANK LIMITED 808.2 2396.14 1192.39
Investments
Investments
Investments
Investments
                                                                                                                                                                               808.2
                                                                                                                                                                                                                                                                                                                          2396.14
                                                 INDIA POST PAYMENTS BANK LIMITED
                                                                                                                                                                694.25
```

\$dmunames

[1] "ALLAHABAD BANK"
[3] "BANK OF BARODA"
[5] "BANK OF MAHARASHTRA"
[7] "CENTRAL BANK OF INDIA"
[9] "INDIAN BANK"
[11] "ORIENTAL BANK OF COMMERCE"
[13] "PUNJAB NATIONAL BANK"
[15] "SYNDICATE BANK"
[17] "UNION BANK OF INDIA"
[19] "AXIS BANK LIMITED"
[21] "CITY UNION BANK LIMITED"
[23] "DCB BANK LIMITED"
[27] "IDBI BANK LIMITED"
[29] "INDUSIND BANK LTD"
[31] "KARNATAKA BANK LTD"
[33] "KOTAK MAHINDRA BANK LTD"
[37] "SOUTH INDIAN BANK LTD"
[39] "THE DHANALAKSHMI BANK LTD"
[41] "AB BANK LIMITED"
[43] "AMERICAN EXPRESS BANKING CORP."
[45] "BANK OF AMERICA , NATIONAL ASSOCIATION"
[47] "BANK OF CEYLON"
[49] "BANK OF CEYLON"
[49] "BANK OF COPLON"
[50] "BANK OF NOVA SCOTIA"
[51] "BNP PARIBAS"
[52] "COOPERATIEVE RABOBANK U.A."
[53] "CREDIT SUISSE AG"
[63] "COOPERATIEVE RABOBANK U.A."
[64] "DOHA BANK Q.P.S.C"
[65] "INDUSTRIAL BANK OF KOREA"
[67] "JDS BANK INDIA LTD."
[67] "JOHA BANK Q.P.S.C"
[67] "INDUSTRIAL BANK OF KOREA"
[67] "JISC VTB BANK"
[68] "MASHREQ BANK PSC"
[68] "SBERBANK"
[68] "SBE "ANDHRA BANK" "BANK OF INDIA" "CANARA BANK" "CORPORATION BANK"
"INDIAN OVERSEAS BANK" "PUNJAB AND SIND BANK"
"STATE BANK OF INDIA" "UCO BANK" "UNITED BANK OF INDIA" "BANDHAN BANK LIMITED" "CSB BANK LIMITED" CSB BANK LIMITED
"FEDERAL BANK LTD"
"ICICI BANK LIMITED"
"IDFC FIRST BANK LIMITED"
"JAMMU & KASHMIR BANK LTD"
"KARUR VYSYA BANK LTD" "LAKSHMI VILAS BANK LTD"
"RBL BANK LIMITED"
"TAMILNAD MERCANTILE BANK LTD"
"YES BANK LTD." "YES BANK LTD.
"ABU DHABI COMMERCIAL BANK PJSC"
"AUSTRALIA AND NEW ZEALAND BANKING GROUP LIMITED"
"BANK OF BAHRAIN & KUWAIT B.S.C."
"BANK OF CHINA LIMITED" "BARCLAYS BANK PLC"
"CITIBANK N.A" "CITIBANK N.A"

"CREDIT AGRICOLE CORPORATE AND INVESTMENT BANK"

"CTBC BANK CO., LTD."

"DEUTSCHE BANK AG"

"EMTRATES NBD BANK (P.J.S.C.)"

"FIRSTRAND BANK LTD"

