Regressão Regular

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```
source("dados_regular.R")
```

```
## -- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
## v dplyr     1.1.4     v readr     2.1.5
## v forcats   1.0.0     v stringr   1.5.1
## v lubridate 1.9.3     v tibble    3.2.1
## v purrr     1.0.2     v tidyr     1.3.1
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
## i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become errors
## Loading required package: splines
##
## Loading required package: gamlss.data
##
##
## Attaching package: 'gamlss.data'
##
##
## The following object is masked from 'package:datasets':
##
##     sleep
##
##
## Loading required package: gamlss.dist
##
## Loading required package: nlme
##
##
## Attaching package: 'nlme'
##
##
## The following object is masked from 'package:dplyr':
##
##     collapse
##
##
## Loading required package: parallel
##
##  **********   GAMLSS Version 5.4-22  **********
##
## For more on GAMLSS look at https://www.gamlss.com/
##
```

```
## Type gamlssNews() to see new features/changes/bug fixes.
##
##
## Loading required package: carData
##
##
## Attaching package: 'car'
##
##
## The following object is masked from 'package:dplyr':
##
##     recode
##
##
## The following object is masked from 'package:purrr':
##
##     some
##
##
## Loading required package: zoo
##
##
## Attaching package: 'zoo'
##
##
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

```
########## Regressão com todos os dados do modelo ###########
modelo1 <- lm(WINP ~ .,data = dados_regressao)
modelo1
```

```
##
## Call:
## lm(formula = WINP ~ ., data = dados_regressao)
##
## Coefficients:
##                (Intercept)          TEAMBoston Celtics
##                  0.3849344                  -0.0120250
##          TEAMBrooklyn Nets       TEAMCharlotte Bobcats
##                  0.0039617                   0.0133796
##      TEAMCharlotte Hornets          TEAMChicago Bulls
##                 -0.0145005                   0.0084856
##    TEAMCleveland Cavaliers        TEAMDallas Mavericks
##                  0.0039967                  -0.0185095
##         TEAMDenver Nuggets         TEAMDetroit Pistons
##                  0.0024464                  -0.0340194
##  TEAMGolden State Warriors         TEAMHouston Rockets
##                 -0.0212880                   0.0120925
##         TEAMIndiana Pacers             TEAMLA Clippers
##                 -0.0059713                  -0.0083375
##   TEAMLos Angeles Clippers      TEAMLos Angeles Lakers
##                 -0.0188479                   0.0052288
##      TEAMMemphis Grizzlies              TEAMMiami Heat
```

```
##                 0.0102977                -0.0047578
##        TEAMMilwaukee Bucks TEAMMinnesota Timberwolves
##                -0.0192852                -0.0476085
##        TEAMNew Jersey Nets    TEAMNew Orleans Hornets
##                -0.0340128                -0.0243073
##   TEAMNew Orleans Pelicans        TEAMNew York Knicks
##                -0.0384255                -0.0247466
##  TEAMOklahoma City Thunder          TEAMOrlando Magic
##                 0.0034222                -0.0196853
##     TEAMPhiladelphia 76ers           TEAMPhoenix Suns
##                -0.0165407                -0.0043497
## TEAMPortland Trail Blazers       TEAMSacramento Kings
##                 0.0109588                -0.0181920
##      TEAMSan Antonio Spurs        TEAMToronto Raptors
##                -0.0117354                -0.0127437
##              TEAMUtah Jazz     TEAMWashington Wizards
##                -0.0294224                -0.0194735
##                       PTS                       FGM
##                -0.0201604                 0.0275384
##                       FGA                       FGP
##                 0.0001698                 0.0172859
##                    `3PM`                     `3PA`
##                 0.0127936                 0.0031094
##                    `3PP`                       FTM
##                 0.0044865                 0.0577332
##                       FTA                       FTP
##                -0.0316353                -0.0086342
##                      OREB                      DREB
##                 0.0629313                 0.0631626
##                       REB                       AST
##                -0.0552165                 0.0017278
##                       TOV                       STL
##                -0.0097114                 0.0112387
##                       BLK                      BLKA
##                -0.0008269                -0.0052525
##                        PF                       PFD
##                -0.0019238                 0.0055098
##                 PlusMinus          Numero_temporada2
##                 0.0258603                 0.0076547
##          Numero_temporada3          Numero_temporada4
##                 0.0057990                 0.0121886
##          Numero_temporada5          Numero_temporada6
##                 0.0003925                 0.0004200
##          Numero_temporada7          Numero_temporada8
##                 0.0048858                 0.0006137
##          Numero_temporada9         Numero_temporada10
##                -0.0010696                -0.0030638
##         Numero_temporada11         Numero_temporada12
##                -0.0004315                 0.0003404
##         Numero_temporada13         Numero_temporada14
##                -0.0050765                -0.0067826
##         Numero_temporada15
##                 0.0017315
```

```r
coef(modelo1)
```

```
##                (Intercept)         TEAMBoston Celtics
##               0.3849343849              -0.0120249534
##          TEAMBrooklyn Nets      TEAMCharlotte Bobcats
##               0.0039616737               0.0133796093
##      TEAMCharlotte Hornets          TEAMChicago Bulls
##              -0.0145004842               0.0084856042
##    TEAMCleveland Cavaliers       TEAMDallas Mavericks
##               0.0039967279              -0.0185095205
##         TEAMDenver Nuggets        TEAMDetroit Pistons
##               0.0024463625              -0.0340193950
##  TEAMGolden State Warriors        TEAMHouston Rockets
##              -0.0212880488               0.0120925104
##         TEAMIndiana Pacers            TEAMLA Clippers
##              -0.0059713348              -0.0083374706
##   TEAMLos Angeles Clippers     TEAMLos Angeles Lakers
##              -0.0188478561               0.0052288163
##      TEAMMemphis Grizzlies             TEAMMiami Heat
##               0.0102977052              -0.0047578049
##        TEAMMilwaukee Bucks TEAMMinnesota Timberwolves
##              -0.0192852414              -0.0476084851
##        TEAMNew Jersey Nets    TEAMNew Orleans Hornets
##              -0.0340127827              -0.0243073352
##   TEAMNew Orleans Pelicans        TEAMNew York Knicks
##              -0.0384255145              -0.0247465856
##  TEAMOklahoma City Thunder          TEAMOrlando Magic
##               0.0034222224              -0.0196853375
##     TEAMPhiladelphia 76ers           TEAMPhoenix Suns
##              -0.0165407145              -0.0043497439
## TEAMPortland Trail Blazers       TEAMSacramento Kings
##               0.0109587608              -0.0181920093
##      TEAMSan Antonio Spurs        TEAMToronto Raptors
##              -0.0117354013              -0.0127437317
##              TEAMUtah Jazz     TEAMWashington Wizards
##              -0.0294224498              -0.0194734725
##                        PTS                        FGM
##              -0.0201603689               0.0275384184
##                        FGA                        FGP
##               0.0001697572               0.0172859360
##                     `3PM`                      `3PA`
##               0.0127935937               0.0031094284
##                     `3PP`                        FTM
##               0.0044864691               0.0577332209
##                        FTA                        FTP
##              -0.0316353188              -0.0086341618
##                       OREB                       DREB
##               0.0629312660               0.0631626382
##                        REB                        AST
##              -0.0552164560               0.0017278023
##                        TOV                        STL
##              -0.0097113923               0.0112387161
##                        BLK                       BLKA
##              -0.0008268940              -0.0052525500
```

```
##                         PF                        PFD
##              -0.0019237932               0.0055097514
##                  PlusMinus           Numero_temporada2
##               0.0258603172               0.0076547454
##           Numero_temporada3           Numero_temporada4
##               0.0057989724               0.0121885856
##           Numero_temporada5           Numero_temporada6
##               0.0003925166               0.0004200458
##           Numero_temporada7           Numero_temporada8
##               0.0048857968               0.0006136884
##           Numero_temporada9          Numero_temporada10
##              -0.0010696264              -0.0030638442
##          Numero_temporada11          Numero_temporada12
##              -0.0004315481               0.0003404450
##          Numero_temporada13          Numero_temporada14
##              -0.0050764532              -0.0067826279
##          Numero_temporada15
##               0.0017314545
```

```
anova(modelo1)
```

```
## Analysis of Variance Table
##
## Response: WINP
##                    Df  Sum Sq Mean Sq   F value    Pr(>F)
## TEAM               33 2.20869 0.06693   46.3437 < 2.2e-16 ***
## PTS                 1 0.60165 0.60165  416.5973 < 2.2e-16 ***
## FGM                 1 0.00683 0.00683    4.7301   0.03025 *
## FGA                 1 2.46158 2.46158 1704.4519 < 2.2e-16 ***
## FGP                 1 0.00083 0.00083    0.5728   0.44960
## `3PM`               1 0.03785 0.03785   26.2051 4.881e-07 ***
## `3PA`               1 0.36987 0.36987  256.1091 < 2.2e-16 ***
## `3PP`               1 0.00479 0.00479    3.3156   0.06941 .
## FTM                 1 0.00222 0.00222    1.5372   0.21580
## FTA                 1 0.05083 0.05083   35.1971 6.696e-09 ***
## FTP                 1 0.00038 0.00038    0.2644   0.60740
## OREB                1 0.38261 0.38261  264.9264 < 2.2e-16 ***
## DREB                1 0.95016 0.95016  657.9123 < 2.2e-16 ***
## REB                 1 0.00237 0.00237    1.6392   0.20122
## AST                 1 0.00520 0.00520    3.6006   0.05851 .
## TOV                 1 0.86940 0.86940  601.9935 < 2.2e-16 ***
## STL                 1 0.81895 0.81895  567.0594 < 2.2e-16 ***
## BLK                 1 0.00390 0.00390    2.7010   0.10111
## BLKA                1 0.03536 0.03536   24.4807 1.129e-06 ***
## PF                  1 0.00596 0.00596    4.1237   0.04298 *
## PFD                 1 0.09815 0.09815   67.9639 2.722e-15 ***
## PlusMinus           1 0.71619 0.71619  495.9076 < 2.2e-16 ***
## Numero_temporada   14 0.00411 0.00029    0.2034   0.99927
## Residuals         381 0.55024 0.00144
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
summary(modelo1) #R^2_ajustado = 0.9318
```

```
##
```

```
## Call:
## lm(formula = WINP ~ ., data = dados_regressao)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.115351 -0.022991  0.001865  0.022976  0.102666
##
## Coefficients:
##                               Estimate Std. Error t value Pr(>|t|)
## (Intercept)                  0.3849344  1.3417687   0.287  0.77436
## TEAMBoston Celtics          -0.0120250  0.0145692  -0.825  0.40968
## TEAMBrooklyn Nets            0.0039617  0.0155735   0.254  0.79934
## TEAMCharlotte Bobcats        0.0133796  0.0203254   0.658  0.51076
## TEAMCharlotte Hornets       -0.0145005  0.0169251  -0.857  0.39212
## TEAMChicago Bulls            0.0084856  0.0146864   0.578  0.56375
## TEAMCleveland Cavaliers      0.0039967  0.0144385   0.277  0.78208
## TEAMDallas Mavericks        -0.0185095  0.0151174  -1.224  0.22156
## TEAMDenver Nuggets           0.0024464  0.0146406   0.167  0.86738
## TEAMDetroit Pistons         -0.0340194  0.0152076  -2.237  0.02586 *
## TEAMGolden State Warriors   -0.0212880  0.0154184  -1.381  0.16818
## TEAMHouston Rockets          0.0120925  0.0150978   0.801  0.42366
## TEAMIndiana Pacers          -0.0059713  0.0145938  -0.409  0.68264
## TEAMLA Clippers             -0.0083375  0.0178968  -0.466  0.64158
## TEAMLos Angeles Clippers    -0.0188479  0.0186301  -1.012  0.31233
## TEAMLos Angeles Lakers       0.0052288  0.0146467   0.357  0.72129
## TEAMMemphis Grizzlies        0.0102977  0.0150216   0.686  0.49343
## TEAMMiami Heat              -0.0047578  0.0148140  -0.321  0.74826
## TEAMMilwaukee Bucks         -0.0192852  0.0143690  -1.342  0.18035
## TEAMMinnesota Timberwolves -0.0476085  0.0145268  -3.277  0.00114 **
## TEAMNew Jersey Nets         -0.0340128  0.0228090  -1.491  0.13674
## TEAMNew Orleans Hornets     -0.0243073  0.0206966  -1.174  0.24094
## TEAMNew Orleans Pelicans    -0.0384255  0.0161205  -2.384  0.01763 *
## TEAMNew York Knicks         -0.0247466  0.0148727  -1.664  0.09696 .
## TEAMOklahoma City Thunder    0.0034222  0.0156672   0.218  0.82721
## TEAMOrlando Magic           -0.0196853  0.0145370  -1.354  0.17649
## TEAMPhiladelphia 76ers      -0.0165407  0.0147469  -1.122  0.26272
## TEAMPhoenix Suns            -0.0043497  0.0149188  -0.292  0.77078
## TEAMPortland Trail Blazers   0.0109588  0.0149226   0.734  0.46317
## TEAMSacramento Kings        -0.0181920  0.0147307  -1.235  0.21760
## TEAMSan Antonio Spurs       -0.0117354  0.0144963  -0.810  0.41871
## TEAMToronto Raptors         -0.0127437  0.0147462  -0.864  0.38802
## TEAMUtah Jazz               -0.0294224  0.0146698  -2.006  0.04560 *
## TEAMWashington Wizards      -0.0194735  0.0147765  -1.318  0.18834
## PTS                         -0.0201604  0.0259402  -0.777  0.43753
## FGM                          0.0275384  0.0524211   0.525  0.59966
## FGA                          0.0001698  0.0151496   0.011  0.99107
## FGP                          0.0172859  0.0270890   0.638  0.52378
## `3PM`                        0.0127936  0.0303270   0.422  0.67337
## `3PA`                        0.0031094  0.0056636   0.549  0.58332
## `3PP`                        0.0044865  0.0039162   1.146  0.25268
## FTM                          0.0577332  0.0327417   1.763  0.07865 .
## FTA                         -0.0316353  0.0201239  -1.572  0.11677
## FTP                         -0.0086342  0.0060603  -1.425  0.15506
## OREB                         0.0629313  0.0383381   1.641  0.10152
```

```
## DREB                         0.0631626  0.0380824   1.659  0.09802 .
## REB                         -0.0552165  0.0378558  -1.459  0.14550
## AST                          0.0017278  0.0017081   1.012  0.31239
## TOV                         -0.0097114  0.0039673  -2.448  0.01482 *
## STL                          0.0112387  0.0043866   2.562  0.01079 *
## BLK                         -0.0008269  0.0030727  -0.269  0.78799
## BLKA                        -0.0052525  0.0045028  -1.166  0.24414
## PF                          -0.0019238  0.0019716  -0.976  0.32981
## PFD                          0.0055098  0.0039269   1.403  0.16141
## PlusMinus                    0.0258603  0.0016049  16.113  < 2e-16 ***
## Numero_temporada2            0.0076547  0.0104220   0.734  0.46311
## Numero_temporada3            0.0057990  0.0102800   0.564  0.57302
## Numero_temporada4            0.0121886  0.0118726   1.027  0.30525
## Numero_temporada5            0.0003925  0.0112801   0.035  0.97226
## Numero_temporada6            0.0004200  0.0109014   0.039  0.96928
## Numero_temporada7            0.0048858  0.0119660   0.408  0.68328
## Numero_temporada8            0.0006137  0.0128188   0.048  0.96184
## Numero_temporada9           -0.0010696  0.0138983  -0.077  0.93869
## Numero_temporada10          -0.0030638  0.0155627  -0.197  0.84403
## Numero_temporada11          -0.0004315  0.0182880  -0.024  0.98119
## Numero_temporada12           0.0003404  0.0186269   0.018  0.98543
## Numero_temporada13          -0.0050765  0.0198890  -0.255  0.79868
## Numero_temporada14          -0.0067826  0.0200097  -0.339  0.73482
## Numero_temporada15           0.0017315  0.0189030   0.092  0.92707
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.038 on 381 degrees of freedom
## Multiple R-squared:  0.946,  Adjusted R-squared:  0.9364
## F-statistic: 98.14 on 68 and 381 DF,  p-value: < 2.2e-16
```

```
#Nesse modelo completo, apenas Plus_Minus foi significante com um alfa de
#5%, mas se alfa = 10%, teremos também STL e PF significantes.
#O único problema que estou achando muito estranho é que pontos está negativo
#ou seja, quanto mais pontos, menor a porcentagem de vitórias durante a temporada.

########## Regressão com apenas Plus_Minus no modelo (que foi o único significante no modelo) #########
modelo2 <- lm(WINP ~ PlusMinus,data = dados_regressao)
modelo2
```

```
##
## Call:
## lm(formula = WINP ~ PlusMinus, data = dados_regressao)
##
## Coefficients:
## (Intercept)    PlusMinus
##     0.49995      0.03128
```

```
coef(modelo2)
```

```
## (Intercept)   PlusMinus
##  0.49994504  0.03128451
```

```
anova(modelo2)
```

```
## Analysis of Variance Table
##
```

```
## Response: WINP
##            Df Sum Sq Mean Sq F value    Pr(>F)
## PlusMinus   1 9.5032  9.5032  6215.5 < 2.2e-16 ***
## Residuals 448 0.6850  0.0015
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
summary(modelo2) #Adjusted R-squared:  0.9326, bem perto do que foi do modelo1
```

```
##
## Call:
## lm(formula = WINP ~ PlusMinus, data = dados_regressao)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.113091 -0.026016  0.003473  0.026282  0.137671
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.4999450  0.0018433  271.23   <2e-16 ***
## PlusMinus   0.0312845  0.0003968   78.84   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.0391 on 448 degrees of freedom
## Multiple R-squared:  0.9328, Adjusted R-squared:  0.9326
## F-statistic:  6216 on 1 and 448 DF,  p-value: < 2.2e-16
```

```
######## Regressão com apenas Plus_Minus, STL e PF no modelo (que foram significantes no modelo com alf
modelo3 <- lm(WINP ~ PlusMinus + STL + PF,data = dados_regressao)
modelo3
```

```
##
## Call:
## lm(formula = WINP ~ PlusMinus + STL + PF, data = dados_regressao)
##
## Coefficients:
## (Intercept)    PlusMinus          STL           PF
##    0.564593     0.031077     0.000554    -0.003402
```

```
coef(modelo3)
```

```
##   (Intercept)     PlusMinus           STL            PF
##  0.5645933548  0.0310769799  0.0005540418 -0.0034023177
```

```
anova(modelo3)#STL não deu significante
```

```
## Analysis of Variance Table
##
## Response: WINP
##            Df Sum Sq Mean Sq   F value  Pr(>F)
## PlusMinus   1 9.5032  9.5032 6276.1926 < 2e-16 ***
## STL         1 0.0002  0.0002    0.1363 0.71216
## PF          1 0.0094  0.0094    6.2369 0.01287 *
## Residuals 446 0.6753  0.0015
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
summary(modelo3) #Adjusted R-squared:  0.9333
```

```
##
## Call:
## lm(formula = WINP ~ PlusMinus + STL + PF, data = dados_regressao)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.116916 -0.025227  0.002979  0.026023  0.128526
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.5645934  0.0289479  19.504   <2e-16 ***
## PlusMinus    0.0310770  0.0004115  75.530   <2e-16 ***
## STL          0.0005540  0.0023056   0.240   0.8102
## PF          -0.0034023  0.0013624  -2.497   0.0129 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.03891 on 446 degrees of freedom
## Multiple R-squared:  0.9337, Adjusted R-squared:  0.9333
## F-statistic:  2094 on 3 and 446 DF,  p-value: < 2.2e-16
```

```r
######### Regressão com apenas Plus_Minus e PF no modelo ########
modelo4 <- lm(WINP ~ PlusMinus + PF,data = dados_regressao)
modelo4
```

```
##
## Call:
## lm(formula = WINP ~ PlusMinus + PF, data = dados_regressao)
##
## Coefficients:
## (Intercept)    PlusMinus           PF
##    0.567207     0.031098    -0.003324
```

```r
coef(modelo4)
```

```
##  (Intercept)    PlusMinus           PF
##  0.567206603  0.031098282 -0.003323831
```

```r
anova(modelo4)
```

```
## Analysis of Variance Table
##
## Response: WINP
##            Df Sum Sq Mean Sq   F value  Pr(>F)
## PlusMinus   1 9.5032  9.5032 6289.4504 < 2e-16 ***
## PF          1 0.0096  0.0096    6.3288 0.01223 *
## Residuals 447 0.6754  0.0015
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
summary(modelo4) #Adjusted R-squared:  0.9334
```

```
##
## Call:
## lm(formula = WINP ~ PlusMinus + PF, data = dados_regressao)
```

```
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.117094 -0.025358  0.002912  0.026178  0.128597
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.5672066  0.0267993  21.165   <2e-16 ***
## PlusMinus    0.0310983  0.0004014  77.481   <2e-16 ***
## PF          -0.0033238  0.0013212  -2.516   0.0122 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.03887 on 447 degrees of freedom
## Multiple R-squared:  0.9337, Adjusted R-squared:  0.9334
## F-statistic:  3148 on 2 and 447 DF,  p-value: < 2.2e-16
```

```
########## backward regression ##########
#Selecão das variáveis para compor o modelo, mas precisa depois fazer os teste de resíduo
completo = lm(WINP ~ ., data = dados_regressao)
vazio = lm(WINP ~ 1, data = dados_regressao)
step(completo, scope=list(upper=completo, lower=vazio), direction='backward', trace=TRUE)
```

```
## Start:  AIC=-2879.99
## WINP ~ TEAM + PTS + FGM + FGA + FGP + `3PM` + `3PA` + `3PP` +
##     FTM + FTA + FTP + OREB + DREB + REB + AST + TOV + STL + BLK +
##     BLKA + PF + PFD + PlusMinus + Numero_temporada
##
##                     Df Sum of Sq     RSS     AIC
## - Numero_temporada 14   0.00411 0.55435 -2904.6
## - FGA               1   0.00000 0.55024 -2882.0
## - BLK               1   0.00010 0.55035 -2881.9
## - `3PM`             1   0.00026 0.55050 -2881.8
## - FGM               1   0.00040 0.55064 -2881.7
## - `3PA`             1   0.00044 0.55068 -2881.6
## - FGP               1   0.00059 0.55083 -2881.5
## - PTS               1   0.00087 0.55111 -2881.3
## - PF                1   0.00138 0.55162 -2880.9
## - AST               1   0.00148 0.55172 -2880.8
## - `3PP`             1   0.00190 0.55214 -2880.4
## - BLKA              1   0.00197 0.55221 -2880.4
## <none>                          0.55024 -2880.0
## - PFD               1   0.00284 0.55309 -2879.7
## - FTP               1   0.00293 0.55317 -2879.6
## - REB               1   0.00307 0.55332 -2879.5
## - FTA               1   0.00357 0.55381 -2879.1
## - OREB              1   0.00389 0.55413 -2878.8
## - DREB              1   0.00397 0.55422 -2878.8
## - FTM               1   0.00449 0.55473 -2878.3
## - TEAM             33   0.09050 0.64075 -2877.5
## - TOV               1   0.00865 0.55890 -2875.0
## - STL               1   0.00948 0.55972 -2874.3
## - PlusMinus         1   0.37498 0.92522 -2648.1
##
## Step:  AIC=-2904.64
```

```
