

```

library(car)

## Loading required package: carData
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"

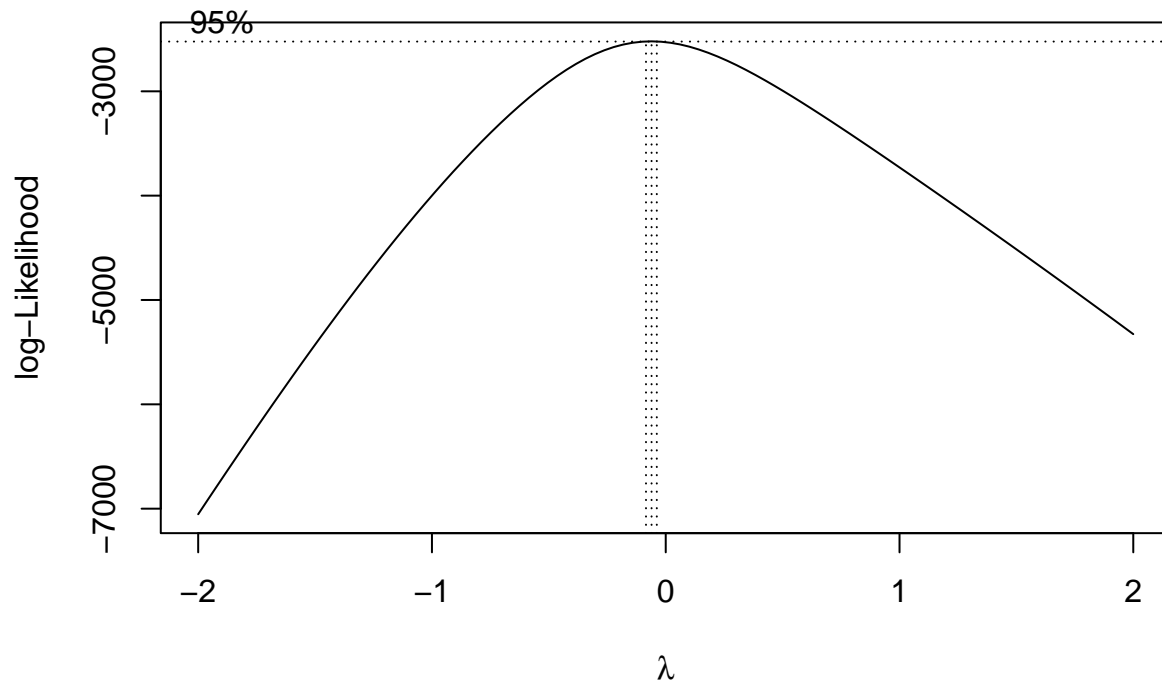
bad_idx

## [1] 662 1009 1169 1077 779 569 728 245 510 264 162
df <- df[-bad_idx, ]

```

Box Cox

```
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 $\lambda \approx 0$.

Iteratively Remove Multicollinear Regressors

```
x <- df
model <- lm(log(Price) ~., data = x)
removed <- c()

finished <- F
while(!finished) {
  temp <- car::vif(model)[, "GVIF^(1/(2*Df))"]
  worst <- names(which.max(temp))
  if (length(temp) > 0 && temp[worst] > sqrt(5)) {
    x <- remove_cols(x, c(worst))
    model <- lm(log(Price) ~., data = x)

    removed <- c(removed, worst)
  } else {
    finished <- T
  }
}

removed

## [1] "Max.Torque.Value" "Max.Power.RPM" "Max.Power.Value"
## [4] "Engine" "Fuel.Tank.Capacity" "Height"
which(abs(rstudent(model)) > 4)

## 44 366 492 1536 1681
```

```
## 39 268 345 1071 1171
```

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

