

CloverLeaf Case Analysis

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Clean Global Environment

```
rm(list=ls())
```

Loading of the relevant libraries

```
library(tidyverse)
```

```
## — Attaching packages — tidyverse 1.3.2 —  
## ✓ ggplot2 3.3.6      ✓ purrr  0.3.4  
## ✓ tibble  3.1.8      ✓ dplyr  1.0.10  
## ✓ tidyr   1.2.1      ✓ stringr 1.4.1  
## ✓ readr   2.1.2      ✓ forcats 0.5.2  
## — Conflicts — tidyverse_conflicts() —  
## X dplyr::filter() masks stats::filter()  
## X dplyr::lag()     masks stats::lag()
```

```
library(readxl)  
library(openxlsx)  
library(ggplot2)  
library(olsrr)
```

```
##  
## Attaching package: 'olsrr'  
##  
## The following object is masked from 'package:datasets':  
##  
##   rivers
```

```
library(modelr)  
library(fastDummies)  
library(stargazer)
```

```
##  
## Please cite as:  
##  
## Hlavac, Marek (2022). stargazer: Well-Formatted Regression and Summary Statistics Tables.  
## R package version 5.2.3. https://CRAN.R-project.org/package=stargazer
```

```
library(ggcorrplot)
library(psych)
```

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

```
library(lme4)
```

```
## Loading required package: Matrix
##
## Attaching package: 'Matrix'
##
## The following objects are masked from 'package:tidyr':
##
##    expand, pack, unpack
```

```
library('lattice')
library('Matrix')
library('equatiomatic')
```

```
##
## Attaching package: 'equatiomatic'
##
## The following object is masked from 'package:olsrr':
##
##    hsb
```

```
library(mediation)
```

```
## Loading required package: MASS
##
## Attaching package: 'MASS'
##
## The following object is masked from 'package:olsrr':
##
##     cement
##
## The following object is masked from 'package:dplyr':
##
##     select
##
## Loading required package: mvtnorm
## Loading required package: sandwich
## mediation: Causal Mediation Analysis
## Version: 4.5.0
##
##
## Attaching package: 'mediation'
##
## The following object is masked from 'package:psych':
##
##     mediate
```

Importing of my 'Cloverleaf' data set and quick exploration.

```
data <- read_xlsx("cloverr.xlsx")
head(data)
```

```
## # A tibble: 6 × 16
##   AdvertID Datestring Impressions Clicks Click...1 LagCl...2 Bidpr...3 Adrank
##   <dbl> <dtm>         <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
## 1  4616 2012-01-09 00:00:00      9      1  0.11      NA      0     10
## 2  6511 2012-01-09 00:00:00      1      0  0          NA      0      4
## 3  6687 2012-01-02 00:00:00      0      0  0          NA      0     10
## 4  6687 2012-01-02 00:00:00      0      0  0          0      0     10
## 5  6687 2012-01-02 00:00:00      0      0  0          0      0     10
## 6  6687 2012-01-02 00:00:00      0      0  0          0      0     10
## # ... with 8 more variables: Conversions <dbl>, Conversionrate <dbl>,
## #   Numberofwords <dbl>, Retailer <dbl>, Brandname <dbl>,
## #   `Ad Copy Quality` <dbl>, `Landing Page Quality` <dbl>, Revenue <dbl>, and
## #   abbreviated variable names 1Clickthroughrate, 2LagClickThrough, 3Bidprice
```

```
str(data)
```

```
## tibble [1,010 × 16] (S3: tbl_df/tbl/data.frame)
## $ AdvertID      : num [1:1010] 4616 6511 6687 6687 6687 ...
## $ Datestring    : POSIXct[1:1010], format: "2012-01-09" "2012-01-09" ...
## $ Impressions   : num [1:1010] 9 1 0 0 0 0 0 0 0 0 ...
## $ Clicks        : num [1:1010] 1 0 0 0 0 0 0 0 0 0 ...
## $ Clickthroughrate : num [1:1010] 0.11 0 0 0 0 0 0 0 0 0 ...
## $ LagClickThrough : num [1:1010] NA NA NA 0 0 0 0 0 0 ...
## $ Bidprice      : num [1:1010] 0 0 0 0 0 0 0 0 0 0 ...
## $ Adrank        : num [1:1010] 10 4 10 10 10 10 10 10 10 10 ...
## $ Conversions    : num [1:1010] 1 0 0 0 0 0 0 0 0 0 ...
## $ Conversionrate : num [1:1010] 1 0 0 0 0 0 0 0 0 0 ...
## $ Numberofwords  : num [1:1010] 4 3 1 1 1 1 1 1 1 1 ...
## $ Retailer       : num [1:1010] 0 0 0 0 0 0 0 0 0 0 ...
## $ Brandname      : num [1:1010] 0 0 0 0 0 0 0 0 0 0 ...
## $ Ad Copy Quality : num [1:1010] 9.9 1 1 1 1 ...
## $ Landing Page Quality: num [1:1010] 10 8.5 4.95 4.95 4.95 ...
## $ Revenue        : num [1:1010] 16 0 0 0 0 ...
```

```
any(is.na(data))
```

```
## [1] TRUE
```

```
summary(data)
```

```
##      AdvertID      Datestring      Impressions
## Min.      : 4616   Min.      :2012-01-02 00:00:00.00   Min.      : 0
## 1st Qu.: 1351925   1st Qu.:2012-01-23 00:00:00.00   1st Qu.: 5
## Median : 1955831   Median :2012-03-12 00:00:00.00   Median : 102
## Mean   :21283776   Mean   :2012-02-23 17:57:51.68   Mean   : 2225
## 3rd Qu.:41761092   3rd Qu.:2012-03-19 00:00:00.00   3rd Qu.: 444
## Max.    :44321713   Max.    :2012-03-26 00:00:00.00   Max.    :109091
##
##      Clicks      Clickthroughrate      LagClickThrough      Bidprice
## Min.      : 0.0   Min.      :0.000000   Min.      :0.00000   Min.      :0.00000
## 1st Qu.: 1.0   1st Qu.:0.007389   1st Qu.:0.00984   1st Qu.:0.00000
## Median : 4.0   Median :0.069614   Median :0.07487   Median :0.00000
## Mean   : 454.8   Mean   :0.198192   Mean   :0.21076   Mean   :0.07650
## 3rd Qu.: 79.0   3rd Qu.:0.365064   3rd Qu.:0.40000   3rd Qu.:0.08023
## Max.    :8974.0   Max.    :1.000000   Max.    :1.00000   Max.    :1.00000
##
##                                     NA's      :119
##      Adrank      Conversions      Conversionrate      Numberofwords
## Min.      : 0.000   Min.      : 0.000   Min.      :0.000000   Min.      :0.000
## 1st Qu.: 1.000   1st Qu.: 0.000   1st Qu.:0.000000   1st Qu.:1.000
## Median : 1.000   Median : 0.000   Median :0.000000   Median :2.000
## Mean   : 5.717   Mean   : 6.798   Mean   :0.034103   Mean   :2.044
## 3rd Qu.: 4.000   3rd Qu.: 1.000   3rd Qu.:0.006237   3rd Qu.:3.000
## Max.    :63.000   Max.    :132.000   Max.    :1.000000   Max.    :5.000
##
##      Retailer      Brandname      Ad Copy Quality      Landing Page Quality
## Min.      :0.0000   Min.      :0.0000   Min.      : 1.000   Min.      : 1.000
## 1st Qu.:0.0000   1st Qu.:0.0000   1st Qu.: 1.000   1st Qu.: 2.945
## Median :0.0000   Median :1.0000   Median : 4.137   Median : 6.631
## Mean   :0.3644   Mean   :0.7366   Mean   : 5.385   Mean   : 5.930
## 3rd Qu.:1.0000   3rd Qu.:1.0000   3rd Qu.:10.000   3rd Qu.: 8.503
## Max.    :1.0000   Max.    :1.0000   Max.    :10.000   Max.    :10.000
##
##      Revenue
## Min.      : 0.00
## 1st Qu.: 0.00
## Median : 0.00
## Mean   : 501.87
## 3rd Qu.: 24.99
## Max.    :10382.10
##
```

