

Analysing the Impact of Car Features on Price and Profitability

Summary

The automotive industry has been experiencing significant changes, with shifts towards fuel efficiency, environmental sustainability, and innovations in alternative fuel vehicles. To help a car manufacturer optimize pricing and product development, data analysis on a provided dataset will be used to understand consumer demand and profitability. The dataset contains 11,159 car models with 16 attributes, such as make, engine, fuel type, MSRP, market category, and fuel efficiency. The analysis will focus on trends in car features, fuel efficiency, pricing, and popularity to inform decisions on pricing strategies and product development.

Insights

Key insights that will be derived from the analysis include:

1. **Market Popularity:** Analysis of how car model popularity varies across market categories.
2. **Price vs. Engine Power:** Understanding the relationship between engine horsepower and price to identify how performance influences pricing.
3. **Price Determinants:** Regression analysis will reveal which features, such as fuel type or transmission, are the most important in determining the price.
4. **Price Across Manufacturers:** Examining the average price by manufacturer will give insight into which brands are priced higher or lower on average.
5. **Fuel Efficiency vs. Engine Cylinders:** A scatter plot and correlation analysis will evaluate the relationship between a car's fuel efficiency (MPG) and the number of cylinders in the engine.

Approach

The project will involve multiple steps:

1. **Data Cleaning:** Remove any missing values, check for outliers, and standardize the format of data.
2. **Exploratory Data Analysis (EDA):** Use pivot tables, charts, and descriptive statistics to understand the relationships between the variables.
3. **Regression Analysis:** Build a model to understand the impact of features (engine type, fuel type, etc.) on price.
4. **Dashboard Creation:** Develop an interactive dashboard using Excel for the client to explore pricing, car features, and popularity based on filters.
5. **Visualization:** Scatter plots, combo charts, and pivot charts will be used for insights, trendlines for regression, and summary statistics for correlation.

Technology Used

- **Excel:** Used for data cleaning, pivot tables, and dashboard creation.
- **Advanced Excel Techniques:** Regression analysis, trendlines, pivot charts, and data visualizations.
- **Visualization Tools:** Scatter plots, line charts, bar charts, combo charts, and slicers will be used to make the dashboard interactive and insightful.
- **Functions:** SUMIF, AVERAGEIF, AVERAGEIFS, and correlation functions will be used to calculate averages, sums, and relationships across different variables.

A.TASKS: ANALYSIS

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- **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.

