Lab4

Diego Castro

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R Markdown

This is an R Markdown document. Markdown is a simple formatting syntax for authoring HTML, PDF, and MS Word documents. For more details on using R Markdown see http://rmarkdown.rstudio.com.

```
setwd("C:/Users/usuario/OneDrive - University of East Anglia/PhD/First Semestre/Econometrics/Laboratories/Lab4")
list.files()
```

```
## [1] "affairs.RData"               "DirectMarketing.csv"
## [3] "ECO-R002-lab04_multireg.pdf" "Lab4.pdf"
## [5] "Lab4.R"                      "Lab4_R.Rmd"
## [7] "Lab4_R.tex"                  "Lab4_R_files"
```

```
library(data.table)
```

```
## Warning: package 'data.table' was built under R version 4.1.1
```

```
library(ggplot2)
library(stargazer)
```

```
## Warning: package 'stargazer' was built under R version 4.1.1
```

```
##
## Please cite as:
```

```
##  Hlavac, Marek (2018). stargazer: Well-Formatted Regression and Summary Statistics Tables.
```

```
##  R package version 5.2.2. https://CRAN.R-project.org/package=stargazer
```

```
load ("affairs.RData")
dt.affairs <- data.table(data)
rm(data)

#Summary statistics
stargazer(dt.affairs, type = "text")
```

```
##
## ===========================================================
## Statistic  N    Mean    St. Dev. Min Pctl(25) Pctl(75)  Max
## -----------------------------------------------------------
## id        601 1,059.722 914.905   4    528     1,453   9,029
```

```
## male      601   0.476    0.500    0     0        1       1
## age       601  32.488    9.289   18     27       37     57
## yrsmarr   601   8.178    5.571    0     4        15     15
## kids      601   0.715    0.452    0     0        1       1
## relig     601   3.116    1.168    1     2        4       5
## educ      601  16.166    2.403    9     14       18     20
## occup     601   4.195    1.819    1     3        6       7
## ratemarr  601   3.932    1.103    1     3        5       5
## naffairs  601   1.456    3.299    0     0        0      12
## affair    601   0.250    0.433    0     0        0       1
## vryhap    601   0.386    0.487    0     0        1       1
## hapavg    601   0.323    0.468    0     0        1       1
## avgmarr   601   0.155    0.362    0     0        0       1
## unhap     601   0.110    0.313    0     0        0       1
## vryrel    601   0.116    0.321    0     0        0       1
## smerel    601   0.316    0.465    0     0        1       1
## slghtrel  601   0.215    0.411    0     0        0       1
## notrel    601   0.273    0.446    0     0        1       1
## ------------------------------------------------------------
```

```
#Hypothesis
#1) An indicator variable affair: you should use this variable to
test/compare the probabiliy/likelihood of having an extra-marital affair.

# Create a group and set your criteria for what being “religious” is and
create an indicator variable
dt.affairs[, religious:= relig>3]
dt.affairs[, .N, by=religious]
```

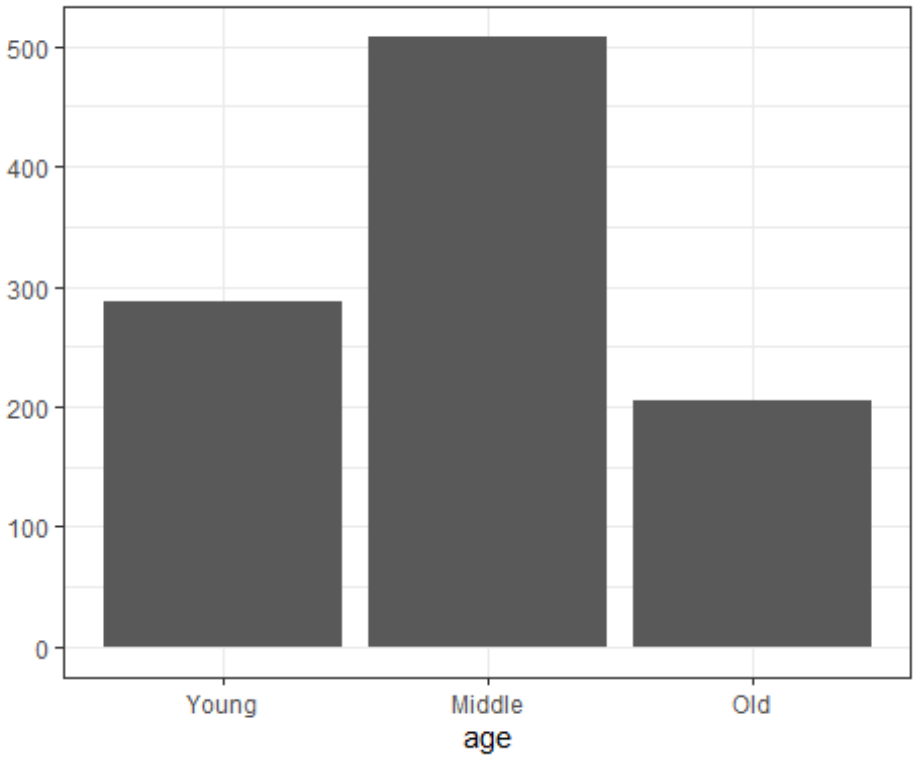
```
##    religious   N
## 1:     FALSE 341
## 2:      TRUE 260
```

```
#Run t.test for the probabilty of havving an affair betwen the religious and
no religious
dt.affairs[, t.test(affair~religious)]
```

