```r
library(car)
```

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

```r
library(reshape2)
library(ggplot2)
library(MASS)
library(interactions)

source("clean_data.R")


df <- remove_cols(df, c("Color", "Model"))

# Remove columns with only one observation and affected rows
res <- convert_categorical(df, categorical)
design <- as.data.frame(res$dummy)

singles <- c()
bad_idx <- c()
for (col in colnames(design)) {
  if (sum(design[, col] != 0) <= 1) {
    singles <- c(singles, col)
    bad_idx <- c(bad_idx, which(design[, col] != 0))
  }
}
singles
```

```
##  [1] "MakeFiat"              "MakeLexus"             "Fuel.TypePetrol + CNG"
##  [4] "LocationDak. Kannada"  "LocationFaizabad"      "LocationGorakhpur"
##  [7] "LocationPurnea"        "LocationRohtak"        "LocationRudrapur"
## [10] "LocationSamastipur"    "LocationValsad"
```

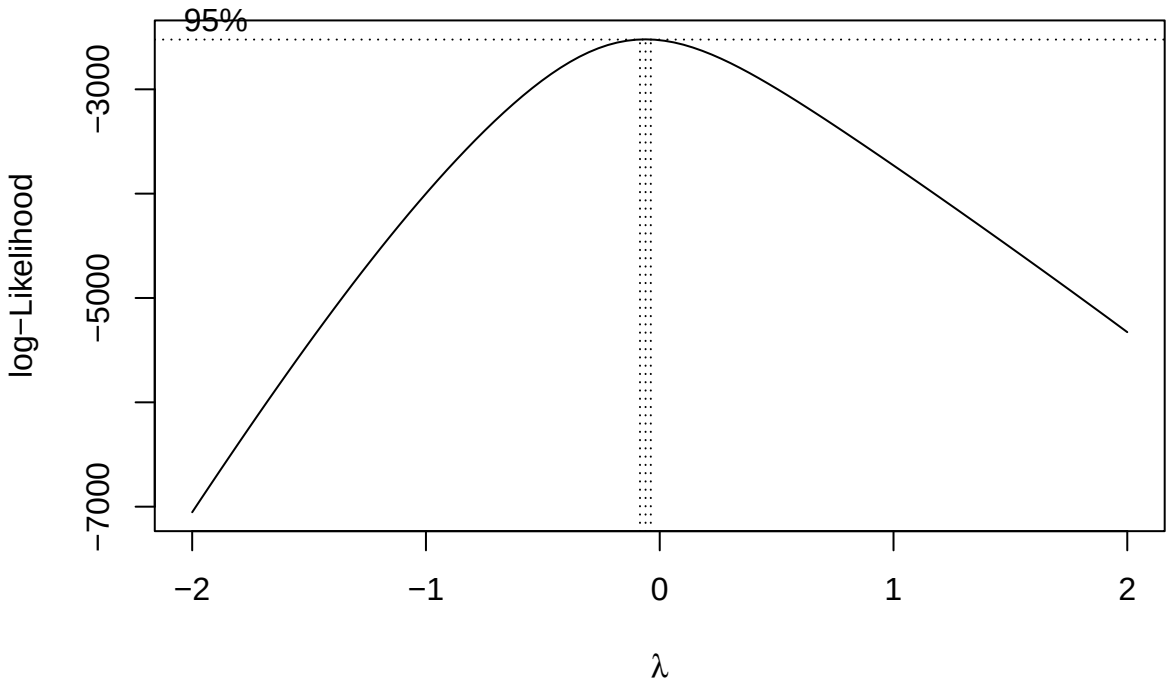
```r
bad_idx
```

```
##  [1]  662 1009 1169 1077  779  569  728  245  510  264  162
```

```r
df <- df[-bad_idx, ]
```

Box cox

```r
bc <- boxcox(Price ~., data = df)
```




```
bc$x[which.max(bc$y)]
```

```
## [1] -0.06060606
```

For the sake of interpretability, we will use a log transformation, since $\lambda \approx 0$.

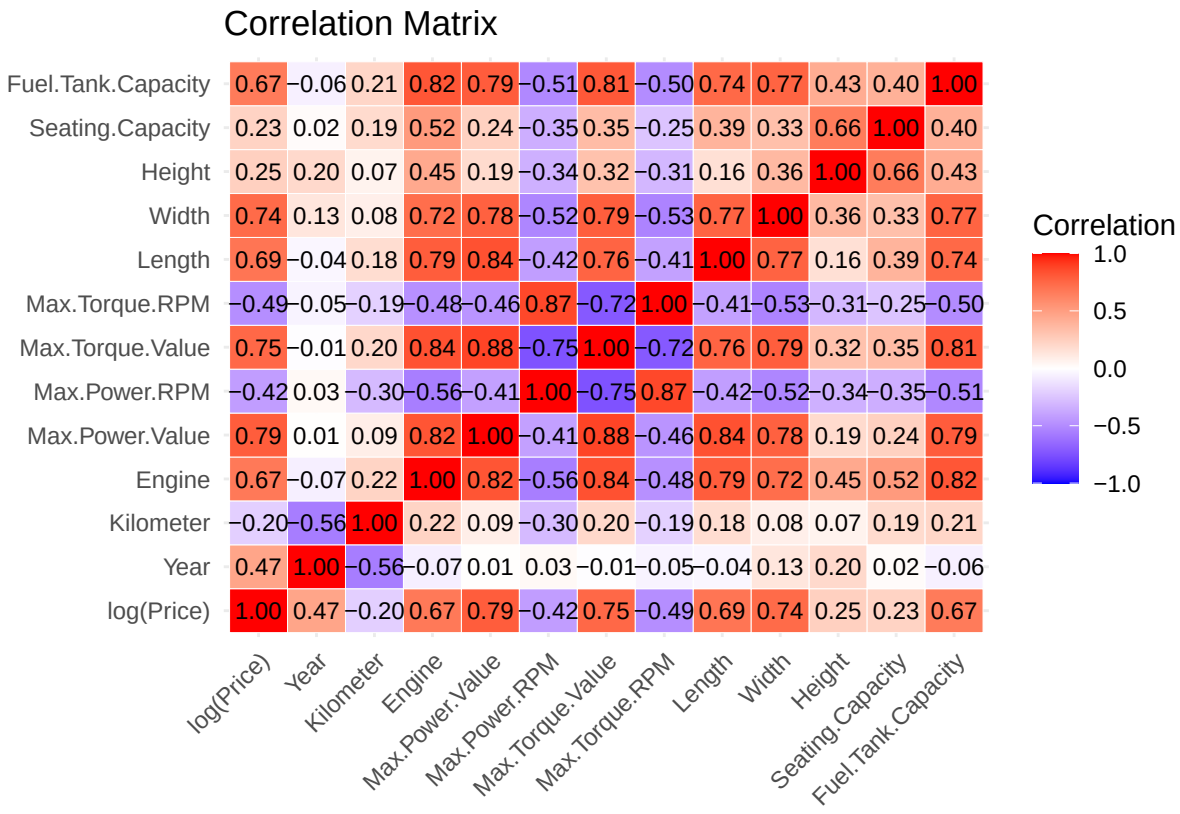
```
x <- df
x$Price <- log(df$Price)
names(x)[names(x) == "Price"] <- "log(Price)"

colnames(x)
```

```
##  [1] "Make"               "log(Price)"         "Year"
##  [4] "Kilometer"          "Fuel.Type"          "Transmission"
##  [7] "Location"           "Owner"              "Seller.Type"
## [10] "Engine"             "Max.Power.Value"    "Max.Power.RPM"
## [13] "Max.Torque.Value"   "Max.Torque.RPM"     "Drivetrain"
## [16] "Length"             "Width"              "Height"
## [19] "Seating.Capacity"   "Fuel.Tank.Capacity"
```

Inspect correlation

```
cor_matrix <- cor(x[, sapply(x, is.numeric)])
cor_melted <- melt(cor_matrix)
ggplot(data = cor_melted, aes(x = Var1, y = Var2, fill = value)) +
    geom_tile(color = "white") +
    scale_fill_gradient2(low = "blue", high = "red", mid = "white",
                         midpoint = 0, limit = c(-1, 1), space = "Lab",
                         name="Correlation") +
    theme_minimal() +
    theme(axis.text.x = element_text(angle = 45, vjust = 1, hjust = 1)) +
    labs(x = "", y = "", title = "Correlation Matrix") +
    geom_text(aes(label = sprintf("%.2f", value)), size = 3)
```



Trim Regressors Based on Intuition

Engine has high correlation with other regressors, and is highly related to more relevant statistics like torque and horsepower, so it is dropped.