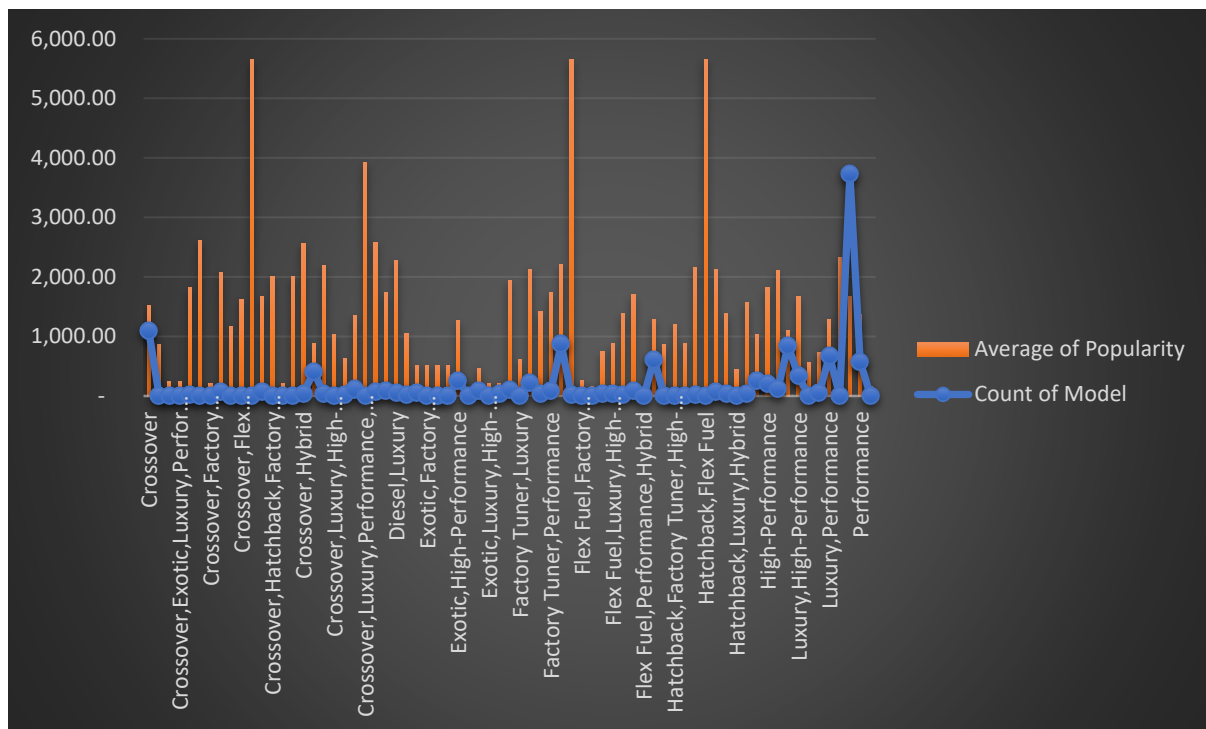
OUTCOMES

Row Labels	Count of Model	Average of Popularity
Crossover	1103	1,529.03
Crossover,Diesel	7	873.00
Crossover,Exotic,Luxury,High-Performance	1	238.00
Crossover,Exotic,Luxury,Performance	1	238.00
Crossover,Factory Tuner,Luxury,High-Performance	26	1,823.46
Crossover,Factory Tuner,Luxury,Performance	5	2,607.40
Crossover,Factory Tuner,Performance	4	210.00
Crossover,Flex Fuel	64	2,073.75
Crossover,Flex Fuel,Luxury	10	1,173.20
Crossover,Flex Fuel,Luxury,Performance	6	1,624.00
Crossover,Flex Fuel,Performance	6	5,657.00
Crossover,Hatchback	72	1,675.69
Crossover,Hatchback,Factory Tuner,Performance	6	2,009.00
Crossover,Hatchback,Luxury	7	204.00
Crossover,Hatchback,Performance	6	2,009.00
Crossover,Hybrid	42	2,563.38
Crossover,Luxury	410	884.55
Crossover,Luxury,Diesel	33	2,195.85
Crossover,Luxury,High-Performance	9	1,037.22
Crossover,Luxury,Hybrid	24	630.92
Crossover,Luxury,Performance	113	1,344.85
Crossover,Luxury,Performance,Hybrid	2	3,916.00
Crossover,Performance	69	2,585.96
Diesel	84	1,730.90
Diesel,Luxury	51	2,275.00
Exotic,Factory Tuner,High-Performance	21	1,046.38
Exotic,Factory Tuner,Luxury,High-Performance	52	517.54
Exotic,Factory Tuner,Luxury,Performance	3	520.00
Exotic,Flex Fuel,Factory Tuner,Luxury,High-Performance	13	520.00
Exotic,Flex Fuel,Luxury,High-Performance	11	520.00
Exotic,High-Performance	252	1,261.57
Exotic,Luxury	12	112.67
Exotic,Luxury,High-Performance	79	467.08
Exotic,Luxury,High-Performance,Hybrid	1	204.00
Exotic,Luxury,Performance	36	217.03
Factory Tuner,High-Performance	106	1,941.42
Factory Tuner,Luxury	2	617.00
Factory Tuner,Luxury,High-Performance	215	2,133.37
Factory Tuner,Luxury,Performance	31	1,413.42
Factory Tuner,Performance	89	1,733.10
Flex Fuel	872	2,217.30

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Flex Fuel,Diesel	16	5,657.00
Flex Fuel,Factory Tuner,Luxury,High-Performance	1	258.00
Flex Fuel,Hybrid	2	155.00
Flex Fuel,Luxury	39	746.54
Flex Fuel,Luxury,High-Performance	33	878.91
Flex Fuel,Luxury,Performance	28	1,380.07
Flex Fuel,Performance	81	1,702.36
Flex Fuel,Performance,Hybrid	2	155.00
Hatchback	614	1,293.00
Hatchback,Diesel	14	873.00
Hatchback,Factory Tuner,High-Performance	13	1,205.15
Hatchback,Factory Tuner,Luxury,Performance	9	886.89
Hatchback,Factory Tuner,Performance	22	2,159.05
Hatchback,Flex Fuel	7	5,657.00
Hatchback,Hybrid	72	2,121.25
Hatchback,Luxury	46	1,379.50
Hatchback,Luxury,Hybrid	3	454.00
Hatchback,Luxury,Performance	38	1,566.13
Hatchback,Performance	252	1,039.65
High-Performance	199	1,821.45
Hybrid	123	2,105.57
Luxury	851	1,107.55
Luxury,High-Performance	334	1,668.02
Luxury,High-Performance,Hybrid	12	568.83
Luxury,Hybrid	48	724.69
Luxury,Performance	673	1,292.62
Luxury,Performance,Hybrid	11	2,333.18
N/A	3728	1,671.39
Performance	584	1,371.08
Performance,Hybrid	1	155.00
Grand Total	11812	1,553.68

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Summary:

- The **blue line** represents the **count of car models** in various **market categories**, while the **orange bars** depict the **average popularity** of car models within each category.
- There are significant spikes in popularity for certain categories, even though the number of models in those categories may be relatively low.
- Conversely, some categories have a high number of car models, but their average popularity is low.