## WINP ~ TEAM + PTS + FGM + FGA + FGP + `3PM` + `3PA` + `3PP` +
##     FTM + FTA + FTP + OREB + DREB + REB + AST + TOV + STL + BLK +
##     BLKA + PF + PFD + PlusMinus
##
##             Df Sum of Sq     RSS     AIC
## - FGA        1   0.00000 0.55436 -2906.6
## - BLK        1   0.00017 0.55452 -2906.5
## - `3PA`      1   0.00026 0.55462 -2906.4
## - `3PM`      1   0.00029 0.55464 -2906.4
## - FGP        1   0.00031 0.55466 -2906.4
## - FGM        1   0.00053 0.55488 -2906.2
## - PTS        1   0.00084 0.55520 -2906.0
## - AST        1   0.00128 0.55563 -2905.6
## - `3PP`      1   0.00131 0.55566 -2905.6
## - PF         1   0.00172 0.55608 -2905.2
## - PFD        1   0.00232 0.55667 -2904.8
## - REB        1   0.00238 0.55673 -2904.7
## - BLKA       1   0.00241 0.55677 -2904.7
## <none>                   0.55435 -2904.6
## - OREB       1   0.00296 0.55731 -2904.2
## - DREB       1   0.00303 0.55739 -2904.2
## - FTP        1   0.00365 0.55801 -2903.7
## - FTA        1   0.00398 0.55834 -2903.4
## - TEAM      33   0.08932 0.64367 -2903.4
## - FTM        1   0.00495 0.55930 -2902.6
## - TOV        1   0.00760 0.56195 -2900.5
## - STL        1   0.00847 0.56282 -2899.8
## - PlusMinus  1   0.71619 1.27055 -2533.4
##
## Step:  AIC=-2906.64
## WINP ~ TEAM + PTS + FGM + FGP + `3PM` + `3PA` + `3PP` + FTM +
##     FTA + FTP + OREB + DREB + REB + AST + TOV + STL + BLK + BLKA +
##     PF + PFD + PlusMinus
##
##             Df Sum of Sq     RSS     AIC
## - BLK        1   0.00017 0.55453 -2908.5
## - `3PA`      1   0.00026 0.55462 -2908.4
## - `3PM`      1   0.00037 0.55473 -2908.3
## - FGM        1   0.00055 0.55491 -2908.2
## - PTS        1   0.00098 0.55534 -2907.8
## - AST        1   0.00127 0.55563 -2907.6
## - `3PP`      1   0.00136 0.55572 -2907.5
## - PF         1   0.00174 0.55610 -2907.2
## - PFD        1   0.00231 0.55667 -2906.8
## - REB        1   0.00237 0.55673 -2906.7
## - BLKA       1   0.00245 0.55681 -2906.7
## <none>                   0.55436 -2906.6
## - OREB       1   0.00296 0.55732 -2906.2
## - DREB       1   0.00303 0.55739 -2906.2
## - FTP        1   0.00365 0.55801 -2905.7
## - FTA        1   0.00399 0.55834 -2905.4
## - TEAM      33   0.08939 0.64375 -2905.4
## - FTM        1   0.00520 0.55956 -2904.4
## - TOV        1   0.00771 0.56207 -2902.4
```

```
## - STL        1   0.00884 0.56320 -2901.5
## - FGP        1   0.01042 0.56478 -2900.3
## - PlusMinus  1   0.73776 1.29212 -2527.8
##
## Step:  AIC=-2908.5
## WINP ~ TEAM + PTS + FGM + FGP + `3PM` + `3PA` + `3PP` + FTM +
##     FTA + FTP + OREB + DREB + REB + AST + TOV + STL + BLKA +
##     PF + PFD + PlusMinus
##
##             Df Sum of Sq     RSS     AIC
## - `3PA`      1   0.00026 0.55479 -2910.3
## - `3PM`      1   0.00038 0.55491 -2910.2
## - FGM        1   0.00054 0.55507 -2910.1
## - PTS        1   0.00098 0.55551 -2909.7
## - AST        1   0.00126 0.55579 -2909.5
## - `3PP`      1   0.00135 0.55588 -2909.4
## - PF         1   0.00184 0.55637 -2909.0
## - REB        1   0.00239 0.55692 -2908.6
## - BLKA       1   0.00243 0.55696 -2908.5
## <none>                   0.55453 -2908.5
## - PFD        1   0.00268 0.55721 -2908.3
## - OREB       1   0.00298 0.55751 -2908.1
## - DREB       1   0.00305 0.55758 -2908.0
## - FTP        1   0.00364 0.55817 -2907.6
## - TEAM      33   0.08928 0.64381 -2907.3
## - FTA        1   0.00401 0.55854 -2907.3
## - FTM        1   0.00520 0.55972 -2906.3
## - TOV        1   0.00802 0.56255 -2904.0
## - STL        1   0.00879 0.56332 -2903.4
## - FGP        1   0.01053 0.56506 -2902.0
## - PlusMinus  1   0.74890 1.30343 -2525.9
##
## Step:  AIC=-2910.29
## WINP ~ TEAM + PTS + FGM + FGP + `3PM` + `3PP` + FTM + FTA + FTP +
##     OREB + DREB + REB + AST + TOV + STL + BLKA + PF + PFD + PlusMinus
##
##             Df Sum of Sq     RSS     AIC
## - FGM        1   0.00048 0.55526 -2911.9
## - PTS        1   0.00090 0.55568 -2911.6
## - `3PM`      1   0.00091 0.55569 -2911.6
## - AST        1   0.00136 0.55614 -2911.2
## - PF         1   0.00175 0.55654 -2910.9
## - BLKA       1   0.00242 0.55720 -2910.3
## <none>                   0.55479 -2910.3
## - REB        1   0.00248 0.55726 -2910.3
## - `3PP`      1   0.00248 0.55726 -2910.3
## - PFD        1   0.00280 0.55759 -2910.0
## - OREB       1   0.00307 0.55786 -2909.8
## - DREB       1   0.00316 0.55795 -2909.7
## - FTP        1   0.00407 0.55886 -2909.0
## - FTA        1   0.00441 0.55919 -2908.7
## - FTM        1   0.00533 0.56011 -2908.0
## - TEAM      33   0.09119 0.64598 -2907.8
## - TOV        1   0.00834 0.56312 -2905.6
```

```
## - STL        1   0.00944 0.56422 -2904.7
## - FGP        1   0.01052 0.56531 -2903.8
## - PlusMinus  1   0.76022 1.31501 -2523.9
##
## Step:  AIC=-2911.9
## WINP ~ TEAM + PTS + FGP + `3PM` + `3PP` + FTM + FTA + FTP + OREB +
##     DREB + REB + AST + TOV + STL + BLKA + PF + PFD + PlusMinus
##
##             Df Sum of Sq     RSS     AIC
## - AST        1   0.00139 0.55665 -2912.8
## - PF         1   0.00169 0.55696 -2912.5
## - REB        1   0.00229 0.55755 -2912.1
## - BLKA       1   0.00238 0.55764 -2912.0
## <none>                   0.55526 -2911.9
## - `3PP`      1   0.00248 0.55775 -2911.9
## - OREB       1   0.00287 0.55814 -2911.6
## - DREB       1   0.00296 0.55823 -2911.5
## - PFD        1   0.00311 0.55838 -2911.4
## - `3PM`      1   0.00386 0.55912 -2910.8
## - FTP        1   0.00470 0.55996 -2910.1
## - TEAM      33   0.09073 0.64600 -2909.8
## - FTA        1   0.00515 0.56042 -2909.8
## - FTM        1   0.00572 0.56099 -2909.3
## - TOV        1   0.00852 0.56378 -2907.1
## - PTS        1   0.00933 0.56459 -2906.4
## - STL        1   0.00956 0.56482 -2906.2
## - FGP        1   0.01123 0.56650 -2904.9
## - PlusMinus  1   0.76164 1.31691 -2525.3
##
## Step:  AIC=-2912.78
## WINP ~ TEAM + PTS + FGP + `3PM` + `3PP` + FTM + FTA + FTP + OREB +
##     DREB + REB + TOV + STL + BLKA + PF + PFD + PlusMinus
##
##             Df Sum of Sq     RSS     AIC
## - PF         1   0.00205 0.55870 -2913.1
## - `3PP`      1   0.00212 0.55877 -2913.1
## - BLKA       1   0.00246 0.55911 -2912.8
## <none>                   0.55665 -2912.8
## - REB        1   0.00256 0.55921 -2912.7
## - OREB       1   0.00312 0.55977 -2912.3
## - DREB       1   0.00324 0.55989 -2912.2
## - `3PM`      1   0.00334 0.55999 -2912.1
## - PFD        1   0.00367 0.56032 -2911.8
## - TEAM      33   0.08935 0.64600 -2911.8
## - FTP        1   0.00473 0.56138 -2911.0
## - FTA        1   0.00534 0.56199 -2910.5
## - FTM        1   0.00566 0.56231 -2910.2
## - TOV        1   0.00735 0.56400 -2908.9
## - PTS        1   0.00803 0.56468 -2908.3
## - STL        1   0.00948 0.56613 -2907.2
## - FGP        1   0.01121 0.56786 -2905.8
## - PlusMinus  1   0.78038 1.33703 -2520.5
##
## Step:  AIC=-2913.13
```

```
## WINP ~ TEAM + PTS + FGP + `3PM` + `3PP` + FTM + FTA + FTP + OREB +
##     DREB + REB + TOV + STL + BLKA + PFD + PlusMinus
##
##             Df Sum of Sq     RSS     AIC
## - `3PP`      1   0.00150 0.56020 -2913.9
## - REB        1   0.00233 0.56103 -2913.3
## - BLKA       1   0.00247 0.56117 -2913.1
## <none>                   0.55870 -2913.1
## - PFD        1   0.00289 0.56159 -2912.8
## - OREB       1   0.00293 0.56163 -2912.8
## - DREB       1   0.00305 0.56175 -2912.7
## - FTP        1   0.00462 0.56332 -2911.4
## - `3PM`      1   0.00466 0.56336 -2911.4
## - FTA        1   0.00529 0.56399 -2910.9
## - FTM        1   0.00566 0.56436 -2910.6
## - TEAM      33   0.09252 0.65122 -2910.2
## - STL        1   0.00974 0.56844 -2907.3
## - TOV        1   0.01024 0.56894 -2906.9
## - PTS        1   0.01061 0.56931 -2906.7
## - FGP        1   0.01432 0.57302 -2903.7
## - PlusMinus  1   0.77840 1.33710 -2522.4
##
## Step:  AIC=-2913.92
## WINP ~ TEAM + PTS + FGP + `3PM` + FTM + FTA + FTP + OREB + DREB +
##     REB + TOV + STL + BLKA + PFD + PlusMinus
##
##             Df Sum of Sq     RSS     AIC
## - BLKA       1   0.00222 0.56243 -2914.1
## - REB        1   0.00234 0.56254 -2914.0
## <none>                   0.56020 -2913.9
## - PFD        1   0.00287 0.56307 -2913.6
## - OREB       1   0.00292 0.56313 -2913.6
## - DREB       1   0.00303 0.56324 -2913.5
## - TEAM      33   0.09137 0.65158 -2911.9
## - FTP        1   0.00534 0.56554 -2911.7
## - FTA        1   0.00615 0.56635 -2911.0
## - `3PM`      1   0.00616 0.56636 -2911.0
## - FTM        1   0.00656 0.56676 -2910.7
## - STL        1   0.00873 0.56893 -2909.0
## - TOV        1   0.01017 0.57037 -2907.8
## - PTS        1   0.01171 0.57191 -2906.6
## - FGP        1   0.01631 0.57652 -2903.0
## - PlusMinus  1   0.84040 1.40061 -2503.6
##
## Step:  AIC=-2914.13
## WINP ~ TEAM + PTS + FGP + `3PM` + FTM + FTA + FTP + OREB + DREB +
##     REB + TOV + STL + PFD + PlusMinus
##
##             Df Sum of Sq     RSS     AIC
## - REB        1   0.00237 0.56480 -2914.2
## <none>                   0.56243 -2914.1
## - TEAM      33   0.08918 0.65161 -2913.9
## - OREB       1   0.00294 0.56537 -2913.8
## - DREB       1   0.00306 0.56549 -2913.7
```

```
## - PFD        1   0.00324 0.56567 -2913.6
## - FTP        1   0.00529 0.56772 -2911.9
## - FTA        1   0.00613 0.56856 -2911.2
## - FTM        1   0.00650 0.56893 -2911.0
## - `3PM`      1   0.00801 0.57044 -2909.8
## - STL        1   0.00823 0.57066 -2909.6
## - TOV        1   0.01290 0.57533 -2905.9
## - PTS        1   0.01372 0.57614 -2905.3
## - FGP        1   0.01916 0.58159 -2901.1
## - PlusMinus  1   0.86681 1.42924 -2496.4
##
## Step:  AIC=-2914.24
## WINP ~ TEAM + PTS + FGP + `3PM` + FTM + FTA + FTP + OREB + DREB +
##     TOV + STL + PFD + PlusMinus
##
##             Df Sum of Sq     RSS     AIC
## - TEAM      33   0.08807 0.65286 -2915.0
## <none>                   0.56480 -2914.2
## - PFD        1   0.00341 0.56821 -2913.5
## - OREB       1   0.00378 0.56858 -2913.2
## - FTP        1   0.00498 0.56977 -2912.3
## - FTA        1   0.00586 0.57065 -2911.6
## - FTM        1   0.00620 0.57100 -2911.3
## - `3PM`      1   0.00772 0.57252 -2910.1
## - STL        1   0.00801 0.57281 -2909.9
## - DREB       1   0.01130 0.57609 -2907.3
## - TOV        1   0.01260 0.57740 -2906.3
## - PTS        1   0.01348 0.57828 -2905.6
## - FGP        1   0.01895 0.58375 -2901.4
## - PlusMinus  1   0.86554 1.43034 -2498.1
##
## Step:  AIC=-2915.04
## WINP ~ PTS + FGP + `3PM` + FTM + FTA + FTP + OREB + DREB + TOV +
##     STL + PFD + PlusMinus
##
##             Df Sum of Sq     RSS     AIC
## - PFD        1   0.00170 0.65457 -2915.9
## - FTP        1   0.00211 0.65497 -2915.6
## - OREB       1   0.00225 0.65512 -2915.5
## - FTA        1   0.00264 0.65550 -2915.2
## <none>                   0.65286 -2915.0
## - FTM        1   0.00299 0.65585 -2915.0
## - STL        1   0.00500 0.65786 -2913.6
## - `3PM`      1   0.00696 0.65982 -2912.3
## - TOV        1   0.00915 0.66201 -2910.8
## - DREB       1   0.01042 0.66328 -2909.9
## - PTS        1   0.01243 0.66529 -2908.6
## - FGP        1   0.01651 0.66938 -2905.8
## - PlusMinus  1   1.11458 1.76744 -2468.9
##
## Step:  AIC=-2915.86
## WINP ~ PTS + FGP + `3PM` + FTM + FTA + FTP + OREB + DREB + TOV +
##     STL + PlusMinus
##
```

```
##             Df Sum of Sq     RSS     AIC
## - OREB       1   0.00143 0.65600 -2916.9
## - FTP        1   0.00165 0.65621 -2916.7
## - FTA        1   0.00185 0.65641 -2916.6
## - FTM        1   0.00233 0.65690 -2916.3
## <none>                   0.65457 -2915.9
## - STL        1   0.00416 0.65872 -2915.0
## - `3PM`      1   0.00582 0.66038 -2913.9
## - TOV        1   0.00779 0.66235 -2912.5
## - DREB       1   0.00905 0.66362 -2911.7
## - PTS        1   0.01091 0.66547 -2910.4
## - FGP        1   0.01483 0.66940 -2907.8
## - PlusMinus  1   1.23558 1.89015 -2440.7
##
## Step:  AIC=-2916.88
## WINP ~ PTS + FGP + `3PM` + FTM + FTA + FTP + DREB + TOV + STL +
##     PlusMinus
##
##             Df Sum of Sq    RSS     AIC
## - FTA        1   0.00171 0.6577 -2917.7
## - FTP        1   0.00172 0.6577 -2917.7
## - FTM        1   0.00204 0.6580 -2917.5
## - STL        1   0.00274 0.6587 -2917.0
## <none>                   0.6560 -2916.9
## - `3PM`      1   0.00554 0.6615 -2915.1
## - TOV        1   0.00648 0.6625 -2914.4
## - DREB       1   0.00885 0.6648 -2912.8
## - PTS        1   0.01519 0.6712 -2908.6
## - FGP        1   0.02510 0.6811 -2902.0
## - PlusMinus  1   2.69923 3.3552 -2184.4
##
## Step:  AIC=-2917.71
## WINP ~ PTS + FGP + `3PM` + FTM + FTP + DREB + TOV + STL + PlusMinus
##
##             Df Sum of Sq    RSS     AIC
## - FTP        1   0.00001 0.6577 -2919.7
## <none>                   0.6577 -2917.7
## - STL        1   0.00294 0.6606 -2917.7
## - FTM        1   0.00369 0.6614 -2917.2
## - `3PM`      1   0.00515 0.6629 -2916.2
## - TOV        1   0.00661 0.6643 -2915.2
## - DREB       1   0.00859 0.6663 -2913.9
## - PTS        1   0.01474 0.6724 -2909.7
## - FGP        1   0.02433 0.6820 -2903.4
## - PlusMinus  1   2.69791 3.3556 -2186.4
##
## Step:  AIC=-2919.7
## WINP ~ PTS + FGP + `3PM` + FTM + DREB + TOV + STL + PlusMinus
##
##             Df Sum of Sq    RSS     AIC
## <none>                   0.6577 -2919.7
## - STL        1   0.00299 0.6607 -2919.7
## - FTM        1   0.00373 0.6614 -2919.2
## - `3PM`      1   0.00514 0.6629 -2918.2
```

```
## - TOV        1   0.00691 0.6646 -2917.0
## - DREB       1   0.00865 0.6664 -2915.8
## - PTS        1   0.01487 0.6726 -2911.6
## - FGP        1   0.02432 0.6820 -2905.4
## - PlusMinus  1   2.69835 3.3561 -2188.3
```

```
##
## Call:
## lm(formula = WINP ~ PTS + FGP + `3PM` + FTM + DREB + TOV + STL +
##     PlusMinus, data = dados_regressao)
##
## Coefficients:
## (Intercept)          PTS          FGP         `3PM`          FTM         DREB
##    0.226147    -0.003108     0.009672     0.003149     0.002312     0.003667
##         TOV          STL    PlusMinus
##   -0.004373     0.003764     0.029249
```

```
# Coefficients:
#   (Intercept)          PTS         FG_P           PF   Plus_Minus
# 0.4105976   -0.0006542    0.0048736   -0.0032414    0.0304204

modelo_back <- lm(WINP ~ PTS + FGP + PF + PlusMinus, data = dados_regressao)
modelo_back
```

```
##
## Call:
## lm(formula = WINP ~ PTS + FGP + PF + PlusMinus, data = dados_regressao)
##
## Coefficients:
## (Intercept)          PTS          FGP           PF    PlusMinus
##   0.4105976   -0.0006542    0.0048736   -0.0032414    0.0304204
```

```
coef(modelo_back)
```

```
##   (Intercept)           PTS           FGP            PF     PlusMinus
##  0.4105975914 -0.0006542452  0.0048736395 -0.0032414270  0.0304203770
```

```
anova(modelo_back)
```

```
## Analysis of Variance Table
##
## Response: WINP
##            Df Sum Sq Mean Sq F value    Pr(>F)
## PTS         1 0.9761  0.9761  655.61 < 2.2e-16 ***
## FGP         1 2.8026  2.8026 1882.29 < 2.2e-16 ***
## PF          1 0.2162  0.2162  145.18 < 2.2e-16 ***
## PlusMinus   1 5.5307  5.5307 3714.59 < 2.2e-16 ***
## Residuals 445 0.6626  0.0015
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
summary(modelo_back) #Adjusted R-squared:  0.9344
```

```
##
## Call:
## lm(formula = WINP ~ PTS + FGP + PF + PlusMinus, data = dados_regressao)
##
## Residuals:
```

```
##       Min        1Q    Median        3Q       Max
## -0.113561 -0.026335  0.002916  0.025377  0.130296
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.4105976  0.0715538   5.738 1.77e-08 ***
## PTS         -0.0006542  0.0003239  -2.020  0.04402 *
## FGP          0.0048736  0.0016969   2.872  0.00427 **
## PF          -0.0032414  0.0013132  -2.468  0.01395 *
## PlusMinus    0.0304204  0.0004991  60.947  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.03859 on 445 degrees of freedom
## Multiple R-squared:  0.935,  Adjusted R-squared:  0.9344
## F-statistic:  1599 on 4 and 445 DF,  p-value: < 2.2e-16
```

```
AIC(modelo_back) #-1645.353
```

```
## [1] -1645.353
```

```
######## Forward Selection ########
completo = lm(WINP ~ ., data = dados_regressao)
vazio = lm(WINP ~ 1, data = dados_regressao)
step(vazio, scope=list(upper=completo, lower=vazio), direction='forward', trace=TRUE)
```

```
## Start:  AIC=-1702.61
## WINP ~ 1
##
##                    Df Sum of Sq     RSS     AIC
## + PlusMinus         1    9.5032  0.6850 -2915.4
## + FGP               1    3.7414  6.4468 -1906.5
## + `3PP`             1    2.9935  7.1946 -1857.2
## + BLKA              1    2.2681  7.9200 -1813.9
## + DREB              1    1.1321  9.0560 -1753.6
## + TEAM             33    2.2087  7.9794 -1746.6
## + PTS               1    0.9761  9.2120 -1745.9
## + TOV               1    0.8424  9.3457 -1739.5
## + FGM               1    0.8183  9.3699 -1738.3
## + AST               1    0.7447  9.4434 -1734.8
## + REB               1    0.6824  9.5057 -1731.8
## + BLK               1    0.6664  9.5217 -1731.0
## + PF                1    0.4418  9.7463 -1720.6
## + `3PM`             1    0.3990  9.7891 -1718.6
## + FTP               1    0.3179  9.8702 -1714.9
## + FTM               1    0.3081  9.8800 -1714.4
## + STL               1    0.2613  9.9268 -1712.3
## + OREB              1    0.1918  9.9964 -1709.2
## + PFD               1    0.1602 10.0280 -1707.7
## + `3PA`             1    0.1323 10.0558 -1706.5
## + FTA               1    0.1261 10.0620 -1706.2
## + FGA               1    0.0883 10.0998 -1704.5
## <none>                          10.1881 -1702.6
## + Numero_temporada 14    0.0007 10.1874 -1674.6
##
```

```
## Step:  AIC=-2915.44
## WINP ~ PlusMinus
##
##                     Df Sum of Sq     RSS     AIC
## + PF                 1  0.009563 0.67540 -2919.8
## + OREB               1  0.008177 0.67679 -2918.8
## + FGP                1  0.006508 0.67846 -2917.7
## + FGA                1  0.004435 0.68053 -2916.4
## + REB                1  0.003347 0.68162 -2915.6
## + BLKA               1  0.003304 0.68166 -2915.6
## <none>                          0.68497 -2915.4
## + `3PP`              1  0.002531 0.68243 -2915.1
## + `3PA`              1  0.001110 0.68386 -2914.2
## + TOV                1  0.000954 0.68401 -2914.1
## + PTS                1  0.000805 0.68416 -2914.0
## + `3PM`              1  0.000801 0.68416 -2914.0
## + FTA                1  0.000655 0.68431 -2913.9
## + FTM                1  0.000615 0.68435 -2913.8
## + BLK                1  0.000583 0.68438 -2913.8
## + PFD                1  0.000425 0.68454 -2913.7
## + FGM                1  0.000211 0.68475 -2913.6
## + STL                1  0.000206 0.68476 -2913.6
## + AST                1  0.000049 0.68492 -2913.5
## + DREB               1  0.000014 0.68495 -2913.4
## + FTP                1  0.000004 0.68496 -2913.4
## + TEAM              33  0.086873 0.59809 -2910.5
## + Numero_temporada  14  0.000013 0.68495 -2887.4
##
## Step:  AIC=-2919.76
## WINP ~ PlusMinus + PF
##
##                     Df Sum of Sq     RSS     AIC
## + FGP                1  0.006764 0.66864 -2922.3
## + OREB               1  0.005783 0.66962 -2921.6
## + FGA                1  0.004846 0.67056 -2921.0
## + REB                1  0.004376 0.67103 -2920.7
## <none>                          0.67540 -2919.8
## + `3PP`              1  0.002805 0.67260 -2919.6
## + BLKA               1  0.002272 0.67313 -2919.3
## + `3PA`              1  0.001668 0.67373 -2918.9
## + `3PM`              1  0.001269 0.67413 -2918.6
## + PTS                1  0.000556 0.67485 -2918.1
## + DREB               1  0.000456 0.67495 -2918.1
## + PFD                1  0.000409 0.67499 -2918.0
## + FGM                1  0.000267 0.67514 -2917.9
## + BLK                1  0.000175 0.67523 -2917.9
## + FTM                1  0.000099 0.67530 -2917.8
## + FTA                1  0.000091 0.67531 -2917.8
## + STL                1  0.000087 0.67532 -2917.8
## + FTP                1  0.000010 0.67539 -2917.8
## + AST                1  0.000004 0.67540 -2917.8
## + TOV                1  0.000001 0.67540 -2917.8
## + TEAM              33  0.081699 0.59370 -2911.8
## + Numero_temporada  14  0.001765 0.67364 -2892.9
```

```
##
## Step:  AIC=-2922.29
## WINP ~ PlusMinus + PF + FGP
##
##                     Df Sum of Sq     RSS     AIC
## + FGM                1  0.007671 0.66097 -2925.5
## + FGA                1  0.007365 0.66127 -2925.3
## + PTS                1  0.006073 0.66256 -2924.4
## + REB                1  0.003148 0.66549 -2922.4
## + `3PA`              1  0.003065 0.66557 -2922.4
## + AST                1  0.003004 0.66563 -2922.3
## <none>                          0.66864 -2922.3
## + `3PM`              1  0.002938 0.66570 -2922.3
## + OREB               1  0.002257 0.66638 -2921.8
## + BLKA               1  0.000987 0.66765 -2921.0
## + DREB               1  0.000912 0.66773 -2920.9
## + `3PP`              1  0.000694 0.66794 -2920.8
## + PFD                1  0.000539 0.66810 -2920.7
## + FTP                1  0.000260 0.66838 -2920.5
## + BLK                1  0.000153 0.66849 -2920.4
## + STL                1  0.000087 0.66855 -2920.3
## + FTA                1  0.000081 0.66856 -2920.3
## + TOV                1  0.000078 0.66856 -2920.3
## + FTM                1  0.000019 0.66862 -2920.3
## + TEAM              33  0.080699 0.58794 -2914.2
## + Numero_temporada  14  0.004714 0.66392 -2897.5
##
## Step:  AIC=-2925.48
## WINP ~ PlusMinus + PF + FGP + FGM
##
##                     Df Sum of Sq     RSS     AIC
## <none>                          0.66097 -2925.5
## + DREB               1  0.002007 0.65896 -2924.8
## + FGA                1  0.001633 0.65933 -2924.6
## + OREB               1  0.001480 0.65949 -2924.5
## + `3PP`              1  0.000571 0.66040 -2923.9
## + STL                1  0.000505 0.66046 -2923.8
## + TOV                1  0.000505 0.66046 -2923.8
## + BLKA               1  0.000446 0.66052 -2923.8
## + REB                1  0.000188 0.66078 -2923.6
## + `3PA`              1  0.000181 0.66079 -2923.6
## + `3PM`              1  0.000149 0.66082 -2923.6
## + BLK                1  0.000139 0.66083 -2923.6
## + FTA                1  0.000113 0.66085 -2923.6
## + PFD                1  0.000112 0.66085 -2923.6
## + FTM                1  0.000092 0.66088 -2923.6
## + AST                1  0.000008 0.66096 -2923.5
## + FTP                1  0.000007 0.66096 -2923.5
## + PTS                1  0.000006 0.66096 -2923.5
## + TEAM              33  0.078255 0.58271 -2916.2
## + Numero_temporada  14  0.005344 0.65562 -2901.1
##
## Call:
```

```
## lm(formula = WINP ~ PlusMinus + PF + FGP + FGM, data = dados_regressao)
##
## Coefficients:
## (Intercept)    PlusMinus           PF          FGP          FGM
##    0.401565     0.030261    -0.003478     0.005746    -0.002433
```

```
# Coefficients:
#   (Intercept)   Plus_Minus           PF         FG_P          FGM
# 0.401565     0.030261    -0.003478     0.005746    -0.002433
```

```
modelo_forw <- lm(formula = WINP ~ PlusMinus + PF + FGP + FGM, data = dados_regressao)
modelo_forw
```

```
##
## Call:
## lm(formula = WINP ~ PlusMinus + PF + FGP + FGM, data = dados_regressao)
##
## Coefficients:
## (Intercept)    PlusMinus           PF          FGP          FGM
##    0.401565     0.030261    -0.003478     0.005746    -0.002433
```

```
coef(modelo_forw)
```

```
##  (Intercept)    PlusMinus           PF          FGP          FGM
##  0.401564997  0.030260547 -0.003477604  0.005745605 -0.002433190
```

```
anova(modelo_forw)
```

