Car Price Estimating Model

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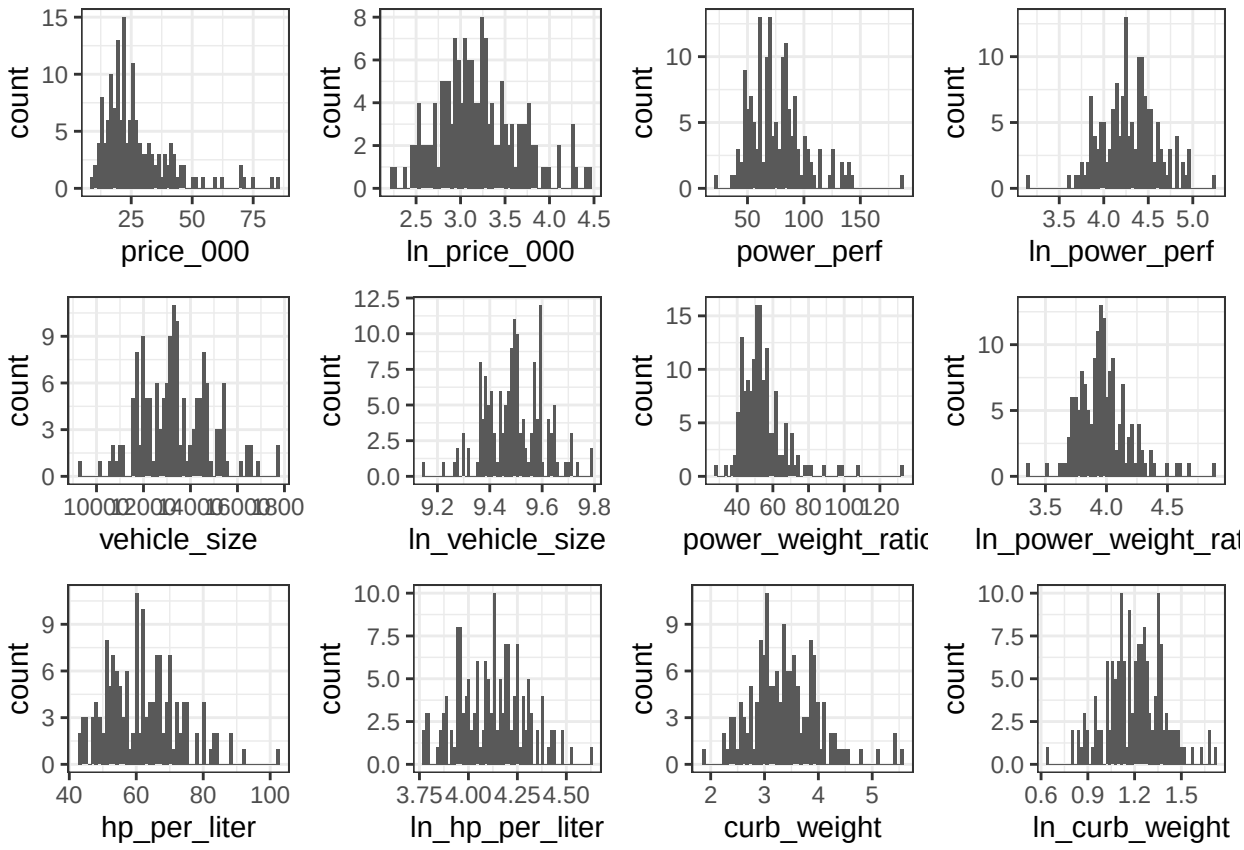
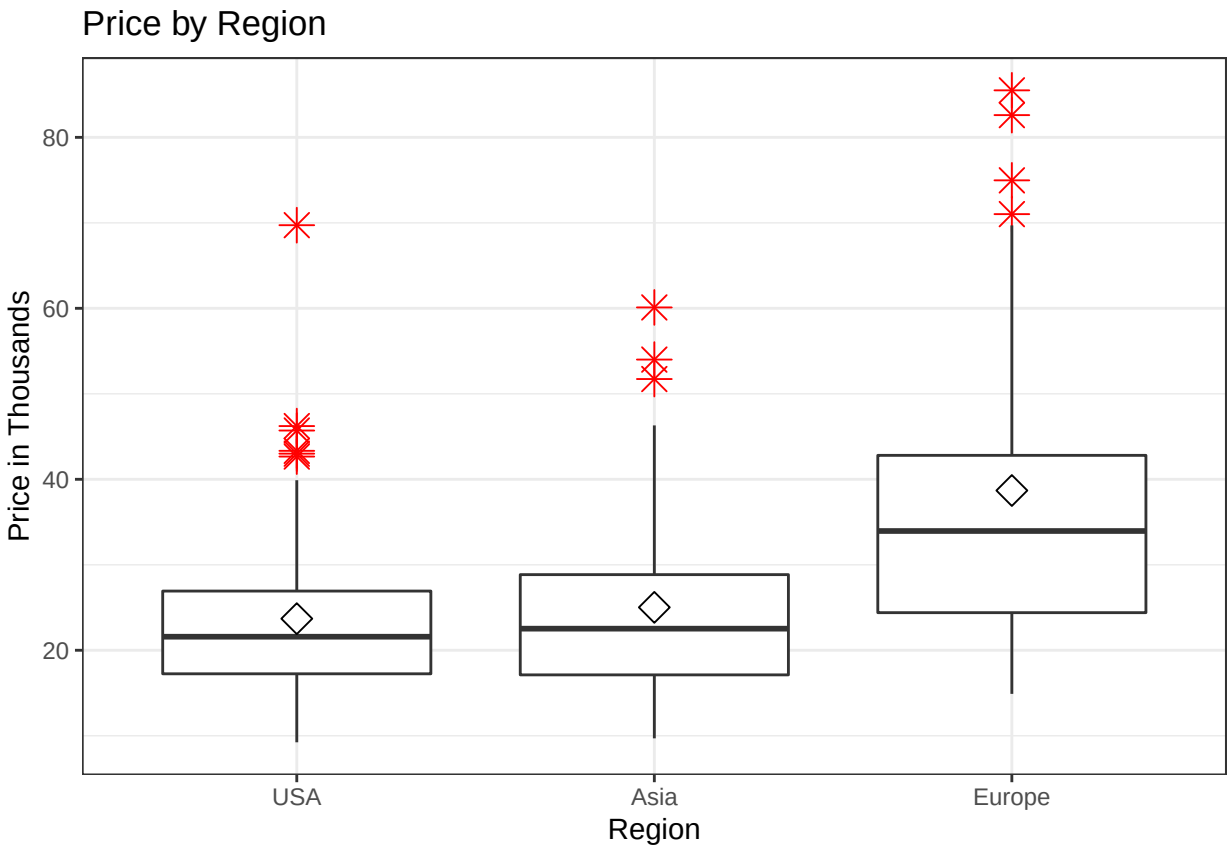

count
price_000
ln_price_000
power_perf
ln_power_perf
vehicle_size
ln_vehicle_size
power_weight_ratio
ln_power_weight_rat
hp_per_liter
ln_hp_per_liter
curb_weight
ln_curb_weight


Price by Region
Price in Thousands
80
60
40
20
USA
Asia
Europe
Region

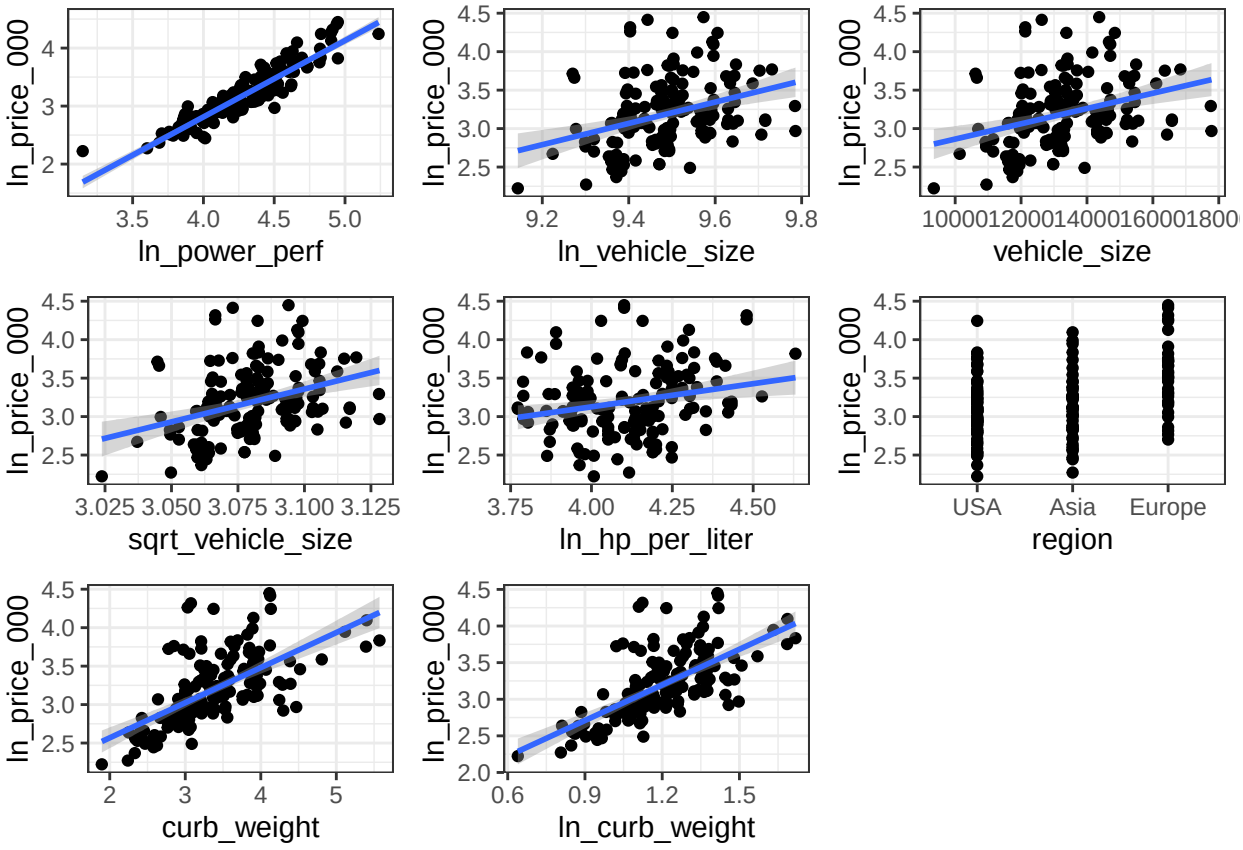
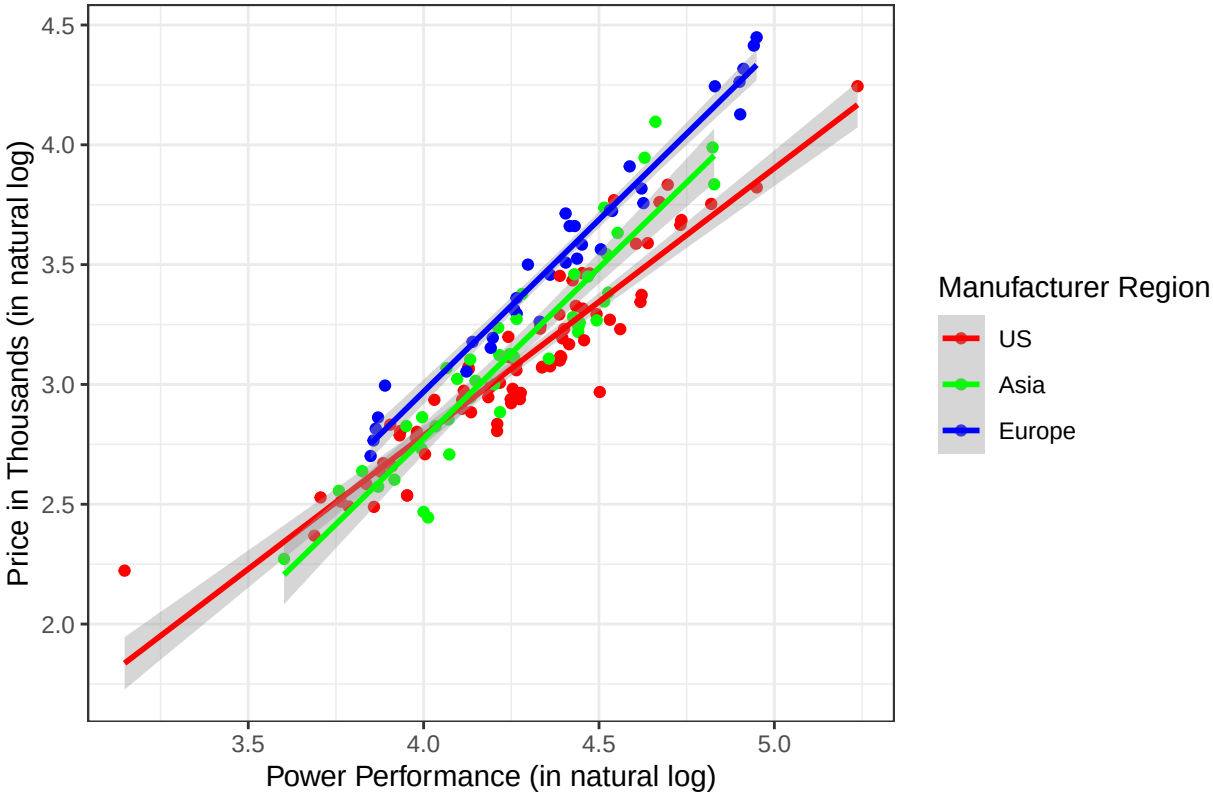
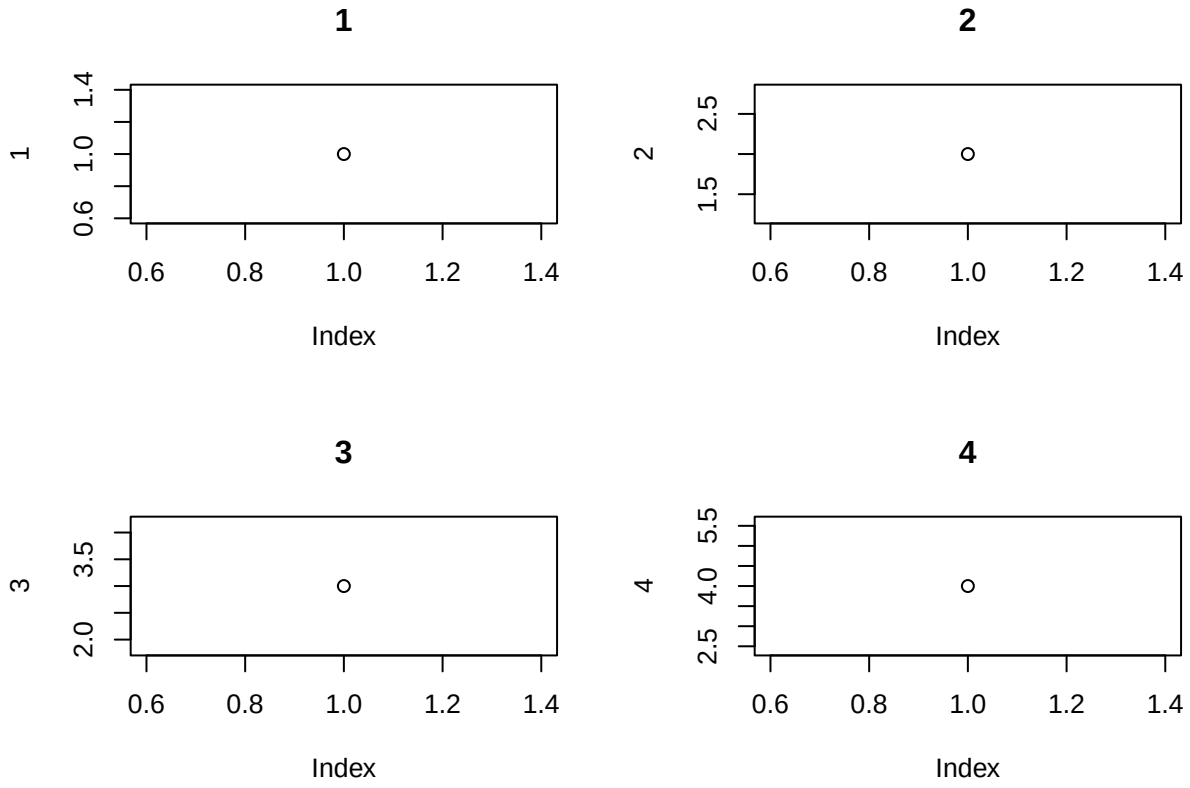

ln_price_000
ln_power_perf
ln_vehicle_size
vehicle_size
sqrt_vehicle_size
ln_hp_per_liter
region
USA
Asia
Europe
curb_weight
ln_curb_weight

Figure 3: Car Price and Power Performance Plot by Manufacturer Region




```