Key Insights:

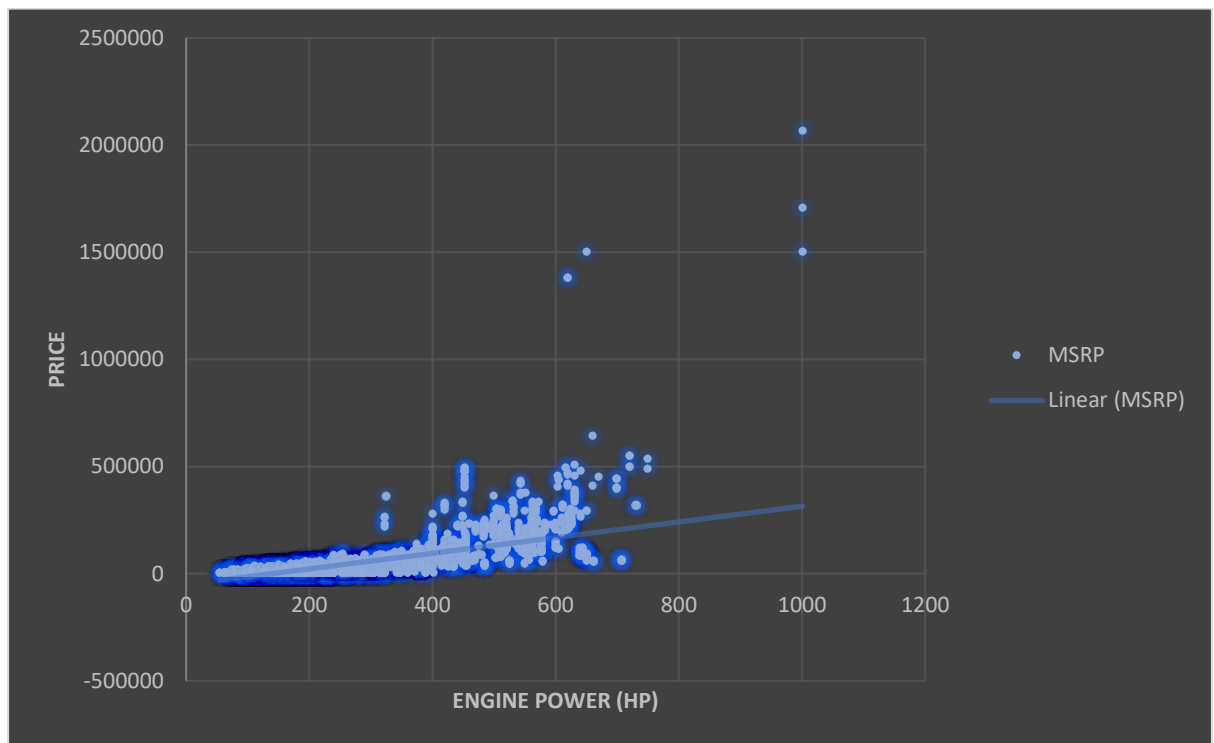
1. **Performance category** has one of the highest popularity spikes despite having fewer car models compared to other categories.
2. **Luxury** and **Crossover** categories have a moderate count of models but tend to show higher popularity in several sub-categories.
3. Categories with **hybrid** or **eco-friendly options** (e.g., **Performance-Hybrid** and **Flex Fuel**) seem to have lower model counts, but varying levels of popularity.
4. The **N/A** category shows a high count of models, but its popularity is relatively low compared to other categories.

This suggests that certain niche markets like **performance** vehicles or high-end categories are highly popular despite fewer options available, while categories like **flex fuel** or **eco-friendly** alternatives might not have gained as much traction. The manufacturer could focus more on these popular categories to maximize profitability.

- **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.

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OUTCOMES-



Outcome of the Graph:

- 1. Positive Correlation Between Engine Power and Price:**
 - There is a general positive correlation between **Engine Power (HP)** and **Price (MSRP)**, meaning that as the horsepower increases, the price of the vehicle tends to increase. This is consistent with expectations, as high-performance vehicles tend to command higher prices.
- 2. Outliers in High-Performance Segment:**
 - A few cars with over **800+ HP** are priced significantly higher than the rest, crossing the **\$1,000,000** price range. These outliers could represent luxury or exotic cars such as supercars or hyper cars, where a combination of extreme performance and brand prestige drives up the price significantly.
- 3. Clustered Distribution:**
 - Most vehicles are clustered between **100-600 HP** and priced under **\$500,000**. This range likely represents mainstream vehicles, including family sedans, SUVs, and sports cars.
- 4. Slight Non-Linear Trend:**
 - The linear trend line slightly increases, reflecting the general positive correlation, but there are diminishing returns at higher horsepower. This indicates that beyond a certain point (e.g., above 600 HP), price increases more sharply, possibly due to the exclusivity or special features of the high-end vehicles.

