

Machine vs Man: An analysis of Formula One Cars and Drivers

By Cooper Hepworth



M. Andretti Lotus 78 (Japan 1976) Photographer — Unknown

Research Question: *Is the performance of a Formula One car, concerning time behind the leader, impacted more by the driver's skill or the constructor's design?*

Null Hypothesis: *The car's impact is more significant than the driver's on determining the time behind the lead racer.*

Data Source: Ergast Developer API <https://ergast.com/mrd/db/#csv>

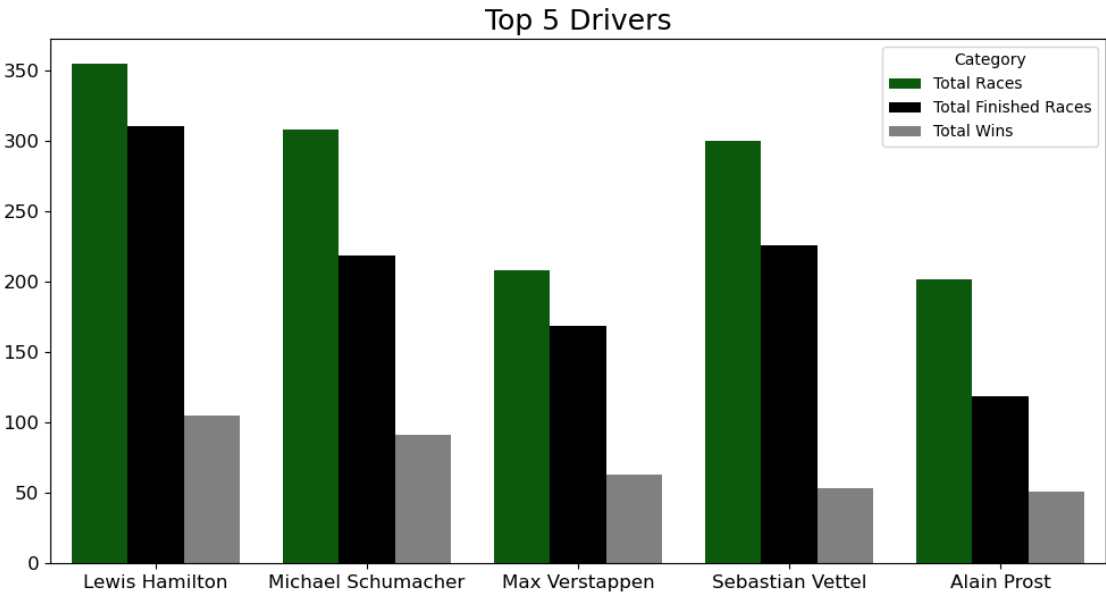
The Data

Total Observations

Group	Unique Count
Drivers	331
Constructors	96
Races	1124

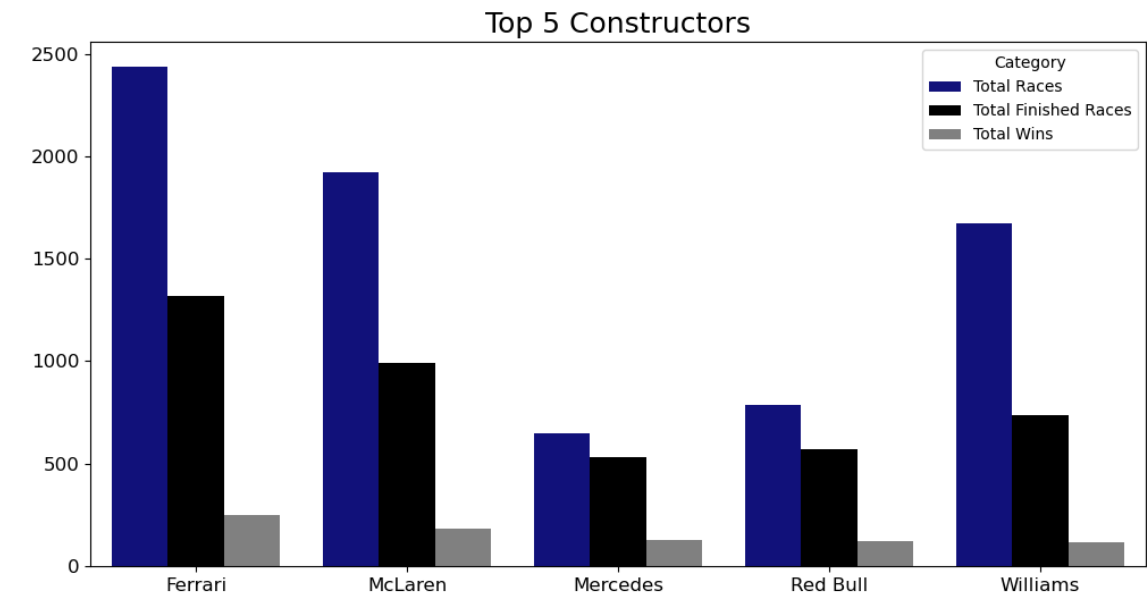
Group	Unique Count
Years	75

Top 5 Drivers



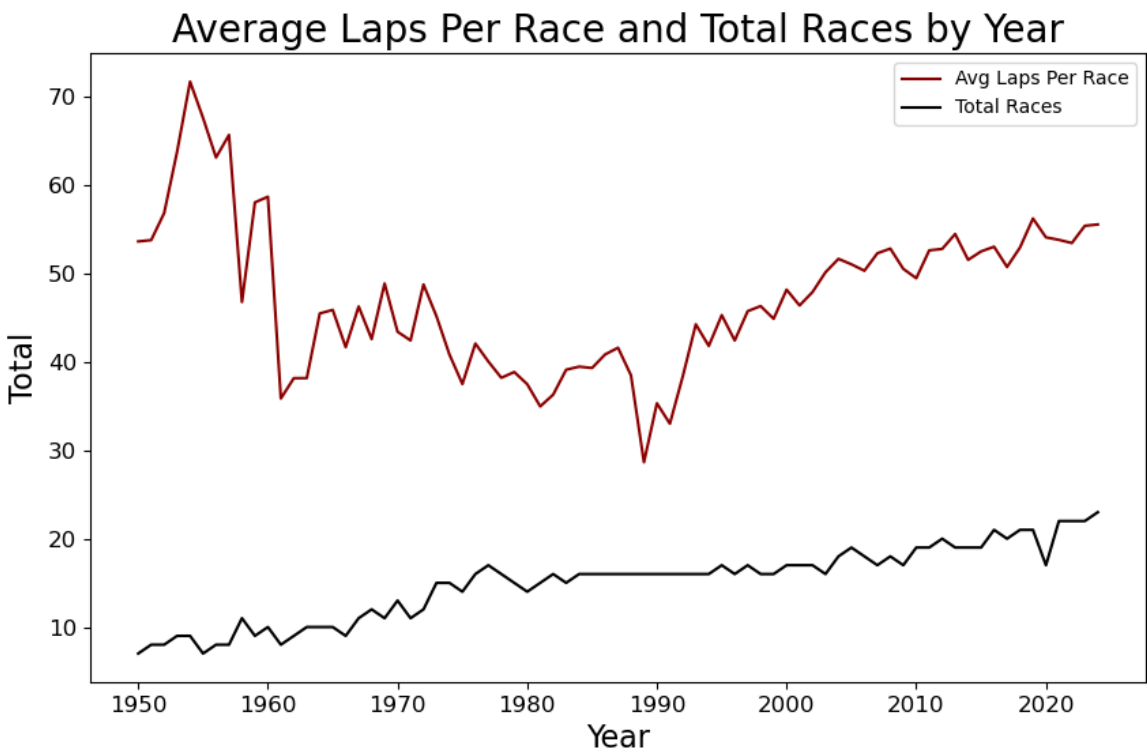
Driver Name	Total Races	Total Finished Races	Total Wins
Lewis Hamilton	355	311	105
Michael Schumacher	308	219	91
Max Verstappen	208	169	63
Sebastian Vettel	300	226	53
Alain Prost	202	119	51

