Analyzing the Impact of Car Features on Price and Profitability

- *Rukmini Annadata*

Project Description:

The automotive industry has undergone significant transformations in recent years, with a growing emphasis on sustainability, technological innovation, and shifting consumer preferences. To thrive in this dynamic landscape, it is imperative for car manufacturers to make data-driven decisions that balance consumer demand, profitability, and competitive positioning.

Business Problem: In this project, we aim to address the following key business problem: How can a car manufacturer optimize pricing and product development strategies to maximize profitability while meeting evolving consumer demand? To answer this question, we will leverage a comprehensive dataset of car models, specifications, and market performance metrics.

Data Sources: The primary data source for this project is the "Car_Data " dataset, collected and made available by Cooper Union. This dataset comprises over 11,000 observations and 16 variables, including information on car make, model, year, engine specifications, fuel type, pricing, and more. While the dataset was last updated in 2017, it provides a valuable historical perspective on the automotive market.

Data Cleaning and Preprocessing:

To ensure data accuracy and reliability, we will conduct thorough data cleaning and preprocessing. This includes handling missing values, identifying and addressing outliers, and standardizing data formats. Our goal is to work with high-quality data that forms the foundation of our analysis.

The selected columns provide crucial information about each car and its attributes. Here's a concise summary of the retained columns:

Make: This represents the car's brand or manufacturer.

Model: It specifies the unique model of the car.

Year: This indicates the year the car was released, providing a temporal context.

Engine Fuel Type: It signifies the type of fuel used by the car, such as gasoline or diesel.

Engine HP: This denotes the horsepower of the car's engine, which impacts its performance.

Engine Cylinders: It reflects the number of cylinders in the car's engine, influencing its power and efficiency.

Transmission Type: This indicates whether the car has an automatic or manual transmission, which affects the driving experience.

Driven Wheels: It describes the type of wheels driven by the car, like front-wheel drive or all-wheel drive.

Number of Doors: This represents the number of doors on the car, an essential aspect of its design.

Market Category: It classifies the car into market categories, such as Luxury or Performance, reflecting its target market.

Vehicle Size: This tells us the size of the car, which influences interior space and comfort.

Vehicle Style (or Body Style): It specifies the car's body style, like Sedan or Coupe, indicating its overall design.

Highway MPG: This is an estimate of the car's miles per gallon on the highway, crucial for fuel efficiency.

City MPG: It represents the estimated miles per gallon the car gets in city driving conditions.

Popularity: This is a ranking of the car's popularity, based on the number of views on Edmunds.com.

MSRP (Manufacturer's Suggested Retail Price): The MSRP provides the manufacturer's recommended price for the car.

These retained columns encompass a wide range of attributes that are pertinent for analyzing car features, pricing, and profitability in the automotive industry.

Approach:

- Data Collection and Familiarization
- Data Cleaning and Preparation
- Data Analysis
- Building the Interactive Dashboard in Power BI
- Project Report in Word doc

Tech Stack Used:

MS Excel

MS Word

TASK: ANALYSIS

A_Task- 1: How does the popularity of a car model vary across different market categories?

A_Task- 2: What is the relationship between a car's engine power and its price?

A_Task- 3: Which car features are most important in determining a car's price?

A_Task- 4: How does the average price of a car vary across different manufacturers?

A_Task- 5: What is the relationship between fuel efficiency and the number of cylinders in a car's engine?

TASK: DASHBOARD

Task- 1: How does the distribution of car prices vary by brand and body style?

Task- 2: Which car brands have the highest and lowest average MSRPs, and how does this vary by body style?

Task- 3: How do the different feature such as transmission type affect the MSRP, and how does this vary by body style?

Task- 4: How does the fuel efficiency of cars vary across different body styles and model years?

Task- 5: How does the car's horsepower, MPG, and price vary across different Brands?

INSIGHTS:

Popularity by Market Category:

The "Flex Fuel" market category is the most popular, with 1,933,488 models, closely followed by "Crossover" with 1,686,521.

Despite "Flex Fuel" having higher popularity, "Crossover" has more models in the market.

Market categories like "luxury," "luxury performance," and "performance" have lower popularity but a significant number of models.

Price Variation Based on Engine Power:

There's a clear relationship between Engine HP and car prices; as Engine HP increases, the average car price rises.

