Course: STAT 488D (Statistics)
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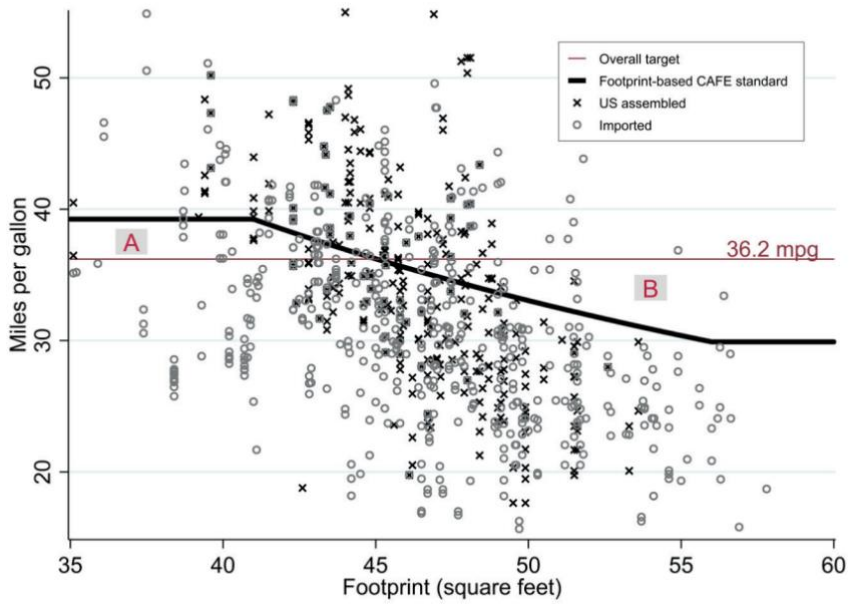
Introduction:

Most people believe there is a linear relationship between fuel consumption in Miles Per Gallon (MPG) and Engine Sizes. However, many other factors and reasonable variables would also change fuel consumptions. As mentioned in the article, "*Miles Per Gallon(MPG) is a unit which we use to evaluate the efficiency of a transporting vehicle in terms of the energy produced".*

"The 'generic' Japanese car ranked highest on the other two factors (fuel economy and reliability)."(Brown,1987). Since Japanese cars have mass production and are well known as the most fuel-efficient car country, we will not take them as experimental variables here.

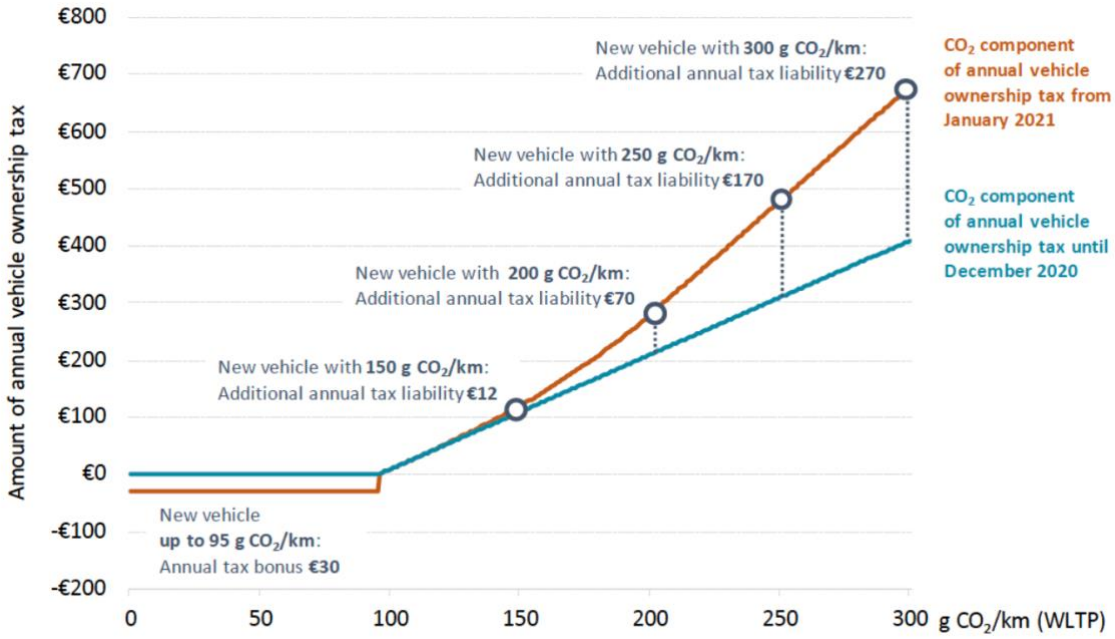
For Ameircan car, we won't consider them in this case as America has cheaper gas prices which is even cheaper than Canada. From the model below, we may see how unstable MPG is in USA.