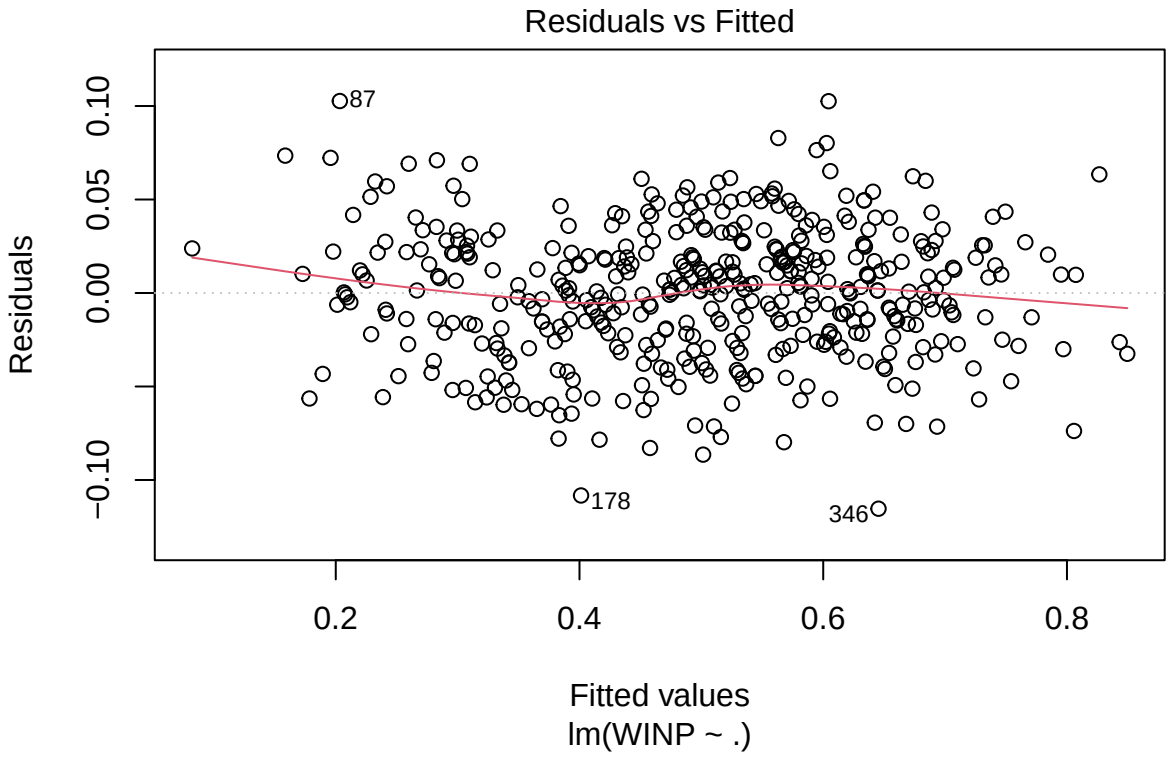
```
## Analysis of Variance Table
##
## Response: WINP
##            Df Sum Sq Mean Sq   F value  Pr(>F)
## PlusMinus   1 9.5032  9.5032 6398.0581 < 2e-16 ***
## PF          1 0.0096  0.0096    6.4381 0.01151 *
## FGP         1 0.0068  0.0068    4.5541 0.03339 *
## FGM         1 0.0077  0.0077    5.1648 0.02353 *
## Residuals 445 0.6610  0.0015
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
summary(modelo_forw) #Adjusted R-squared:  0.9345
```

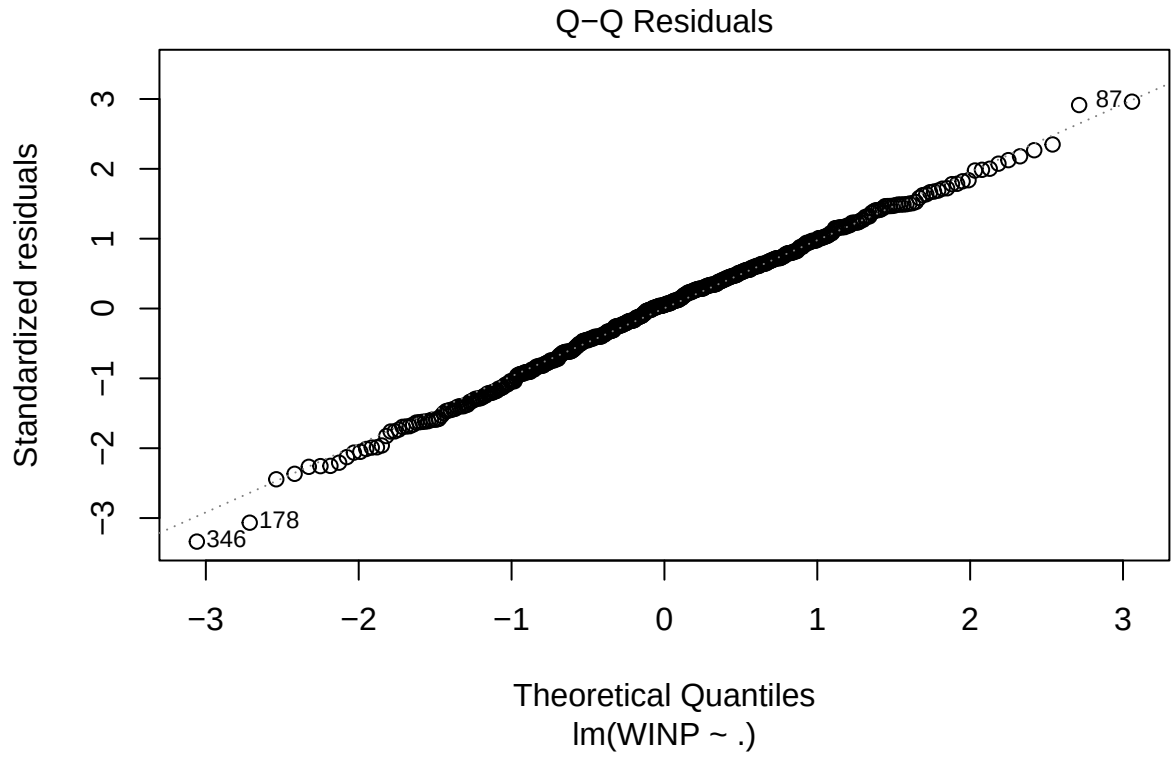
```
##
## Call:
## lm(formula = WINP ~ PlusMinus + PF + FGP + FGM, data = dados_regressao)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.113414 -0.024898  0.002528  0.025502  0.129168
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.4015650  0.0718776   5.587 4.04e-08 ***
## PlusMinus    0.0302605  0.0005057  59.834  < 2e-16 ***
## PF          -0.0034776  0.0013110  -2.653  0.00827 **
## FGP          0.0057456  0.0018603   3.089  0.00214 **
## FGM         -0.0024332  0.0010707  -2.273  0.02353 *
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.03854 on 445 degrees of freedom
## Multiple R-squared:  0.9351, Adjusted R-squared:  0.9345
## F-statistic:  1604 on 4 and 445 DF,  p-value: < 2.2e-16
```

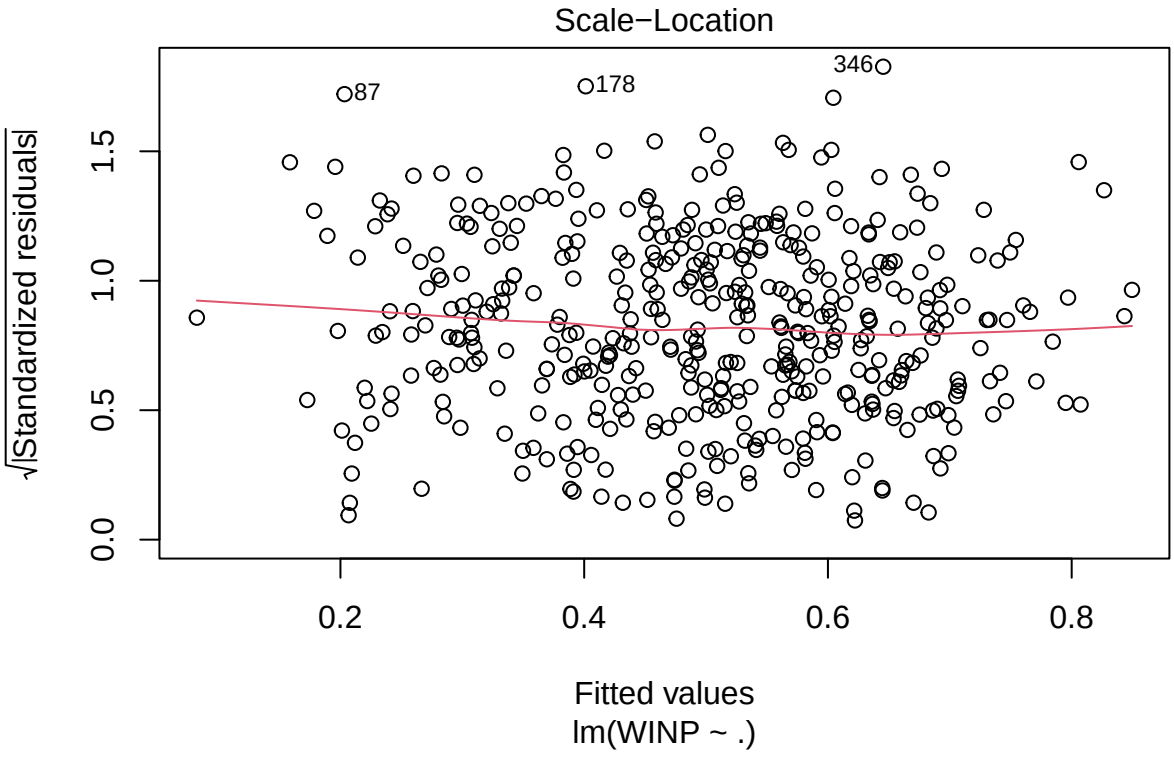
```
############### Análise de resíduos #############
##### Modelo completo #####
plot(modelo1, which = 1)
```



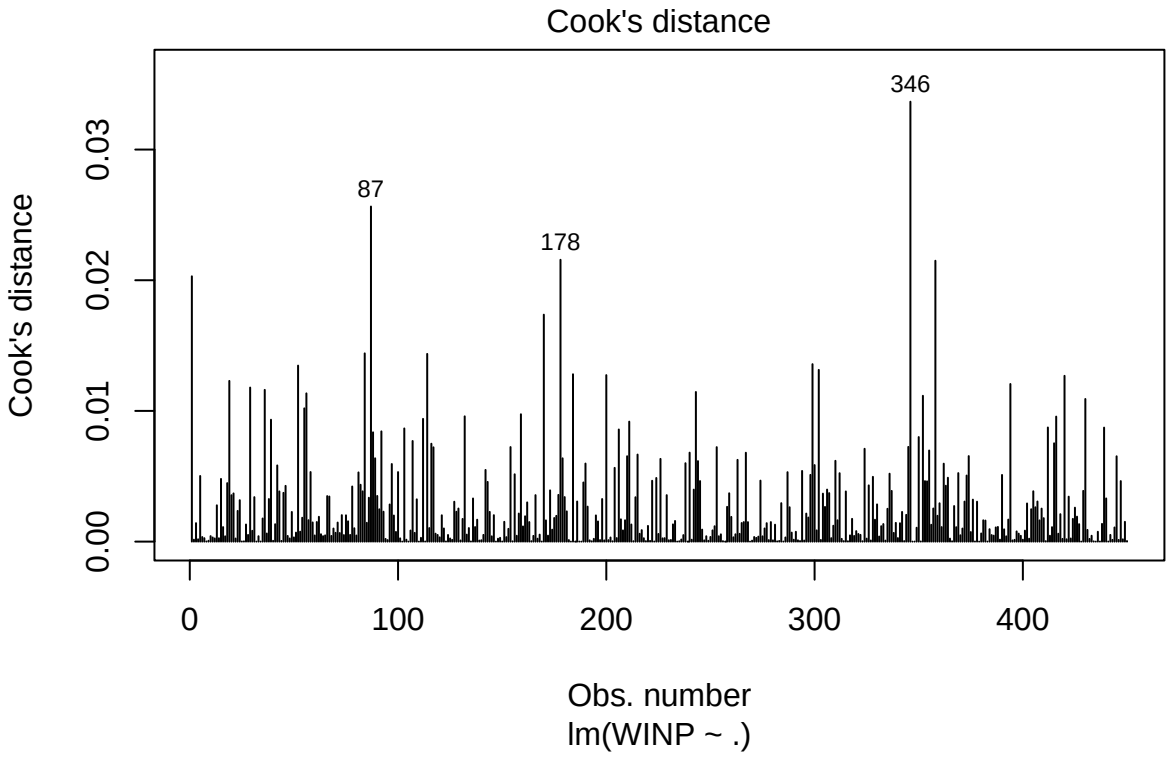

```
plot(modelo1, which = 2)
```



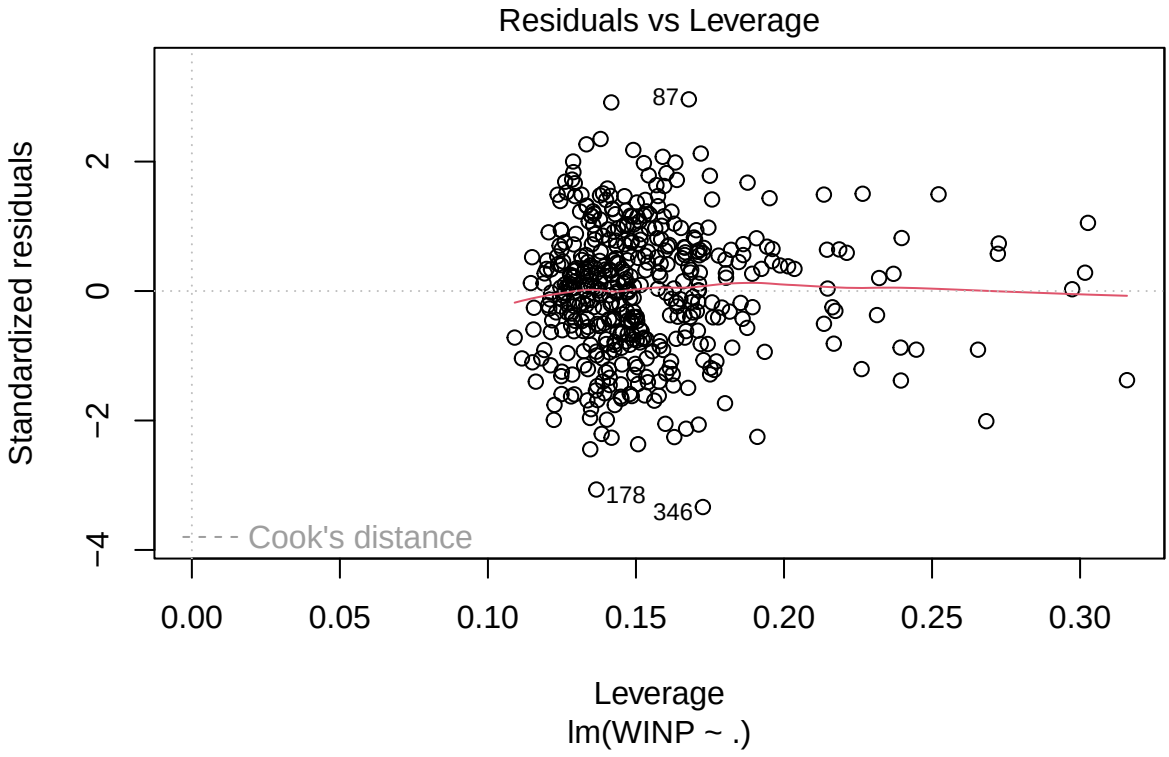

```
plot(modelo1, which = 3)
```



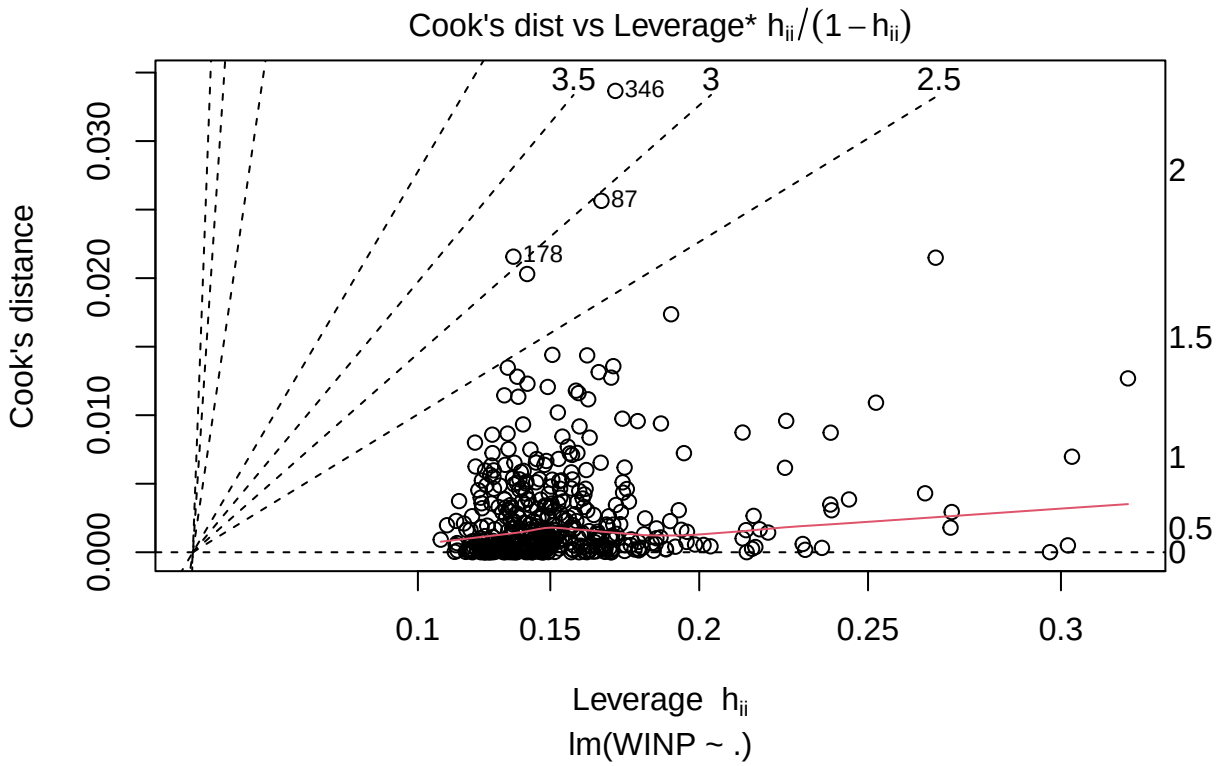

```
plot(modelo1, which = 4)
```




```
plot(modelo1, which = 5)
```




```
plot(modelo1, which = 6)
```




```
shapiro.test(modelo1$residuals) #p-value = 0.1885, normal
```

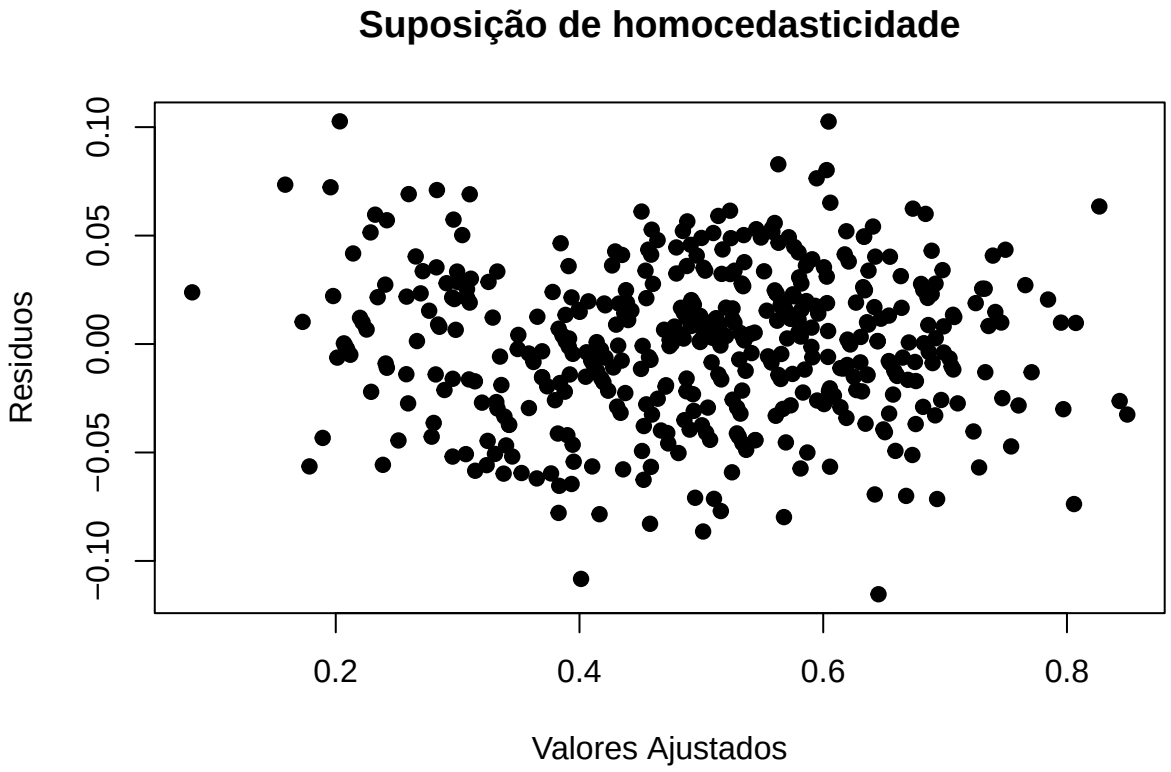
```
##
##  Shapiro-Wilk normality test
##
## data:  modelo1$residuals
## W = 0.99713, p-value = 0.6228
```

```
#Teste de durbin watson para independencia
library(lmtest)
dwtest(modelo1) #p-value = 0.1306
```

```
##
##  Durbin-Watson test
##
## data:  modelo1
## DW = 1.9425, p-value = 0.09558
## alternative hypothesis: true autocorrelation is greater than 0
```

```
#Independência
plot(modelo1$residuals,
     ylab = "Residuos",
     xlab = "Index dos Imovéis",
     main = "Suposição de independência",
     pch = 19)
```


```
#Homocedasticidade
plot(modelo1$fitted.values, modelo1$residuals,
     xlab = "Valores Ajustados",
     ylab = "Residuos",
     pch = 19,
     main = "Suposição de homocedasticidade"
)
```




```
#Breusch_Pagan para homocedasticdade
bptest(modelo1) #p-value = 0.2463, heterocedasticidade
```

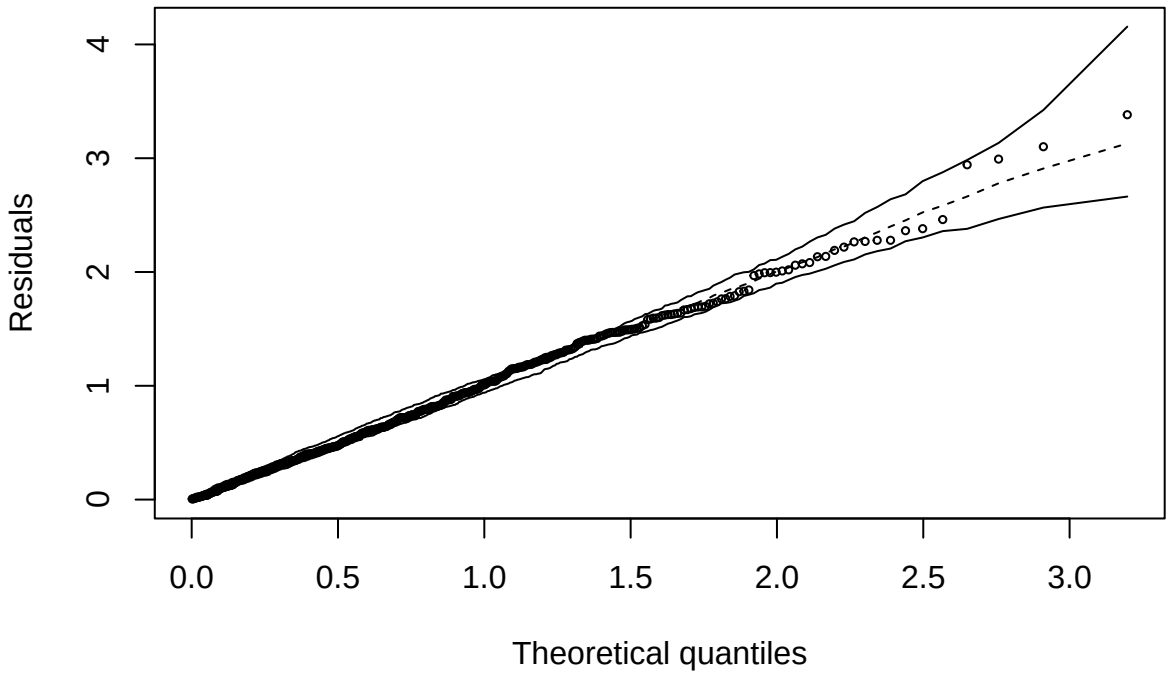
```
##
##  studentized Breusch-Pagan test
##
## data:  modelo1
## BP = 67.811, df = 68, p-value = 0.4837
```

```
#QQ Plot
library(hnp)
```

```
## Loading required package: MASS
##
## Attaching package: 'MASS'
##
## The following object is masked from 'package:patchwork':
##
##     area
##
## The following object is masked from 'package:dplyr':
##
##     select
```

```
hnp(modelo1)
```