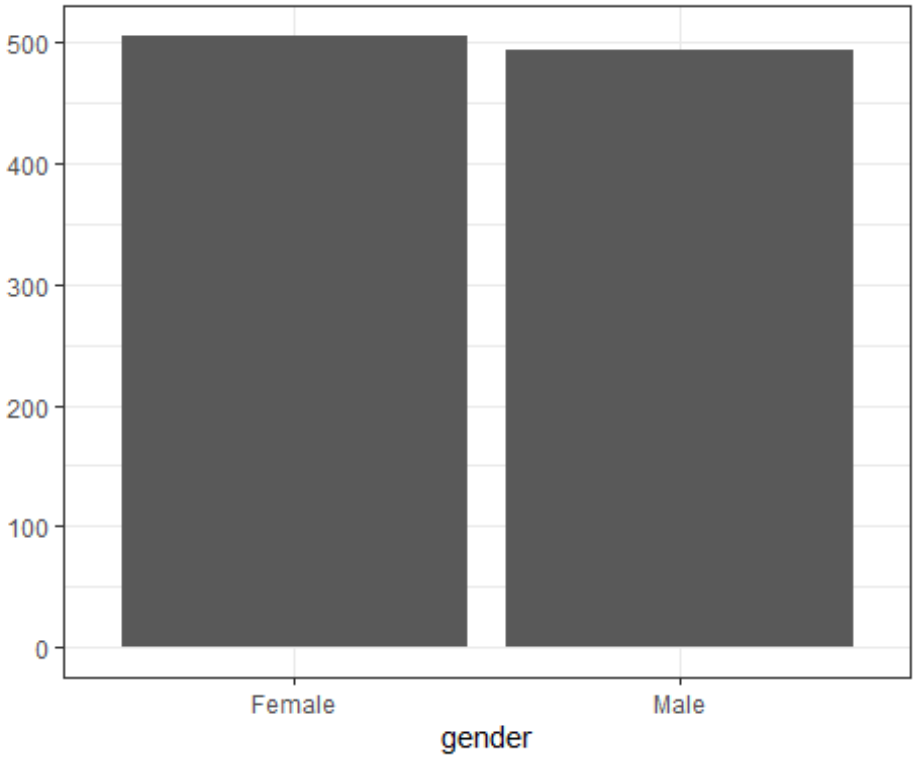
```
##
##  Welch Two Sample t-test
##
## data:  affair by religious
## t = 3.7191, df = 594.76, p-value = 0.0002189
## alternative hypothesis: true difference in means between group FALSE and
group TRUE is not equal to 0
## 95 percent confidence interval:
##  0.06043572 0.19568880
## sample estimates:
## mean in group FALSE  mean in group TRUE
##           0.3049853           0.1769231
```

```r
#The p-value is below 0.05 so we reject the null hypothesis that there is no difference in the mean probability of having an affair between these groups.


#2) Number of affairs naffair: you should use this variable to test/compare the average number of extramarital affairs.

dt.affairs[, t.test(naffairs~religious)]

##
##  Welch Two Sample t-test
##
## data:  naffairs by religious
## t = 4.0676, df = 593.3, p-value = 5.393e-05
## alternative hypothesis: true difference in means between group FALSE and group TRUE is not equal to 0
## 95 percent confidence interval:
##  0.5382493 1.5432981
## sample estimates:
## mean in group FALSE  mean in group TRUE
##           1.9061584           0.8653846

#The p-value is below 0.05 so we reject the null hypothesis that there is no difference in the average number of affairs.

#One-sided hypothesis test
dt.affairs[, t.test(affair ~ religious, alternative = c("greater"))]

##
##  Welch Two Sample t-test
##
## data:  affair by religious
## t = 3.7191, df = 594.76, p-value = 0.0001094
## alternative hypothesis: true difference in means between group FALSE and group TRUE is greater than 0
## 95 percent confidence interval:
##  0.07133542        Inf
## sample estimates:
## mean in group FALSE  mean in group TRUE
##           0.3049853           0.1769231

dt.affairs[, t.test(naffairs ~ religious, alternative = c("greater"))]

##
##  Welch Two Sample t-test
##
## data:  naffairs by religious
## t = 4.0676, df = 593.3, p-value = 2.696e-05
## alternative hypothesis: true difference in means between group FALSE and group TRUE is greater than 0
## 95 percent confidence interval:
```