```
vif(model, type = "predictor")
```

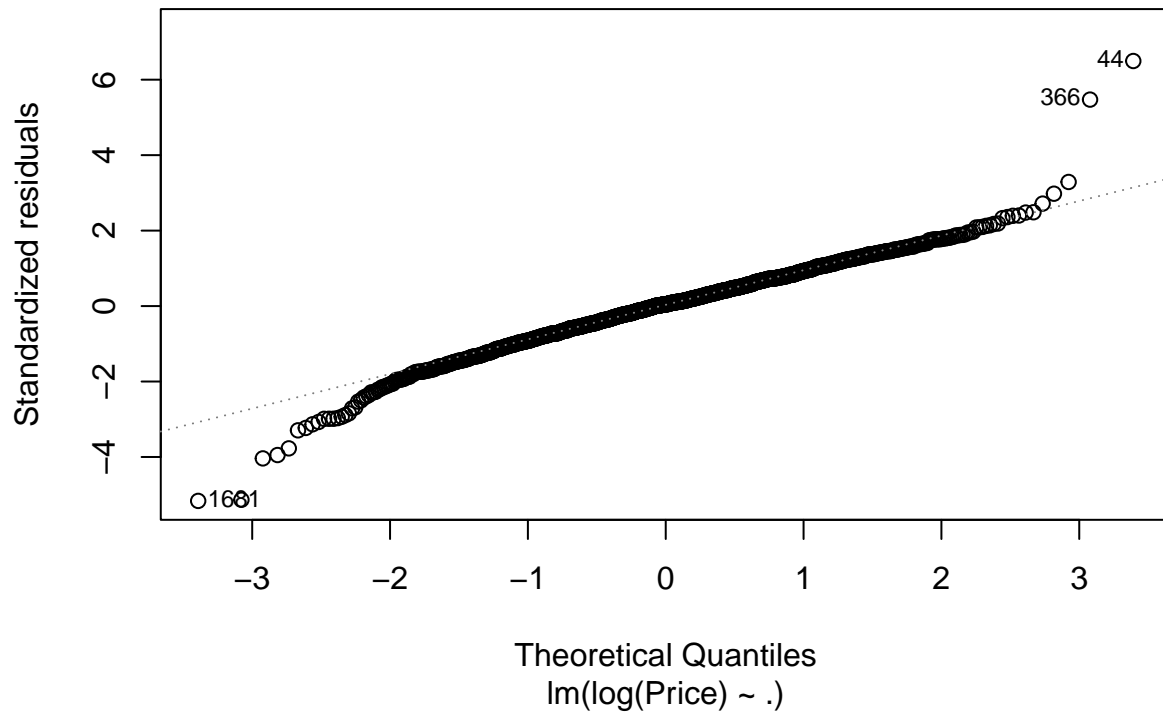
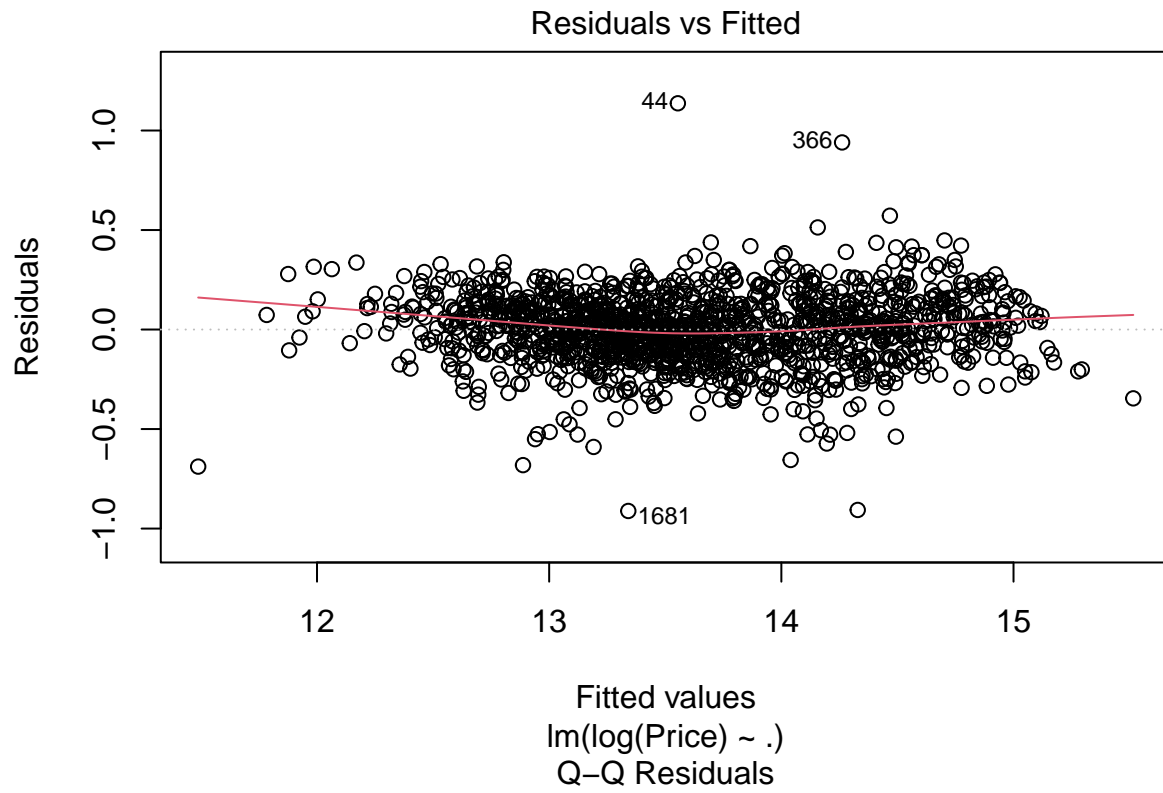
```
## GVIFs computed for predictors
```

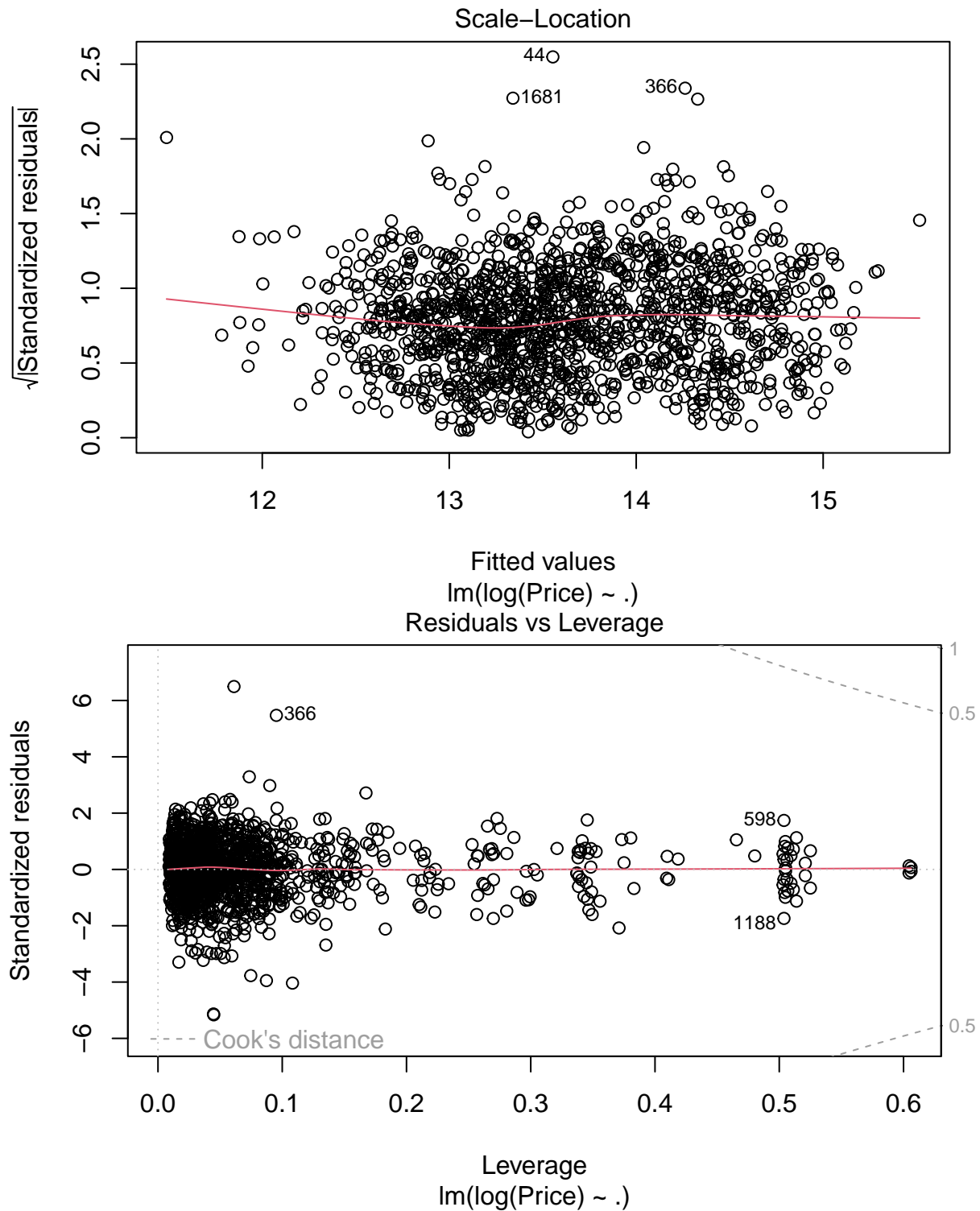
```
##           GVIF Df GVIF^(1/(2*Df)) Interacts With
## Make          76.706634 25         1.090678      --
## Year           2.038829  1         1.427876      --
## Kilometer       2.089964  1         1.445671      --
## Fuel.Type       5.026586  2         1.497333      --
## Transmission    1.843543  1         1.357771      --
## Location       13.438914 63         1.020834      --
## Owner          1.628105  3         1.084627      --
## Seller.Type     1.329867  2         1.073871      --
## Max.Torque.RPM  4.220839  1         2.054468      --
## Drivetrain      3.872635  2         1.402819      --
## Length          4.511737  1         2.124085      --
## Width           4.596043  1         2.143838      --
## Seating.Capacity 2.506336  1         1.583141      --
```

