

# Analyzing the Impact of Car Features on Price and Profitability

- ▲ **Project Description:** To help a car manufacturer optimize pricing and product development, data analysis can be used to study the relationship between car features, market segments, and pricing. By identifying which features and categories are most popular with consumers and most profitable, the manufacturer can make informed decisions. Techniques like regression analysis and market segmentation can guide a pricing strategy that balances demand and profitability. This analysis can also highlight which features to prioritize in future models, ultimately improving market competitiveness and boosting profits.

- ▲ **Approach:**

1. Analytical Methods:

In this project, we employed a variety of analytical methods. Descriptive statistics were used to summarize key characteristics of the data, such as the distribution of car features and prices across different market categories. Visualization techniques, like bar charts and scatter plots, helped in identifying trends and patterns in consumer preferences. Machine learning models, such as regression analysis, were used to predict pricing based on car features and market segments. Optimization techniques were applied to balance pricing with profitability.

2. Reasoning Behind the Choice:

Descriptive statistics and visualizations provided a clear understanding of the dataset, allowing us to spot relationships and trends easily. Regression analysis was chosen because it helps quantify the relationship between multiple variables (features and pricing), making it easier to identify which features drive demand and profitability. Optimization techniques were selected to create a pricing model that maximizes profitability while meeting consumer preferences.

**Data Cleaning:** In the given dataset, a total of 108 null values were identified. These null values were removed to ensure the dataset's integrity, resulting in a clean and consistent dataset for analysis. Upon further inspection for data imbalances or other issues such as outliers or duplicate entries, no significant problems were found, confirming the dataset was well-structured and ready for operations without the need for additional preprocessing steps. This clean dataset served as the foundation for accurate analysis and reliable model performance.

- ▲ **Insights:**

- I. **Insight Required:** How does the popularity of a car model vary across different market categories?

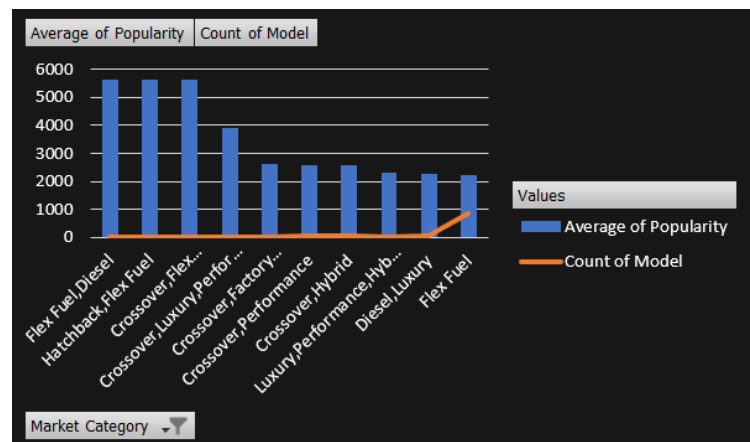
- **Conclusion:**

Categories combining multiple features like Flex Fuel, Diesel, Performance, or Luxury tend to have higher popularity, whereas more general categories like Flex Fuel alone, despite a large number of models, show lower popularity.

- **Task1.A:** Create a pivot table that shows the number of car models in each market category and their corresponding popularity scores.
- **Conclusion:** We calculate this in top 10 Model Category with the average of popularity.

