

myusuf2_Assignment_4

Contents

Problem Statement

An equities analyst is studying the pharmaceutical industry and would like your help in exploring and understanding the industry.

Data Preparation

```
## 'r
getwd()
```

```
## [1] "C:/Users/Mukht/OneDrive/Desktop/Kent State University/College of Business Admin-Bus. Analytics I"
```

```
setwd("C:\\Users\\Mukht\\OneDrive\\Desktop\\Kent State University\\College of Business Admin-Bus. Analytics I")
```

```
Assignment4<-read.csv("Pharmaceuticals.csv", stringsAsFactors = FALSE)
str(Assignment4)
```

```
## 'data.frame':    21 obs. of  14 variables:
## $ Symbol          : chr  "ABT" "AGN" "AHM" "AZN" ...
## $ Name             : chr  "Abbott Laboratories" "Allergan, Inc." "Amersham plc" "AstraZeneca PLC" ...
## $ Market_Cap       : num  68.44 7.58 6.3 67.63 47.16 ...
## $ Beta             : num  0.32 0.41 0.46 0.52 0.32 1.11 0.5 0.85 1.08 0.18 ...
## $ PE_Ratio         : num  24.7 82.5 20.7 21.5 20.1 27.9 13.9 26 3.6 27.9 ...
## $ ROE              : num  26.4 12.9 14.9 27.4 21.8 3.9 34.8 24.1 15.1 31 ...
## $ ROA              : num  11.8 5.5 7.8 15.4 7.5 1.4 15.1 4.3 5.1 13.5 ...
## $ Asset_Turnover    : num  0.7 0.9 0.9 0.9 0.6 0.6 0.9 0.6 0.3 0.6 ...
## $ Leverage          : num  0.42 0.6 0.27 0 0.34 0 0.57 3.51 1.07 0.53 ...
## $ Rev_Growth        : num  7.54 9.16 7.05 15 26.81 ...
## $ Net_Profit_Margin : num  16.1 5.5 11.2 18 12.9 2.6 20.6 7.5 13.3 23.4 ...
## $ Median_Recommendation: chr  "Moderate Buy" "Moderate Buy" "Strong Buy" "Moderate Sell" ...
## $ Location          : chr  "US" "CANADA" "UK" "UK" ...
## $ Exchange          : chr  "NYSE" "NYSE" "NYSE" "NYSE" ...
```