```
##
## Make          Year, Kilometer, Fuel.Type, Transmission, Location, Owner, Seller.Type, Max.Torque.L
## Year          Make, Kilometer, Fuel.Type, Transmission, Location, Owner, Seller.Type, Max.Torque.L
## Kilometer     Make, Year, Fuel.Type, Transmission, Location, Owner, Seller.Type, Max.Torque.L
## Fuel.Type     Make, Year, Kilometer, Transmission, Location, Owner, Seller.Type, Max.Torque.L
## Transmission  Make, Year, Kilometer, Fuel.Type, Location, Owner, Seller.Type, Max.Torque.L
## Location      Make, Year, Kilometer, Fuel.Type, Transmission, Owner, Seller.Type, Max.Torque.L
## Owner         Make, Year, Kilometer, Fuel.Type, Transmission, Location, Seller.Type, Max.Torque.L
## Seller.Type   Make, Year, Kilometer, Fuel.Type, Transmission, Location, Owner, Max.Torque.L
## Max.Torque.RPM Make, Year, Kilometer, Fuel.Type, Transmission, Location, Owner, Seller.T
## Drivetrain    Make, Year, Kilometer, Fuel.Type, Transmission, Location, Owner, Seller.Type,
## Length        Make, Year, Kilometer, Fuel.Type, Transmission, Location, Owner, Seller.Type, Max
## Width         Make, Year, Kilometer, Fuel.Type, Transmission, Location, Owner, Seller.Type, Max.
## Seating.Capacity Make, Year, Kilometer, Fuel.Type, Transmission, Location, Owner, Seller
```

We get that $GVIF^{1/(2 \cdot Df)} < 2.236068 \approx \sqrt{5}$ for all regressors, and no interactions are indicated, so there is likely no multicollinearity.

```
plot(model)
```





Backwards Stepwise Search

We do a backwards search since our model already conforms to the linear assumptions and is performing well. We simply wish to reduce the model size now.

```
reduced_model <- step(model, direction = "backward", data = x, trace = 0)
old <- names(model$coefficients)
new <- names(reduced_model$coefficients)

old[!(old %in% new)]
```

```
## [1] "Seller.TypeCorporate" "Seller.TypeIndividual" "Seating.Capacity"

Seller type and seating capacity were removed by AIC.
```

Inspect Model Coefficients