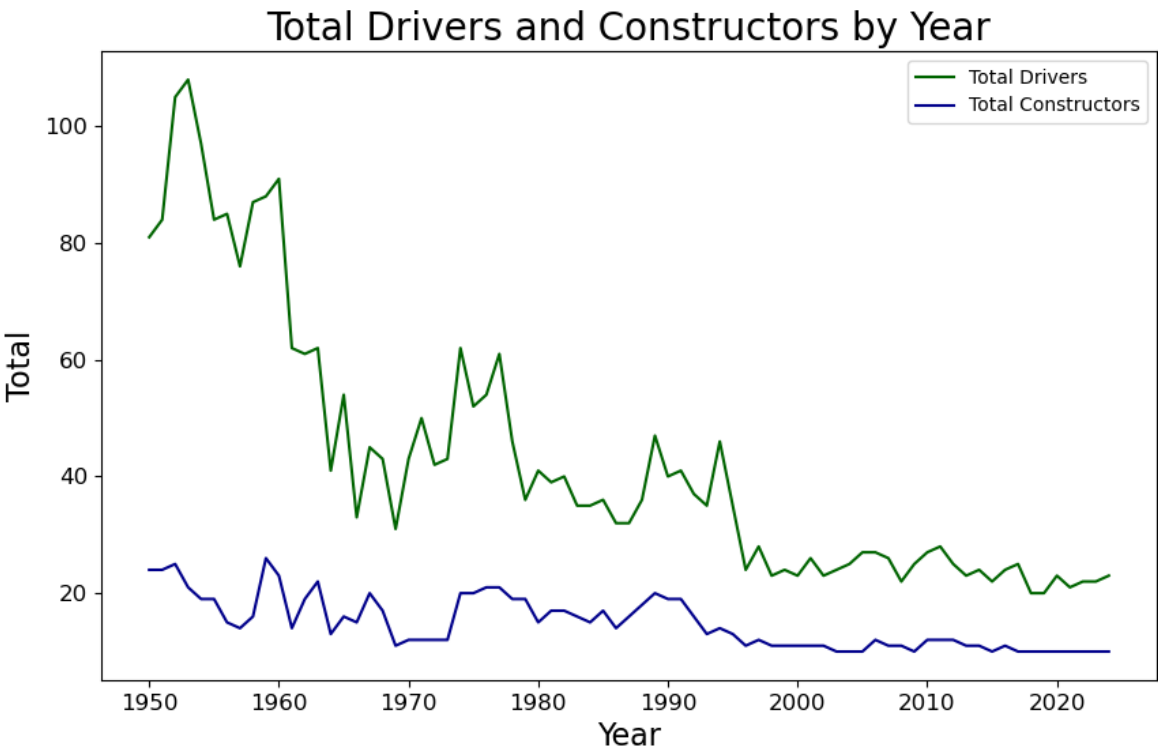
Top 5 Constructors



Constructor Name	Total Races	Total Finished Races	Total Wins
Ferrari	2437	1319	249
McLaren	1921	989	184
Mercedes	650	533	129
Red Bull	786	568	122
Williams	1674	734	114