```
head(Assignment4)
```

	Symbol	Name	Market_Cap	Beta	PE_Ratio	ROE	ROA	Asset_Turnover
## 1	ABT	Abbott Laboratories	68.44	0.32	24.7	26.4	11.8	0.7
## 2	AGN	Allergan, Inc.	7.58	0.41	82.5	12.9	5.5	0.9
## 3	AHM	Amersham plc	6.30	0.46	20.7	14.9	7.8	0.9
## 4	AZN	AstraZeneca PLC	67.63	0.52	21.5	27.4	15.4	0.9
## 5	AVE	Aventis	47.16	0.32	20.1	21.8	7.5	0.6
## 6	BAY	Bayer AG	16.90	1.11	27.9	3.9	1.4	0.6

```
##      Leverage Rev_Growth Net_Profit_Margin Median_Recommendation Location Exchange
## 1      0.42      7.54          16.1          Moderate Buy      US      NYSE
## 2      0.60      9.16           5.5          Moderate Buy    CANADA  NYSE
## 3      0.27      7.05          11.2           Strong Buy      UK      NYSE
## 4      0.00     15.00          18.0          Moderate Sell      UK      NYSE
## 5      0.34     26.81          12.9          Moderate Buy    FRANCE  NYSE
## 6      0.00     -3.17           2.6              Hold    GERMANY  NYSE
```

```
library(tidyr)
library(dplyr)
library(tidyverse)
library(class)
library(caret)
library(lattice)
library(ggplot2)
library(ISLR)
library(factoextra)
library(flexclust)
set.seed(123)
```

```
#Summary
summary(Assignment4)
```

```
##      Symbol      Name      Market_Cap      Beta
## Length:21      Length:21      Min.   : 0.41      Min.   :0.1800
## Class :character Class :character 1st Qu.: 6.30      1st Qu.:0.3500
## Mode  :character Mode  :character Median : 48.19      Median :0.4600
##                                     Mean  : 57.65      Mean  :0.5257
##                                     3rd Qu.: 73.84      3rd Qu.:0.6500
##                                     Max.   :199.47      Max.   :1.1100
##      PE_Ratio      ROE      ROA      Asset_Turnover      Leverage
## Min.   : 3.60      Min.   : 3.9      Min.   : 1.40      Min.   :0.3      Min.   :0.0000
## 1st Qu.:18.90      1st Qu.:14.9      1st Qu.: 5.70      1st Qu.:0.6      1st Qu.:0.1600
## Median :21.50      Median :22.6      Median :11.20      Median :0.6      Median :0.3400
## Mean   :25.46      Mean   :25.8      Mean   :10.51      Mean   :0.7      Mean   :0.5857
## 3rd Qu.:27.90      3rd Qu.:31.0      3rd Qu.:15.00      3rd Qu.:0.9      3rd Qu.:0.6000
## Max.   :82.50      Max.   :62.9      Max.   :20.30      Max.   :1.1      Max.   :3.5100
##      Rev_Growth      Net_Profit_Margin      Median_Recommendation      Location
## Min.   : -3.17      Min.   : 2.6      Length:21      Length:21
## 1st Qu.: 6.38      1st Qu.:11.2      Class :character      Class :character
## Median : 9.37      Median :16.1      Mode  :character      Mode  :character
## Mean   :13.37      Mean   :15.7
## 3rd Qu.:21.87      3rd Qu.:21.1
## Max.   :34.21      Max.   :25.5
##      Exchange
## Length:21
## Class :character
## Mode  :character
##
##
##
```

```
selected.var<-c(3,4,5,6,7,8,9,10,11)
```

```
Assignment4_factor<-factor(3:11)
Assignment4_factor
```

```
## [1] 3 4 5 6 7 8 9 10 11
## Levels: 3 4 5 6 7 8 9 10 11
```

```
#Tidy data
```