```
summary(reduced_model)
```

```
##
## Call:
## lm(formula = log(Price) ~ Make + Year + Kilometer + Fuel.Type +
##     Transmission + Location + Owner + Max.Torque.RPM + Drivetrain +
##     Length + Width, data = x)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.91740 -0.10178  0.00844  0.11055  1.11535
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -2.067e+02  4.777e+00 -43.283  < 2e-16 ***
## MakeBMW        -1.660e-02  4.195e-02  -0.396  0.692407
## MakeChevrolet  -7.467e-01  9.520e-02  -7.843  8.90e-15 ***
## MakeDatsun     -8.741e-01  7.262e-02 -12.036  < 2e-16 ***
## MakeFord       -5.640e-01  3.942e-02 -14.310  < 2e-16 ***
## MakeHonda      -4.779e-01  3.153e-02 -15.158  < 2e-16 ***
## MakeHyundai    -4.549e-01  2.800e-02 -16.248  < 2e-16 ***
## MakeIsuzu      -3.860e-01  1.342e-01  -2.877  0.004079 **
## MakeJaguar      4.938e-02  8.072e-02   0.612  0.540843
## MakeJeep       -2.964e-01  5.270e-02  -5.625  2.26e-08 ***
## MakeKia        -4.044e-01  4.559e-02  -8.869  < 2e-16 ***
## MakeLand Rover  2.115e-01  1.081e-01   1.956  0.050634 .
## MakeMahindra   -5.916e-01  3.332e-02 -17.756  < 2e-16 ***
## MakeMaruti Suzuki -5.206e-01  2.890e-02 -18.018  < 2e-16 ***
## MakeMercedes-Benz 1.174e-01  3.440e-02   3.413  0.000661 ***
## MakeMG         -5.009e-01  5.619e-02  -8.913  < 2e-16 ***
## MakeMINI        6.704e-01  7.892e-02   8.495  < 2e-16 ***
## MakeMitsubishi  -2.839e-01  1.181e-01  -2.404  0.016333 *
## MakeNissan      -7.499e-01  5.403e-02 -13.879  < 2e-16 ***
## MakeRenault     -7.568e-01  4.035e-02 -18.757  < 2e-16 ***
## MakeSkoda       -4.845e-01  3.909e-02 -12.395  < 2e-16 ***
## MakeSsangyong   -8.935e-01  1.186e-01  -7.536  8.88e-14 ***
## MakeTata        -7.105e-01  3.812e-02 -18.639  < 2e-16 ***
## MakeToyota      -2.423e-01  3.111e-02  -7.790  1.34e-14 ***
## MakeVolkswagen  -5.111e-01  3.865e-02 -13.225  < 2e-16 ***
## MakeVolvo       2.244e-02  5.902e-02   0.380  0.703809
## Year           1.073e-01  2.379e-03  45.121  < 2e-16 ***
## Kilometer      -1.560e-06  2.500e-07  -6.239  5.90e-10 ***
```

## Fuel.TypeDiesel	-1.546e-01	3.925e-02	-3.940	8.57e-05	***
## Fuel.TypePetrol	-1.774e-01	3.578e-02	-4.958	8.02e-07	***
## TransmissionManual	-1.510e-01	1.328e-02	-11.366	< 2e-16	***
## LocationAhmedabad	8.582e-02	5.097e-02	1.684	0.092486	.
## LocationAllahabad	-8.659e-02	1.137e-01	-0.762	0.446360	
## LocationAmbala Cantt	-1.065e-01	7.322e-02	-1.454	0.146109	
## LocationAmritsar	1.285e-01	1.024e-01	1.255	0.209680	
## LocationAurangabad	3.084e-01	1.138e-01	2.710	0.006819	**
## LocationBangalore	2.608e-01	4.823e-02	5.408	7.54e-08	***
## LocationBhopal	5.187e-02	1.139e-01	0.455	0.648909	
## LocationBhubaneswar	1.313e-01	1.184e-01	1.108	0.267917	
## LocationBulandshahar	-3.198e-01	1.380e-01	-2.318	0.020614	*
## LocationChandigarh	7.874e-02	6.507e-02	1.210	0.226472	
## LocationChennai	2.464e-01	5.348e-02	4.607	4.48e-06	***
## LocationCoimbatore	3.155e-01	6.230e-02	5.065	4.66e-07	***
## LocationDehradun	7.819e-02	6.119e-02	1.278	0.201545	
## LocationDelhi	9.985e-02	4.621e-02	2.161	0.030895	*
## LocationDharwad	1.891e-01	1.356e-01	1.395	0.163320	
## LocationErnakulam	2.481e-01	1.359e-01	1.825	0.068181	.
## LocationFaridabad	-2.716e-02	5.920e-02	-0.459	0.646431	
## LocationGhaziabad	2.704e-02	1.366e-01	0.198	0.843129	
## LocationGoa	2.665e-01	1.030e-01	2.588	0.009771	**
## LocationGurgaon	4.919e-02	5.891e-02	0.835	0.403872	
## LocationGuwahati	1.792e-01	9.379e-02	1.911	0.056223	.
## LocationHaldwani	5.280e-02	1.359e-01	0.388	0.697782	
## LocationHyderabad	2.073e-01	4.892e-02	4.237	2.42e-05	***
## LocationIndore	2.991e-01	1.014e-01	2.951	0.003221	**
## LocationJaipur	1.483e-01	5.753e-02	2.577	0.010060	*
## LocationJalandhar	1.605e-01	6.068e-02	2.645	0.008259	**
## LocationJamshedpur	6.619e-02	9.381e-02	0.706	0.480561	
## LocationKanpur	-4.922e-02	5.417e-02	-0.909	0.363656	
## LocationKarnal	1.535e-01	7.815e-02	1.964	0.049694	*
## LocationKharar	1.221e-01	1.358e-01	0.899	0.369021	
## LocationKheda	-8.026e-02	1.357e-01	-0.592	0.554196	
## LocationKolkata	-6.067e-02	5.104e-02	-1.189	0.234775	
## LocationKollam	2.606e-01	1.359e-01	1.917	0.055406	.
## LocationKota	2.510e-01	1.479e-01	1.698	0.089818	.
## LocationLucknow	5.772e-02	5.118e-02	1.128	0.259596	
## LocationLudhiana	5.733e-02	5.401e-02	1.061	0.288662	
## LocationMangalore	2.293e-02	1.015e-01	0.226	0.821305	
## LocationMeerut	1.097e-01	7.837e-02	1.400	0.161810	
## LocationMirzapur	1.248e-01	1.475e-01	0.846	0.397805	
## LocationMohali	1.444e-01	5.845e-02	2.471	0.013607	*
## LocationMumbai	1.343e-01	4.608e-02	2.914	0.003622	**
## LocationMuzaffarpur	-4.256e-02	1.357e-01	-0.314	0.753909	
## LocationMysore	3.525e-01	8.216e-02	4.290	1.91e-05	***
## LocationNagpur	2.141e-01	1.138e-01	1.882	0.060072	.
## LocationNashik	8.267e-02	8.196e-02	1.009	0.313302	
## LocationNavi Mumbai	1.257e-01	6.601e-02	1.905	0.057011	.
## LocationNoida	1.377e-01	6.737e-02	2.045	0.041093	*
## LocationPanchkula	-2.845e-02	1.135e-01	-0.251	0.802107	
## LocationPatna	8.508e-02	5.466e-02	1.556	0.119834	
## LocationPune	1.601e-01	4.835e-02	3.312	0.000951	***
## LocationRaipur	1.215e-01	6.354e-02	1.913	0.056013	.

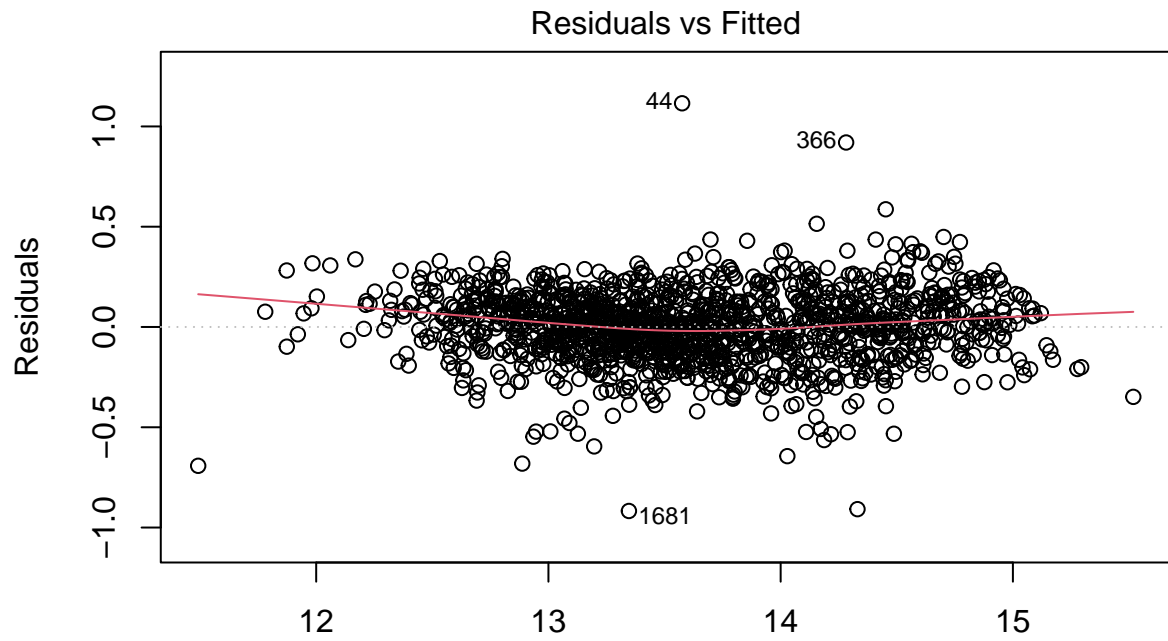
```
## LocationRanchi      -2.487e-02  6.274e-02  -0.396  0.691903
## LocationRanga Reddy -6.185e-03  1.366e-01  -0.045  0.963889
## LocationRoorkee     1.429e-01  1.153e-01   1.239  0.215402
## LocationSalem       4.715e-01  1.357e-01   3.475  0.000527 ***
## LocationSurat       4.199e-02  9.256e-02   0.454  0.650163
## LocationThane       1.338e-01  6.537e-02   2.047  0.040862 *
## LocationUdupi       1.739e-01  7.796e-02   2.231  0.025828 *
## LocationVadodara    -9.672e-03  1.137e-01  -0.085  0.932227
## LocationVaranasi    -3.960e-02  6.365e-02  -0.622  0.533915
## LocationWarangal    -6.094e-02  1.357e-01  -0.449  0.653562
## LocationYamunanagar  4.642e-02  1.145e-01   0.405  0.685259
## LocationZirakpur    -6.192e-03  6.506e-02  -0.095  0.924184
## OwnerSecond         -2.486e-02  1.409e-02  -1.765  0.077820 .
## OwnerThird          -1.277e-01  5.081e-02  -2.513  0.012092 *
## OwnerUnRegistered Car 7.080e-02  9.651e-02   0.734  0.463343
## Max.Torque.RPM      -5.461e-05  7.772e-06  -7.026  3.37e-12 ***
## DrivetrainFWD       -2.495e-01  2.326e-02 -10.724 < 2e-16 ***
## DrivetrainRWD       -1.768e-01  2.778e-02  -6.364  2.70e-10 ***
## Length              5.920e-04  2.591e-05  22.850 < 2e-16 ***
## Width               1.409e-03  1.130e-04  12.474 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1805 on 1339 degrees of freedom
## Multiple R-squared:  0.9376, Adjusted R-squared:  0.9328
## F-statistic: 199 on 101 and 1339 DF, p-value: < 2.2e-16
```