"INDUSTRIAL AND COMMERCIAL BANK OF CHINA"

"JPMORGAN CHASE BANK NATIONAL ASSOCIATION" "KEB HANA BANK" "KRUNG THAI BANK PUBLIC COMPANY LIMITED" "MIZUHO BANK LTD"
"NATWEST MARKETS PLC" [73] "MUFG BANK LTD"
[75] "PT BANK MAYBANK INDONESIA TBK"
[77] "SBERBANK"
[79] "SHINHAN BANK"
[81] "SONALI BANK"
[83] "SUMITOMO MITSUI BANKING CORPORATION"
[85] "WESTPAC BANKING CORPORATION"
[87] "AU SMALL FINANCE BANK LIMITED"
[89] "EQUITAS SMALL FINANCE BANK LIMITED"
[91] "FINCARE SMALL FINANCE BANK LIMITED"
[93] "NORTH EAST SMALL FINANCE BANK LIMITED"
[95] "UJJIVAN SMALL FINANCE BANK LIMITED"
[97] "INDIA POST PAYMENTS BANK LIMITED" NAIWESI MARKEIS PLC
"QATAR NATIONAL BANK (Q.P.S.C.)"
"SBM BANK (INDIA) LTD."
"SOCIETE GENERALE"
"STANDARD CHARTERED BANK" "UNITED OVERSEAS BANK LTD"
"WOORI BANK" WOURL BANK
"CAPITAL SMALL FINANCE BANK LIMITED"
"ESAF SMALL FINANCE BANK LIMITED"
"JANA SMALL FINANCE BANK LIMITED"
"SURYODAY SMALL FINANCE BANK LIMITED" "UTKARSH SMALL FINANCE BANK LIMITED"

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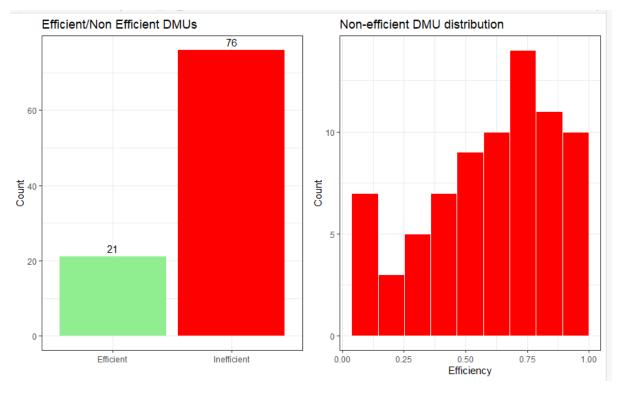
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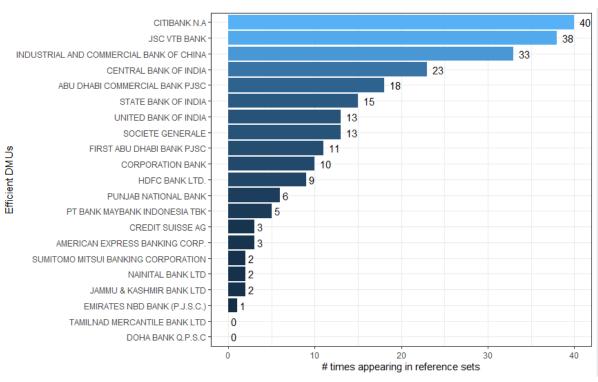
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4 RESULT

1	DMU	eff	
2	ALLAHABAD BANK	0.95171	
3	ANDHRA BANK	0.7571	
4	BANK OF BARODA	0.8716	
5	BANK OF INDIA	0.76634	
6	BANK OF MAHARASHTRA	0.83633	
7	CANARA BANK	0.97087	
8	CENTRAL BANK OF INDIA	1	
9	CORPORATION BANK	1	
10	INDIAN BANK	0.89842	
11	INDIAN OVERSEAS BANK	0.77273	
12	ORIENTAL BANK OF COMMERCE	0.88066	
13	PUNJAB AND SIND BANK	0.81517	
14	PUNJAB NATIONAL BANK	1	
15	STATE BANK OF INDIA	1	
16	SYNDICATE BANK	0.9463	
17	UCO BANK	0.84466	
18	UNION BANK OF INDIA	0.87135	
19	UNITED BANK OF INDIA	1	
20	AXIS BANK LIMITED	0.68868	
21	BANDHAN BANK LIMITED	0.39351	
22	CITY UNION BANK LIMITED	0.73315	
23	CSB BANK LIMITED	0.76325	
24	DCB BANK LIMITED	0.55212	
25	FEDERAL BANK LTD	0.67797	

26	HDFC BANK LTD.	1	
27	ICICI BANK LIMITED	0.88223	
28	IDBI BANK LIMITED	0.55023	
29	IDFC FIRST BANK LIMITED	0.77665	
30	INDUSIND BANK LTD	0.74204	
31	JAMMU & KASHMIR BANK LTD	1	
32	KARNATAKA BANK LTD	0.69426	
33	KARUR VYSYA BANK LTD	0.9716	
34	KOTAK MAHINDRA BANK LTD.	0.69532	
35	LAKSHMI VILAS BANK LTD	0.65466	
36	NAINITAL BANK LTD	1	
37	RBL BANK LIMITED	0.66721	
38	SOUTH INDIAN BANK LTD	0.79232	
39	TAMILNAD MERCANTILE BANK LTD	1	
40	THE DHANALAKSHMI BANK LTD	0.79112	
41	YES BANK LTD.	0.55045	
42	AB BANK LIMITED	0.05943	
43	ABU DHABI COMMERCIAL BANK PJSC	1	
44	AMERICAN EXPRESS BANKING CORP.	1	
45	AUSTRALIA AND NEW ZEALAND BANKING GRO	0.75242	
46	BANK OF AMERICA , NATIONAL ASSOCIATION	0.77854	