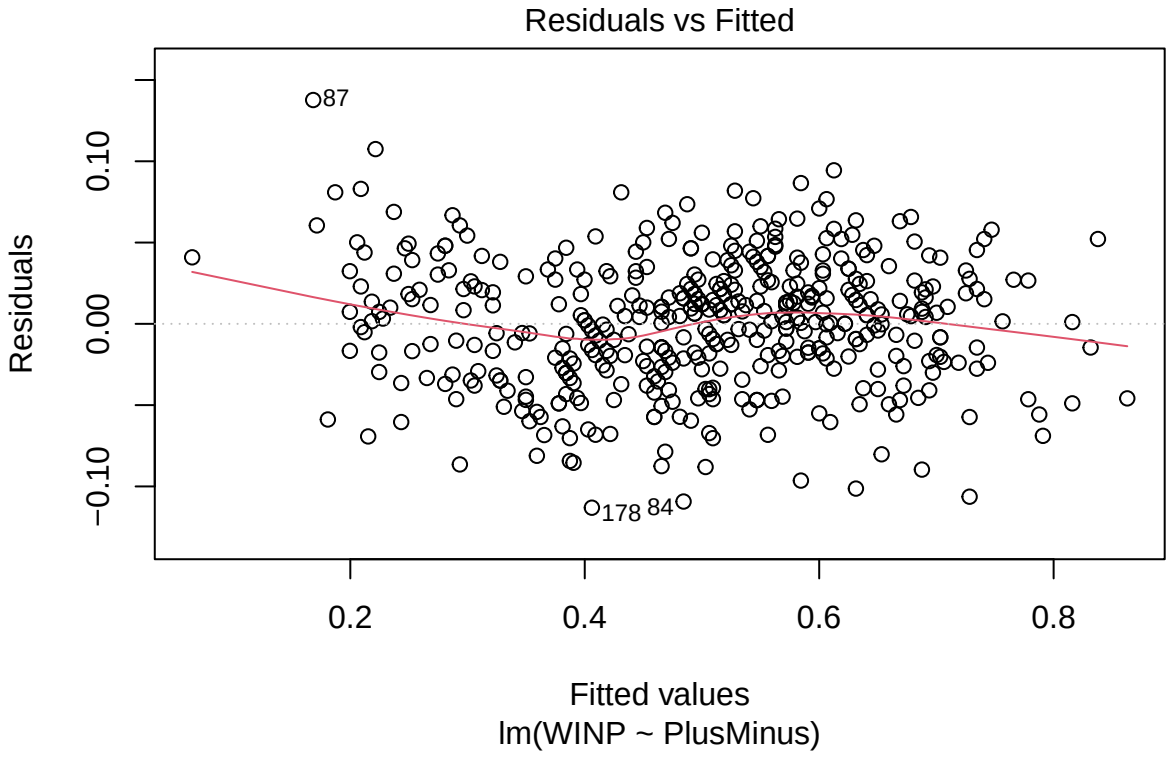
```
## Gaussian model (lm object)
```



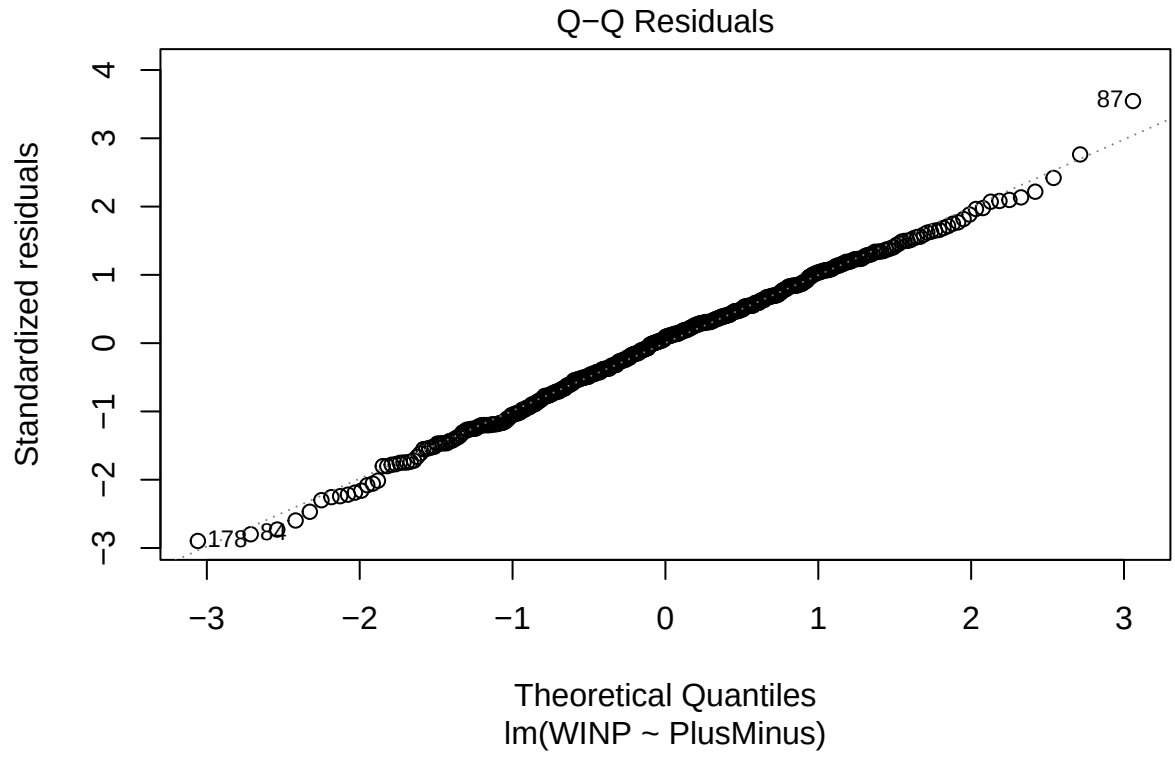

```r
AIC(modelo1)
```

```
## [1] -1600.945
```

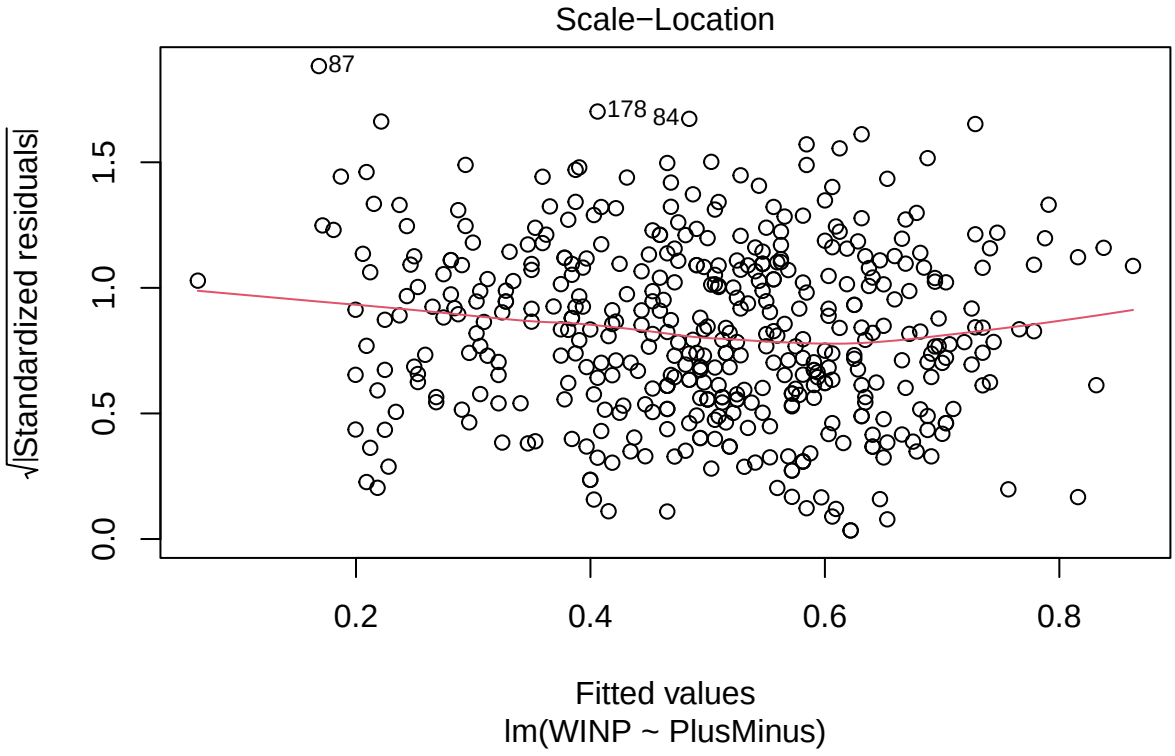
```r
######## Modelo 2 #####
plot(modelo2, which = 1)
```



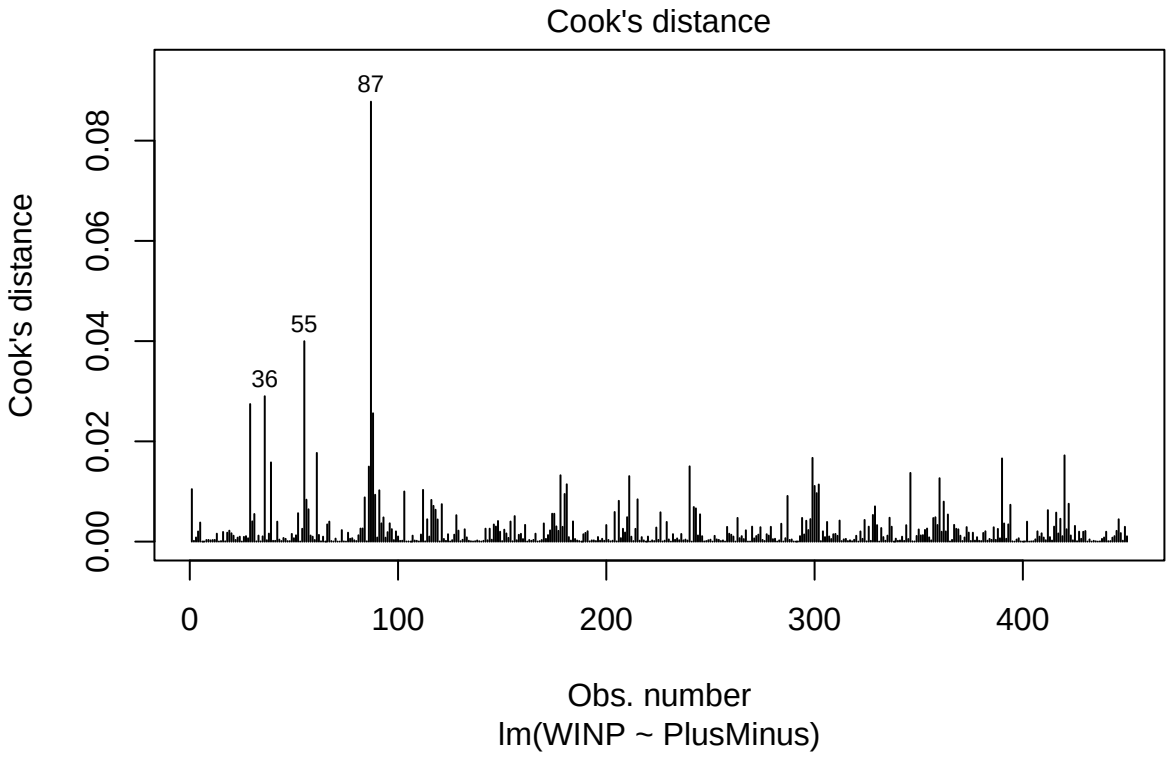
```
plot(modelo2, which = 2)
```



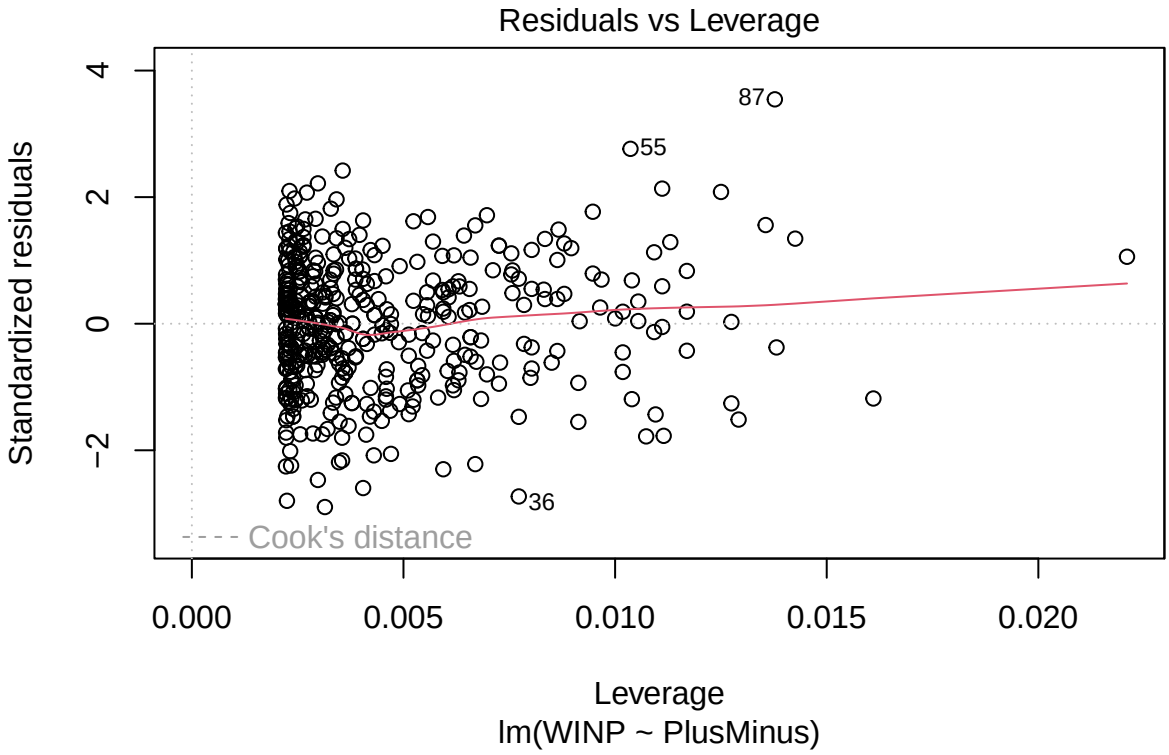

```
plot(modelo2, which = 3)
```



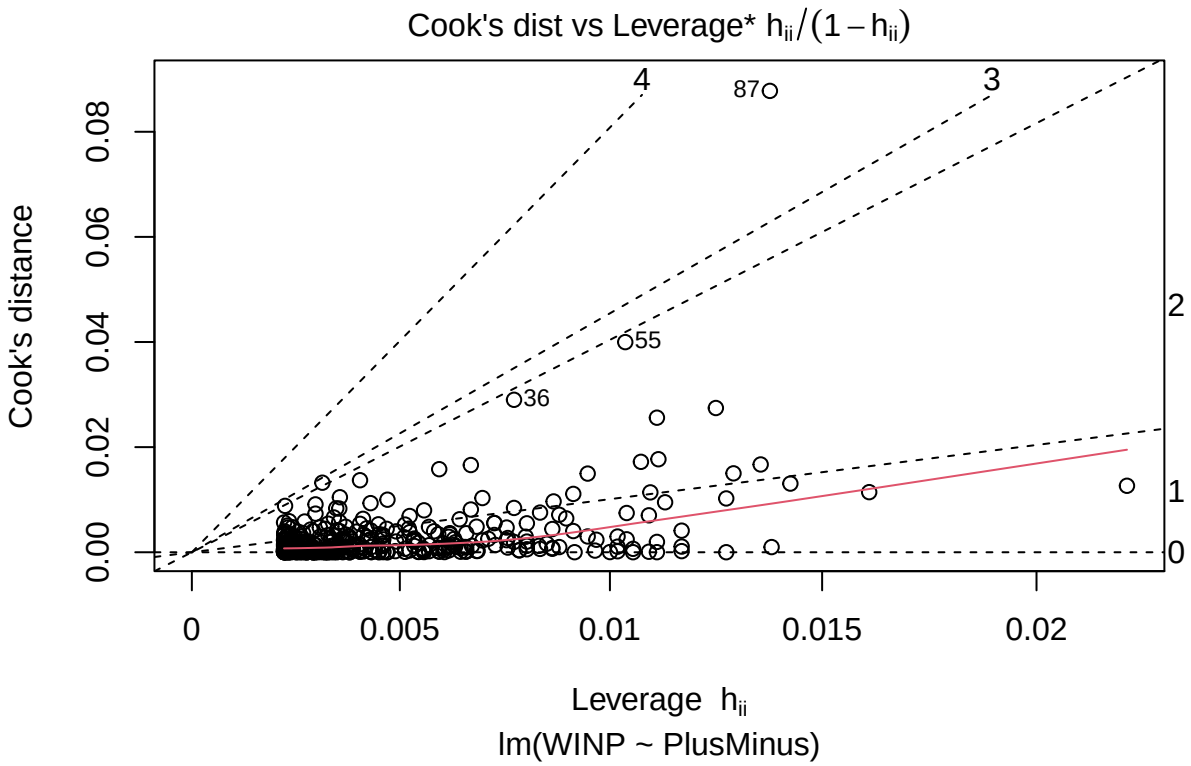

```
plot(modelo2, which = 4)
```




```
plot(modelo2, which = 5)
```




```
plot(modelo2, which = 6)
```




```r
shapiro.test(modelo2$residuals) #p-value = 0.5054, normal
```

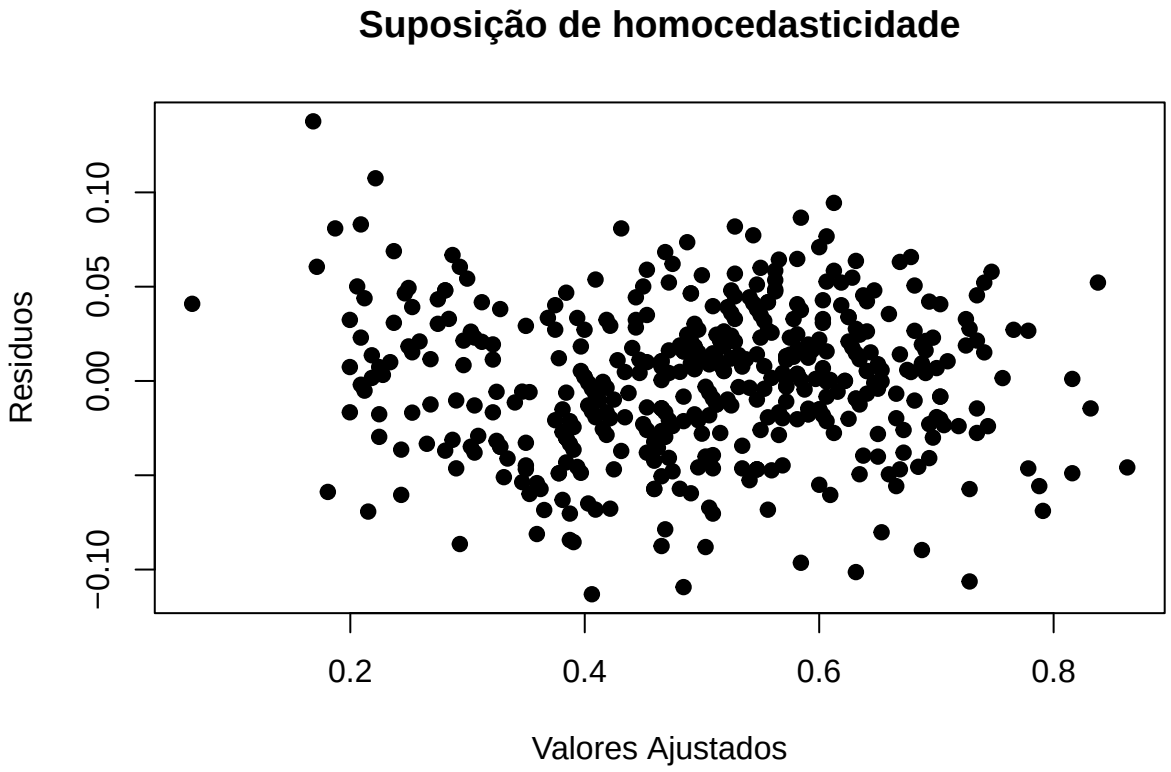
```
##
##  Shapiro-Wilk normality test
##
## data:  modelo2$residuals
## W = 0.99675, p-value = 0.5054
```

```r
#Teste de durbin watson para independencia
library(lmtest)
dwtest(modelo2) #p-value = 0.2889
```

```
##
##  Durbin-Watson test
##
## data:  modelo2
## DW = 1.9507, p-value = 0.2889
## alternative hypothesis: true autocorrelation is greater than 0
```

```r
#Independência
plot(modelo2$residuals,
     ylab = "Residuos",
     xlab = "Index dos Imovéis",
     main = "Suposição de independência",
     pch = 19)
```


```
#Homocedasticidade
plot(modelo2$fitted.values, modelo2$residuals,
     xlab = "Valores Ajustados",
     ylab = "Residuos",
     pch = 19,
     main = "Suposição de homocedasticidade"
)
```

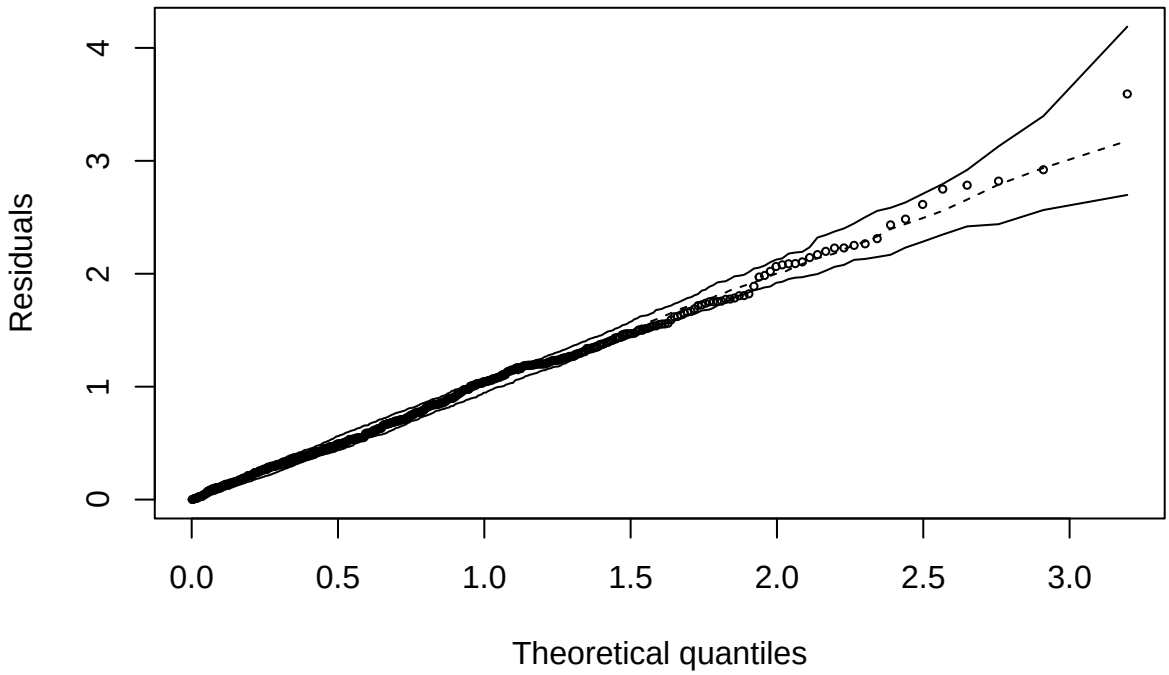



```
#Breusch_Pagan para homocedasticdade
bptest(modelo2) #p-value = 0.03674, heterocedasticidade
```