Business Implication:

The price of vehicles increases with higher engine power, but there is a steep premium for high-performance vehicles (above 800 HP). Manufacturers might focus on optimizing pricing strategies

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for the high-performance segment, while mid-range cars may not experience the same price premium for additional horsepower.

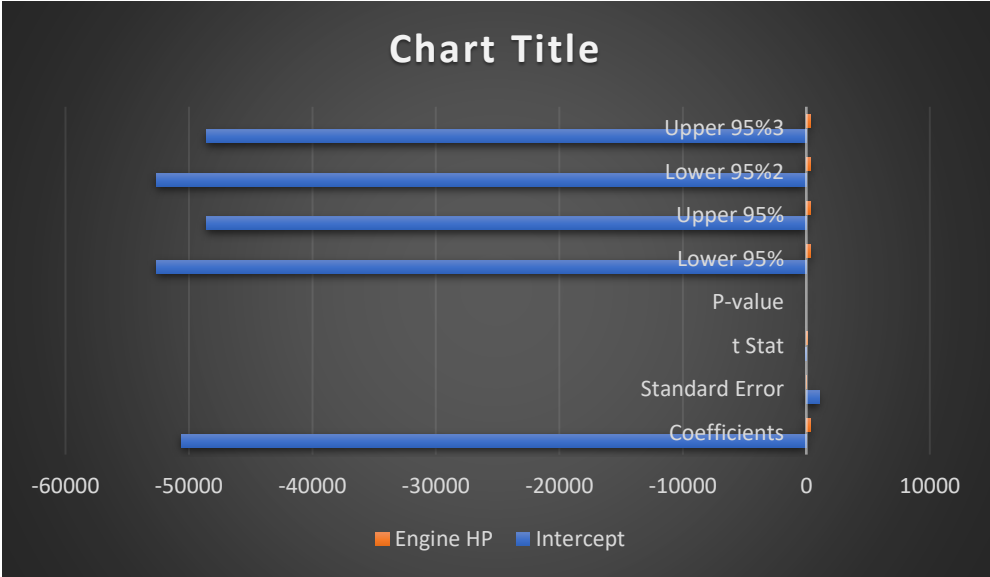
Task 3: Use regression analysis to identify the variables that have the strongest relationship with a car's price. Then create a bar chart that shows the coefficient values for each variable to visualize their relative importance.

OUTCOMES:

SUMMARY OUTPUT	Column1						
Regression Statistics							
Multiple R	0.661827336						
R Square	0.438015422						
Adjusted R Square	0.437967837						
Standard Error	45194.29489						
Observations	11812						

ANOVA	Column1	Column2	Column3	Column4	Column5		
	df	SS	MS	F	Significance F		
Regression	1	1.88011E+13	1.88011E+13	9204.811559	0		
Residual	11810	2.41222E+13	2042524291				
Total	11811	4.29233E+13					

Column1	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	
Intercept	-50594.08409	1037.114028	-48.78353075	0	-52626.99853	-48561.16966	-5
Engine HP	365.340201	3.80793926	95.94170917	0	357.8760124	372.8043896	3



- Task 4.A:** Create a pivot table that shows the average price of cars for each manufacturer.

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- **Task 4.B:** Create a bar chart or a horizontal stacked bar chart that visualizes the relationship between manufacturer and average price.

OUTCOMES: The bar graph represents the average Manufacturer's Suggested Retail Price (MSRP) for various car manufacturers. Here's a summary of the key observations:

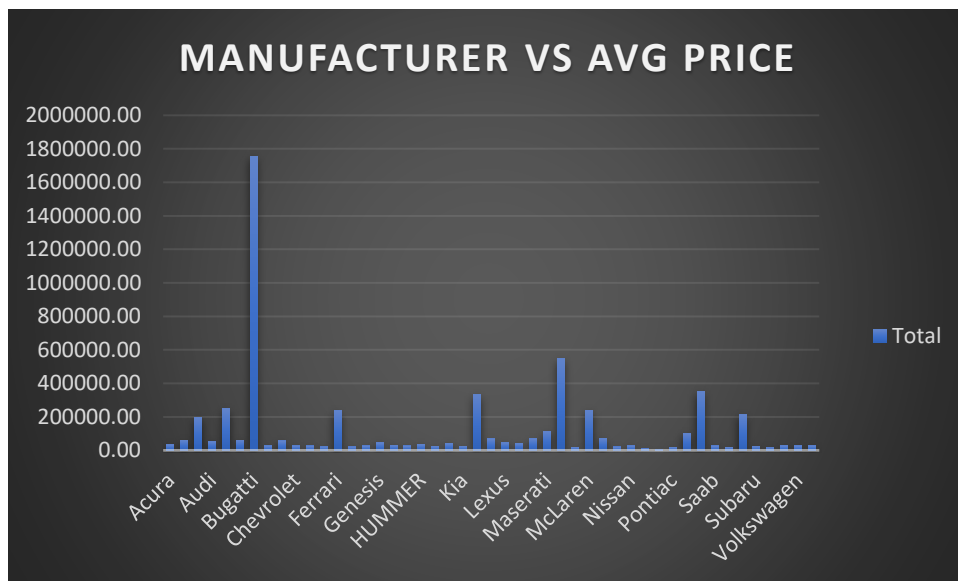
1. Bugatti stands out with the highest average MSRP, surpassing 15,000,000, significantly more than any other brand.
2. Ferrari, McLaren, and Maserati show higher average prices compared to most manufacturers, though they are considerably lower than Bugatti.
3. Brands like Acura, Audi, Chevrolet, Kia, Nissan, and Volkswagen have relatively lower average prices compared to luxury and high-performance brands.
4. Chevrolet shows a notable spike in comparison to other mass-market manufacturers.
5. Many brands like Genesis, HUMMER, and Lexus fall within the mid-range pricing category.

