

# **PROJECT 7**

## **Analyzing the Impact of Car Features on Price and Profitability**

### **DATASET LINK:**

[https://drive.google.com/drive/folders/1QKxdjww1wOoA4IICiFnzfPxEbPFQwXsC?usp=drive\\_link](https://drive.google.com/drive/folders/1QKxdjww1wOoA4IICiFnzfPxEbPFQwXsC?usp=drive_link)

### **PROJECT DESCRIPTION**

#### **Project Overview:**

The project aims to assist a car manufacturer in optimizing pricing and product development decisions to maximize profitability while meeting consumer demand. This involves analyzing the relationship between car features, market category, pricing, and consumer preferences.

#### **Business Problem:**

The key challenge is to identify which car features and market categories are most popular among consumers and most profitable for the manufacturer. This requires understanding consumer preferences and market dynamics to develop an effective pricing strategy that balances profitability with demand.

#### **Data Sources:**

The project utilizes various data sources such as sales data, consumer surveys, market research reports, and possibly competitor analysis. These sources provide insights into consumer behaviour, market trends, and competitor strategies.

#### **Data Cleaning and Preprocessing:**

- 1. Data Integration:** Combining data from different sources to create a comprehensive dataset.
- 2. Data Cleaning:** Removing duplicates, handling missing values, and correcting inconsistencies.
- 3. Feature Engineering:** Creating new features based on existing ones, such as deriving fuel efficiency from engine specifications.
- 4. Normalization/Standardization:** Scaling numerical features to a standard range for better model performance.

**5. Encoding Categorical Variables:** Converting categorical variables into numerical format for analysis.

**6. Outlier Detection and Handling:** Identifying and addressing outliers that may skew the analysis.

#### **Assumptions:**

1. The dataset accurately represents consumer preferences and market dynamics.
2. Consumer preferences and market trends remain relatively stable during the analysis period.
3. Competitor pricing and product offerings are considered as reference points but are not the sole determinant of the manufacturer's strategy.
4. The analysis assumes that consumer preferences and willingness to pay for certain features can be inferred from the data accurately.

#### **APPROACH**

##### **Analytical Methods Used:**

- 1. Descriptive Statistics:** Utilized to summarize the distribution of car features and prices across different categories and brands.
- 2. Visualization:** Implemented to visually explore relationships between variables and identify trends, patterns, and outliers.
- 3. Filtering and Slicing:** Employed to make the dashboard interactive, allowing users to dynamically explore the data based on their preferences.
- 4. Aggregation Techniques:** Utilized to calculate summary statistics such as average prices, total MSRPs, and average MPG across various dimensions.

##### **Reasoning Behind Analytical Methods:**

- 1. Descriptive Statistics:** Provides a clear understanding of the data's distribution and helps in identifying potential insights.
- 2. Visualization:** Enables intuitive exploration and communication of complex relationships and trends in the data.

**3. Filtering and Slicing:** Enhances user interactivity and flexibility in exploring different aspects of the data.

**4. Aggregation Techniques:** Facilitates the calculation of summary metrics required for generating insights and visualizations.

### **Modeling Techniques Used:**

**1. Trendline Analysis:** Employed to visualize the relationship between engine power and price, as well as between fuel efficiency and the number of cylinders.

**2. Regression Analysis:** Used to identify the variables that have the strongest relationship with a car's price and determine their relative importance.

### **Challenges and Limitations:**

**1. Data Quality:** Ensuring the accuracy and completeness of the dataset, especially for variables like engine power, MPG, and price, is crucial for reliable analysis.

**2. Interpretability:** While visualization aids in understanding relationships, interpreting complex models or trends may require additional context or expertise.

**3. Data Integration:** Combining data from different sources while maintaining consistency and integrity can be challenging.

**4. User Interface Design:** Designing an intuitive and user-friendly dashboard that effectively communicates insights without overwhelming the user requires careful consideration of layout and interactivity.

**5. Performance Optimization:** Ensuring the dashboard's responsiveness and performance, especially with large datasets, may require optimization techniques.

**6. Assumptions:** The validity of assumptions made during analysis, such as the relationships between variables or the representativeness of the data, may impact the accuracy of the insights generated.

### **TECH STACK USED**

#### **Tech-Stack Used:**

**1. Microsoft Excel 2010:** Utilized as the primary software for data analysis, visualization, and dashboard creation.

**2. Pivot Table:** Leveraged for summarizing and aggregating data to generate insights, such as counting car models by market category and calculating average prices by manufacturer.

**3. Charts:** Employed to visualize relationships between variables, including combo charts, scatter charts with trendlines, and bar charts.

**4. Functions:** Utilized built-in Excel functions such as AVERAGEIF, SUMIF, and AVERAGEIFS for calculating summary statistics and aggregating data.

**5. Add-ins:** Utilized add-ins like Data Analysis ToolPak for additional statistical analysis capabilities, if needed.

#### **Reasoning Behind the Choice of Tech Stack:**

**1. Microsoft Excel:** Widely accessible and familiar software, making it suitable for collaboration and communication with stakeholders who may not have specialized data analysis skills.

**2. Pivot Table:** Provides a powerful and intuitive tool for summarizing and analyzing large datasets, facilitating quick insights generation.

**3. Charts and Functions:** Excel offers a diverse range of chart types and functions, allowing for flexible visualization and analysis of data.

**4. Data Analysis ToolPak:** Provides additional statistical functions and analysis tools, enhancing the capabilities of Excel for more advanced analysis if required.

#### **Additional Libraries or Packages Used:**

No additional libraries or packages used.

## Tasks: Analysis

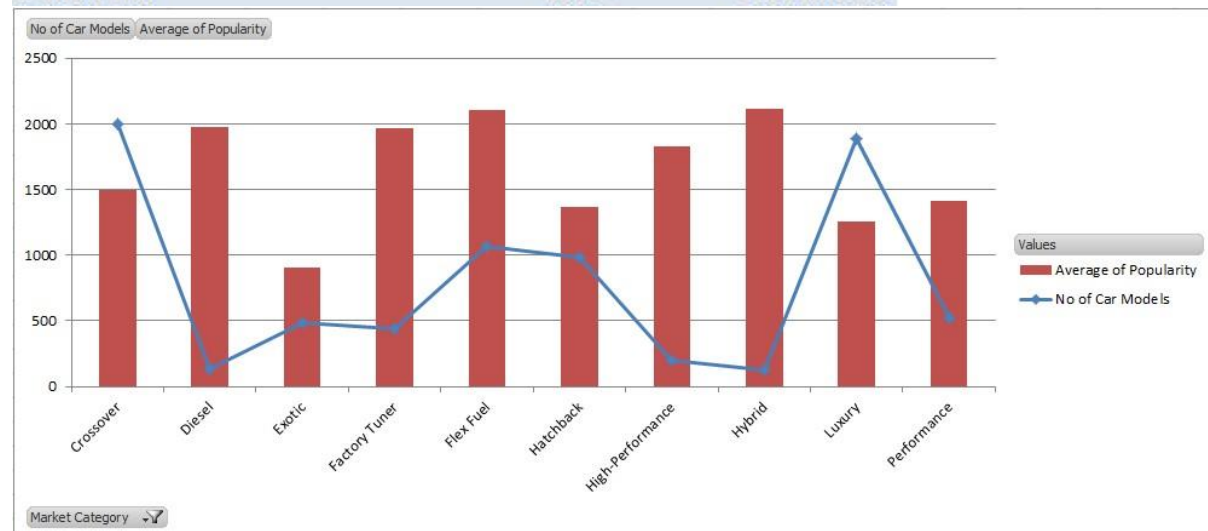
**Insight Required:** How does the popularity of a car model vary across different market categories?

● **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.

### INSIGHTS:

| Market Category    | No of Car Models | Average of Popularity |
|--------------------|------------------|-----------------------|
| Crossover          | 1994             | 1493.821464           |
| Diesel             | 131              | 1976.740458           |
| Exotic             | 483              | 906.4037267           |
| Factory Tuner      | 435              | 1970.216092           |
| Flex Fuel          | 1062             | 2106.477401           |
| Hatchback          | 982              | 1363.775967           |
| High-Performance   | 198              | 1823.378788           |
| Hybrid             | 121              | 2116.586777           |
| Luxury             | 1887             | 1251.00318            |
| Performance        | 521              | 1412.790787           |
| <b>Grand Total</b> | <b>7814</b>      | <b>1513.004863</b>    |



The average popularity of cars based on their **Market Category**.