## Proposed Second Model
layout(matrix(c(1, 2, 3, 4), nrow = 2, ncol = 2, byrow = TRUE))
plot(1, main = 1)
plot(2, main = 2)
plot(3, main = 3)
plot(4, main = 4)
```




```
car_base_size <- car_sales %>% lm(ln_price_000 ~ ln_power_perf + region, data = .)
car_base_size_se <- car_base_size %>%
  vcovHC(type = "HC1") %>%
  diag() %>%
  sqrt()
stargazer(car_base_size, type = "text", se = list(car_base_size_se))
```

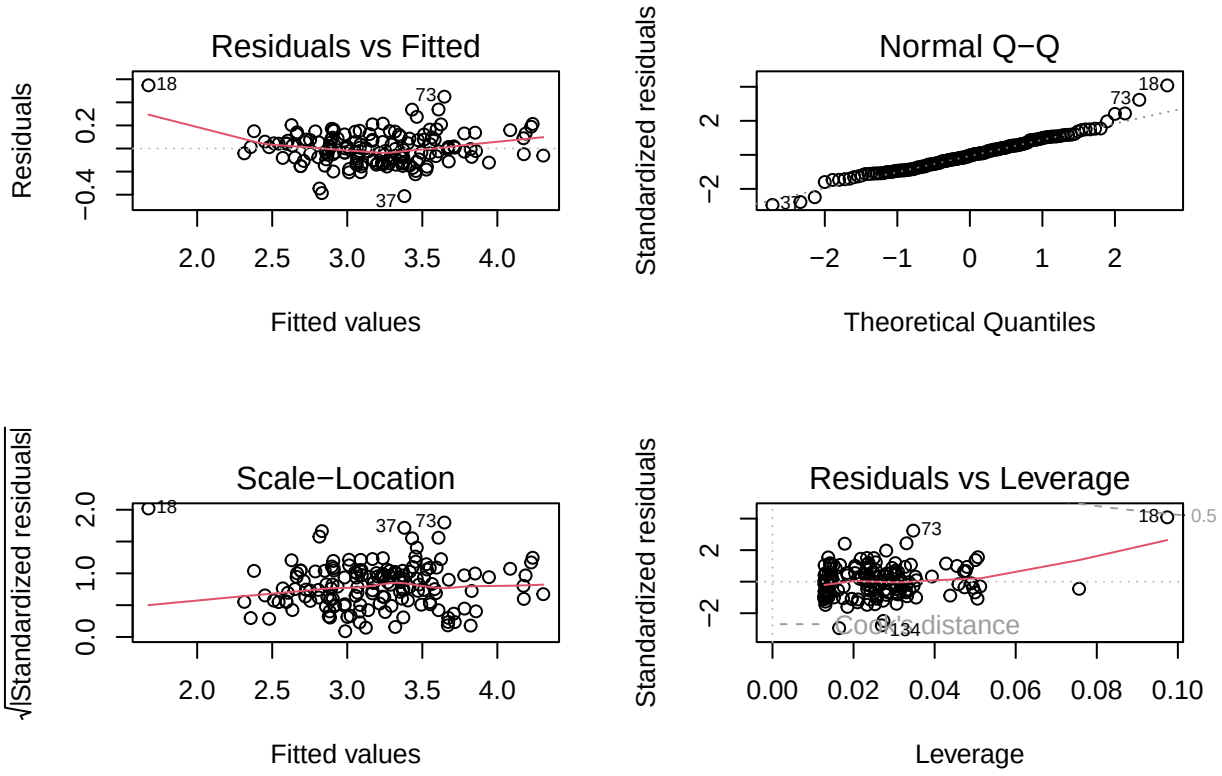
```
##
## ================================================
##                          Dependent variable:
##                      ---------------------------
##                              ln_price_000
## ------------------------------------------------
## ln_power_perf                 1.259***
##                                (0.053)
##