47	BANK OF BAHRAIN & KUWAIT B.S.C.	0.49252	
48	BANK OF CEYLON	0.03912	
49	BANK OF CHINA LIMITED	0.99914	
50	BANK OF NOVA SCOTIA	0.89211	

50	BANK OF NOVA SCOTIA	0.89211
51	BARCLAYS BANK PLC	0.65876
52	BNP PARIBAS	0.59097
53	CITIBANK N.A	1
54	COOPERATIEVE RABOBANK U.A.	0.41907
55	CREDIT AGRICOLE CORPORATE AND INVESTM	0.59102
56	CREDIT SUISSE AG	1
57	CTBC BANK CO., LTD.	0.38726
58	DBS BANK INDIA LTD.	0.90825
59	DEUTSCHE BANK AG	0.56116
60	DOHA BANK Q.P.S.C	1
61	EMIRATES NBD BANK (P.J.S.C.)	1
62	FIRST ABU DHABI BANK PJSC	1
63	FIRSTRAND BANK LTD	0.76821
64	HONGKONG AND SHANGHAI BANKING CORPN	0.82275
65	INDUSTRIAL AND COMMERCIAL BANK OF CHIL	1
66	INDUSTRIAL BANK OF KOREA	0.03764
67	JPMORGAN CHASE BANK NATIONAL ASSOCIAT	0.89396
68	JSC VTB BANK	1
69	KEB HANA BANK	0.13586
70	KOOKMIN BANK	0.28728
71	KRUNG THAI BANK PUBLIC COMPANY LIMITEI	0.49584
72	MASHREQ BANK PSC	0.59963
73	MIZUHO BANK LTD	0.41571
74	MUFG BANK LTD	0.64167
75	NATWEST MARKETS PLC	0.33873

76	PT BANK MAYBANK INDONESIA TBK	1
77	QATAR NATIONAL BANK (Q.P.S.C.)	0.56722
78	SBERBANK	0.10726
79	SBM BANK (INDIA) LTD.	0.91736
80	SHINHAN BANK	0.44165
81	SOCIETE GENERALE	1
82	SONALI BANK	0.11024
83	STANDARD CHARTERED BANK	0.59381
84	SUMITOMO MITSUI BANKING CORPORATION	1
85	UNITED OVERSEAS BANK LTD	0.14854
86	WESTPAC BANKING CORPORATION	0.93903
87	WOORI BANK	0.47328
88	AU SMALL FINANCE BANK LIMITED	0.78532
89	CAPITAL SMALL FINANCE BANK LIMITED	0.57794
90	EQUITAS SMALL FINANCE BANK LIMITED	0.23487
91	ESAF SMALL FINANCE BANK LIMITED	0.35384
92	FINCARE SMALL FINANCE BANK LIMITED	0.40436
93	JANA SMALL FINANCE BANK LIMITED	0.49446
94	NORTH EAST SMALL FINANCE BANK LIMITED	0.29749
95	SURYODAY SMALL FINANCE BANK LIMITED	0.40015
96	UJJIVAN SMALL FINANCE BANK LIMITED	0.19044
97	UTKARSH SMALL FINANCE BANK LIMITED	0.25656
98	INDIA POST PAYMENTS BANK LIMITED	0.04519

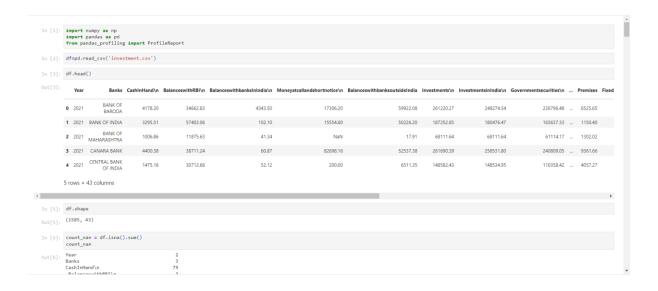
SO, HERE IN EFF COLUMN THE BANKS WITH VALUE 1 IS EFFICIENT BANKS

PYTHON

Linear Regression and Decision Trees Model

4 Description

- ✓ **Decision Tree** is a Supervised learning technique that can be used for both classification and Regression problems, but mostly it is preferred for solving Classification problems. It is a tree-structured classifier, where internal nodes represent the features of a dataset, branches represent the decision rules and each leaf node represents the outcome.
- ✓ **Linear regression** is one of the easiest and most popular Machine Learning algorithms. It is a statistical method that is used for predictive analysis. Linear regression makes predictions for continuous/real or numeric variables such as sales, salary, age, product price, etc.