We need really only one dimension of the car. Height and length are not as correlated to price as width, and width gives more information about engine capacity,

All the torque and horsepower regressors are highly related. A typical car driver will prioritize maximum horsepower over the others, so only Max.Power.Value was kept.

Fuel tank capacity information seems to be included in many other stats due its high correlation with many other regressors, so it was dropped.

We do not think that color will be a useful predictor. Additionally, there are too many car models, so color and model are removed.

```
x_trim <- remove_cols(x, c("Engine", "Length", "Max.Torque.RPM", "Max.Torque.Value", "Max.Power.RPM", "
colnames(x_trim)
```

```
##  [1] "Make"             "log(Price)"       "Year"             "Kilometer"
##  [5] "Fuel.Type"        "Transmission"     "Location"         "Owner"
##  [9] "Seller.Type"      "Max.Power.Value"  "Drivetrain"       "Width"
## [13] "Seating.Capacity"
```

Inspect Multicollinearity and Leverage

```
final <- lm(`log(Price)` ~., data = x_trim)
vif(final, type = "predictor")
```

```
## GVIFs computed for predictors
```

```
##                      GVIF Df GVIF^(1/(2*Df)) Interacts With
## Make             61.500005 25        1.085869           --
## Year              2.011353  1        1.418222           --
## Kilometer         2.084479  1        1.443772           --
## Fuel.Type         2.485084  2        1.255554           --
## Transmission      1.905348  1        1.380344           --
## Location         12.752030 63        1.020409           --
## Owner             1.617812  3        1.083481           --
## Seller.Type       1.332316  2        1.074365           --
## Max.Power.Value   6.060695  1        2.461848           --
## Drivetrain        4.168416  2        1.428870           --
## Width             4.220083  1        2.054284           --
## Seating.Capacity  2.283411  1        1.511096           --
##
## Make             Year, Kilometer, Fuel.Type, Transmission, Location, Owner, Seller.Type, Max.Power.Va
## Year             Make, Kilometer, Fuel.Type, Transmission, Location, Owner, Seller.Type, Max.Power.Va
## Kilometer             Make, Year, Fuel.Type, Transmission, Location, Owner, Seller.Type, Max.Power.Va
## Fuel.Type             Make, Year, Kilometer, Transmission, Location, Owner, Seller.Type, Max.Power.Va
## Transmission             Make, Year, Kilometer, Fuel.Type, Location, Owner, Seller.Type, Max.Power.Va
## Location             Make, Year, Kilometer, Fuel.Type, Transmission, Owner, Seller.Type, Max.Power.Va
## Owner             Make, Year, Kilometer, Fuel.Type, Transmission, Location, Seller.Type, Max.Power.Va
## Seller.Type             Make, Year, Kilometer, Fuel.Type, Transmission, Location, Owner, Max.Power.Va
## Max.Power.Value             Make, Year, Kilometer, Fuel.Type, Transmission, Location, Owner, Seller.T
## Drivetrain             Make, Year, Kilometer, Fuel.Type, Transmission, Location, Owner, Seller.Type,
## Width             Make, Year, Kilometer, Fuel.Type, Transmission, Location, Owner, Seller.Type, Max.P
## Seating.Capacity             Make, Year, Kilometer, Fuel.Type, Transmission, Location, Owner, Seller
```

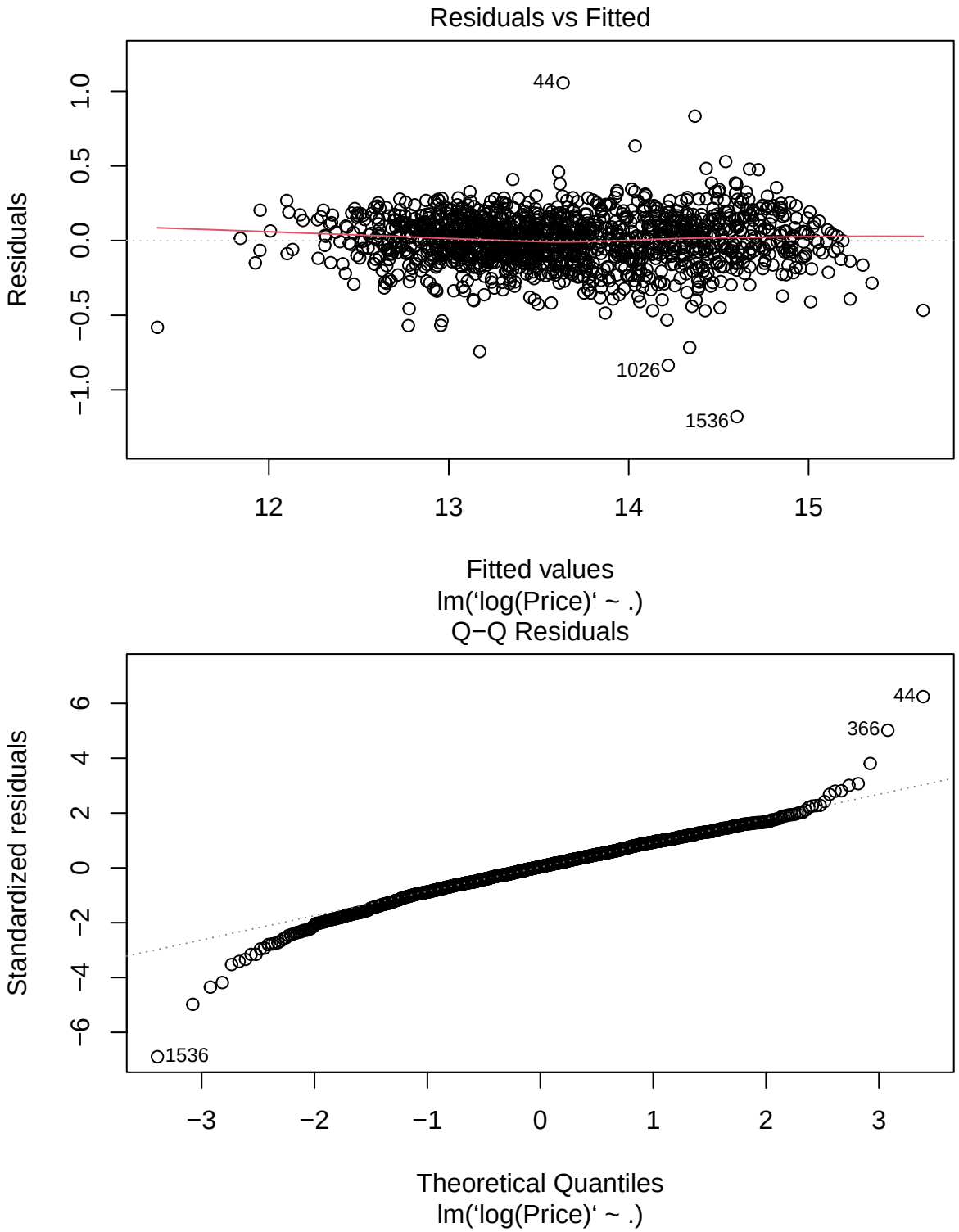
We get that GVIF^(1/(2*Df)) $> 2.236068 \approx \sqrt{5}$, for "Max.Power.Value," but this is known to be important, does not exceed the threshold by a lot, and no interactions are indicated, so we keep it.