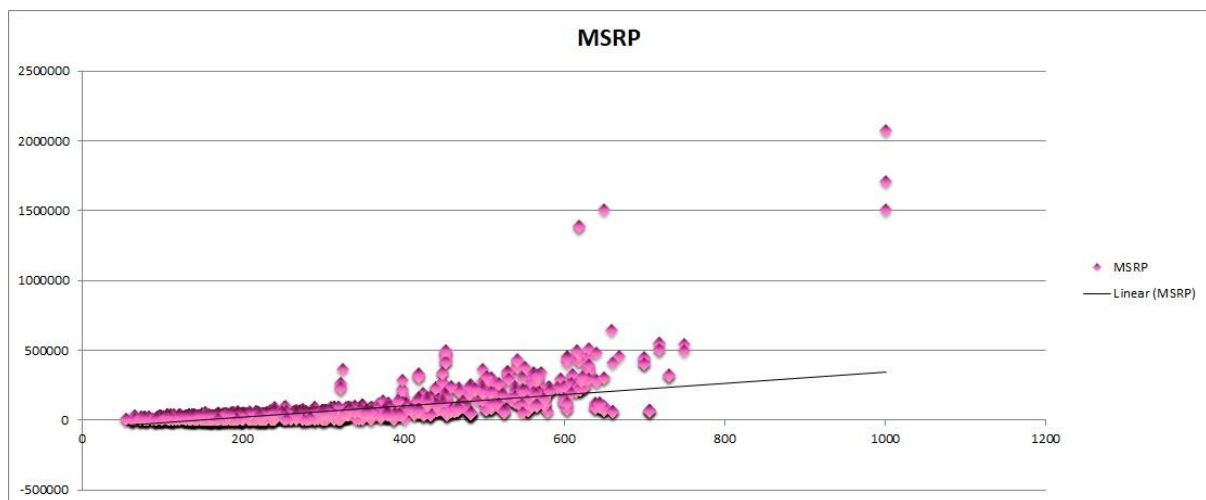
**Least popular: Exotic**

**Most popular: Hybrid**

**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.

**INSIGHTS:**



As higher **Engine HP** requires more complex level of design and engineering and more expensive sub-parts. We can observe the trendline has **positive** slope.

**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.

### INSIGHTS:

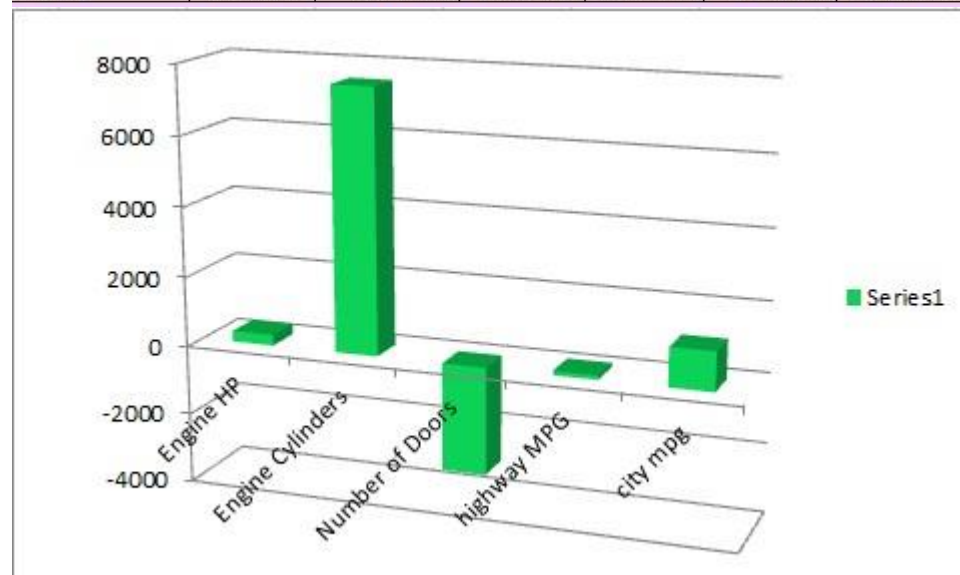
#### SUMMARY OUTPUT

| Regression Statistics |             |
|-----------------------|-------------|
| Multiple R            | 0.758722297 |
| R Square              | 0.575659523 |
| Adjusted R Square     | 0.575153513 |
| Standard Error        | 37883.2098  |
| Observations          | 4199        |

#### ANOVA

|            | df   | SS          | MS          | F           | Significance F |
|------------|------|-------------|-------------|-------------|----------------|
| Regression | 5    | 8.16337E+12 | 1.63267E+12 | 1137.643244 | 0              |
| Residual   | 4193 | 6.01753E+12 | 1435137585  |             |                |
| Total      | 4198 | 1.41809E+13 |             |             |                |

|                  | Coefficients | Standard Error | t Stat       | P-value     | Lower 95%    | Upper 95%    | Lower 95.0%  | Upper 95.0%  |
|------------------|--------------|----------------|--------------|-------------|--------------|--------------|--------------|--------------|
| Intercept        | -90570.2115  | 4751.346667    | -19.0620087  | 9.3163E-78  | -99885.36877 | -81255.05422 | -99885.36877 | -81255.05422 |
| Engine HP        | 305.8578546  | 8.192673319    | 37.3330954   | 1.2423E-263 | 289.7958735  | 321.9198357  | 289.7958735  | 321.9198357  |
| Engine Cylinders | 7521.201064  | 592.6406529    | 12.69099753  | 3.05419E-36 | 6359.311335  | 8683.090792  | 6359.311335  | 8683.090792  |
| Number of Doors  | -3079.5246   | 630.234508     | -4.886315429 | 1.06576E-06 | -4315.118206 | -1843.930994 | -4315.118206 | -1843.930994 |
| highway MPG      | 115.7868688  | 104.4147965    | 1.10891246   | 0.267531546 | -88.92146318 | 320.4952008  | -88.92146318 | 320.4952008  |
| city mpg         | 1112.480894  | 131.3602388    | 8.468931724  | 3.38227E-17 | 854.9452159  | 1370.016571  | 854.9452159  | 1370.016571  |



From the column chart we get that **Engine Cylinders** are most important in determining in car's price. Other factors like Engine HP, highway MPG and city mpg also matters except **Number of doors**.

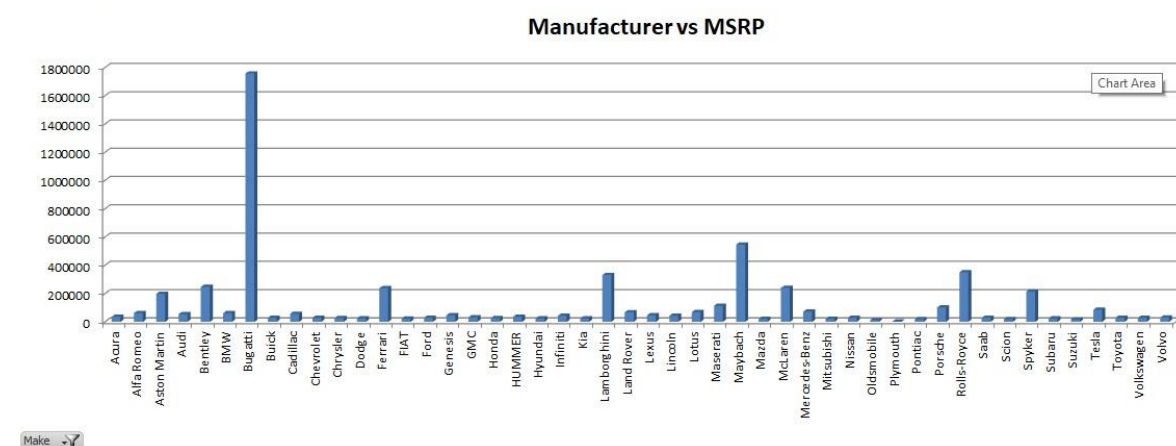
**Insight Required:** How does the average price of a car vary across different manufacturers?