This chart suggests a clear distinction between high-end luxury or performance car brands (Bugatti, Ferrari, McLaren) and more common car manufacturers (Acura, Nissan, Kia) in terms of average pricing. The substantial gap between Bugatti and others is indicative of its status as a premium hyper car manufacturer.

Row Labels	Average of MSRP
Acura	34887.59
Alfa Romeo	61600.00
Aston Martin	197910.38
Audi	53452.11
Bentley	247169.32
BMW	61546.76
Bugatti	1757223.67
Buick	28206.61
Cadillac	56231.32
Chevrolet	28273.36
Chrysler	26722.96
Dodge	22390.06
Ferrari	237383.82
FIAT	22206.02
Ford	27393.42
Genesis	46616.67
GMC	30493.30
Honda	26629.82
HUMMER	36464.41
Hyundai	24597.04
Infiniti	42394.21
Kia	25112.39
Lamborghini	331567.31
Land Rover	67823.22
Lexus	47549.07
Lincoln	42494.37
Lotus	69188.28
Maserati	114207.71

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Maybach	546221.88
Mazda	19719.06
McLaren	239805.00
Mercedes-Benz	71537.81
Mitsubishi	21215.47
Nissan	28513.37
Oldsmobile	11542.54
Plymouth	3122.90
Pontiac	19321.55
Porsche	101622.40
Rolls-Royce	351130.65
Saab	27413.50
Scion	19932.50
Spyker	213323.33
Subaru	24827.50
Suzuki	17900.96
Toyota	28946.15
Volkswagen	28076.20
Volvo	28541.16
Grand Total	40559.93532



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.

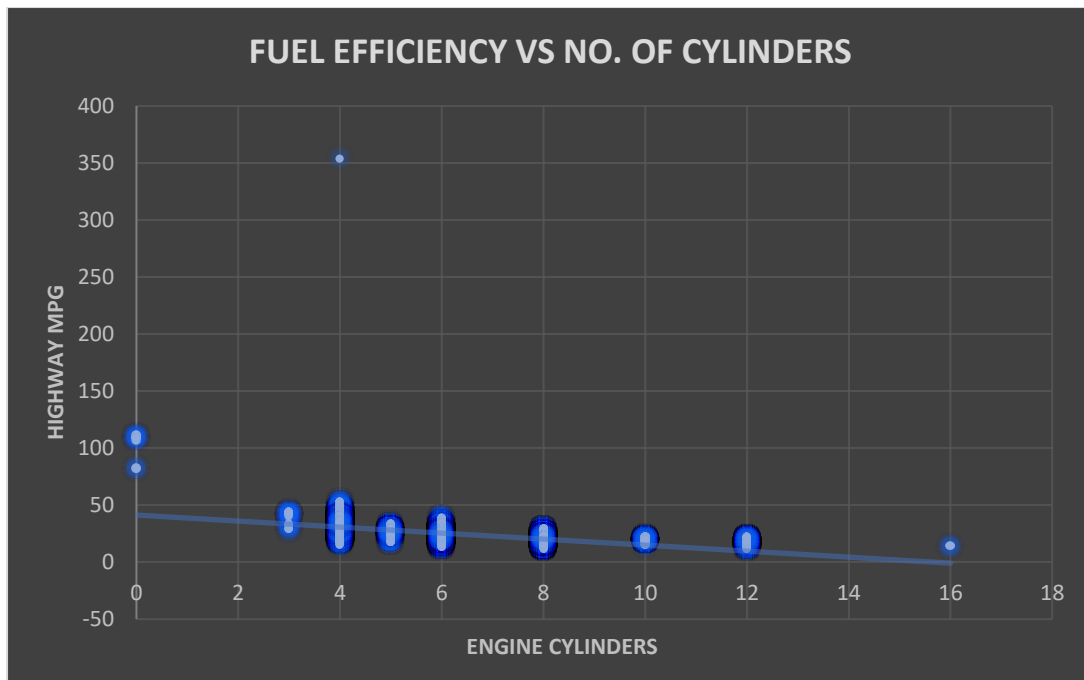
Task 5.B: Calculate the correlation coefficient between the number of cylinders and highway MPG to quantify the strength and direction of the relationship.