data selection and description.

```
data <- dplyr::select(data, -AdvertID, -Datestring) #Selection of the relevant variables
head(data)
```

```
## # A tibble: 6 × 14
##   Impres...1 Clicks Click...2 LagCl...3 Bidpr...4 Adrank Conve...5 Conve...6 Numbe...7 Retai...8
##   <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
## 1     9     1  0.11    NA     0    10     1     1     4     0
## 2     1     0   0      NA     0     4     0     0     3     0
## 3     0     0   0      NA     0    10     0     0     1     0
## 4     0     0   0      0     0    10     0     0     1     0
## 5     0     0   0      0     0    10     0     0     1     0
## 6     0     0   0      0     0    10     0     0     1     0
## # ... with 4 more variables: Brandname <dbl>, `Ad Copy Quality` <dbl>,
## #   `Landing Page Quality` <dbl>, Revenue <dbl>, and abbreviated variable names
## #   1Impressions, 2Clickthroughrate, 3LagClickThrough, 4Bidprice, 5Conversions,
## #   6Conversionrate, 7Numberofwords, 8Retailer
```

```
data_descriptives <- describe(data) #to get my descriptive statistics
data_descriptives
```

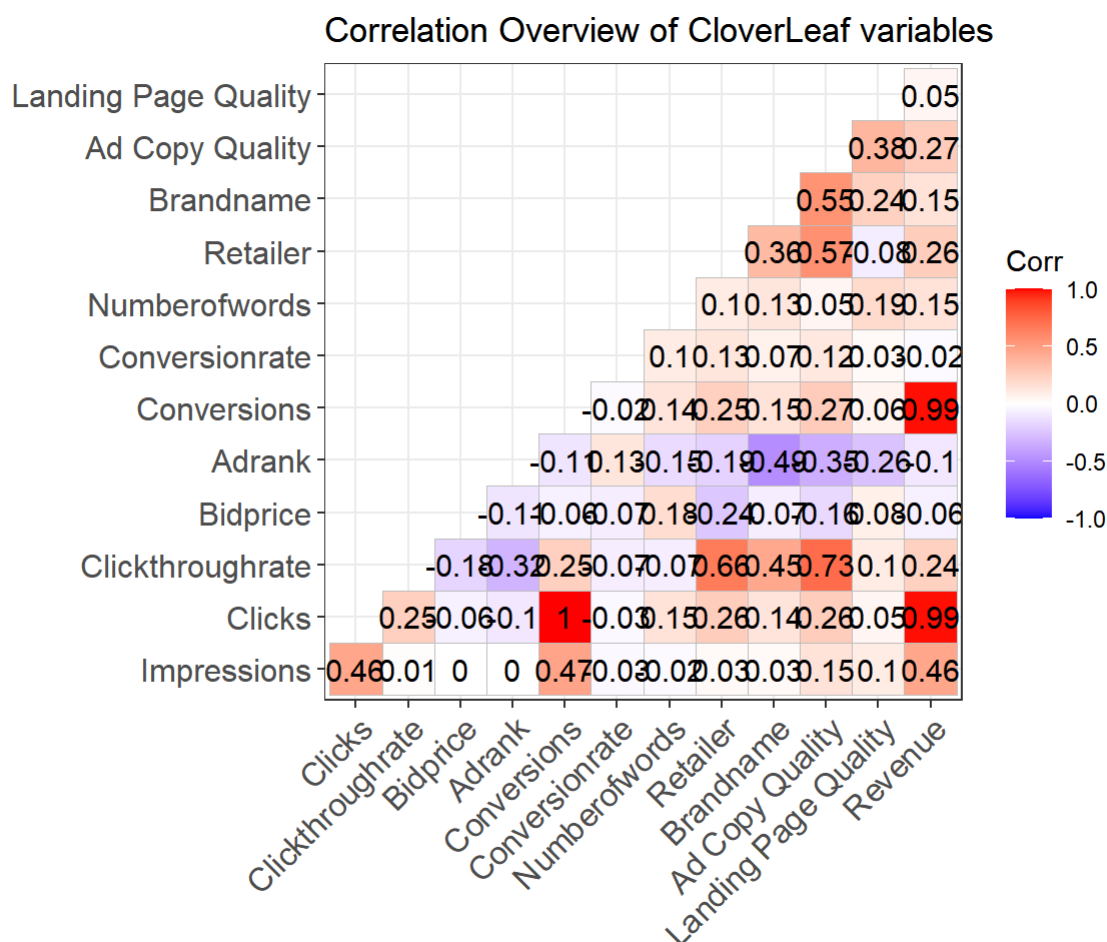
```
##           vars      n    mean      sd median trimmed      mad min
## Impressions      1 1010 2224.80 8807.17 102.00 381.22 146.78  0
## Clicks           2 1010 454.83 1734.79  4.00  41.49  5.93  0
## Clickthroughrate  3 1010  0.20  0.23  0.07  0.17  0.10  0
## LagClickThrough  4  891  0.21  0.23  0.07  0.18  0.11  0
## Bidprice         5 1010  0.08  0.13  0.00  0.05  0.00  0
## Adrank           6 1010  5.72  11.46  1.00  2.71  0.00  0
## Conversions       7 1010  6.80  25.28  0.00  0.56  0.00  0
## Conversionrate    8 1010  0.03  0.16  0.00  0.00  0.00  0
## Numberofwords     9 1010  2.04  1.07  2.00  2.13  1.48  0
## Retailer        10 1010  0.36  0.48  0.00  0.33  0.00  0
## Brandname        11 1010  0.74  0.44  1.00  0.80  0.00  0
## Ad Copy Quality   12 1010  5.38  4.06  4.14  5.36  4.65  1
## Landing Page Quality 13 1010  5.93  2.98  6.63  5.99  4.12  1
## Revenue          14 1010 501.87 1890.17  0.00 40.10  0.00  0
##           max      range skew kurtosis      se
## Impressions 109091.0 109091.0 9.25  105.17 277.13
## Clicks       8974.0  8974.0  4.44  18.44  54.59
## Clickthroughrate  1.0    1.0  0.96  -0.16  0.01
## LagClickThrough  1.0    1.0  0.81  -0.52  0.01
## Bidprice        1.0    1.0  2.03   4.71  0.00
## Adrank          63.0   63.0  3.07   9.59  0.36
## Conversions     132.0  132.0  4.40  18.28  0.80
## Conversionrate   1.0    1.0  5.70  31.09  0.01
## Numberofwords    5.0    5.0 -0.38  -0.78  0.03
## Retailer         1.0    1.0  0.56  -1.68  0.02
## Brandname        1.0    1.0 -1.07  -0.85  0.01
## Ad Copy Quality  10.0    9.0  0.09  -1.83  0.13
## Landing Page Quality 10.0    9.0 -0.10  -1.40  0.09
## Revenue        10382.1 10382.1 4.48  18.91 59.48
```

```
# stargazer(data_descriptives, type = "html", out = "Clovers_data_description.html")# to stargaze it for my writing
```

data Correlation table

```
data_correaltion <- data %>% dplyr::select(Impressions,Clicks, Clickthroughrate, LagClickThrough,
Bidprice,Adrank,Conversions,Conversionrate,Numberofwords,Retailer, Brandname,`Ad Copy Quality`,
`Landing Page Quality`, Revenue) %>% cor() %>% ggcorrplot(method = "square", type = "lower",
lab = T, title = "Correlation Overview of CloverLeaf variables", ggtheme = theme_bw())
```