```
anova(reduced_model)
```

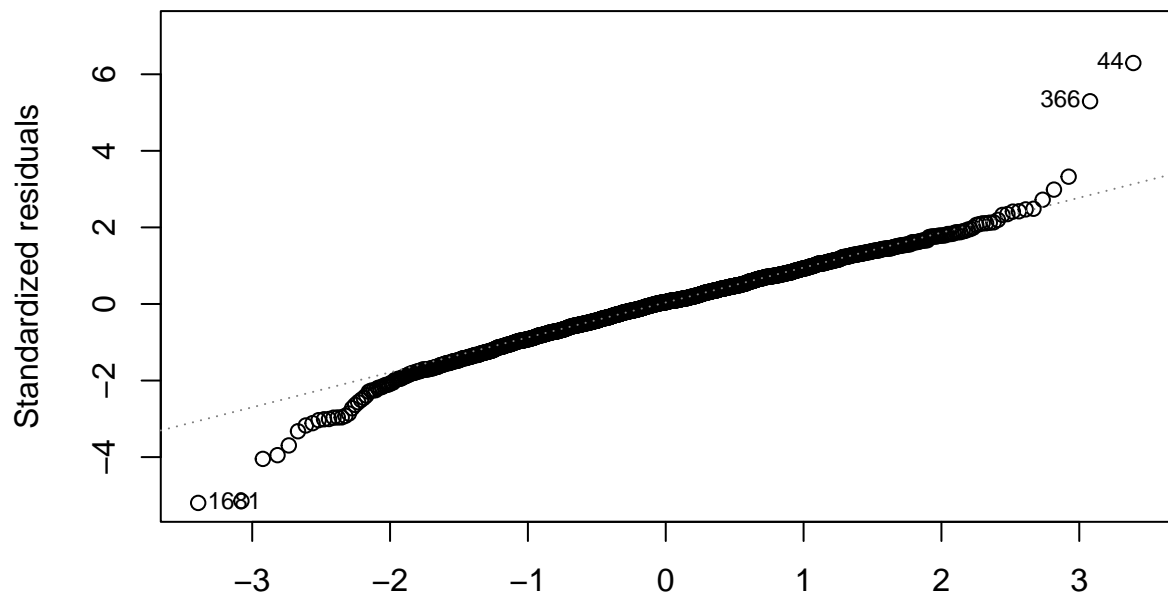
```
## Analysis of Variance Table
##
## Response: log(Price)
##              Df Sum Sq Mean Sq    F value    Pr(>F)
## Make          25 354.44   14.178   434.9783 < 2.2e-16 ***
## Year           1 178.52  178.525  5477.2505 < 2.2e-16 ***
## Kilometer      1   0.98   0.982   30.1137 4.867e-08 ***
## Fuel.Type      2  19.23   9.615  295.0000 < 2.2e-16 ***
## Transmission   1  20.31  20.313  623.2010 < 2.2e-16 ***
## Location       63  16.76   0.266    8.1606 < 2.2e-16 ***
## Owner          3   0.46   0.153    4.7041 0.002846 **
## Max.Torque.RPM 1   1.73   1.728   53.0240 5.602e-13 ***
## Drivetrain      2   5.72   2.859   87.7308 < 2.2e-16 ***
## Length         1  52.04  52.042 1596.6843 < 2.2e-16 ***
## Width          1   5.07   5.072  155.5973 < 2.2e-16 ***
## Residuals     1339  43.64   0.033
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Final Model Verification

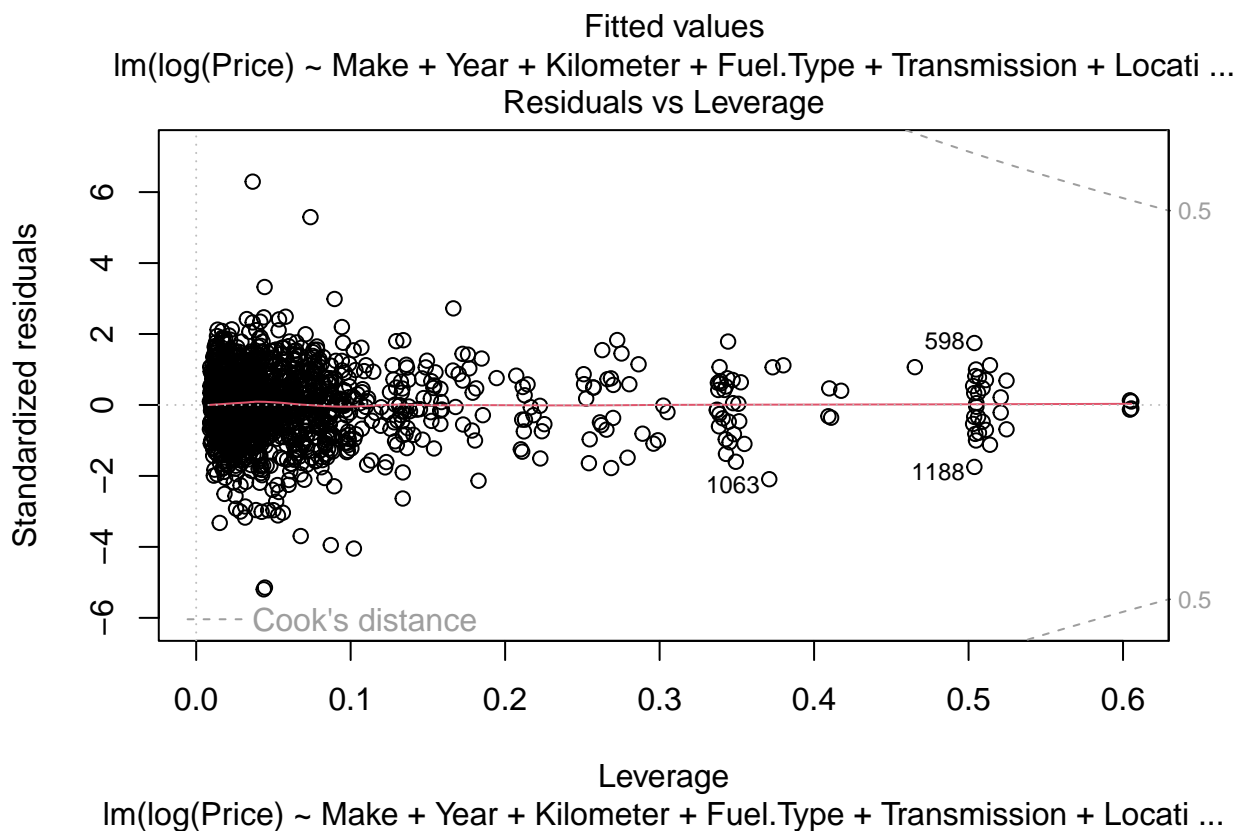
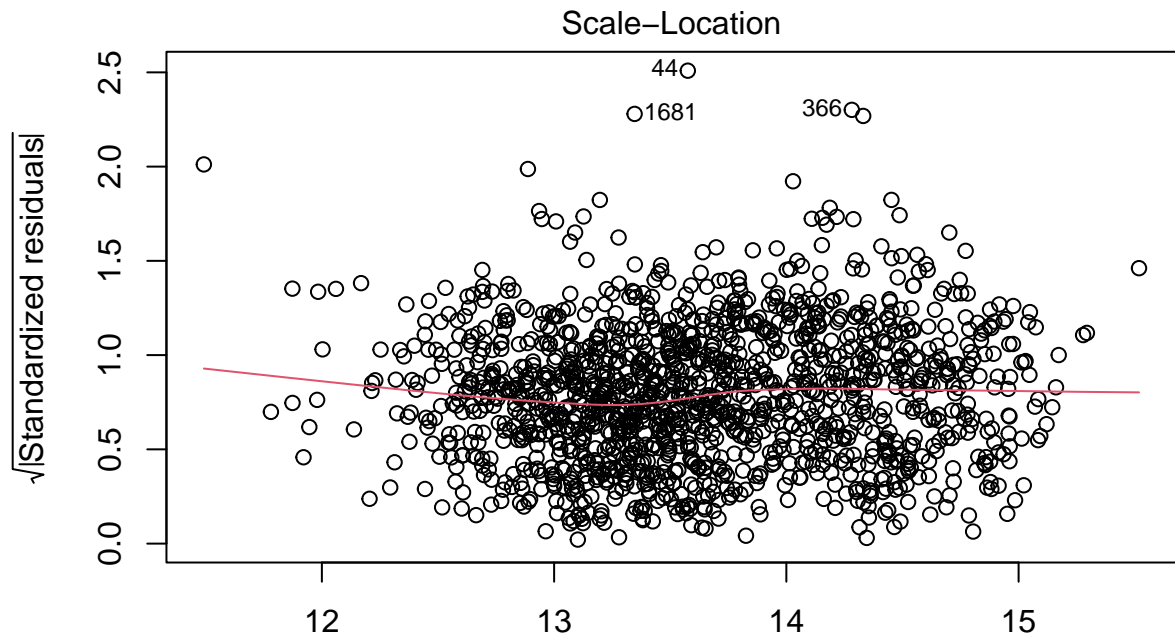
```
plot(reduced_model)
```