● **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.

### INSIGHTS:

| Row Labels   | Average of MSRP |                    |                    |
|--------------|-----------------|--------------------|--------------------|
|              |                 | Lexus              | 47549.06931        |
| Acura        | 35087.4878      | Lincoln            | 43860.825          |
| Alfa Romeo   | 61600           | Lotus              | 68377.14286        |
| Aston Martin | 198123.4615     | Maserati           | 113684.4909        |
| Audi         | 54574.1215      | Maybach            | 546221.875         |
| Bentley      | 247169.3243     | Mazda              | 20416.62379        |
| BMW          | 62162.55864     | McLaren            | 239805             |
| Bugatti      | 1757223.667     | Mercedes-Benz      | 72069.52786        |
| Buick        | 29034.18947     | Mitsubishi         | 21340.5625         |
| Cadillac     | 56368.26515     | Nissan             | 28921.15245        |
| Chevrolet    | 29074.72576     | Oldsmobile         | 12843.79545        |
| Chrysler     | 26722.96257     | Plymouth           | 3296.873239        |
| Dodge        | 24857.04537     | Pontiac            | 19800.0442         |
| Ferrari      | 238218.8406     | Porsche            | 101622.3971        |
| FIAT         | 22670.24194     | Rolls-Royce        | 351130.6452        |
| Ford         | 28511.30788     | Saab               | 27879.80734        |
| Genesis      | 46616.66667     | Scion              | 19932.5            |
| GMC          | 32444.08506     | Spyker             | 214990             |
| Honda        | 26655.14781     | Subaru             | 24240.67364        |
| HUMMER       | 36464.41176     | Suzuki             | 18026.4152         |
| Hyundai      | 24926.26255     | Tesla              | 85255.55556        |
| Infiniti     | 42640.27134     | Toyota             | 28846.5605         |
| Kia          | 25513.75546     | Volkswagen         | 28978.52289        |
| Lamborghini  | 331567.3077     | Volvo              | 29724.68421        |
| Land Rover   | 68067.08633     | <b>Grand Total</b> | <b>41925.92714</b> |



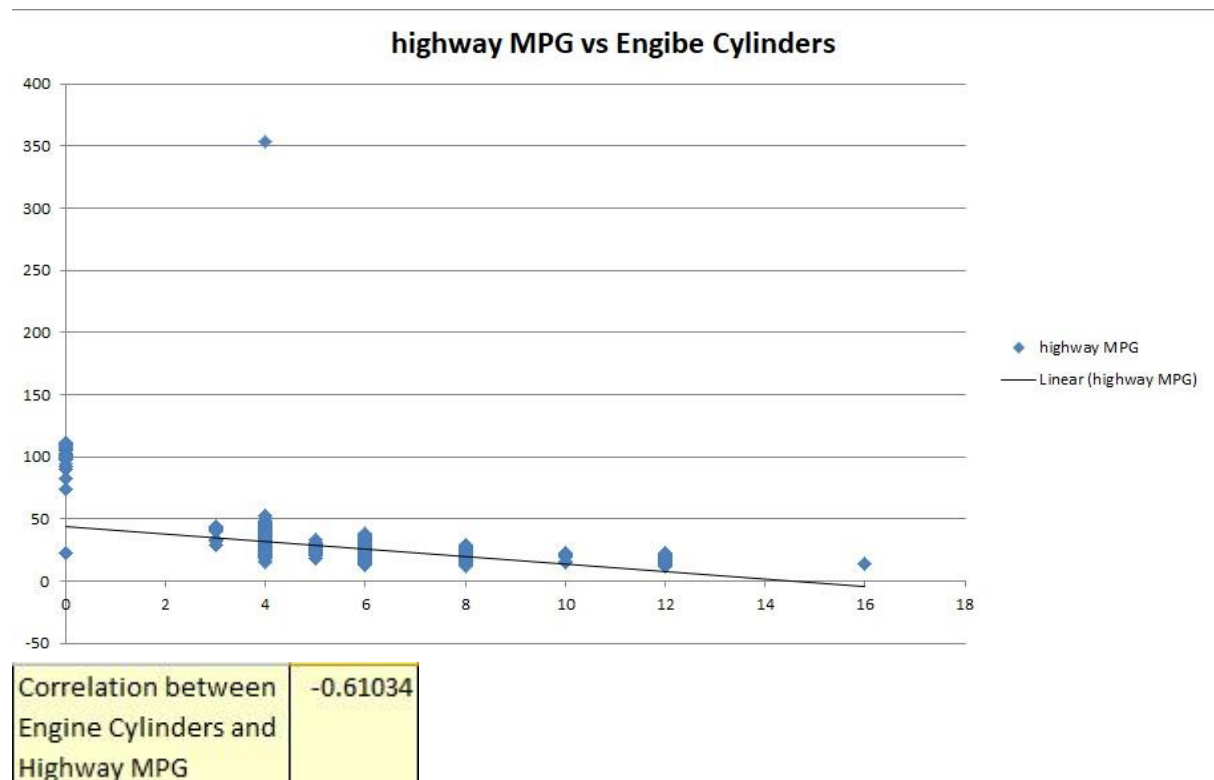
We can observe that the most expensive cars are of **Bugatti** brand followed by **Maybach**, **Rolls-Royce**, **Lamborghini** etc. All these car brands are **High-Performance** and **Luxury** brands.



**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.



The correlation coefficient is **-0.61034** (negative) and the **slope** of the scatter plot is also negative as **the number of Engine Cylinder** increases, **highway MPG** decreases.

## Building the Dashboard:

Now for the Next portion of the Project, you need to create the Interactive Dashboard.

Use filters and slicers to make the chart interactive. The client has requested these questions given below:

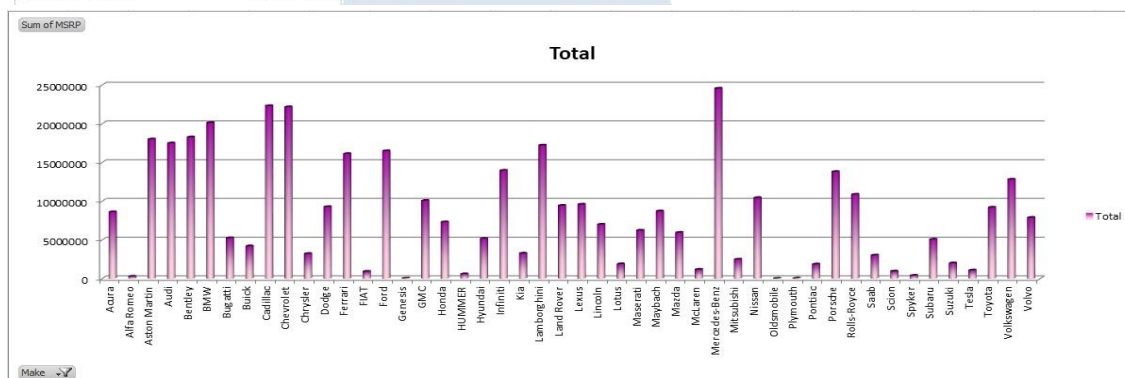
**Task 1:** How does the distribution of car prices vary by brand and body style?

● **Hints:** Stacked column chart to show the distribution of car prices by brand and body style. Use filters and slicers to make the chart interactive. Calculate the total MSRP for each brand and body style using SUMIF or Pivot Tables.