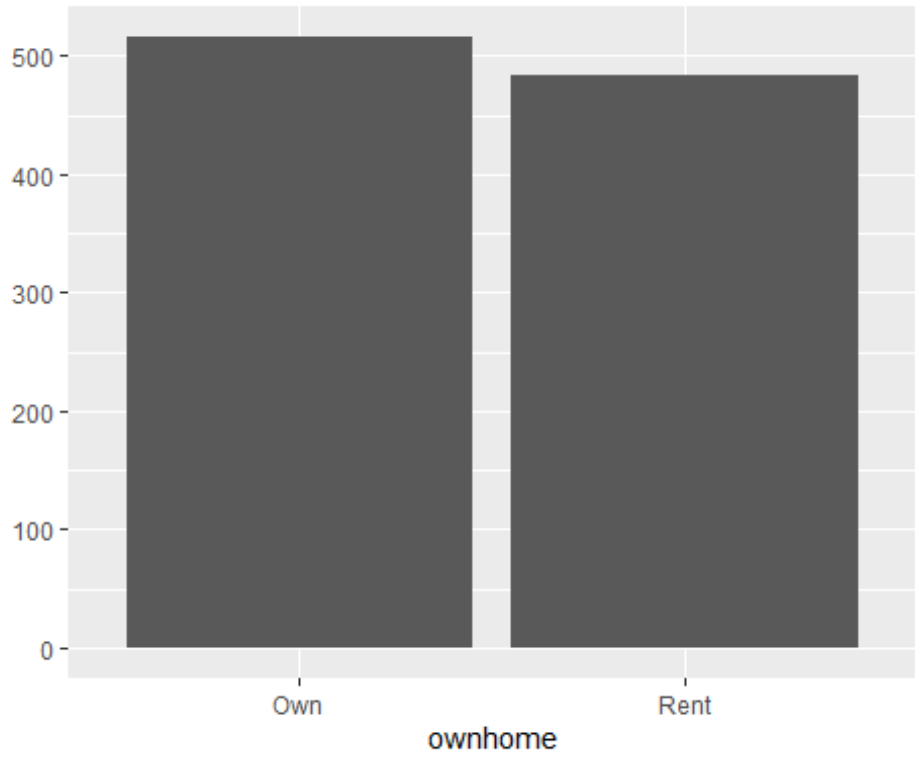
```
##  0.6192441       Inf
## sample estimates:
## mean in group FALSE  mean in group TRUE
##           1.9061584           0.8653846

#MULTIPLE REGRESSION

dt.mktg <- data.table(read.csv("DirectMarketing.csv"))
dt.mktg <- setnames(dt.mktg, tolower(names(dt.mktg)))

summary(dt.mktg)

##      age               gender            ownhome            married
##  Length:1000        Length:1000        Length:1000        Length:1000
##  Class :character   Class :character   Class :character   Class :character
##  Mode  :character   Mode  :character   Mode  :character   Mode  :character
##
##
##
##    location            salary          children       history
##  Length:1000        Min.   : 10100   Min.   :0.000   Length:1000
##  Class :character   1st Qu.: 29975   1st Qu.:0.000   Class :character
##  Mode  :character   Median : 53700   Median :1.000   Mode  :character
##                     Mean   : 56104   Mean   :0.934
##                     3rd Qu.: 77025   3rd Qu.:2.000
##                     Max.   :168800   Max.   :3.000
##     catalogs      amountspent
##  Min.   : 6.00   Min.   :  38.0
##  1st Qu.: 6.00   1st Qu.: 488.2
##  Median :12.00   Median : 962.0
##  Mean   :14.68   Mean   :1216.8
##  3rd Qu.:18.00   3rd Qu.:1688.5
##  Max.   :24.00   Max.   :6217.0

stargazer(dt.mktg, type = "text")

##
## ===============================================================================
## Statistic     N      Mean     St. Dev.   Min   Pctl(25) Pctl(75)   Max
## -------------------------------------------------------------------------------
## salary      1,000 56,103.900 30,616.310 10,100  29,975   77,025  168,800
## children    1,000   0.934      1.051      0       0        2        3
## catalogs    1,000   14.682     6.623      6       6        18      24
## amountspent 1,000 1,216.770   961.069     38    488.2   1,688.5   6,217
## -------------------------------------------------------------------------------

qplot ( data = dt.mktg, x = age, geom = 'bar') + theme_bw() +
xlim("Young","Middle","Old")
```




```
qplot ( data = dt.mktg, x = gender, geom = 'bar') + theme_bw() #####
theme_bw() is to put a white background on the plot
```