Fitted values
 $\text{lm}(\log(\text{Price}) \sim \text{Make} + \text{Year} + \text{Kilometer} + \text{Fuel.Type} + \text{Transmission} + \text{Locati} \dots$
 Q-Q Residuals



Theoretical Quantiles
 $\text{lm}(\log(\text{Price}) \sim \text{Make} + \text{Year} + \text{Kilometer} + \text{Fuel.Type} + \text{Transmission} + \text{Locati} \dots$



Normalized Coefficients

```
# removed by AIC. remember multicollinear columns were already removed
normalized <- remove_cols(x, c("Seating.Capacity", "Seller.Type"))
```

```

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

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

```

```

##
## Call:
## lm(formula = log(Price) ~ ., data = normalized)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.91740 -0.10178  0.00844  0.11055  1.11535
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)    14.422332   0.060388  238.828 < 2e-16 ***
## MakeBMW        -0.016601   0.041955  -0.396 0.692407
## MakeChevrolet  -0.746677   0.095199  -7.843 8.90e-15 ***
## MakeDatsun     -0.874115   0.072625 -12.036 < 2e-16 ***
## MakeFord       -0.564037   0.039415 -14.310 < 2e-16 ***
## MakeHonda      -0.477895   0.031528 -15.158 < 2e-16 ***
## MakeHyundai    -0.454895   0.027996 -16.248 < 2e-16 ***
## MakeIsuzu      -0.385954   0.134153  -2.877 0.004079 **
## MakeJaguar      0.049376   0.080719   0.612 0.540843
## MakeJeep       -0.296413   0.052699  -5.625 2.26e-08 ***
## MakeKia        -0.404354   0.045594  -8.869 < 2e-16 ***
## MakeLand Rover  0.211451   0.108085   1.956 0.050634 .
## MakeMahindra   -0.591598   0.033319 -17.756 < 2e-16 ***
## MakeMaruti Suzuki -0.520639   0.028896 -18.018 < 2e-16 ***
## MakeMercedes-Benz 0.117419   0.034401   3.413 0.000661 ***
## MakeMG         -0.500865   0.056192  -8.913 < 2e-16 ***
## MakeMINI       0.670392   0.078917   8.495 < 2e-16 ***
## MakeMitsubishi -0.283899   0.118073  -2.404 0.016333 *
## MakeNissan     -0.749855   0.054027 -13.879 < 2e-16 ***
## MakeRenault    -0.756789   0.040348 -18.757 < 2e-16 ***
## MakeSkoda      -0.484501   0.039089 -12.395 < 2e-16 ***
## MakeSsangyong  -0.893454   0.118556  -7.536 8.88e-14 ***
## MakeTata       -0.710538   0.038121 -18.639 < 2e-16 ***
## MakeToyota     -0.242339   0.031111  -7.790 1.34e-14 ***
## MakeVolkswagen -0.511094   0.038647 -13.225 < 2e-16 ***
## MakeVolvo      0.022445   0.059024   0.380 0.703809
## Year           0.306014   0.006782  45.121 < 2e-16 ***
## Kilometer     -0.042771   0.006856  -6.239 5.90e-10 ***
## Fuel.TypeDiesel -0.154630   0.039248  -3.940 8.57e-05 ***
## Fuel.TypePetrol -0.177389   0.035777  -4.958 8.02e-07 ***
## TransmissionManual -0.150968   0.013283 -11.366 < 2e-16 ***
## LocationAhmedabad 0.085822   0.050974   1.684 0.092486 .
## LocationAllahabad -0.086593   0.113681  -0.762 0.446360
## LocationAmbala Cantt -0.106483   0.073221  -1.454 0.146109