data_correaltion



CTR Histogram

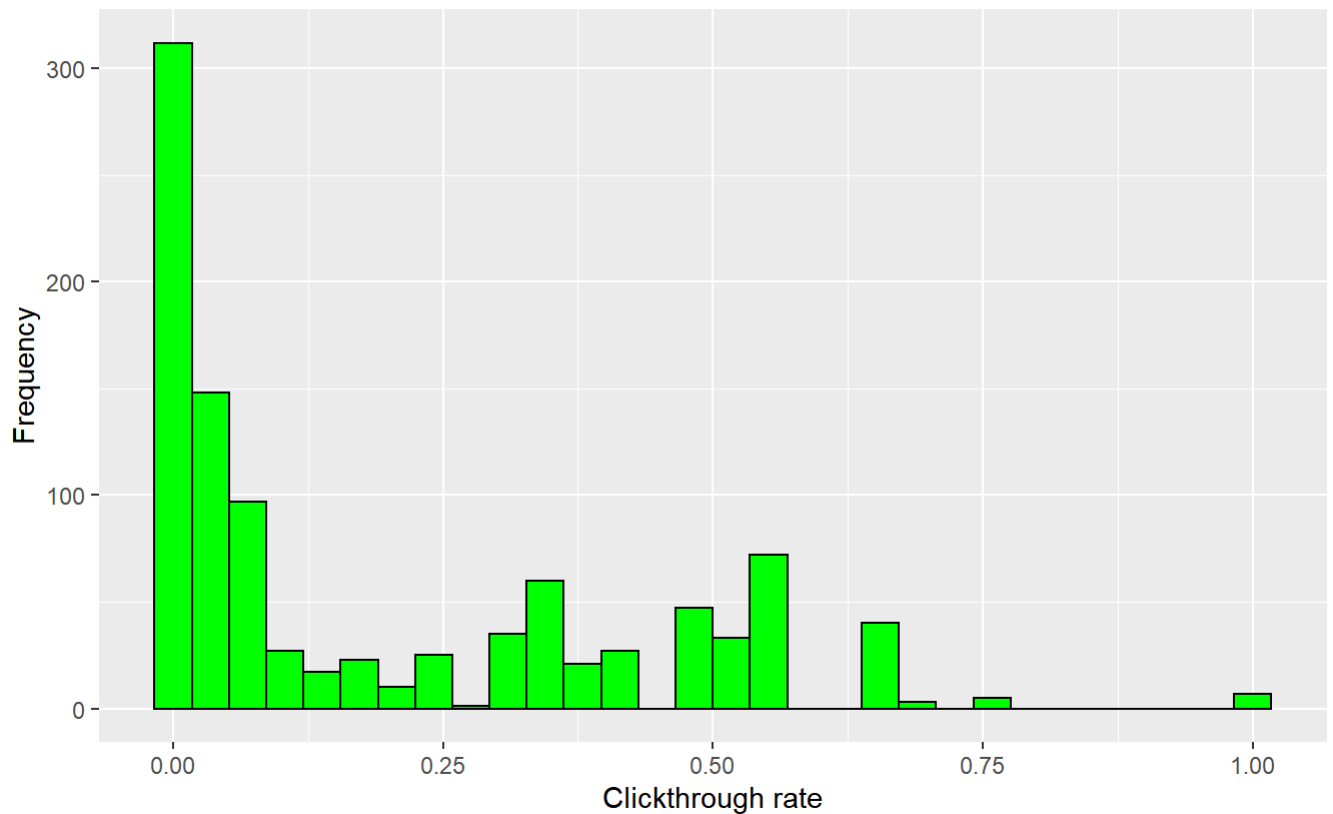
```
data_hist <- data %>% ggplot(aes(Clickthroughrate)) + geom_histogram(color = "black",fill = "green")+
labs(title = "Frequency count vs Clickthroughrate", subtitle = 'From CloverLeaf dataset',
y='Frequency', x='Clickthrough rate', caption = 'CTR Frequency')
```

data_hist

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

Frequency count vs Clickthroughrate

From CloverLeaf dataset



CTR Frequency

data cleaning for OLS regression modelling

```
data <- data %>% na.omit() #removing NA values  
any(is.na(data))
```

```
## [1] FALSE
```

```
str(data)
```



```
## tibble [891 × 14] (S3: tbl_df/tbl/data.frame)
## $ Impressions      : num [1:891] 0 0 0 0 0 0 0 0 0 0 ...
## $ Clicks           : num [1:891] 0 0 0 0 0 0 0 0 0 0 ...
## $ Clickthroughrate : num [1:891] 0 0 0 0 0 0 0 0 0 0 ...
## $ LagClickThrough  : num [1:891] 0 0 0 0 0 0 0 0 0 0 ...
## $ Bidprice         : num [1:891] 0 0 0 0 0 0 0 0 0 0 ...
## $ Adrank           : num [1:891] 10 10 10 10 10 10 10 10 10 10 ...
## $ Conversions      : num [1:891] 0 0 0 0 0 0 0 0 0 0 ...
## $ Conversionrate   : num [1:891] 0 0 0 0 0 0 0 0 0 0 ...
## $ Numberofwords    : num [1:891] 1 1 1 1 1 1 1 1 1 1 ...
## $ Retailer         : num [1:891] 0 0 0 0 0 0 0 0 0 0 ...
## $ Brandname        : num [1:891] 0 0 0 0 0 0 0 0 0 0 ...
## $ Ad Copy Quality  : num [1:891] 1 1 1 1 1 1 1 1 1 1 ...
## $ Landing Page Quality: num [1:891] 4.95 4.95 4.95 4.95 4.95 ...
## $ Revenue          : num [1:891] 0 0 0 0 0 0 0 0 0 0 ...
## - attr(*, "na.action")= 'omit' Named int [1:119] 1 2 3 15 19 20 22 114 229 236 ...
## ...- attr(*, "names")= chr [1:119] "1" "2" "3" "15" ...
```