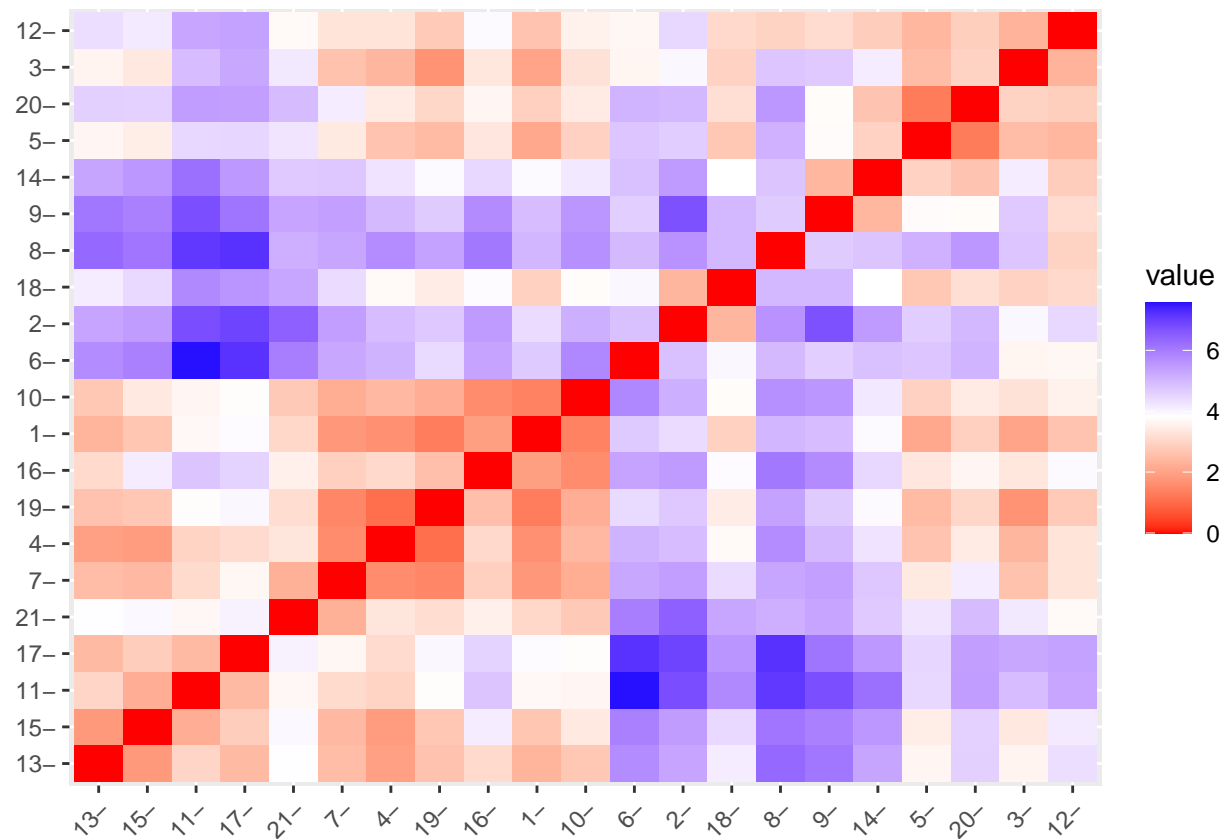
```
Assignment4a<-Assignment4 %>%
  pivot_longer(Market_Cap:Net_Profit_Margin, names_to = "financial", values_to = "values")
Assignment4a
```

```
## # A tibble: 189 x 7
```

```
##   Symbol Name           Median_Recommen~ Location Exchange financial values
##   <chr> <chr>           <chr>         <chr>    <chr>    <chr>    <dbl>
## 1 ABT      Abbott Laboratories Moderate Buy   US      NYSE    Market_C~ 68.4
## 2 ABT      Abbott Laboratories Moderate Buy   US      NYSE    Beta      0.32
## 3 ABT      Abbott Laboratories Moderate Buy   US      NYSE    PE_Ratio  24.7
## 4 ABT      Abbott Laboratories Moderate Buy   US      NYSE    ROE       26.4
## 5 ABT      Abbott Laboratories Moderate Buy   US      NYSE    ROA       11.8
## 6 ABT      Abbott Laboratories Moderate Buy   US      NYSE    Asset_Tu~ 0.7
## 7 ABT      Abbott Laboratories Moderate Buy   US      NYSE    Leverage  0.42
## 8 ABT      Abbott Laboratories Moderate Buy   US      NYSE    Rev_Grow~ 7.54
## 9 ABT      Abbott Laboratories Moderate Buy   US      NYSE    Net_Prof~ 16.1
## 10 AGN     Allergan, Inc.      Moderate Buy   CANADA  NYSE    Market_C~ 7.58
## # ... with 179 more rows
```

```
#scaling the data frame (z-score)
```

```
Assignment4[, 3:11]<-scale(Assignment4[,3:11])
distance<-get_dist(Assignment4[, 3:11])
fviz_dist(distance)
```



```
k4<-kmeans(Assignment4[, 3:11], centers = 4, nstart = 25)
k4$centers #Centroid
```

```