## regionAsia                     0.066**
##                                (0.030)
##
## regionEurope                  0.291***
##                                (0.024)
##
## Constant                      -2.286***
##                                (0.232)
##
## ------------------------------------------------
```

```
## Observations                    154
## R2                             0.905
## Adjusted R2                    0.904
## Residual Std. Error      0.141 (df = 150)
## F Statistic          478.810*** (df = 3; 150)
## ================================================
## Note:                *p<0.1; **p<0.05; ***p<0.01
```

```
coeftest(car_base_size, vconv = vcovHC(type = "HC1"))
```

```
##
## t test of coefficients:
##
##                Estimate Std. Error  t value Pr(>|t|)
## (Intercept)   -2.286406   0.157076 -14.5560  < 2e-16 ***
## ln_power_perf  1.258761   0.036596  34.3960  < 2e-16 ***
## regionAsia     0.066217   0.026841   2.4670  0.01475 *
## regionEurope   0.291465   0.029708   9.8111  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
plot(car_base_size)
```




```
lmtest::bptest(car_base_size)
```

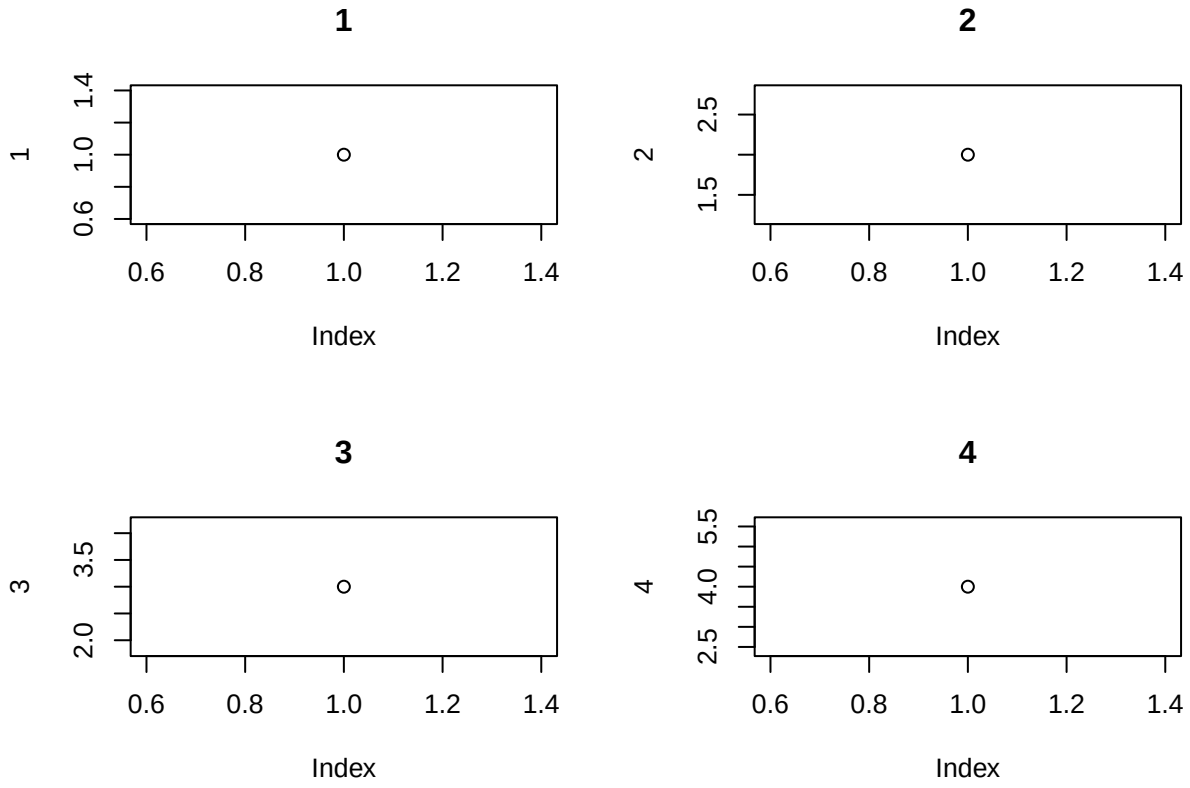
```
##
##  studentized Breusch-Pagan test
##
```

```
## data:  car_base_size
## BP = 3.4195, df = 3, p-value = 0.3314
```

```
ols_vif_tol(car_base_size)
```

```
##       Variables Tolerance      VIF
## 1 ln_power_perf 0.9677470 1.033328
## 2    regionAsia 0.8935386 1.119146
## 3  regionEurope 0.8718906 1.146933
```

```
## Proposed Third Model (Ed)
layout(matrix(c(1, 2, 3, 4), nrow = 2, ncol = 2, byrow = TRUE))