Estimating OLS regression model

```
data_result <- lm(Clickthroughrate ~ Impressions+Clicks+Conversions+LagClickThrough+Bidprice+Ad
rank+Conversionrate+Numberofwords+Retailer +Brandname +Revenue+`Landing Page Quality`+`Ad Copy
Quality`, data = data ) # all variables

data_result_NEW <- lm(Clickthroughrate ~ `Ad Copy Quality`+ Retailer +Brandname +`Landing Page Q
uality`+ LagClickThrough+Bidprice+Adrank+Numberofwords, data = data )

summary(data_result_NEW)
```

```
##
## Call:
## lm(formula = Clickthroughrate ~ `Ad Copy Quality` + Retailer +
##      Brandname + `Landing Page Quality` + LagClickThrough + Bidprice +
##      Adrank + Numberofwords, data = data)
##
## Residuals:
##      Min        1Q    Median        3Q        Max
## -0.83179 -0.01149  0.00347  0.01418  0.58166
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      0.0131035   0.0088543    1.480   0.139
## `Ad Copy Quality`  0.0048853   0.0011135    4.387 1.29e-05 ***
## Retailer          0.0506526   0.0075254    6.731 3.03e-11 ***
## Brandname         0.0099237   0.0076351    1.300   0.194
## `Landing Page Quality` -0.0001021  0.0010473   -0.097   0.922
## LagClickThrough    0.7921720   0.0174008   45.525 < 2e-16 ***
## Bidprice          0.0009863   0.0216213    0.046   0.964
## Adrank            -0.0003553   0.0002461   -1.444   0.149
## Numberofwords     -0.0104364   0.0024695   -4.226 2.62e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.07164 on 882 degrees of freedom
## Multiple R-squared:  0.9043, Adjusted R-squared:  0.9034
## F-statistic: 1041 on 8 and 882 DF,  p-value: < 2.2e-16
```

```
data_result_NEW %>% stargazer(type = 'html', out = 'clover_leaf Ols_new.html')
```

```
##
## <table style="text-align:center"><tr><td colspan="2" style="border-bottom: 1px solid black">
</td></tr><tr><td style="text-align:left"></td><td><em>Dependent variable:</em></td></tr>
## <tr><td></td><td colspan="1" style="border-bottom: 1px solid black"></td></tr>
## <tr><td style="text-align:left"></td><td>Clickthroughrate</td></tr>
## <tr><td colspan="2" style="border-bottom: 1px solid black"></td></tr><tr><td style="text-align:left">`Ad Copy Quality`</td><td>0.005<sup>***</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.001)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Retailer</td><td>0.051<sup>***</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.008)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Brandname</td><td>0.010</td></tr>
## <tr><td style="text-align:left"></td><td>(0.008)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">`Landing Page Quality`</td><td>-0.0001</td></tr>
## <tr><td style="text-align:left"></td><td>(0.001)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">LagClickThrough</td><td>0.792<sup>***</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.017)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Bidprice</td><td>0.001</td></tr>
## <tr><td style="text-align:left"></td><td>(0.022)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Adrank</td><td>-0.0004</td></tr>
## <tr><td style="text-align:left"></td><td>(0.0002)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Numberofwords</td><td>-0.010<sup>***</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.002)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Constant</td><td>0.013</td></tr>
## <tr><td style="text-align:left"></td><td>(0.009)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td colspan="2" style="border-bottom: 1px solid black"></td></tr><tr><td style="text-align:left">Observations</td><td>891</td></tr>
## <tr><td style="text-align:left">R<sup>2</sup></td><td>0.904</td></tr>
## <tr><td style="text-align:left">Adjusted R<sup>2</sup></td><td>0.903</td></tr>
## <tr><td style="text-align:left">Residual Std. Error</td><td>0.072 (df = 882)</td></tr>
## <tr><td style="text-align:left">F Statistic</td><td>1,041.324<sup>***</sup> (df = 8; 882)</td></tr>
## <tr><td colspan="2" style="border-bottom: 1px solid black"></td></tr><tr><td style="text-align:left"><em>Note:</em></td><td style="text-align:right"><sup>*</sup>p<0.1; <sup>**</sup>p<0.05;
<sup>***</sup>p<0.01</td></tr>
## </table>
```

```
summary(data_result)
```

```
##
## Call:
## lm(formula = Clickthroughrate ~ Impressions + Clicks + Conversions +
##      LagClickThrough + Bidprice + Adrank + Conversionrate + Numberofwords +
##      Retailer + Brandname + Revenue + `Landing Page Quality` +
##      `Ad Copy Quality`, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.81465 -0.00894  0.00377  0.01417  0.57245
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.134e-02  8.843e-03   1.282   0.2001
## Impressions   -6.767e-07  3.301e-07  -2.050   0.0407 *
## Clicks         3.083e-05  1.886e-05   1.634   0.1025
## Conversions   -2.111e-03  1.220e-03  -1.730   0.0840 .
## LagClickThrough  7.641e-01  1.820e-02  41.984 < 2e-16 ***
## Bidprice       1.225e-03  2.143e-02   0.057   0.9544
## Adrank        -1.419e-04  2.479e-04  -0.572   0.5672
## Conversionrate -7.294e-02  1.748e-02  -4.173 3.30e-05 ***
## Numberofwords  -1.210e-02  2.566e-03  -4.718 2.77e-06 ***
## Retailer       5.358e-02  7.567e-03   7.081 2.94e-12 ***
## Brandname      1.458e-02  7.613e-03   1.915   0.0558 .
## Revenue        2.982e-06  1.093e-05   0.273   0.7850
## `Landing Page Quality` 1.037e-05  1.045e-03   0.010   0.9921
## `Ad Copy Quality`   6.088e-03  1.145e-03   5.317 1.34e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.07068 on 877 degrees of freedom
## Multiple R-squared:  0.9073, Adjusted R-squared:  0.906
## F-statistic: 660.6 on 13 and 877 DF,  p-value: < 2.2e-16
```

```
data_result %>% stargazer(type = 'html', out = 'clover_leaf Ols.html')
```

```
##
## <table style="text-align:center"><tr><td colspan="2" style="border-bottom: 1px solid black">
</td></tr><tr><td style="text-align:left"></td><td><em>Dependent variable:</em></td></tr>
## <tr><td></td><td colspan="1" style="border-bottom: 1px solid black"></td></tr>
## <tr><td style="text-align:left"></td><td>Clickthroughrate</td></tr>
## <tr><td colspan="2" style="border-bottom: 1px solid black"></td></tr><tr><td style="text-align:left">Impressions</td><td>-0.00000<sup>**</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.00000)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Clicks</td><td>0.00003</td></tr>
## <tr><td style="text-align:left"></td><td>(0.00002)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Conversions</td><td>-0.002<sup>*</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.001)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">LagClickThrough</td><td>0.764<sup>***</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.018)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Bidprice</td><td>0.001</td></tr>
## <tr><td style="text-align:left"></td><td>(0.021)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Adrank</td><td>-0.0001</td></tr>
## <tr><td style="text-align:left"></td><td>(0.0002)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Conversionrate</td><td>-0.073<sup>***</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.017)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Numberofwords</td><td>-0.012<sup>***</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.003)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Retailer</td><td>0.054<sup>***</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.008)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Brandname</td><td>0.015<sup>*</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.008)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Revenue</td><td>0.00000</td></tr>
## <tr><td style="text-align:left"></td><td>(0.00001)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">`Landing Page Quality`</td><td>0.00001</td></tr>
## <tr><td style="text-align:left"></td><td>(0.001)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">`Ad Copy Quality`</td><td>0.006<sup>***</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.001)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Constant</td><td>0.011</td></tr>
## <tr><td style="text-align:left"></td><td>(0.009)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td colspan="2" style="border-bottom: 1px solid black"></td></tr><tr><td style="text-align:left">Observations</td><td>891</td></tr>
## <tr><td style="text-align:left">R<sup>2</sup></td><td>0.907</td></tr>
## <tr><td style="text-align:left">Adjusted R<sup>2</sup></td><td>0.906</td></tr>
```

```
## <tr><td style="text-align:left">Residual Std. Error</td><td>0.071 (df = 877)</td></tr>
## <tr><td style="text-align:left">F Statistic</td><td>660.562<sup>***</sup> (df = 13; 877)</td>
</tr>
## <tr><td colspan="2" style="border-bottom: 1px solid black"></td></tr><tr><td style="text-align:left"><em>Note:</em></td><td style="text-align:right"><sup>*</sup>p<0.1; <sup>*</sup>p<0.05;
<sup>***</sup>p<0.01</td></tr>
## </table>
```

Running Diagnostics - multicollinearity

```
library('car')
```

```
## Loading required package: carData
```

```
##
## Attaching package: 'car'
```

