

Analyzing the Impact of Car Features on Price and Profitability

Project Description:

This project analyzes the impact of various car features on pricing and profitability to help manufacturers optimize pricing and product development decisions. Using a dataset containing 11,159 car models, the project examines factors like engine power, fuel efficiency, transmission type, and market categories to understand their relationship with car prices. The central aim is to address how manufacturers can maximize profitability while meeting consumer demand. Data cleaning steps included removing duplicates, handling missing values, and standardizing formats. Through regression analysis and visualizations like scatter plots and pivot tables, the project identifies key features that influence price and consumer preferences. The results can guide manufacturers in balancing consumer demand with profitability, helping them stay competitive in a rapidly evolving automotive market.

Approach:

The project used descriptive statistics and data visualization (scatter plots, bar charts) to explore relationships between key variables like MSRP, horsepower, and fuel efficiency. Regression analysis was applied to identify features most impacting price, and pivot tables were used to calculate averages and distributions. These methods were chosen for their ability to reveal patterns and inform pricing strategies. Challenges included handling missing data, but the combination of statistical and visual techniques provided valuable insights for decision-making.

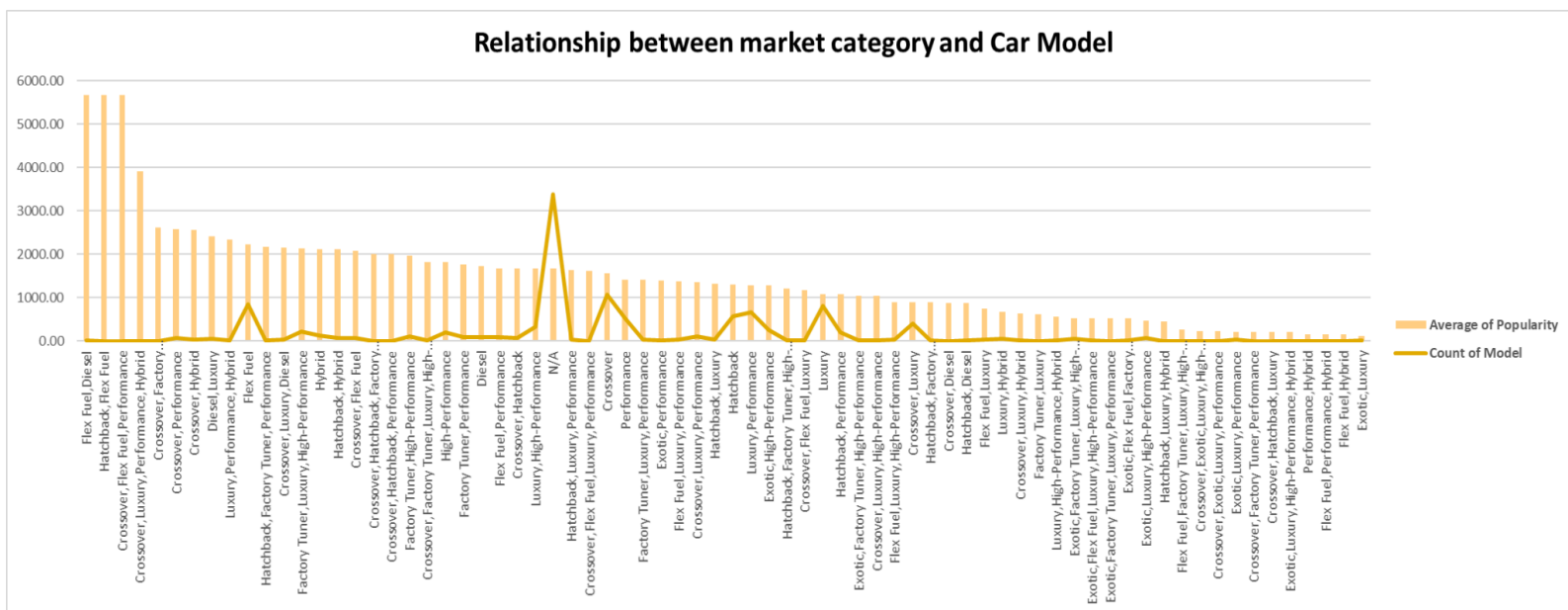
Tech-Stack Used:

The project was primarily executed using Excel 2021, chosen for its robust data analysis capabilities, including pivot tables, regression analysis, and visualization tools like scatter plots and bubble charts. Excel's built-in functions such as AVERAGEIFS, SUMIFS, and its Data Analysis Toolpak were used for calculations and regression modeling. No additional libraries or packages were necessary, as Excel 2021 provided all the essential tools for data cleaning, analysis, and visualization in a user-friendly environment. The choice of Excel allowed for easy data manipulation and interactive dashboards.

