Pràctica 2: Neteja i validació de les dades

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Taula de contingut

1 Descripció del dataset.

Treballarem amb el dataset que vam generar a la pràctica 1 amb les companyies més importants de la llista Fortune.

Aquest dataset és interessant, ja que ens dóna una visió de quines són les companyies més importants dels EUA i de les seves característiques.

- **rank** → Posició en la llista fortune
- **title** → Nom de la companyia
- **revenue** → Ingressos de l'últim any fiscal
- **ceo** → Nom del CEO
- **position** → Càrrec que ocupa el CEO
- **sector** → Sector industrial en el qual opera l'empresa
- **industry** → Indústria dins del sector en la cual opera l'empresa
- **hq** → Ubicació de la seu general
- **website** → URL de la pàgina web de la companyia
- **years** → Anys en la llista fortune
- **employees** → Nombre d'empleats
- **image** → Nom del fitxer amb la imatge corporativa

Analitzant aquest conjunt de dades intentarem estudiar quins són els sectors dominants i la diferència entre el nombre d'homes i dones que ocupen càrrecs directius.

El dataset original es troba al següent repositori: https://github.com/victor427/PRAC1-Web-Scraping

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2 Neteja de les dades.

2.1 Carregar el fitxer

Fem una primera inspecció del fitxer, el que podem veure és un fitxer del tipus CSV amb algunes característiques com:

- Els valors es separen amb una coma (;)
- Té capçalera
- Els números fan servir la notació americana i fan servir la coma (,) per separar els milers i el punt (.) com a separador decimal

Amb aquesta informació podem fer servir la funció *read.csv* per llegir el fitxer i transformar-lo en dades estructurades.

```
inputFile <- "./PRAC1-Web-Scraping-master/data/fortune500.csv"


writeLines(readLines(inputFile, n = 5))
```

```
## rank;title;revenue;ceo;position;sector;industry;hq;website;years;em
ployees;image;

## 1;Walmart;$500,343;C. Douglas McMillon;President, Chief Executive O
fficer & Director;Retailing;General Merchandisers;Bentonville, Ark.;ww
w.stock.walmart.com;24;2,300,000;walmart-fortune-5001;

## 2;Exxon Mobil;$244,363;Darren W. Woods;Chairman & Chief Executive O
fficer;Energy;Petroleum Refining;Irving, Texas;www.exxonmobil.com;24;7
1,200;exxonmobil-fortune-500;

## 3;Berkshire Hathaway;$242,137;Warren E. Buffett;Chairman, President
& Chief Executive Officer;Financials;Insurance: Property and Casualty
(Stock);Omaha;www.berkshirehathaway.com;24;377,000;berkshire-hathaway-
fortune-5001;

## 4;Apple;$229,234;Timothy D. Cook;Chairman & Chief Executive Officer
;Technology;Computers, Office Equipment;Cupertino, Calif.;www.apple.co
m;24;123,000;apple-fortune-500;
```

```
f500 <- read.csv(inputFile, header = TRUE, sep = ";", quote = "\"", de
c = ".")
```

El fitxer conté 1000 companyies.

2.2 Identificar les variables

Aquestes són les diferents variables que tenim a les nostres dades i el seu tipus.

- **rank** → Quantitativa discreta
- **title** → Qualitativa nominal
- **revenue** → Quantitativa contínua
- **ceo** → Qualitativa nominal
- **position** → Qualitativa nominal
- **sector** → Qualitativa nominal
- **industry** → Qualitativa nominal
- **hq** → Qualitativa nominal
- **website** → Qualitativa nominal
- **years** → Quantitativa discreta
- **employees** → Quantitativa discreta
- **image** → Qualitativa nominal

2.3 Corretgir el tipus de variables

Per saber quin tipus hi ha assignat R a cada variable podem fer servir la funció class sobre el conjunt de dades. Si s'ha identificat erròniament alguna variable definirem manualment el tipus que volem.

```
lapply(f500, class)
```

```
## $rank
## [1] "integer"
##
## $title
## [1] "factor"
##
## $revenue
## [1] "factor"
##
## $ceo
## [1] "factor"
##
## $position
## [1] "factor"
##
## $sector
## [1] "factor"
##
## $industry
```

```
## [1] "factor"
##
## $hq
## [1] "factor"
##
## $website
## [1] "factor"
##
## $years
## [1] "factor"
##
## $employees
## [1] "factor"
##
## $image
## [1] "factor"
##
## $X
## [1] "logical"
f500[13] <- NULL

f500$revenue <- gsub('[$]','',f500$revenue)
f500$revenue <- gsub('[,]','',f500$revenue)

f500$rank      <- as.integer(f500$rank)
f500$title     <- as.factor(f500$title)
f500$revenue   <- as.numeric(f500$revenue)
f500$ceo       <- sapply(f500$ceo, toString)
f500$position  <- as.factor(f500$position)
f500$sector    <- as.factor(f500$sector)
f500$industry  <- as.factor(f500$industry)
f500$hq        <- as.factor(f500$hq)
f500$website   <- as.factor(f500$website)
f500$years     <- as.integer(f500$years)
f500$employees <- as.integer(f500$employees)
f500$image     <- as.factor(f500$image)
```

```
lapply(f500, class)
```

```
## $rank
## [1] "integer"
##
## $title
## [1] "factor"
##
## $revenue
## [1] "numeric"
##
## $ceo
## [1] "character"
##
## $position
## [1] "factor"
##
## $sector
## [1] "factor"
##
## $industry
## [1] "factor"
##
## $hq
## [1] "factor"
##
## $website
## [1] "factor"
##
## $years
## [1] "integer"
##
## $employees
## [1] "integer"
##
## $image
## [1] "factor"
```

2.4 Búsqueda de valors atípics

Fem un boxplot per les variables quantitatives i observem si existeixen outliers

En aquest cas els outliers de la variable revenue són dades coherents, i per la variable employees no hem trobat cap valor atípic.

2.4.1 Eliminar variables que no utilitzem

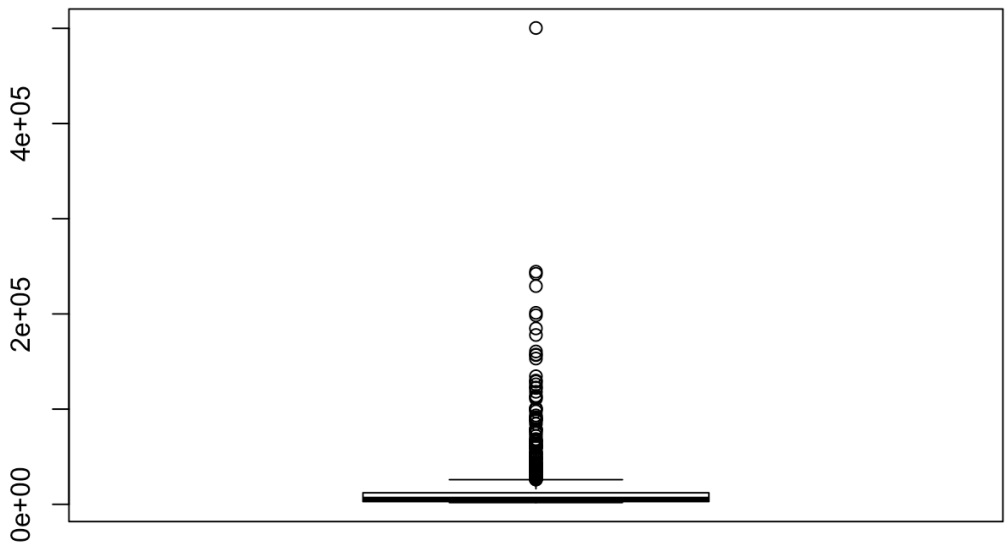
Les variables website i image no les utilitzarem així que les eliminarem del dataset.

La variable website és l'URL de la pàgina web de la companyia, la variable imatge és el nom del fitxer .jpg associat amb la imatge corporativa. No són característiques que estudiarem així que les podem deixar fora.

```
# website
f500[12] <- NULL
# image
f500[9] <- NULL
```

2.4.2 Boxplots de les variables quantitatives

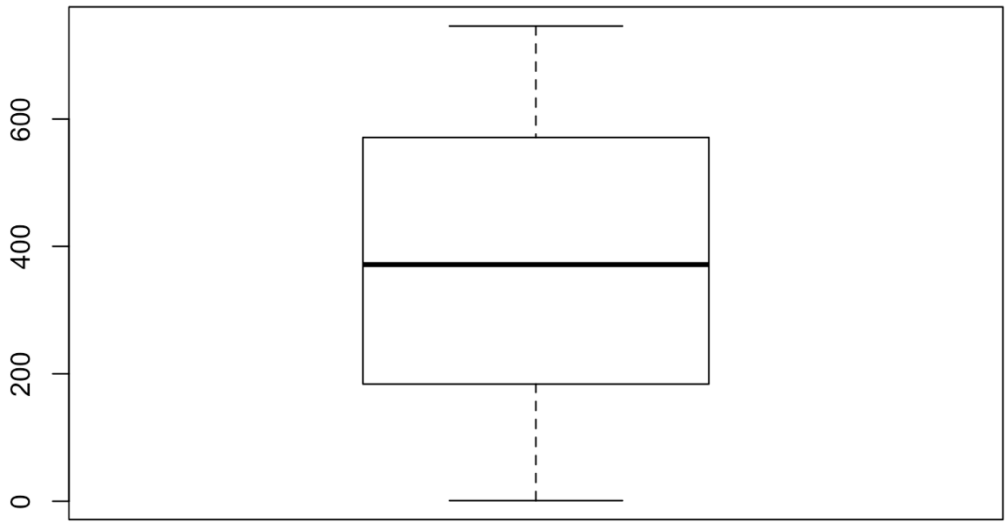
```
boxplot(f500$revenue)
```



```
boxplot.stats(f500$revenue)$out
```

```
##   [1] 500343.0 244363.0 242137.0 229234.0 201159.0 198533.0 184765.
0
##   [8] 177866.0 160546.0 157311.0 156776.0 153144.0 134533.0 129976.
0
##  [15] 129025.0 126034.0 122662.0 122274.0 118214.0 113899.0 112394.
0
##  [22] 110855.0 100904.0 100264.0 100064.6  97741.0  93392.0  91568.
0
##  [29]  90039.4  89950.0  88407.0  87966.0  84526.0  79139.0  78660.
0
##  [36]  78330.8  76450.0  74676.0  71879.0  68619.0  67610.0  66217.
0
##  [43]  66153.0  65872.0  63525.0  62761.0  62683.0  60828.0  60535.
0
##  [50]  60319.0  59837.0  59689.0  59678.2  55371.1  55137.0  53767.
0
##  [57]  52546.0  52056.0  51048.0  49520.0  48572.0  48005.0  47653.
0
##  [64]  47487.0  45462.0  43939.9  43642.0  42687.0  42296.0  42254.
0
##  [71]  42207.0  42151.0  41616.0  41581.0  41244.0  40653.0  40534.
0
##  [78]  40122.0  38524.0  38260.0  37736.0  37728.0  36775.0  36025.
3
##  [85]  35864.7  35583.0  35410.0  34836.8  34350.0  34204.0  33695.
5
##  [92]  33531.0  33495.4  32845.1  32584.0  31934.8  31657.0  31271.
0
##  [99]  30973.0  30015.8  29999.0  29737.7  29423.6  29331.0  29241.
5
## [106]  28902.0  28871.0  28748.0  28500.0  28216.0  27390.0  26839.
0
## [113]  26812.5  26232.0  26223.0  26107.0
```

```
boxplot(f500$employees)
```




```
boxplot.stats(f500$employees)$out
```

```
## integer(0)
```

2.5 Valors perduts

S'han trobat valors perduts en les variables ceo, position, industry, hq, website, years, employees i image.