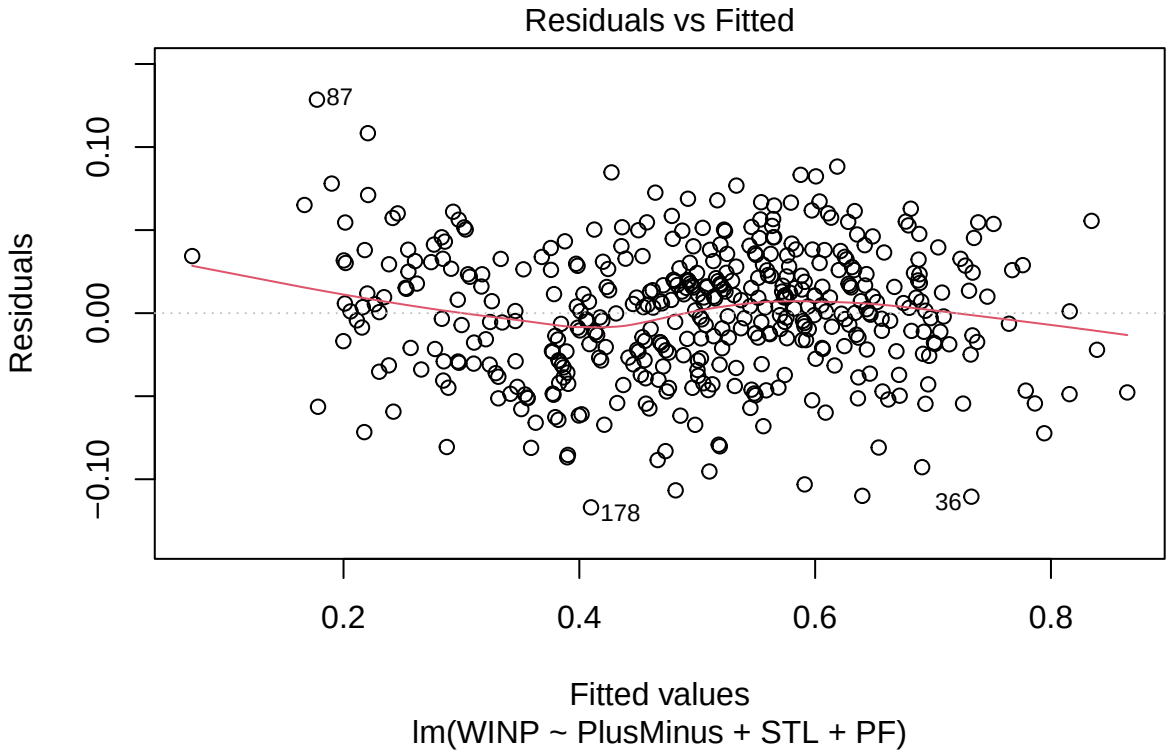
```
##
##  studentized Breusch-Pagan test
##
## data:  modelo2
## BP = 4.3624, df = 1, p-value = 0.03674
```

```
#QQ Plot
library(hnp)
hnp(modelo2)
```

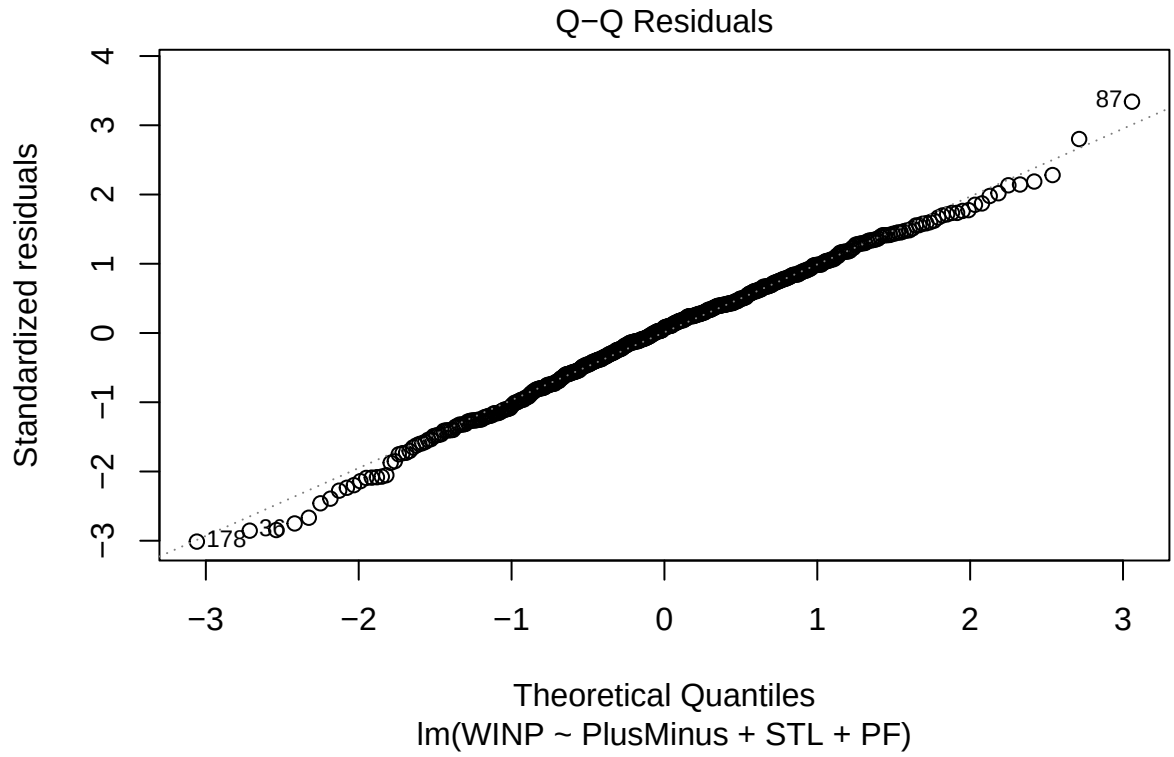
```
## Gaussian model (lm object)
```



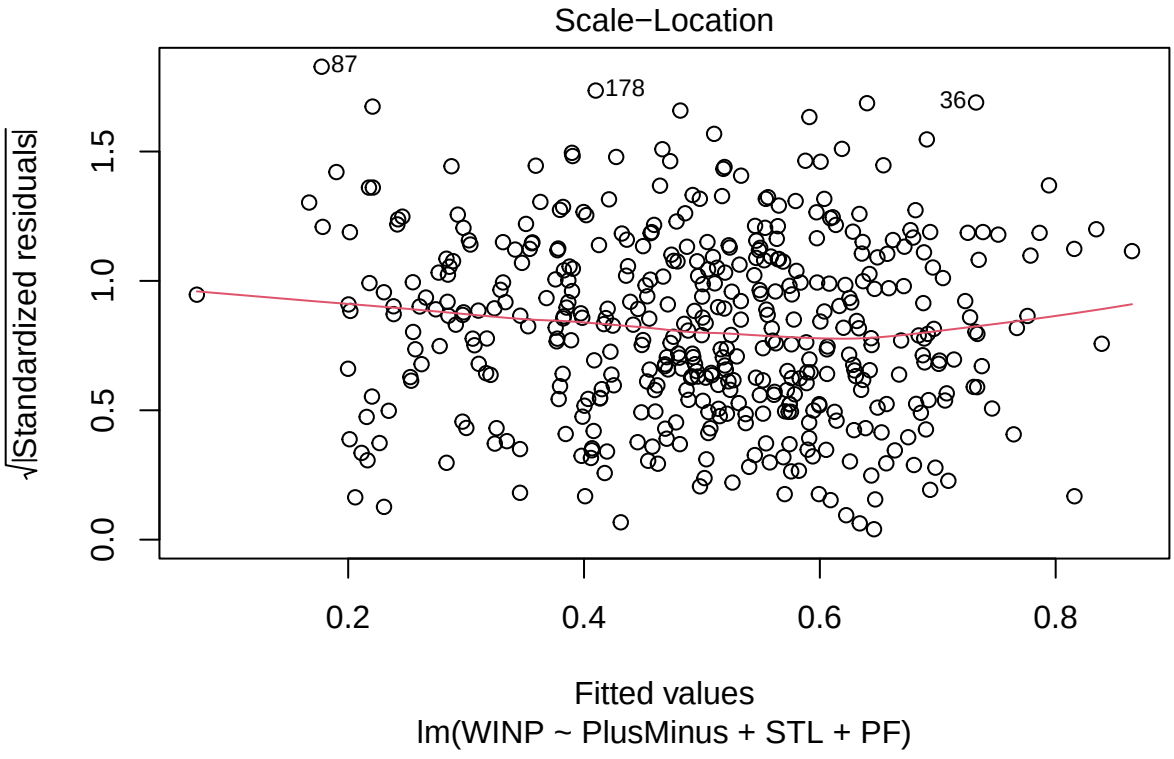

```
###### Modelo 3 ########
plot(modelo3, which = 1)
```



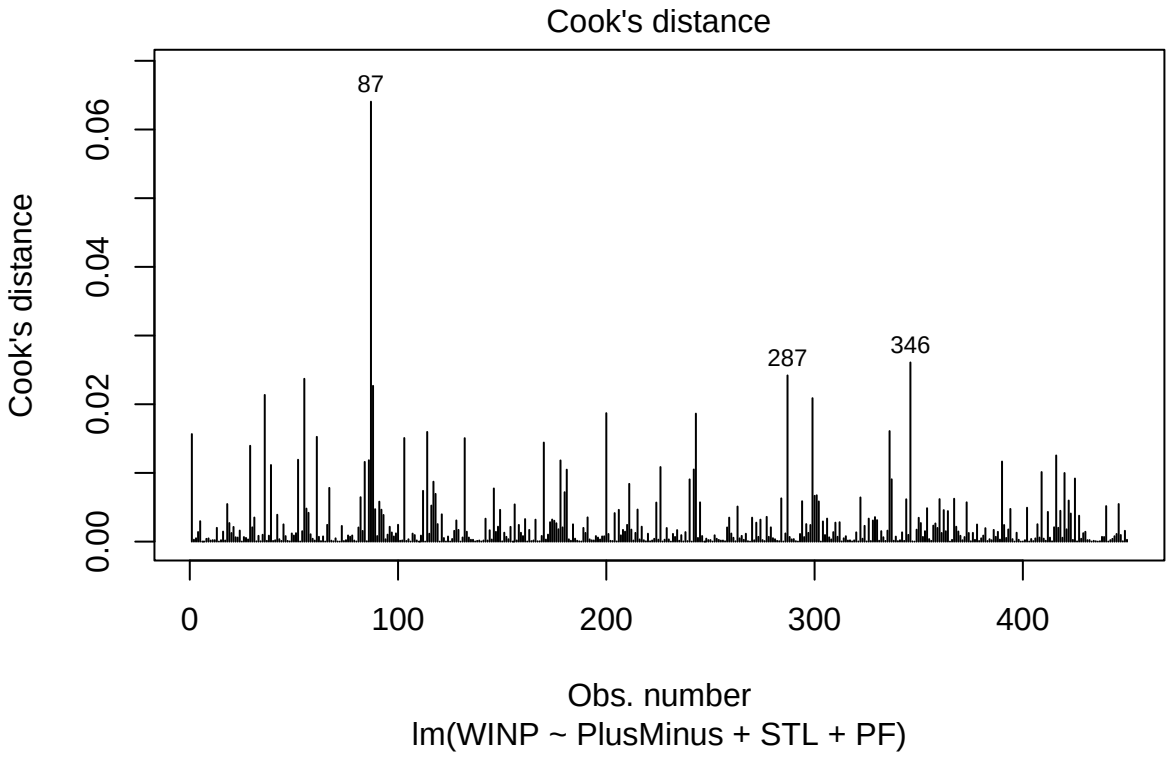

```
plot(modelo3, which = 2)
```



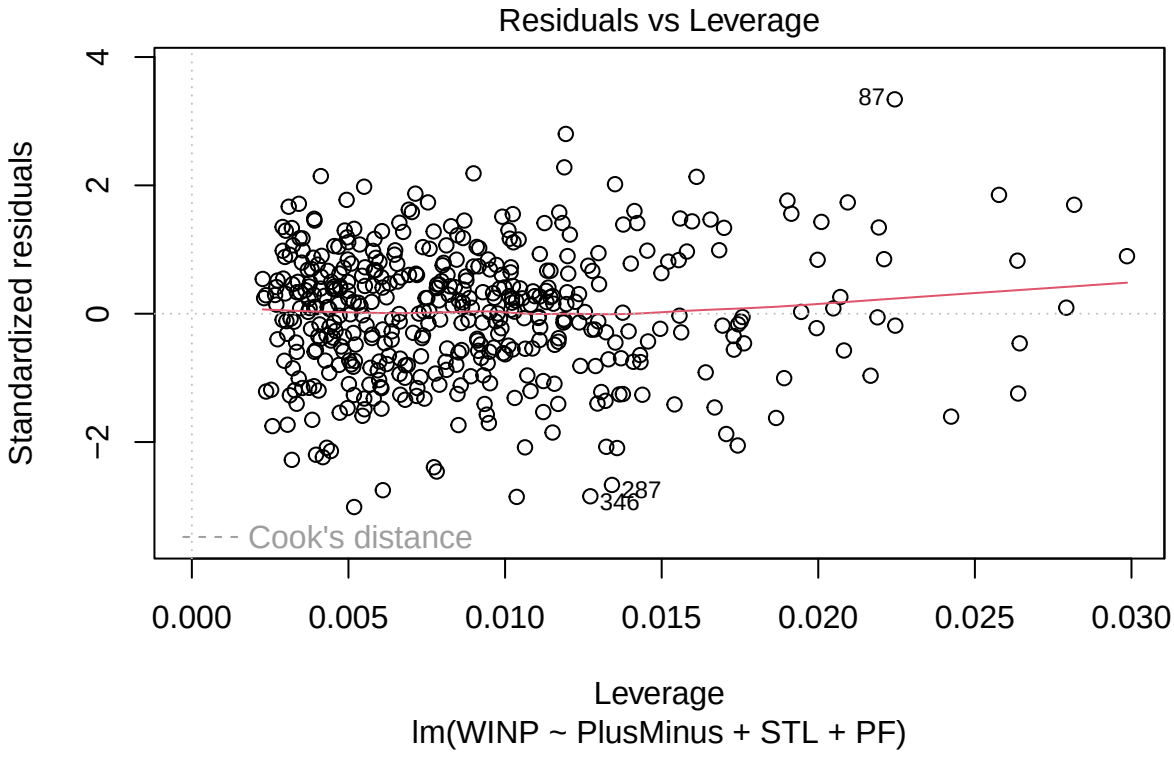

```
plot(modelo3, which = 3)
```



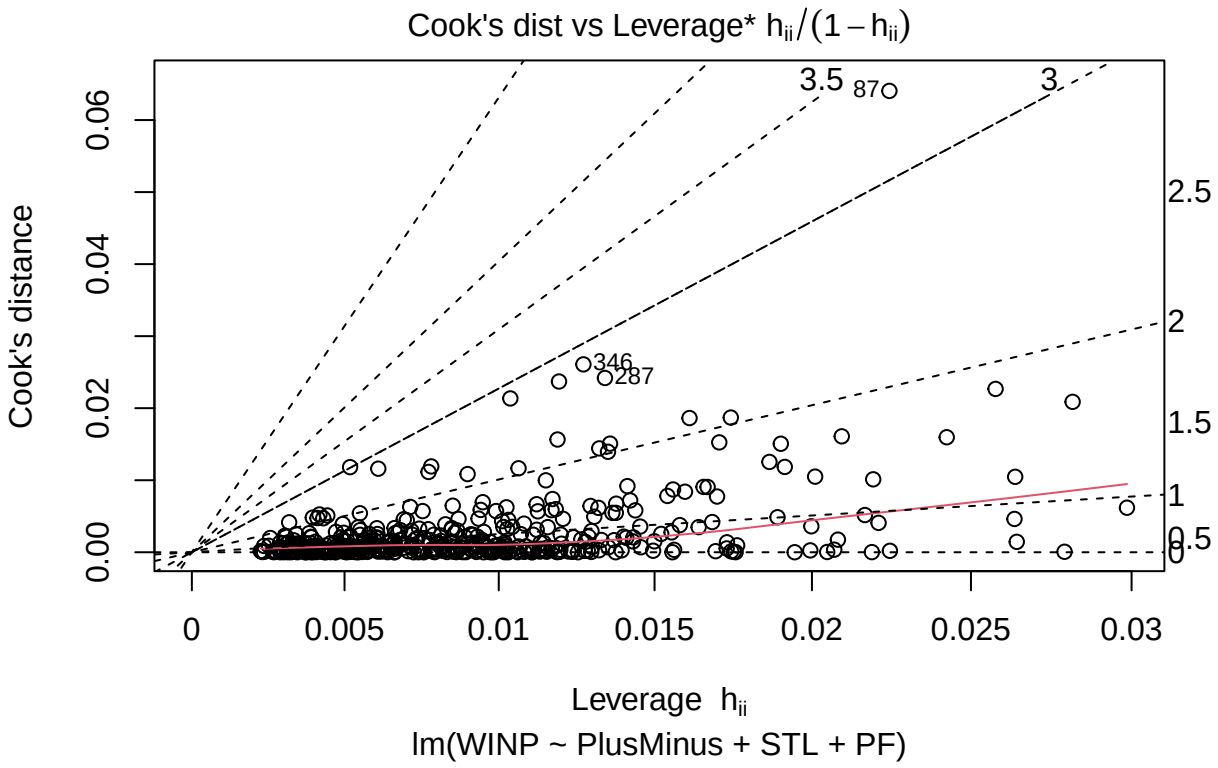

```
plot(modelo3, which = 4)
```




```
plot(modelo3, which = 5)
```




```
plot(modelo3, which = 6)
```




```
shapiro.test(modelo3$residuals) #p-value = 0.1847, normal
```

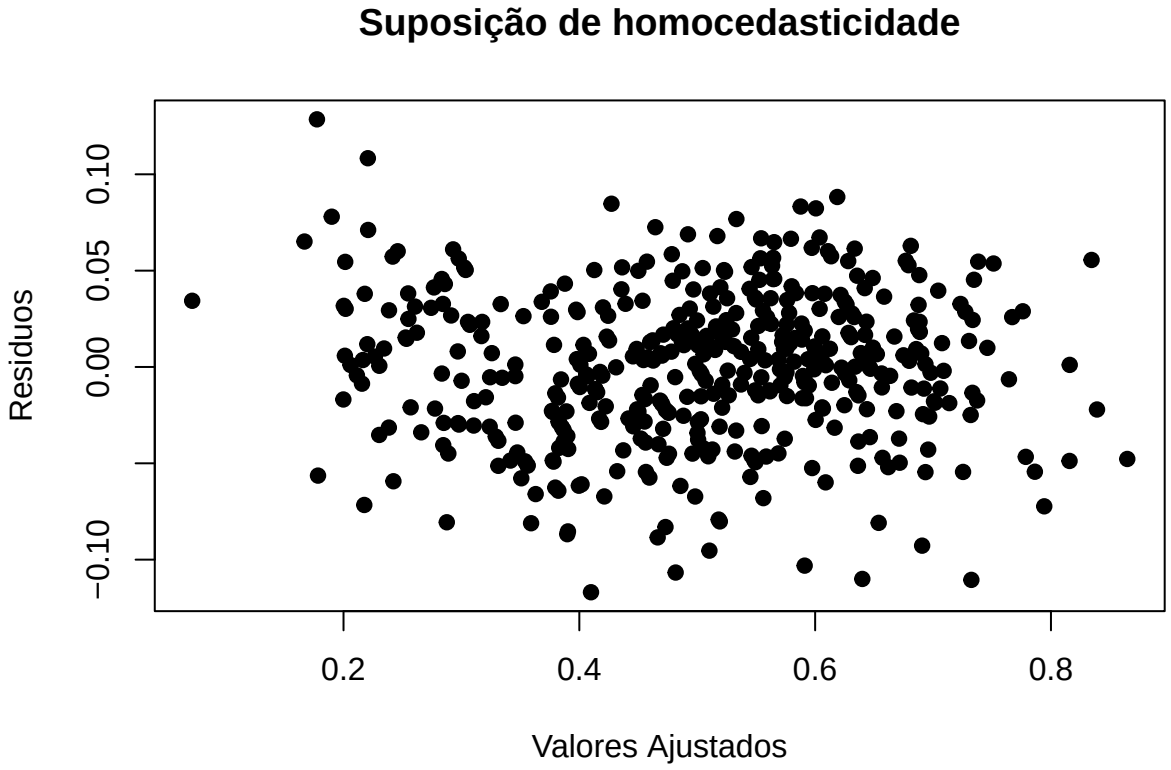
```
##
##  Shapiro-Wilk normality test
##
## data:  modelo3$residuals
## W = 0.99524, p-value = 0.1847
```

```
#Teste de durbin watson para independencia
library(lmtest)
dwtest(modelo3) #p-value = 0.2497
```

```
##
##  Durbin-Watson test
##
## data:  modelo3
## DW = 1.9408, p-value = 0.2497
## alternative hypothesis: true autocorrelation is greater than 0
```

```
#Independência
plot(modelo3$residuals,
     ylab = "Residuos",
     xlab = "Index dos Imovéis",
     main = "Suposição de independência",
     pch = 19)
```


```
#Homocedasticidade
plot(modelo3$fitted.values, modelo3$residuals,
     xlab = "Valores Ajustados",
     ylab = "Residuos",
     pch = 19,
     main = "Suposição de homocedasticidade"
)
```

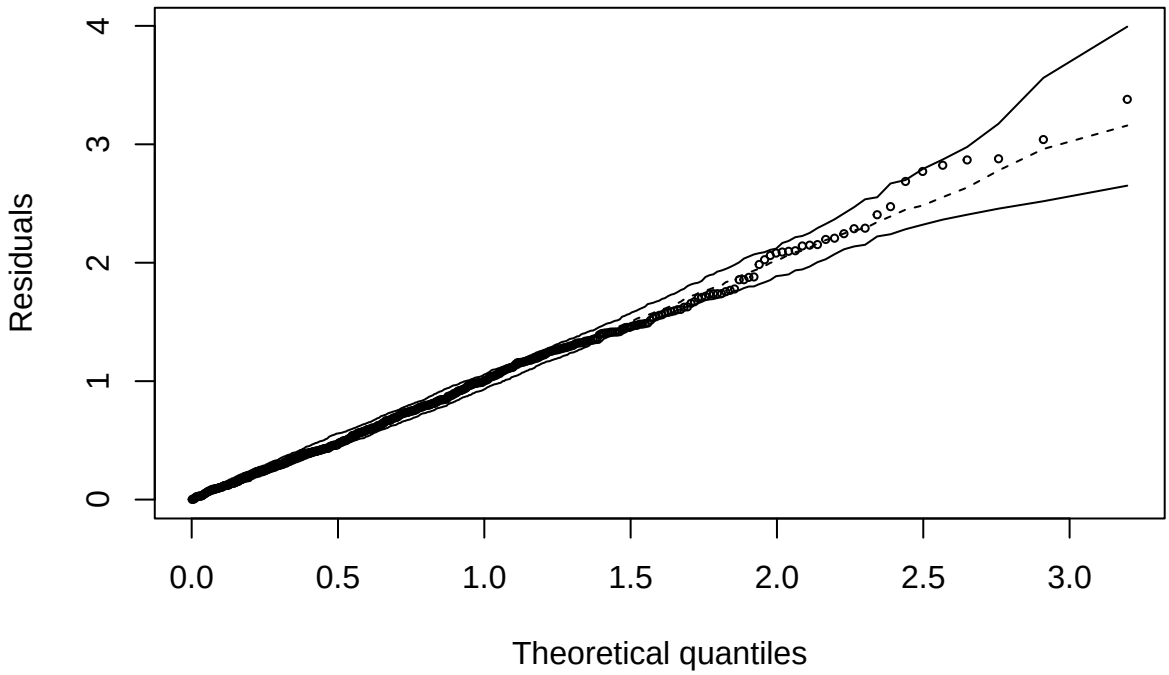



```
#Breusch_Pagan para homocedasticdade
bptest(modelo3) #p-value = 0.001367, heterocedasticidade
```

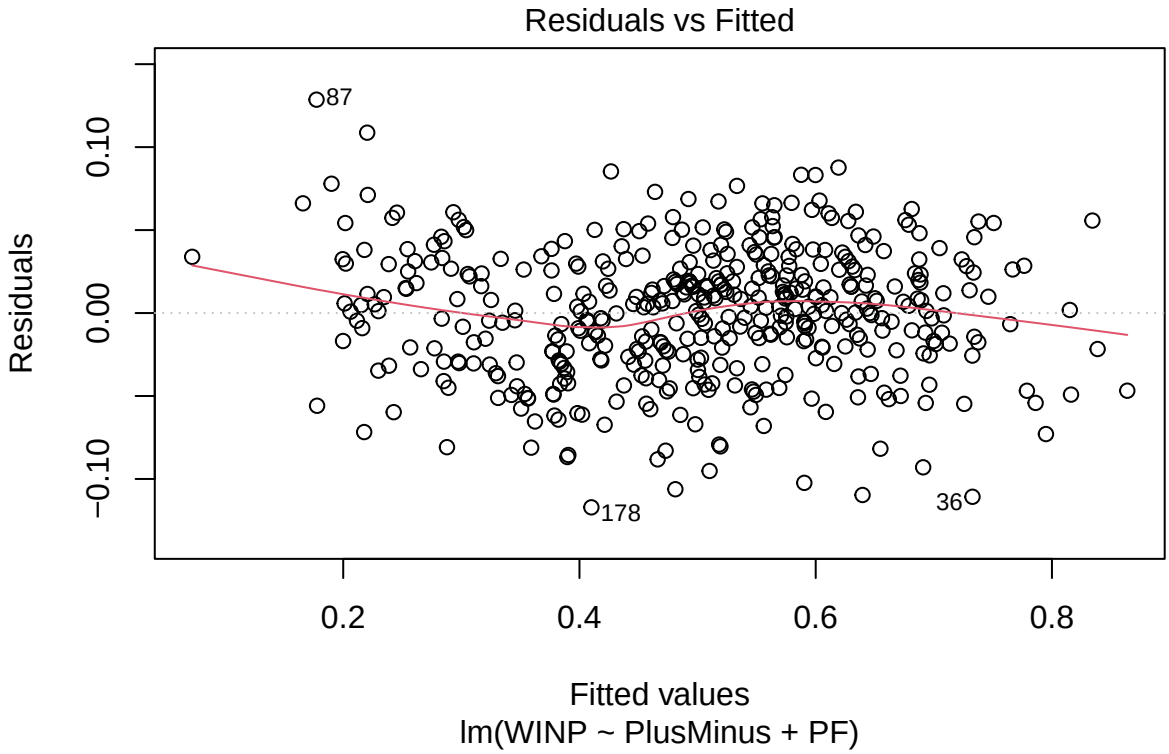
```
##
##  studentized Breusch-Pagan test
##
## data:  modelo3
## BP = 15.604, df = 3, p-value = 0.001367
```

```
#QQ Plot
library(hnp)
hnp(modelo3)
```