Analysis:

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

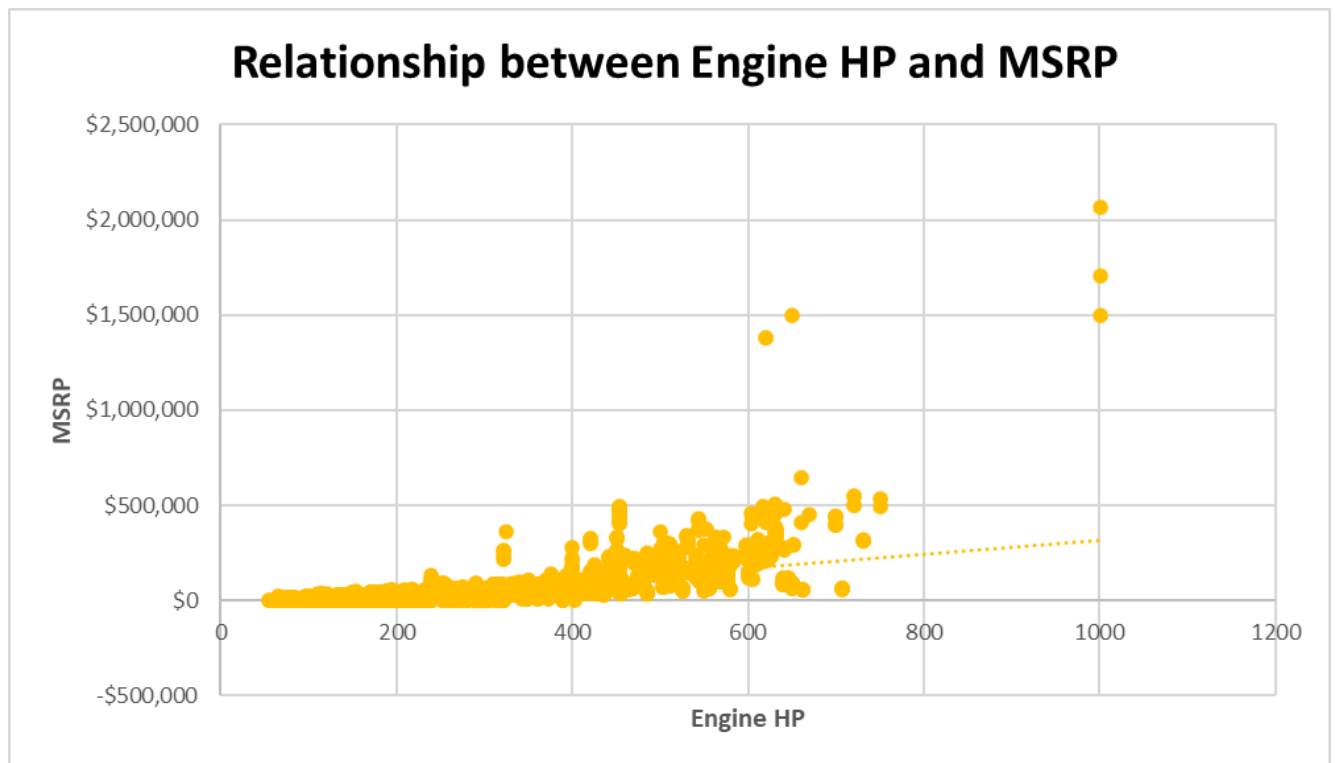
- **Task 1.A:** Create a pivot table that shows the number of car models in each market category and their corresponding popularity scores.
- **Task 1.B:** Create a combo chart that visualizes the relationship between market category and popularity.



The most popular market categories for car models are Flex Fuel, Diesel ; Hatchback, Flex Fuel ; Crossover, Flex Fuel Performance.

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

- **Task 2:** 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.

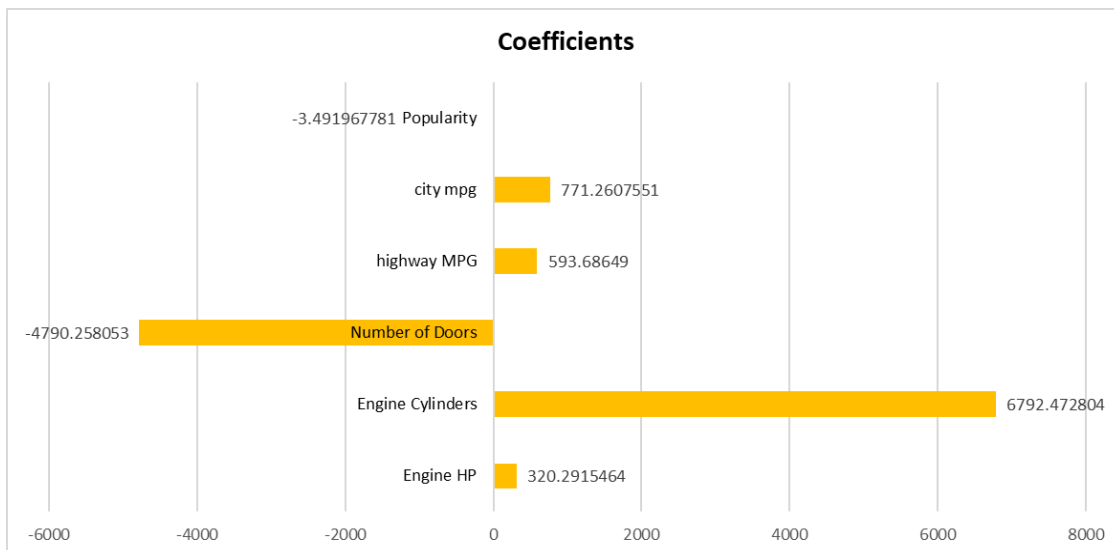


The chart illustrates a positive correlation between engine horsepower and price, indicating that as horsepower increases, car prices tend to rise.