##      Market_Cap      Beta  PE_Ratio      ROE      ROA Asset_Turnover
## 1  1.69558112 -0.1780563 -0.1984582  1.2349879  1.3503431  1.153164e+00
## 2 -0.03142211 -0.4360989 -0.3172485  0.1950459  0.4083915  1.729746e-01
## 3 -0.82617719  0.4775991 -0.3696184 -0.5631589 -0.8514589 -9.994088e-01
## 4 -0.52462814  0.4451409  1.8498439 -1.0404550 -1.1865838  1.480297e-16
##      Leverage Rev_Growth Net_Profit_Margin
## 1 -0.4680782  0.4671788      0.5912425
## 2 -0.2744931 -0.7041516      0.5569544
## 3  0.8502201  0.9158889     -0.3319956
## 4 -0.3443544 -0.5769454     -1.6095439
```

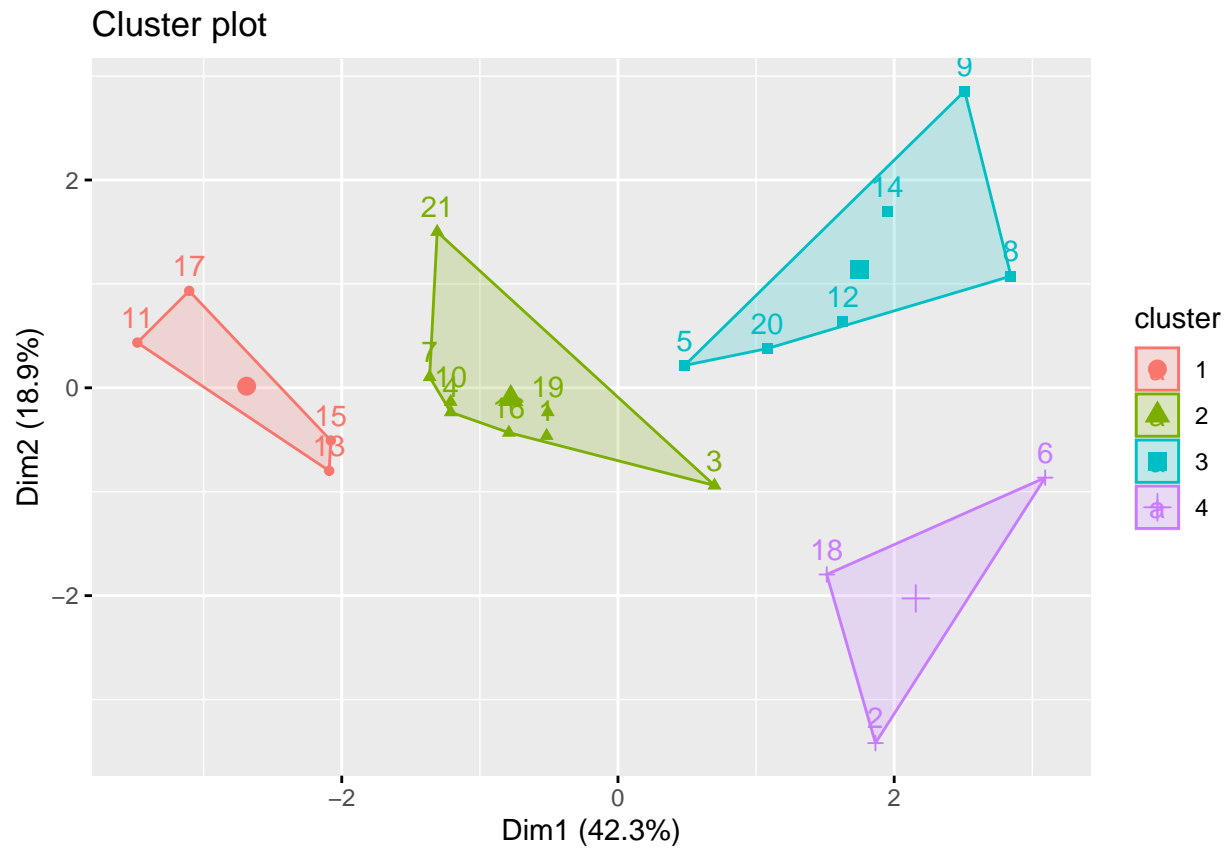
```
k4$size #Size of each Cluster
```

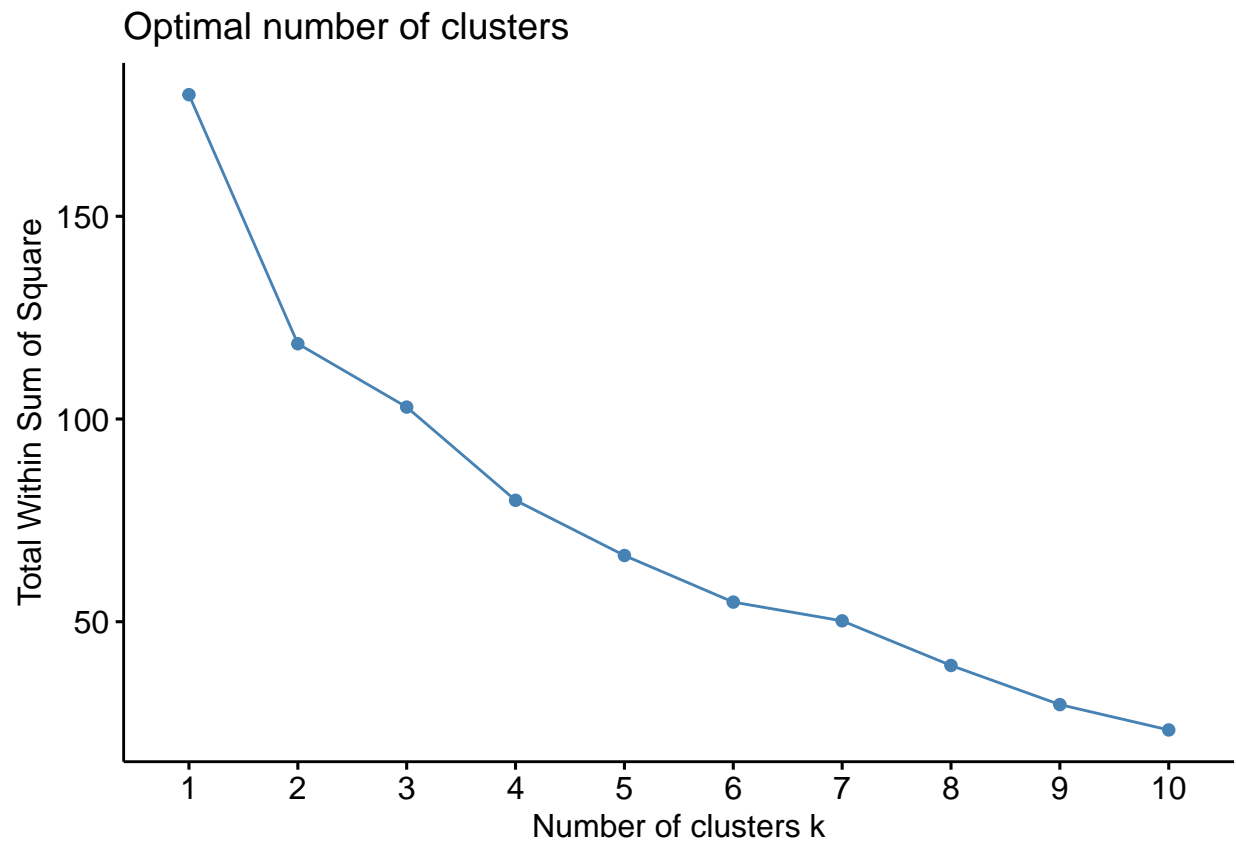
```
## [1] 4 8 6 3
```

```
k4$cluster[9] #Find the cluster of 9th observation in the dataset
```

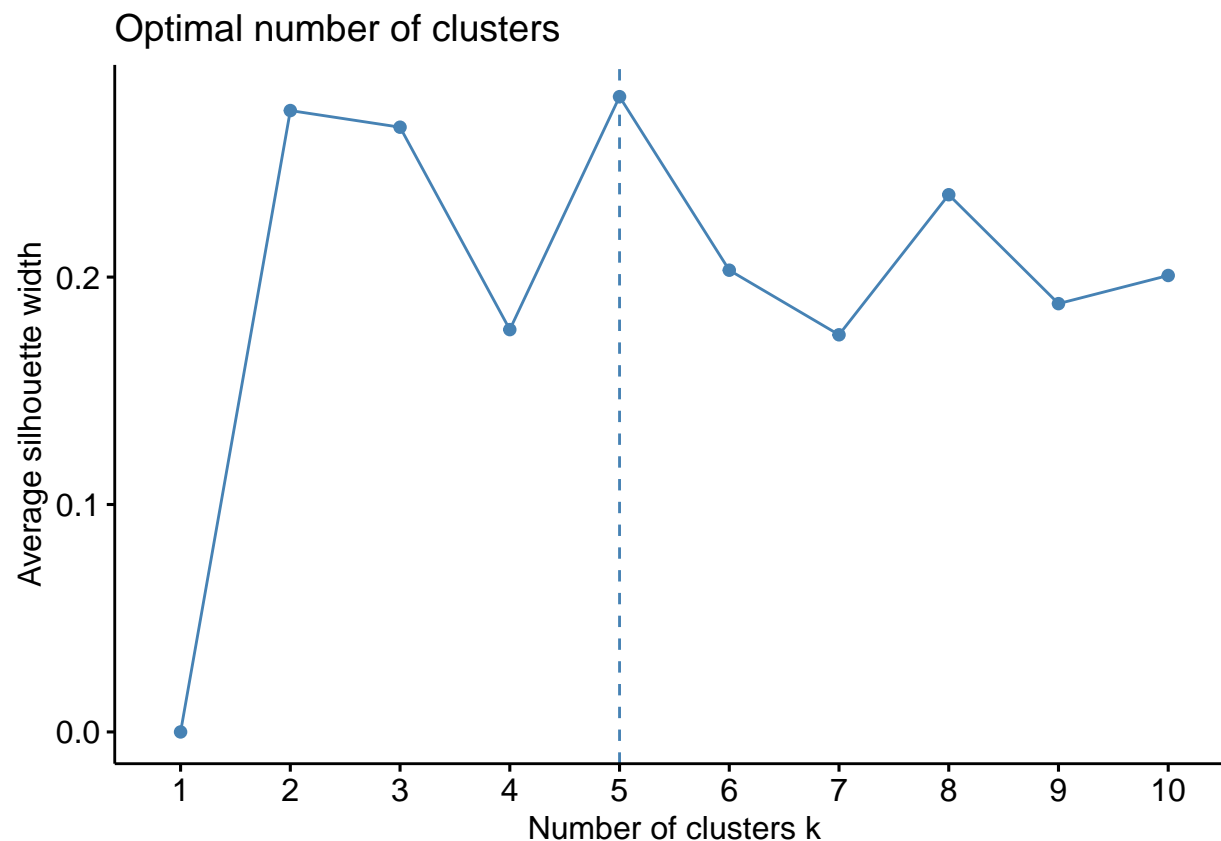
```
## [1] 3
```

```
fviz_cluster(k4, data = Assignment4[, 3:11])
```





```
Assignment4[, 3:11]<-scale(Assignment4[, 3:11])  
fviz_nbclust(Assignment4[, 3:11], kmeans, method = "silhouette")
```



```
m<-k4$cluster
c<-cbind(m, Assignment4)
c
```

##	m	Symbol	Name	Market_Cap	Beta
## 1	2	ABT	Abbott Laboratories	0.1840960	-0.80125356
## 2	4	AGN	Allergan, Inc.	-0.8544181	-0.45070513
## 3	2	AHM	Amersham plc	-0.8762600	-0.25595600
## 4	2	AZN	AstraZeneca PLC	0.1702742	-0.02225704
## 5	3	AVE	Aventis	-0.1790256	-0.80125356
## 6	4	BAY	Bayer AG	-0.6953818	2.27578267
## 7	2	BMJ	Bristol-Myers Squibb Company	-0.1078688	-0.10015669
## 8	3	CHTT	Chattem, Inc	-0.9767669	1.26308721
## 9	3	ELN	Elan Corporation, plc	-0.9704532	2.15893320
## 10	2	LLY	Eli Lilly and Company	0.2762415	-1.34655112
## 11	1	GSK	