```
451
Moneyatcallandshortnotice\n
BalanceswithbanksoutsideIndia
                                  91
Investments\n
                                   30
InvestmentsinIndia\n
                                   30
Governmentsecurities\n
                                  35
Otherapprovedsecurities\n
                                978
Shares\n
                                 540
DebenturesandBonds\n
                                 454
SubsidiariesandOrjointventures\n 967
Others\n
                                 375
InvestmentsoutsideIndia\n
                                1159
Governmentsecurities\n.1
SubsidiariesandOrjointVentures\n 1335
Others\n
                                1213
Advances\n
Billspurchasedanddiscounted\n
                               175
                                 86
Cashcreditsoverdraftsand loans\n
Termloans\n
Securedbytangibleassets\n
                                  89
CoveredbyBankGovtGuarantees\n
                                369
Unsecured\n
                                   93
AdvancesinIndia
                                   30
Prioritysectors \n
                                   96
Publicsectors\n
                                  603
Banks\n
                                  733
others\n
                                   54
AdvancesoutsideIndia
                                 1082
FixedAssets
                                   10
Premises
                                  398
Fixedassetsunderconstruction
                                 719
OtherFixedassets\n
                                  13
OtherAssets
                                   3
Interofficeadjustmentsnet\n
                               1145
Interestaccrued \n
                                  13
Taxpaid\n
                                  149
StationeryandStamps\n
                                  477
Others\n.1
                                    3
TotalAssets
                                    3
dtype: int64
```