### INSIGHTS:

#### Distribution of car prices(MSRP) by brand (Make)

| Row Labels   | Sum of MSRP |                    |                  |
|--------------|-------------|--------------------|------------------|
| Acura        | 8631522     | Lexus              | 9604912          |
| Alfa Romeo   | 308000      | Lincoln            | 7017732          |
| Aston Martin | 18029235    | Lotus              | 1914560          |
| Audi         | 17518293    | Maserati           | 6252647          |
| Bentley      | 18290530    | Maybach            | 8739550          |
| BMW          | 20140669    | Mazda              | 5969890          |
| Bugatti      | 5271671     | McLaren            | 1199025          |
| Buick        | 4221300     | Mercedes-Benz      | 24575709         |
| Cadillac     | 22321833    | Mitsubishi         | 2511323          |
| Chevrolet    | 22182946    | Nissan             | 10460022         |
| Chrysler     | 3237718     | Oldsmobile         | 104604           |
| Dodge        | 9293666     | Plymouth           | 154996           |
| Ferrari      | 16142100    | Pontiac            | 1879776          |
| FIAT         | 945485      | Porsche            | 13820646         |
| Ford         | 16514249    | Rolls-Royce        | 10885050         |
| Genesis      | 139850      | Saab               | 3038899          |
| GMC          | 10094152    | Scion              | 979005           |
| Honda        | 7328413     | Spyker             | 429980           |
| HUMMER       | 619895      | Subaru             | 5088826          |
| Hyundai      | 5182120     | Suzuki             | 2035504          |
| Infiniti     | 13986009    | Tesla              | 1109100          |
| Kia          | 3286275     | Toyota             | 9221570          |
| Lamborghini  | 17241500    | Volkswagen         | 12832665         |
| Land Rover   | 9461325     | Volvo              | 7906766          |
|              |             | <b>Grand Total</b> | <b>398121513</b> |



Mercedes-Benz has the highest sum of 24575709. Oldsmobile has the lowest sum of 104604.

## FILTERS AND SLICERS

Right click anywhere in the Pivot table. In the **Filter** option click on Top 10. This will give us the top 10 Brands that have highest car prices.

| Row Labels  | Sum of MSRP |
|-------------|-------------|
| Audi        | 17518293    |
| Grand Total | 17518293    |

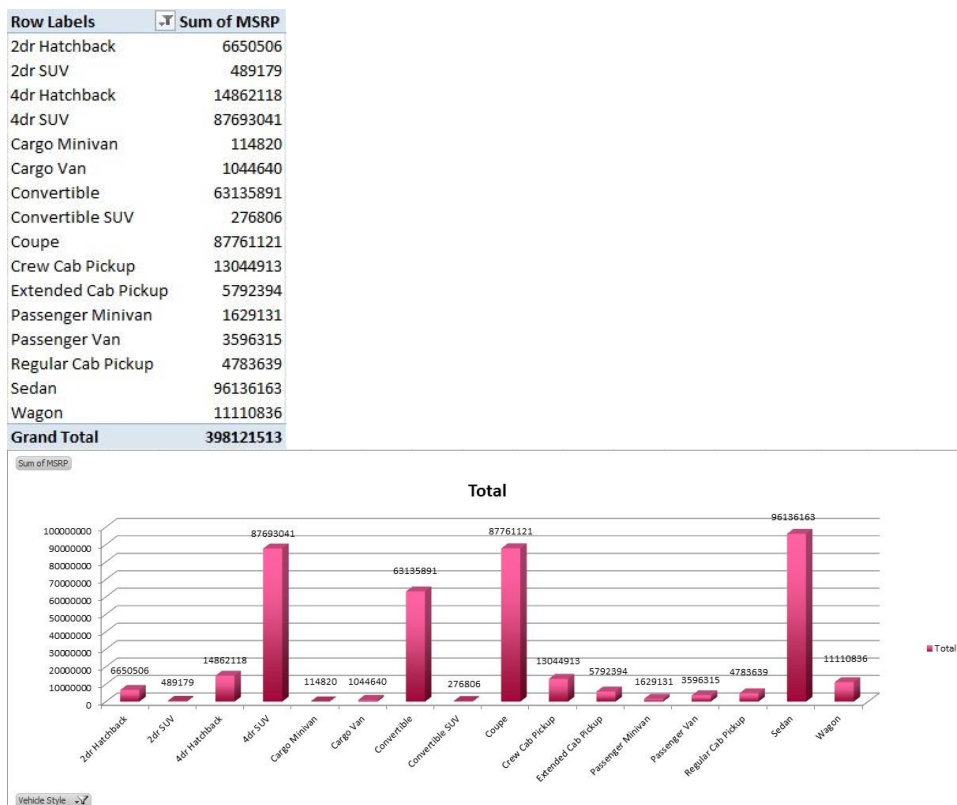
| Row Labels    | Sum of MSRP |
|---------------|-------------|
| Aston Martin  | 18029235    |
| Audi          | 17518293    |
| Bentley       | 18290530    |
| BMW           | 20140669    |
| Cadillac      | 22321833    |
| Chevrolet     | 22182946    |
| Ferrari       | 16142100    |
| Ford          | 16514249    |
| Lamborghini   | 17241500    |
| Mercedes-Benz | 24575709    |
| Grand Total   | 192957064   |

| Make         |
|--------------|
| Acura        |
| Alfa Romeo   |
| Aston Martin |
| Audi         |
| Bentley      |
| BMW          |
| Bugatti      |
| Buick        |

**Slicers** are interactive visual filters that allow users to easily filter and analyse data in Pivot Table or Pivot Charts.

Basically, it works as a switch for Pivot table. For example, if we only want to see the BMW stats in Pivot table we can just click BMW in Slicer and it will show data related to only BMW.



Sedan has the highest sum of 96136163. Cargo Minivan has the lowest sum of 114820.

| Row Labels         | Sum of MSRP    |
|--------------------|----------------|
| Cargo Van          | 1044640        |
| <b>Grand Total</b> | <b>1044640</b> |

| Vehicle Style   |
|-----------------|
| 2dr Hatchback   |
| 2dr SUV         |
| 4dr Hatchback   |
| 4dr SUV         |
| Cargo Minivan   |
| Cargo Van       |
| Convertible     |
| Convertible SUV |

| Row Labels         | Sum of MSRP      |
|--------------------|------------------|
| 4dr Hatchback      | 14862118         |
| 4dr SUV            | 87693041         |
| Convertible        | 63135891         |
| Coupe              | 87761121         |
| Sedan              | 96136163         |
| <b>Grand Total</b> | <b>349588334</b> |

By using filter function we can see the top 5 Body Styles which have highest car prices.

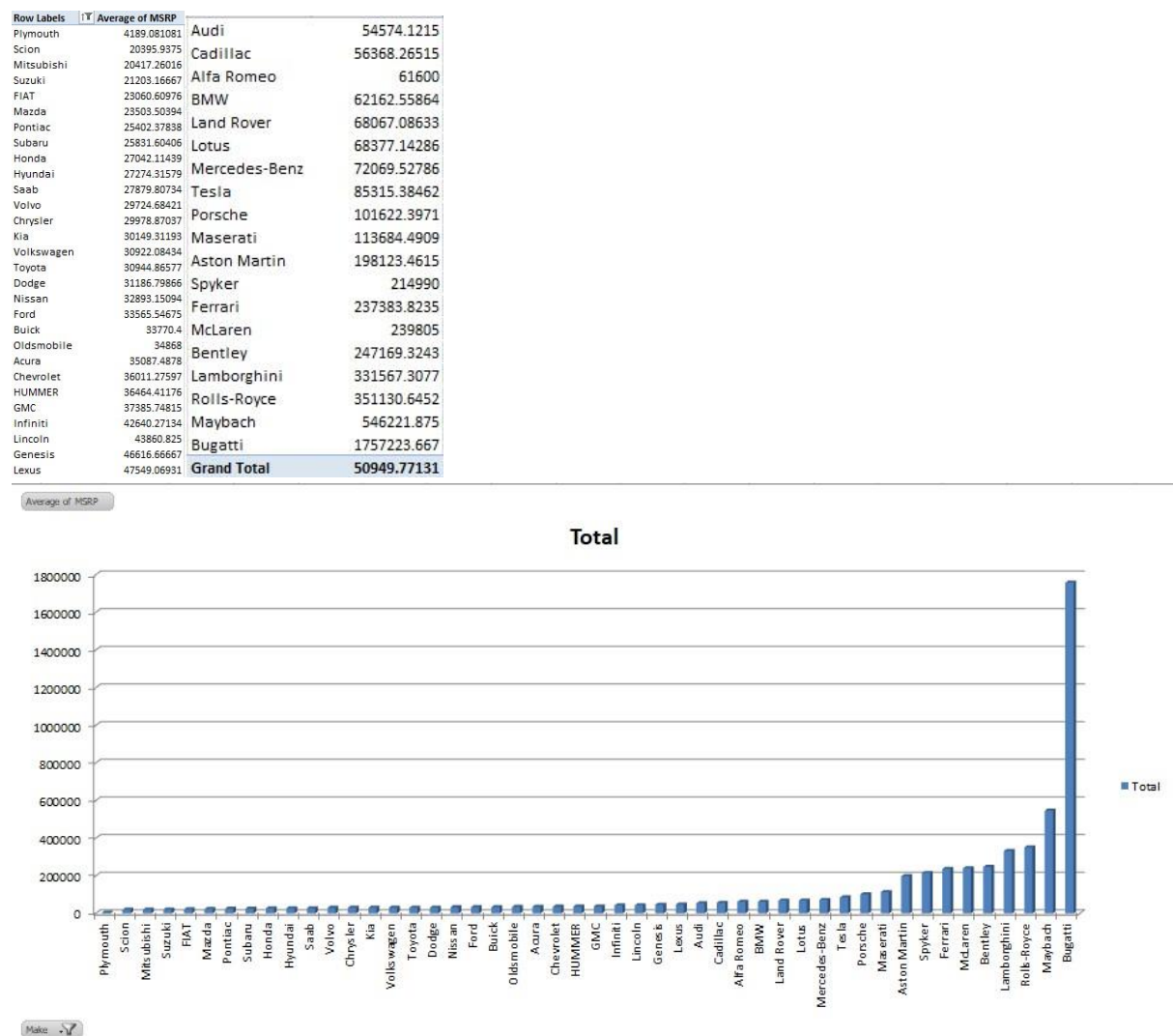
We can also use **SUMIF** function for this task.