GlaxoSmithKline plc	1.0999201	-0.68440408
## 12	3	IVX	IVAX Corporation	-0.9393967	0.48409069
## 13	1	JNJ	Johnson & Johnson	1.9841758	-0.25595600
## 14	3	MRX	Medicis Pharmaceutical Corporation	-0.9632863	0.87358895
## 15	1	MRK	Merck & Co., Inc.	1.2782387	-0.25595600
## 16	2	NVS	Novartis AG	0.6654710	-1.30760129
## 17	1	PFE	Pfizer Inc	2.4199899	0.48409069
## 18	4	PHA	Pharmacia Corporation	-0.0240846	-0.48965495
## 19	2	SGP	Schering-Plough Corporation	-0.4018812	-0.06120687
## 20	3	WPI	Watson Pharmaceuticals, Inc.	-0.9281345	-1.11285216
## 21	2	WYE	Wyeth	-0.1614497	0.40619104

##	PE_Ratio	ROE	ROA	Asset_Turnover	Leverage	Rev_Growth
## 1	-0.04671323	0.04009035	0.2416121	-1.807623e-16	-0.21209793	-0.52776752
## 2	3.49706911	-0.85483986	-0.9422871	9.225312e-01	0.01828430	-0.38113909
## 3	-0.29195768	-0.72225761	-0.5100700	9.225312e-01	-0.40408312	-0.57211809
## 4	-0.24290879	0.10638147	0.9181259	9.225312e-01	-0.74965647	0.14744734
## 5	-0.32874435	-0.26484883	-0.5664461	-4.612656e-01	-0.31449003	1.21638667
## 6	0.14948233	-1.45146000	-1.7127612	-4.612656e-01	-0.74965647	-1.49714434
## 7	-0.70887325	0.59693581	0.8617498	9.225312e-01	-0.02011273	-0.96584257
## 8	0.03299122	-0.11237924	-1.1677918	-4.612656e-01	3.74279705	-0.63276071
## 9	-1.34037772	-0.70899938	-1.0174553	-1.845062e+00	0.61983791	1.88617085
## 10	0.14948233	0.34502953	0.5610770	-4.612656e-01	-0.07130879	-0.64814764
## 11	-0.45749769	2.45971647	1.8389364	1.383797e+00	-0.31449003	0.76926048
## 12	-0.34100657	-0.29136529	-0.6979905	-4.612656e-01	1.10620040	0.05603085
## 