```
In [7]: cnt=0
for i in count_nan:
    if(i)300):
    cnt=1
print(cnt)

18

In [8]: df2=df.copy()

In [9]: list=[]
for names, values in df.iteritems():
    iis1.append(names)

In [93]: dicto=()
    for i in range(0,len(count_nan)):
    dicto[list[i]]=count_nan[i]

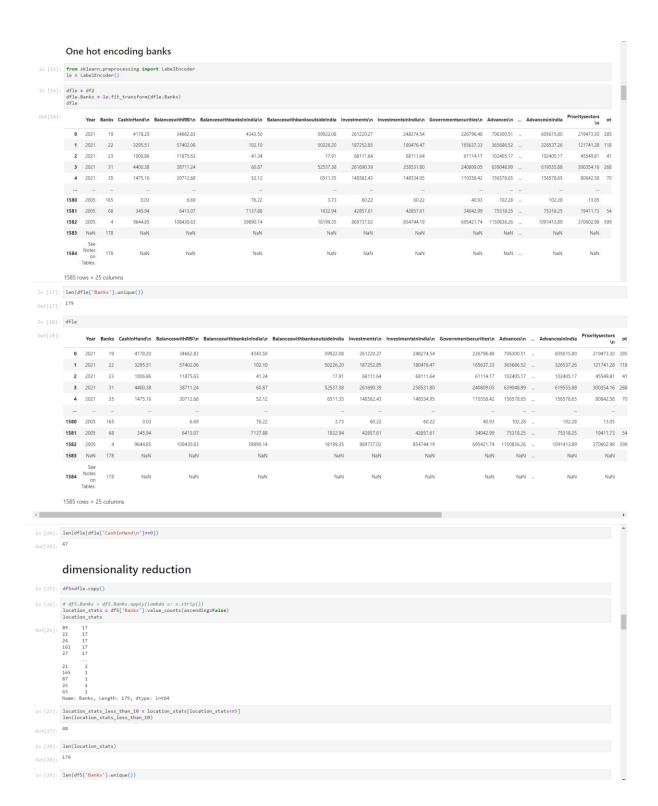
In [92]: lis2=[]
    for i in range(0,len(count_nan)):
    dicto[list[i]]=count_nan[i]

In [12]: df2.drop(lis2,axis=1,inplace=true)

In [13]: df2.drop(lis2,axis=1,inplace=true)

In [13]: df2.drop(lis2,axis=1,inplace=true)