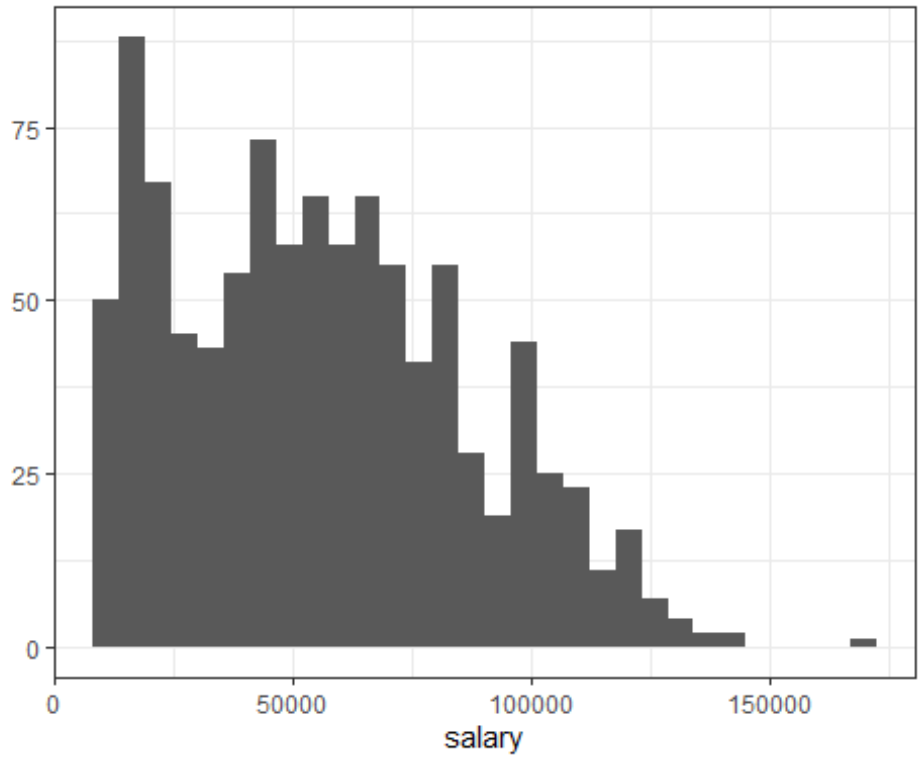


```
qplot ( data = dt.mktg, x = ownhome, geom = 'bar')
```