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

- **Task 3:** 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.

SUMMARY OUTPUT									
Regression Statistics									
Multiple R	0.680918212								
R Square	0.463649612								
Adjusted R Square	0.46335998								
Standard Error	45214.2793								
Observations	11118								
ANOVA									
	df	SS	MS	F	Significance F				
Regression	6	1.96357E+13	3.27261E+12	1600.822571	0				
Residual	11111	2.27146E+13	2044331052						
Total	11117	4.23502E+13							
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%	
Intercept	-86539.2049	3707.442675	-23.34202103	1.0967E-117	-93806.45067	-79271.95914	-93806.45067	-79271.95914	
Engine HP	320.2915464	6.362254989	50.34245671	0	307.8203972	332.7626955	307.8203972	332.7626955	
Engine Cylinders	6792.472804	450.6444428	15.07279833	7.76815E-51	5909.1297	7675.815907	5909.1297	7675.815907	
Number of Doors	-4790.258053	497.1311255	-9.635803931	6.87423E-22	-5764.723307	-3815.7928	-5764.723307	-3815.7928	
highway MPG	593.68649	109.0344273	5.444945279	5.29241E-08	379.9596574	807.4133226	379.9596574	807.4133226	
city mpg	771.2607551	113.8286913	6.775627006	1.30132E-11	548.1363139	994.3851963	548.1363139	994.3851963	
Popularity	-3.491967781	0.297544763	-11.73594101	1.2813E-31	-4.075208334	-2.908727228	-4.075208334	-2.908727228	

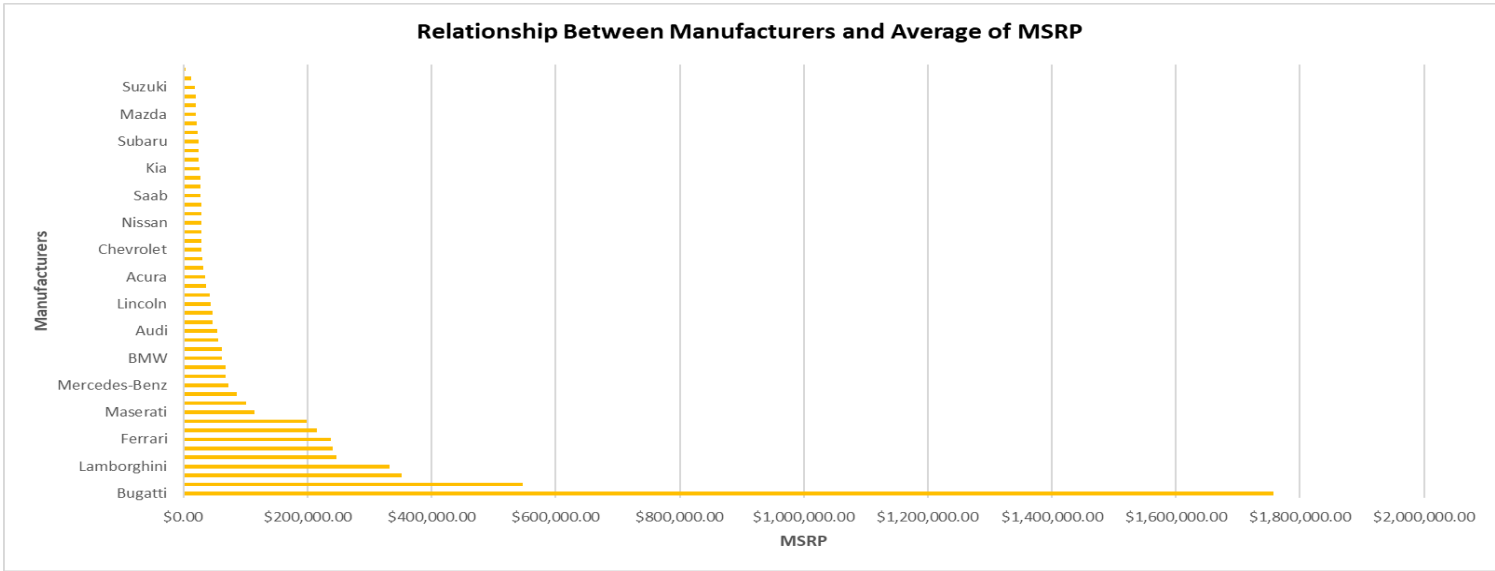


Engine cylinders have the biggest positive impact on car prices, while the number of doors has a negative effect. Other factors like horsepower and MPG have smaller positive influences.

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

- **Task 4.A:** Create a pivot table that shows the average price of cars for each manufacturer.
- **Task 4.B:** Create a bar chart or a horizontal stacked bar chart that visualizes the relationship between manufacturer and average price.