Yearly Data

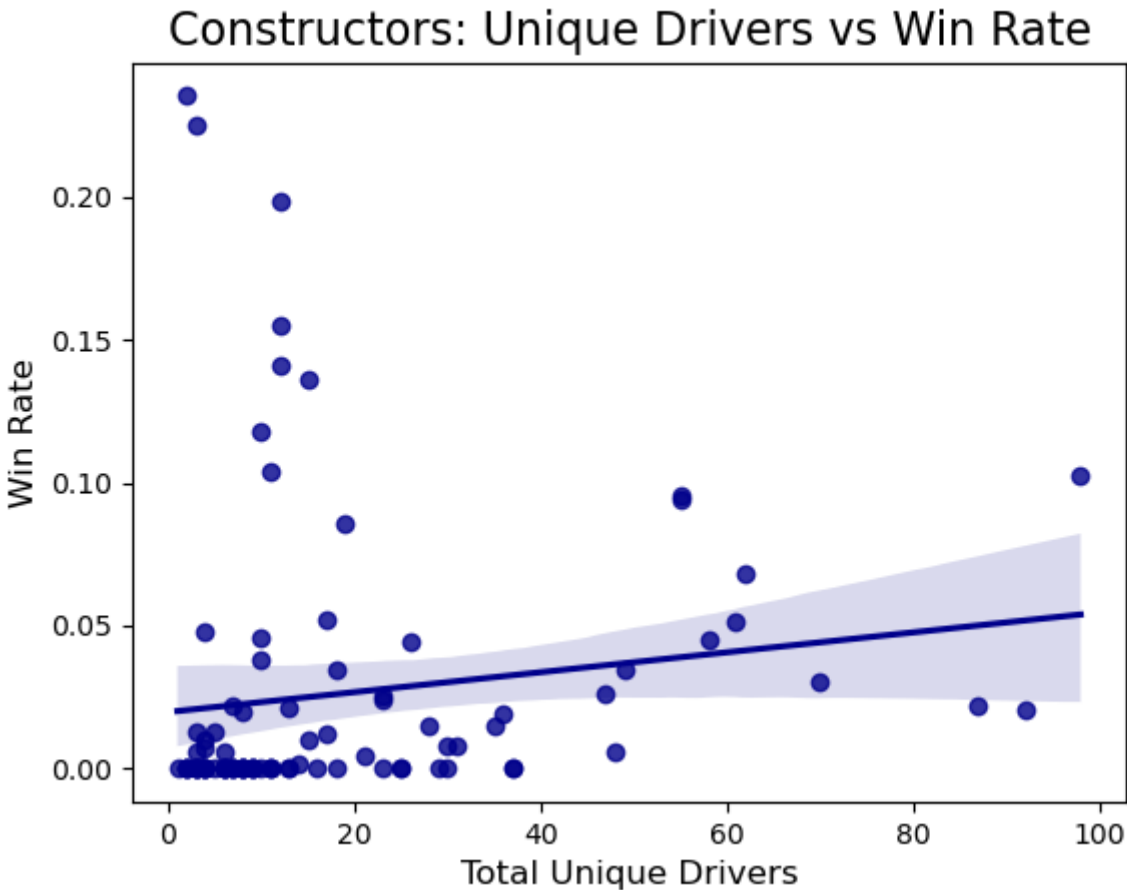
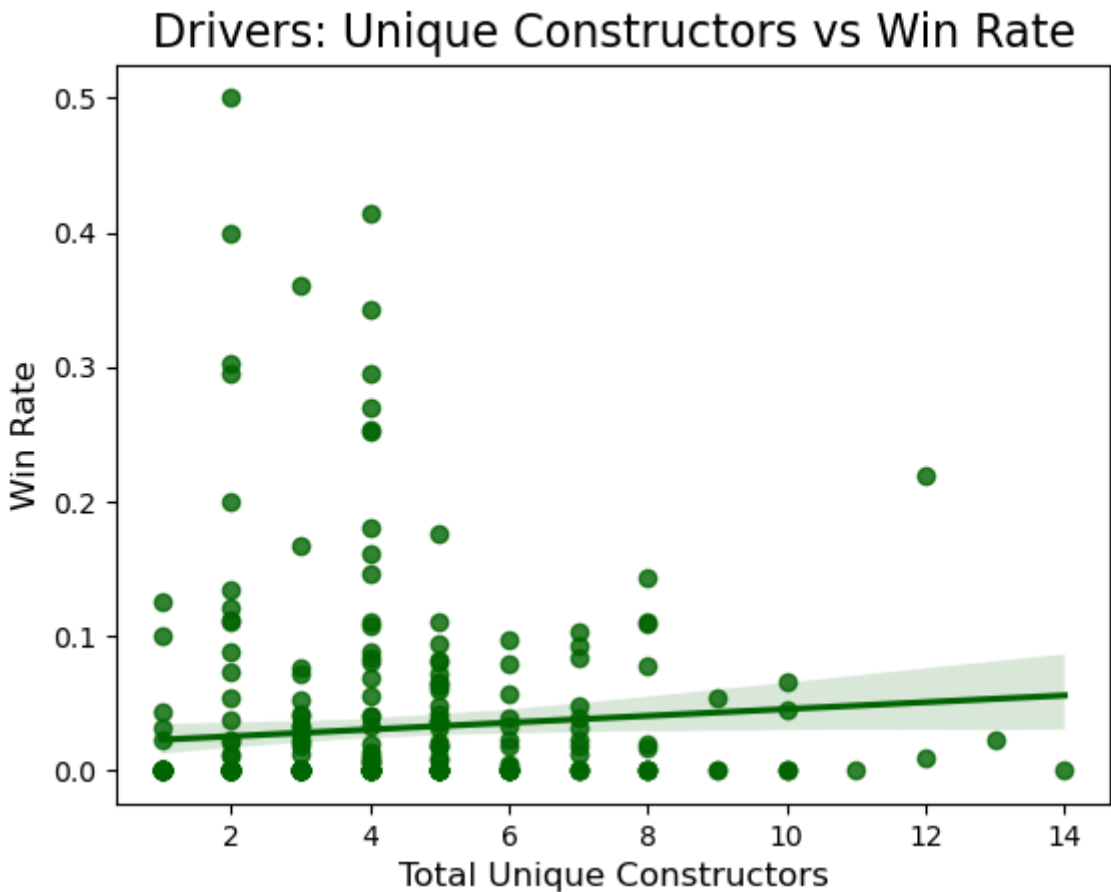




Unique Combination Data

The average driver had X unique constructors.