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

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

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

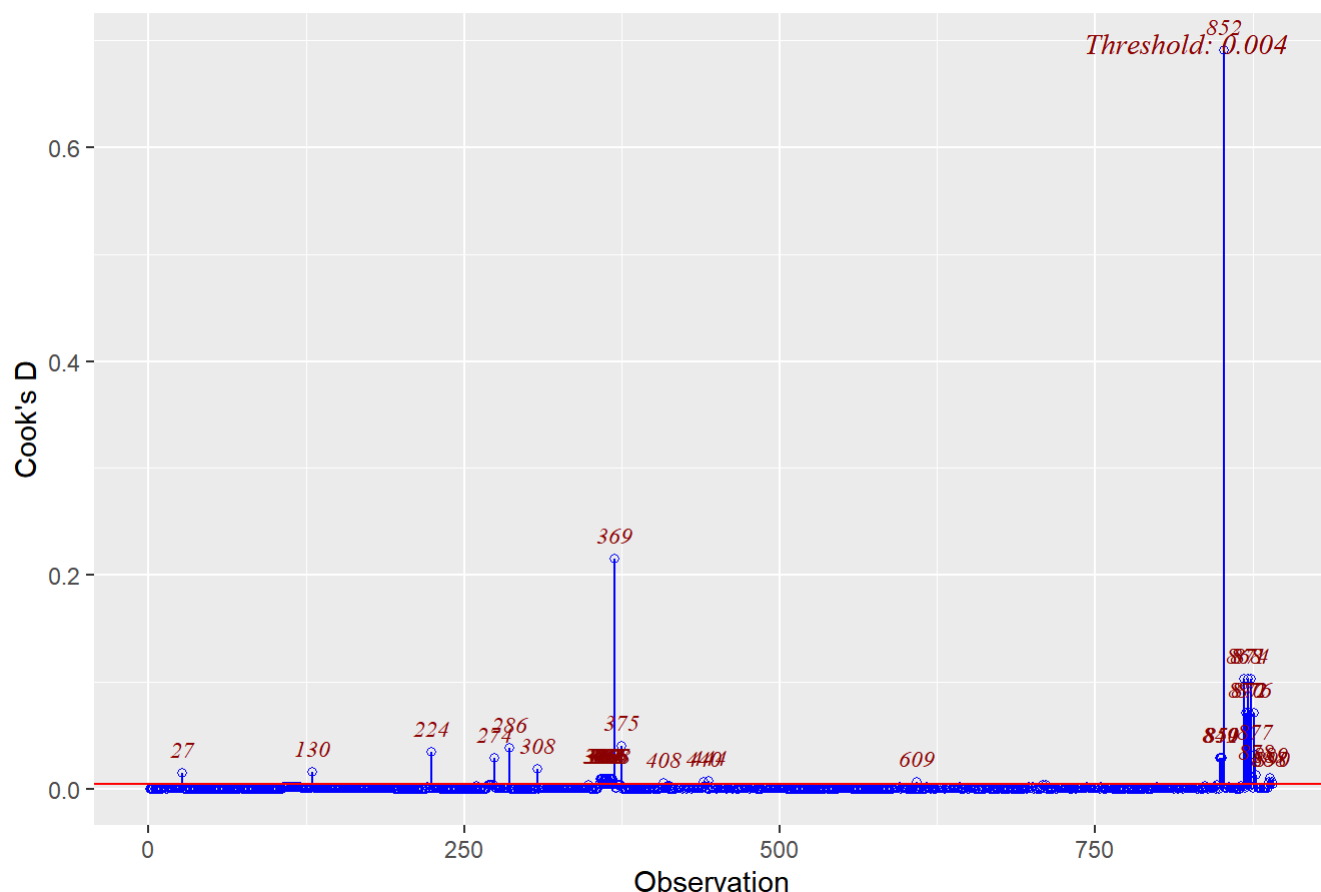
```
vif(data_result_NEW)
```

```
##      `Ad Copy Quality`      Retailer      Brandname
##      3.551721             2.335367      1.846977
## `Landing Page Quality`      LagClickThrough      Bidprice
##      1.680823             2.806842      1.177050
##      Adrank             Numberofwords
##      1.508781             1.222349
```

Running Diagnostics - Outliers

```
data_result_NEW %>% ols_plot_cooks_d_chart()
```

Cook's D Chart



Running Diagnostics - Normally distributed

```
data_result_NEW %>% ols_test_normality()
```

```
## Warning in ks.test.default(y, "pnorm", mean(y), sd(y)): ties should not be
## present for the Kolmogorov-Smirnov test
```

```
## -----
##      Test           Statistic      pvalue
## -----
## Shapiro-Wilk         0.5139         0.0000
## Kolmogorov-Smirnov    0.3043         0.0000
## Cramer-von Mises     275.7199         0.0000
## Anderson-Darling     115.1833         0.0000
## -----
```

Running Diagnostics - heteroscedasticity**

```
data_result_NEW%>% ols_test_breusch_pagan()
```

```
##
## Breusch Pagan Test for Heteroskedasticity
## -----
## Ho: the variance is constant
## Ha: the variance is not constant
##
##                      Data
## -----
## Response : Clickthroughrate
## Variables: fitted values of Clickthroughrate
##
##          Test Summary
## -----
## DF          =      1
## Chi2         =    238.6945
## Prob > Chi2  =    7.574572e-54
```

Adding Moderation Effect on the OLS

```
data_result_moderation <- lm(Clickthroughrate ~ Impressions+Clicks+Conversions+LagClickThrough+
Bidprice+Adrank+Conversionrate+Numberofwords+Retailer +Brandname +Revenue+`Landing Page Quality`
+`Ad Copy Quality`+`Ad Copy Quality`*Retailer, data = data ) # no dv

data_result_moderar <- lm(Clickthroughrate ~ `Ad Copy Quality`+ Retailer +Brandname +`Landing Pa
ge Quality`+ LagClickThrough+Bidprice+Adrank+Numberofwords+ `Ad Copy Quality`*Retailer, data =
data )

data_mod <- lm(Clickthroughrate ~`Ad Copy Quality`*Retailer, data = data)
summary(data_mod)
```



```
##
## Call:
## lm(formula = Clickthroughrate ~ `Ad Copy Quality` * Retailer,
##     data = data)
##
## Residuals:
```

	Min	1Q	Median	3Q	Max
	-0.45191	-0.03052	0.00670	0.07357	0.74721

```
##
## Coefficients:
```

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	-0.016372	0.008569	-1.910	0.0564 .
`Ad Copy Quality`	0.026916	0.001629	16.521	< 2e-16 ***
Retailer	0.131293	0.025398	5.169	2.9e-07 ***
`Ad Copy Quality`:Retailer	0.007333	0.003107	2.360	0.0185 *

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1378 on 887 degrees of freedom
## Multiple R-squared:  0.6437, Adjusted R-squared:  0.6425
## F-statistic: 534.1 on 3 and 887 DF,  p-value: < 2.2e-16
```

```
summary(data_result_moderar)
```

```
##
## Call:
## lm(formula = Clickthroughrate ~ `Ad Copy Quality` + Retailer +
##      Brandname + `Landing Page Quality` + LagClickThrough + Bidprice +
##      Adrank + Numberofwords + `Ad Copy Quality` * Retailer, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.82148 -0.01131  0.00513  0.01327  0.57264
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    0.0174090   0.0091069   1.912  0.05625 .
## `Ad Copy Quality` 0.0037398   0.0012550   2.980  0.00296 **
## Retailer        0.0284553   0.0135560   2.099  0.03609 *
## Brandname       0.0110719   0.0076451   1.448  0.14791
## `Landing Page Quality` 0.0003407   0.0010696   0.319  0.75017
## LagClickThrough  0.7876758   0.0175223  44.953 < 2e-16 ***
## Bidprice       -0.0006721   0.0216027  -0.031  0.97519
## Adrank         -0.0004038   0.0002469  -1.635  0.10235
## Numberofwords   -0.0117480   0.0025540  -4.600 4.85e-06 ***
## `Ad Copy Quality`:Retailer 0.0033741   0.0017152   1.967  0.04947 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.07152 on 881 degrees of freedom
## Multiple R-squared:  0.9047, Adjusted R-squared:  0.9037
## F-statistic: 929.1 on 9 and 881 DF,  p-value: < 2.2e-16
```

```
summary(data_result_moderation)
```

```
##
## Call:
## lm(formula = Clickthroughrate ~ Impressions + Clicks + Conversions +
##      LagClickThrough + Bidprice + Adrank + Conversionrate + Numberofwords +
##      Retailer + Brandname + Revenue + `Landing Page Quality` +
##      `Ad Copy Quality` + `Ad Copy Quality` * Retailer, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.80490 -0.01083  0.00276  0.01374  0.56384
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)      1.524e-02  9.073e-03   1.680   0.0933 .
## Impressions     -6.628e-07  3.297e-07  -2.010   0.0447 *
## Clicks           2.946e-05  1.885e-05   1.563   0.1184
## Conversions     -1.976e-03  1.220e-03  -1.619   0.1058
## LagClickThrough   7.597e-01  1.832e-02  41.470 < 2e-16 ***
## Bidprice        -2.538e-04  2.142e-02  -0.012   0.9905
## Adrank          -1.855e-04  2.486e-04  -0.746   0.4558
## Conversionrate   -7.393e-02  1.746e-02  -4.234 2.54e-05 ***
## Numberofwords    -1.322e-02  2.630e-03  -5.026 6.08e-07 ***
## Retailer         3.282e-02  1.341e-02   2.448   0.0146 *
## Brandname        1.562e-02  7.622e-03   2.049   0.0407 *
## Revenue          2.280e-06  1.092e-05   0.209   0.8346
## `Landing Page Quality` 4.039e-04  1.065e-03   0.379   0.7045
## `Ad Copy Quality`   5.020e-03  1.277e-03   3.930 9.15e-05 ***
## Retailer:`Ad Copy Quality` 3.185e-03  1.699e-03   1.875   0.0612 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.07058 on 876 degrees of freedom
## Multiple R-squared:  0.9077, Adjusted R-squared:  0.9062
## F-statistic: 615.4 on 14 and 876 DF,  p-value: < 2.2e-16
```