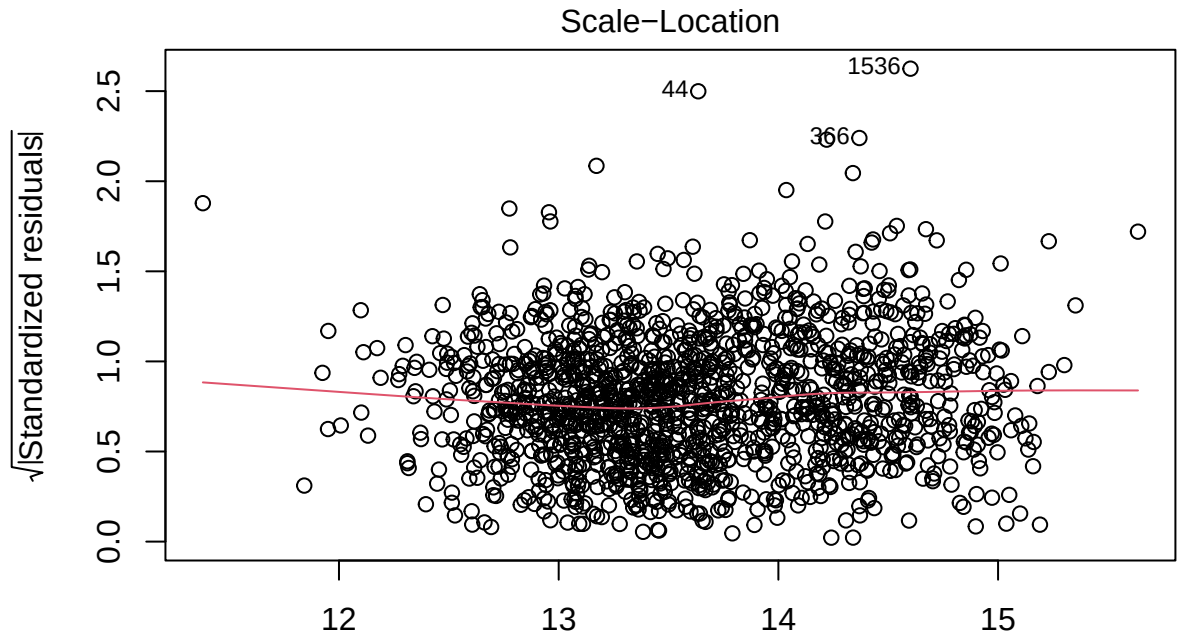
```
which(abs(rstudent(final)) > 4)
```

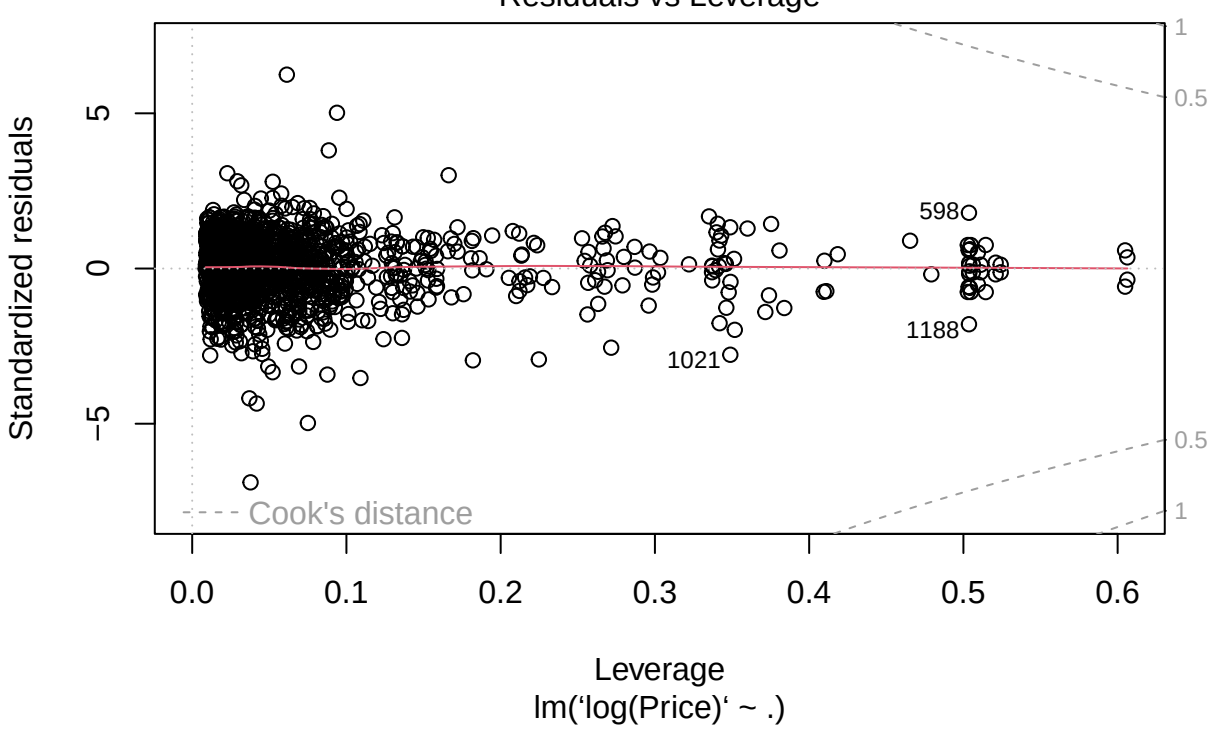
```
##   44  366 1003 1026 1536 1681
##   39  268  702  721 1071 1171
```

After inspecting these data points, we do not find a good reason to remove them (i.e., they are not clerical errors).

```
plot(final)
```


Residuals vs Fitted
Residuals
Fitted values
lm(‘log(Price)‘ ~ .)
44
1026
1536
Q−Q Residuals
Standardized residuals
Theoretical Quantiles
lm(‘log(Price)‘ ~ .)
44
366
1536