```

## LocationAmritsar	0.128540	0.102419	1.255	0.209680	
## LocationAurangabad	0.308413	0.113815	2.710	0.006819	**
## LocationBangalore	0.260803	0.048226	5.408	7.54e-08	***
## LocationBhopal	0.051873	0.113911	0.455	0.648909	
## LocationBhubaneswar	0.131256	0.118427	1.108	0.267917	
## LocationBulandshahar	-0.319758	0.137962	-2.318	0.020614	*
## LocationChandigarh	0.078741	0.065072	1.210	0.226472	
## LocationChennai	0.246373	0.053481	4.607	4.48e-06	***
## LocationCoimbatore	0.315540	0.062299	5.065	4.66e-07	***
## LocationDehradun	0.078192	0.061193	1.278	0.201545	
## LocationDelhi	0.099845	0.046210	2.161	0.030895	*
## LocationDharwad	0.189144	0.135611	1.395	0.163320	
## LocationErnakulam	0.248083	0.135915	1.825	0.068181	.
## LocationFaridabad	-0.027163	0.059200	-0.459	0.646431	
## LocationGhaziabad	0.027036	0.136591	0.198	0.843129	
## LocationGoa	0.266482	0.102987	2.588	0.009771	**
## LocationGurgaon	0.049192	0.058914	0.835	0.403872	
## LocationGuwahati	0.179224	0.093788	1.911	0.056223	.
## LocationHaldwani	0.052795	0.135930	0.388	0.697782	
## LocationHyderabad	0.207264	0.048921	4.237	2.42e-05	***
## LocationIndore	0.299107	0.101353	2.951	0.003221	**
## LocationJaipur	0.148287	0.057533	2.577	0.010060	*
## LocationJalandhar	0.160502	0.060676	2.645	0.008259	**
## LocationJamshedpur	0.066195	0.093814	0.706	0.480561	
## LocationKanpur	-0.049221	0.054165	-0.909	0.363656	
## LocationKarnal	0.153506	0.078146	1.964	0.049694	*
## LocationKharar	0.122055	0.135826	0.899	0.369021	
## LocationKheda	-0.080264	0.135664	-0.592	0.554196	
## LocationKolkata	-0.060667	0.051037	-1.189	0.234775	
## LocationKollam	0.260633	0.135934	1.917	0.055406	.
## LocationKota	0.251000	0.147857	1.698	0.089818	.
## LocationLucknow	0.057720	0.051178	1.128	0.259596	
## LocationLudhiana	0.057333	0.054012	1.061	0.288662	
## LocationMangalore	0.022935	0.101521	0.226	0.821305	
## LocationMeerut	0.109703	0.078372	1.400	0.161810	
## LocationMirzapur	0.124799	0.147548	0.846	0.397805	
## LocationMohali	0.144406	0.058447	2.471	0.013607	*
## LocationMumbai	0.134301	0.046081	2.914	0.003622	**
## LocationMuzaffarpur	-0.042562	0.135742	-0.314	0.753909	
## LocationMysore	0.352506	0.082164	4.290	1.91e-05	***
## LocationNagpur	0.214130	0.113787	1.882	0.060072	.
## LocationNashik	0.082674	0.081961	1.009	0.313302	
## LocationNavi Mumbai	0.125732	0.066006	1.905	0.057011	.
## LocationNoida	0.137734	0.067366	2.045	0.041093	*
## LocationPanchkula	-0.028454	0.113509	-0.251	0.802107	
## LocationPatna	0.085080	0.054662	1.556	0.119834	
## LocationPune	0.160145	0.048354	3.312	0.000951	***
## LocationRaipur	0.121517	0.063535	1.913	0.056013	.
## LocationRanchi	-0.024868	0.062742	-0.396	0.691903	
## LocationRanga Reddy	-0.006185	0.136591	-0.045	0.963889	
## LocationRoorkee	0.142886	0.115283	1.239	0.215402	
## LocationSalem	0.471496	0.135674	3.475	0.000527	***
## LocationSurat	0.041990	0.092562	0.454	0.650163	
## LocationThane	0.133810	0.065372	2.047	0.040862	*

```
## LocationUdupi      0.173946    0.077958    2.231 0.025828 *
## LocationVadodara  -0.009672    0.113716   -0.085 0.932227
## LocationVaranasi  -0.039602    0.063648   -0.622 0.533915
## LocationWarangal  -0.060940    0.135748   -0.449 0.653562
## LocationYamunanagar 0.046423    0.114516    0.405 0.685259
## LocationZirakpur  -0.006192    0.065059   -0.095 0.924184
## OwnerSecond       -0.024858    0.014085   -1.765 0.077820 .
## OwnerThird        -0.127686    0.050813   -2.513 0.012092 *
## OwnerUnRegistered Car 0.070799    0.096514    0.734 0.463343
## Max.Torque.RPM    -0.068578    0.009760   -7.026 3.37e-12 ***
## DrivetrainFWD     -0.249485    0.023264  -10.724 < 2e-16 ***
## DrivetrainRWD     -0.176804    0.027783   -6.364 2.70e-10 ***
## Length            0.219144    0.009591   22.850 < 2e-16 ***
## Width             0.126933    0.010176   12.474 < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1805 on 1339 degrees of freedom
## Multiple R-squared:  0.9376, Adjusted R-squared:  0.9328
## F-statistic: 199 on 101 and 1339 DF, p-value: < 2.2e-16
```

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

```
##      (Intercept)      MakeSsangyong      MakeDatsun
## 14.422331946      0.893453664      0.874115097
##      MakeRenault      MakeNissan      MakeChevrolet
## 0.756789092      0.749854698      0.746676928
##      MakeTata      MakeMINI      MakeMahindra
## 0.710537806      0.670391812      0.591598387
##      MakeFord      MakeMaruti Suzuki      MakeVolkswagen
## 0.564036870      0.520639151      0.511094260
##      MakeMG      MakeSkoda      MakeHonda
## 0.500864834      0.484500740      0.477895200
##      LocationSalem      MakeHyundai      MakeKia
## 0.471496194      0.454895198      0.404353786
##      MakeIsuzu      LocationMysore      LocationBulandshahar
## 0.385954057      0.352505512      0.319757692
##      LocationCoimbatore      LocationAurangabad      Year
## 0.315539550      0.308413454      0.306013924
##      LocationIndore      MakeJeep      MakeMitsubishi
## 0.299106588      0.296413110      0.283899084
##      LocationGoa      LocationBangalore      LocationKollam
## 0.266481566      0.260802811      0.260632558
##      LocationKota      DrivetrainFWD      LocationErnakulam
## 0.250999983      0.249485231      0.248083073
##      LocationChennai      MakeToyota      Length
## 0.246373288      0.242338666      0.219144442
##      LocationNagpur      MakeLand Rover      LocationHyderabad
## 0.214130235      0.211450534      0.207263541
##      LocationDharwad      LocationGuwahati      Fuel.TypePetrol
## 0.189144181      0.179224464      0.177389427
##      DrivetrainRWD      LocationUdupi      LocationJalandhar
## 0.176803732      0.173945856      0.160501623
##      LocationPune      Fuel.TypeDiesel      LocationKarnal
## 0.160144711      0.154629693      0.153506476
```