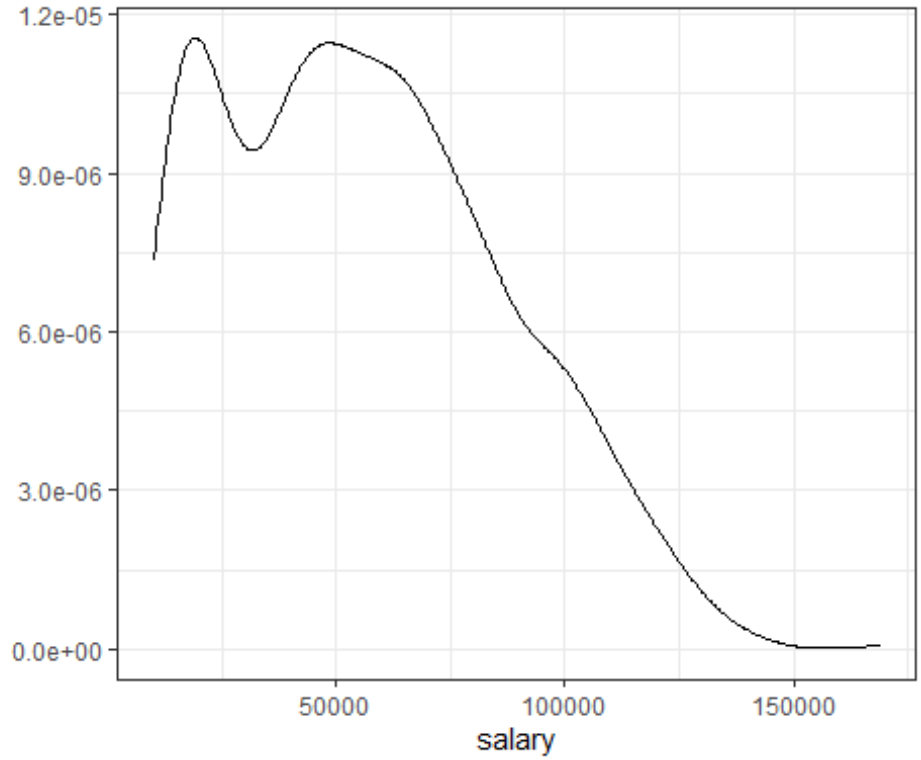



```
qplot ( data = dt.mktg, x = salary, geom = 'histogram') + theme_bw()
```