In [14]: # profile=ProfileReport(df2,title='Pandus Profiling Report', explorative=True)
# profile.te_noteood.fframe()
```

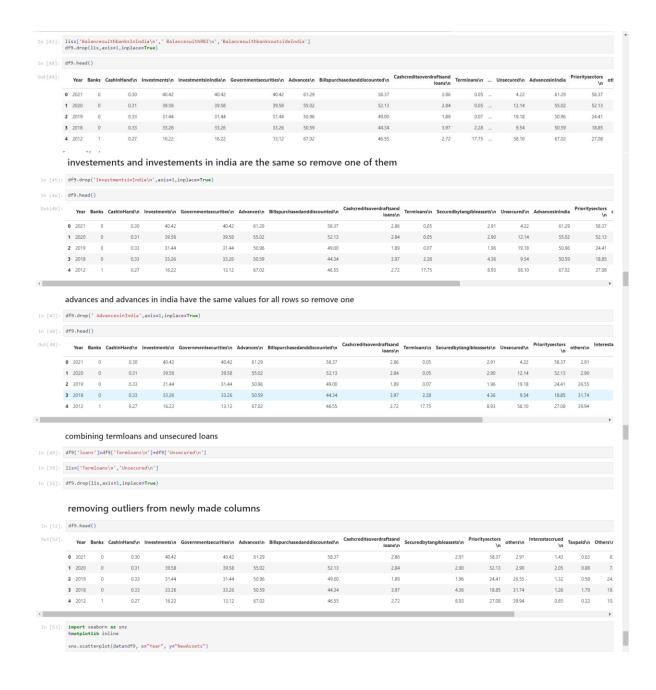


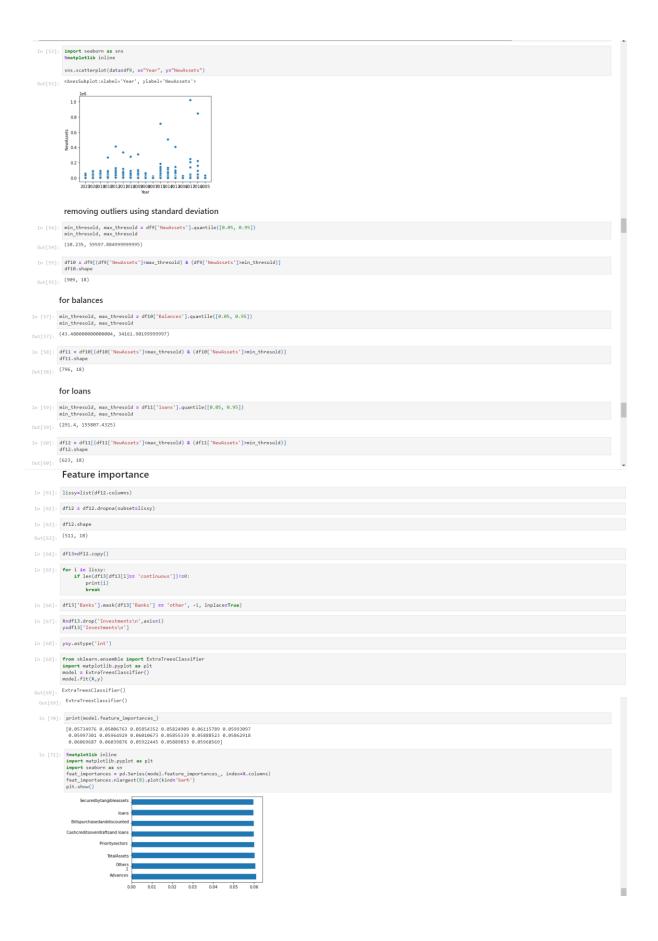
```
Out[29]: 179
  In [30]: df6=df5.copy()
  In [31]: df6.Banks = df6.Banks.apply(lambda x: 'other' if x in location_stats_less_than_10 else x) len(df6.Banks.unique())
  Out[31]: 132
           Outlier removal
 Out[32]: (1012, 25)
  In [33]: #573 columns have been removed as outliers df6.shape[\theta]-df7.shape[\theta]
  In [34]: df7['FixedAssets'].describe()
Out[32]: (1012, 25)
In [33]: #573 columns have been removed as outliers df6.shape[\theta]-df7.shape[\theta]
In [34]: df7['FixedAssets'].describe()
                   1012.00000
1980.08666
8439.07275
0.06000
15.04500
Out[34]: count mean std min 25%
         75% 157.86000
75% 1252.24250
max 150685.40000
Name: FixedAssets, dtype: float64
           feature engineering
           combining FixedAssets OtherFixedassets\n OtherAssets
  In [35]: df7.head()
             Year Banks CashinHand\n BalanceswithBl\n BalanceswithbanksInIndia\n BalanceswithbanksoutsideIndia Investments\n Investments\n InvestmentsinIndia\n Governmentsecurities\n Advances\n ... Advances\n ... Advances\n ... Advances\n ... Advances\n ... Advances\n ...
                                              4.72
                                                                                                                                                                       61.29
                                                                                              130.12
                                                                                                           40.42
                                                                                                                             40.42
                                                                                                                                                40.42
                                                                                                                                                          61.29
           0 2021
                                                                                                                                                                                       58.37
           1 2020 0 0.31
                                           2.44
                                                                                                                                                                      55.02
                                                                                                                                                                                   52.13 2.90
                                                                    31.55
                                                                                             48.55
                                                                                                         39.58
                                                                                                                          39.58
                                                                                                                                              39.58
                                                                                                                                                         55.02 ...
                                                                                                                                                31.44
                                                                                                                                                                                       24.41
                                                                                                                                                                                               26.55
                                0.33
                                               2.23
                                                                                                                                                                     50.59 18.85 31.74
           3 2018 0 0.33
                                                                                                          33.26
                                                                                                                            33.26
                                                                                                                                               33.26 50.59 ...
 4
  In [37]: df8['NewAssets']=df7['FixedAssets']+df7['OtherFixedassets\n']+df7['OtherAssets']
          1 2020 0 0.31 2.44
                                                                 31.55
                                                                                             48.55
                                                                                                      39.58
                                                                                                                  39.58
                                                                                                                                     39.58
                                                                                                                                                       55.02 ...
                                                                                                                                                                              2.90 12.14
                               0.33
                                                                     22.06
                                                                                             111.60
                                                                                                          31.44
                                                                                                                                                31.44
                                                                                                                                          33.26 50.59 ...
          3 2018 0 0.33 2.68
                                                                    24.83
                                                                                             68.59 33.26
                                                                                                                           33.26
                                                                                                                                                                                   4.36 9.54
                                                                                                                                                          67.02 ...
          4 2012
                               0.27
                                              1.68
                                                                                              13.45
                                                                                                          16.22
                                                                                                                            16.22
                                                                                                                                                13.12
                                                                                                                                                                                   8.93
         5 rows × 23 columns
 In [41]: df9['Balances']=df8[' BalanceswithRBI\n']+df8['BalanceswithbanksInIndia\n']+df8['BalanceswithbanksoutsideIndia']
            Year Banks CashinHand\n BalanceswithRBI\n BalanceswithbanksinIndia\n Bala
                                                                                   ithbanksoutsideIndia Investments\n InvestmentsinIndia\n G