Inspect Model Coefficients

```
summary(final)
```

```
##
## Call:
```

```
## lm(formula = `log(Price)` ~ ., data = x_trim)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -1.1788 -0.0936  0.0070  0.1048  1.0556
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)           -2.066e+02  4.589e+00 -45.009  < 2e-16 ***
## MakeBMW               -6.801e-02  4.107e-02  -1.656 0.097979 .
## MakeChevrolet         -6.841e-01  9.217e-02  -7.421 2.05e-13 ***
## MakeDatsun            -8.521e-01  7.095e-02 -12.010  < 2e-16 ***
## MakeFord              -5.038e-01  3.910e-02 -12.885  < 2e-16 ***
## MakeHonda             -3.624e-01  3.028e-02 -11.970  < 2e-16 ***
## MakeHyundai           -3.914e-01  2.807e-02 -13.943  < 2e-16 ***
## MakeIsuzu             -3.528e-01  1.300e-01  -2.714 0.006728 **
## MakeJaguar            -6.465e-02  7.892e-02  -0.819 0.412789
## MakeJeep              -3.852e-01  5.098e-02  -7.555 7.75e-14 ***
## MakeKia               -3.155e-01  4.467e-02  -7.064 2.60e-12 ***
## MakeLand Rover         3.731e-02  1.044e-01   0.357 0.720792
## MakeMahindra          -5.573e-01  3.501e-02 -15.919  < 2e-16 ***
## MakeMaruti Suzuki     -3.826e-01  3.038e-02 -12.596  < 2e-16 ***
## MakeMercedes-Benz      1.584e-01  3.364e-02   4.709 2.74e-06 ***
## MakeMG                -4.226e-01  5.448e-02  -7.757 1.71e-14 ***
## MakeMINI               5.599e-01  7.595e-02   7.372 2.94e-13 ***
## MakeMitsubishi        -2.957e-01  1.146e-01  -2.579 0.010002 *
## MakeNissan            -4.724e-01  5.426e-02  -8.705  < 2e-16 ***
## MakeRenault           -6.060e-01  4.054e-02 -14.948  < 2e-16 ***
## MakeSkoda             -3.263e-01  3.719e-02  -8.775  < 2e-16 ***
## MakeSsangyong         -9.066e-01  1.154e-01  -7.853 8.26e-15 ***
## MakeTata              -6.491e-01  3.786e-02 -17.146  < 2e-16 ***
## MakeToyota            -1.331e-01  3.217e-02  -4.137 3.73e-05 ***
## MakeVolkswagen        -3.037e-01  3.862e-02  -7.863 7.66e-15 ***
## MakeVolvo             -5.644e-02  5.724e-02  -0.986 0.324243
## Year                   1.076e-01  2.287e-03  47.069  < 2e-16 ***
## Kilometer             -1.625e-06  2.420e-07  -6.713 2.82e-11 ***
## Fuel.TypeDiesel       -2.671e-02  3.629e-02  -0.736 0.461907
## Fuel.TypePetrol       -1.822e-01  3.467e-02  -5.255 1.73e-07 ***
## TransmissionManual    -1.149e-01  1.306e-02  -8.798  < 2e-16 ***
## LocationAhmedabad      8.765e-02  4.919e-02   1.782 0.075017 .
## LocationAllahabad      1.529e-02  1.098e-01   0.139 0.889254
## LocationAmbala Cantt  -1.034e-01  7.075e-02  -1.461 0.144246
## LocationAmritsar       6.766e-02  9.904e-02   0.683 0.494599
## LocationAurangabad     2.871e-01  1.099e-01   2.612 0.009099 **
## LocationBangalore      2.483e-01  4.652e-02   5.336 1.11e-07 ***
## LocationBhopal         1.209e-01  1.146e-01   1.055 0.291666
## LocationBhubaneswar    7.228e-02  1.145e-01   0.631 0.527825
## LocationBulandshahar  -2.226e-01  1.334e-01  -1.668 0.095464 .
## LocationChandigarh     8.443e-02  6.268e-02   1.347 0.178249
## LocationChennai        2.322e-01  5.168e-02   4.493 7.64e-06 ***
## LocationCoimbatore     3.059e-01  6.002e-02   5.096 3.96e-07 ***
## LocationDehradun       1.156e-01  5.914e-02   1.955 0.050791 .
## LocationDelhi          8.410e-02  4.458e-02   1.886 0.059470 .
## LocationDharwad        1.692e-01  1.310e-01   1.291 0.196825
```

```
## LocationErnakulam      2.420e-01  1.313e-01   1.843 0.065580 .
## LocationFaridabad      9.322e-04  5.718e-02   0.016 0.986996
## LocationGhaziabad      4.576e-02  1.318e-01   0.347 0.728573
## LocationGoa            2.901e-01  9.966e-02   2.911 0.003665 **
## LocationGurgaon        5.750e-02  5.693e-02   1.010 0.312628
## LocationGuwahati       1.489e-01  9.076e-02   1.641 0.101090
## LocationHaldwani      -8.909e-02  1.310e-01  -0.680 0.496575
## LocationHyderabad      1.938e-01  4.721e-02   4.104 4.31e-05 ***
## LocationIndore         2.509e-01  9.795e-02   2.561 0.010541 *
## LocationJaipur         1.521e-01  5.560e-02   2.735 0.006320 **
## LocationJalandhar      1.344e-01  5.866e-02   2.291 0.022101 *
## LocationJamshedpur     1.022e-01  9.068e-02   1.127 0.260073
## LocationKanpur         9.010e-03  5.247e-02   0.172 0.863696
## LocationKarnal         1.598e-01  7.555e-02   2.115 0.034623 *
## LocationKharar        -2.486e-02  1.310e-01  -0.190 0.849550
## LocationKheda         -6.737e-02  1.311e-01  -0.514 0.607476
## LocationKolkata       -5.834e-02  4.930e-02  -1.183 0.236829
## LocationKollam         1.808e-01  1.314e-01   1.376 0.169059
## LocationKota           1.494e-01  1.429e-01   1.045 0.296256
## LocationLucknow        6.768e-02  4.942e-02   1.370 0.171067
## LocationLudhiana       6.475e-02  5.219e-02   1.241 0.214963
## LocationMangalore     -1.987e-02  9.801e-02  -0.203 0.839364
## LocationMeerut         7.456e-02  7.565e-02   0.986 0.324483
## LocationMirzapur       1.012e-01  1.426e-01   0.709 0.478163
## LocationMohali         1.475e-01  5.643e-02   2.613 0.009070 **
## LocationMumbai         1.376e-01  4.446e-02   3.095 0.002006 **
## LocationMuzaffurpur   -7.528e-02  1.312e-01  -0.574 0.566380
## LocationMysore         3.610e-01  7.935e-02   4.550 5.84e-06 ***
## LocationNagpur         2.157e-01  1.099e-01   1.962 0.049984 *
## LocationNashik         1.162e-01  7.918e-02   1.467 0.142513
## LocationNavi Mumbai    1.427e-01  6.371e-02   2.239 0.025311 *
## LocationNoida          1.558e-01  6.497e-02   2.398 0.016611 *
## LocationPanchkula     -2.334e-02  1.097e-01  -0.213 0.831556
## LocationPatna          1.480e-01  5.290e-02   2.798 0.005210 **
## LocationPune           1.763e-01  4.671e-02   3.774 0.000168 ***
## LocationRaipur         1.286e-01  6.136e-02   2.096 0.036299 *
## LocationRanchi        -9.018e-03  6.148e-02  -0.147 0.883404
## LocationRanga Reddy   -1.460e-01  1.320e-01  -1.106 0.269077
## LocationRoorkee        2.055e-01  1.115e-01   1.842 0.065644 .
## LocationSalem          4.922e-01  1.311e-01   3.754 0.000182 ***
## LocationSurat          3.403e-02  8.943e-02   0.380 0.703638
## LocationThane          1.302e-01  6.320e-02   2.060 0.039573 *
## LocationUdupi          1.843e-01  7.533e-02   2.447 0.014521 *
## LocationVadodara      -1.282e-01  1.099e-01  -1.167 0.243313
## LocationVaranasi      -6.636e-02  6.139e-02  -1.081 0.279905
## LocationWarangal      -6.413e-02  1.311e-01  -0.489 0.624885
## LocationYamunanagar    1.672e-01  1.109e-01   1.508 0.131690
## LocationZirakpur       1.246e-02  6.302e-02   0.198 0.843268
## OwnerSecond           -2.029e-02  1.361e-02  -1.490 0.136368
## OwnerThird            -6.480e-02  4.900e-02  -1.322 0.186255
## OwnerUnRegistered Car  6.593e-02  9.328e-02   0.707 0.479774
## Seller.TypeCorporate   4.772e-02  1.012e-01   0.472 0.637250
## Seller.TypeIndividual  4.740e-02  9.600e-02   0.494 0.621572
## Max.Power.Value        7.017e-03  2.827e-04  24.825  < 2e-16 ***
```

```
## DrivetrainFWD         -4.080e-02  2.334e-02  -1.748 0.080674 .
## DrivetrainRWD         -8.037e-02  2.790e-02  -2.881 0.004027 **
## Width                  1.438e-03  1.049e-04  13.712  < 2e-16 ***
## Seating.Capacity       5.365e-02  9.557e-03   5.614 2.40e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1745 on 1337 degrees of freedom
## Multiple R-squared:  0.9418, Adjusted R-squared:  0.9373
## F-statistic:   210 on 103 and 1337 DF,  p-value: < 2.2e-16
```

```
anova(final)
```

```
## Analysis of Variance Table
##
## Response: log(Price)
##                    Df Sum Sq Mean Sq   F value    Pr(>F)
## Make               25 354.44  14.178  465.8167 < 2.2e-16 ***
## Year                1 178.52 178.525 5865.5685 < 2.2e-16 ***
## Kilometer           1   0.98   0.982   32.2486 1.662e-08 ***
## Fuel.Type           2  19.23   9.615  315.9144 < 2.2e-16 ***
## Transmission        1  20.31  20.313  667.3838 < 2.2e-16 ***
## Location           63  16.76   0.266    8.7392 < 2.2e-16 ***
## Owner               3   0.46   0.153    5.0376  0.001788 **
## Seller.Type         2   0.33   0.165    5.4332  0.004466 **
## Max.Power.Value     1  60.04  60.045 1972.8181 < 2.2e-16 ***
## Drivetrain          2   0.01   0.007    0.2451  0.782698
## Width               1   6.16   6.161  202.4342 < 2.2e-16 ***
## Seating.Capacity    1   0.96   0.959   31.5183 2.400e-08 ***
## Residuals        1337  40.69   0.030
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Drivetrain is not a significant predictor. We will drop it for model simplicity.