En el cas de les variables website i image no és rellevant, ja que no les farem servir en l'estudi del dataset i molts registres no tenen aquestes dades.

Després s'han torbat 14 registres que estan incomplets i depenent de les observacions que estem fent sobre el dataset haurem de tenir present treure aquestes dades.

```
sapply(f500, function(x) sum(is.na(x)))
```

```
##      rank     title   revenue       ceo  position    sector  indust
ry
##         0         0         0         0        14         0
14
##        hq     years employees
##        14        14        14
```

3 Anàlisi de les dades.

3.1 Estudi de les companyies per sector

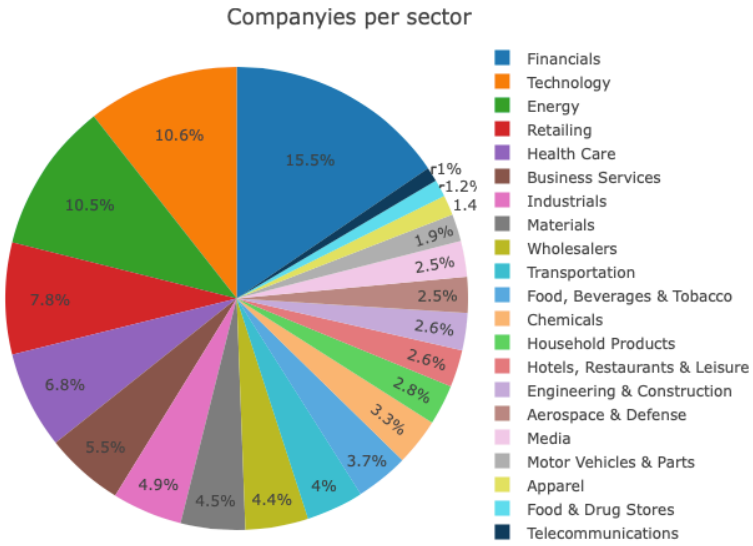
Visualitzem en un gràfic com es distribueixen les empreses de la llista per sector comercial (variable sector).

Els setors comercials presents al dataset són:

```
levels(f500$sector)
```

```
##  [1] "Aerospace & Defense"           "Apparel"
##  [3] "Business Services"             "Chemicals"
##  [5] "Energy"                        "Engineering & Construction"
##  [7] "Financials"                    "Food & Drug Stores"
##  [9] "Food, Beverages & Tobacco"     "Health Care"
## [11] "Hotels, Restaurants & Leisure" "Household Products"
## [13] "Industrials"                   "Materials"
## [15] "Media"                         "Motor Vehicles & Parts"
## [17] "Retailing"                     "Technology"
## [19] "Telecommunications"            "Transportation"
## [21] "Wholesalers"
```

```
plot_ly(f500, labels = ~sector, type = 'pie') %>%
  layout(title = 'Companyies per sector',
         xaxis = list(showgrid = FALSE, zeroline = FALSE, showticklabels = FALSE),
         yaxis = list(showgrid = FALSE, zeroline = FALSE, showticklabels = FALSE))
```


Companyies per sector
15.5%
10.6%
10.5%
7.8%
6.8%
5.5%
4.9%
4.5%
4.4%
4%
3.7%
3.3%
2.8%
2.6%
2.6%
2.5%
2.5%
1.9%
1.4
Financials
Technology
Energy
Retailing
Health Care
Business Services
Industrials
Materials
Wholesalers
Transportation
Food, Beverages & Tobacco
Chemicals
Household Products
Hotels, Restaurants & Leisure
Engineering & Construction
Aerospace & Defense
Media
Motor Vehicles & Parts
Apparel
Food & Drug Stores
Telecommunications

El camp industry ens dóna informació sobre a quina indústria dins del sector comercial es dedica la companya, podríem veure aquest atribut com un nivell més de la categoria sector. Les categories que disposem són moltes, les podem veure a continuació en la llista, i en un gràfic general no ens aportaria gaire informació. Estudiarem aquesta variable en els sectors més importants (quant a volum d'empreses que hi participen).

```
levels(f500$industry)
```

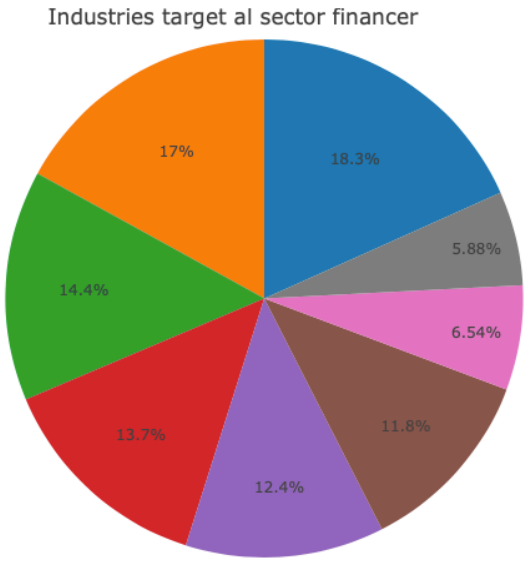
```
##  [1] "Advertising, marketing"
##  [2] "Aerospace and Defense"
##  [3] "Airlines"
##  [4] "Apparel"
##  [5] "Automotive Retailing, Services"
##  [6] "Beverages"
##  [7] "Building Materials, Glass"
##  [8] "Chemicals"
##  [9] "Commercial Banks"
## [10] "Computer Software"
## [11] "Computers, Office Equipment"
## [12] "Construction and Farm Machinery"
## [13] "Diversified Financials"
## [14] "Diversified Outsourcing Services"
## [15] "Education"
## [16] "Electronics, Electrical Equip."
## [17] "Energy"
## [18] "Engineering, Construction"
## [19] "Entertainment"
## [20] "Financial Data Services"
## [21] "Food Consumer Products"
## [22] "Food Production"
## [23] "Food Services"
## [24] "Food and Drug Stores"
## [25] "Forest and Paper Products"
## [26] "General Merchandisers"
## [27] "Health Care: Insurance and Managed Care"
## [28] "Health Care: Medical Facilities"
## [29] "Health Care: Pharmacy and Other Services"
## [30] "Home Equipment, Furnishings"
## [31] "Homebuilders"
## [32] "Hotels, Casinos, Resorts"
```

```
## [33] "Household and Personal Products"
## [34] "Industrial Machinery"
## [35] "Information Technology Services"
## [36] "Insurance: Life, Health (Mutual)"
## [37] "Insurance: Life, Health (stock)"
## [38] "Insurance: Property and Casualty (Mutual)"
## [39] "Insurance: Property and Casualty (Stock)"
## [40] "Internet Services and Retailing"
## [41] "Mail, Package, and Freight Delivery"
## [42] "Medical Products and Equipment"
## [43] "Metals"
## [44] "Mining, Crude-Oil Production"
## [45] "Miscellaneous"
## [46] "Motor Vehicles and Parts"
## [47] "Network and Other Communications Equipment"
## [48] "Oil and Gas Equipment, Services"
## [49] "Packaging, Containers"
## [50] "Petroleum Refining"
## [51] "Pharmaceuticals"
## [52] "Pipelines"
## [53] "Publishing, Printing"
## [54] "Railroads"
## [55] "Real estate"
## [56] "Scientific,Photographic and  Control Equipment"
## [57] "Securities"
## [58] "Semiconductors and Other Electronic Components"
## [59] "Shipping"
## [60] "Specialty Retailers: Apparel"
## [61] "Specialty Retailers: Other"
## [62] "Telecommunications"
## [63] "Temporary Help"
## [64] "Tobacco"
## [65] "Toys, Sporting Goods"
## [66] "Transportation Equipment"
## [67] "Transportation and Logistics"
## [68] "Trucking, Truck Leasing"
## [69] "Utilities: Gas and Electric"
```

```
## [70] "Waste Management"
## [71] "Wholesalers: Diversified"
## [72] "Wholesalers: Electronics and Office Equipment"
## [73] "Wholesalers: Food and Grocery"
## [74] "Wholesalers: Health Care"
```

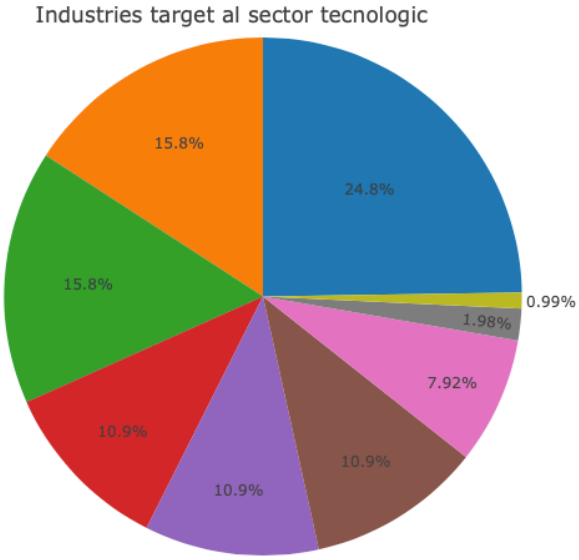
3.1.1 Industries target al sector financer

```
dfFinancials <- f500[ which(f500$sector=='Financials' & !is.na(f500$industry)), ]


plot_ly(dfFinancials, labels = ~industry, type = 'pie') %>%
  layout(title = 'Industries target al sector financer', showlegend = F,
         xaxis = list(showgrid = FALSE, zeroline = FALSE, showticklabels = FALSE),
         yaxis = list(showgrid = FALSE, zeroline = FALSE, showticklabels = FALSE))
```



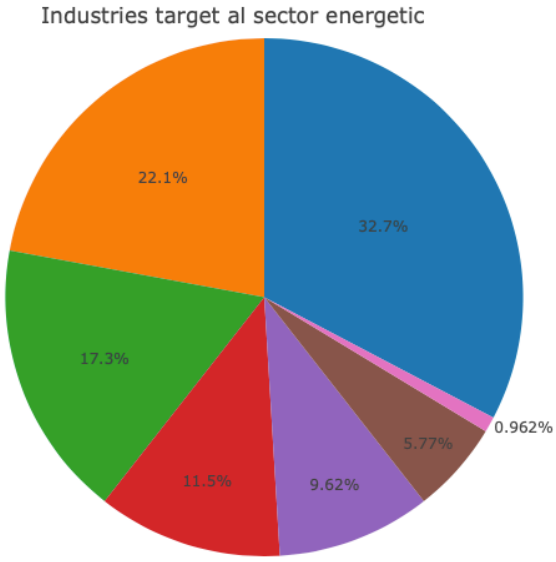
3.1.2 Industries target al sector tecnològic

```
dfTechnology <- f500[ which(f500$sector=='Technology' & !is.na(f500$in
dustry)), ]


plot_ly(dfTechnology, labels = ~industry, type = 'pie') %>%
  layout(title = 'Industries target al sector tecnologic', showlegend
= F,
         xaxis = list(showgrid = FALSE, zeroline = FALSE, showticklabe
ls = FALSE),
         yaxis = list(showgrid = FALSE, zeroline = FALSE, showticklabe
ls = FALSE))
```



3.1.3 Industries target al sector energètic

```
dfEnergy <- f500[ which(f500$sector=='Energy' & !is.na(f500$industry))
, ]


plot_ly(dfEnergy, labels = ~industry, type = 'pie') %>%
  layout(title = 'Industries target al sector energetic', showlegend =
F,
         xaxis = list(showgrid = FALSE, zeroline = FALSE, showticklabe
ls = FALSE),
         yaxis = list(showgrid = FALSE, zeroline = FALSE, showticklabe
ls = FALSE))
```



3.2 Estudi dels CEOs de les companyies

Estudiarem quantes dones i homes ocupen càrrecs directius en les empreses de la llisa fortune.