Row Labels	Average of MSRP		
Bugatti	\$1,757,223.67	HUMMER	\$36,464.41
Maybach	\$546,221.88	Acura	\$35,087.49
Rolls-Royce	\$351,130.65	GMC	\$32,444.09
Lamborghini	\$331,567.31	Volvo	\$29,724.68
Bentley	\$247,169.32	Chevrolet	\$29,074.73
McLaren	\$239,805.00	Buick	\$29,034.19
Ferrari	\$238,218.84	Volkswagen	\$28,978.52
Spyker	\$214,990.00	Nissan	\$28,921.15
Aston Martin	\$198,123.46	Toyota	\$28,846.56
Maserati	\$113,684.49	Ford	\$28,511.31
Porsche	\$101,622.40	Saab	\$27,879.81
Tesla	\$85,255.56	Chrysler	\$26,722.96
Mercedes-Benz	\$72,069.53	Honda	\$26,655.15
Lotus	\$68,377.14	Kia	\$25,513.76
Land Rover	\$68,067.09	Hyundai	\$24,926.26
BMW	\$62,162.56	Dodge	\$24,857.05
Alfa Romeo	\$61,600.00	Subaru	\$24,240.67
Cadillac	\$56,368.27	FIAT	\$22,670.24
Audi	\$54,574.12	Mitsubishi	\$21,340.56
Lexus	\$47,549.07	Mazda	\$20,416.62
Genesis	\$46,616.67	Scion	\$19,932.50
Lincoln	\$43,860.83	Pontiac	\$19,800.04
Infiniti	\$42,640.27	Suzuki	\$18,026.42
		Oldsmobile	\$12,843.80
		Plymouth	\$3,296.87

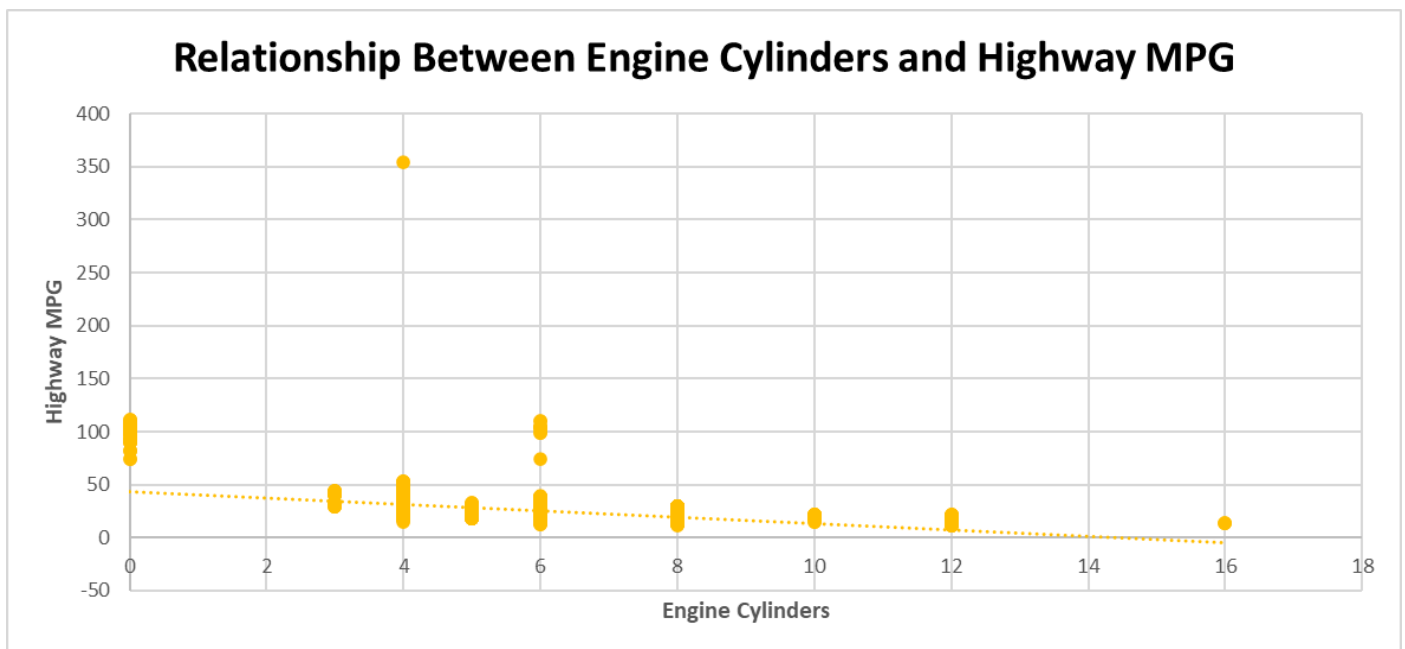


Bugatti has the highest average price, followed by Lamborghini and Ferrari, while brands like Suzuki and Mazda have much lower average MSRPs.

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

- **Task 5.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.
- **Task 5.B:** Calculate the correlation coefficient between the number of cylinders and highway MPG to quantify the strength and direction of the relationship.