For instance, cars with 55 Engine HP have an average cost of $2,000, while those with 1001 Engine HP have an average cost of $1,757,223.67.

Relative Importance of Car Features on Price:

Regression analysis reveals that "vehicle size" has the least influence on the car's price, while "engine cylinder" has the highest importance.

Other features that significantly impact car prices include "City MPG," "Highway MPG," "engine HP," "vehicle style," and "engine fuel type."

Price Comparison Across Manufacturers:

Manufacturers like "Bugatti," "Maybach," and "Rolls Royce" have the highest average car prices.

"Bugatti" exhibits the widest average price range, while "Plymouth" offers the lowest average prices among manufacturers.

Relation between Cylinders and Highway MPG:

There's an inverse relationship between the number of engine cylinders and average highway MPG.

Cars with fewer cylinders tend to have higher average highway MPG, whereas those with more cylinders have lower average highway MPG.

Car Price Distribution by Brand and Body Style:

The distribution of car prices varies by brand and body style, with different brands and styles having distinct price ranges.

For example, "Genesis" exclusively manufactures "Sedans" with an average MSRP of $139,850, while "Chevrolet" offers various body styles, with "Sedans" having a total MSRP of $306,812.

Average MSRP by Car Brand and Body Style:

"Bugatti" has the highest average MSRP, primarily due to its "Coupe" body style, closely followed by "Maybach."

Conversely, "Plymouth" and "Oldsmobile" have the lowest average MSRP among manufacturers, despite offering multiple body styles.

Impact of Transmission Type on MSRP by Body Style:

The choice of transmission type influences average MSRP, particularly when considering different body styles.

For instance, "Coupes" with "automated manual" transmission have the highest average MSRP, while "Convertibles" with "automatic" transmission have a comparatively lower average MSRP.

Fuel Efficiency Across Body Styles and Model Years:

Fuel efficiency, indicated by city MPG and highway MPG, varies across different body styles and model years.

While there are fluctuations over the years, there's a general trend of improving city and highway MPG.

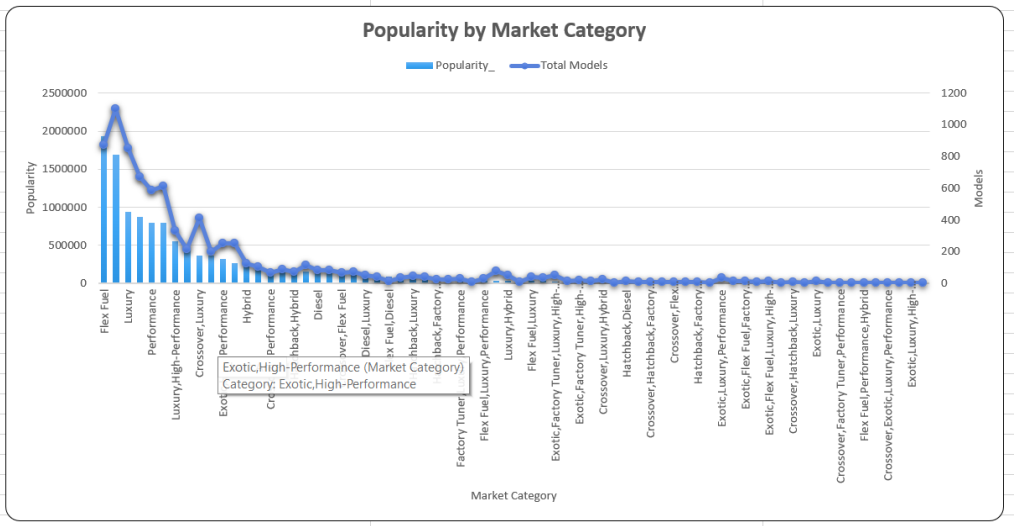
Exploring Variation in Horsepower, MPG, and Price Across Car Brands:

Different car brands offer varying levels of engine horsepower, city MPG, highway MPG, and prices.