3.2.1 Incorporar la variable Sex

Per a realitzar l'estudi necessitem introduir una nova variable Sex que indiqui si el CEO de l'empresa és una dona (F) o un home (M). Això ho farem amb el paquet gender.

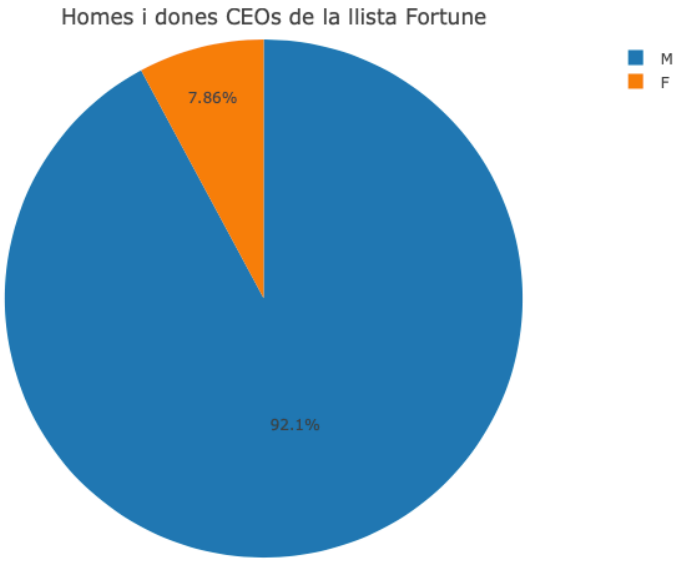
```
predictGender <- function(name) {

  if (is.na(name)) {
    return(NA)
  }

  fullName <- unlist(strsplit(name, " ", fixed = TRUE))

  if (length(fullName) > 1) {
    if (nchar(fullName[1]) > 2) {
      name <- fullName[1]
    } else {
      name <- fullName[2]
    }
  } else {
    name <- fullName[1]
  }

  predGender <- gender(name)

  if (nrow(predGender) != 1) {
    return(NA)
  }

  gender <- predGender$gender

  if (gender == "female") {
    return('F')
  } else {
    return('M')
```

```
  }

}

f500$sex <- NA

f500$sex <- sapply(f500$ceo, predictGender)

f500$sex  <- as.factor(f500$sex)

head(f500[, c(4, 11)], n = 20)
```

```
##                       ceo sex
## 1    C. Douglas McMillon   M
## 2         Darren W. Woods   M
## 3       Warren E. Buffett   M
## 4         Timothy D. Cook   M
## 5       David S. Wichmann   M
## 6      John H. Hammergren   M
## 7          Larry J. Merlo   M
## 8        Jeffrey P. Bezos   M
## 9  Randall L. Stephenson   M
## 10          Mary T. Barra   F
## 11       James P. Hackett   M
## 12       Steven H. Collis   M
## 13       Michael K. Wirth   M
## 14   Michael C. Kaufmann   M
## 15       W. Craig Jelinek   M
## 16       Hans E. Vestberg   M
## 17    W. Rodney McMullen   M
## 18  H. Lawrence Culp Jr.   M
## 19        Stefano Pessina   M
## 20            James Dimon   M
```

3.2.2 Gràfic Homes i dones CEOs de la llista Fortune

```
f500 <- f500[ which(!is.na(f500$sex)), ]


plot_ly(f500, labels = ~sex, type = 'pie') %>%
  layout(title = 'Homes i dones CEOs de la llista Fortune',
         xaxis = list(showgrid = FALSE, zeroline = FALSE, showticklabels = FALSE),
         yaxis = list(showgrid = FALSE, zeroline = FALSE, showticklabels = FALSE))
```



```
f500[which(f500$sex == 'F'), c(2, 4, 5)]
```

```
##                                 title                    ceo
## 10                     General Motors          Mary T. Barra
## 29                             Anthem      Gail K. Boudreaux
## 30                          Microsoft          Satya Nadella
## 34                                IBM    Virginia M. Rometty
## 47                          DowDuPont                     NA
## 59                     Lockheed Martin     Marillyn A. Hewson
## 63                     HCA Healthcare                     NA
## 90                           Andeavor                     NA
## 99                   General Dynamics     Phebe N. Novakovic
## 112                     Progressive Susan Patricia Griffith
## 125                     Duke Energy           Lynn J. Good
## 157                 Kohl\342\200\231s       Michelle D. Gass
## 159                           Jabil                     NA
## 168                      PG&E Corp.     Geisha J. Williams
## 173              Synchrony Financial      Margaret M. Keane
## 175          Bank of New York Mellon                     NA
## 209                     Ross Stores         Barbara Rentler
## 216          Land O\342\200\231Lakes               Beth Ford
## 220             Occidental Petroleum        Vicki A. Hollub
## 231                         L Brands       Leslie H. Wexner
## 233                 Dominion Energy                     NA
## 234     Reinsurance Group of America           Anna Manning
## 235                     J.C. Penney         Jill A. Soltau
## 239 Guardian Life Ins. Co. of America     Deanna M. Mulligan
## 250                      BB&T Corp.          Kelly S. King
## 304                   IQVIA Holdings                     NA
## 335            Hertz Global Holdings   Kathryn V. Marinello
## 346                         Veritiv     Mary A. Laschinger
## 358                   Campbell Soup     Denise M. Morrison
## 372                WEC Energy Group          Gale E. Klappa
## 376   Jones Financial (Edward Jones)                     NA
## 379                         Hershey        Michele G. Buck
## 402                 JetBlue Airways            Robin Hayes
## 412                         KeyCorp         Beth E. Mooney
```

```
## 421                    Ralph Lauren          Patrice Louvet
## 426                Graybar Electric  Kathleen M. Mazzarella
## 429                     CMS Energy       Patricia K. Poppe
## 471                     Ulta Beauty          Mary N. Dillon
## 485                   Avon Products          Jan Zijderveld
## 506          Advanced Micro Devices              Lisa T. Su
## 508                Williams-Sonoma          Laura J. Alber
## 525              Commercial Metals        Barbara R. Smith
## 543         Brookdale Senior Living        Lucinda M. Baier
## 555                        Tapestry                    NA
## 584       Bloomin\342\200\231 Brands      Elizabeth A. Smith
## 593                   Quad/Graphics                    NA
## 606                Encompass Health                    NA
## 608                          Nasdaq       Adena T. Friedman
## 616            Taylor Morrison Home        Sheryl D. Palmer
## 652                          Ventas         Debra A. Cafaro
## 658                       CIT Group        Ellen R. Alemany
## 666             Abercrombie & Fitch  Fran Horowitz-Bonadies
## 669                     Puget Energy     Kimberly J. Harris
## 682                  Alliant Energy    Patricia L. Kampling
## 690            American Water Works          Susan N. Story
## 698             IAC/InterActiveCorp                    NA
## 708                             USG     Jennifer F. Scanlon
## 742  Cracker Barrel Old Country Store       Sandra B. Cochran
## 761       Penn Mutual Life Insurance     Eileen C. McDonnell
## 763                         ArcBest      Judy R. McReynolds
## 772                       Convergys         Andrea J. Ayers
## 778                         Caleres       Diane M. Sullivan
## 795                          Revlon       Debra G. Perelman
## 814                             ITT         Denise L. Ramos
## 819     Hawaiian Electric Industries        Constance H. Lau
## 842            Hovnanian Enterprises        Ara K. Hovnanian
## 846            Parexel International         Jamie Macdonald
## 867                 Cleveland-Cliffs                    NA
## 881           Chico\342\200\231s FAS      Shelley G. Broader
## 883                  Herman Miller              Andi Owen
## 894                Tupperware Brands     Patricia A. Stitzel
```

```
## 953         Portland General Electric           Maria M. Pope
## 957           AMN Healthcare Services          Susan R. Salka
## 963                           M/I Homes                      NA
## 976                 Engility Holdings           Lynn A. Dugle
## 989       Aerojet Rocketdyne Holdings         Eileen P. Drake
## 993       Children\342\200\231s Place          Jane T. Elfers
##                                          position
## 10             Chairman & Chief Executive Officer
## 29  President, Chief Executive Officer & Director
## 30             Chief Executive Officer & Director
## 34  Chairman, President & Chief Executive Officer
## 47                                          <NA>
## 59  Chairman, President & Chief Executive Officer
## 63                                          <NA>
## 90                                          <NA>
## 99             Chairman & Chief Executive Officer
## 112 President, Chief Executive Officer & Director
## 125 Chairman, President & Chief Executive Officer
## 157            Chairman & Chief Executive Officer
## 159                                         <NA>
## 168 President, Chief Executive Officer & Director
## 173 President, Chief Executive Officer & Director
## 175                                         <NA>
## 209            Chairman & Chief Executive Officer
## 216 President, Chief Executive Officer & Director
## 220 President, Chief Executive Officer & Director
## 231 Chairman, President & Chief Executive Officer
## 233                                         <NA>
## 234 President, Chief Executive Officer & Director
## 235            Chairman & Chief Executive Officer
## 239 President, Chief Executive Officer & Director
## 250            Chairman & Chief Executive Officer
## 304                                         <NA>
## 335 President, Chief Executive Officer & Director
## 346            Chairman & Chief Executive Officer
## 358 President, Chief Executive Officer & Director
## 372            Chairman & Chief Executive Officer
```

```
## 376                                              <NA>
## 379 President, Chief Executive Officer & Director
## 402 President, Chief Executive Officer & Director
## 412 Chairman, President & Chief Executive Officer
## 421 President, Chief Executive Officer & Director
## 426 Chairman, President & Chief Executive Officer
## 429 President, Chief Executive Officer & Director
## 471            Chairman & Chief Executive Officer
## 485            Chairman & Chief Executive Officer
## 506 President, Chief Executive Officer & Director
## 508 President, Chief Executive Officer & Director
## 525 Chairman, President & Chief Executive Officer
## 543 President, Chief Executive Officer & Director
## 555                                              <NA>
## 584 Chairman, President & Chief Executive Officer
## 593                                              <NA>
## 606                                              <NA>
## 608 President, Chief Executive Officer & Director
## 616 Chairman, President & Chief Executive Officer
## 652            Chairman & Chief Executive Officer
## 658                               Chairwoman & CEO
## 666            Chief Executive Officer & Director
## 669 President, Chief Executive Officer & Director
## 682            Chairman & Chief Executive Officer
## 690 President, Chief Executive Officer & Director
## 698                                              <NA>
## 708 President, Chief Executive Officer & Director
## 742 President, Chief Executive Officer & Director
## 761            Chairman & Chief Executive Officer
## 763 Chairman, President & Chief Executive Officer
## 772 President, Chief Executive Officer & Director
## 778 Chairman, President & Chief Executive Officer
## 795       Vice Chairman & Chief Executive Officer
## 814 President, Chief Executive Officer & Director
## 819 President, Chief Executive Officer & Director
## 842 Chairman, President & Chief Executive Officer
## 846                         Chief Executive Officer
```

```
## 867                                          <NA>
## 881 President, Chief Executive Officer & Director
## 883 President, Chief Executive Officer & Director
## 894 President, Chief Executive Officer & Director
## 953 President, Chief Executive Officer & Director
## 957 President, Chief Executive Officer & Director
## 963                                          <NA>
## 976 Chairman, President & Chief Executive Officer
## 989 President, Chief Executive Officer & Director
## 993 President, Chief Executive Officer & Director
```

Intentarem crear un model que pugui relacionar l'observació de la variable sex amb les característiques de la companya (sector, indústria, ingressos i rànquing).