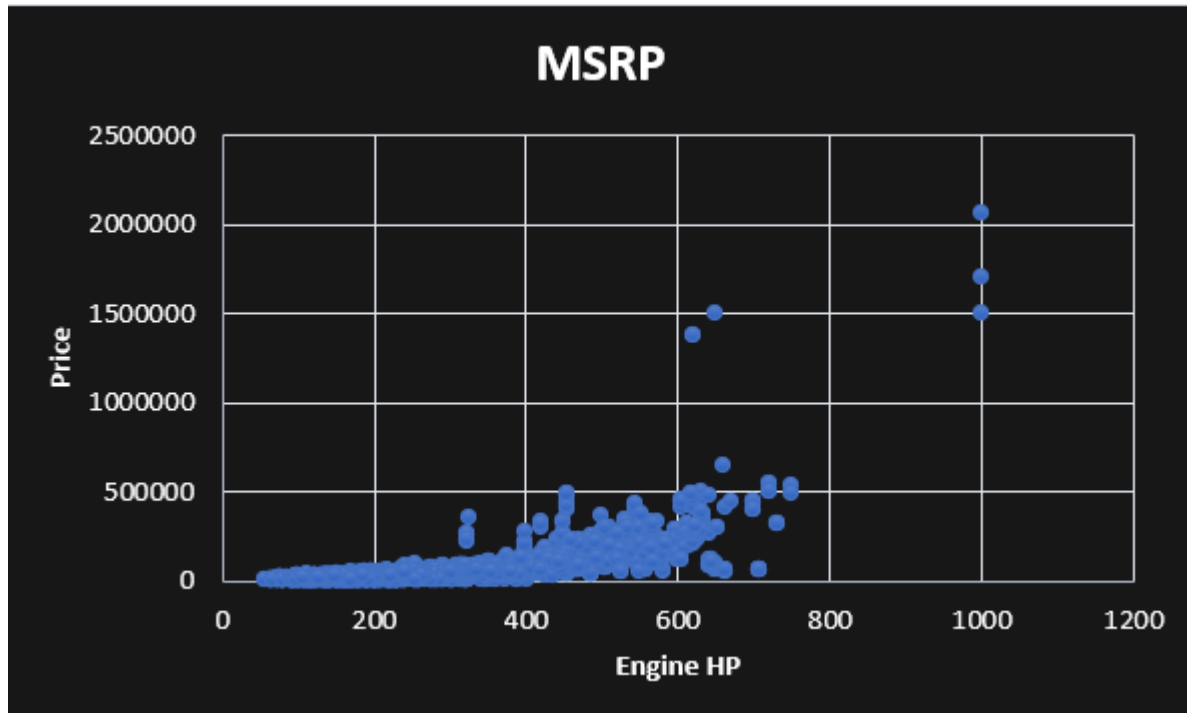
Model Category	Average of Popularity	Count of Model
Flex Fuel,Diesel	5657	16
Hatchback,Flex Fuel	5657	7
Crossover,Flex Fuel,Performance	5657	6
Crossover,Luxury,Performance,Hybrid	3916	2
Crossover,Factory Tuner,Luxury,Performance	2607.4	5
Crossover,Performance	2585.956522	69
Crossover,Hybrid	2563.380952	42
Luxury,Performance,Hybrid	2333.181818	11
Diesel,Luxury	2275	51
Flex Fuel	2217.302752	872
<b>Grand Total</b>	<b>2355.40518</b>	<b>1081</b>

- **Task1.B:** Create a combo chart that visualizes the relationship between market category and popularity.