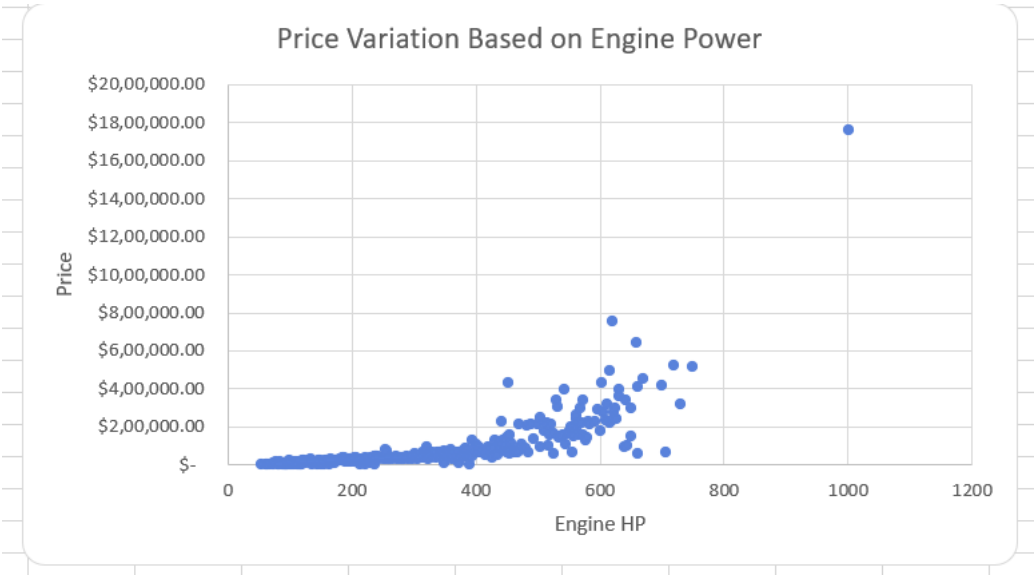
For instance, "BMW" provides a balance between engine horsepower, MPG, and an average price, while "Bugatti" offers high horsepower, low MPG, and a significantly higher average price.

Results: ANALYSIS

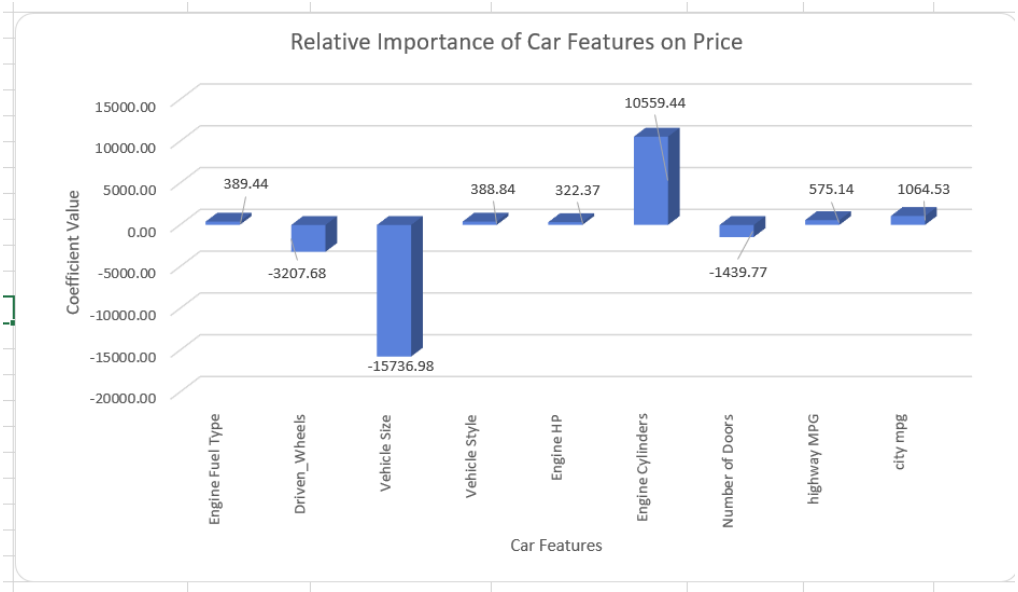
Task- 1: How does the popularity of a car model vary across different market categories?