The average constructor had X unique drivers.

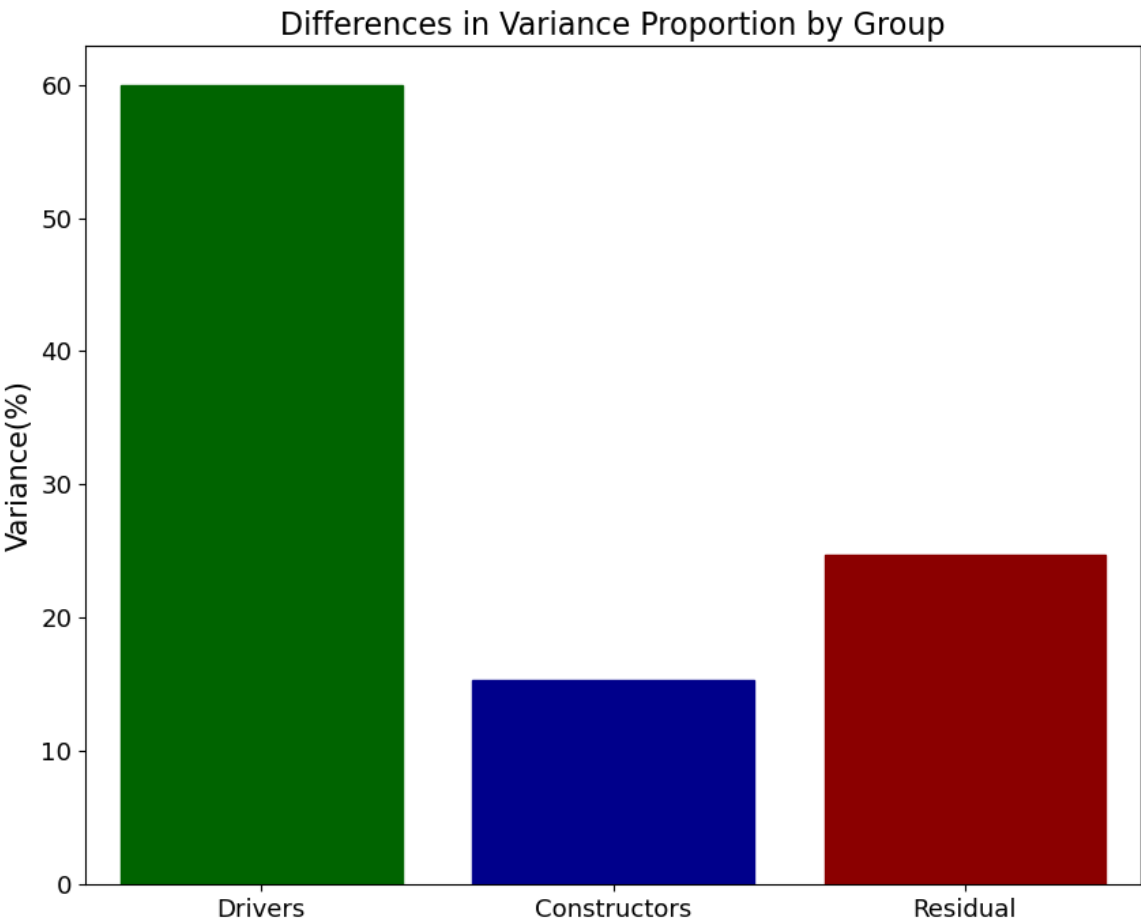


R code to generate mixed effects model

```
tbl_model_combined <- lmer(tbl ~ 1 + (1 | constructorId) + (1 | driverId), data =  
f1data)
```

```
Linear mixed model fit by REML ['lmerMod']  
Formula: tbl ~ 1 + (1 | Constructor) + (1 | Driver)  
Data: f1data  
  
REML criterion at convergence: 194063.5  
  
Scaled residuals:  
    Min      1Q  Median      3Q     Max  
-5.906 -0.324 -0.084  0.259 66.955  
  
Random effects:  
Groups      Name      Variance Std.Dev.  
Driver      (Intercept) 1.190e+10 109107  
Constructor (Intercept) 3.042e+09  55157  
Residual                    4.917e+09  70118  
Number of obs: 7670, groups: Driver, 331; Constructor, 96  
  
Fixed effects:  
              Estimate Std. Error t value  
(Intercept)   123189      8927    13.8
```