## II. Insight Required: What is the relationship between a car's engine power and its price?

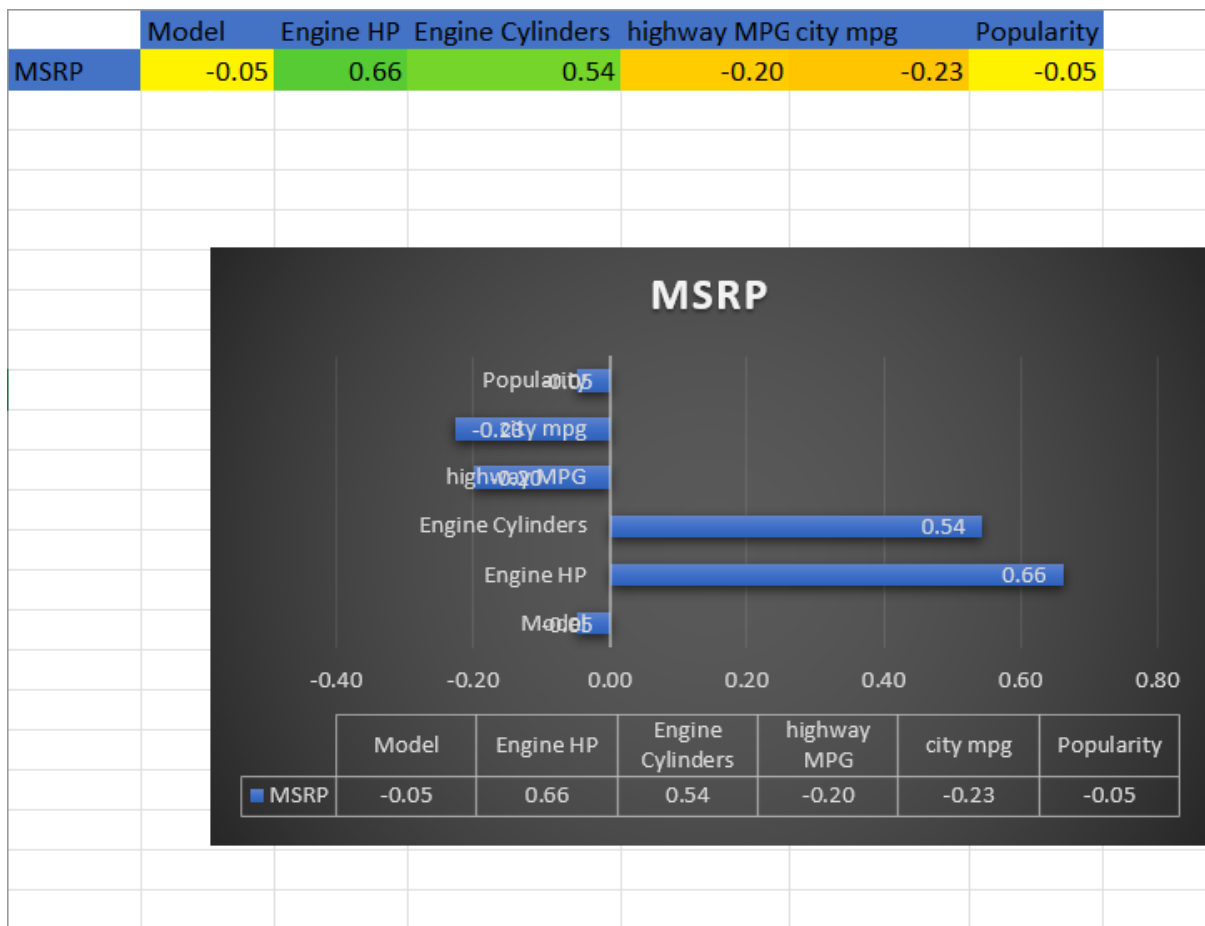
- **Conclusion:** While higher engine horsepower generally leads to higher prices, there is also substantial variation, likely due to other factors influencing the final price, such as brand, luxury features, or market segment.
- **Task2:** Create a scatter chart that plots engine power on the x-axis and price on the y-axis. Add a trendline to the chart to visualize the relationship between these variables.



**III. Insight Required:** Which car features are most important in determining a car's price?


- **Conclusion:** Engine HP and Engine Cylinders are the most influential factors in determining a car's price, while fuel efficiency (MPG) tends to lower the price. Popularity and model type have minimal impact on pricing.

**Task3:** Use regression analysis to identify the variables that have the strongest relationship with a car's price. Then create a bar chart that shows the coefficient values for each variable to visualize their relative importance.