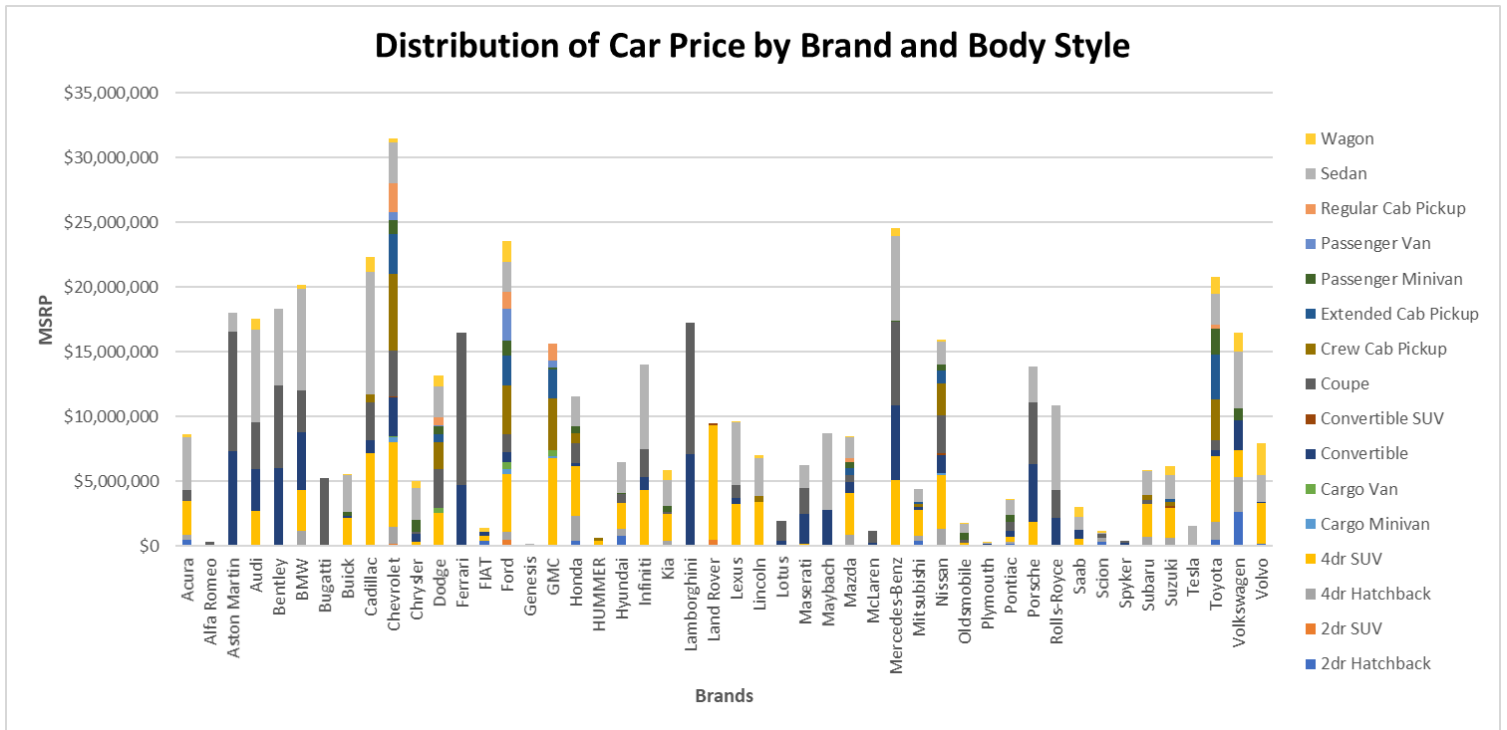
Correlation Coefficient	-0.596246019
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As the number of engine cylinders increases, highway MPG generally decreases, indicating an inverse relationship between engine size and fuel efficiency.