plot(1, main = 1)
plot(2, main = 2)
plot(3, main = 3)
plot(4, main = 4)
```




```
car_size_tier <- car_sales %>% lm(ln_price_000 ~ ln_power_perf + region + curb_weight, data = .)
car_size_tier_se <- car_size_tier %>%
  vcovHC(type = "HC1") %>%
  diag() %>%
  sqrt()
stargazer(car_size_tier, type = "text", se = list(car_size_tier_se))
```

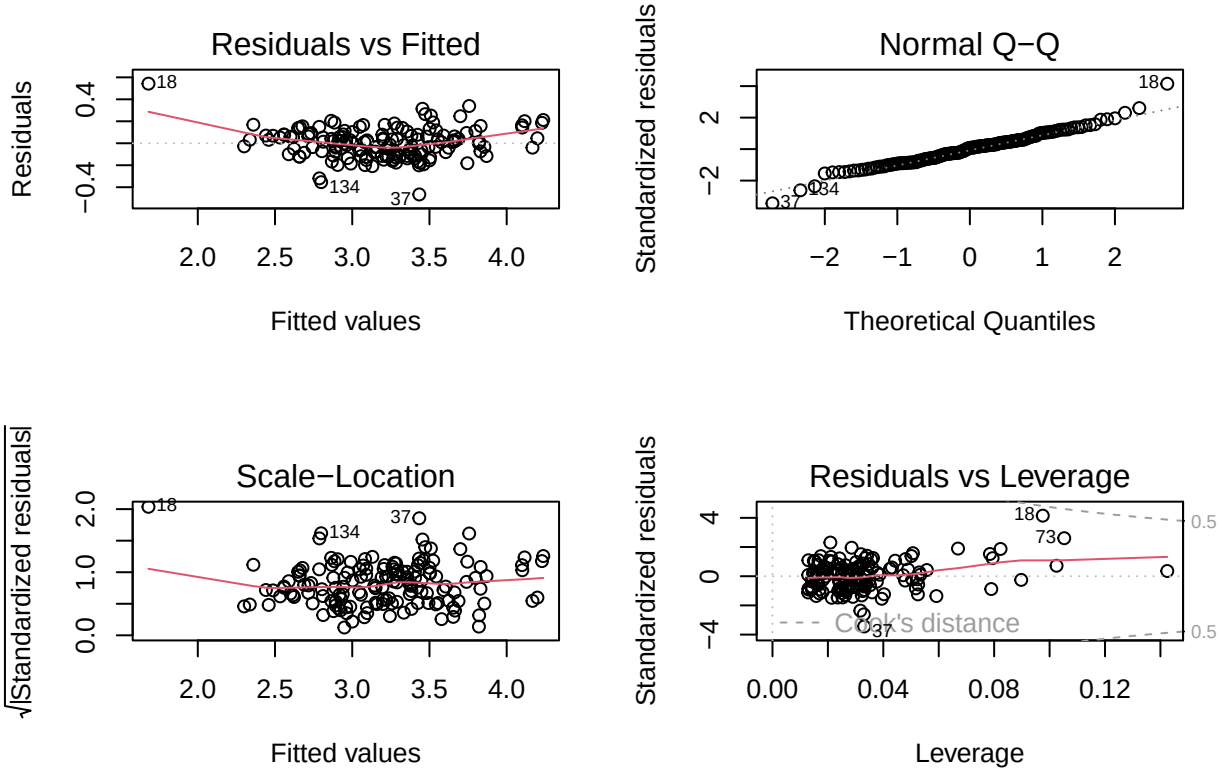
```
##
## ===============================================
##                         Dependent variable:
##                     ---------------------------
```

```
##                            ln_price_000
## ------------------------------------------------
## ln_power_perf                1.152***
##                               (0.064)
##
## regionAsia                    