ANALYZING THE IMPACT OF CAR FEATURES ON PRICE AND PROFITABILITY

Presented by:Adnan Ashraf

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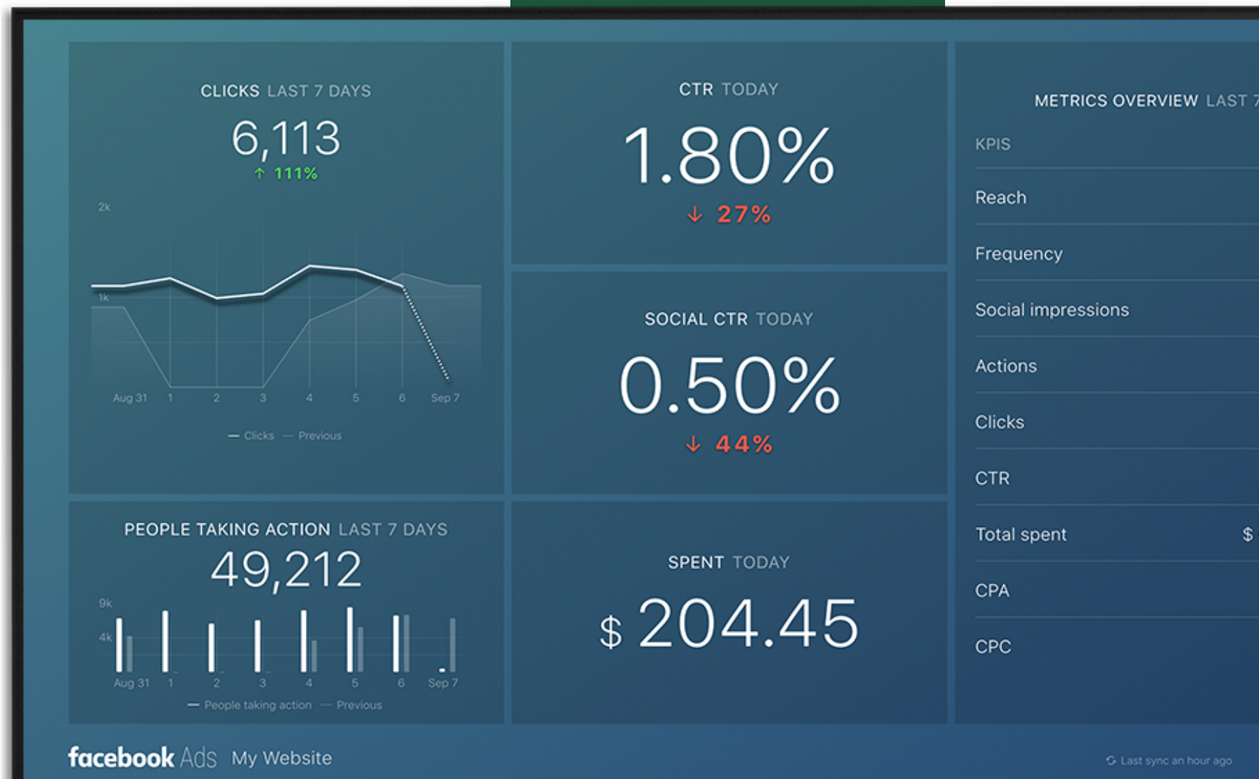

Project Description

Overview

The automotive industry is witnessing rapid evolution, driven by factors such as fuel efficiency, environmental sustainability, and technological innovation. This project aims to analyze the given dataset titled "Car Features and MSRP" to understand the key factors influencing consumer demand, pricing, and profitability in the car manufacturing industry.

Business Problem:

The client seeks insights into how a car manufacturer can optimize pricing and product development decisions to maximize profitability while meeting consumer demand. To address this, we will explore the relationships between car features, market categories, and pricing using data analysis techniques.

Data Sources:

The dataset used in this project, titled "Car Features and MSRP," contains information on over 11,000 car models, including specifications like make, model, year, fuel type, engine power, transmission, market category, and manufacturer's suggested retail price (MSRP).

Data Cleaning and Preprocessing:

Prior to analysis, thorough data cleaning was performed to ensure accurate and reliable results. This involved handling missing values, checking for outliers, and transforming variables as needed. Additionally, the dataset was explored to understand its structure and characteristics.