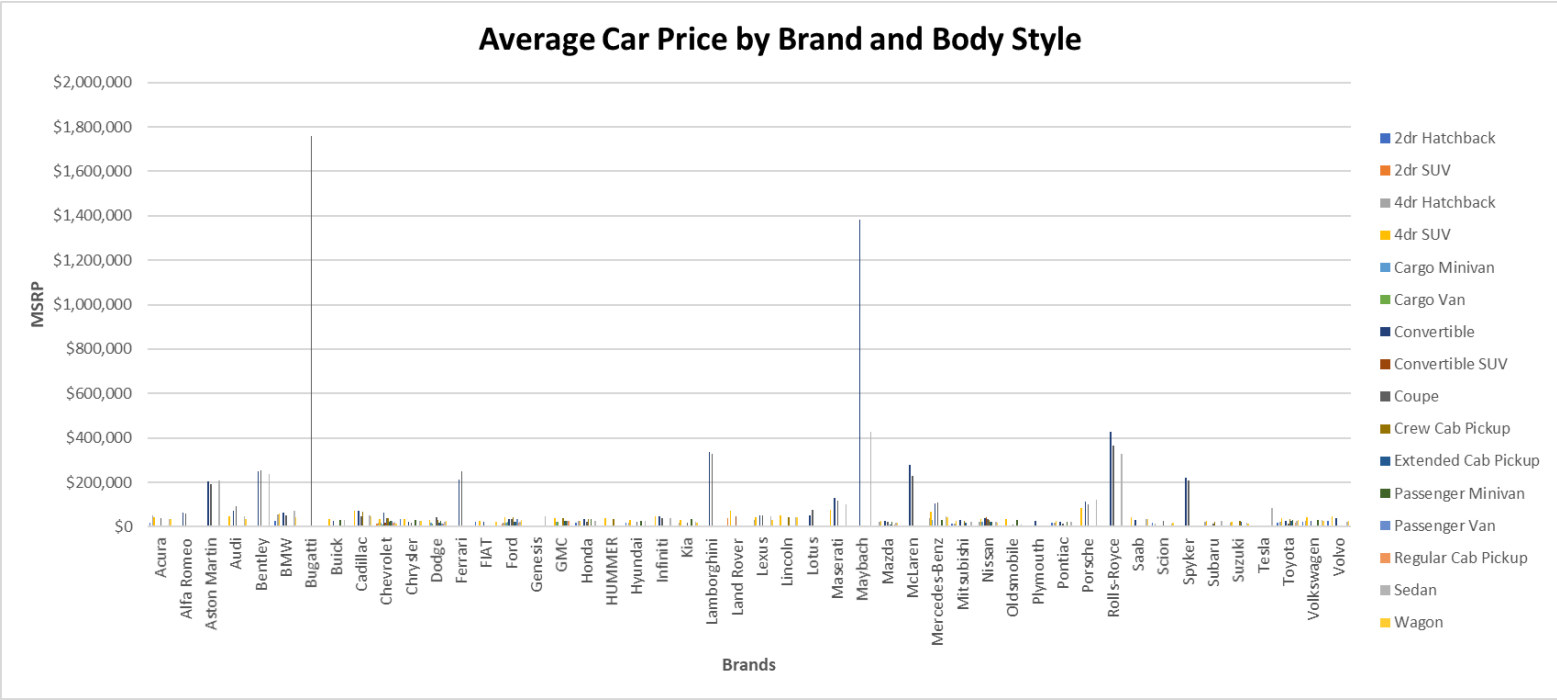
Building the Dashboard:

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



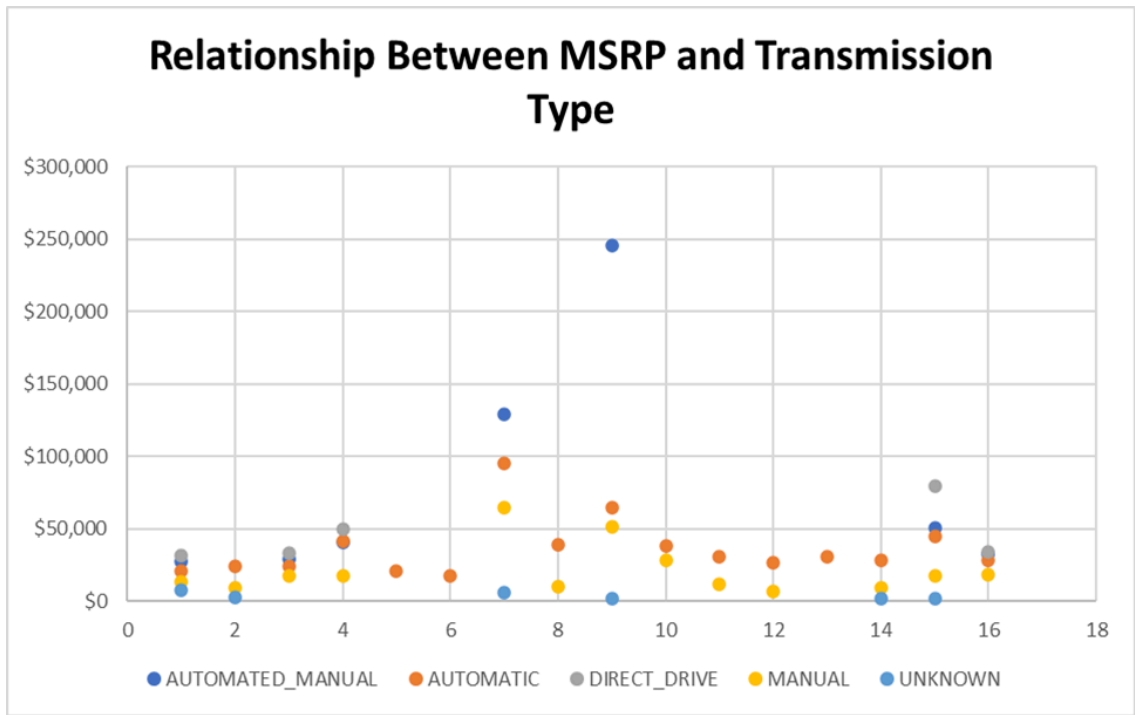
Chevrolet has the highest car price distribution followed by Mercedes - Benz, Ford and Cadillac.