OUTCOMES: Highway MPG tends to decline as the number of engine cylinders grows, according to investigation, which finds as negative association between the two variables. The automobile with 16

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cylinders, for instance, has the lowest highway MPG of 14, demonstrating how engine capacity affects fuel economy.

In addition a relative Significant negative link is indicated by the correlation coefficient of -0.610337 which is derived between number of cylinders and highway MPG. This statistical metric quantifies the relationships strength and direction, indicating that highway MPG tends to decline with increasing strength.



CORRELATION COEFFICIENT

-0.62031

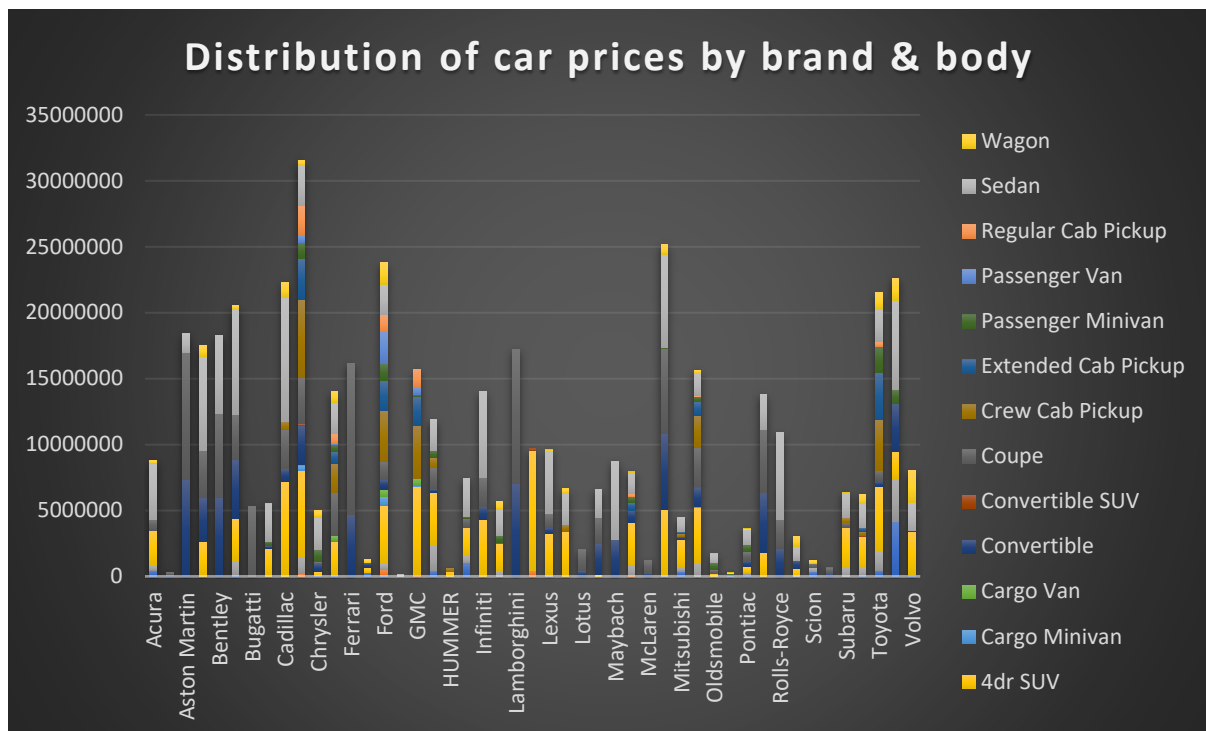
DASHBOARD TASKS-

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

OUTCOMES:

- After doing this study we find that Mercedes_ Benz comes in second place with \$24,575,709, while Chevrolet comes in first place with \$31,487,928, the greatest total of prices. When it comes to car types, Sedans cost the most, coming in at \$115,033,523, followed by 4-door SUVs at \$99,137,486,