0.070**
##                               (0.028)
##
## regionEurope                 0.314***
##                               (0.025)
##
## curb_weight                   0.075**
##                               (0.032)
##
## Constant                     -2.087***
##                               (0.233)
##
## ------------------------------------------------
## Observations                    154
## R2                             0.911
## Adjusted R2                    0.908
## Residual Std. Error      0.138 (df = 149)
## F Statistic          380.641*** (df = 4; 149)
## ================================================
## Note:               *p<0.1; **p<0.05; ***p<0.01
```

```
coeftest(car_size_tier, vconv = vcovHC(type = "HC1"))
```

```
##
## t test of coefficients:
##
##                Estimate Std. Error  t value  Pr(>|t|)
## (Intercept)   -2.087245   0.166731 -12.5186 < 2.2e-16 ***
## ln_power_perf  1.152046   0.050294  22.9063 < 2.2e-16 ***
## regionAsia     0.070018   0.026179   2.6746  0.008318 **
## regionEurope   0.313977   0.029893  10.5033 < 2.2e-16 ***
## curb_weight    0.074878   0.024891   3.0083  0.003085 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
plot(car_size_tier)
```




```
lmtest::bptest(car_size_tier)
```

```
##
##  studentized Breusch-Pagan test
##
## data:  car_size_tier
## BP = 4.3924, df = 4, p-value = 0.3555
```

```
ols_vif_tol(car_size_tier)
```

```
##       Variables Tolerance      VIF
## 1 ln_power_perf 0.4862968 2.056357
## 2    regionAsia 0.8914574 1.121759
## 3  regionEurope 0.8172513 1.223614
## 4   curb_weight 0.4993138 2.002749
```

Estimated Car Price Linear Regression Models

	Output Variable: Price in Thousands of Dollars (in natural l		
	(1)	(2)	(3)
Power Performance Ratio (in natural log)	1.318***	1.259***	1.152***
	(0.062)	(0.053)	(0.064)
Asia	0.066*	0.070*	
	(0.030)	(0.028)	
Europe	0.291***	0.314***	
	(0.024)	(0.025)	

Weight	0.075*	(0.032)	
Constant	-2.458***	-2.286***	-2.087***
	(0.262)	(0.232)	(0.233)
Observations	154	154	154
R2	0.844	0.905	0.911
Adjusted R2	0.843	0.904	0.908
Residual Std. Error	0.180 (df = 152)	0.141 (df = 150)	0.138 (df = 149)
F Statistic	825.440*** (df = 1; 152)	478.810*** (df = 3; 150)	380.641*** (df = 4; 149)

Note: *p<0.05;* ***p<0.01;*** p<0.001
HCrobust standard errors in parentheses. American Vehicles are the base Tier