3.2.3 Model de regressió lineal múltiple

```
genderToNumber <- function(sex) {


  if (sex == 'F') {
    return(1)
    } else {
    return(0)
    }
}


f500 <- f500[ which(!is.na(f500$industry)), ]


f500$sexCoef <- NA


f500$sexCoef <- sapply(f500$sex, genderToNumber)


f500$sexCoef  <- as.numeric(f500$sexCoef)


model1 <- lm(sexCoef ~ sector + industry + revenue + rank, data = f500
)


summary(model1)
```

```
##
## Call:
## lm(formula = sexCoef ~ sector + industry + revenue + rank, data = f
500)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.30074 -0.08353 -0.03742  0.00007  0.96487
##
## Coefficients: (12 not defined because of singularities)
##                                                    Estimate
## (Intercept)                                       1.585e-01
## sectorApparel                                    -8.299e-02
## sectorBusiness Services                          -1.594e-01
## sectorChemicals                                  -1.600e-01
```

```
## sectorEnergy                                    8.406e-01
## sectorEngineering & Construction                6.689e-03
## sectorFinancials                               -1.101e-01
## sectorFood & Drug Stores                       -1.600e-01
## sectorFood, Beverages & Tobacco                -1.600e-01
## sectorHealth Care                              -1.607e-01
## sectorHotels, Restaurants & Leisure            -1.600e-01
## sectorHousehold Products                       -1.597e-01
## sectorIndustrials                              -1.585e-01
## sectorMaterials                                -1.588e-01
## sectorMedia                                    -1.604e-01
## sectorMotor Vehicles & Parts                   -1.074e-01
## sectorRetailing                                -1.604e-01
## sectorTechnology                               -1.602e-01
## sectorTelecommunications                       -1.600e-01
## sectorTransportation                           -6.924e-02
## sectorWholesalers                              -1.605e-01
## industryAerospace and Defense                          NA
## industryAirlines                                2.061e-02
## industryApparel                                        NA
## industryAutomotive Retailing, Services          1.009e-01
## industryBeverages                               2.327e-04
## industryBuilding Materials, Glass               8.192e-02
## industryChemicals                                      NA
## industryCommercial Banks                        7.024e-02
## industryComputer Software                       7.683e-02
## industryComputers, Office Equipment             1.647e-04
## industryConstruction and Farm Machinery        -1.114e-03
## industryDiversified Financials                  5.941e-03
## industryDiversified Outsourcing Services        7.083e-02
## industryEducation                              -1.094e-03
## industryElectronics, Electrical Equip.         -1.516e-03
## industryEnergy                                 -1.001e+00
## industryEngineering, Construction              -1.665e-01
## industryEntertainment                           4.629e-04
## industryFinancial Data Services                -6.877e-04
## industryFood Consumer Products                  1.582e-01
```

```
## industryFood Production                                    2.052e-04
## industryFood Services                                      1.667e-01
## industryFood and Drug Stores                                      NA
## industryForest and Paper Products                         -1.231e-03
## industryGeneral Merchandisers                              1.817e-01
## industryHealth Care: Insurance and Managed Care            1.007e-01
## industryHealth Care: Medical Facilities                    8.419e-02
## industryHealth Care: Pharmacy and Other Services           1.542e-01
## industryHome Equipment, Furnishings                        9.058e-02
## industryHomebuilders                                              NA
## industryHotels, Casinos, Resorts                                  NA
## industryHousehold and Personal Products                    2.140e-01
## industryIndustrial Machinery                               3.536e-02
## industryInformation Technology Services                    6.275e-02
## industryInsurance: Life, Health (Mutual)                   5.038e-02
## industryInsurance: Life, Health (stock)                    5.557e-02
## industryInsurance: Property and Casualty (Mutual)         -4.983e-02
## industryInsurance: Property and Casualty (Stock)          -1.404e-02
## industryInternet Services and Retailing                    1.766e-04
## industryMail, Package, and Freight Delivery               -9.054e-02
## industryMedical Products and Equipment                     6.432e-04
## industryMetals                                             8.231e-02
## industryMining, Crude-Oil Production                      -9.551e-01
## industryMiscellaneous                                     -8.083e-04
## industryMotor Vehicles and Parts                                  NA
## industryNetwork and Other Communications Equipment         2.316e-04
## industryOil and Gas Equipment, Services                   -1.001e+00
## industryPackaging, Containers                             -9.691e-04
## industryPetroleum Refining                                -1.001e+00
## industryPharmaceuticals                                    1.020e-03
## industryPipelines                                         -1.000e+00
## industryPublishing, Printing                               3.497e-04
## industryRailroads                                         -9.058e-02
## industryReal estate                                       -4.632e-03
## industryScientific,Photographic and  Control Equipment    -2.545e-05
## industrySecurities                                                NA
## industrySemiconductors and Other Electronic Components     4.364e-02
```

```
## industryShipping                                          -9.148e-02
## industrySpecialty Retailers: Apparel                       3.003e-01
## industrySpecialty Retailers: Other                         6.722e-02
## industryTelecommunications                                        NA
## industryTemporary Help                                    -5.871e-04
## industryTobacco                                                   NA
## industryToys, Sporting Goods                              -1.334e-04
## industryTransportation Equipment                          -9.078e-02
## industryTransportation and Logistics                      -9.069e-02
## industryTrucking, Truck Leasing                                   NA
## industryUtilities: Gas and Electric                       -7.579e-01
## industryWaste Management                                  -3.943e-04
## industryWholesalers: Diversified                           8.385e-02
## industryWholesalers: Electronics and Office Equipment      8.396e-04
## industryWholesalers: Food and Grocery                      1.101e-03
## industryWholesalers: Health Care                                  NA
## revenue                                                    1.838e-08
## rank                                                       2.343e-06
##                                                         Std. Error t
value
## (Intercept)                                                5.304e-02
2.989
## sectorApparel                                              8.369e-02
-0.992
## sectorBusiness Services                                    1.800e-01
-0.885
## sectorChemicals                                            6.584e-02
-2.430
## sectorEnergy                                               3.350e-01
2.509
## sectorEngineering & Construction                           8.597e-02
0.078
## sectorFinancials                                           7.351e-02
-1.498
## sectorFood & Drug Stores                                   8.610e-02
-1.859
## sectorFood, Beverages & Tobacco                            1.798e-01
-0.890
## sectorHealth Care                                          4.004e-01
-0.401
## sectorHotels, Restaurants & Leisure                        8.171e-02
-1.958
```

```
## sectorHousehold Products                                3.349e-01
-0.477

## sectorIndustrials                                       3.359e-01
-0.472

## sectorMaterials                                         3.354e-01
-0.473

## sectorMedia                                             3.578e-01
-0.448

## sectorMotor Vehicles & Parts                            7.450e-02
-1.442

## sectorRetailing                                         3.470e-01
-0.462

## sectorTechnology                                        3.081e-01
-0.520

## sectorTelecommunications                                9.205e-02
-1.738

## sectorTransportation                                    8.865e-02
-0.781

## sectorWholesalers                                       1.129e-01
-1.421

## industryAerospace and Defense                                 NA
NA

## industryAirlines                                        1.103e-01
0.187

## industryApparel                                               NA
NA

## industryAutomotive Retailing, Services                  3.523e-01
0.286

## industryBeverages                                       1.962e-01
0.001

## industryBuilding Materials, Glass                       3.395e-01
0.241

## industryChemicals                                             NA
NA

## industryCommercial Banks                                7.392e-02
0.950

## industryComputer Software                               3.116e-01
0.247

## industryComputers, Office Equipment                     3.132e-01
0.001

## industryConstruction and Farm Machinery                 3.430e-01
-0.003

## industryDiversified Financials                          7.999e-02
0.074

## industryDiversified Outsourcing Services                1.852e-01
0.382
```

```
## industryEducation                                        3.002e-01
-0.004

## industryElectronics, Electrical Equip.                   3.393e-01
-0.004

## industryEnergy                                           3.364e-01
-2.974

## industryEngineering, Construction                        9.627e-02
-1.730

## industryEntertainment                                    3.500e-01
0.001

## industryFinancial Data Services                          1.810e-01
-0.004

## industryFood Consumer Products                           1.820e-01
0.870

## industryFood Production                                  1.935e-01
0.001

## industryFood Services                                    9.625e-02
1.732

## industryFood and Drug Stores                                    NA
NA

## industryForest and Paper Products                        3.537e-01
-0.003

## industryGeneral Merchandisers                            3.513e-01
0.517

## industryHealth Care: Insurance and Managed Care          4.053e-01
0.249

## industryHealth Care: Medical Facilities                  4.037e-01
0.209

## industryHealth Care: Pharmacy and Other Services         4.031e-01
0.383

## industryHome Equipment, Furnishings                      3.394e-01
0.267

## industryHomebuilders                                            NA
NA

## industryHotels, Casinos, Resorts                                NA
NA

## industryHousehold and Personal Products                  3.377e-01
0.634

## industryIndustrial Machinery                             3.359e-01
0.105

## industryInformation Technology Services                  3.103e-01
0.202

## industryInsurance: Life, Health (Mutual)                 9.510e-02
0.530

## industryInsurance: Life, Health (stock)                  7.862e-02
0.707
```

```
## industryInsurance: Property and Casualty (Mutual)       9.836e-02
-0.507

## industryInsurance: Property and Casualty (Stock)        7.200e-02
-0.195

## industryInternet Services and Retailing                 3.130e-01
0.001

## industryMail, Package, and Freight Delivery             1.892e-01
-0.478

## industryMedical Products and Equipment                  4.021e-01
0.002

## industryMetals                                          3.391e-01
0.243

## industryMining, Crude-Oil Production                    3.355e-01
-2.847

## industryMiscellaneous                                   2.237e-01
-0.004

## industryMotor Vehicles and Parts                               NA
NA

## industryNetwork and Other Communications Equipment      3.179e-01
0.001

## industryOil and Gas Equipment, Services                 3.462e-01
-2.891

## industryPackaging, Containers                           3.372e-01
-0.003

## industryPetroleum Refining                              3.406e-01
-2.938

## industryPharmaceuticals                                 4.026e-01
0.003

## industryPipelines                                       3.395e-01
-2.947

## industryPublishing, Printing                            3.709e-01
0.001

## industryRailroads                                       1.321e-01
-0.686

## industryReal estate                                     7.560e-02
-0.061

## industryScientific,Photographic and  Control Equipment  3.130e-01
0.000

## industrySecurities                                             NA
NA

## industrySemiconductors and Other Electronic Components  3.084e-01
0.141

## industryShipping                                        1.883e-01
-0.486

## industrySpecialty Retailers: Apparel                    3.480e-01
0.863
```

```
## industrySpecialty Retailers: Other                          3.465e-01
0.194
## industryTelecommunications                                         NA
NA
## industryTemporary Help                                      2.049e-01
-0.003
## industryTobacco                                                    NA
NA