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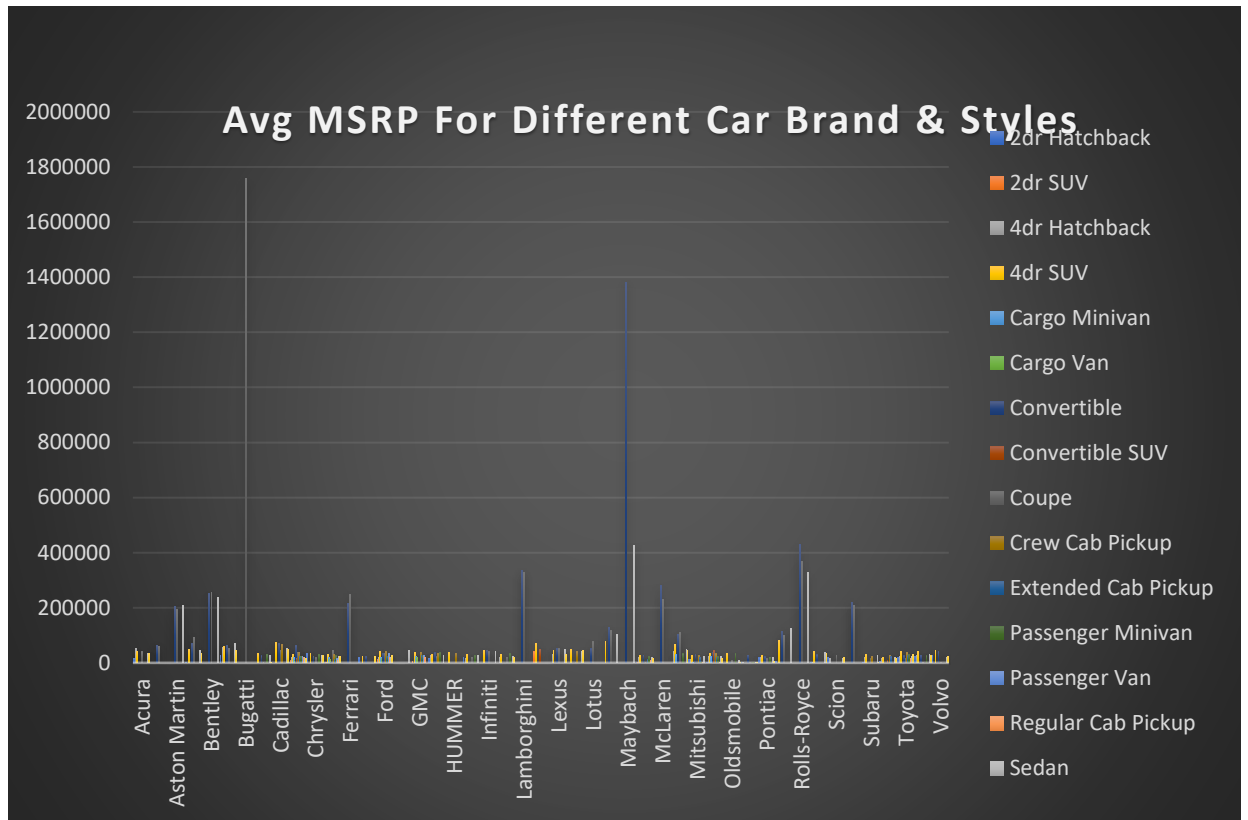


Task 2: Which car brands have the highest and lowest average MSRPs, and how does this vary by body style?

OUTCOMES:

- In terms of brand analysis, Bugatti has the highest average price of \$1,757,224, while Maybach is next closest with \$546,222, with regard to body style, couples come in second at \$77,595.28 and convertibles at \$88,216.79 having the highest average price
- Plymouth has the lowest average price per brand at \$3,296.87 while Oldsmobile comes in second at \$12,843.79
- When it comes to body style, the most affordable 2_door SUVs are \$14,306.54 followed by 2-door Hatchbacks at \$16,177.7

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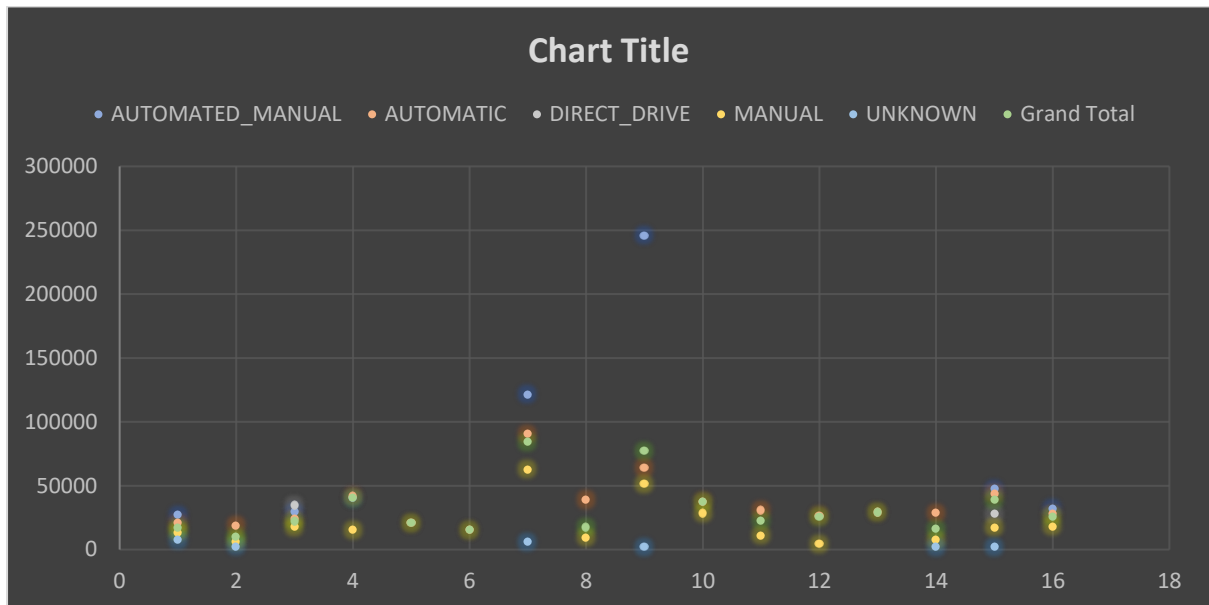
Task 3: How do the different feature such as transmission type affect the MSRP, and how does this vary by body style?