| =SUMIF(A:A,A2,C:C) |          |             |            | =SUMIF(B:B,B3,C:C) |          |             |            |
|--------------------|----------|-------------|------------|--------------------|----------|-------------|------------|
| D                  | E        | F           | G          | D                  | E        | F           | G          |
|                    | Brand    |             | Body Style |                    | Brand    |             | Body Style |
| BMW                | 20140669 | CONVERTIBLE | 63135891   | BMW                | 20140669 | CONVERTIBLE | 63135891   |

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

● **Hints:** Clustered column chart to compare the average MSRPs across different car brands and body styles. Calculate the average MSRP for each brand and body style using AVERAGEIF or Pivot Tables.

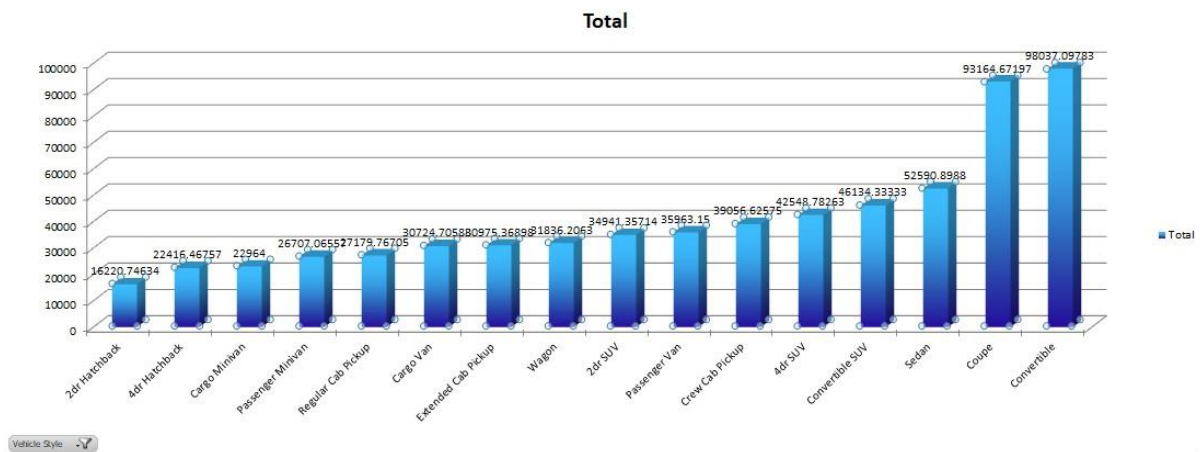
### INSIGHTS:



Plymouth car brand has the lowest average MSRP and Bugatti car brand has the highest average MSRP.

| Row Labels          | Average of MSRP    |
|---------------------|--------------------|
| 2dr Hatchback       | 16220.74634        |
| 4dr Hatchback       | 22416.46757        |
| Cargo Minivan       | 22964              |
| Passenger Minivan   | 26707.06557        |
| Regular Cab Pickup  | 27179.76705        |
| Cargo Van           | 30724.70588        |
| Extended Cab Pickup | 30975.36898        |
| Wagon               | 31836.2063         |
| 2dr SUV             | 34941.35714        |
| Passenger Van       | 35963.15           |
| Crew Cab Pickup     | 39056.62575        |
| 4dr SUV             | 42548.78263        |
| Convertible SUV     | 46134.33333        |
| Sedan               | 52590.8988         |
| Coupe               | 93164.67197        |
| Convertible         | 98037.09783        |
| <b>Grand Total</b>  | <b>50949.77131</b> |

Average of MSRP



2dr Hatchback has the lowest average MSRP and Convertible has the highest average MSRP.

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

● **Hints:** Scatter plot chart to visualize the relationship between MSRP and transmission type, with different symbols for each body style. Calculate the average MSRP for each combination of transmission type and body style using AVERAGEIFS or Pivot Tables.

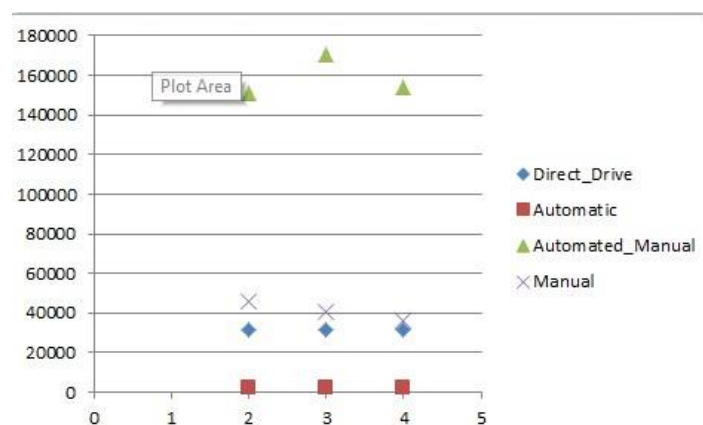
### INSIGHTS:

| Transmission Type | Average of MSRP | Vehicle Style       | Average of MSRP |
|-------------------|-----------------|---------------------|-----------------|
| AUTOMATED_MANUAL  | 110415.1859     | 2dr Hatchback       | 16220.74634     |
| AUTOMATIC         | 48584.57168     | 2dr SUV             | 34941.35714     |
| DIRECT_DRIVE      | 45226.46552     | 4dr Hatchback       | 22416.46757     |
| MANUAL            | 39322.07619     | 4dr SUV             | 42548.78263     |
| (blank)           |                 | Cargo Minivan       | 22964           |
| Grand Total       | 50949.77131     | Cargo Van           | 30724.70588     |
|                   |                 | Convertible         | 98037.09783     |
|                   |                 | Convertible SUV     | 46134.33333     |
|                   |                 | Coupe               | 93164.67197     |
|                   |                 | Crew Cab Pickup     | 39056.62575     |
|                   |                 | Extended Cab Pickup | 30975.36898     |
|                   |                 | Passenger Minivan   | 26707.06557     |
|                   |                 | Passenger Van       | 35963.15        |
|                   |                 | Regular Cab Pickup  | 27179.76705     |
|                   |                 | Sedan               | 52590.8988      |
|                   |                 | Wagon               | 31836.2063      |
|                   |                 | (blank)             |                 |
|                   |                 | Grand Total         | 50949.77131     |