## industryToys, Sporting Goods                                4.118e-01
0.000
## industryTransportation Equipment                            1.320e-01
-0.688
## industryTransportation and Logistics                        1.242e-01
-0.730
## industryTrucking, Truck Leasing                                    NA
NA
## industryUtilities: Gas and Electric                         3.341e-01
-2.269
## industryWaste Management                                    2.120e-01
-0.002
## industryWholesalers: Diversified                            1.139e-01
0.736
## industryWholesalers: Electronics and Office Equipment       1.336e-01
0.006
## industryWholesalers: Food and Grocery                       1.427e-01
0.008
## industryWholesalers: Health Care                                   NA
NA
## revenue                                                     3.190e-07
0.058
## rank                                                        3.420e-05
0.069
##                                                            Pr(>|t|)
## (Intercept)                                                 0.00288 **
## sectorApparel                                               0.32163
## sectorBusiness Services                                     0.37627
## sectorChemicals                                             0.01528 *
## sectorEnergy                                                0.01227 *
## sectorEngineering & Construction                            0.93800
## sectorFinancials                                            0.13460
## sectorFood & Drug Stores                                    0.06342 .
## sectorFood, Beverages & Tobacco                             0.37383
## sectorHealth Care                                           0.68835
```

```
## sectorHotels, Restaurants & Leisure                    0.05058 .
## sectorHousehold Products                               0.63365
## sectorIndustrials                                      0.63708
## sectorMaterials                                        0.63601
## sectorMedia                                            0.65409
## sectorMotor Vehicles & Parts                           0.14963
## sectorRetailing                                        0.64414
## sectorTechnology                                       0.60328
## sectorTelecommunications                               0.08251 .
## sectorTransportation                                   0.43502
## sectorWholesalers                                      0.15571
## industryAerospace and Defense                               NA
## industryAirlines                                       0.85183
## industryApparel                                             NA
## industryAutomotive Retailing, Services                 0.77457
## industryBeverages                                      0.99905
## industryBuilding Materials, Glass                      0.80936
## industryChemicals                                           NA
## industryCommercial Banks                               0.34221
## industryComputer Software                              0.80533
## industryComputers, Office Equipment                    0.99958
## industryConstruction and Farm Machinery                0.99741
## industryDiversified Financials                         0.94081
## industryDiversified Outsourcing Services               0.70225
## industryEducation                                      0.99709
## industryElectronics, Electrical Equip.                 0.99644
## industryEnergy                                         0.00301 **
## industryEngineering, Construction                      0.08399 .
## industryEntertainment                                  0.99895
## industryFinancial Data Services                        0.99697
## industryFood Consumer Products                         0.38478
## industryFood Production                                0.99915
## industryFood Services                                  0.08366 .
## industryFood and Drug Stores                                NA
## industryForest and Paper Products                      0.99722
## industryGeneral Merchandisers                          0.60506
## industryHealth Care: Insurance and Managed Care        0.80377
```

```
## industryHealth Care: Medical Facilities                 0.83485
## industryHealth Care: Pharmacy and Other Services        0.70215
## industryHome Equipment, Furnishings                     0.78965
## industryHomebuilders                                         NA
## industryHotels, Casinos, Resorts                             NA
## industryHousehold and Personal Products                 0.52642
## industryIndustrial Machinery                            0.91617
## industryInformation Technology Services                 0.83977
## industryInsurance: Life, Health (Mutual)                0.59640
## industryInsurance: Life, Health (stock)                 0.47988
## industryInsurance: Property and Casualty (Mutual)       0.61255
## industryInsurance: Property and Casualty (Stock)        0.84541
## industryInternet Services and Retailing                 0.99955
## industryMail, Package, and Freight Delivery             0.63244
## industryMedical Products and Equipment                  0.99872
## industryMetals                                          0.80826
## industryMining, Crude-Oil Production                    0.00452 **
## industryMiscellaneous                                   0.99712
## industryMotor Vehicles and Parts                             NA
## industryNetwork and Other Communications Equipment      0.99942
## industryOil and Gas Equipment, Services                 0.00394 **
## industryPackaging, Containers                           0.99771
## industryPetroleum Refining                              0.00339 **
## industryPharmaceuticals                                 0.99798
## industryPipelines                                       0.00329 **
## industryPublishing, Printing                            0.99925
## industryRailroads                                       0.49308
## industryReal estate                                     0.95116
## industryScientific,Photographic and  Control Equipment  0.99994
## industrySecurities                                           NA
## industrySemiconductors and Other Electronic Components  0.88751
## industryShipping                                        0.62717
## industrySpecialty Retailers: Apparel                    0.38842
## industrySpecialty Retailers: Other                      0.84621
## industryTelecommunications                                   NA
## industryTemporary Help                                  0.99771
## industryTobacco                                              NA
```

```
## industryToys, Sporting Goods                                    0.99974
## industryTransportation Equipment                                0.49171
## industryTransportation and Logistics                            0.46560
## industryTrucking, Truck Leasing                                      NA
## industryUtilities: Gas and Electric                             0.02352 *
## industryWaste Management                                        0.99852
## industryWholesalers: Diversified                                0.46190
## industryWholesalers: Electronics and Office Equipment           0.99499
## industryWholesalers: Food and Grocery                           0.99384
## industryWholesalers: Health Care                                     NA
## revenue                                                         0.95407
## rank                                                            0.94540
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2447 on 882 degrees of freedom
## Multiple R-squared:  0.1034, Adjusted R-squared:  0.01908
## F-statistic: 1.226 on 83 and 882 DF,  p-value: 0.09095
```

```
# Importància de les variables que defineixen el model:
varImp(model1, scale = FALSE)
```

```
##                                                        Overall
## sectorApparel                                     9.916619e-01
## sectorBusiness Services                           8.852347e-01
## sectorChemicals                                   2.430377e+00
## sectorEnergy                                      2.509397e+00
## sectorEngineering & Construction                  7.780615e-02
## sectorFinancials                                  1.497597e+00
## sectorFood & Drug Stores                          1.858554e+00
## sectorFood, Beverages & Tobacco                   8.897825e-01
## sectorHealth Care                                 4.012327e-01
## sectorHotels, Restaurants & Leisure               1.957714e+00
## sectorHousehold Products                          4.767555e-01
## sectorIndustrials                                 4.719500e-01
## sectorMaterials                                   4.734461e-01
## sectorMedia                                       4.482401e-01
## sectorMotor Vehicles & Parts                      1.442085e+00
## sectorRetailing                                   4.620799e-01
```

```
## sectorTechnology                                    5.198784e-01
## sectorTelecommunications                            1.738258e+00
## sectorTransportation                                7.809947e-01
## sectorWholesalers                                   1.420862e+00
## industryAirlines                                    1.868374e-01
## industryAutomotive Retailing, Services              2.864897e-01
## industryBeverages                                   1.185793e-03
## industryBuilding Materials, Glass                   2.413193e-01
## industryCommercial Banks                            9.503245e-01
## industryComputer Software                           2.465250e-01
## industryComputers, Office Equipment                 5.258066e-04
## industryConstruction and Farm Machinery             3.248533e-03
## industryDiversified Financials                      7.427427e-02
## industryDiversified Outsourcing Services            3.824124e-01
## industryEducation                                   3.644856e-03
## industryElectronics, Electrical Equip.              4.467144e-03
## industryEnergy                                      2.974494e+00
## industryEngineering, Construction                   1.729967e+00
## industryEntertainment                               1.322555e-03
## industryFinancial Data Services                     3.798935e-03
## industryFood Consumer Products                      8.695584e-01
## industryFood Production                             1.060360e-03
## industryFood Services                               1.731780e+00
## industryForest and Paper Products                   3.480081e-03
## industryGeneral Merchandisers                       5.173198e-01
## industryHealth Care: Insurance and Managed Care     2.485517e-01
## industryHealth Care: Medical Facilities             2.085527e-01
## industryHealth Care: Pharmacy and Other Services    3.825486e-01
## industryHome Equipment, Furnishings                 2.668453e-01
## industryHousehold and Personal Products             6.337275e-01
## industryIndustrial Machinery                        1.052833e-01
## industryInformation Technology Services             2.022434e-01
## industryInsurance: Life, Health (Mutual)            5.297814e-01
## industryInsurance: Life, Health (stock)             7.067889e-01
## industryInsurance: Property and Casualty (Mutual)   5.066158e-01
## industryInsurance: Property and Casualty (Stock)    1.950366e-01
## industryInternet Services and Retailing             5.642618e-04
```

```
## industryMail, Package, and Freight Delivery            4.784623e-01
## industryMedical Products and Equipment                 1.599644e-03
## industryMetals                                         2.427433e-01
## industryMining, Crude-Oil Production                   2.847005e+00
## industryMiscellaneous                                  3.613038e-03
## industryNetwork and Other Communications Equipment     7.283575e-04
## industryOil and Gas Equipment, Services                2.890524e+00
## industryPackaging, Containers                          2.873859e-03
## industryPetroleum Refining                             2.938349e+00
## industryPharmaceuticals                                2.533960e-03
## industryPipelines                                      2.947235e+00
## industryPublishing, Printing                           9.426668e-04
## industryRailroads                                      6.857061e-01
## industryReal estate                                    6.126824e-02
## industryScientific,Photographic and  Control Equipment 8.130467e-05
## industrySemiconductors and Other Electronic Components 1.414996e-01
## industryShipping                                       4.858827e-01
## industrySpecialty Retailers: Apparel                   8.629052e-01
## industrySpecialty Retailers: Other                     1.940076e-01
## industryTemporary Help                                 2.865276e-03
## industryToys, Sporting Goods                           3.238649e-04
## industryTransportation Equipment                       6.878753e-01
## industryTransportation and Logistics                   7.299664e-01
## industryUtilities: Gas and Electric                    2.268902e+00
## industryWaste Management                               1.860114e-03
## industryWholesalers: Diversified                       7.360456e-01
## industryWholesalers: Electronics and Office Equipment  6.282117e-03
## industryWholesalers: Food and Grocery                  7.720244e-03
## revenue                                                5.761537e-02
## rank                                                   6.850666e-02
f500$sexPred1 <- predict(model1, f500, type="response")
```