OUTCOMES:

When examining transmission types, direct drive transmissions, with an average price of \$47,351.3, are closely followed by automated manual transmissions, which have the highest average price of \$108,719.0. In terms of body shape, coupes come in second at \$77,595.3, and convertibles have the highest average price at \$88,216. 8. Conversely, manual transmissions are in second place at \$28,267.9, while unknown transmissions have the lowest average price per gearbox type at \$3,647.8. With an average price of \$14,306.54, 2-door SUVs are the least expensive body shape; 2-door hatchbacks are next, at \$16,177.74.

These insights offer useful information for comprehending price trends in the car industry across various body shapes and gearbox types.

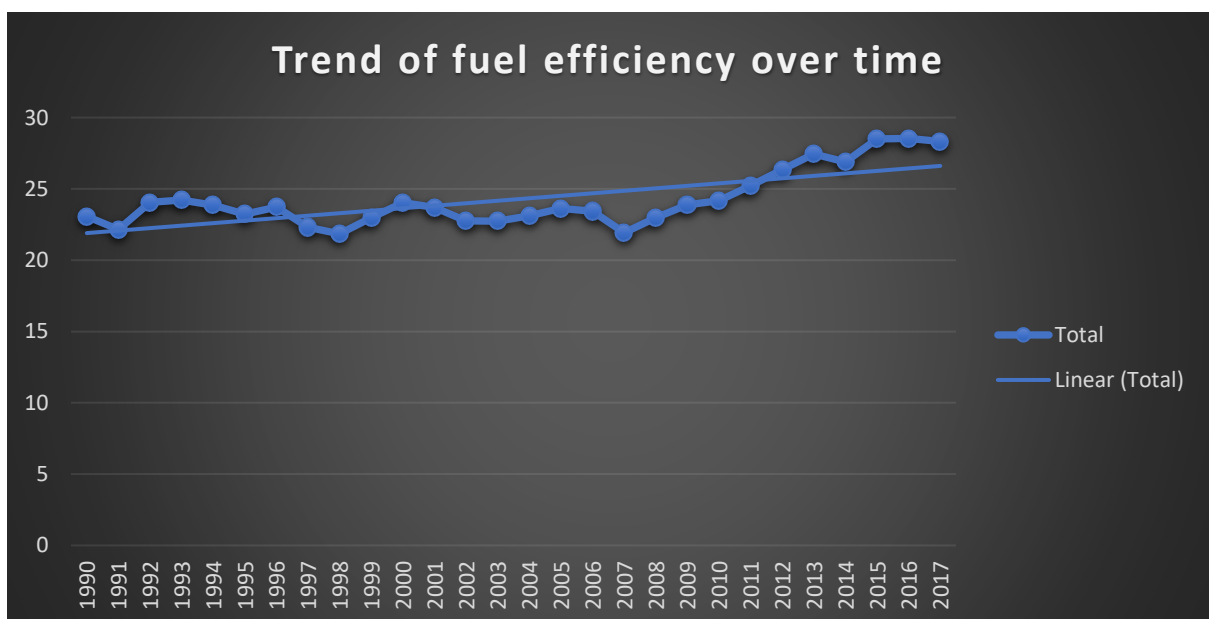
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Task 4: How does the fuel efficiency of cars vary across different body styles and model years?

OUTCOMES:

According to the data, there appears to be a tendency towards increased fuel efficiency as car model years advance, which may be attributed to developments in automotive technology and legislation aimed at reducing emissions and improving fuel economy.



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

OUTCOMES:

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- Indeed, Bugatti has the greatest average engine horsepower (1001), the highest average highway mileage (14), and the highest average cost (\$1,757,224). In contrast, Tesla has the highest average highway MPG (99), the highest average engine horsepower (538), and the highest average price (\$85,256).

- In conclusion, those wanting unmatched performance will find Bugatti's high-performance cars intriguing because they command top-tier engine power and pricing. On the other hand, Tesla's emphasis on electric cars highlights their remarkable price and fuel economy, which appeals to customers who care about the environment. This comparison highlights how different goals and preferences exist within the automobile industry, serving a broad spectrum of customers with different requirements and interests.