```
data_result_moderation %>% stargazer(type = 'html', out = 'clover_leaf_moderation.html')
```

```

##
## <table style="text-align:center"><tr><td colspan="2" style="border-bottom: 1px solid black">
</td></tr><tr><td style="text-align:left"></td><td><em>Dependent variable:</em></td></tr>
## <tr><td></td><td colspan="1" style="border-bottom: 1px solid black"></td></tr>
## <tr><td style="text-align:left"></td><td>Clickthroughrate</td></tr>
## <tr><td colspan="2" style="border-bottom: 1px solid black"></td></tr><tr><td style="text-align:left">Impressions</td><td>-0.00000<sup>**</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.00000)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Clicks</td><td>0.00003</td></tr>
## <tr><td style="text-align:left"></td><td>(0.00002)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Conversions</td><td>-0.002</td></tr>
## <tr><td style="text-align:left"></td><td>(0.001)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">LagClickThrough</td><td>0.760<sup>***</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.018)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Bidprice</td><td>-0.0003</td></tr>
## <tr><td style="text-align:left"></td><td>(0.021)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Adrank</td><td>-0.0002</td></tr>
## <tr><td style="text-align:left"></td><td>(0.0002)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Conversionrate</td><td>-0.074<sup>***</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.017)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Numberofwords</td><td>-0.013<sup>***</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.003)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Retailer</td><td>0.033<sup>**</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.013)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Brandname</td><td>0.016<sup>**</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.008)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Revenue</td><td>0.00000</td></tr>
## <tr><td style="text-align:left"></td><td>(0.00001)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">`Landing Page Quality`</td><td>0.0004</td></tr>
## <tr><td style="text-align:left"></td><td>(0.001)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">`Ad Copy Quality`</td><td>0.005<sup>***</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.001)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Retailer:`Ad Copy Quality`</td><td>0.003<sup>*</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.002)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>
## <tr><td style="text-align:left">Constant</td><td>0.015<sup>*</sup></td></tr>
## <tr><td style="text-align:left"></td><td>(0.009)</td></tr>
## <tr><td style="text-align:left"></td><td></td></tr>

```

```
## <tr><td colspan="2" style="border-bottom: 1px solid black"></td></tr><tr><td style="text-align:left">Observations</td><td>891</td></tr>
## <tr><td style="text-align:left">R<sup>2</sup></td><td>0.908</td></tr>
## <tr><td style="text-align:left">Adjusted R<sup>2</sup></td><td>0.906</td></tr>
## <tr><td style="text-align:left">Residual Std. Error</td><td>0.071 (df = 876)</td></tr>
## <tr><td style="text-align:left">F Statistic</td><td>615.388<sup>***</sup> (df = 14; 876)</td></tr>
## <tr><td colspan="2" style="border-bottom: 1px solid black"></td></tr><tr><td style="text-align:left"><em>Note:</em></td><td style="text-align:right"><sup>*</sup>p<0.1; <sup>***</sup>p<0.05;
<sup>***</sup>p<0.01</td></tr>
## </table>
```

Adding Mediation Effect on the OLS

```
# we are interested in the differences before and after controlling
mediation_model <- lm(`Ad Copy Quality`~Adrank, data = data)
summary(mediation_model)
```

```
##
## Call:
## lm(formula = `Ad Copy Quality` ~ Adrank, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -5.4455 -3.7689  0.9109  3.6852  6.1690
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  6.44551     0.14034   45.93  <2e-16 ***
## Adrank      -0.13072     0.01049  -12.46  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 3.752 on 889 degrees of freedom
## Multiple R-squared:  0.1486, Adjusted R-squared:  0.1477
## F-statistic: 155.2 on 1 and 889 DF,  p-value: < 2.2e-16
```

```
full_model <- lm(Clickthroughrate~`Ad Copy Quality`+Adrank, data = data )
summary(full_model)
```

```
##
## Call:
## lm(formula = Clickthroughrate ~ `Ad Copy Quality` + Adrank, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.39345 -0.05696 -0.01103  0.10797  0.60797
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)   -0.0067323   0.0107073   -0.629   0.52967
## `Ad Copy Quality`  0.0400180   0.0013933  28.721 < 2e-16 ***
## Adrank         -0.0014220   0.0004725   -3.010  0.00269 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1559 on 888 degrees of freedom
## Multiple R-squared:  0.5436, Adjusted R-squared:  0.5426
## F-statistic: 528.9 on 2 and 888 DF,  p-value: < 2.2e-16
```

```
mediation_result <- mediate(mediation_model,full_model,treat = "Ad Copy Quality",mediator = "Adrank", boot = T,sims = 500)
```

```
## Running nonparametric bootstrap
```

```
summary(mediation_result)
```

```
##
## Causal Mediation Analysis
##
## Nonparametric Bootstrap Confidence Intervals with the Percentile Method
##
##              Estimate 95% CI Lower 95% CI Upper p-value
## ACME              0.0000      0.0000      0.00      1
## ADE                0.0400      0.0373      0.04 <2e-16 ***
## Total Effect      0.0400      0.0373      0.04 <2e-16 ***
## Prop. Mediated    0.0000      0.0000      0.00      1
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Sample Size Used: 891
##
##
## Simulations: 500
```

test for Panel data How to intrepret Lmer functions

```
data_panel <- lmer(Clickthroughrate ~LagClickThrough+Bidprice+Impressions+Adrank+Conversionrate+  
Numberofwords+Retailer +Brandname +Revenue +Bidprice+Conversions+`Ad Copy Quality`:Retailer+(`A  
d Copy Quality`|Retailer) , data = data)
```

```
## Warning: Some predictor variables are on very different scales: consider  
## rescaling
```

```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, : Model is nearl  
y unidentifiable: large eigenvalue ratio  
## - Rescale variables?
```

```
summary(data_panel)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: Clickthroughrate ~ LagClickThrough + Bidprice + Impressions +
##      Adrank + Conversionrate + Numberofwords + Retailer + Brandname +
##      Revenue + Bidprice + Conversions + `Ad Copy Quality`:Retailer +
##      (`Ad Copy Quality` | Retailer)
## Data: data
##
## REML criterion at convergence: -2055.3
##
## Scaled residuals:
##      Min      1Q   Median      3Q      Max
## -11.4038  -0.1639   0.0203   0.2045   7.9145
##
## Random effects:
## Groups Name Variance Std.Dev. Corr
## Retailer (Intercept) 3.350e-03 0.057879
##      `Ad Copy Quality` 2.496e-05 0.004996 -0.98
## Residual 4.984e-03 0.070600
## Number of obs: 891, groups: Retailer, 2
##
## Fixed effects:
## Estimate Std. Error t value
## (Intercept) 7.163e-02 1.632e-02 4.389
## LagClickThrough 7.618e-01 1.817e-02 41.931
## Bidprice 6.692e-04 2.138e-02 0.031
## Impressions -6.468e-07 3.296e-07 -1.963
## Adrank -1.799e-04 2.475e-04 -0.727
## Conversionrate -7.736e-02 1.726e-02 -4.481
## Numberofwords -1.221e-02 2.486e-03 -4.914
## Retailer -2.383e-02 6.068e-02 -0.393
## Brandname 1.518e-02 7.584e-03 2.001
## Revenue 8.720e-06 9.949e-06 0.876
## Conversions -4.443e-04 7.479e-04 -0.594
## Retailer:`Ad Copy Quality` 8.215e-03 5.236e-03 1.569
##
## Correlation of Fixed Effects:
##      (Intr) LgClcT Bidprc Imprss Adrank Cnvrnsr Nmbrfw Retalr Brndnm
## LgClcThrh -0.365
## Bidprice -0.058 0.010
## Impressions -0.169 0.186 -0.063
## Adrank -0.221 0.076 0.164 -0.047
## Conversinrt -0.060 0.265 0.004 0.061 -0.191
## Numberfwrds -0.253 0.252 -0.196 0.099 0.089 -0.040
## Retailer -0.204 0.054 0.013 0.033 -0.008 0.020 0.012
## Brandname -0.450 -0.066 0.002 0.034 0.392 -0.111 -0.115 0.046
## Revenue 0.048 0.082 -0.062 0.072 0.003 0.025 -0.089 -0.011 0.029
## Conversions -0.038 -0.097 0.069 -0.146 0.001 -0.020 0.064 0.011 -0.028
## Rtlr:`ACQl` 0.080 -0.130 0.006 -0.031 -0.009 -0.046 -0.058 -0.957 -0.040
##      Revenu Cnvrnsr
## LgClcThrh
## Bidprice
## Impressions
```