### Relationship of Transmission type and body style

| Row Labels       | Count of Vehicle Style |
|------------------|------------------------|
| AUTOMATED_MANUAL | 538                    |
| AUTOMATIC        | 5643                   |
| DIRECT_DRIVE     | 58                     |
| MANUAL           | 1575                   |
| Grand Total      | 7814                   |

### Relationship between MSRP and Transmission Type



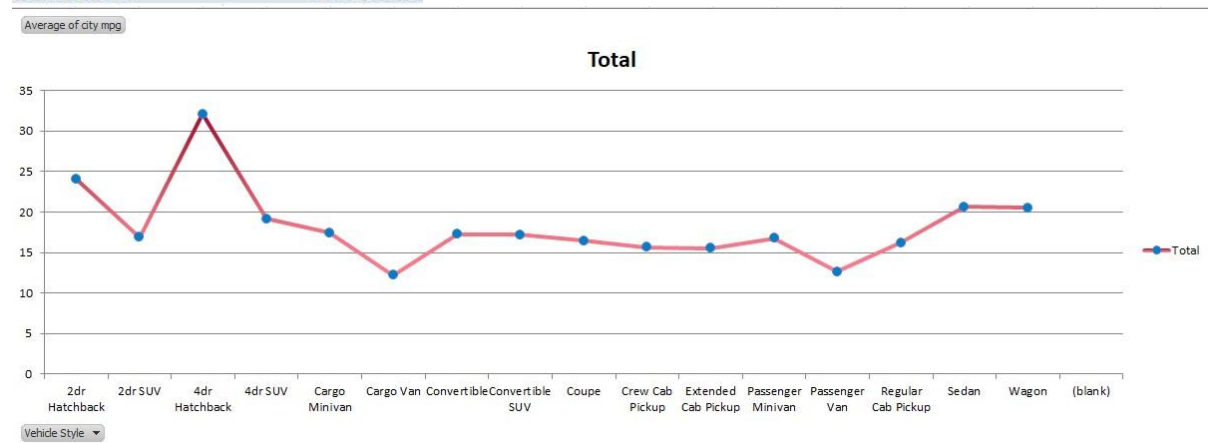


**Task 4:** How does the fuel efficiency of cars vary across different body styles and model years?

● **Hints:** Line chart to show the trend of fuel efficiency (MPG) over time for each body style. Calculate the average MPG for each combination of body style and model year using AVERAGEIFS or Pivot Tables.

### INSIGHTS:

| Body Styles         | Average of city mpg |
|---------------------|---------------------|
| 2dr Hatchback       | 24.0804878          |
| 2dr SUV             | 16.85714286         |
| 4dr Hatchback       | 32.08898944         |
| 4dr SUV             | 19.12178554         |
| Cargo Minivan       | 17.4                |
| Cargo Van           | 12.17647059         |
| Convertible         | 17.2189441          |
| Convertible SUV     | 17.16666667         |
| Coupe               | 16.47346072         |
| Crew Cab Pickup     | 15.65568862         |
| Extended Cab Pickup | 15.50802139         |
| Passenger Minivan   | 16.75409836         |
| Passenger Van       | 12.64               |
| Regular Cab Pickup  | 16.19318182         |
| Sedan               | 20.61214442         |
| Wagon               | 20.4756447          |
| (blank)             |                     |
| <b>Grand Total</b>  | <b>19.97632455</b>  |

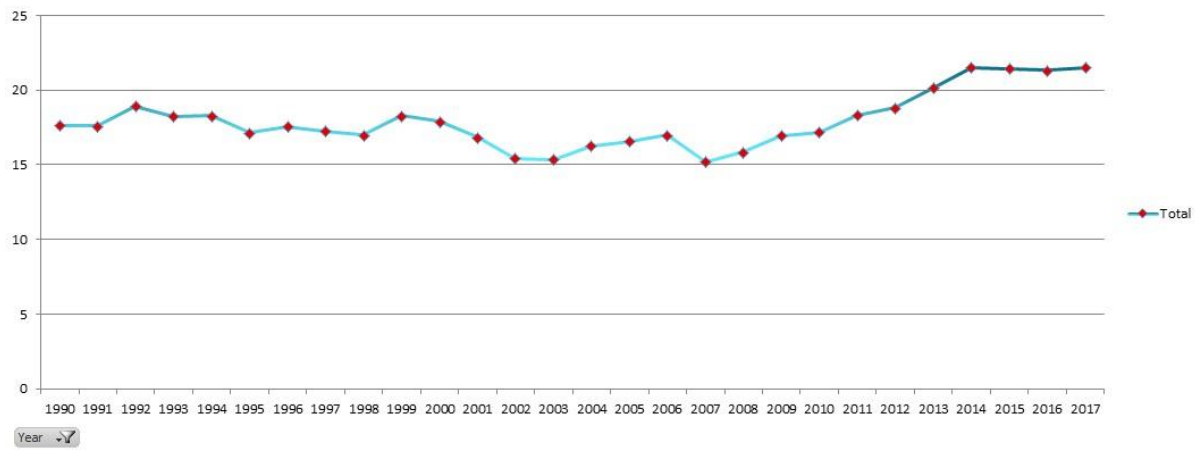




| Model Year  | Average of city mpg |
|-------------|---------------------|
| 1990        | 17.58823529         |
| 1991        | 17.56363636         |
| 1992        | 18.91543296         |
| 1993        | 18.22222222         |
| 1994        | 18.24137931         |
| 1995        | 17.11538462         |
| 1996        | 17.54166667         |
| 1997        | 17.22807018         |
| 1998        | 16.96774194         |
| 1999        | 18.24444444         |
| 2000        | 17.875              |
| 2001        | 16.8030303          |
| 2002        | 15.38026169         |
| 2003        | 15.32954545         |
| 2004        | 16.21978022         |
| 2005        | 16.56521739         |
| 2006        | 16.96078431         |
| 2007        | 15.22072072         |
| 2008        | 15.82162162         |
| 2009        | 16.33165468         |
| 2010        | 17.16216216         |
| 2011        | 18.2991453          |
| 2012        | 18.79285714         |
| 2013        | 20.13620072         |
| 2014        | 21.47433265         |
| 2015        | 21.39343294         |
| 2016        | 21.28937729         |
| 2017        | 21.5110935          |
| Grand Total | 19.97632455         |

Average of city mpg

## Total

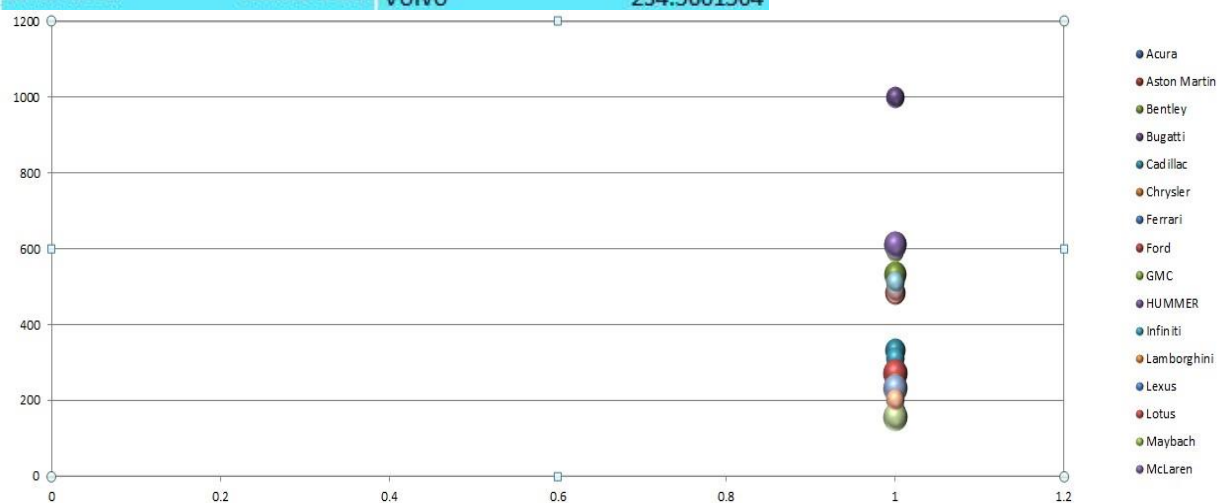


**Task 5:** How does the car's horsepower, MPG, and price vary across different Brands?

● **Hints:** Bubble chart to visualize the relationship between horsepower, MPG, and price across different car brands. Assign different colors to each brand and label the bubbles with the car model name. Calculate the average horsepower, MPG, and MSRP for each car brand using AVERAGEIFS or Pivot Tables.