Figure 1. Car models by fuel economy and footprint; model year 2015.



German cars have been designed and used since World War Two. The Global Fuel Economy website indicates:*"Germany is the fourth car manufacturer globally (after China, the United States and Japan) and the main one in Europe. The average fuel economy of newly registered LDVs reached 6.0 Lge/100 km in 2015, which is ahead of the global average of 7.6 Lge/100 km."*

Another reason for German cars is they have huge taxes on pollution. From the model below, the more Carbon Dioxide we emit, the more tax we pay. This could limit the extreme powerful performance cars and get more realistic data from the daily family using purpose.



Brands are also important. *"The rivalry is quite intense, especially among the major players that include Audi, BMW, Mercedes-Benz (and Toyota's Lexus Motors in the US). These companies not only compete vigorously for market leadership in the major luxury car markets across the world, but also for the recognition of being the leading luxury brand of vehicle from the perception of the consumers." (Haleder,2018).* This indicates Audi, BMW and Benz are reliable brands and they are not only just focusing on fuel-saving technology but developing in a balanced way.

Client(audience): Sales representative Luke in Mercedes-Benz Midtown wants to know if the fuel consumption is related to body styles with same engine sizes. The client provides a contact information: (416)847-7400.

BMW service representative-Denver wants to see whether CO2 emissions has correlation with fuel consumption or not. The phone number to contact is (416) 444-4269 from Parkview BMW.

Topic: Considering CO2, Engine Sizes and Vehicle Class, what factor(s) would significantly effect the Fuel Consumption of BMW, Audi and Benz?

Possible Problem(s):

1. What is data Looks like?
2. Which brand has more fuel consumption?
3. How MPG varies across Brands?
4. What is the proportion for each vehicle class among three brands?
5. Should we use CO2 or CO2.Emissions?
6. Would fuel consumption(MPG) has any correlation with CO2.Emissions?
7. Combine both CO2.Emissions and Engine Size first. Any correlation between them and fuel consumption(MPG)?

Variables:
Year
Make (The brand of the car)
Model (The model name of a car)
Vehicle Class (body styles)
Engine Size (from 1.2 to 8 Litres)
Cylinders
Transmission
Fuel type
Fuel Consumption (City, Highway, KM/H and MPG Combined)
CO2 Emissions (the tailpipe emissions of carbon dioxide in grams per kilometre for combined city and highway driving
CO2 (the tailpipe emissions of carbon dioxide rated on a scale from 1 (worst) to 10 (best))
Smog (the tailpipe emissions of smog-forming pollutants rated on a scale from 1 (worst) to 10 (best))

Data: MY2022 Fuel Consumption Ratings.csv
Source from:
https://open.canada.ca/data/en/dataset/98f1a129-f628-4ce4-b24d-6f16bf24dd64/resource/87fc1b5e-fafc-4d44-ac52-66656fc2a245

Methodology:
The original data has some variables we won't use in this project. The *useful* variables are:
Make (The brand of the car)
Model (The model name of a car)
Vehicle Class (body styles)
Engine Size (from 1.2 to 8 Litres)
Fuel Consumption (MPG Combined)
CO2 Emissions (the tailpipe emissions of carbon dioxide in grams per kilometre for combined city and highway driving)

Model:
Multi-linear regression and possion regression

Reference

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