3.2.4 Model de regressió logística

```
model2 <- glm(sex ~ sector + industry + revenue + rank, data = f500, f
amily = binomial(logit))


summary(model2)
```

```
##
## Call:
## glm(formula = sex ~ sector + industry + revenue + rank, family = bi
nomial(logit),
##     data = f500)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -8.4904   0.0000   0.1375   1.6237   8.4904
##
## Coefficients: (9 not defined because of singularities)
##                                                    Estimate
## (Intercept)                                       8.181e+01
## sectorApparel                                    -8.397e+01
## sectorBusiness Services                           2.912e+05
## sectorChemicals                                  -6.117e+01
## sectorEnergy                                     -4.504e+15
## sectorEngineering & Construction                 -8.289e+01
## sectorFinancials                                 -8.278e+01
## sectorFood & Drug Stores                         -6.301e+01
## sectorFood, Beverages & Tobacco                   2.013e+15
## sectorHealth Care                                -4.504e+15
## sectorHotels, Restaurants & Leisure               3.323e+15
## sectorHousehold Products                          4.504e+15
## sectorIndustrials                                -1.327e+04
## sectorMaterials                                  -2.714e+04
## sectorMedia                                       4.504e+15
## sectorMotor Vehicles & Parts                     -8.167e+01
## sectorRetailing                                   4.504e+15
## sectorTechnology                                 -4.255e+05
## sectorTelecommunications                          4.504e+15
## sectorTransportation                             -7.981e+01
```

```
## sectorWholesalers                                    -3.971e+15
## industryAerospace and Defense                               NA
## industryAirlines                                     5.286e-01
## industryApparel                                             NA
## industryAutomotive Retailing, Services               -4.504e+15
## industryBeverages                                    -2.013e+15
## industryBuilding Materials, Glass                    2.706e+04
## industryChemicals                                           NA
## industryCommercial Banks                             -3.196e+00
## industryComputer Software                            4.254e+05
## industryComputers, Office Equipment                  4.254e+05
## industryConstruction and Farm Machinery              -1.067e+07
## industryDiversified Financials                       -1.759e+00
## industryDiversified Outsourcing Services             -2.913e+05
## industryEducation                                    4.504e+15
## industryElectronics, Electrical Equip.               1.321e+04
## industryEnergy                                       9.007e+15
## industryEngineering, Construction                    2.491e+01
## industryEntertainment                                2.624e+06
## industryFinancial Data Services                      1.208e+05
## industryFood Consumer Products                       -2.013e+15
## industryFood Production                              2.490e+15
## industryFood Services                                -3.323e+15
## industryFood and Drug Stores                                NA
## industryForest and Paper Products                    2.708e+04
## industryGeneral Merchandisers                        -4.504e+15
## industryHealth Care: Insurance and Managed Care      4.504e+15
## industryHealth Care: Medical Facilities              4.504e+15
## industryHealth Care: Pharmacy and Other Services     4.504e+15
## industryHome Equipment, Furnishings                  -4.504e+15
## industryHomebuilders                                        NA
## industryHotels, Casinos, Resorts                     -3.323e+15
## industryHousehold and Personal Products              -4.504e+15
## industryIndustrial Machinery                         1.318e+04
## industryInformation Technology Services              4.254e+05
## industryInsurance: Life, Health (Mutual)             -9.350e-01
## industryInsurance: Life, Health (stock)              -1.673e+00
```

```
## industryInsurance: Property and Casualty (Mutual)      -9.699e+02
## industryInsurance: Property and Casualty (Stock)       -6.328e+00
## industryInternet Services and Retailing                 2.052e+05
## industryMail, Package, and Freight Delivery            -1.803e+08
## industryMedical Products and Equipment                  9.007e+15
## industryMetals                                          2.706e+04
## industryMining, Crude-Oil Production                    4.504e+15
## industryMiscellaneous                                   1.321e+04
## industryMotor Vehicles and Parts                               NA
## industryNetwork and Other Communications Equipment      4.254e+05
## industryOil and Gas Equipment, Services                 4.504e+15
## industryPackaging, Containers                           4.504e+15
## industryPetroleum Refining                              9.007e+15
## industryPharmaceuticals                                 4.504e+15
## industryPipelines                                       4.504e+15
## industryPublishing, Printing                            4.056e+06
## industryRailroads                                      -2.509e-01
## industryReal estate                                    -4.477e-03
## industryScientific,Photographic and  Control Equipment  4.504e+15
## industrySecurities                                             NA
## industrySemiconductors and Other Electronic Components  4.254e+05
## industryShipping                                        8.260e+00
## industrySpecialty Retailers: Apparel                   -4.504e+15
## industrySpecialty Retailers: Other                     -4.504e+15
## industryTelecommunications                                     NA
## industryTemporary Help                                 -1.772e+02
## industryTobacco                                        -2.013e+15
## industryToys, Sporting Goods                            3.294e+02
## industryTransportation Equipment                        1.986e+01
## industryTransportation and Logistics                    2.015e+01
## industryTrucking, Truck Leasing                                NA
## industryUtilities: Gas and Electric                     4.504e+15
## industryWaste Management                               -1.677e+02
## industryWholesalers: Diversified                        3.971e+15
## industryWholesalers: Electronics and Office Equipment   3.971e+15
## industryWholesalers: Food and Grocery                   8.475e+15
## industryWholesalers: Health Care                        8.475e+15
```

```
## revenue                                          1.136e-04
## rank                                             4.682e-03
##                                                 Std. Error
## (Intercept)                                      2.120e+00
## sectorApparel                                    2.247e+00
## sectorBusiness Services                          4.745e+07
## sectorChemicals                                  4.949e+04
## sectorEnergy                                     9.087e+07
## sectorEngineering & Construction                 2.205e+00
## sectorFinancials                                 2.322e+00
## sectorFood & Drug Stores                         7.643e+04
## sectorFood, Beverages & Tobacco                  5.254e+14
## sectorHealth Care                                1.090e+08
## sectorHotels, Restaurants & Leisure              4.090e+14
## sectorHousehold Products                         9.087e+07
## sectorIndustrials                                6.127e+07
## sectorMaterials                                  9.087e+07
## sectorMedia                                      9.721e+07
## sectorMotor Vehicles & Parts                     2.223e+00
## sectorRetailing                                  9.443e+07
## sectorTechnology                                 8.343e+07
## sectorTelecommunications                         2.246e+07
## sectorTransportation                             2.239e+00
## sectorWholesalers                                8.689e+14
## industryAerospace and Defense                           NA
## industryAirlines                                 1.120e+00
## industryApparel                                         NA
## industryAutomotive Retailing, Services           9.443e+07
## industryBeverages                                5.254e+14
## industryBuilding Materials, Glass                9.087e+07
## industryChemicals                                       NA
## industryCommercial Banks                         1.194e+00
## industryComputer Software                        8.343e+07
## industryComputers, Office Equipment              8.343e+07
## industryConstruction and Farm Machinery          6.570e+07
## industryDiversified Financials                   1.201e+00
## industryDiversified Outsourcing Services         4.745e+07
```

```
## industryEducation                                        8.219e+07
## industryElectronics, Electrical Equip.                   6.127e+07
## industryEnergy                                           9.223e+07
## industryEngineering, Construction                        7.089e+04
## industryEntertainment                                    9.598e+07
## industryFinancial Data Services                          4.956e+07
## industryFood Consumer Products                           5.254e+14
## industryFood Production                                  5.254e+14
## industryFood Services                                    4.090e+14
## industryFood and Drug Stores                                    NA
## industryForest and Paper Products                        9.087e+07
## industryGeneral Merchandisers                            9.443e+07
## industryHealth Care: Insurance and Managed Care          1.090e+08
## industryHealth Care: Medical Facilities                  1.090e+08
## industryHealth Care: Pharmacy and Other Services         1.090e+08
## industryHome Equipment, Furnishings                      9.087e+07
## industryHomebuilders                                            NA
## industryHotels, Casinos, Resorts                         4.090e+14
## industryHousehold and Personal Products                  9.087e+07
## industryIndustrial Machinery                             6.127e+07
## industryInformation Technology Services                  8.343e+07
## industryInsurance: Life, Health (Mutual)                 1.459e+00
## industryInsurance: Life, Health (stock)                  1.250e+00
## industryInsurance: Property and Casualty (Mutual)        2.492e+05
## industryInsurance: Property and Casualty (Stock)         1.450e+00
## industryInternet Services and Retailing                  8.585e+07
## industryMail, Package, and Freight Delivery              4.745e+07
## industryMedical Products and Equipment                   1.102e+08
## industryMetals                                           9.087e+07
## industryMining, Crude-Oil Production                     9.087e+07
## industryMiscellaneous                                    6.126e+07
## industryMotor Vehicles and Parts                                NA
## industryNetwork and Other Communications Equipment       8.343e+07
## industryOil and Gas Equipment, Services                  9.087e+07
## industryPackaging, Containers                            9.240e+07
## industryPetroleum Refining                               9.331e+07
## industryPharmaceuticals                                  1.103e+08
```

```
## industryPipelines                                          9.087e+07
## industryPublishing, Printing                               1.017e+08
## industryRailroads                                          1.169e+00
## industryReal estate                                        1.428e+00
## industryScientific,Photographic and  Control Equipment     8.585e+07
## industrySecurities                                               NA
## industrySemiconductors and Other Electronic Components     8.343e+07
## industryShipping                                           1.533e+02
## industrySpecialty Retailers: Apparel                       9.443e+07
## industrySpecialty Retailers: Other                         9.443e+07
## industryTelecommunications                                       NA
## industryTemporary Help                                     5.615e+07
## industryTobacco                                            5.254e+14
## industryToys, Sporting Goods                               1.130e+08
## industryTransportation Equipment                           2.164e+04
## industryTransportation and Logistics                       2.056e+04
## industryTrucking, Truck Leasing                                  NA
## industryUtilities: Gas and Electric                        9.087e+07
## industryWaste Management                                   5.812e+07
## industryWholesalers: Diversified                           8.689e+14
## industryWholesalers: Electronics and Office Equipment      8.689e+14
## industryWholesalers: Food and Grocery                      8.689e+14
## industryWholesalers: Health Care                           8.689e+14
## revenue                                                    5.727e-06
## rank                                                       5.611e-04
##                                                              z value P
r(>|z|)
## (Intercept)                                                3.859e+01
< 2e-16