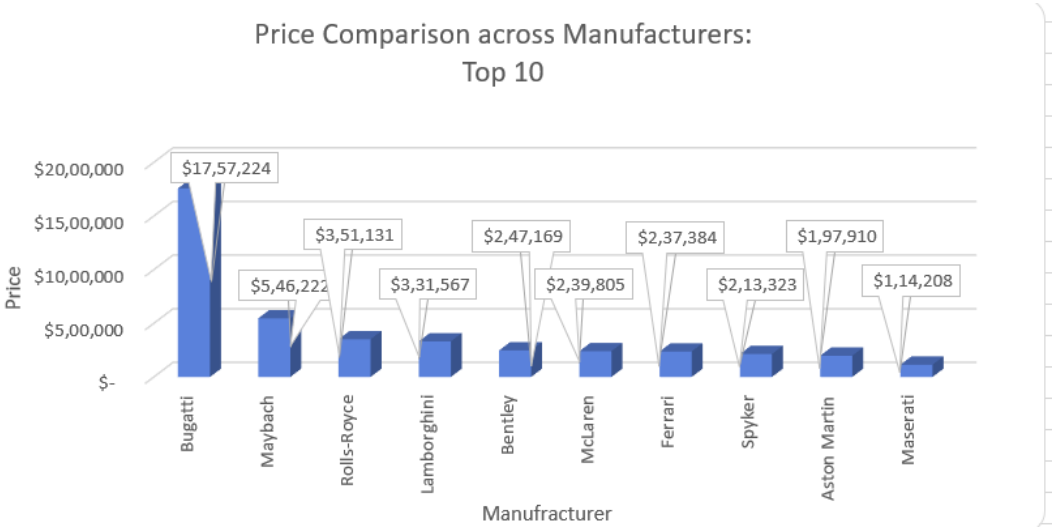
Task- 2: What is the relationship between a car's engine power and its price?

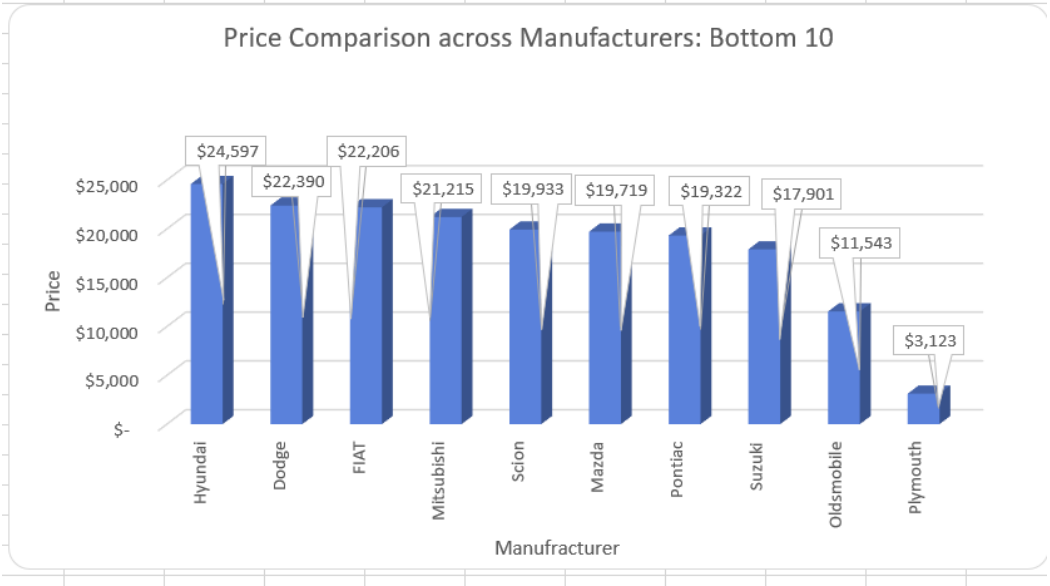


Task- 3: Which car features are most important in determining a car's price?