```
## Adrank
## Conversinrt
## Numberfwrds
## Retailer
## Brandname
## Revenue
## Conversions -0.989
## Rtlr:`ACQl` -0.015 0.013
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (nloptwrap) convergence code: 0 (OK)
## Model is nearly unidentifiable: large eigenvalue ratio
## - Rescale variables?
```

```
ranef(data_panel, condVar=TRUE)
```

```
## $Retailer
##      (Intercept) `Ad Copy Quality`
## 0 -5.569132e-02      4.883082e-03
## 1 2.248501e-13      -1.973535e-14
##
## with conditional variances for "Retailer"
```

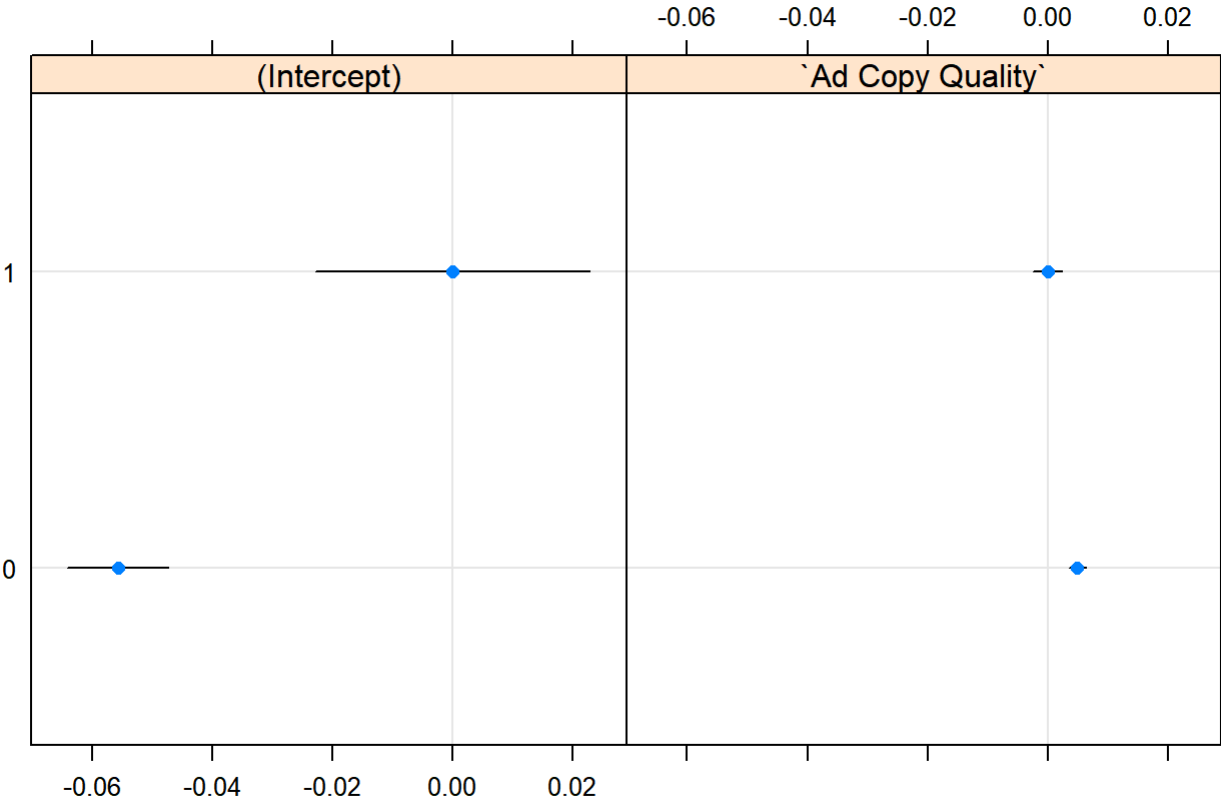
```
fixef(data_panel, condVar=TRUE)
```

```
##      (Intercept)      LagClickThrough
##      7.162903e-02      7.618045e-01
##      Bidprice      Impressions
##      6.691806e-04      -6.467661e-07
##      Adrank      Conversionrate
##      -1.798824e-04      -7.736172e-02
##      Numberofwords      Retailer
##      -1.221266e-02      -2.383230e-02
##      Brandname      Revenue
##      1.517502e-02      8.719848e-06
##      Conversions Retailer:`Ad Copy Quality`
##      -4.442596e-04      8.215419e-03
```

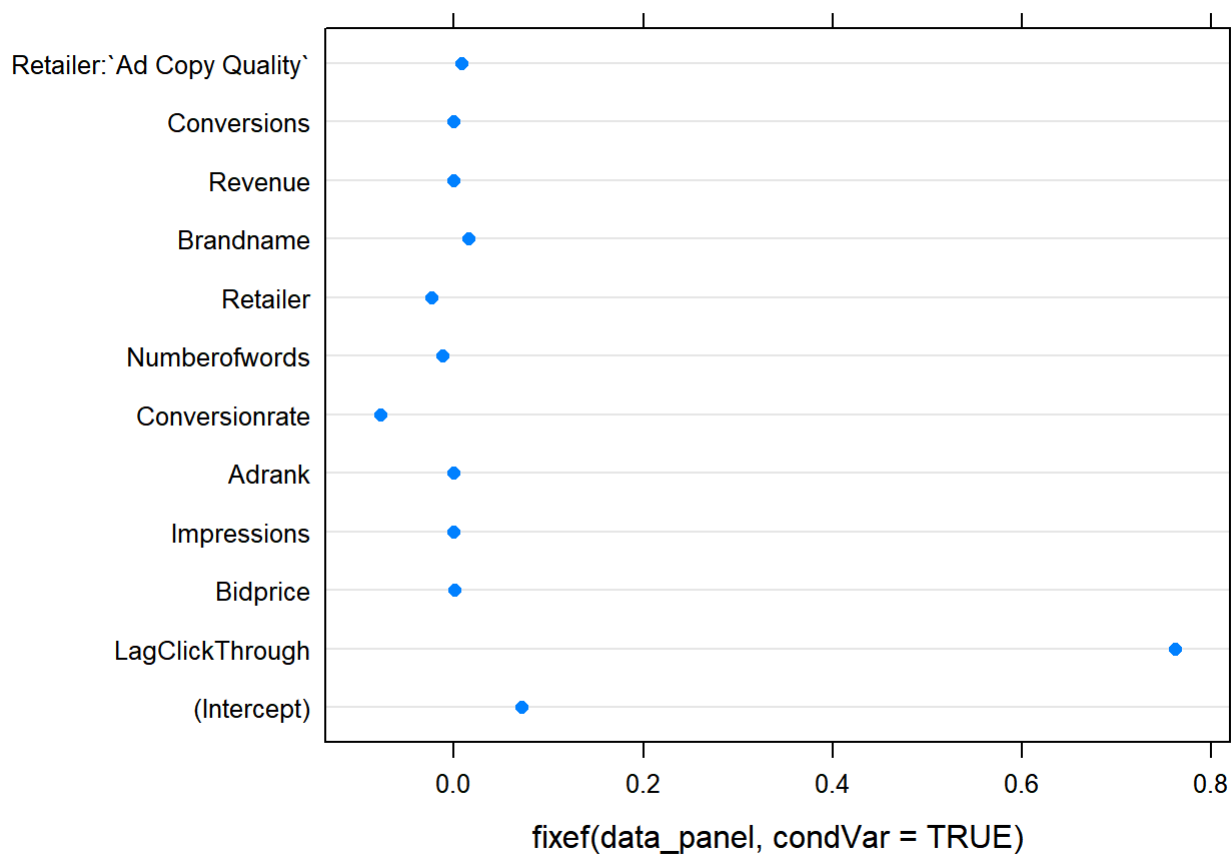
```
dotplot(ranef(data_panel, condVar=TRUE))
```