        0
        2021
        0
        0.30
        4.72

        1
        2020
        0
        0.31
        2.44

                                                                     51.00
                                                                                             130.12
                                                                                                           40.42
                                                                                                                                                40.42
                                                                                                                                                                         4.22
                                                                                                                                                          61.29 ..
                                                                                          48.55 39.58
                                                                    31.55
                                                                                                                         39.58
                                                                                                                                               39.58
                                                                                                                                                         55.02 ...
                                                                                                                                                                        12.14
                                                                                                                                                                                     55.02
                                                                                                                                            33.26 50.59 ...
         5 rows × 24 columns
```





4 RESULT

linear regression

```
In [84]: import pandas as pd
import numpy as np
from sklearn import linear_model
import matplotlib.pyplot as plt

In [86]: # Create linear regression object
reg = linear_model.LinearRegression()
reg.fit(X_train,y_train)

Out[86]: LinearRegression()

In [87]: reg.score(X_test,y_test)

Out[87]: 0.9921689502921978
```

decision trees

```
In [90]: from sklearn.tree import DecisionTreeRegressor
    # create a regressor object
    regressor = DecisionTreeRegressor(random_state = 0)

# fit the regressor with X and Y data
    regressor.fit(X_train, y_train)

Out[90]: DecisionTreeRegressor(random_state=0)

In [91]: regressor.score(X_test,y_test)

Out[91]: 0.876234468552862
```

♣ Why is linear regression better?

Linear-regression models have become a proven way to scientifically and reliably predict the future. Because linear regression is a long-established statistical procedure, the properties of linear-regression models are well understood and can be trained very quickly

4 CONCLUSION

Banks are considered to be the backbone of the financial system; they play an important role in the economic development as they play the role of intermediary to transfer funds from surplus units to deficit units. So, the efficiency of a bank is essential and needs to be paid more attention.