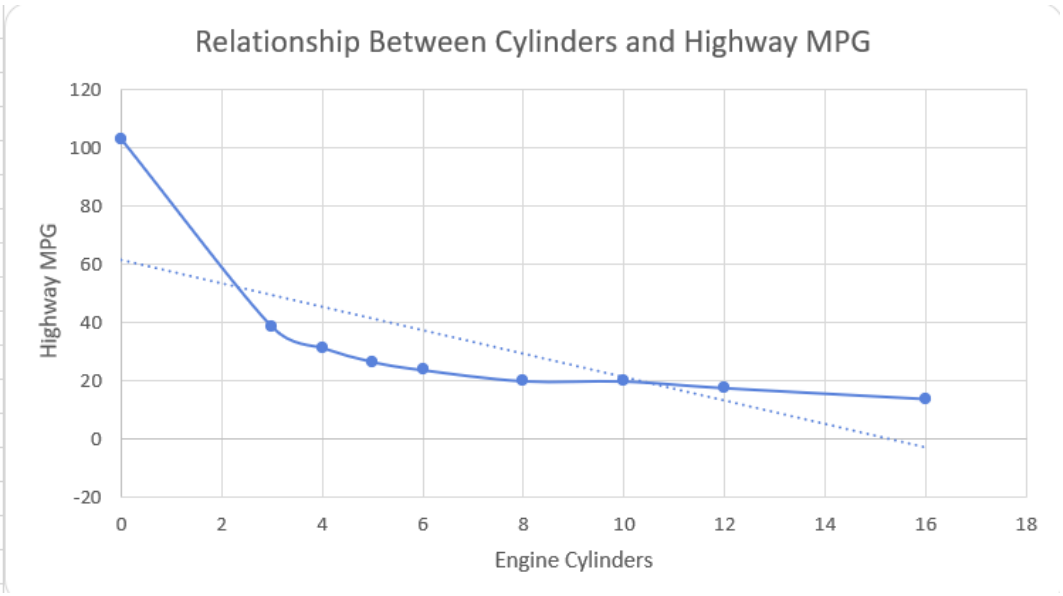


Task- 4: How does the average price of a car vary across different manufacturers?





Task- 5: What is the relationship between fuel efficiency and the number of cylinders in a car's engine? Correlation Coefficient of engine cylinder and average highway MPG = -0.72709001321741



Results: DASHBOARDS

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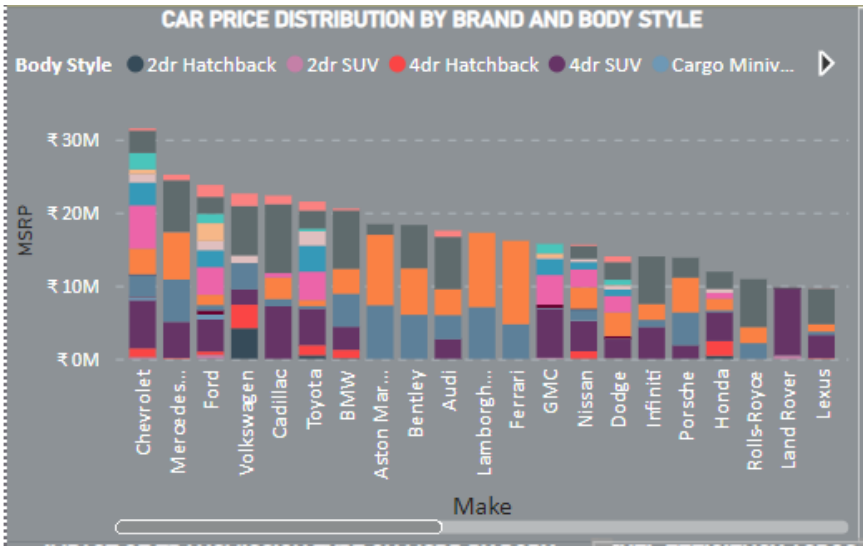
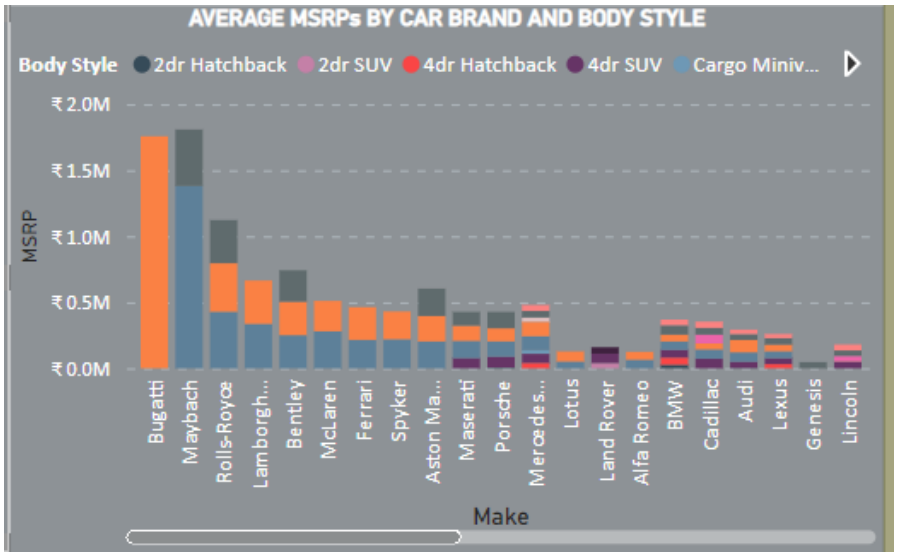
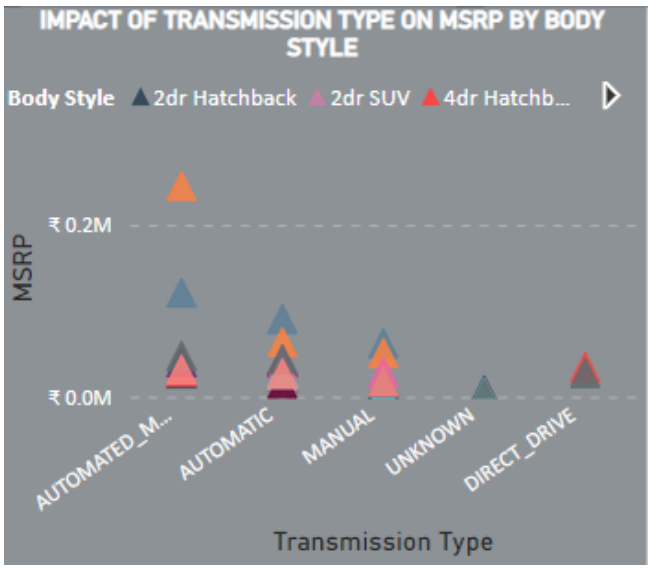