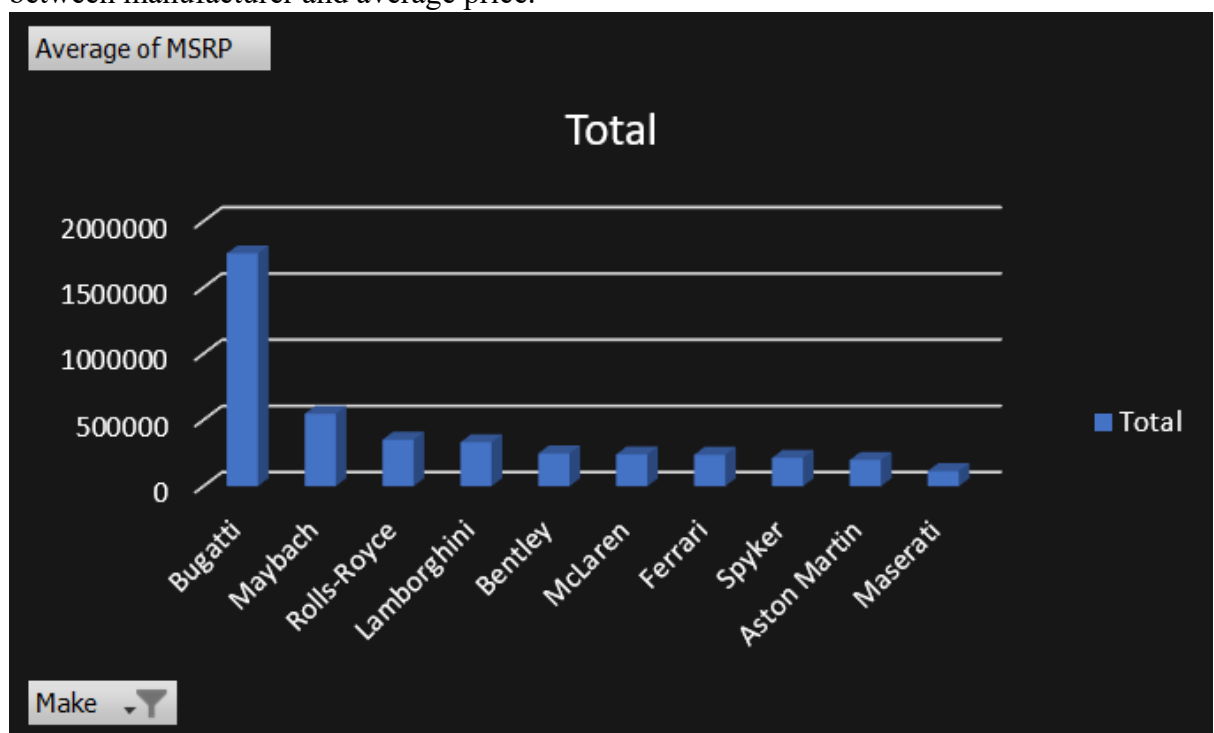


#### IV. **Insight Required:** How does the average price of a car vary across different manufacturers?

- ✓ **Conclusion:** When examining how the average price of a car varies across different manufacturers, it's clear that luxury and performance brands dominate the high-end market. The following manufacturers are the top 10 in terms of average car price *Bugatti, Maybach, Rolls-Royce, Lamborghini, Bentley, McLaren, Ferrari, Spyker, Aston Martin, and Maserati*. These manufacturers are known for their exclusive, high-performance, and luxury vehicles. Their higher average car prices are driven by factors such as powerful engines, cutting-edge technology, limited production, and brand prestige. In contrast, mass-market manufacturers with more economical models tend to have lower average prices. This highlights a clear segmentation between luxury/performance brands and general consumer manufacturers in terms of pricing strategy.
- **Task4.A:** Create a pivot table that shows the average price of cars for each manufacturer.

Manufacturer 	Average of MSRP
Bugatti	1757223.667
Maybach	546221.875
Rolls-Royce	351130.6452
Lamborghini	331567.3077
Bentley	247169.3243
McLaren	239805
Ferrari	237383.8235
Spyker	213323.3333
Aston Martin	197910.3763
Maserati	114207.7069
<b>Grand Total</b>	<b>256672.7246</b>