```
temp <- final
final <- lm(`log(Price)` ~ . - Drivetrain, data = x_trim)

summary(final)
```

```
##
## Call:
## lm(formula = `log(Price)` ~ . - Drivetrain, data = x_trim)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.20036 -0.09693  0.00517  0.10785  1.01383
##
## Coefficients:
##                          Estimate Std. Error t value Pr(>|t|)
## (Intercept)           -2.067e+02  4.599e+00 -44.941  < 2e-16 ***
## MakeBMW               -1.007e-01  3.850e-02  -2.616 0.009009 **
## MakeChevrolet         -6.918e-01  9.233e-02  -7.492 1.22e-13 ***
## MakeDatsun            -8.570e-01  7.109e-02 -12.055  < 2e-16 ***
## MakeFord              -5.109e-01  3.911e-02 -13.063  < 2e-16 ***
## MakeHonda             -3.708e-01  3.011e-02 -12.316  < 2e-16 ***
```

```
## MakeHyundai           -3.987e-01  2.794e-02 -14.269  < 2e-16 ***
## MakeIsuzu             -3.906e-01  1.293e-01  -3.020 0.002572 **
## MakeJaguar            -1.234e-01  7.568e-02  -1.630 0.103302
## MakeJeep              -3.886e-01  5.108e-02  -7.608 5.22e-14 ***
## MakeKia               -3.250e-01  4.455e-02  -7.297 5.04e-13 ***
## MakeLand Rover         6.688e-02  1.038e-01   0.644 0.519403
## MakeMahindra          -5.510e-01  3.467e-02 -15.891  < 2e-16 ***
## MakeMaruti Suzuki     -3.879e-01  3.037e-02 -12.772  < 2e-16 ***
## MakeMercedes-Benz      1.245e-01  3.095e-02   4.023 6.07e-05 ***
## MakeMG                -4.261e-01  5.452e-02  -7.816 1.09e-14 ***
## MakeMINI               5.486e-01  7.586e-02   7.231 8.04e-13 ***
## MakeMitsubishi        -3.023e-01  1.143e-01  -2.644 0.008296 **
## MakeNissan            -4.814e-01  5.430e-02  -8.866  < 2e-16 ***
## MakeRenault           -6.131e-01  4.056e-02 -15.115  < 2e-16 ***
## MakeSkoda             -3.384e-01  3.673e-02  -9.214  < 2e-16 ***
## MakeSsangyong         -8.658e-01  1.146e-01  -7.554 7.81e-14 ***
## MakeTata              -6.630e-01  3.763e-02 -17.617  < 2e-16 ***
## MakeToyota            -1.512e-01  3.107e-02  -4.866 1.28e-06 ***
## MakeVolkswagen        -3.091e-01  3.866e-02  -7.996 2.76e-15 ***
## MakeVolvo             -6.336e-02  5.724e-02  -1.107 0.268549
## Year                   1.077e-01  2.292e-03  46.996  < 2e-16 ***
## Kilometer             -1.624e-06  2.425e-07  -6.695 3.17e-11 ***
## Fuel.TypeDiesel       -2.816e-02  3.638e-02  -0.774 0.438968
## Fuel.TypePetrol       -1.846e-01  3.472e-02  -5.318 1.23e-07 ***
## TransmissionManual    -1.150e-01  1.308e-02  -8.790  < 2e-16 ***
## LocationAhmedabad      8.598e-02  4.929e-02   1.744 0.081330 .
## LocationAllahabad      1.133e-02  1.100e-01   0.103 0.917963
## LocationAmbala Cantt  -1.067e-01  7.084e-02  -1.506 0.132263
## LocationAmritsar       6.379e-02  9.926e-02   0.643 0.520570
## LocationAurangabad     2.948e-01  1.101e-01   2.678 0.007503 **
## LocationBangalore      2.466e-01  4.663e-02   5.288 1.44e-07 ***
## LocationBhopal         1.064e-01  1.147e-01   0.928 0.353727
## LocationBhubaneswar    6.721e-02  1.147e-01   0.586 0.557902
## LocationBulandshahar  -2.231e-01  1.337e-01  -1.669 0.095383 .
## LocationChandigarh     8.564e-02  6.282e-02   1.363 0.173055
## LocationChennai        2.341e-01  5.180e-02   4.519 6.77e-06 ***
## LocationCoimbatore     3.084e-01  6.012e-02   5.130 3.32e-07 ***
## LocationDehradun       1.139e-01  5.926e-02   1.921 0.054901 .
## LocationDelhi          8.061e-02  4.467e-02   1.805 0.071367 .
## LocationDharwad        1.656e-01  1.313e-01   1.261 0.207580
## LocationErnakulam      2.400e-01  1.316e-01   1.824 0.068374 .
## LocationFaridabad      5.110e-03  5.730e-02   0.089 0.928941
## LocationGhaziabad      3.530e-02  1.321e-01   0.267 0.789294
## LocationGoa            2.742e-01  9.960e-02   2.753 0.005993 **
## LocationGurgaon        5.989e-02  5.698e-02   1.051 0.293422
## LocationGuwahati       1.636e-01  9.070e-02   1.804 0.071412 .
## LocationHaldwani      -9.132e-02  1.313e-01  -0.695 0.486876
## LocationHyderabad      1.907e-01  4.731e-02   4.031 5.87e-05 ***
## LocationIndore         2.404e-01  9.805e-02   2.452 0.014348 *
## LocationJaipur         1.531e-01  5.572e-02   2.747 0.006089 **
## LocationJalandhar      1.255e-01  5.871e-02   2.137 0.032750 *
## LocationJamshedpur     9.924e-02  9.088e-02   1.092 0.275018
## LocationKanpur         7.001e-03  5.259e-02   0.133 0.894113
## LocationKarnal         1.556e-01  7.562e-02   2.058 0.039812 *
```

```
## LocationKharar        -2.573e-02  1.313e-01  -0.196 0.844684
## LocationKheda         -6.852e-02  1.314e-01  -0.521 0.602168
## LocationKolkata       -6.161e-02  4.940e-02  -1.247 0.212520
## LocationKollam         1.776e-01  1.317e-01   1.348 0.177812
## LocationKota           1.295e-01  1.429e-01   0.906 0.365079
## LocationLucknow        6.551e-02  4.948e-02   1.324 0.185771
## LocationLudhiana       6.025e-02  5.228e-02   1.153 0.249310
## LocationMangalore     -1.950e-02  9.824e-02  -0.198 0.842705
## LocationMeerut         7.254e-02  7.581e-02   0.957 0.338789
## LocationMirzapur       9.903e-02  1.429e-01   0.693 0.488460
## LocationMohali         1.403e-01  5.651e-02   2.483 0.013155 *
## LocationMumbai         1.351e-01  4.455e-02   3.032 0.002478 **
## LocationMuzaffurpur   -7.849e-02  1.314e-01  -0.597 0.550522
## LocationMysore         3.634e-01  7.950e-02   4.571 5.30e-06 ***
## LocationNagpur         2.128e-01  1.102e-01   1.931 0.053679 .
## LocationNashik         1.126e-01  7.931e-02   1.419 0.155987
## LocationNavi Mumbai    1.378e-01  6.382e-02   2.159 0.031013 *
## LocationNoida          1.517e-01  6.510e-02   2.330 0.019971 *
## LocationPanchkula     -2.553e-02  1.099e-01  -0.232 0.816433
## LocationPatna          1.399e-01  5.289e-02   2.645 0.008258 **
## LocationPune           1.728e-01  4.680e-02   3.691 0.000232 ***
## LocationRaipur         1.309e-01  6.149e-02   2.129 0.033433 *
## LocationRanchi        -1.051e-02  6.162e-02  -0.170 0.864646
## LocationRanga Reddy   -1.508e-01  1.323e-01  -1.140 0.254587
## LocationRoorkee        1.913e-01  1.116e-01   1.715 0.086632 .
## LocationSalem          4.880e-01  1.314e-01   3.714 0.000213 ***
## LocationSurat          2.488e-02  8.956e-02   0.278 0.781209
## LocationThane          1.276e-01  6.334e-02   2.014 0.044222 *
## LocationUdupi          1.812e-01  7.549e-02   2.400 0.016541 *
## LocationVadodara      -1.386e-01  1.100e-01  -1.259 0.208200
## LocationVaranasi      -6.930e-02  6.153e-02  -1.126 0.260241
## LocationWarangal      -6.717e-02  1.314e-01  -0.511 0.609405
## LocationYamunanagar    1.793e-01  1.108e-01   1.617 0.106010
## LocationZirakpur       1.594e-02  6.316e-02   0.252 0.800724
## OwnerSecond           -1.855e-02  1.362e-02  -1.362 0.173415
## OwnerThird            -5.702e-02  4.904e-02  -1.163 0.245163
## OwnerUnRegistered Car  7.442e-02  9.338e-02   0.797 0.425654
## Seller.TypeCorporate   5.167e-02  1.013e-01   0.510 0.610247
## Seller.TypeIndividual  5.094e-02  9.621e-02   0.530 0.596545
## Max.Power.Value        7.105e-03  2.716e-04  26.165  < 2e-16 ***
## Width                  1.432e-03  1.046e-04  13.698  < 2e-16 ***
## Seating.Capacity       4.572e-02  8.909e-03   5.132 3.29e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1749 on 1339 degrees of freedom
## Multiple R-squared:  0.9414, Adjusted R-squared:  0.937
## F-statistic:   213 on 101 and 1339 DF,  p-value: < 2.2e-16
```