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

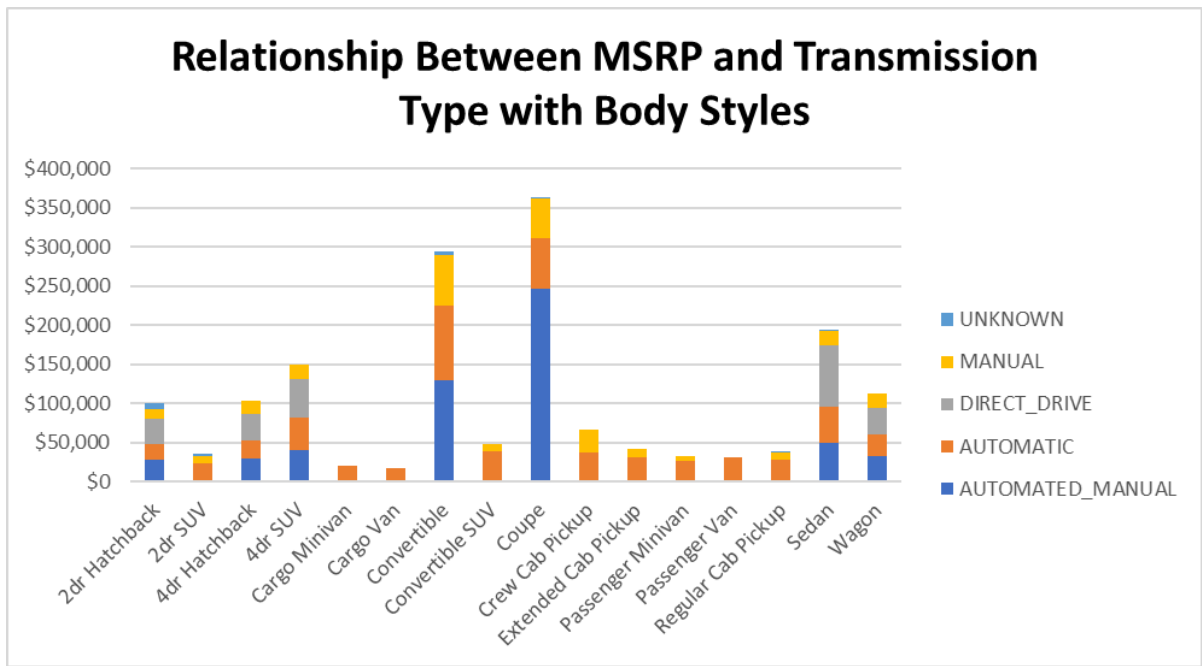


Bugatti has the average car price by body style. Followed by Maybach.

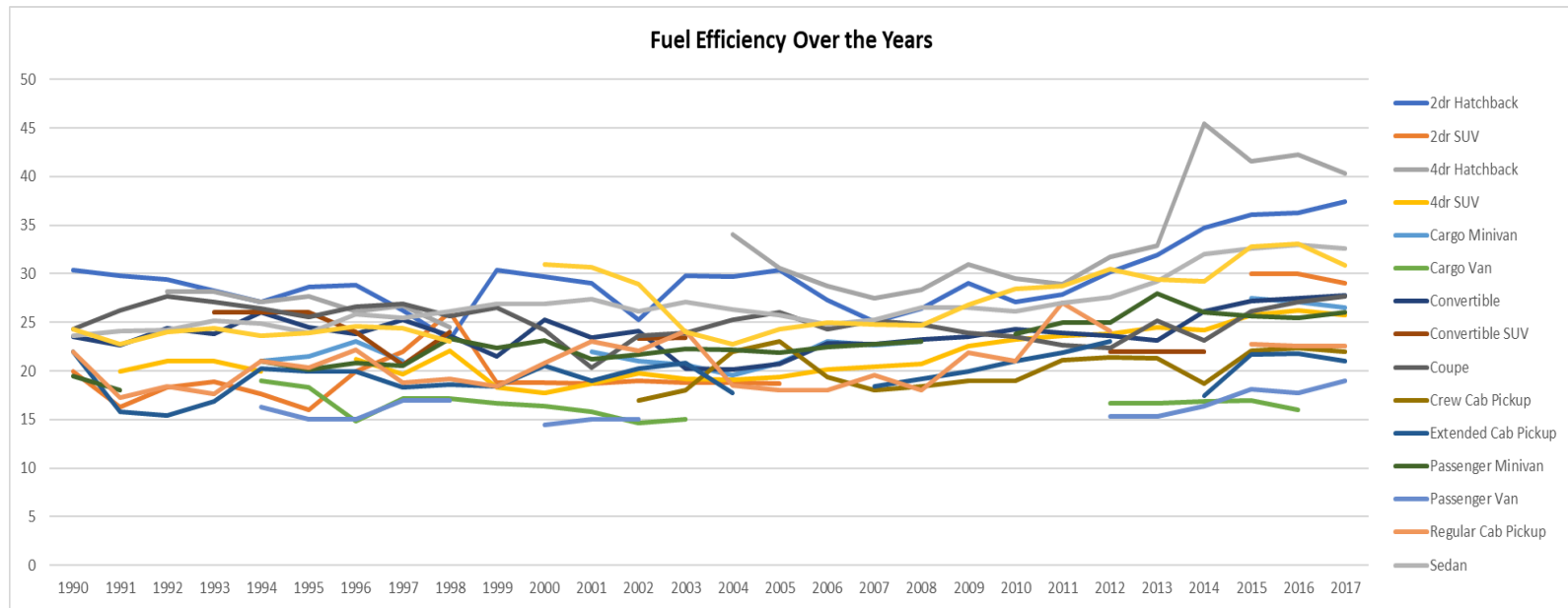
Task 3: How do the different features such as transmission type affect the MSRP, and how does this vary by body style?