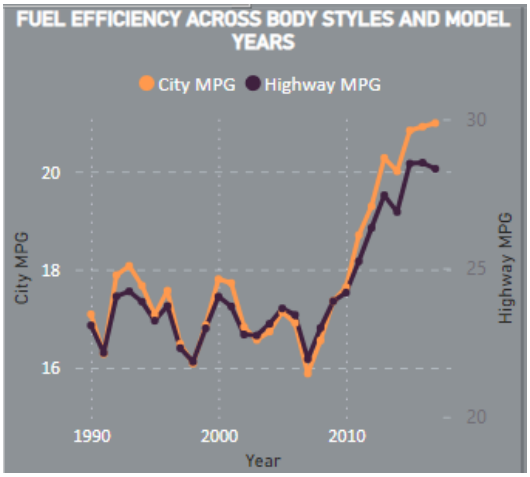
Task- 2: Which car brands have the highest and lowest average MSRPs, and how does this vary by body style?



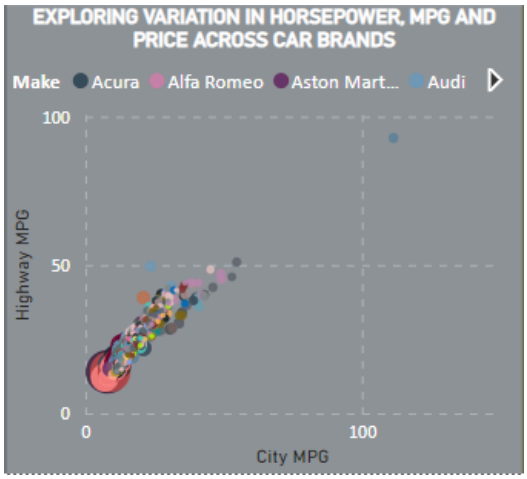
Task- 3: How do the different feature such as transmission type affect the MSRP, and how does this vary by body style?