```
anova(final)
```

```
## Analysis of Variance Table
##
## Response: log(Price)
##                     Df Sum Sq Mean Sq   F value    Pr(>F)
```

```
## Make               25 354.44  14.178  463.6198 < 2.2e-16 ***
## Year                1 178.52 178.525 5837.9045 < 2.2e-16 ***
## Kilometer           1   0.98   0.982   32.0965 1.794e-08 ***
## Fuel.Type           2  19.23   9.615  314.4245 < 2.2e-16 ***
## Transmission        1  20.31  20.313  664.2362 < 2.2e-16 ***
## Location           63  16.76   0.266    8.6980 < 2.2e-16 ***
## Owner               3   0.46   0.153    5.0138  0.001848 **
## Seller.Type         2   0.33   0.165    5.4076  0.004581 **
## Max.Power.Value     1  60.04  60.045 1963.5137 < 2.2e-16 ***
## Width               1   6.08   6.076  198.6922 < 2.2e-16 ***
## Seating.Capacity    1   0.81   0.805   26.3390 3.287e-07 ***
## Residuals        1339  40.95   0.031
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Normalized Coefficients

```
normalized <- x_trim
for (col in colnames(normalized)) {
  if (col != "log(Price)" && !(col %in% categorical)) {
    normalized[, col] <- (normalized[, col] - mean(normalized[, col])) / sd(normalized[, col])
  }
}

normalized_model <- lm(`log(Price)` ~ . - Drivetrain, data = normalized)

summary(normalized_model)
```

```
##
## Call:
## lm(formula = `log(Price)` ~ . - Drivetrain, data = normalized)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.20036 -0.09693  0.00517  0.10785  1.01383
##
## Coefficients:
##                        Estimate Std. Error t value Pr(>|t|)
## (Intercept)           13.988853   0.112467 124.382  < 2e-16 ***
## MakeBMW               -0.100690   0.038497  -2.616 0.009009 **
## MakeChevrolet         -0.691804   0.092333  -7.492 1.22e-13 ***
## MakeDatsun            -0.857001   0.071093 -12.055  < 2e-16 ***
## MakeFord              -0.510918   0.039112 -13.063  < 2e-16 ***
## MakeHonda             -0.370792   0.030107 -12.316  < 2e-16 ***
## MakeHyundai           -0.398703   0.027942 -14.269  < 2e-16 ***
## MakeIsuzu             -0.390553   0.129302  -3.020 0.002572 **
## MakeJaguar            -0.123368   0.075679  -1.630 0.103302
## MakeJeep              -0.388592   0.051076  -7.608 5.22e-14 ***
## MakeKia               -0.325030   0.044546  -7.297 5.04e-13 ***
## MakeLand Rover         0.066877   0.103775   0.644 0.519403
## MakeMahindra          -0.550986   0.034672 -15.891  < 2e-16 ***
## MakeMaruti Suzuki     -0.387872   0.030369 -12.772  < 2e-16 ***
## MakeMercedes-Benz      0.124509   0.030950   4.023 6.07e-05 ***
## MakeMG                -0.426113   0.054515  -7.816 1.09e-14 ***
```

```
## MakeMINI               0.548568   0.075865   7.231 8.04e-13 ***
## MakeMitsubishi        -0.302274   0.114336  -2.644 0.008296 **
## MakeNissan            -0.481426   0.054297  -8.866  < 2e-16 ***
## MakeRenault           -0.613058   0.040559 -15.115  < 2e-16 ***
## MakeSkoda             -0.338425   0.036729  -9.214  < 2e-16 ***
## MakeSsangyong         -0.865808   0.114623  -7.554 7.81e-14 ***
## MakeTata              -0.663006   0.037634 -17.617  < 2e-16 ***
## MakeToyota            -0.151191   0.031073  -4.866 1.28e-06 ***
## MakeVolkswagen        -0.309138   0.038662  -7.996 2.76e-15 ***
## MakeVolvo             -0.063355   0.057238  -1.107 0.268549
## Year                   0.307109   0.006535  46.996  < 2e-16 ***
## Kilometer             -0.044526   0.006651  -6.695 3.17e-11 ***
## Fuel.TypeDiesel       -0.028162   0.036377  -0.774 0.438968
## Fuel.TypePetrol       -0.184644   0.034720  -5.318 1.23e-07 ***
## TransmissionManual    -0.114993   0.013083  -8.790  < 2e-16 ***
## LocationAhmedabad      0.085981   0.049292   1.744 0.081330 .
## LocationAllahabad      0.011332   0.110004   0.103 0.917963
## LocationAmbala Cantt  -0.106702   0.070844  -1.506 0.132263
## LocationAmritsar       0.063786   0.099257   0.643 0.520570
## LocationAurangabad     0.294754   0.110077   2.678 0.007503 **
## LocationBangalore      0.246577   0.046629   5.288 1.44e-07 ***
## LocationBhopal         0.106439   0.114733   0.928 0.353727
## LocationBhubaneswar    0.067211   0.114674   0.586 0.557902
## LocationBulandshahar  -0.223114   0.133694  -1.669 0.095383 .
## LocationChandigarh     0.085637   0.062822   1.363 0.173055
## LocationChennai        0.234054   0.051795   4.519 6.77e-06 ***
## LocationCoimbatore     0.308448   0.060124   5.130 3.32e-07 ***
## LocationDehradun       0.113856   0.059259   1.921 0.054901 .
## LocationDelhi          0.080614   0.044672   1.805 0.071367 .
## LocationDharwad        0.165589   0.131330   1.261 0.207580
## LocationErnakulam      0.240045   0.131603   1.824 0.068374 .
## LocationFaridabad      0.005110   0.057296   0.089 0.928941
## LocationGhaziabad      0.035302   0.132077   0.267 0.789294
## LocationGoa            0.274162   0.099602   2.753 0.005993 **
## LocationGurgaon        0.059888   0.056979   1.051 0.293422
## LocationGuwahati       0.163644   0.090698   1.804 0.071412 .
## LocationHaldwani      -0.091317   0.131301  -0.695 0.486876
## LocationHyderabad      0.190685   0.047308   4.031 5.87e-05 ***
## LocationIndore         0.240374   0.098046   2.452 0.014348 *
## LocationJaipur         0.153072   0.055717   2.747 0.006089 **
## LocationJalandhar      0.125477   0.058707   2.137 0.032750 *
## LocationJamshedpur     0.099239   0.090876   1.092 0.275018
## LocationKanpur         0.007001   0.052586   0.133 0.894113
## LocationKarnal         0.155601   0.075619   2.058 0.039812 *
## LocationKharar        -0.025730   0.131312  -0.196 0.844684
## LocationKheda         -0.068516   0.131406  -0.521 0.602168
## LocationKolkata       -0.061613   0.049399  -1.247 0.212520
## LocationKollam         0.177588   0.131719   1.348 0.177812
## LocationKota           0.129478   0.142906   0.906 0.365079
## LocationLucknow        0.065508   0.049482   1.324 0.185771
## LocationLudhiana       0.060255   0.052281   1.153 0.249310
## LocationMangalore     -0.019497   0.098235  -0.198 0.842705
## LocationMeerut         0.072540   0.075807   0.957 0.338789
## LocationMirzapur       0.099027   0.142906   0.693 0.488460
```

```
## LocationMohali          0.140299   0.056507   2.483 0.013155 *
## LocationMumbai          0.135076   0.044553   3.032 0.002478 **
## LocationMuzaffurpur    -0.078489   0.131445  -0.597 0.550522
## LocationMysore          0.363400   0.079498   4.571 5.30e-06 ***
## LocationNagpur          0.212766   0.110178   1.931 0.053679 .
## LocationNashik          0.112574   0.079305   1.419 0.155987
## LocationNavi Mumbai     0.137805   0.063823   2.159 0.031013 *
## LocationNoida           0.151670   0.065103   2.330 0.019971 *
## LocationPanchkula      -0.025526   0.109940  -0.232 0.816433
## LocationPatna           0.139919   0.052894   2.645 0.008258 **
## LocationPune            0.172766   0.046803   3.691 0.000232 ***
## LocationRaipur          0.130918   0.061492   2.129 0.033433 *
## LocationRanchi         -0.010506   0.061620  -0.170 0.864646
## LocationRanga Reddy    -0.150829   0.132333  -1.140 0.254587
## LocationRoorkee         0.191337   0.111587   1.715 0.086632 .
## LocationSalem           0.487998   0.131410   3.714 0.000213 ***
## LocationSurat           0.024880   0.089561   0.278 0.781209
## LocationThane           0.127567   0.063344   2.014 0.044222 *
## LocationUdupi           0.181155   0.075488   2.400 0.016541 *
## LocationVadodara       -0.138556   0.110041  -1.259 0.208200
## LocationVaranasi       -0.069297   0.061526  -1.126 0.260241
## LocationWarangal       -0.067174   0.131446  -0.511 0.609405
## LocationYamunanagar     0.179274   0.110836   1.617 0.106010
## LocationZirakpur        0.015945   0.063158   0.252 0.800724
## OwnerSecond            -0.018554   0.013622  -1.362 0.173415
## OwnerThird             -0.057020   0.049041  -1.163 0.245163
## OwnerUnRegistered Car   0.074418   0.093385   0.797 0.425654
## Seller.TypeCorporate    0.051666   0.101338   0.510 0.610247
## Seller.TypeIndividual   0.050943   0.096209   0.530 0.596545
## Max.Power.Value         0.284498   0.010873  26.165  < 2e-16 ***
## Width                   0.128990   0.009417  13.698  < 2e-16 ***
## Seating.Capacity        0.033238   0.006476   5.132 3.29e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1749 on 1339 degrees of freedom
## Multiple R-squared:  0.9414, Adjusted R-squared:  0.937
## F-statistic:   213 on 101 and 1339 DF,  p-value: < 2.2e-16
```

```
sort(abs(normalized_model$coefficients), decreasing = T)
```

```
##           (Intercept)         MakeSsangyong             MakeDatsun
##          13.988852729           0.865808028           0.857000750
##         MakeChevrolet             MakeTata           MakeRenault
##           0.691804198           0.663005651           0.613058040
##          MakeMahindra             MakeMINI              MakeFord
##           0.550986428           0.548568066           0.510918181
##         LocationSalem            MakeNissan                MakeMG
##           0.487997813           0.481426313           0.426112914
##           MakeHyundai             MakeIsuzu              MakeJeep
##           0.398702915           0.390553018           0.388591703
##     MakeMaruti Suzuki             MakeHonda        LocationMysore
##           0.387871820           0.370791913           0.363400177
##             MakeSkoda               MakeKia        MakeVolkswagen
##           0.338425375           0.325030336           0.309137690
```

```
##    LocationCoimbatore                 Year        MakeMitsubishi
##           0.308448127          0.307109499           0.302273825
##    LocationAurangabad       Max.Power.Value           LocationGoa
##           0.294753951          0.284498208           0.274161701
##     LocationBangalore        LocationIndore     LocationErnakulam
##           0.246577259          0.240373624           0.240045064
##       LocationChennai  LocationBulandshahar        LocationNagpur
##           0.234054447          0.223114101           0.212766204
##       LocationRoorkee     LocationHyderabad       Fuel.TypePetrol
##           0.191336894          0.190685192           0.184644204
##         LocationUdupi   LocationYamunanagar        LocationKollam
##           0.181155234          0.179274401           0.177587717
##          LocationPune       LocationDharwad      LocationGuwahati
##           0.172766125          0.165588706           0.163643683
##        LocationKarnal        LocationJaipur         LocationNoida
##           0.155600695          0.153072008           0.151669999
##            MakeToyota   LocationRanga Reddy        LocationMohali
##           0.151191262          0.150828619           0.140299358
##         LocationPatna      LocationVadodara   LocationNavi Mumbai
##           0.139919337          0.138556389           0.137805062
##        LocationMumbai        LocationRaipur          LocationKota
##           0.135076065          0.130918171           0.129478494
##                 Width         LocationThane     LocationJalandhar
##           0.128990174          0.127566707           0.125476956
##     MakeMercedes-Benz            MakeJaguar    TransmissionManual
##           0.124508515          0.123368385           0.114992835
##      LocationDehradun        LocationNashik  LocationAmbala Cantt
##           0.113855648          0.112573831           0.106701691
##        LocationBhopal              MakeBMW    LocationJamshedpur
##           0.106438610          0.100689663           0.099238781
##      LocationMirzapur      LocationHaldwani     LocationAhmedabad
##           0.099027002          0.091316861           0.085981258
##    LocationChandigarh         LocationDelhi   LocationMuzaffurpur
##           0.085637389          0.080613545           0.078489443
## OwnerUnRegistered Car        LocationMeerut      LocationVaranasi
##           0.074417751          0.072539773           0.069297044
##         LocationKheda   LocationBhubaneswar      LocationWarangal
##           0.068516415          0.067211083           0.067174342
##        MakeLand Rover       LocationLucknow      LocationAmritsar
##           0.066876590          0.065507926           0.063786181
##              MakeVolvo       LocationKolkata      LocationLudhiana
##           0.063355209          0.061613493           0.060254752
##       LocationGurgaon             OwnerThird  Seller.TypeCorporate
##           0.059888444          0.057019612           0.051666499
## Seller.TypeIndividual               Kilometer     LocationGhaziabad
##           0.050943149          0.044526457           0.035301671
##      Seating.Capacity       Fuel.TypeDiesel        LocationKharar
##           0.033237595          0.028162035           0.025729770
##     LocationPanchkula         LocationSurat     LocationMangalore
##           0.025525803          0.024879914           0.019497064
##           OwnerSecond      LocationZirakpur     LocationAllahabad
##           0.018553537          0.015944827           0.011332467
##        LocationRanchi        LocationKanpur     LocationFaridabad
##           0.010505883          0.007000683           0.005110470
```