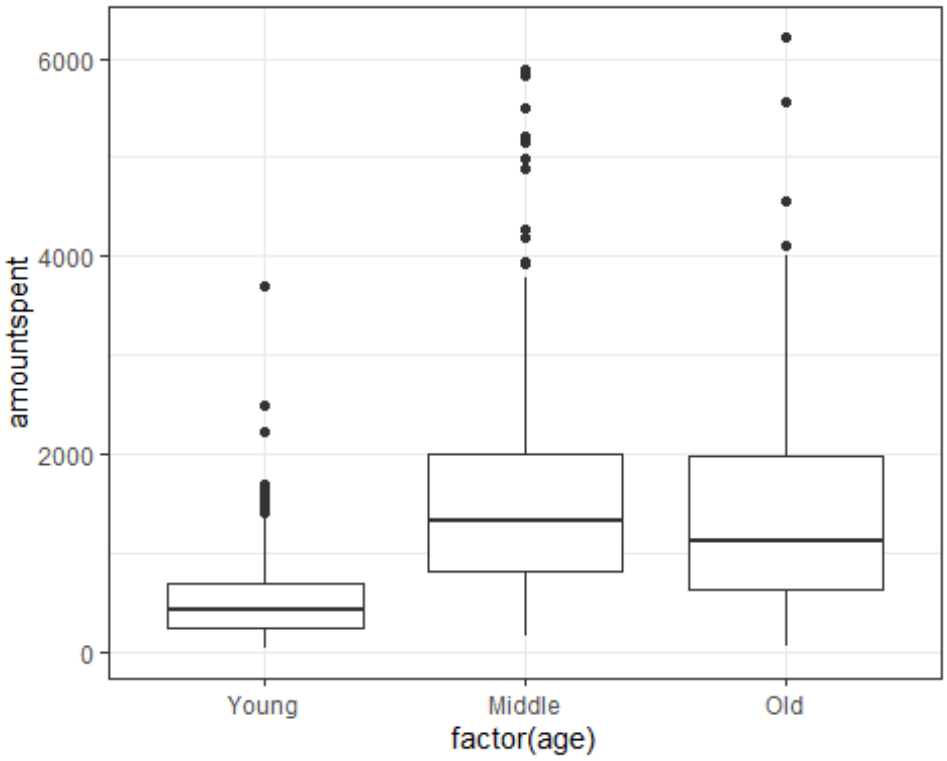
```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



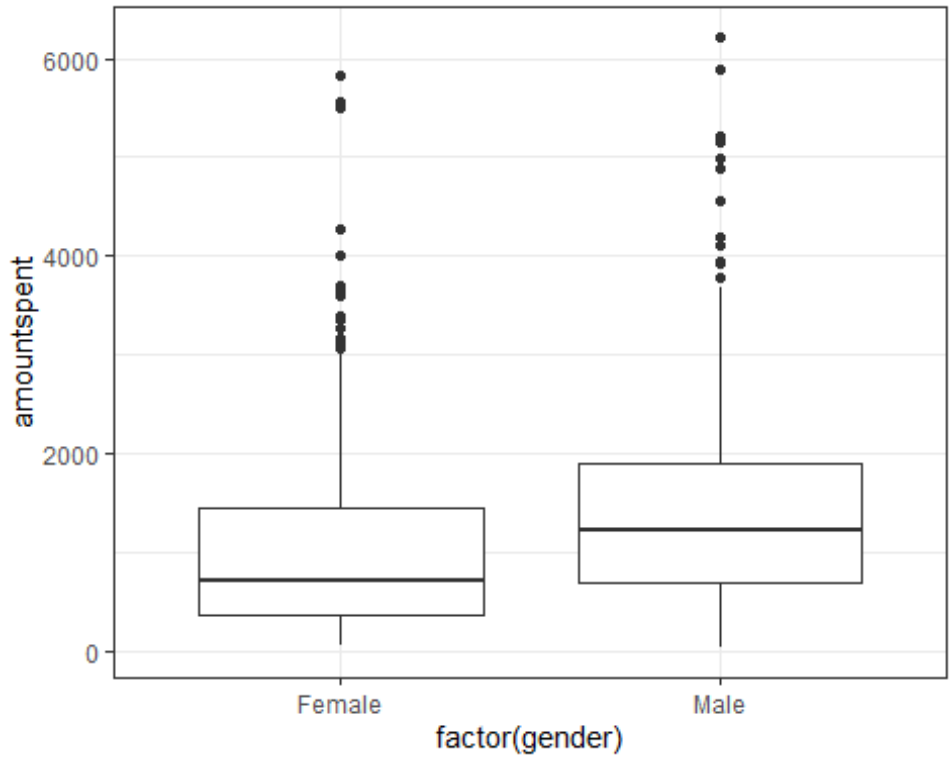

```
qplot ( data = dt.mktg, x = salary, geom = 'density') + theme_bw()
```



```
#Now lets explore the amount spent by the different customer segments.

qplot( data = dt.mktg, x = factor(age), y = amountspent, geom ='boxplot') +
theme_bw() + xlim("Young","Middle","Old")
```




```
qplot( data = dt.mktg, x = factor(gender), y = amountspent, geom ='boxplot')
+ theme_bw()
```




```
#Simple Regression Interpretation
lm1 <- lm(amountspent ~ salary, data = dt.mktg)
stargazer(lm1, type = 'text')
```

```
##
## ================================================
##                         Dependent variable:
##                     ---------------------------
##                             amountspent
## ------------------------------------------------
## salary                       0.022***
##                               (0.001)
##
## Constant                     -15.318
##                             (45.374)
##
## ------------------------------------------------
## Observations                  1,000
## R2                            0.489
## Adjusted R2                   0.489
## Residual Std. Error     687.065 (df = 998)
## F Statistic          956.694*** (df = 1; 998)
## ================================================
## Note:               *p<0.1; **p<0.05; ***p<0.01
```

```
lm2 <- lm(amountspent ~ location, data = dt.mktg)
stargazer(lm2, type = 'text')
```

```
##
## ================================================
##                          Dependent variable:
##                      ---------------------------
##                                amountspent
## ------------------------------------------------
## locationFar                    534.773***
##                                 (64.837)
##
## Constant                      1,061.686***
##                                 (34.916)
##
## ------------------------------------------------
## Observations                      1,000
## R2                                0.064
## Adjusted R2                       0.063
## Residual Std. Error     930.364 (df = 998)
## F Statistic           68.028*** (df = 1; 998)
## ================================================
## Note:               *p<0.1; **p<0.05; ***p<0.01
```