Coupe with Automated Manual has the highest average MSRP among others.

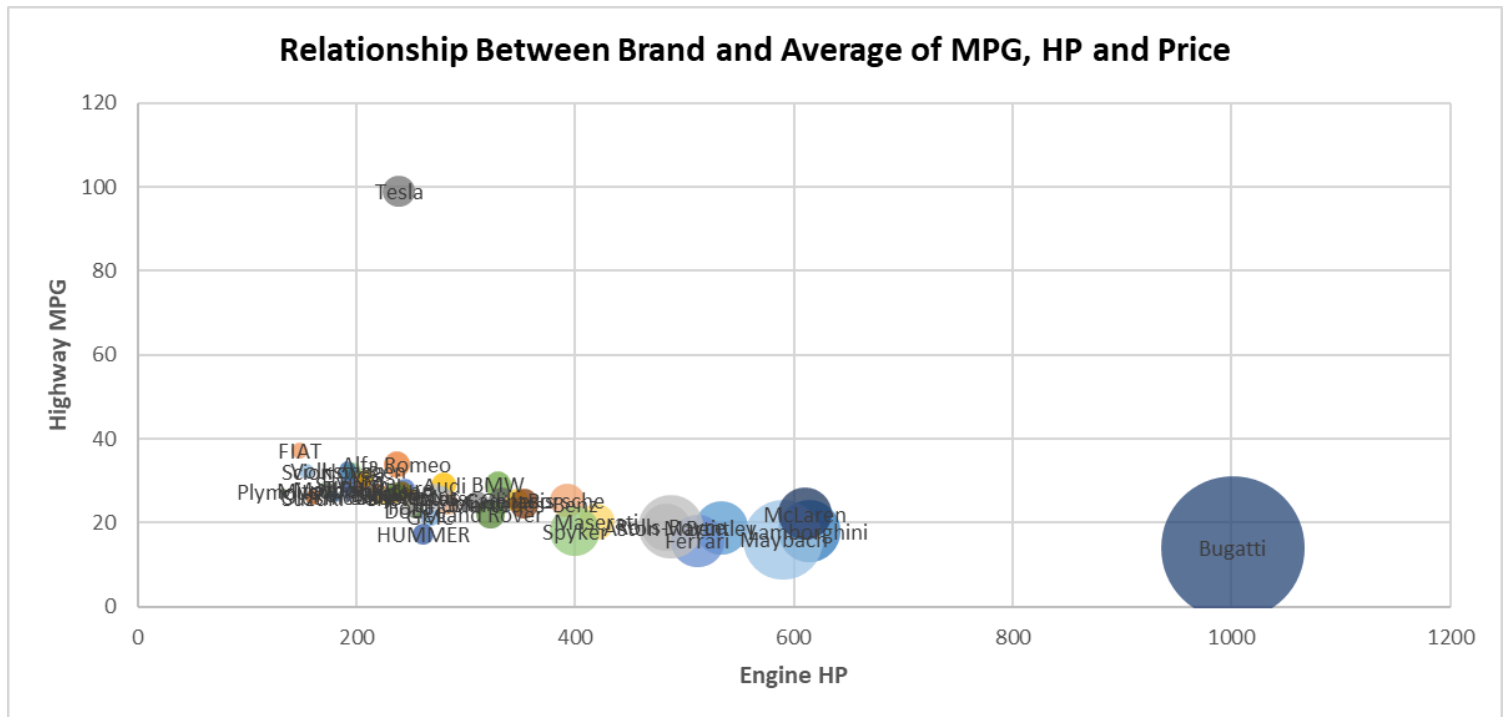


Task 4: How does the fuel efficiency of cars vary across different body styles and model years?



Fuel efficiency has increased over the years, Sedan being the highest in around 2014 - 2015.

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



As Engine HP increases, Highway MPG tends to decrease, while the car's price typically rises, highlighting a trade-off between performance and fuel efficiency. In this case: Bugatti.

Result:

The analysis results were visualized using various charts, such as bubble charts, scatter plots, and bar charts, providing insights into the relationships between car features like engine horsepower, fuel efficiency, and pricing. The charts revealed a positive correlation between engine HP and MSRP, and a negative correlation between engine cylinders and fuel efficiency.

The results imply that cars with higher engine power tend to be more expensive, but less fuel-efficient, which could influence consumer purchasing decisions. While this analysis helps understand these relationships, there are limitations, such as potential unaccounted variables like technological advancements.

Future directions could include integrating more recent data, conducting deeper analysis on emerging electric and hybrid cars, and exploring consumer preferences in more detail to guide product development and pricing strategies.

Excel File Link: [project_7_excel.xlsx](#)