Confidence Intervals

```
confint(normalized_model, level = 0.95)
```

```
##                              2.5 %       97.5 %
## (Intercept)           13.768221910 14.209483547
## MakeBMW               -0.176210320 -0.025169006
## MakeChevrolet         -0.872937617 -0.510670779
## MakeDatsun            -0.996466563 -0.717534938
## MakeFord              -0.587644684 -0.434191678
## MakeHonda             -0.429854574 -0.311729251
## MakeHyundai           -0.453518010 -0.343887819
## MakeIsuzu             -0.644209567 -0.136896468
## MakeJaguar            -0.271829896  0.025093126
## MakeJeep              -0.488790299 -0.288393106
## MakeKia               -0.412417669 -0.237643003
## MakeLand Rover        -0.136703472  0.270456651
## MakeMahindra          -0.619003688 -0.482969168
## MakeMaruti Suzuki     -0.447448294 -0.328295347
## MakeMercedes-Benz      0.063792924  0.185224105
## MakeMG                -0.533057660 -0.319168167
## MakeMINI               0.399741736  0.697394396
## MakeMitsubishi        -0.526571927 -0.077975723
## MakeNissan            -0.587943382 -0.374909244
## MakeRenault           -0.692624872 -0.533491207
## MakeSkoda             -0.410478493 -0.266372257
## MakeSsangyong         -1.090667701 -0.640948355
## MakeTata              -0.736833825 -0.589177477
## MakeToyota            -0.212149256 -0.090233268
## MakeVolkswagen        -0.384982924 -0.233292457
## MakeVolvo             -0.175641424  0.048931007
## Year                   0.294290071  0.319928926
## Kilometer             -0.057573938 -0.031478977
## Fuel.TypeDiesel       -0.099524376  0.043200307
## Fuel.TypePetrol       -0.252755580 -0.116532828
## TransmissionManual    -0.140657377 -0.089328293
## LocationAhmedabad     -0.010715947  0.182678463
## LocationAllahabad     -0.204465646  0.227130579
## LocationAmbala Cantt  -0.245678493  0.032275110
## LocationAmritsar      -0.130929934  0.258502295
## LocationAurangabad     0.078811804  0.510696097
## LocationBangalore      0.155103297  0.338051220
## LocationBhopal        -0.118637294  0.331514513
## LocationBhubaneswar   -0.157748264  0.292170429
## LocationBulandshahar  -0.485386997  0.039158794
## LocationChandigarh    -0.037602496  0.208877274
## LocationChennai        0.132445796  0.335663098
## LocationCoimbatore     0.190501062  0.426395192
## LocationDehradun      -0.002394072  0.230105369
## LocationDelhi         -0.007020940  0.168248030
## LocationDharwad       -0.092046856  0.423224267
## LocationErnakulam     -0.018126189  0.498216316
## LocationFaridabad     -0.107289989  0.117510930
## LocationGhaziabad     -0.223798282  0.294401624
```

```
## LocationGoa            0.078768502  0.469554901
## LocationGurgaon       -0.051889759  0.171666646
## LocationGuwahati      -0.014281003  0.341568369
## LocationHaldwani      -0.348894170  0.166260448
## LocationHyderabad      0.097879467  0.283490916
## LocationIndore         0.048033274  0.432713973
## LocationJaipur         0.043769922  0.262374093
## LocationJalandhar      0.010310056  0.240643856
## LocationJamshedpur    -0.079035712  0.277513275
## LocationKanpur        -0.096159894  0.110161261
## LocationKarnal         0.007256436  0.303944955
## LocationKharar        -0.283329265  0.231869725
## LocationKheda         -0.326300658  0.189267828
## LocationKolkata       -0.158521433  0.035294447
## LocationKollam        -0.080810392  0.435985825
## LocationKota          -0.150866381  0.409823370
## LocationLucknow       -0.031562728  0.162578581
## LocationLudhiana      -0.042305854  0.162815359
## LocationMangalore     -0.212209242  0.173215115
## LocationMeerut        -0.076173394  0.221252941
## LocationMirzapur      -0.181317026  0.379371029
## LocationMohali         0.029447590  0.251151127
## LocationMumbai         0.047673853  0.222478277
## LocationMuzaffurpur   -0.336349094  0.179370209
## LocationMysore         0.207446781  0.519353573
## LocationNagpur        -0.003373536  0.428905943
## LocationNashik        -0.043002605  0.268150267
## LocationNavi Mumbai    0.012601991  0.263008134
## LocationNoida          0.023954366  0.279385632
## LocationPanchkula     -0.241198222  0.190146617
## LocationPatna          0.036155494  0.243683181
## LocationPune           0.080950314  0.264581936
## LocationRaipur         0.010287994  0.251548347
## LocationRanchi        -0.131387482  0.110375715
## LocationRanga Reddy   -0.410431046  0.108773809
## LocationRoorkee       -0.027566534  0.410240323
## LocationSalem          0.230206070  0.745789557
## LocationSurat         -0.150814414  0.200574242
## LocationThane          0.003302657  0.251830758
## LocationUdupi          0.033066818  0.329243649
## LocationVadodara      -0.354427308  0.077314530
## LocationVaranasi      -0.189995711  0.051401622
## LocationWarangal      -0.325035949  0.190687264
## LocationYamunanagar   -0.038156007  0.396704809
## LocationZirakpur      -0.107954155  0.139843810
## OwnerSecond           -0.045276101  0.008169027
## OwnerThird            -0.153225419  0.039186195
## OwnerUnRegistered Car -0.108778582  0.257614085
## Seller.TypeCorporate  -0.147132811  0.250465809
## Seller.TypeIndividual -0.137794544  0.239680843
## Max.Power.Value        0.263167656  0.305828759
## Width                  0.110516763  0.147463586
## Seating.Capacity       0.020532697  0.045942493
```