```
dt.mktg[location=="Close", mean(amountspent)]
```

```
## [1] 1061.686
```

```
dt.mktg[location=="Far", mean(amountspent)]
```

```
## [1] 1596.459
```

```
lm3 <- lm(amountspent ~ history, data = dt.mktg)
stargazer(lm3, type = 'text')
```

```
##
## ================================================
##                          Dependent variable:
##                      ---------------------------
##                                amountspent
## ------------------------------------------------
## historyLow                    -1,829.050***
##                                 (56.917)
##
## historyMedium                 -1,235.736***
##                                 (58.174)
##
## Constant                      2,186.137***
##                                 (39.196)
##
## ------------------------------------------------
## Observations                       697
## R2                                0.610
## Adjusted R2                       0.608
```

```
## Residual Std. Error     625.902 (df = 694)
## F Statistic          541.884*** (df = 2; 694)
## ================================================
## Note:                *p<0.1; **p<0.05; ***p<0.01

dt.mktg[history=="High", mean(amountspent)]

## [1] 2186.137

#Multiple Regression
lm.spend1 <- lm(amountspent~ gender + location + salary + children +
catalogs, data = dt.mktg)
stargazer(lm.spend1, type = 'text')

##
## ================================================
##                         Dependent variable:
##                     ---------------------------
##                              amountspent
## ------------------------------------------------
## genderMale                     -42.309
##                                (33.959)
##
## locationFar                   508.129***
##                                (36.207)
##
## salary                         0.021***
##                                 (0.001)
##
## children                      -205.806***
##                                (15.731)
##
## catalogs                       42.802***
##                                 (2.544)
##
## Constant                      -528.143***
##                                (50.454)
##
## ------------------------------------------------
## Observations                     1,000
## R2                               0.715
## Adjusted R2                      0.714
## Residual Std. Error     514.103 (df = 994)
## F Statistic          499.438*** (df = 5; 994)
## ================================================
## Note:                *p<0.1; **p<0.05; ***p<0.01

#Shorcut for tje Multiple Regression

lm.spend2 <- lm(amountspent ~ ., data = dt.mktg)
stargazer(lm.spend1, lm.spend2 , type = 'text')
```

```
##
## ========================================================================
##                                   Dependent variable:
##                     ---------------------------------------------------
##                                        amountspent
##                              (1)                        (2)
## ------------------------------------------------------------------------
## ageOld                                                   41.385
##                                                         (52.764)
##
## ageYoung                                                 89.654
##                                                         (58.741)
##
## genderMale                  -42.309                      -53.701
##                             (33.959)                    (38.016)
##
## ownhomeRent                                              -18.288
##                                                         (41.512)
##
## marriedSingle                                            19.503
##                                                         (49.812)
##
## locationFar                508.129***                   608.992***
##                             (36.207)                    (43.985)
##
## salary                      0.021***                     0.019***
##                             (0.001)                      (0.001)
##
## children                   -205.806***                  -268.283***
##                             (15.731)                    (25.019)
##
## historyLow                                              -267.514***
##                                                         (88.617)
##
## historyMedium                                           -344.553***
##                                                         (59.964)
##
## catalogs                    42.802***                    40.521***
##                             (2.544)                      (2.868)
##
## Constant                   -528.143***                  -249.579*
##                             (50.454)                    (134.031)
##
## ------------------------------------------------------------------------
## Observations                  1,000                        697
## R2                            0.715                       0.789
## Adjusted R2                   0.714                       0.785
## Residual Std. Error    514.103 (df = 994)       463.457 (df = 685)
## F Statistic         499.438*** (df = 5; 994) 232.493*** (df = 11; 685)
```

```
## ================================================================
## Note:                                    *p<0.1; **p<0.05; ***p<0.01
```

```
#Predict amount spent by new customer

new.client <- data.table( gender = "Male", location = "Close", salary =
53700, children = 1, catalogs = 12)

new.client
```

```
##    gender location salary children catalogs
## 1:   Male    Close  53700        1       12
```

```
my.pred <- predict(lm.spend1, newdata = new.client)
my.pred
```

```
##        1
## 868.9695
```

```
my.pred <- predict(lm.spend1, newdata = new.client, interval="prediction",
level = .95)
my.pred
```

```
##        fit       lwr      upr
## 1 868.9695 -141.2554 1879.194
```