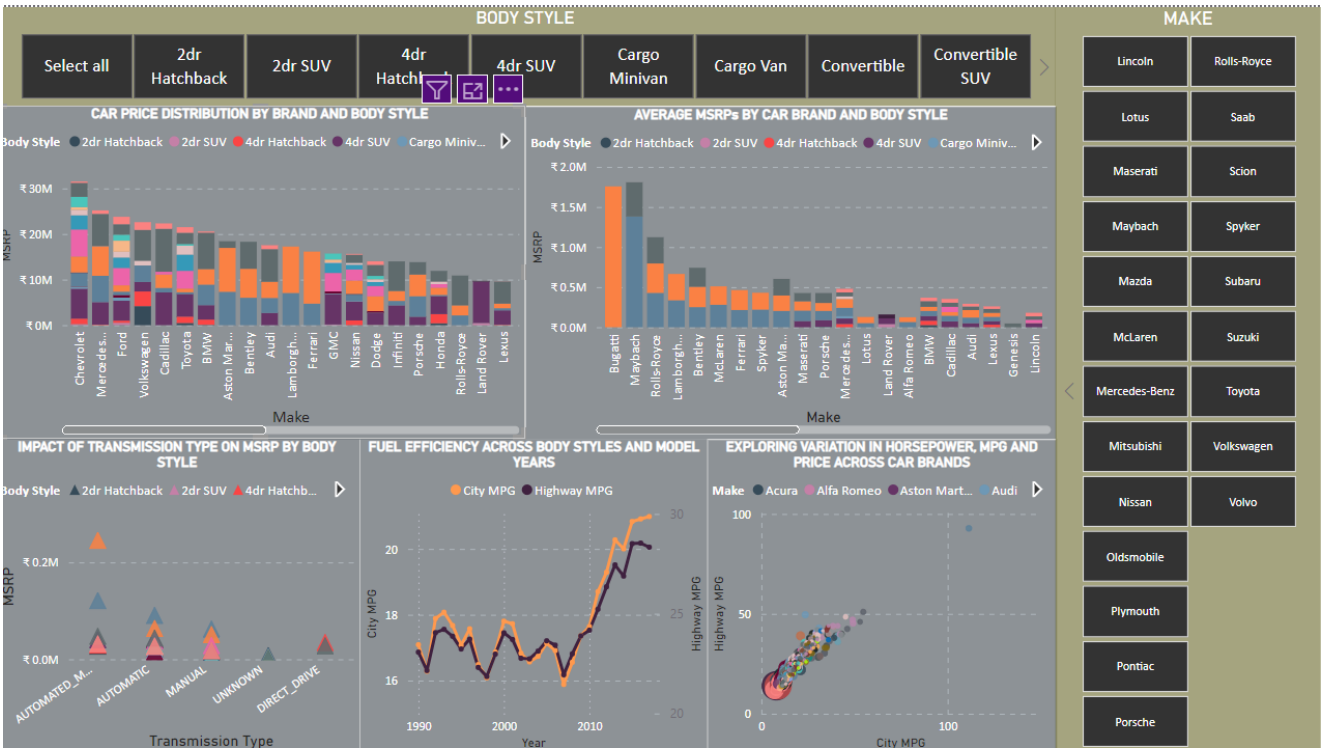
Task- 4: How does the fuel efficiency of cars vary across different body styles and model years?



Task- 5: How does the car's horsepower, MPG, and price vary across different Brands?



Interactive Dashboard:



Conclusion and Future Directions:

I will conclude by summarizing our findings, highlighting their implications, and providing actionable recommendations to the client. Additionally, we will address project limitations and propose future directions for further analysis or data collection to keep pace with the ever-evolving automotive industry.

- Car prices differ a lot depending on the brand and how the car looks. Some brands, like Bugatti, Maybach, and Rolls Royce, have expensive cars. And, the style of the car also affects its price. Some styles cost more than others.
- The power of the car's engine, measured in horsepower (HP), really matters for car prices. If a car has more HP, it usually costs more. This shows that people are ready to pay extra for a powerful engine.
- Different car features, like how many cylinders the engine has, miles per gallon (MPG), engine HP, the car's style, and the type of fuel it uses, all affect how much the car costs. These factors are essential for car makers to set the right prices and meet what customers want.
- Cars are getting more fuel-efficient over time, but some car styles are still more efficient than others. This information helps people choose cars that are better for the environment and save on fuel costs.

This project aims to empower our client with actionable insights, leveraging data analytics to optimize pricing and product development strategies for success in a rapidly changing automotive landscape.