Inspection of Seller Type

First we check the data in general.

```
comp <- aov(`log(Price)`~Seller.Type, data = x)
summary(comp)
```

```
##               Df Sum Sq Mean Sq F value  Pr(>F)
## Seller.Type    2    4.8  2.4087    4.99 0.00692 **
## Residuals   1438  694.1  0.4827
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
TukeyHSD(comp, conf.level=.95)
```

```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##
## Fit: aov(formula = `log(Price)` ~ Seller.Type, data = x)
##
## $Seller.Type
##                                          diff         lwr         upr     p adj
## Corporate-Commercial Registration   0.7704811 -0.08982006  1.63078234 0.0899342
## Individual-Commercial Registration  0.4253785 -0.39077327  1.24153018 0.4398371
## Individual-Corporate               -0.3451027 -0.62403742 -0.06616795 0.0104896
```

Next, we check what our model would say.

```
linearHypothesis(final, c("Seller.TypeCorporate = Seller.TypeIndividual"))
```

```
##
## Linear hypothesis test:
## Seller.TypeCorporate - Seller.TypeIndividual = 0
##
## Model 1: restricted model
## Model 2: `log(Price)` ~ (Make + Year + Kilometer + Fuel.Type + Transmission +
##     Location + Owner + Seller.Type + Max.Power.Value + Drivetrain +
##     Width + Seating.Capacity) - Drivetrain
##
##   Res.Df    RSS Df  Sum of Sq     F Pr(>F)
## 1   1340 40.947
## 2   1339 40.947  1 1.6292e-05 5e-04 0.9816
```

Corporate sellers are able to sell their cars at a statistically significantly higher price compared to individual sellers. Considering that our model states that their impact on price is not significant, it could mean that there are covariates that affect the seller's ability get a price, and this covariates could be handled by our model.

Inspection of Owner Number

First inspect the data alone.

```
comp <- aov(`log(Price)`~Owner, data = x)
summary(comp)
```

```
##               Df Sum Sq Mean Sq F value  Pr(>F)
## Owner          3    6.1  2.0398   4.231 0.00548 **
## Residuals   1437  692.8  0.4821
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
TukeyHSD(comp, conf.level=.95)
```

```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##
## Fit: aov(formula = `log(Price)` ~ Owner, data = x)
##
## $Owner
##                                 diff        lwr         upr     p adj
## Second-First            -0.03011638 -0.1561399  0.09590711 0.9274380
## Third-First             -0.63639970 -1.1004315 -0.17236793 0.0024410
## UnRegistered Car-First  -0.08600727 -0.9804556  0.80844104 0.9946869
## Third-Second            -0.60628332 -1.0814693 -0.13109731 0.0058198
## UnRegistered Car-Second -0.05589089 -0.9561764  0.84439465 0.9985509
## UnRegistered Car-Third   0.55039243 -0.4545740  1.55535890 0.4940875
```

Next, we check what our model would say.

```
linearHypothesis(final, c("OwnerSecond = 0", "OwnerThird = 0", "OwnerUnRegistered Car = 0"))
```

```
##
## Linear hypothesis test:
## OwnerSecond = 0
## OwnerThird = 0
## OwnerUnRegistered Car = 0
##
## Model 1: restricted model
## Model 2: `log(Price)` ~ (Make + Year + Kilometer + Fuel.Type + Transmission +
##     Location + Owner + Seller.Type + Max.Power.Value + Drivetrain +
##     Width + Seating.Capacity) - Drivetrain
##
##   Res.Df    RSS Df Sum of Sq      F Pr(>F)
## 1   1342 41.058
## 2   1339 40.947  3   0.11062 1.2058 0.3063
```

None are significantly different from baseline (first owner) according to our model, but for some reason third owner is significantly different from first and second in the original data. This heavily implies that there is some other covariate impacting the price for third owner cars.