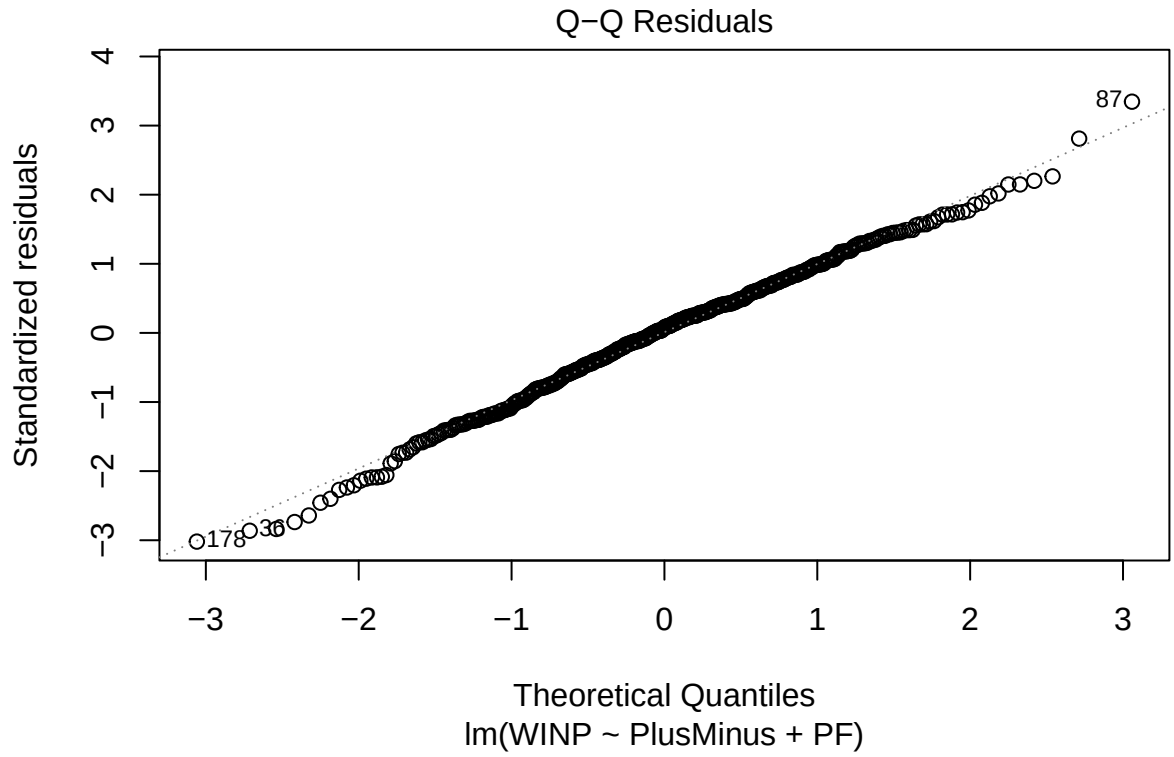
```
## Gaussian model (lm object)
```



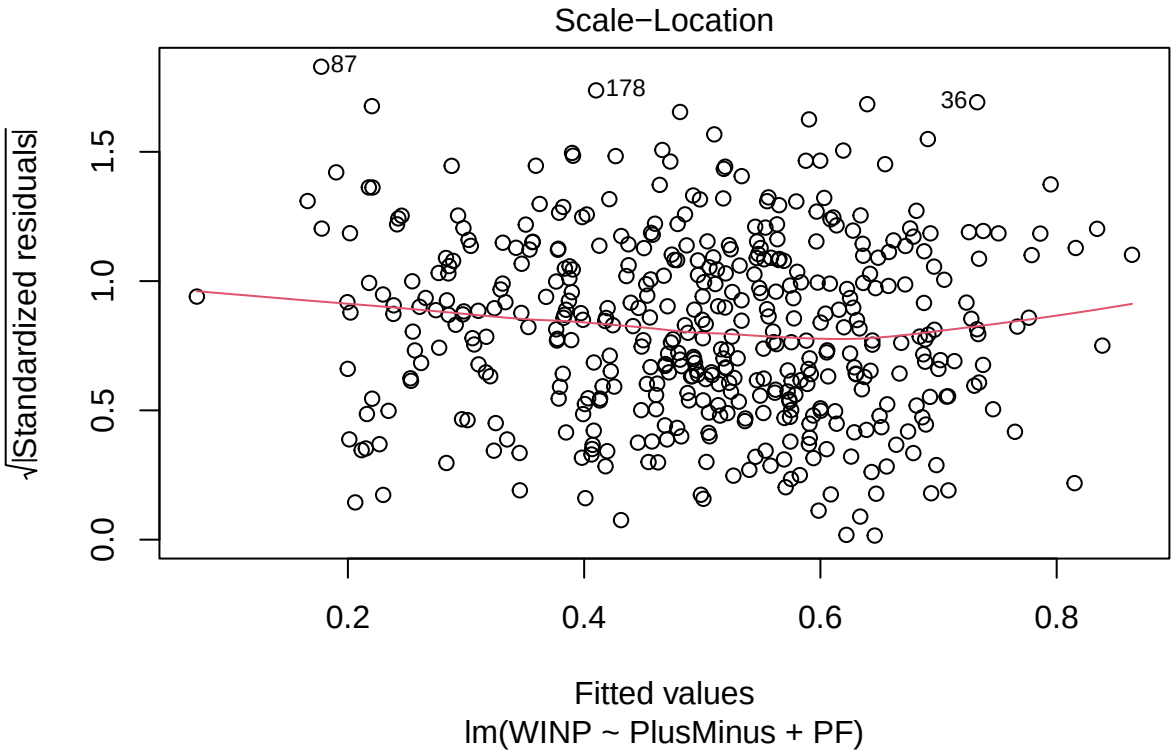

```
##### Modelo 4 ######
plot(modelo4, which = 1)
```



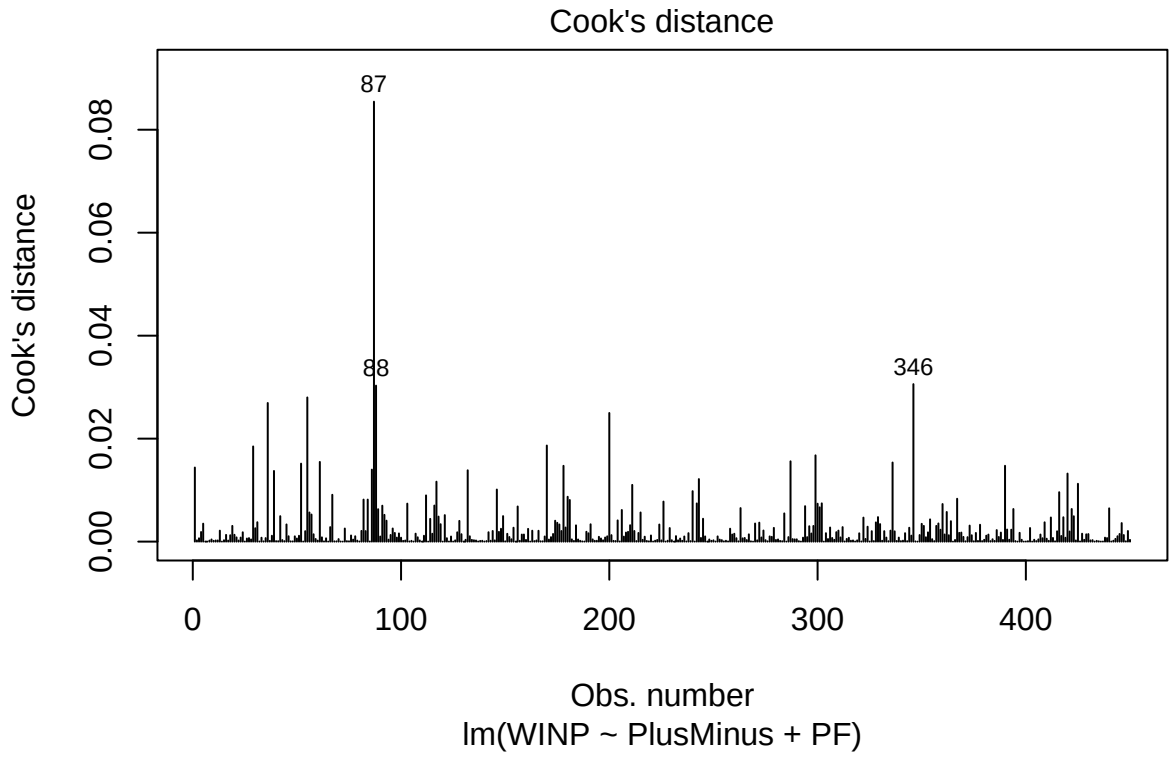

```
plot(modelo4, which = 2)
```



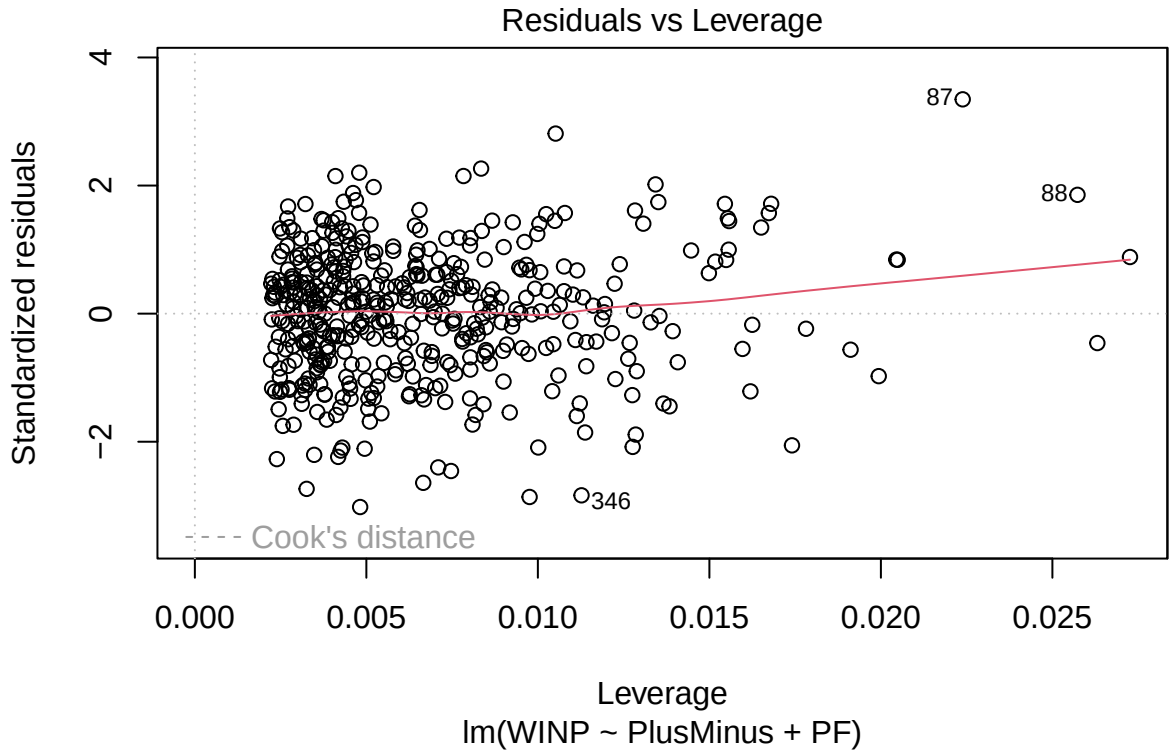

```
plot(modelo4, which = 3)
```



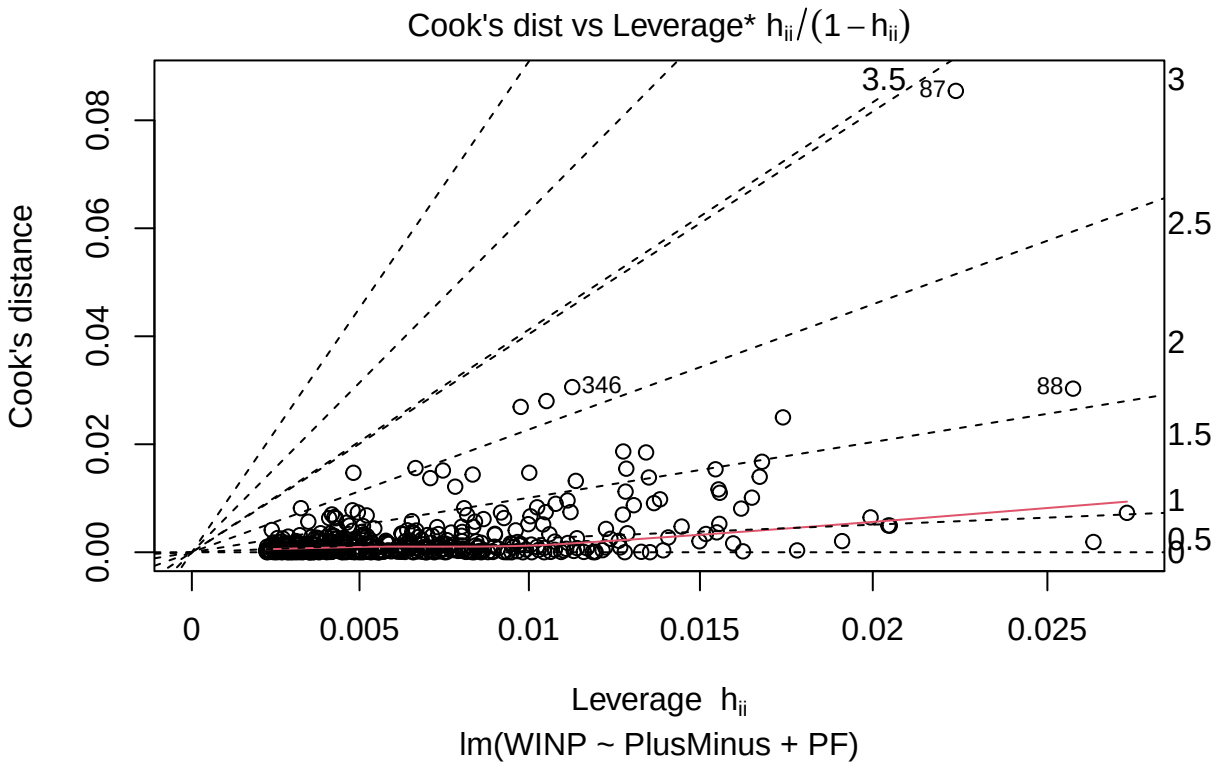

```
plot(modelo4, which = 4)
```




```
plot(modelo4, which = 5)
```




```
plot(modelo4, which = 6)
```




```
shapiro.test(modelo4$residuals) #p-value = 0.1829, normal
```

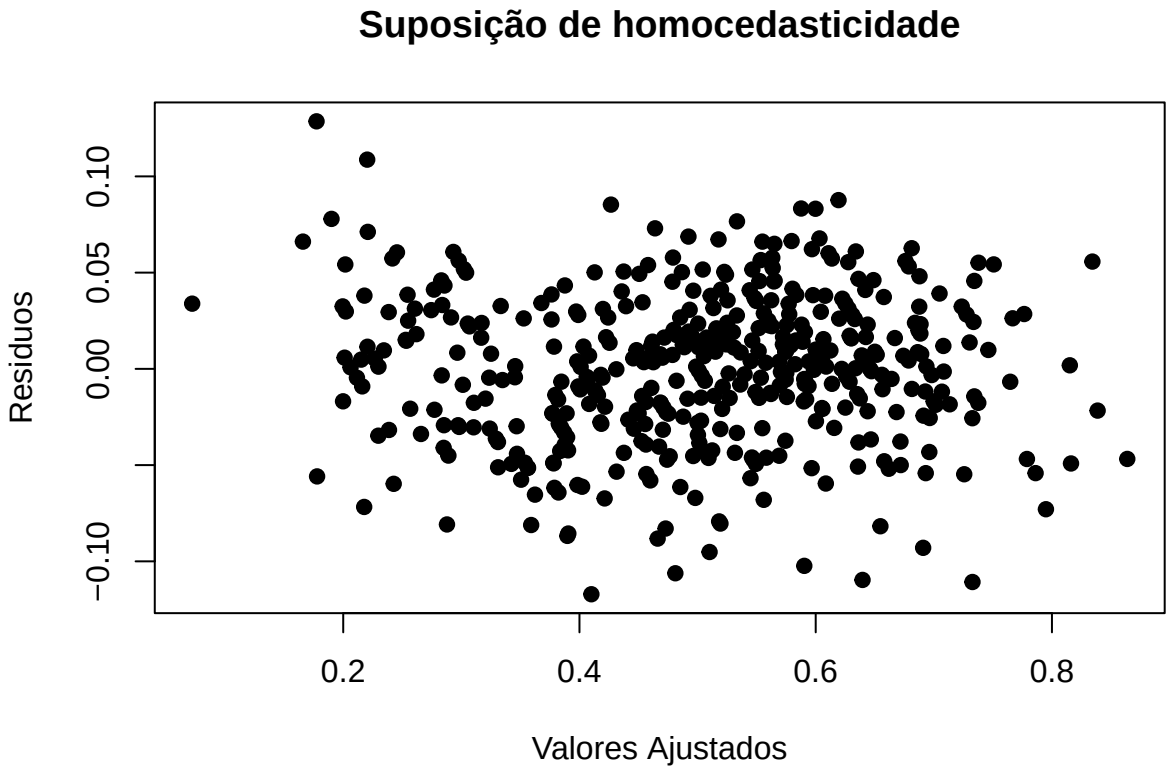
```
##
##  Shapiro-Wilk normality test
##
## data:  modelo4$residuals
## W = 0.99523, p-value = 0.1829
```

```
#Teste de durbin watson para independencia
library(lmtest)
dwtest(modelo4) #p-value = 0.254
```

```
##
##  Durbin-Watson test
##
## data:  modelo4
## DW = 1.9415, p-value = 0.254
## alternative hypothesis: true autocorrelation is greater than 0
```

```
#Independência
plot(modelo4$residuals,
     ylab = "Residuos",
     xlab = "Index dos Imovéis",
     main = "Suposição de independência",
     pch = 19)
```


```
#Homocedasticidade
plot(modelo4$fitted.values, modelo4$residuals,
     xlab = "Valores Ajustados",
     ylab = "Residuos",
     pch = 19,
     main = "Suposição de homocedasticidade"
)
```

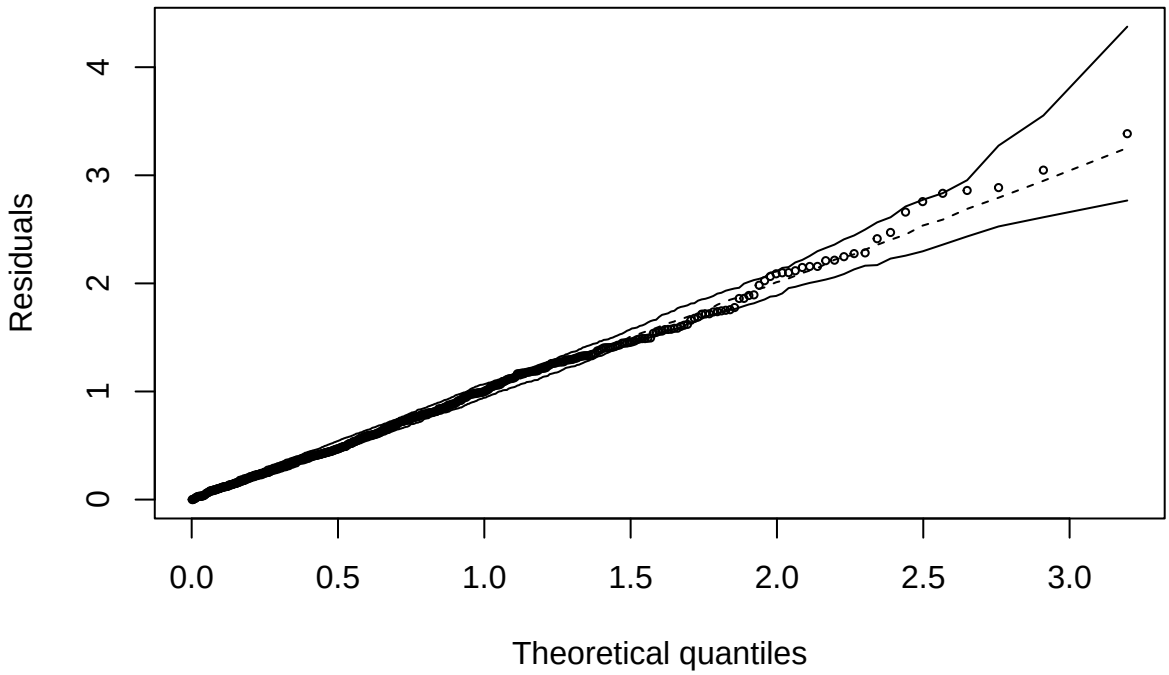



```
#Breusch_Pagan para homocedasticdade
bptest(modelo4) #p-value = 0.0008406, heterocedasticidade
```

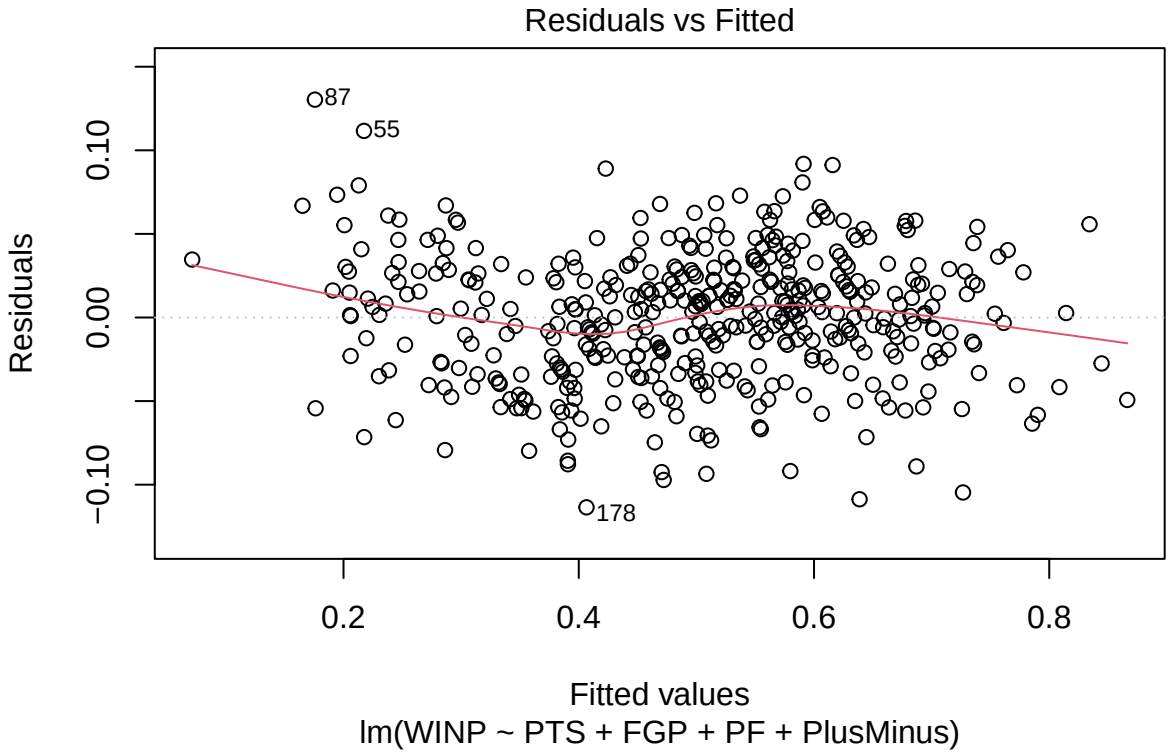
```
##
##  studentized Breusch-Pagan test
##
## data:  modelo4
## BP = 14.163, df = 2, p-value = 0.0008406
```

```
#QQ Plot
library(hnp)
hnp(modelo4)
```