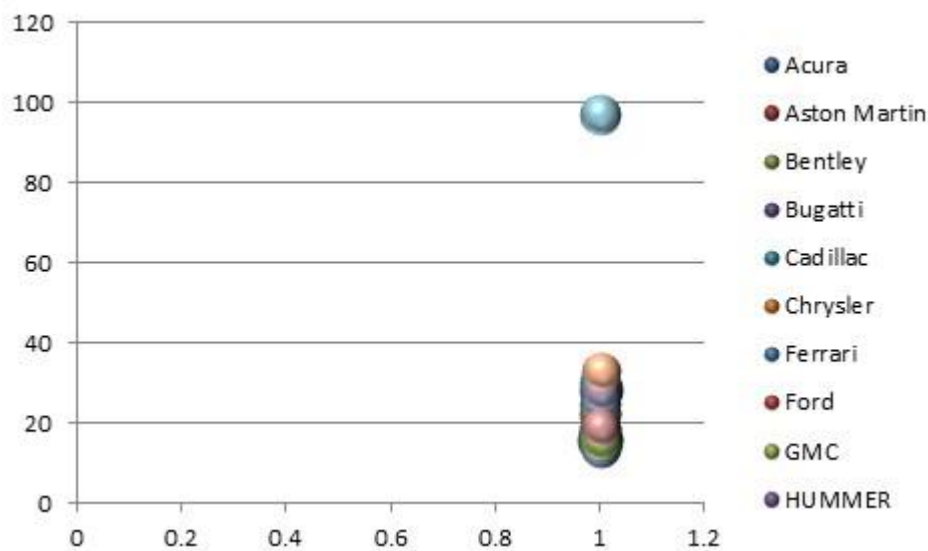
### Relationship between Brands and Average Horse Power

| Brands       | Avg Horse Power | Lexus         | 277.4158416 |
|--------------|-----------------|---------------|-------------|
| Acura        | 244.9634146     | Lincoln       | 285.56875   |
| Alfa Romeo   | 237             | Lotus         | 271.5357143 |
| Aston Martin | 483.7582418     | Maserati      | 419.5454545 |
| Audi         | 280             | Maybach       | 590.5       |
| Bentley      | 533.8513514     | Mazda         | 181.7401575 |
| BMW          | 329.6203704     | McLaren       | 610.4       |
| Bugatti      | 1001            | Mercedes-Benz | 353.1671554 |
| Buick        | 228.112         | Mitsubishi    | 170.8211382 |
| Cadillac     | 332.7954545     | Nissan        | 259.4937107 |
| Chevrolet    | 284.6834416     | Oldsmobile    | 250         |
| Chrysler     | 241.3888889     | Plymouth      | 139.2162162 |
| Dodge        | 295.5134228     | Pontiac       | 233.5405405 |
| Ferrari      | 509.9117647     | Porsche       | 392.7941176 |
| FIAT         | 144.2682927     | Rolls-Royce   | 487.5483871 |
| Ford         | 274.453252      | Saab          | 221.1743119 |
| Genesis      | 347.3333333     | Scion         | 155.7083333 |
| GMC          | 279.9851852     | Spyker        | 400         |
| Honda        | 195.195572      | Subaru        | 203.5685279 |
| HUMMER       | 261.2352941     | Suzuki        | 183.9895833 |
| Hyundai      | 221.6263158     | Tesla         | 511.5384615 |
| Infiniti     | 310.6768293     | Toyota        | 222.2550336 |
| Kia          | 232.8440367     | Volkswagen    | 202.3060241 |
| Lamborghini  | 614.0769231     | Volvo         | 234.5601504 |
| Land Rover   | 322.5179856     |               |             |



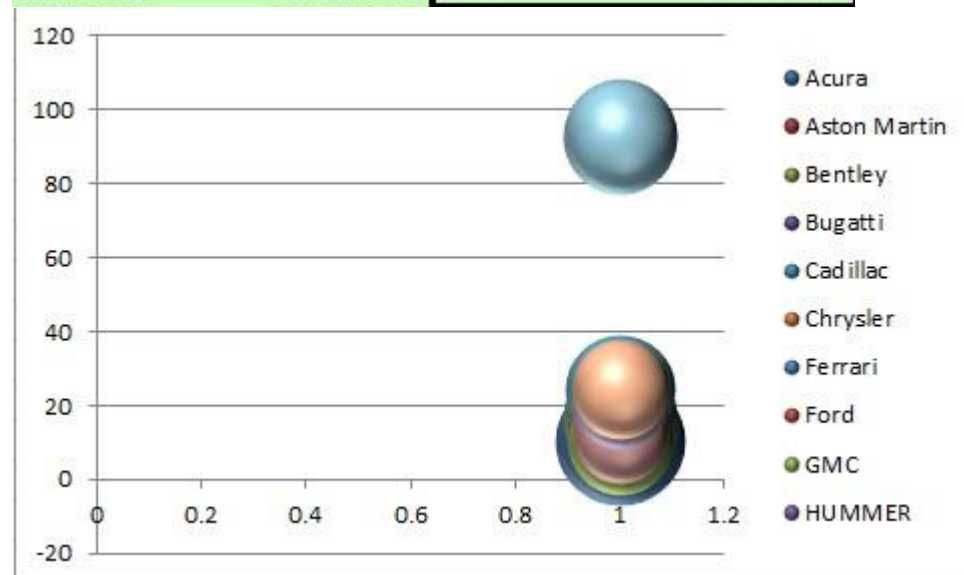
## Relationship between Brands and Avg of Highway MPG

| Brands       | Avg of Highway MPG | Lexus         | 25.87623762 |
|--------------|--------------------|---------------|-------------|
| Acura        | 28.2195122         | Lincoln       | 24.5375     |
| Alfa Romeo   | 34                 | Lotus         | 26.10714286 |
| Aston Martin | 18.93406593        | Maserati      | 20.16363636 |
| Audi         | 28.92834891        | Maybach       | 16          |
| Bentley      | 18.90540541        | Mazda         | 28.77559055 |
| BMW          | 29.12654321        | McLaren       | 22.2        |
| Bugatti      | 14                 | Mercedes-Benz | 24.56891496 |
| Buick        | 27.512             | Mitsubishi    | 30.06504065 |
| Cadillac     | 25.24494949        | Nissan        | 29.29874214 |
| Chevrolet    | 26.53571429        | Oldsmobile    | 23.66666667 |
| Chrysler     | 26.62037037        | Plymouth      | 26.2972973  |
| Dodge        | 22.9966443         | Pontiac       | 25.28378378 |
| Ferrari      | 15.72058824        | Porsche       | 25.36764706 |
| FIAT         | 39.34146341        | Rolls-Royce   | 19.12903226 |
| Ford         | 25.2804878         | Saab          | 26.37614679 |
| Genesis      | 25.33333333        | Scion         | 32.8125     |
| GMC          | 22.36296296        | Spyker        | 18          |
| Honda        | 32.77121771        | Subaru        | 28.30456853 |
| HUMMER       | 17.29411765        | Suzuki        | 25.86458333 |
| Hyundai      | 28.51052632        | Tesla         | 97.15384615 |
| Infiniti     | 24.79573171        | Toyota        | 30.11409396 |
| Kia          | 29.03669725        | Volkswagen    | 33.05301205 |
| Lamborghini  | 18.01923077        | Volvo         | 27.26315789 |
| Land Rover   | 21.97841727        |               |             |