13	0.18013789	0.18593083	1.0872544	9.225312e-01	-0.62166634	-0.36213170
## 14	0.19240011	-0.96753478	-0.9610792	-1.845062e+00	0.44065173	1.53860717
## 15	-0.40231769	0.98142435	0.8429577	1.845062e+00	-0.39128411	0.36014907
## 16	-0.23677768	-0.52338423	0.1288598	-9.225312e-01	-0.67286239	-1.45369888
## 17	-0.11415545	1.31287998	1.6322239	4.612656e-01	-0.54487226	1.10143723
## 18	1.90298017	-0.81506519	-0.9047030	-4.612656e-01	-0.30169102	0.14744734
## 19	-0.40231769	-0.21181593	0.5234929	4.612656e-01	-0.74965647	-0.43544591
## 20	-0.43297324	-1.03382590	-0.6979905	-9.225312e-01	-0.49367621	1.43089863
## 21	-0.75792214	1.92938746	0.5422849	-4.612656e-01	0.68383297	-1.17763919
##	Net_Profit_Margin	Median_Recommendation	Location	Exchange		
## 1	0.06168225	Moderate Buy	US	NYSE		
## 2	-1.55366706	Moderate Buy	CANADA	NYSE		
## 3	-0.68503583	Strong Buy	UK	NYSE		
## 4	0.35122600	Moderate Sell	UK	NYSE		
## 5	-0.42597037	Moderate Buy	FRANCE	NYSE		
## 6	-1.99560225	Hold	GERMANY	NYSE		
## 7	0.74744375	Moderate Sell	US	NYSE		
## 8	-1.24888417	Moderate Buy	US	NASDAQ		
## 9	-0.36501379	Moderate Sell	IRELAND	NYSE		
## 10	1.17413980	Hold	US	NYSE		
## 11	0.82363947	Hold	UK	NYSE		
## 12	-0.71551412	Hold	US	AMEX		
## 13	0.33598685	Moderate Buy	US	NYSE		
## 14	0.85411776	Moderate Buy	US	NYSE		
## 15	-0.24310064	Hold	US	NYSE		
## 16	1.02174835	Hold	SWITZERLAND	NYSE		
## 17	1.44844440	Moderate Buy	US	NYSE		
## 18	-1.27936246	Hold	US	NYSE		
## 19	0.29026942	Hold	US	NYSE		
## 20	-0.09070919	Moderate Sell	US	NYSE		
## 21	1.49416183	Hold	US	NYSE		