Differences in Variances



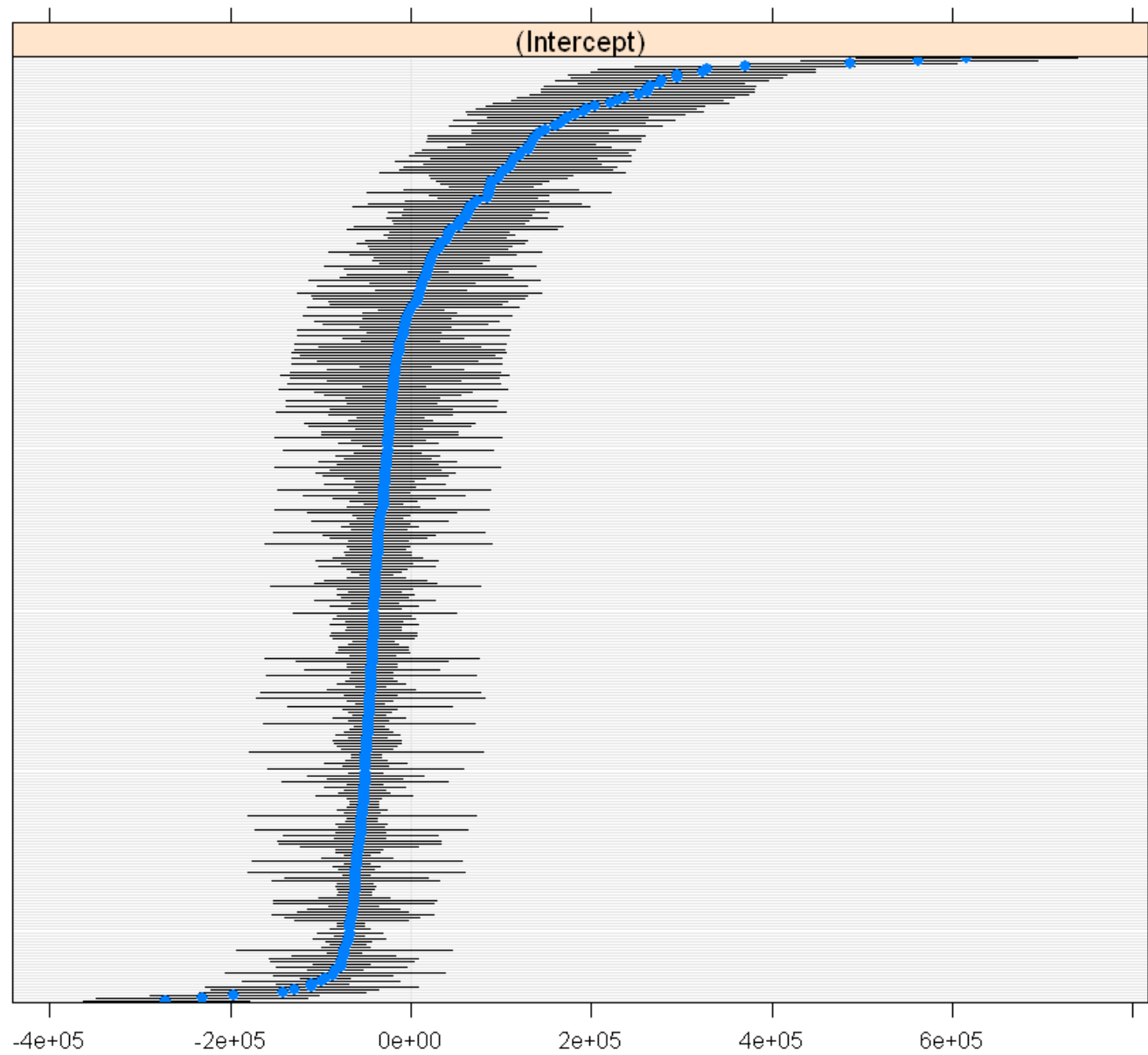
Group	Variance	Proportion
Drivers	109,107 ²	59.93%
Constructors	55,157 ²	15.32%
Residual	70,118 ²	24.75%

Drivers account for almost 4 times the variance that constructors account for. Therefore we reject the null hypothesis.

Caterpillar Plots

Drivers

Driver



Constructors

Constructor