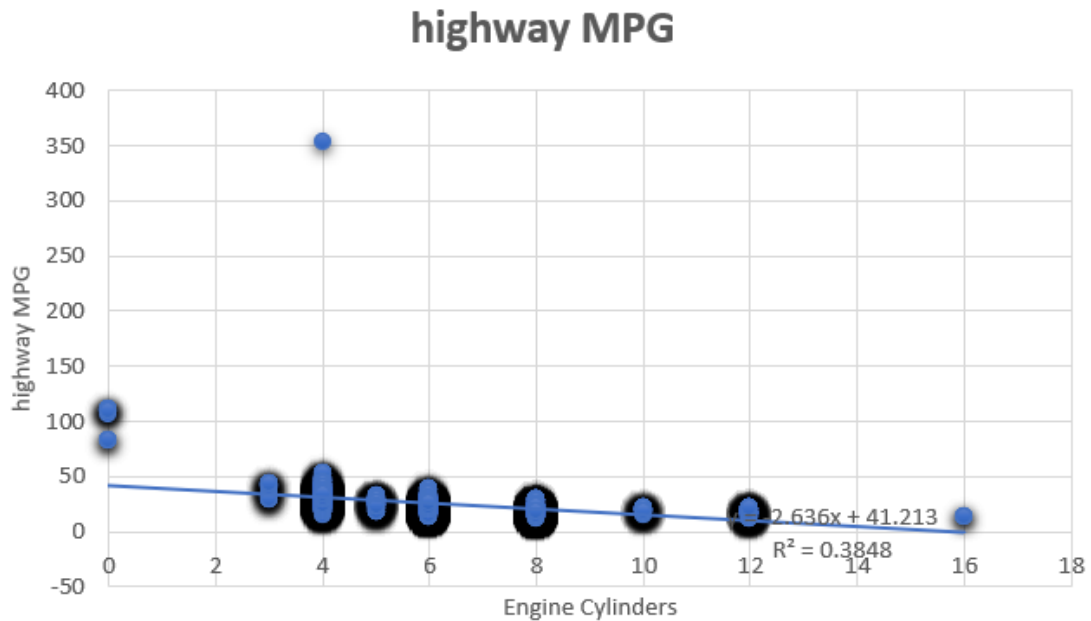
- **Task4.B:** Create a bar chart or a horizontal stacked bar chart that visualizes the relationship between manufacturer and average price.



V. **Insight Required:** What is the relationship between fuel efficiency and the number of cylinders in a car's engine?

- ✓ **Conclusion:** Fuel efficiency decreases as the number of engine cylinders increases, but there are additional factors affecting this relationship since the  $R^2$  value indicates that the number of cylinders alone does not fully explain the variation in highway MPG.

- **Task5.A:** Create a scatter plot with the number of cylinders on the x-axis and highway MPG on the y-axis. Then create a trendline on the scatter plot to visually estimate the slope of the relationship and assess its significance.

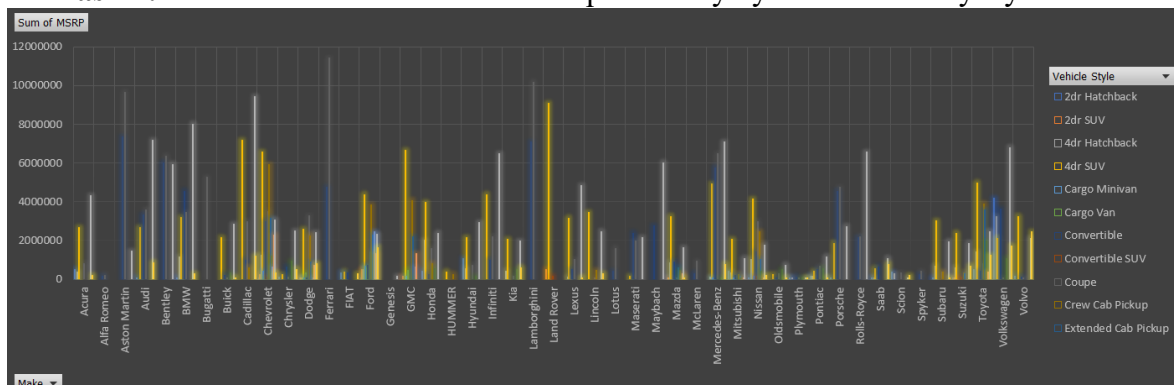


- **Task5.B:** Calculate the correlation coefficient between the number of cylinders and highway MPG to quantify the strength and direction of the relationship.