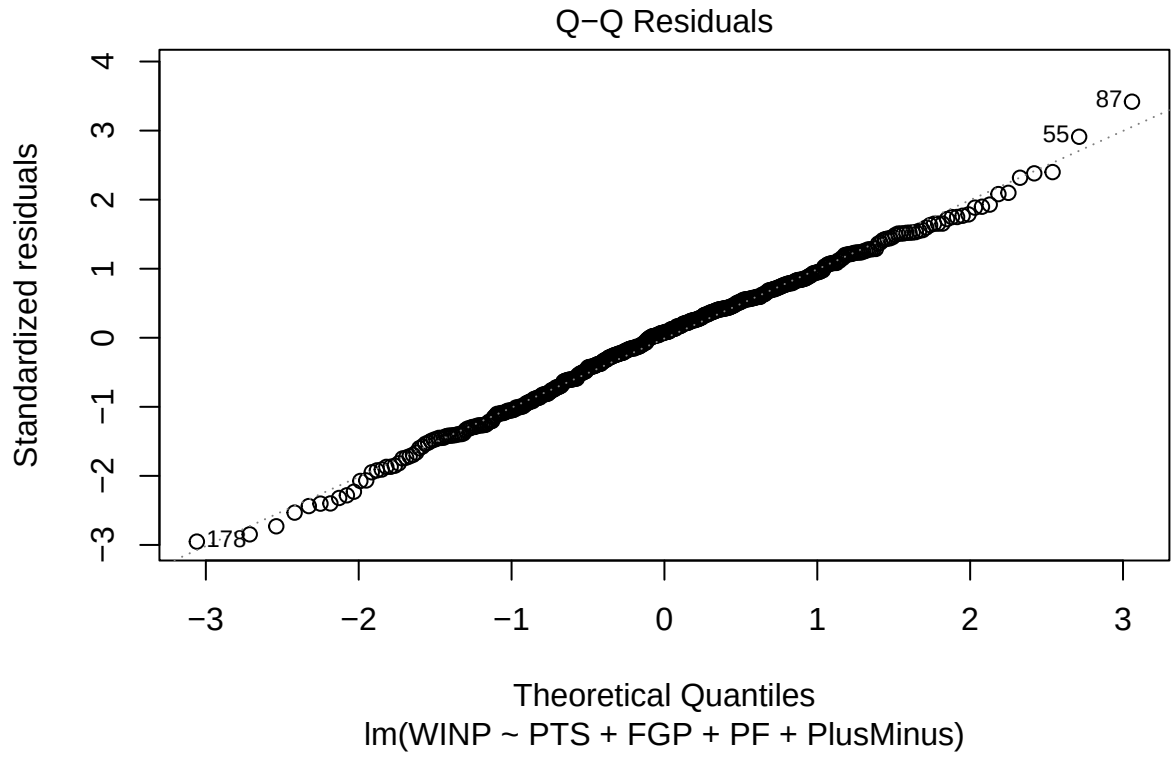
```
## Gaussian model (lm object)
```



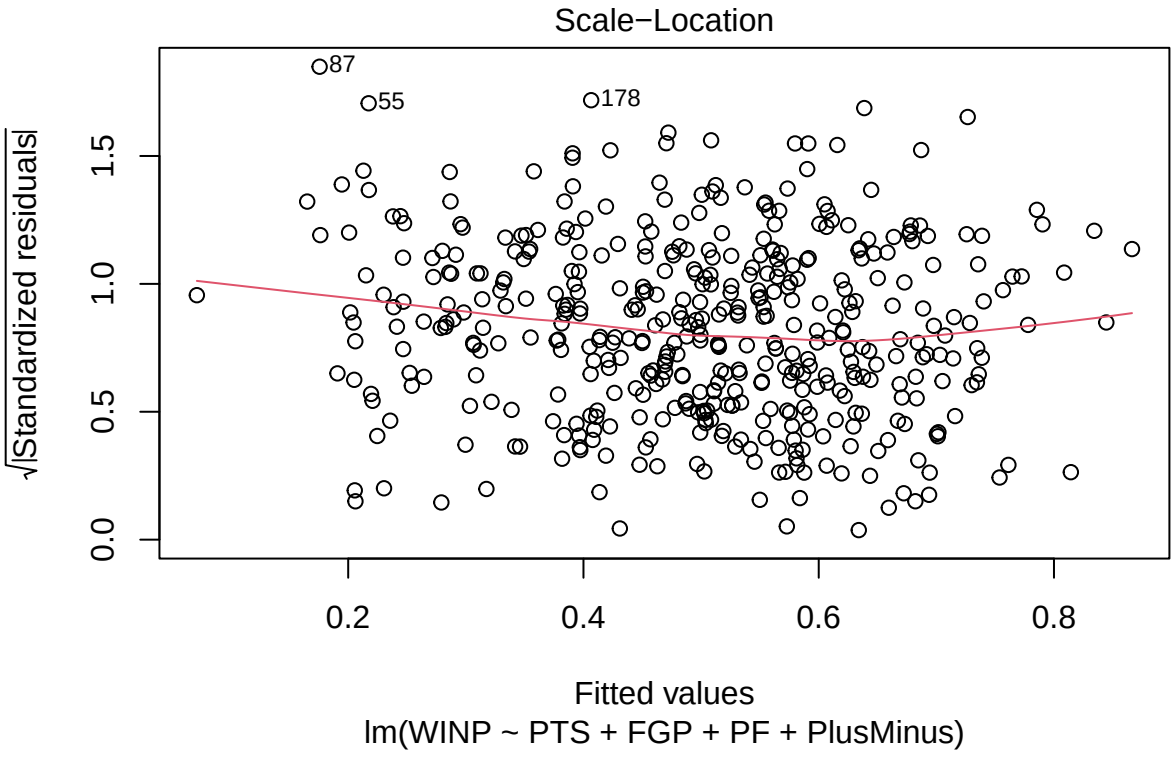

```
####### Backward ############
plot(modelo_back, which = 1)
```



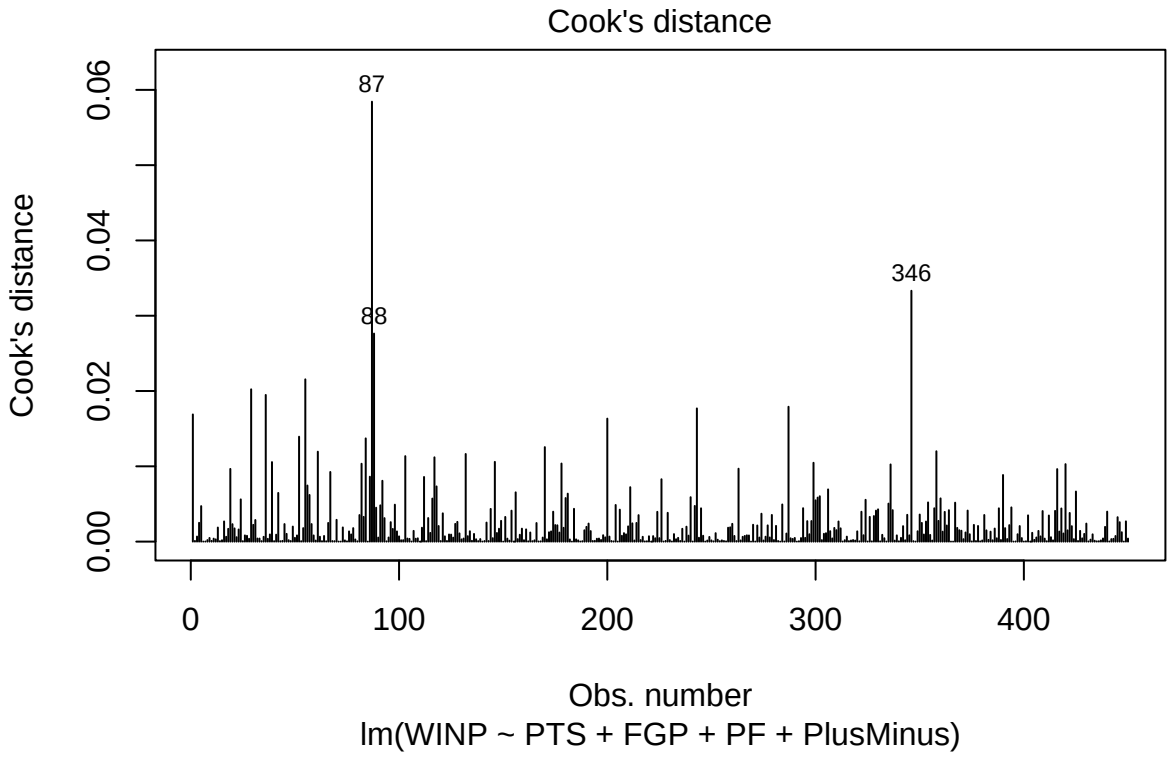

```
plot(modelo_back, which = 2)
```



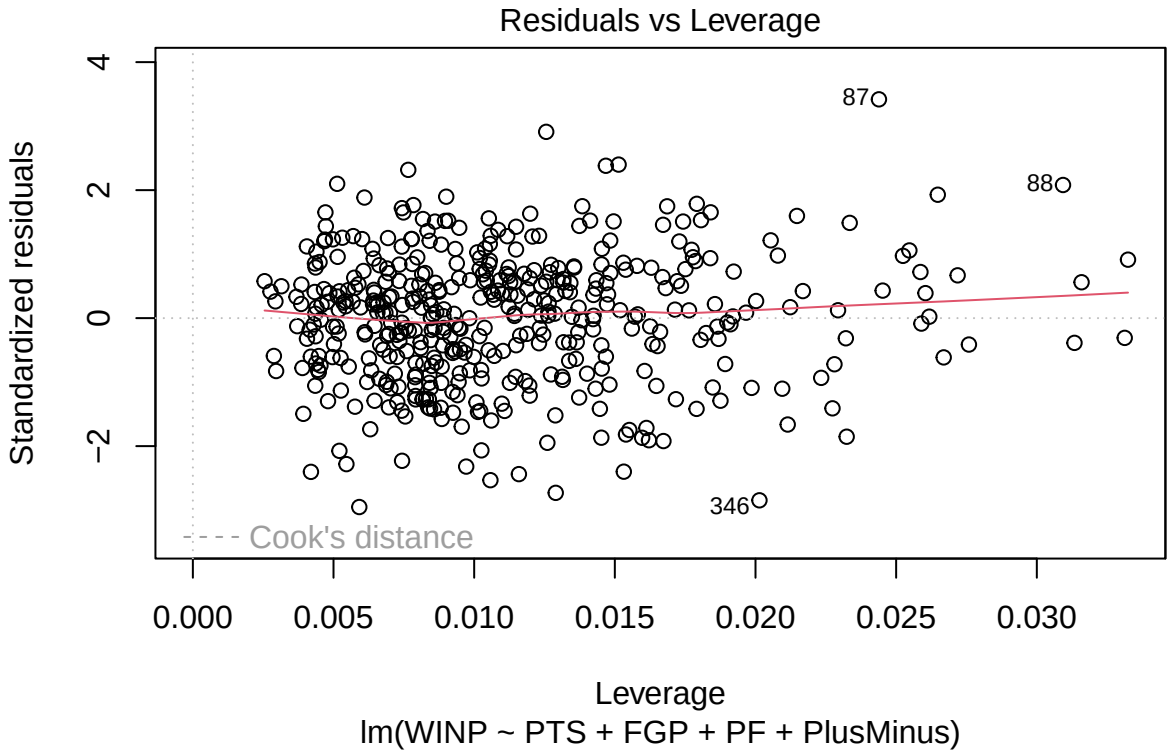

```
plot(modelo_back, which = 3)
```



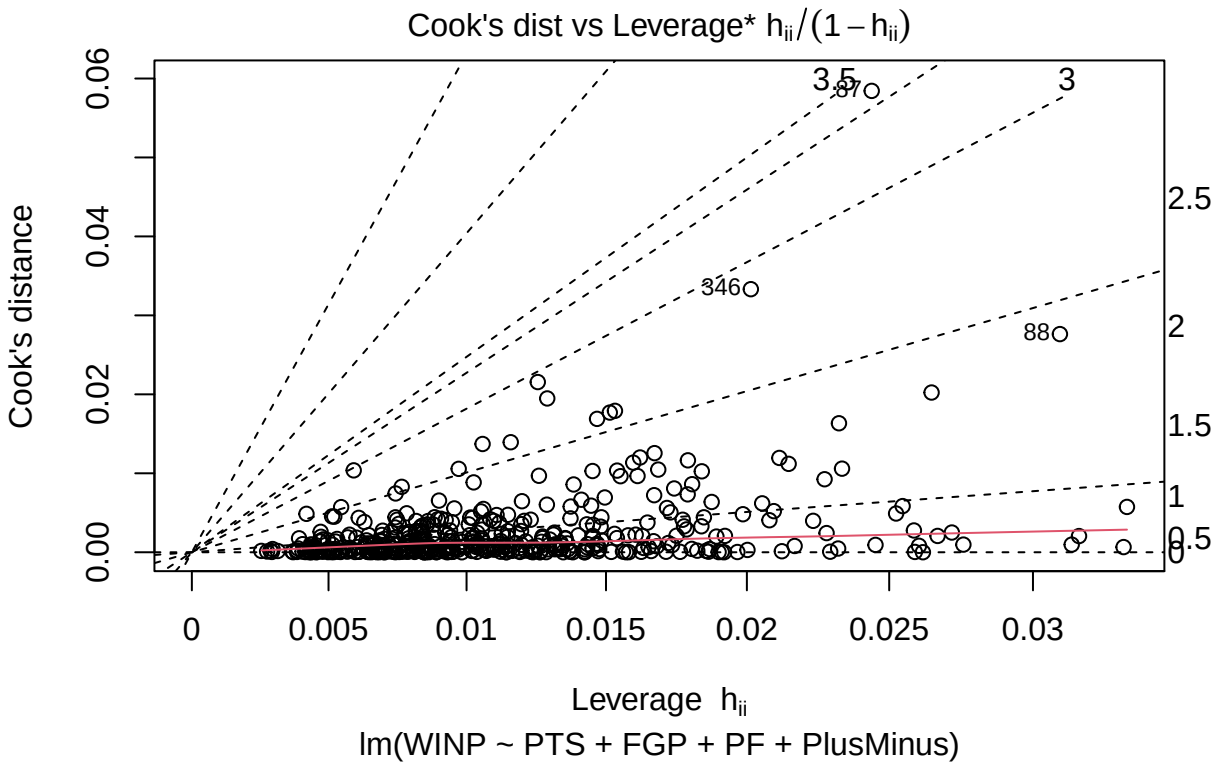

```
plot(modelo_back, which = 4)
```




```
plot(modelo_back, which = 5)
```




```
plot(modelo_back, which = 6)
```




```
shapiro.test(modelo_back$residuals) #p-value = 0.2669, normal
```

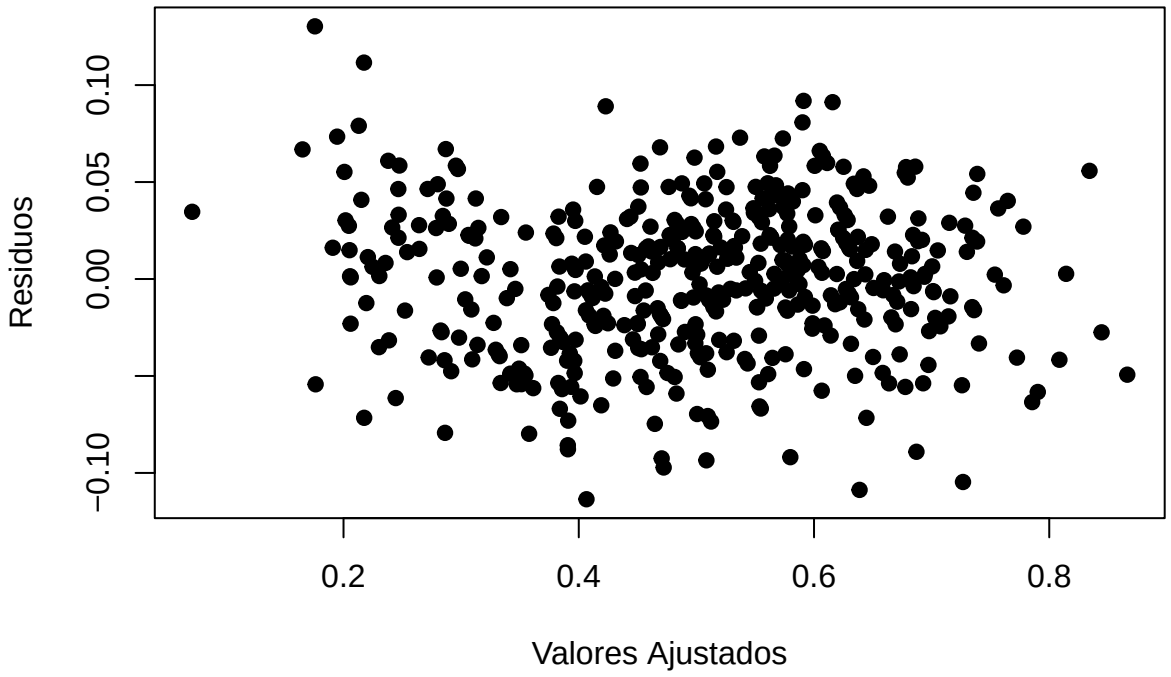
```
##
##  Shapiro-Wilk normality test
##
## data:  modelo_back$residuals
## W = 0.99576, p-value = 0.2669
```

```
#Teste de durbin watson para independencia
library(lmtest)
dwtest(modelo_back) #p-value = 0.1735
```

```
##
##  Durbin-Watson test
##
## data:  modelo_back
## DW = 1.9193, p-value = 0.1735
## alternative hypothesis: true autocorrelation is greater than 0
```

```
#Independência
plot(modelo_back$residuals,
     ylab = "Residuos",
     xlab = "Index dos Imovéis",
     main = "Suposição de independência",
     pch = 19)
```


```
#Homocedasticidade
plot(modelo_back$fitted.values, modelo_back$residuals,
     xlab = "Valores Ajustados",
     ylab = "Residuos",
     pch = 19,
     main = "Suposição de homocedasticidade"
)
```

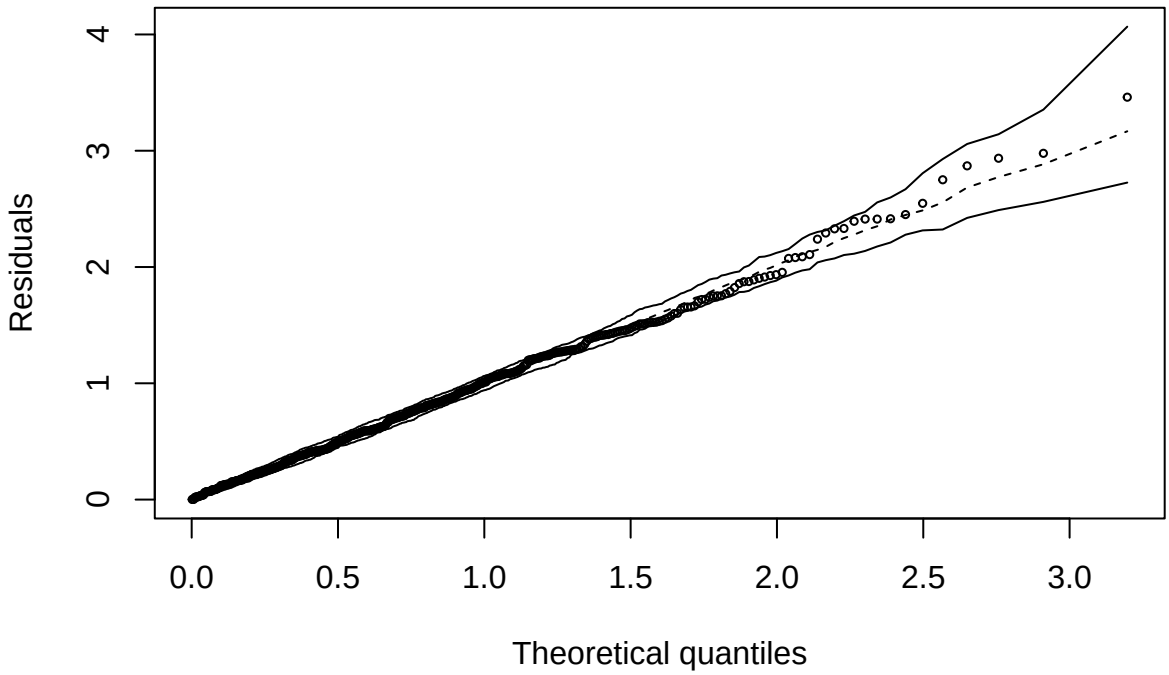



```
#Breusch_Pagan para homocedasticdade
bptest(modelo_back) #p-value = 0.0006407, heterocedasticidade
```

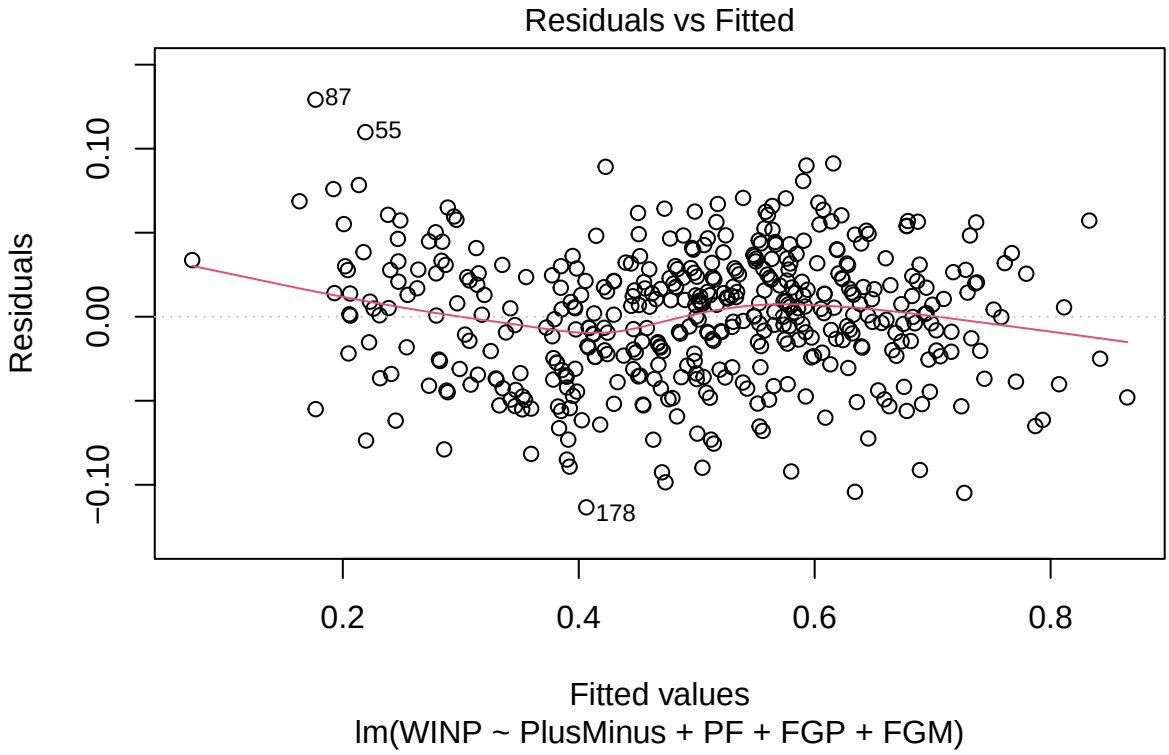
```
##
##  studentized Breusch-Pagan test
##
## data:  modelo_back
## BP = 19.451, df = 4, p-value = 0.0006407
```

```
#QQ Plot
library(hnp)
hnp(modelo_back)
```

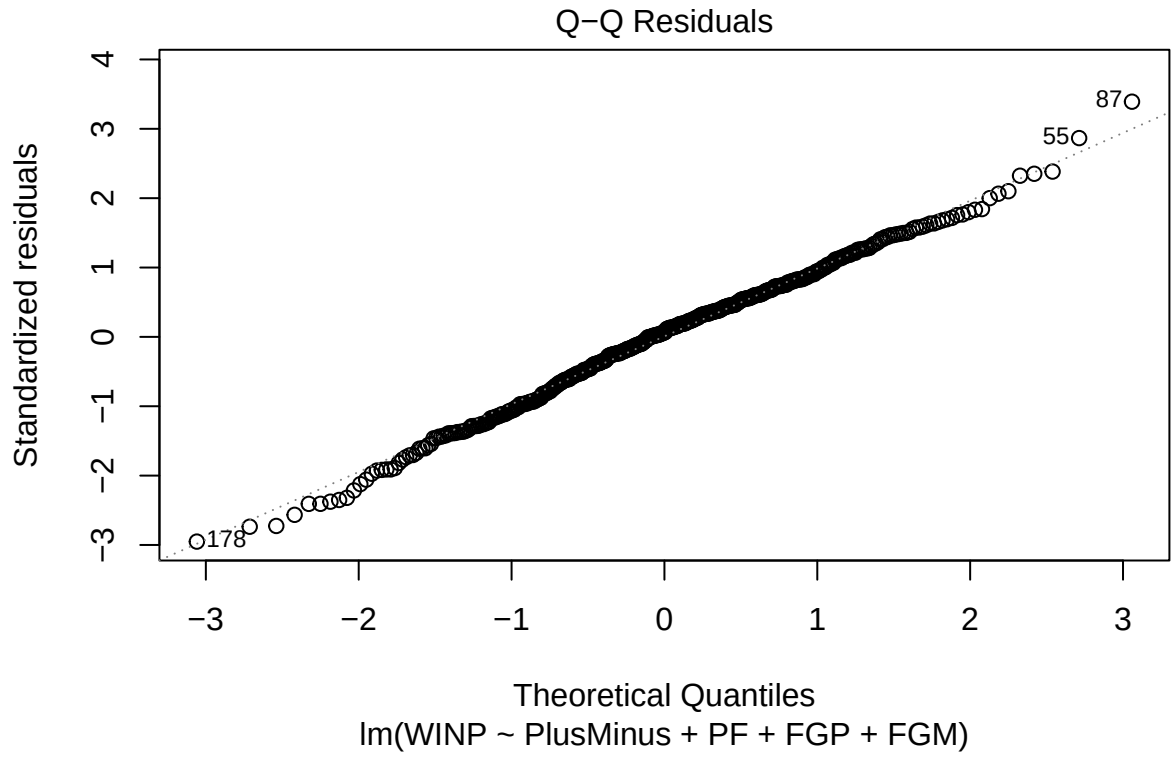
```
## Gaussian model (lm object)
```



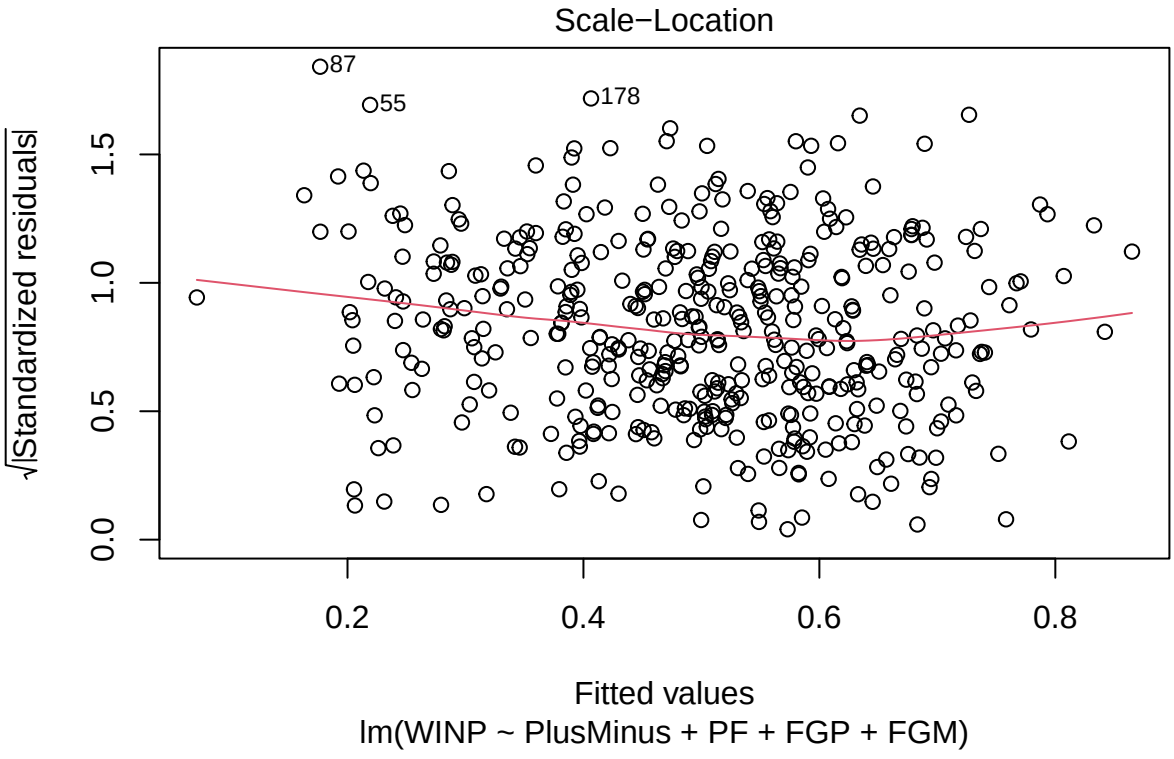

```
######## Forward ##########
plot(modelo_forw, which = 1)
```