##	TransmissionManual	LocationJaipur	LocationMohali
##	0.150968369	0.148286950	0.144405729
##	LocationRoorkee	LocationNoida	LocationMumbai
##	0.142885962	0.137733928	0.134301360
##	LocationThane	LocationBhubaneswar	LocationAmritsar
##	0.133809767	0.131256447	0.128540324
##	OwnerThird	Width	LocationNavi Mumbai
##	0.127686100	0.126932796	0.125731737
##	LocationMirzapur	LocationKharar	LocationRaipur
##	0.124798985	0.122054786	0.121516753
##	MakeMercedes-Benz	LocationMeerut	LocationAmbala Cantt
##	0.117419177	0.109703201	0.106483066
##	LocationDelhi	LocationAllahabad	LocationAhmedabad
##	0.099845145	0.086593412	0.085822163
##	LocationPatna	LocationNashik	LocationKheda
##	0.085079768	0.082673606	0.080263531
##	LocationChandigarh	LocationDehradun	OwnerUnRegistered Car
##	0.078740658	0.078191997	0.070799473
##	Max.Torque.RPM	LocationJamshedpur	LocationWarangal
##	0.068578366	0.066194955	0.060940065
##	LocationKolkata	LocationLucknow	LocationLudhiana
##	0.060667188	0.057719836	0.057332548
##	LocationHaldwani	LocationBhopal	MakeJaguar
##	0.052795127	0.051872816	0.049375705
##	LocationKanpur	LocationGurgaon	LocationYamunanagar
##	0.049221414	0.049192336	0.046423248
##	Kilometer	LocationMuzaffarpur	LocationSurat
##	0.042771369	0.042562283	0.041989614
##	LocationVaranasi	LocationPanchkula	LocationFaridabad
##	0.039601642	0.028453531	0.027162838
##	LocationGhaziabad	LocationRanchi	OwnerSecond
##	0.027035620	0.024868360	0.024858313
##	LocationMangalore	MakeVolvo	MakeBMW
##	0.022934701	0.022444651	0.016600527
##	LocationVadodara	LocationZirakpur	LocationRanga Reddy
##	0.009672493	0.006192437	0.006185187

Confidence Intervals

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

##	2.5 %	97.5 %
## (Intercept)	14.3038664591	14.540797432
## MakeBMW	-0.0989050089	0.065703955
## MakeChevrolet	-0.9334319075	-0.559921949
## MakeDatsun	-1.0165857117	-0.731644482
## MakeFord	-0.6413594359	-0.486714304
## MakeHonda	-0.5397452260	-0.416045174
## MakeHyundai	-0.5098166170	-0.399973779
## MakeIsuzu	-0.6491274129	-0.122780700
## MakeJaguar	-0.1089744767	0.207725886
## MakeJeep	-0.3997952587	-0.193030962
## MakeKia	-0.4937976970	-0.314909875
## MakeLand Rover	-0.0005847891	0.423485857

## MakeMahindra	-0.6569610320	-0.526235742
## MakeMaruti Suzuki	-0.5773248249	-0.463953477
## MakeMercedes-Benz	0.0499337444	0.184904610
## MakeMG	-0.6110996657	-0.390630002
## MakeMINI	0.5155774884	0.825206135
## MakeMitsubishi	-0.5155274044	-0.052270763
## MakeNissan	-0.8558412951	-0.643868101
## MakeRenault	-0.8359403158	-0.677637869
## MakeSkoda	-0.5611839740	-0.407817506
## MakeSsangyong	-1.1260286730	-0.660878656
## MakeTata	-0.7853213482	-0.635754265
## MakeToyota	-0.3033695542	-0.181307777
## MakeVolkswagen	-0.5869089914	-0.435279529
## MakeVolvo	-0.0933442808	0.138233582
## Year	0.2927091359	0.319318712
## Kilometer	-0.0562202401	-0.029322497
## Fuel.TypeDiesel	-0.2316232344	-0.077636151
## Fuel.TypePetrol	-0.2475740207	-0.107204834
## TransmissionManual	-0.1770261858	-0.124910552
## LocationAhmedabad	-0.0141762430	0.185820568
## LocationAllahabad	-0.3096058719	0.136419048
## LocationAmbala Cantt	-0.2501244017	0.037158269
## LocationAmritsar	-0.0723779735	0.329458622
## LocationAurangabad	0.0851381651	0.531688742
## LocationBangalore	0.1661970450	0.355408576
## LocationBhopal	-0.1715900927	0.275335725
## LocationBhubaneswar	-0.1010662222	0.363579116
## LocationBulandshahar	-0.5904025404	-0.049112843
## LocationChandigarh	-0.0489136950	0.206395011
## LocationChennai	0.1414583830	0.351288193
## LocationCoimbatore	0.1933252628	0.437753837
## LocationDehradun	-0.0418527848	0.198236779
## LocationDelhi	0.0091940576	0.190496233
## LocationDharwad	-0.0768884688	0.455176830
## LocationErnakulam	-0.0185463989	0.514712545
## LocationFaridabad	-0.1432983850	0.088972709
## LocationGhaziabad	-0.2409200881	0.294991327
## LocationGoa	0.0644483616	0.468514770
## LocationGurgaon	-0.0663808553	0.164765526
## LocationGuwahati	-0.0047622119	0.363211140
## LocationHaldwani	-0.2138638451	0.319454099
## LocationHyderabad	0.1112933590	0.303233723
## LocationIndore	0.1002785380	0.497934638
## LocationJaipur	0.0354227838	0.261151116
## LocationJalandhar	0.0414719616	0.279531285
## LocationJamshedpur	-0.1178433022	0.250233212
## LocationKanpur	-0.1554789127	0.057036084
## LocationKarnal	0.0002054821	0.306807469
## LocationKharar	-0.1444002122	0.388509784
## LocationKheda	-0.3464013050	0.185874243
## LocationKolkata	-0.1607889102	0.039454535
## LocationKollam	-0.0060337456	0.527298862
## LocationKota	-0.0390562443	0.541056210
## LocationLucknow	-0.0426778870	0.158117559

## LocationLudhiana	-0.0486243100	0.163289405
## LocationMangalore	-0.1762230203	0.222092423
## LocationMeerut	-0.0440413925	0.263447794
## LocationMirzapur	-0.1646516418	0.414249611
## LocationMohali	0.0297489744	0.259062484
## LocationMumbai	0.0439023896	0.224700330
## LocationMuzaffarpur	-0.3088522878	0.223727721
## LocationMysore	0.1913213158	0.513689708
## LocationNagpur	-0.0090891776	0.437349647
## LocationNashik	-0.0781116976	0.243458909
## LocationNavi Mumbai	-0.0037537149	0.255217188
## LocationNoida	0.0055798981	0.269887958
## LocationPanchkula	-0.2511293160	0.194222254
## LocationPatna	-0.0221530957	0.192312632
## LocationPune	0.0652873913	0.255002031
## LocationRaipur	-0.0031223758	0.246155881
## LocationRanchi	-0.1479514703	0.098214750
## LocationRanga Reddy	-0.2741409727	0.261770598
## LocationRoorkee	-0.0832693365	0.369041261
## LocationSalem	0.2053403067	0.737652082
## LocationSurat	-0.1395924151	0.223571643
## LocationThane	0.0055674564	0.262052078
## LocationUdupi	0.0210126407	0.326879071
## LocationVadodara	-0.2327525081	0.213407523
## LocationVaranasi	-0.1644614719	0.085258188
## LocationWarangal	-0.3272419631	0.205361833
## LocationYamunanagar	-0.1782273606	0.271073856
## LocationZirakpur	-0.1338208025	0.121435928
## OwnerSecond	-0.0524900682	0.002773443
## OwnerThird	-0.2273674872	-0.028004712
## OwnerUnRegistered Car	-0.1185366050	0.260135551
## Max.Torque.RPM	-0.0877255064	-0.049431226
## DrivetrainFWD	-0.2951221867	-0.203848275
## DrivetrainRWD	-0.2313068974	-0.122300567
## Length	0.2003303851	0.237958499
## Width	0.1069703536	0.146895238