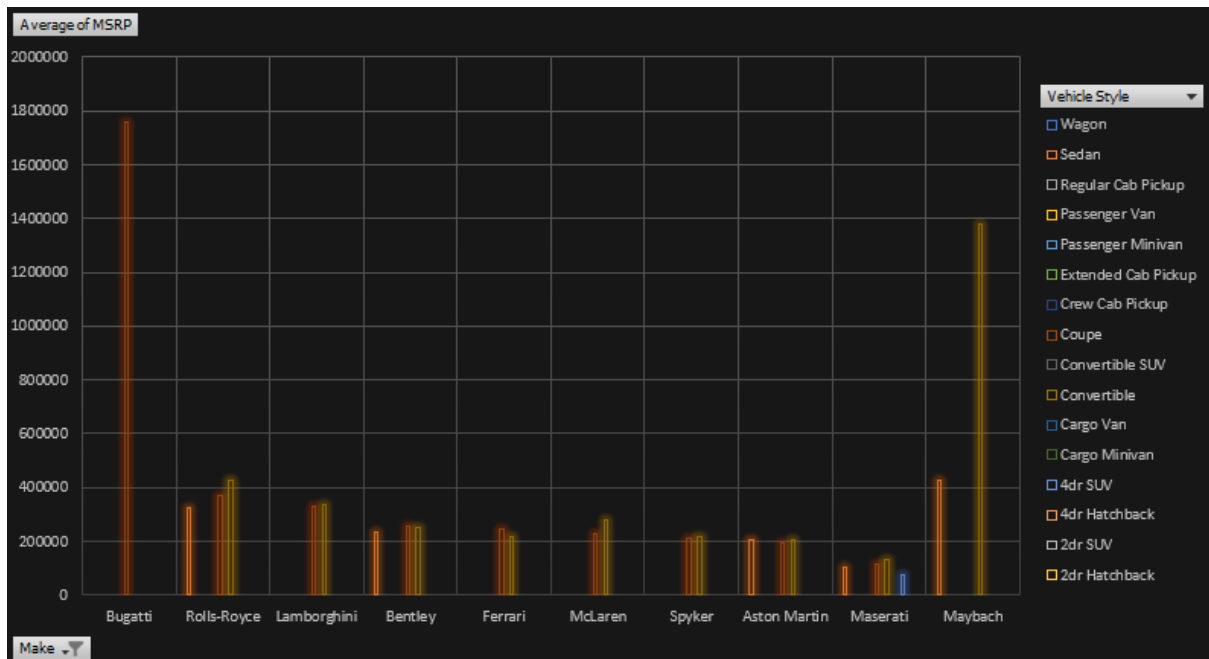
Column1	Engine Cylinder	highway MPG
Engine Cylinders	1	
highway MPG	-0.620312551	1

## ▲ Building the Dashboard:

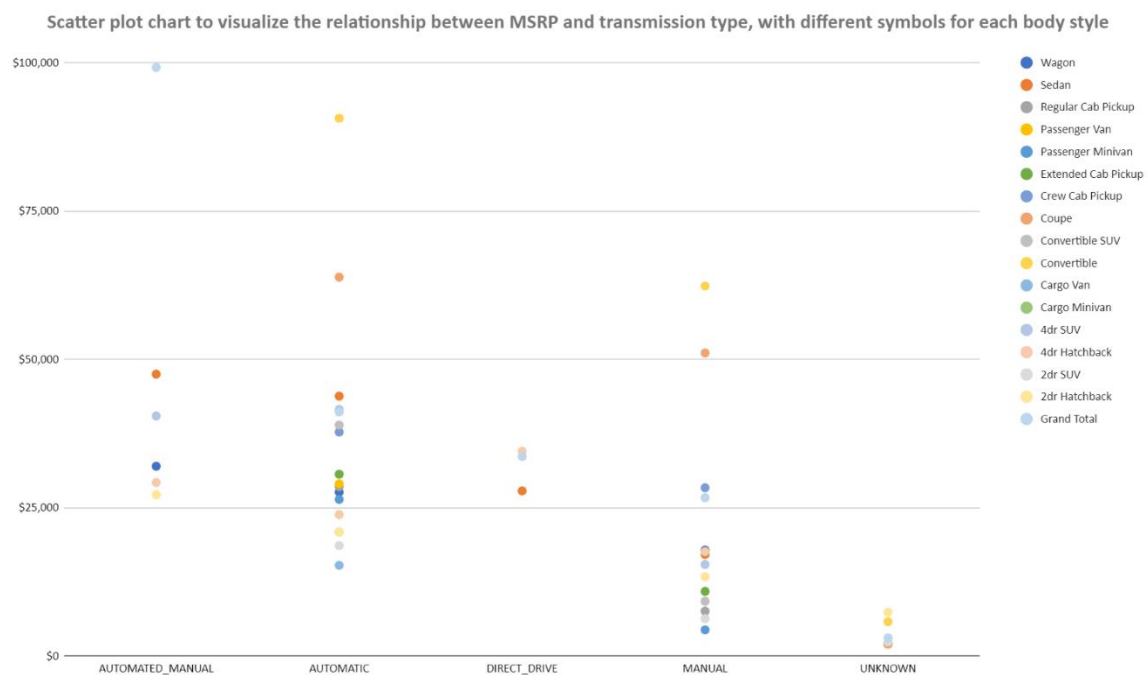
- **Task 1:** How does the distribution of car prices vary by brand and body style?