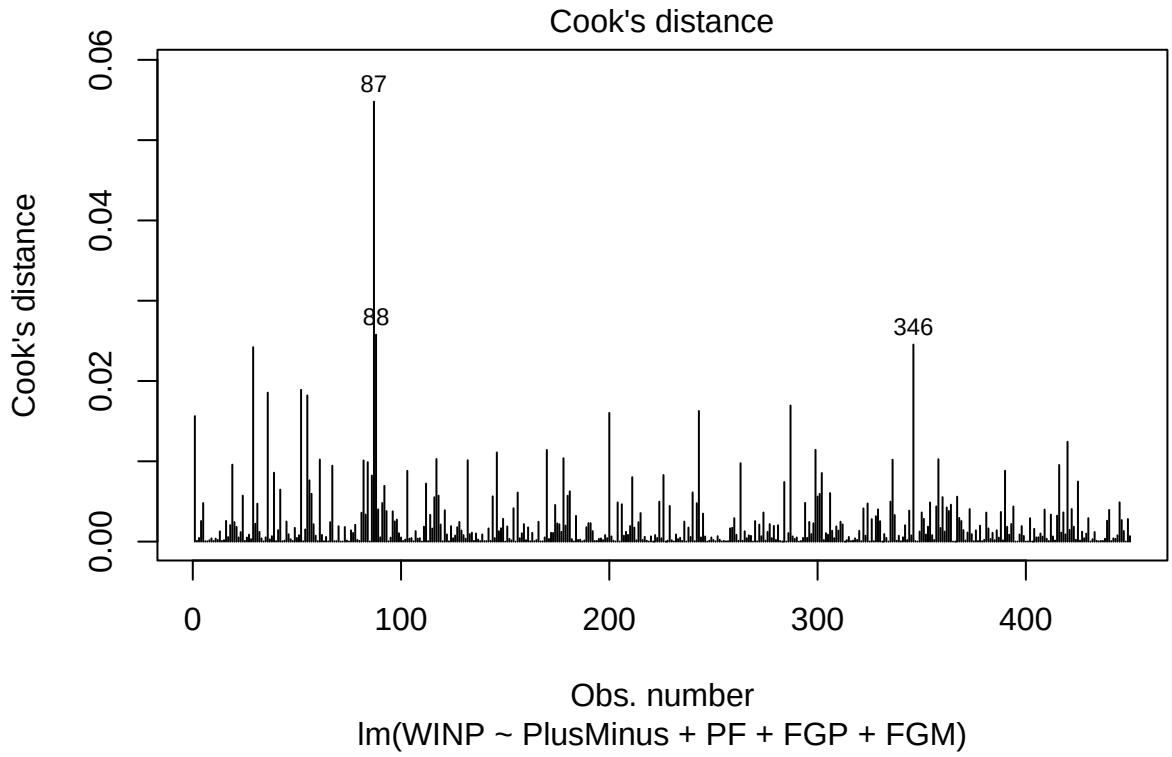

```
plot(modelo_forw, which = 2) #QQ-plot
```



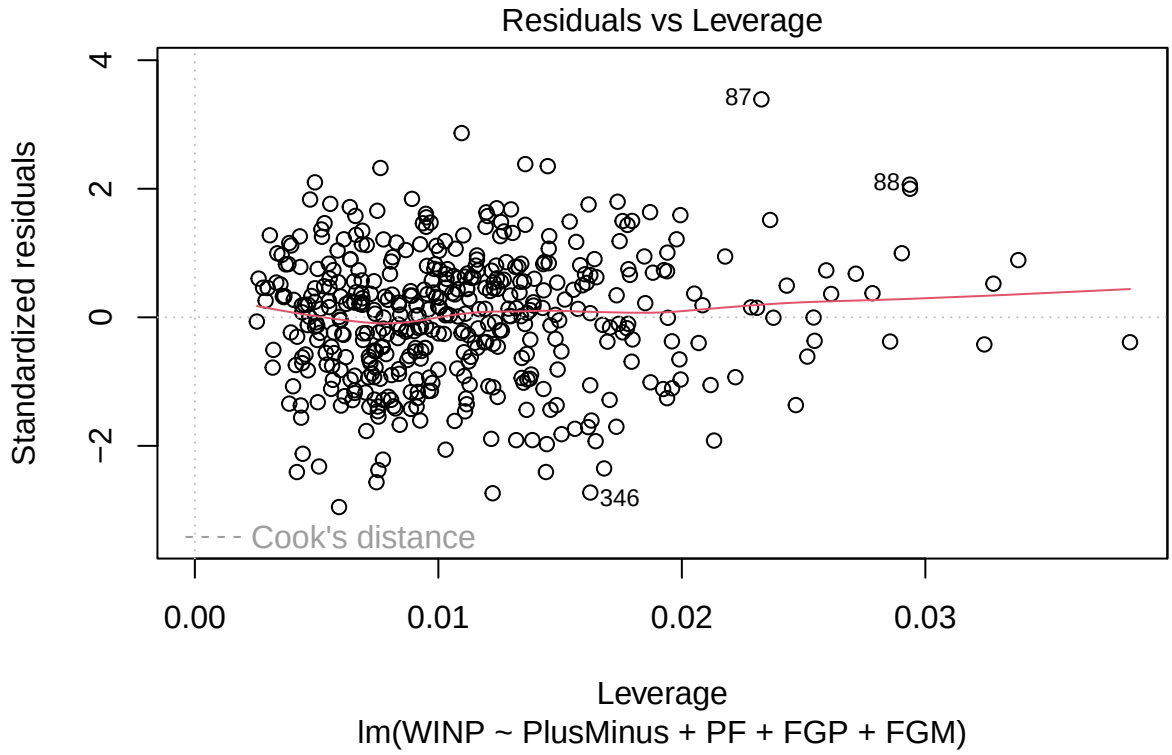

```
plot(modelo_forw, which = 3)
```



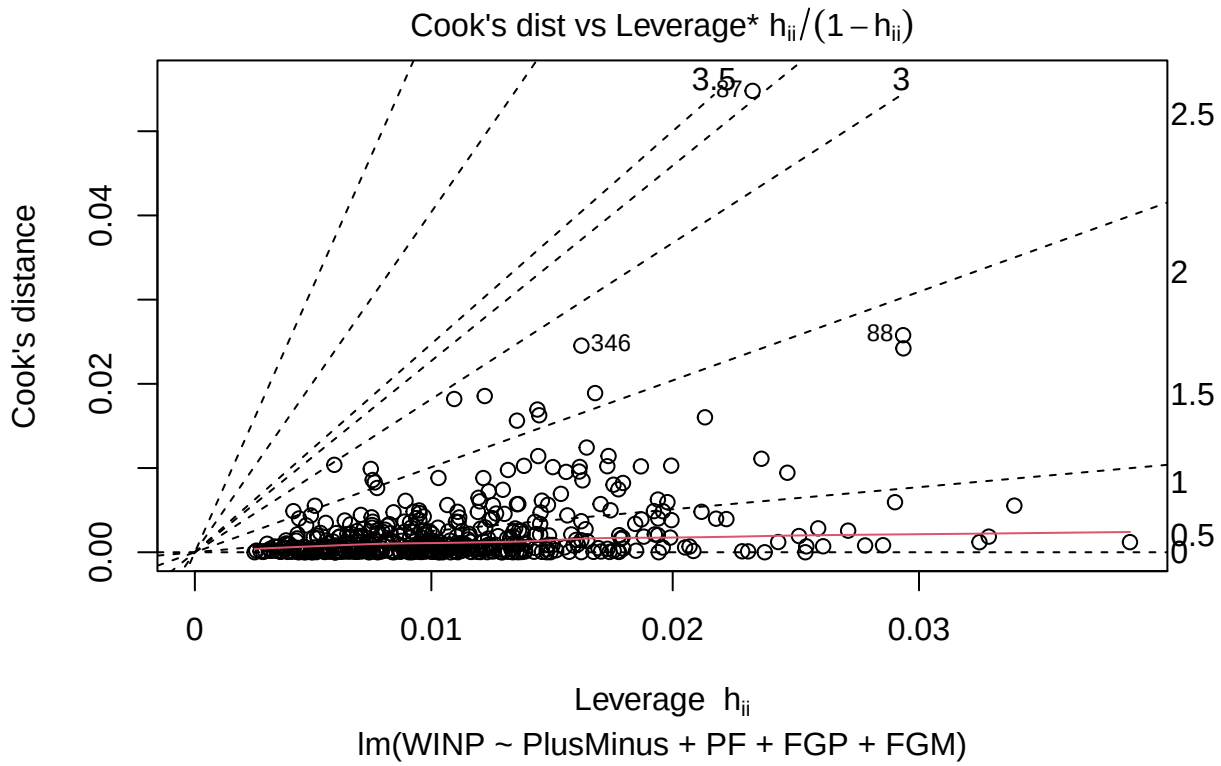

```
plot(modelo_forw, which = 4)
```




```
plot(modelo_forw, which = 5)
```




```
plot(modelo_forw, which = 6)
```




```
shapiro.test(modelo_forw$residuals) #p-value = 0.2296, não normal
```

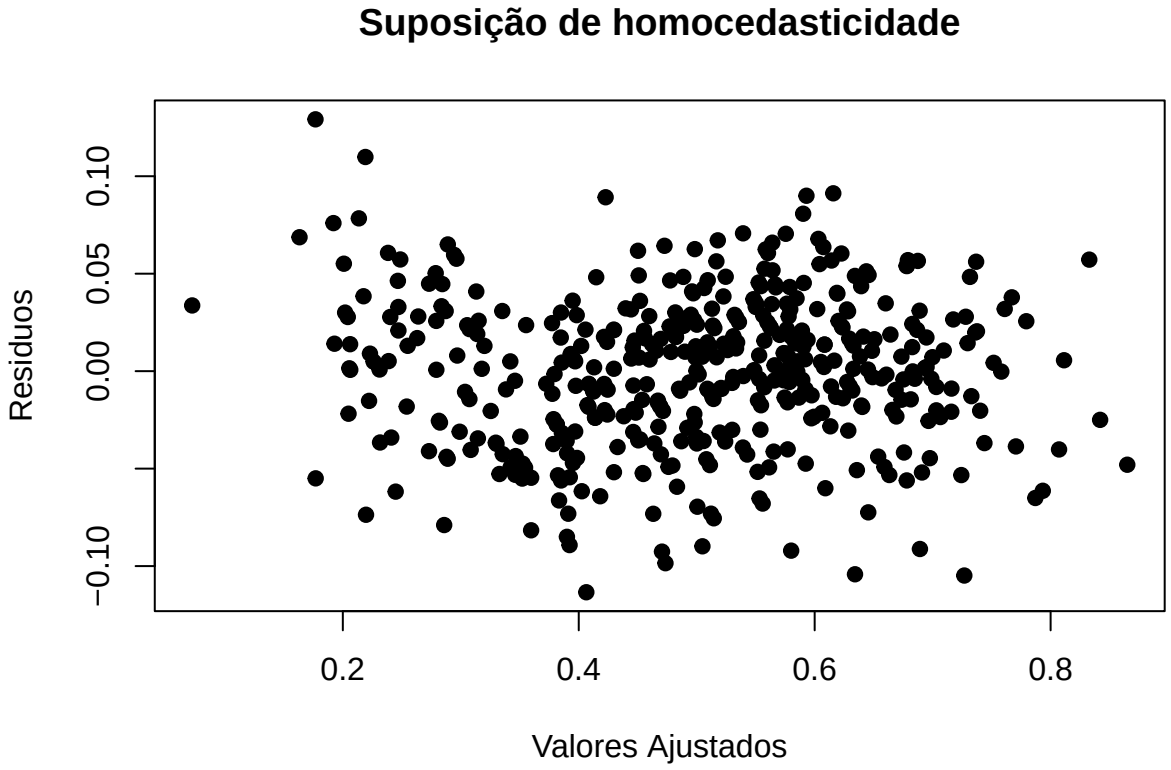
```
##
##  Shapiro-Wilk normality test
##
## data:  modelo_forw$residuals
## W = 0.99555, p-value = 0.2296
```

```
#Teste de durbin watson para independencia
library(lmtest)
dwtest(modelo_forw) #p-value = 0.195
```

```
##
##  Durbin-Watson test
##
## data:  modelo_forw
## DW = 1.9266, p-value = 0.195
## alternative hypothesis: true autocorrelation is greater than 0
```

```
#Independência
plot(modelo_forw$residuals,
     ylab = "Residuos",
     xlab = "Index dos Imovéis",
     main = "Suposição de independência",
     pch = 19)
```


```r
#Homocedasticidade
plot(modelo_forw$fitted.values, modelo_forw$residuals,
     xlab = "Valores Ajustados",
     ylab = "Residuos",
     pch = 19,
     main = "Suposição de homocedasticidade"
)
```

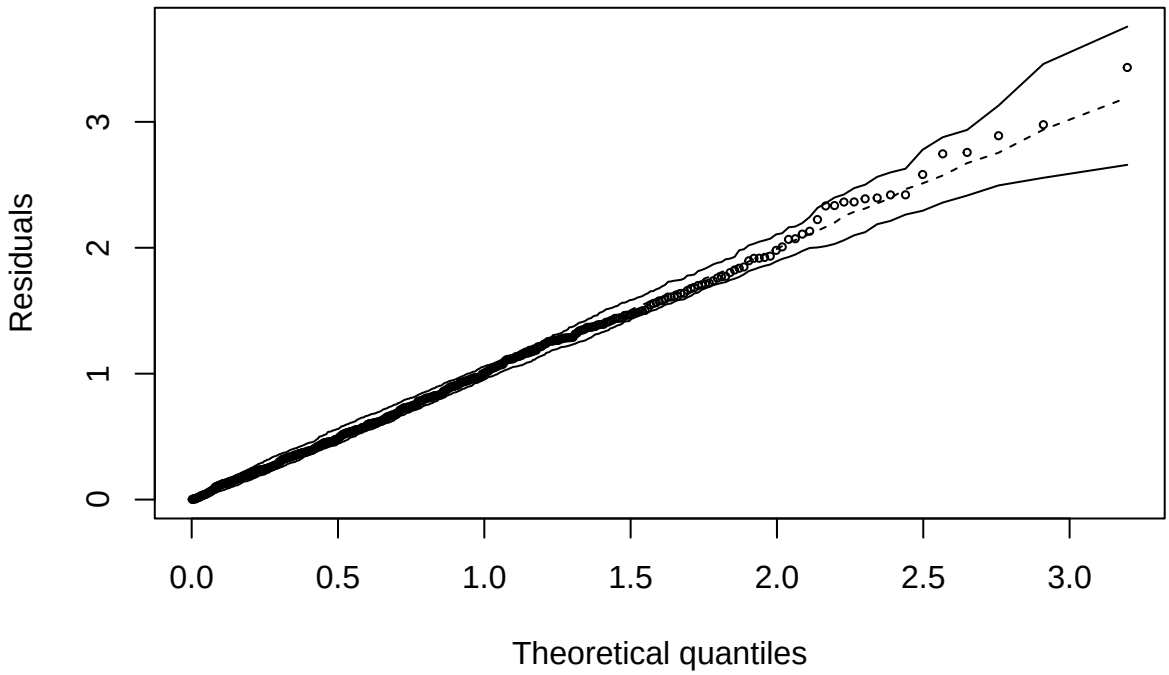



```
#Breusch_Pagan para homocedasticdade
bptest(modelo_forw) #p-value = 0.001575, heterocedasticidade
```

```
##
##  studentized Breusch-Pagan test
##
## data:  modelo_forw
## BP = 17.457, df = 4, p-value = 0.001575
```

```
library(hnp)
hnp(modelo_forw)
```

```
## Gaussian model (lm object)
```




```
################### Análise de Anova ###############
modelo1 #Completo
```

```
##
## Call:
## lm(formula = WINP ~ ., data = dados_regressao)
##
## Coefficients:
##                (Intercept)          TEAMBoston Celtics
##                  0.3849344                  -0.0120250
##          TEAMBrooklyn Nets       TEAMCharlotte Bobcats
##                  0.0039617                   0.0133796
##      TEAMCharlotte Hornets           TEAMChicago Bulls
##                 -0.0145005                   0.0084856
##    TEAMCleveland Cavaliers        TEAMDallas Mavericks
##                  0.0039967                  -0.0185095
##         TEAMDenver Nuggets         TEAMDetroit Pistons
##                  0.0024464                  -0.0340194
##  TEAMGolden State Warriors         TEAMHouston Rockets
##                 -0.0212880                   0.0120925
##         TEAMIndiana Pacers             TEAMLA Clippers
##                 -0.0059713                  -0.0083375
##   TEAMLos Angeles Clippers      TEAMLos Angeles Lakers
##                 -0.0188479                   0.0052288
##      TEAMMemphis Grizzlies              TEAMMiami Heat
##                  0.0102977                  -0.0047578
##        TEAMMilwaukee Bucks  TEAMMinnesota Timberwolves
##                 -0.0192852                  -0.0476085
##        TEAMNew Jersey Nets     TEAMNew Orleans Hornets
##                 -0.0340128                  -0.0243073
##   TEAMNew Orleans Pelicans         TEAMNew York Knicks
##                 -0.0384255                  -0.0247466
```

```
##  TEAMOklahoma City Thunder           TEAMOrlando Magic
##                  0.0034222                  -0.0196853
##     TEAMPhiladelphia 76ers            TEAMPhoenix Suns
##                 -0.0165407                  -0.0043497
## TEAMPortland Trail Blazers        TEAMSacramento Kings
##                  0.0109588                  -0.0181920
##      TEAMSan Antonio Spurs         TEAMToronto Raptors
##                 -0.0117354                  -0.0127437
##              TEAMUtah Jazz      TEAMWashington Wizards
##                 -0.0294224                  -0.0194735
##                        PTS                         FGM
##                 -0.0201604                   0.0275384
##                        FGA                         FGP
##                  0.0001698                   0.0172859
##                      `3PM`                       `3PA`
##                  0.0127936                   0.0031094
##                      `3PP`                         FTM
##                  0.0044865                   0.0577332
##                        FTA                         FTP
##                 -0.0316353                  -0.0086342
##                       OREB                        DREB
##                  0.0629313                   0.0631626
##                        REB                         AST
##                 -0.0552165                   0.0017278
##                        TOV                         STL
##                 -0.0097114                   0.0112387
##                        BLK                        BLKA
##                 -0.0008269                  -0.0052525
##                         PF                         PFD
##                 -0.0019238                   0.0055098
##                  PlusMinus           Numero_temporada2
##                  0.0258603                   0.0076547
##          Numero_temporada3           Numero_temporada4
##                  0.0057990                   0.0121886
##          Numero_temporada5           Numero_temporada6
##                  0.0003925                   0.0004200
##          Numero_temporada7           Numero_temporada8
##                  0.0048858                   0.0006137
##          Numero_temporada9          Numero_temporada10
##                 -0.0010696                  -0.0030638
##         Numero_temporada11          Numero_temporada12
##                 -0.0004315                   0.0003404
##         Numero_temporada13          Numero_temporada14
##                 -0.0050765                  -0.0067826
##         Numero_temporada15
##                  0.0017315
```

```
modelo2 #Plus_Minus
```

```
##
## Call:
## lm(formula = WINP ~ PlusMinus, data = dados_regressao)
##
## Coefficients:
## (Intercept)    PlusMinus
```

```
##     0.49995      0.03128
```

```
modelo3 #PlusMinus, STL, PF
```

```
##
## Call:
## lm(formula = WINP ~ PlusMinus + STL + PF, data = dados_regressao)
##
## Coefficients:
## (Intercept)    PlusMinus          STL           PF
##    0.564593     0.031077     0.000554    -0.003402
```

```
modelo4 #PlusMinus, PF
```

```
##
## Call:
## lm(formula = WINP ~ PlusMinus + PF, data = dados_regressao)
##
## Coefficients:
## (Intercept)    PlusMinus           PF
##    0.567207     0.031098    -0.003324
```

```
modelo_back #PTS + FGP + PF + PlusMinus
```

```
##
## Call:
## lm(formula = WINP ~ PTS + FGP + PF + PlusMinus, data = dados_regressao)
##
## Coefficients:
## (Intercept)          PTS          FGP           PF    PlusMinus
##   0.4105976   -0.0006542    0.0048736   -0.0032414    0.0304204
```

```
modelo_forw #PlusMinus + PF + FGP + FGM
```

```
##
## Call:
## lm(formula = WINP ~ PlusMinus + PF + FGP + FGM, data = dados_regressao)
##
## Coefficients:
## (Intercept)    PlusMinus           PF          FGP          FGM
##    0.401565     0.030261    -0.003478     0.005746    -0.002433
```

```
anova(modelo2, modelo4) #0.01223
```

```
## Analysis of Variance Table
##
## Model 1: WINP ~ PlusMinus
## Model 2: WINP ~ PlusMinus + PF
##   Res.Df     RSS Df Sum of Sq      F  Pr(>F)
## 1    448 0.68497
## 2    447 0.67540  1 0.0095626 6.3288 0.01223 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#Isto significa que adicionar PF ao modelo levou a um ajuste significativamente
#melhor em relação ao modelo 2.

anova(modelo4, modelo3) #0.8102
```

```
## Analysis of Variance Table
##
## Model 1: WINP ~ PlusMinus + PF
## Model 2: WINP ~ PlusMinus + STL + PF
##   Res.Df     RSS Df  Sum of Sq      F Pr(>F)
## 1    447 0.67540
## 2    446 0.67532  1 8.7436e-05 0.0577 0.8102
```

```
#Isto significa que adicionar STL ao modelo levou a um ajuste significativamente
#pior em relação ao modelo 3.


#PF + PlusMinus #Modelo4

modelo41 <- lm(WINP ~ FGP +  PF + PlusMinus, data = dados_regressao)
anova(modelo4, modelo41) # 0.03421
```

```
## Analysis of Variance Table
##
## Model 1: WINP ~ PlusMinus + PF
## Model 2: WINP ~ FGP + PF + PlusMinus
##   Res.Df     RSS Df Sum of Sq     F  Pr(>F)
## 1    447 0.67540
## 2    446 0.66864  1 0.0067643 4.512 0.03421 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#Colocar o FGP melhorou  o modelo

anova(modelo41, modelo_back)
```

```
## Analysis of Variance Table
##
## Model 1: WINP ~ FGP + PF + PlusMinus
## Model 2: WINP ~ PTS + FGP + PF + PlusMinus
##   Res.Df     RSS Df Sum of Sq     F  Pr(>F)
## 1    446 0.66864
## 2    445 0.66256  1 0.0060733 4.079 0.04402 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# Colocar PTS melhorou o modelo FGP +  PF + PlusMinus

anova(modelo41, modelo_forw)
```

```
## Analysis of Variance Table
##
## Model 1: WINP ~ FGP + PF + PlusMinus
## Model 2: WINP ~ PlusMinus + PF + FGP + FGM
##   Res.Df     RSS Df Sum of Sq      F  Pr(>F)
## 1    446 0.66864
## 2    445 0.66097  1 0.0076714 5.1648 0.02353 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# Colocar FGM no modelo FGP +  PF + PlusMinus melhorou
```

```r
modelo51 <- lm(WINP ~ FGM + PTS + FGP +  PF + PlusMinus, data = dados_regressao)
anova(modelo_back, modelo51)#0.2998
```

```
## Analysis of Variance Table
##
## Model 1: WINP ~ PTS + FGP + PF + PlusMinus
## Model 2: WINP ~ FGM + PTS + FGP + PF + PlusMinus
##   Res.Df     RSS Df Sum of Sq      F Pr(>F)
## 1    445 0.66256
## 2    444 0.66096  1 0.0016039 1.0774 0.2998
```

```r
#Adicionar FGM ao modelo back piorou o modelo

anova(modelo_forw, modelo51)#0.9504
```

```
## Analysis of Variance Table
##
## Model 1: WINP ~ PlusMinus + PF + FGP + FGM
## Model 2: WINP ~ FGM + PTS + FGP + PF + PlusMinus
##   Res.Df     RSS Df  Sum of Sq      F Pr(>F)
## 1    445 0.66097
## 2    444 0.66096  1 5.7703e-06 0.0039 0.9504
```

```r
#Adicionar PTS ao modelo back piorou o modelo

############## Conclusão #############
#Dos modelos testados modelo_forw e modelo_back foram os melhores encontrados,
#precisando fazer uma análise mais aprofundada.
```