## sectorApparel                                             -3.736e+01
< 2e-16
## sectorBusiness Services                                    6.000e-03 0
.995103
## sectorChemicals                                           -1.000e-03 0
.999014
## sectorEnergy                                              -4.956e+07
< 2e-16
## sectorEngineering & Construction                          -3.760e+01
< 2e-16
```

```
## sectorFinancials                                    -3.565e+01
< 2e-16

## sectorFood & Drug Stores                            -1.000e-03 0
.999342

## sectorFood, Beverages & Tobacco                      3.832e+00 0
.000127

## sectorHealth Care                                   -4.133e+07
< 2e-16

## sectorHotels, Restaurants & Leisure                  8.125e+00 4
.48e-16

## sectorHousehold Products                             4.956e+07
< 2e-16

## sectorIndustrials                                    0.000e+00 0
.999827

## sectorMaterials                                      0.000e+00 0
.999762

## sectorMedia                                          4.633e+07
< 2e-16

## sectorMotor Vehicles & Parts                        -3.674e+01
< 2e-16

## sectorRetailing                                      4.769e+07
< 2e-16

## sectorTechnology                                    -5.000e-03 0
.995931

## sectorTelecommunications                             2.005e+08
< 2e-16

## sectorTransportation                                -3.564e+01
< 2e-16

## sectorWholesalers                                   -4.571e+00 4
.86e-06

## industryAerospace and Defense                               NA
NA

## industryAirlines                                     4.720e-01 0
.637069

## industryApparel                                             NA
NA

## industryAutomotive Retailing, Services              -4.769e+07
< 2e-16

## industryBeverages                                   -3.832e+00 0
.000127

## industryBuilding Materials, Glass                    0.000e+00 0
.999762

## industryChemicals                                           NA
NA

## industryCommercial Banks                            -2.678e+00 0
.007409
```

```
## industryComputer Software                                  5.000e-03 0
.995932

## industryComputers, Office Equipment                        5.000e-03 0
.995932

## industryConstruction and Farm Machinery                   -1.620e-01 0
.870947

## industryDiversified Financials                            -1.465e+00 0
.143006

## industryDiversified Outsourcing Services                  -6.000e-03 0
.995102

## industryEducation                                          5.479e+07
< 2e-16

## industryElectronics, Electrical Equip.                     0.000e+00 0
.999828

## industryEnergy                                             9.766e+07
< 2e-16

## industryEngineering, Construction                          0.000e+00 0
.999720

## industryEntertainment                                      2.700e-02 0
.978186

## industryFinancial Data Services                            2.000e-03 0
.998056

## industryFood Consumer Products                            -3.832e+00 0
.000127

## industryFood Production                                    4.740e+00 2
.14e-06

## industryFood Services                                     -8.125e+00 4
.48e-16

## industryFood and Drug Stores                                      NA
NA

## industryForest and Paper Products                          0.000e+00 0
.999762

## industryGeneral Merchandisers                             -4.769e+07
< 2e-16

## industryHealth Care: Insurance and Managed Care            4.133e+07
< 2e-16

## industryHealth Care: Medical Facilities                    4.133e+07
< 2e-16

## industryHealth Care: Pharmacy and Other Services           4.133e+07
< 2e-16

## industryHome Equipment, Furnishings                       -4.956e+07
< 2e-16

## industryHomebuilders                                              NA
NA

## industryHotels, Casinos, Resorts                          -8.125e+00 4
.48e-16
```

```
## industryHousehold and Personal Products                -4.956e+07
< 2e-16

## industryIndustrial Machinery                            0.000e+00 0
.999828

## industryInformation Technology Services                 5.000e-03 0
.995932

## industryInsurance: Life, Health (Mutual)                -6.410e-01 0
.521518

## industryInsurance: Life, Health (stock)                 -1.338e+00 0
.180772

## industryInsurance: Property and Casualty (Mutual)       -4.000e-03 0
.996894

## industryInsurance: Property and Casualty (Stock)        -4.365e+00 1
.27e-05

## industryInternet Services and Retailing                 2.000e-03 0
.998093

## industryMail, Package, and Freight Delivery             -3.801e+00 0
.000144

## industryMedical Products and Equipment                  8.170e+07
< 2e-16

## industryMetals                                          0.000e+00 0
.999762

## industryMining, Crude-Oil Production                    4.956e+07
< 2e-16

## industryMiscellaneous                                   0.000e+00 0
.999828

## industryMotor Vehicles and Parts                               NA
NA

## industryNetwork and Other Communications Equipment      5.000e-03 0
.995932

## industryOil and Gas Equipment, Services                 4.956e+07
< 2e-16

## industryPackaging, Containers                           4.874e+07
< 2e-16

## industryPetroleum Refining                              9.653e+07
< 2e-16

## industryPharmaceuticals                                 4.082e+07
< 2e-16

## industryPipelines                                       4.956e+07
< 2e-16

## industryPublishing, Printing                            4.000e-02 0
.968198

## industryRailroads                                       -2.150e-01 0
.830045

## industryReal estate                                     -3.000e-03 0
.997499
```

```
## industryScientific,Photographic and  Control Equipment  5.246e+07
< 2e-16

## industrySecurities                                           NA
NA

## industrySemiconductors and Other Electronic Components  5.000e-03 0
.995932

## industryShipping                                          5.400e-02 0
.957022

## industrySpecialty Retailers: Apparel                    -4.769e+07
< 2e-16

## industrySpecialty Retailers: Other                      -4.769e+07
< 2e-16

## industryTelecommunications                                   NA
NA

## industryTemporary Help                                    0.000e+00 0
.999997

## industryTobacco                                         -3.832e+00 0
.000127

## industryToys, Sporting Goods                              0.000e+00 0
.999998

## industryTransportation Equipment                          1.000e-03 0
.999268

## industryTransportation and Logistics                      1.000e-03 0
.999218

## industryTrucking, Truck Leasing                              NA
NA

## industryUtilities: Gas and Electric                       4.956e+07
< 2e-16

## industryWaste Management                                  0.000e+00 0
.999998

## industryWholesalers: Diversified                          4.571e+00 4
.86e-06

## industryWholesalers: Electronics and Office Equipment   4.571e+00 4
.86e-06

## industryWholesalers: Food and Grocery                     9.753e+00
< 2e-16

## industryWholesalers: Health Care                          9.753e+00
< 2e-16

## revenue                                                   1.983e+01
< 2e-16

## rank                                                      8.343e+00
< 2e-16

##

## (Intercept)                                             ***

## sectorApparel                                           ***
```

```
## sectorBusiness Services
## sectorChemicals
## sectorEnergy                                          ***
## sectorEngineering & Construction                      ***
## sectorFinancials                                      ***
## sectorFood & Drug Stores
## sectorFood, Beverages & Tobacco                       ***
## sectorHealth Care                                     ***
## sectorHotels, Restaurants & Leisure                   ***
## sectorHousehold Products                              ***
## sectorIndustrials
## sectorMaterials
## sectorMedia                                           ***
## sectorMotor Vehicles & Parts                          ***
## sectorRetailing                                       ***
## sectorTechnology
## sectorTelecommunications                              ***
## sectorTransportation                                  ***
## sectorWholesalers                                     ***
## industryAerospace and Defense
## industryAirlines
## industryApparel
## industryAutomotive Retailing, Services                ***
## industryBeverages                                     ***
## industryBuilding Materials, Glass
## industryChemicals
## industryCommercial Banks                              **
## industryComputer Software
## industryComputers, Office Equipment
## industryConstruction and Farm Machinery
## industryDiversified Financials
## industryDiversified Outsourcing Services
## industryEducation                                     ***
## industryElectronics, Electrical Equip.
## industryEnergy                                        ***
## industryEngineering, Construction
## industryEntertainment
```

```
## industryFinancial Data Services
## industryFood Consumer Products                              ***
## industryFood Production                                     ***
## industryFood Services                                       ***
## industryFood and Drug Stores
## industryForest and Paper Products
## industryGeneral Merchandisers                               ***
## industryHealth Care: Insurance and Managed Care             ***
## industryHealth Care: Medical Facilities                     ***
## industryHealth Care: Pharmacy and Other Services            ***
## industryHome Equipment, Furnishings                         ***
## industryHomebuilders
## industryHotels, Casinos, Resorts                            ***
## industryHousehold and Personal Products                     ***
## industryIndustrial Machinery
## industryInformation Technology Services
## industryInsurance: Life, Health (Mutual)
## industryInsurance: Life, Health (stock)
## industryInsurance: Property and Casualty (Mutual)
## industryInsurance: Property and Casualty (Stock)            ***
## industryInternet Services and Retailing
## industryMail, Package, and Freight Delivery                 ***
## industryMedical Products and Equipment                      ***
## industryMetals
## industryMining, Crude-Oil Production                        ***
## industryMiscellaneous
## industryMotor Vehicles and Parts
## industryNetwork and Other Communications Equipment
## industryOil and Gas Equipment, Services                     ***
## industryPackaging, Containers                               ***
## industryPetroleum Refining                                  ***
## industryPharmaceuticals                                     ***
## industryPipelines                                           ***
## industryPublishing, Printing
## industryRailroads
## industryReal estate
## industryScientific,Photographic and  Control Equipment      ***
```

```
## industrySecurities
## industrySemiconductors and Other Electronic Components
## industryShipping
## industrySpecialty Retailers: Apparel                    ***
## industrySpecialty Retailers: Other                      ***
## industryTelecommunications
## industryTemporary Help
## industryTobacco                                         ***
## industryToys, Sporting Goods
## industryTransportation Equipment
## industryTransportation and Logistics
## industryTrucking, Truck Leasing
## industryUtilities: Gas and Electric                     ***
## industryWaste Management
## industryWholesalers: Diversified                        ***
## industryWholesalers: Electronics and Office Equipment   ***
## industryWholesalers: Food and Grocery                   ***
## industryWholesalers: Health Care                        ***
## revenue                                                 ***
## rank                                                    ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance:  465.78  on 965  degrees of freedom
## Residual deviance: 9692.64  on 879  degrees of freedom
## AIC: 9866.6
##
## Number of Fisher Scoring iterations: 25
varImp(model2, scale = FALSE)
##                                                  Overall
## sectorApparel                                3.736227e+01
## sectorBusiness Services                      6.137501e-03
## sectorChemicals                              1.235962e-03
## sectorEnergy                                 4.956318e+07
## sectorEngineering & Construction             3.760133e+01
```

```