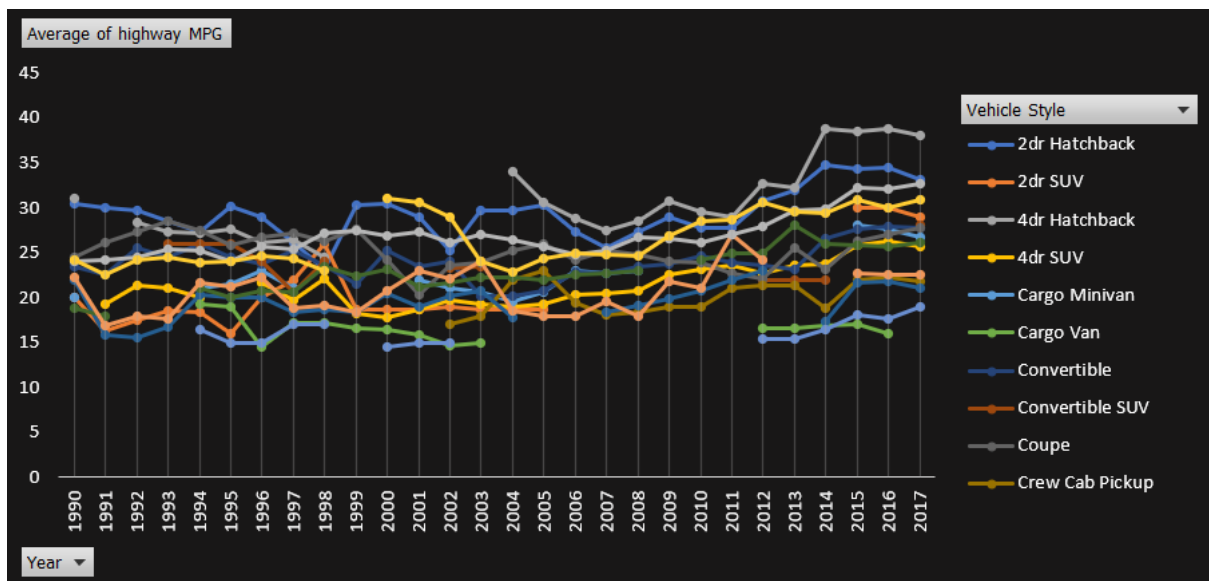
- **Task 2:** Which car brands have the highest and lowest average MSRPs, and how does this vary by body style?