```
## $Retailer
```

Retailer



```
dotplot(fixef(data_panel, condVar=TRUE))
```



```
data_result_panel <- lmer(Clickthroughrate ~ `Ad Copy Quality` + Retailer + Brandname + `Landing Page Quality` + LagClickThrough + Bidprice + Adrank + Numberofwords + `Ad Copy Quality`:Retailer + (`Ad Copy Quality`|Retailer), data = data )
```

```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, :  
## unable to evaluate scaled gradient
```

```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, :  
## Model failed to converge: degenerate Hessian with 1 negative eigenvalues
```

```
summary(data_result_panel)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: Clickthroughrate ~ `Ad Copy Quality` + Retailer + Brandname +
##   `Landing Page Quality` + LagClickThrough + Bidprice + Adrank +
##   Numberofwords + `Ad Copy Quality`:Retailer + (`Ad Copy Quality` |
##   Retailer)
## Data: data
##
## REML criterion at convergence: -2082.1
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -11.4856  -0.1581   0.0717   0.1855   8.0064
##
## Random effects:
## Groups   Name                Variance Std.Dev. Corr
## Retailer (Intercept)          0.005089 0.07134
##           `Ad Copy Quality` 0.031970 0.17880  -0.01
## Residual                    0.005115 0.07152
## Number of obs: 891, groups: Retailer, 2
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)      0.0174090  0.0719189   0.242
## `Ad Copy Quality` 0.0037398  0.1788070   0.021
## Retailer         0.0284553  0.1017967   0.280
## Brandname        0.0110719  0.0076451   1.448
## `Landing Page Quality` 0.0003407  0.0010696   0.319
## LagClickThrough  0.7876758  0.0175223  44.953
## Bidprice        -0.0006721  0.0216027  -0.031
## Adrank          -0.0004038  0.0002469  -1.635
## Numberofwords   -0.0117480  0.0025540  -4.600
## `Ad Copy Quality`:Retailer 0.0033741  0.2528708   0.013
##
## Correlation of Fixed Effects:
##              (Intr) `ACQl` Retalr Brndnm `LPQl` LgClcT Bidprc Adrank Nmbrfw
## `AdCpyQlty` -0.007
## Retailer    -0.699  0.005
## Brandname   -0.053 -0.002 -0.009
## `LndnPQlty` -0.044 -0.004  0.004  0.040
## LgClckThrh -0.024 -0.002 -0.013 -0.039  0.081
## Bidprice    -0.024  0.001  0.016  0.003 -0.048  0.020
## Adrank      -0.076  0.000  0.010  0.381  0.089  0.148  0.162
## Numberfwrds -0.047  0.001  0.008 -0.126 -0.254  0.235 -0.177  0.065
## `AdCQlty`:R 0.005 -0.707 -0.007  0.001  0.001 -0.001  0.000 -0.001 -0.002
## optimizer (nloptwrap) convergence code: 0 (OK)
## unable to evaluate scaled gradient
## Model failed to converge: degenerate Hessian with 1 negative eigenvalues
```

```
ranef(data_result_panel, condVar=TRUE)
```

```
## $Retailer
##      (Intercept) `Ad Copy Quality`
## 0 -2.163804e-13    -1.299768e-11
## 1  1.075972e-12     6.001178e-12
##
## with conditional variances for "Retailer"
```

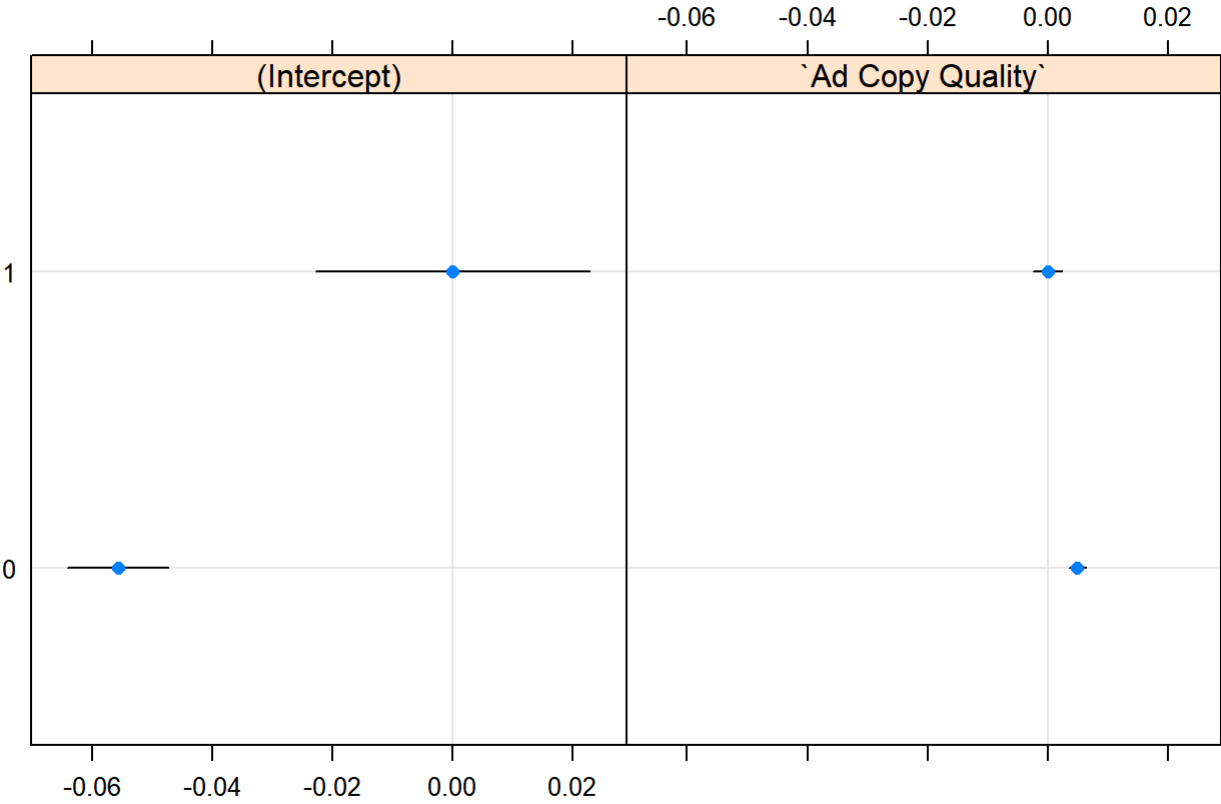
```
fixef(data_result_panel, condVar=TRUE)
```

```
##      (Intercept)      `Ad Copy Quality`
##      0.0174090261      0.0037397913
##      Retailer      Brandname
##      0.0284552819      0.0110718578
## `Landing Page Quality`      LagClickThrough
##      0.0003406824      0.7876758436
##      Bidprice      Adrank
##      -0.0006721206      -0.0004037873
##      Numberofwords `Ad Copy Quality`:Retailer
##      -0.0117479771      0.0033741415
```

```
dotplot(ranef(data_panel, condVar=TRUE))
```

```
## $Retailer
```

Retailer



```
dotplot(fixef(data_panel, condVar=TRUE))
```