## sectorFinancials                                    3.565395e+01
## sectorFood & Drug Stores                            8.244514e-04
## sectorFood, Beverages & Tobacco                     3.832234e+00
## sectorHealth Care                                   4.133113e+07
## sectorHotels, Restaurants & Leisure                 8.124754e+00
## sectorHousehold Products                            4.956318e+07
## sectorIndustrials                                   2.165016e-04
## sectorMaterials                                     2.987139e-04
## sectorMedia                                         4.633061e+07
## sectorMotor Vehicles & Parts                        3.674323e+01
## sectorRetailing                                     4.769426e+07
## sectorTechnology                                    5.099730e-03
## sectorTelecommunications                            2.004923e+08
## sectorTransportation                                3.564228e+01
## sectorWholesalers                                   4.570545e+00
## industryAirlines                                    4.718014e-01
## industryAutomotive Retailing, Services              4.769426e+07
## industryBeverages                                   3.832234e+00
## industryBuilding Materials, Glass                   2.978140e-04
## industryCommercial Banks                            2.677876e+00
## industryComputer Software                           5.098798e-03
## industryComputers, Office Equipment                 5.098760e-03
## industryConstruction and Farm Machinery             1.624557e-01
## industryDiversified Financials                      1.464689e+00
## industryDiversified Outsourcing Services            6.139239e-03
## industryEducation                                   5.479416e+07
## industryElectronics, Electrical Equip.              2.155893e-04
## industryEnergy                                      9.765774e+07
## industryEngineering, Construction                   3.513649e-04
## industryEntertainment                               2.734312e-02
## industryFinancial Data Services                     2.436697e-03
## industryFood Consumer Products                      3.832234e+00
## industryFood Production                             4.739664e+00
## industryFood Services                               8.124754e+00
## industryForest and Paper Products                   2.980543e-04
## industryGeneral Merchandisers                       4.769426e+07
## industryHealth Care: Insurance and Managed Care     4.133113e+07
```

```
## industryHealth Care: Medical Facilities                4.133113e+07
## industryHealth Care: Pharmacy and Other Services       4.133113e+07
## industryHome Equipment, Furnishings                    4.956318e+07
## industryHotels, Casinos, Resorts                       8.124754e+00
## industryHousehold and Personal Products                4.956318e+07
## industryIndustrial Machinery                           2.151258e-04
## industryInformation Technology Services                5.098782e-03
## industryInsurance: Life, Health (Mutual)               6.410069e-01
## industryInsurance: Life, Health (stock)                1.338382e+00
## industryInsurance: Property and Casualty (Mutual)      3.892717e-03
## industryInsurance: Property and Casualty (Stock)       4.364706e+00
## industryInternet Services and Retailing                2.389839e-03
## industryMail, Package, and Freight Delivery            3.800554e+00
## industryMedical Products and Equipment                 8.169950e+07
## industryMetals                                         2.978246e-04
## industryMining, Crude-Oil Production                   4.956318e+07
## industryMiscellaneous                                  2.156405e-04
## industryNetwork and Other Communications Equipment     5.098982e-03
## industryOil and Gas Equipment, Services                4.956311e+07
## industryPackaging, Containers                          4.873936e+07
## industryPetroleum Refining                             9.652855e+07
## industryPharmaceuticals                                4.081825e+07
## industryPipelines                                      4.956318e+07
## industryPublishing, Printing                           3.986806e-02
## industryRailroads                                      2.146441e-01
## industryReal estate                                    3.134246e-03
## industryScientific,Photographic and  Control Equipment 5.246141e+07
## industrySemiconductors and Other Electronic Components 5.098774e-03
## industryShipping                                       5.389084e-02
## industrySpecialty Retailers: Apparel                   4.769426e+07
## industrySpecialty Retailers: Other                     4.769426e+07
## industryTemporary Help                                 3.155214e-06
## industryTobacco                                        3.832234e+00
## industryToys, Sporting Goods                           2.915807e-06
## industryTransportation Equipment                       9.175981e-04
## industryTransportation and Logistics                   9.799625e-04
## industryUtilities: Gas and Electric                    4.956318e+07
```

```
## industryWaste Management                                    2.884875e-06
## industryWholesalers: Diversified                            4.570545e+00
## industryWholesalers: Electronics and Office Equipment       4.570545e+00
## industryWholesalers: Food and Grocery                       9.753453e+00
## industryWholesalers: Health Care                            9.753453e+00
## revenue                                                     1.982783e+01
## rank                                                        8.343462e+00
```

```
f500$sexPred2 <- predict(model2, f500, type="response")


head(f500[, c(4, 11, 12, 13, 14)], n = 100)
```

```
##                           ceo sex sexCoef      sexPred1     sexPred
2
## 1         C. Douglas McMillon   M       0  1.890554e-01 7.611609e-0
4
## 2            Darren W. Woods   M       0  2.716634e-03 1.000000e+0
0
## 3          Warren E. Buffett   M       0  3.882830e-02 1.000000e+0
0
## 4            Timothy D. Cook   M       0  2.716567e-03 1.000000e+0
0
## 5          David S. Wichmann   M       0  1.022892e-01 1.000000e+0
0
## 6         John H. Hammergren   M       0  1.682775e-03 1.000000e+0
0
## 7             Larry J. Merlo   M       0  1.554745e-01 9.999978e-0
1
## 8           Jeffrey P. Bezos   M       0  1.611212e-03 1.000000e+0
0
## 9      Randall L. Stephenson   M       0  1.474235e-03 1.000000e+0
0
## 10             Mary T. Barra   F       1  5.399019e-02 1.000000e+0
0
## 11          James P. Hackett   M       0  5.398270e-02 1.000000e+0
0
## 12          Steven H. Collis   M       0  8.626237e-04 1.000000e+0
0
## 13          Michael K. Wirth   M       0  7.238309e-04 1.000000e+0
0
## 14       Michael C. Kaufmann   M       0  4.415029e-04 1.000000e+0
0
## 15          W. Craig Jelinek   M       0  1.822637e-01 2.220446e-1
6
## 16          Hans E. Vestberg   M       0  8.563350e-04 1.000000e+0
0
```

```
## 17          W. Rodney McMullen   M       0  7.742411e-04 1.000000e+0
0
## 18       H. Lawrence Culp Jr.   M       0  3.765187e-02 9.999897e-0
1
## 19            Stefano Pessina   M       0  6.971764e-04 1.000000e+0
0
## 20                James Dimon   M       0  1.207978e-01 9.998587e-0
1
## 21      Timothy J. Mayopoulos   M       0  5.647020e-02 9.999603e-0
1
## 22                 Larry Page   M       0  5.949939e-04 2.220446e-1
6
## 23            Craig A. Menear   M       0  6.727648e-02 9.985940e-0
1
## 24          Brian T. Moynihan   M       0  1.205566e-01 9.993480e-0
1
## 25       Timothy C. Wentworth   M       0  1.539600e-01 9.701039e-0
1
## 26           Timothy J. Sloan   M       0  1.205149e-01 9.991400e-0
1
## 27       Dennis A. Muilenburg   M       0  1.602847e-01 1.000000e+0
0
## 28            Greg C. Garland   M       0 -3.068588e-05 1.000000e+0
0
## 29          Gail K. Boudreaux   F       1  1.003031e-01 1.000000e+0
0
## 30              Satya Nadella   F       1  7.688099e-02 9.999995e-0
1
## 31           Joseph W. Gorder   M       0 -8.175417e-05 1.000000e+0
0
## 32          Michael L. Corbat   M       0  1.203493e-01 9.974671e-0
1
## 33           Brian L. Roberts   M       0  1.332818e-04 1.000000e+0
0
## 34        Virginia M. Rometty   F       1  6.261575e-02 9.999932e-0
1
## 35            Michael S. Dell   M       0  2.177975e-05 9.999535e-0
1
## 36         Michael L. Tipsord   M       0  1.055853e-04 2.220446e-1
6
## 37                Alex Gorsky   M       0  3.519263e-04 2.220446e-1
6
## 38           Donald H. Layton   M       0  5.581680e-02 9.973534e-0
1
## 39           Brian C. Cornell   M       0  1.812697e-01 2.220446e-1
6
```

```
## 40          Marvin R. Ellison   M       0  6.672294e-02 9.516239e-0
1
## 41           Gary R. Heminger   M       0 -4.405571e-04 1.000000e+0
0
## 42            David S. Taylor   M       0  2.141602e-01 9.999006e-0
1
## 43        Steven A. Kandarian   M       0  1.052986e-01 9.937826e-0
1
## 44            David P. Abney   M       0  4.400154e-05 2.220446e-1
6
## 45            Ramon Laguarta   M       0  1.580135e-01 9.995355e-0
1
## 46            Robert H. Swan   M       0  4.323241e-02 9.999173e-0
1
## 48           Juan R. Luciano   M       0 -4.168550e-05 1.000000e+0
0
## 49          Mark T. Bertolini   M       0  9.980773e-02 9.999993e-0
1
## 50         Frederick W. Smith   M       0 -4.400154e-05 2.220446e-1
6
## 51           Gregory J. Hayes   M       0  1.597242e-01 1.000000e+0
0
## 52         John R. Strangfeld   M       0  1.052009e-01 9.876577e-0
1
## 53           Robert G. Miller   M       0 -2.990069e-04 1.000000e+0
0
## 54  Thomas L. Ben\357\277\275   M       0  2.653679e-04 1.000000e+0
0
## 55            Robert A. Iger   M       0 -2.751090e-04 1.000000e+0
0
## 56         Bruce D. Broussard   M       0  9.969973e-02 9.999984e-0
1
## 57               Ian C. Read   M       0 -4.055398e-05 2.220446e-1
6
## 58           Dion J. Weisler   M       0 -4.132960e-04 9.991435e-0
1
## 59         Marillyn A. Hewson   F       1  1.595814e-01 1.000000e+0
0
## 60          Brian Duperreault   M       0  3.542171e-02 1.994353e-0
1
## 61        Michael F. Neidorff   M       0  9.961597e-02 9.999972e-0
1
## 62         Charles H. Robbins   M       0 -4.114802e-04 1.000000e+0
0
## 64         John W. McReynolds   M       0 -3.376170e-04 2.023511e-0
5
```

```
## 65       D. James Umpleby III   M       0 -1.271278e-04 2.220446e-1
6
## 66       Stephen S. Rasmussen   M       0 -4.562080e-04 2.220446e-1
6
## 67            James P. Gorman   M       0  1.196167e-01 7.514953e-0
1
## 68              David H. Long   M       0  3.531486e-02 1.063784e-0
1
## 69         Theodore A. Mathas   M       0  9.973740e-02 9.617484e-0
1
## 70           David M. Solomon   M       0  1.195982e-01 7.237296e-0
1
## 71          W. Douglas Parker   M       0  1.108219e-01 9.995248e-0
1
## 72             Hubert B. Joly   M       0  6.631144e-02 5.308273e-0
1
## 73           David M. Cordani   M       0  9.951624e-02 9.999943e-0
1
## 74         Thomas M. Rutledge   M       0 -5.599586e-04 1.000000e+0
0
## 75          Edward H. Bastian   M       0  1.108136e-01 9.994798e-0
1
## 76           Mark Zuckerberg   M       0 -5.687503e-04 2.220446e-1
6
## 77           Darius Adamczyk   M       0 -5.909111e-04 1.000000e+0
0
## 78         Kenneth C. Frazier   M       0 -2.197000e-04 2.220446e-1
6
## 79           Thomas J. Wilson   M       0  3.526412e-02 7.246009e-0
2
## 80                Noel White   M       0 -3.814996e-04 1.000000e+0
0
## 81              Oscar Munoz   M       0  1.107632e-01 9.992469e-0
1
## 83           Richard T. Hume   M       0 -2.702330e-04 1.000000e+0
0
## 84      Roger W. Ferguson Jr.   M       0  9.965729e-02 9.297425e-0
1
## 85           Ernie L. Herrman   M       0  2.992858e-01 2.220446e-1
6
## 86          Stephen J. Squeri   M       0  5.521076e-02 8.477981e-0
1
## 87           James R. Quincey   M       0 -3.899915e-04 2.220446e-1
6
## 88       Randall T. Jones Sr.   M       0 -6.735761e-04 1.000000e+0
0
```

```
## 89             Mark G. Parker   M       0  7.635021e-02 8.962419e-0
1
## 91          Michael J. Kasbar   M       0 -6.143238e-04 1.000000e+0
0
## 92       Christopher M. Crane   M       0  2.420212e-01 7.014055e-0
4
## 93          Roger W. Crandall   M       0  9.963188e-02 9.119435e-0
1
## 94           John T. Standley   M       0 -6.961258e-04 1.000000e+0
0
## 95              Ryan M. Lance   M       0  4.485453e-02 1.426161e-0
4
## 96            Jay D. Debertin   M       0 -4.602686e-04 1.000000e+0
0
## 97           Michael F. Roman   M       0 -2.675269e-17 1.000000e+0
0
## 98               John Stankey   M       0 -6.130101e-04 1.000000e+0
0
## 99         Phebe N. Novakovic   F       1  1.593062e-01 1.000000e+0
0
## 100             Stuart Parker   M       0  3.515694e-02 3.175881e-0
2
## 101       Richard D. Fairbank   M       0  1.194456e-01 4.296168e-0
1
## 102           Samuel R. Allen   M       0 -3.294479e-04 2.220446e-1
6
## 103          Sean M. O'Connor   M       0  5.513738e-02 7.498118e-0
1
## 104         John E. Schlifske   M       0  9.958111e-02 8.717164e-0
1
```

4 Resultats i conclusions.

Quant als sectors podem dir que predominen el sector financer, tecnològic i energètic.

Dintre de cada sector podem destacar:

- En el sector financer la majoria de companyies són companyies asseguradores, bancs, o de gestió de propietats immobiliàries.
- En el sector tecnològic les principals companyies s'encarreguen de la creació de components electrònics, seguidament tenim les companyies que es dediquen a crear software i després les companyies orientades a les tecnologies de la informació i comunicació.
- En el sector energètic predominen dos tipus de companyies, les que es dediquen a proveir de gas i electricitat i les companyies que es dediquen a l'extracció de minerals i petroli.

Referent al nombre de dones i homes que són CEOs de les empreses de la llista fortune, podem dir que la gran majoria d'empreses (en un 92,1%) estan dirigides per homes, mentre que el 7,86% restant tenen a una dona com CEO.

Els models predictius extrets entre el CEO i el tipus de sector i indústria no han demostrat cap relació entre aquests fets, segurament degut al tipus de variables no són les adequades o el nombre de mostres és molt petit.

5 Dataset resultant amb les dades netes.

write.csv(f500, file="fortune_clean.csv", sep = ";")