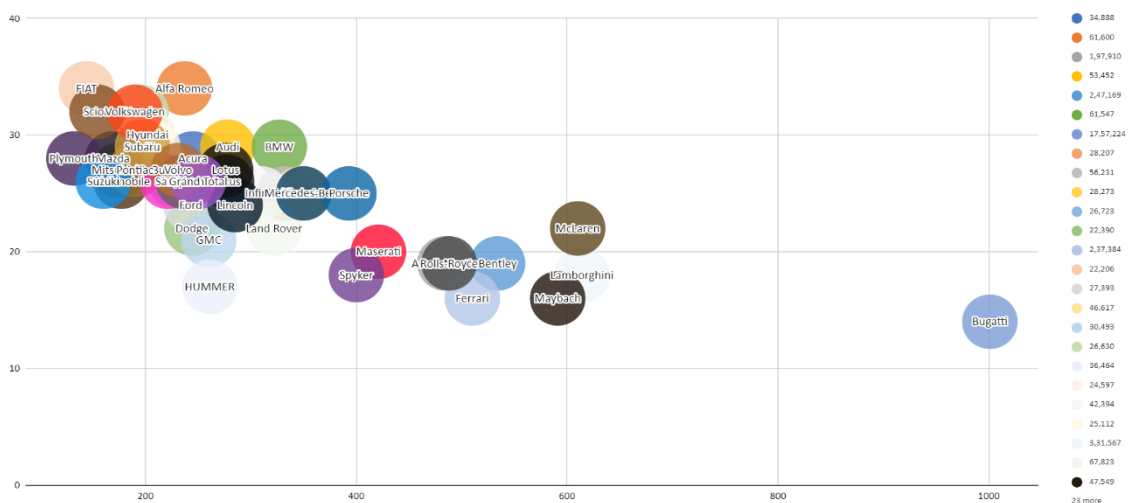
- **Task 3:** How do the different feature such as transmission type affect the MSRP, and how does this vary by body style?



- ▲ **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?



### ▲ Key Insights:

The key insights suggest that dynamic pricing strategies and real-time market data can enhance decision-making in the automotive industry. Leveraging machine learning techniques for predictive modeling can optimize pricing and product development. Additionally, continuous monitoring of market trends and consumer preferences is crucial for maintaining competitiveness in a rapidly evolving market. These insights offer valuable guidance for car manufacturers to stay ahead in a changing landscape.



⤴ **Business Problem:** Car manufacturers face challenges in optimizing their pricing strategies in a highly competitive and dynamic market. Fluctuating market conditions, evolving consumer preferences, and diverse vehicle body styles contribute to the complexity of determining optimal prices. Additionally, the lack of real-time insights and predictive models hinders manufacturers from adapting swiftly to market trends. The business needs to develop data-driven, dynamic pricing models and leverage advanced analytics to remain competitive, maximize profitability, and align their offerings with customer demands in the rapidly evolving automotive industry.

⤴ **Recommendations:** Based on the insights gained, we recommend that car manufacturers focus on developing fuel-efficient models, strategically price cars based on feature importance, and tailor marketing strategies to target popular market categories.

⤴ **Result:**

- **Visualization:** We used visualizations such as pivot tables, scatter plots, and bar charts to present the results obtained from the analysis. These visualizations help stakeholders interpret the findings more effectively and facilitate decision-making.
- **Discussion:** The results obtained from the analysis have significant implications for car manufacturers, providing valuable insights into consumer preferences, pricing dynamics, and market trends. These findings can guide strategic decisions aimed at enhancing profitability and competitiveness.
- **Future Directions:** The future direction emphasizes the need for car manufacturers to adopt dynamic pricing strategies, leveraging real-time market data and consumer trends. Advanced machine learning techniques for predictive modeling should be incorporated to optimize pricing and product development. Continuous monitoring of market and consumer behaviors is essential to staying competitive in a rapidly changing industry. These approaches will help manufacturers remain agile, innovative, and responsive to evolving market demands.

Overall, the insights gained from this analysis provide valuable guidance for car manufacturers seeking to optimize pricing and product development strategies in a rapidly changing market landscape.

⤴ **Excel Sheet Link:**

<https://docs.google.com/spreadsheets/d/1Bh3rVXNC5mgaik2G2zS4hC1izLTmGwOK/edit?usp=sharing&ouid=116406143301160000153&rtpof=true&sd=true>