## Relationship between Brands and Avg City MPG

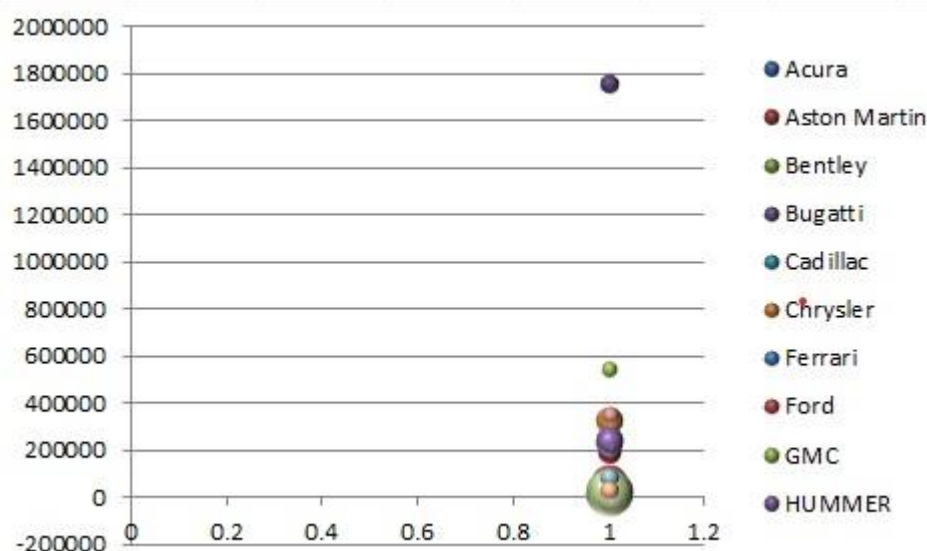
| Brands       | Avg of City MPG |               |             |
|--------------|-----------------|---------------|-------------|
| Acura        | 20.00406504     | Lexus         | 20.31188119 |
| Alfa Romeo   | 24              | Lincoln       | 17.95625    |
| Aston Martin | 12.56043956     | Lotus         | 18.67857143 |
| Audi         | 19.63551402     | Maserati      | 13.2        |
| Bentley      | 11.55405405     | Maybach       | 10          |
| BMW          | 20.70061728     | Mazda         | 22.1023622  |
| Bugatti      | 8               | McLaren       | 15.6        |
| Buick        | 19.456          | Mercedes-Benz | 18.01759531 |
| Cadillac     | 17.36111111     | Mitsubishi    | 24.65853659 |
| Chevrolet    | 19.69642857     | Nissan        | 23.64465409 |
| Chrysler     | 17.63888889     | Oldsmobile    | 15.33333333 |
| Dodge        | 16.06711409     | Plymouth      | 19.62162162 |
| Ferrari      | 10.55882353     | Pontiac       | 17.52702703 |
| FIAT         | 33.14634146     | Porsche       | 17.47058824 |
| Ford         | 19.1199187      | Rolls-Royce   | 11.83870968 |
| Genesis      | 16.33333333     | Saab          | 17.76146789 |
| GMC          | 16.47777778     | Scion         | 25.72916667 |
| Honda        | 26.34686347     | Spyker        | 13          |
| HUMMER       | 13.52941176     | Subaru        | 21.62436548 |
| Hyundai      | 21.13157895     | Suzuki        | 19.3125     |
| Infiniti     | 17.83841463     | Tesla         | 92.61538462 |
| Kia          | 21.67889908     | Toyota        | 26.54362416 |
| Lamborghini  | 11.51923077     | Volkswagen    | 24.64337349 |
| Land Rover   | 16.14388489     | Volvo         | 19.65413534 |





## Relationship between Brands and Avg of MSRP

| Brands       | Avg of MSRP | Brands        | Avg of MSRP |
|--------------|-------------|---------------|-------------|
| Acura        | 35087.4878  | Lexus         | 47549.06931 |
| Alfa Romeo   | 61600       | Lincoln       | 43860.825   |
| Aston Martin | 198123.4615 | Lotus         | 68377.14286 |
| Audi         | 54574.1215  | Maserati      | 113684.4909 |
| Bentley      | 247169.3243 | Maybach       | 546221.875  |
| BMW          | 62162.55864 | Mazda         | 23503.50394 |
| Bugatti      | 1757223.667 | McLaren       | 239805      |
| Buick        | 33770.4     | Mercedes-Benz | 72069.52786 |
| Cadillac     | 56368.26515 | Mitsubishi    | 20417.26016 |
| Chevrolet    | 36011.27597 | Nissan        | 32893.15094 |
| Chrysler     | 29978.87037 | Oldsmobile    | 34868       |
| Dodge        | 31186.79866 | Plymouth      | 4189.081081 |
| Ferrari      | 237383.8235 | Pontiac       | 25402.37838 |
| FIAT         | 23060.60976 | Porsche       | 101622.3971 |
| Ford         | 33565.54675 | Rolls-Royce   | 351130.6452 |
| Genesis      | 46616.66667 | Saab          | 27879.80734 |
| GMC          | 37385.74815 | Scion         | 20395.9375  |
| Honda        | 27042.11439 | Spyker        | 214990      |
| HUMMER       | 36464.41176 | Subaru        | 25831.60406 |
| Hyundai      | 27274.31579 | Suzuki        | 21203.16667 |
| Infiniti     | 42640.27134 | Tesla         | 85315.38462 |
| Kia          | 30149.31193 | Toyota        | 30944.86577 |
| Lamborghini  | 331567.3077 | Volkswagen    | 30922.08434 |
| Land Rover   | 68067.08633 | Volvo         | 29724.68421 |



## **RESULT:**

### **1. Popularity of Car Models Across Market Categories:**

Task 1.A: The pivot table displays the number of car models in each market category along with their popularity scores.

Task 1.B: The combo chart visually represents the relationship between market category and popularity, allowing for easy comparison across categories.

### **2. Relationship Between Engine Power and Price:**

Task 2: The scatter chart plots engine power against price and includes a trendline to visualize the relationship. Generally, there appears to be a positive correlation between engine power and price, indicating that cars with higher engine power tend to have higher prices.

### **3. Importance of Car Features in Determining Price:**

Task 3: Regression analysis identifies variables with the strongest relationship with a car's price. The bar chart displays the coefficient values for each variable, highlighting their relative importance. Features such as engine power, fuel efficiency, and vehicle type may have significant impacts on price.

### **4. Variation in Average Price Across Manufacturers:**

Task 4.A: The pivot table presents the average price of cars for each manufacturer.

Task 4.B: The bar chart or horizontal stacked bar chart visualizes the relationship between manufacturer and average price, providing insights into pricing strategies adopted by different manufacturers.

### **5. Relationship Between Fuel Efficiency and Number of Cylinders:**

Task 5.A: The scatter plot with a trendline depicts the relationship between the number of cylinders and highway MPG, allowing for visual estimation of the slope and significance of the relationship.

Task 5.B: The correlation coefficient quantifies the strength and direction of the relationship between the number of cylinders and highway MPG.

**Discussion of Results and Implications:**

The analysis provides valuable insights into consumer preferences, pricing strategies, and market dynamics within the automotive industry.

Understanding the relationships between car features, market categories, and pricing allows manufacturers to optimize pricing and product development decisions to maximize profitability while meeting consumer demand.

Manufacturers can leverage these insights to develop targeted marketing strategies, prioritize product features, and adjust pricing strategies to gain a competitive edge in the market.

**Limitations and Uncertainties:**

The analysis relies on the assumption that the dataset accurately represents consumer preferences and market dynamics. Any biases or inaccuracies in the data could lead to misleading conclusions.

External factors such as economic conditions, regulatory changes, and technological advancements may impact consumer behavior and market trends, introducing uncertainties into the analysis.

**Possible Future Directions:**

Conduct further analysis to explore additional factors influencing consumer demand and pricing, such as brand reputation, safety ratings, and technological innovations.

Incorporate real time data sources and advanced analytics techniques, such as predictive modeling and machine learning, for more accurate and dynamic insights.

Explore opportunities for segmentation analysis to identify specific consumer segments with distinct preferences and behaviors, enabling targeted marketing strategies and product offerings.

**THANKYOU**