Assumptions:

Certain assumptions were made during the project, such as considering the dataset's last update in 2017 and potential limitations in reflecting current industry trends.

Approach:

Analytical Methods Used:

- Descriptive statistics
- Visualization techniques
- Regression analysis
- Pivot tables
- Sensitivity analysis
- Optimization
- Time series analysis

Challenges or Limitations Encountered:

Throughout the project, challenges related to data quality and potential biases were addressed. Limitations include the dataset's last update in 2017, which may not capture recent industry changes.

Tech-Stack Used:

Microsoft Excel

Microsoft PowerPoint

Microsoft Excel was the primary tool used for data analysis, leveraging advanced Excel functions, pivot tables, and charting capabilities. The decision to use Excel was based on its widespread accessibility and effectiveness for data manipulation and visualization.

Task 1: Analyzing the Popularity of Car Models Across Different Market Categories
Insight Required: How does the popularity of a car model vary across different market categories?

Row Labels	Count of Model	Average of Popularity
Crossover	1108	1544.386282
Crossover,Diesel	7	873.000000
Crossover,Exotic,Luxury,High-Performance	1	238.000000
Crossover,Exotic,Luxury,Performance	1	238.000000
Crossover,Factory Tuner,Luxury,High-Performance	26	1823.461538
Crossover,Factory Tuner,Luxury,Performance	5	2607.400000
Crossover,Factory Tuner,Performance	4	210.000000
Crossover,Flex Fuel	64	2073.750000
Crossover,Flex Fuel,Luxury	10	1173.200000
Crossover,Flex Fuel,Luxury,Performance	6	1624.000000
Crossover,Flex Fuel,Performance	6	5657.000000
Crossover,Hatchback	72	1675.694444
Crossover,Hatchback,Factory Tuner,Performance	6	2009.000000
Crossover,Hatchback,Luxury	7	204.000000
Crossover,Hatchback,Performance	6	2009.000000
Crossover,Hybrid	42	2563.380952
Crossover,Luxury	410	884.548780
Crossover,Luxury,Diesel	33	2195.848485
Crossover,Luxury,High-Performance	9	1037.222222
Crossover,Luxury,Hybrid	24	630.916667
Crossover,Luxury,Performance	113	1344.849558
Crossover,Luxury,Performance,Hybrid	2	3916.000000
Crossover,Performance	69	2585.956522
Diesel	84	1730.904762
Diesel,Luxury	51	2275.000000
Exotic,Factory Tuner,High-Performance	21	1046.380952
Exotic,Factory Tuner,Luxury,High-Performance	52	517.538462
Exotic,Factory Tuner,Luxury,Performance	3	520.000000
Exotic,Flex Fuel,Factory Tuner,Luxury,High-Performance	13	520.000000
Exotic,Flex Fuel,Luxury,High-Performance	11	520.000000
Exotic,High-Performance	253	1267.549407
Exotic,Luxury	12	112.666667
Exotic,Luxury,High-Performance	79	467.075949
Exotic,Luxury,High-Performance,Hybrid	1	204.000000
Exotic,Luxury,Performance	36	217.027778
Factory Tuner,High-Performance	106	1941.415094
Factory Tuner,Luxury	2	617.000000
Factory Tuner,Luxury,High-Performance	215	2133.367442
Factory Tuner,Luxury,Performance	31	1413.419355
Factory Tuner,Performance	91	1707.890110
Flex Fuel	872	2217.302752
Flex Fuel,Diesel	16	5657.000000
Flex Fuel,Factory Tuner,Luxury,High-Performance	1	258.000000
Flex Fuel,Hybrid	2	155.000000
Flex Fuel,Luxury	39	746.538462
Flex Fuel,Luxury,High-Performance	33	878.909091
Flex Fuel,Luxury,Performance	28	1380.071429
Flex Fuel,Performance	87	1680.471264
Flex Fuel,Performance,Hybrid	2	155.000000
Hatchback	631	1307.928685
Hatchback,Diesel	14	873.000000
Hatchback,Factory Tuner,High-Performance	13	1205.153846
Hatchback,Factory Tuner,Luxury,Performance	9	886.888889
Hatchback,Factory Tuner,Performance	22	2159.045455
Hatchback,Flex Fuel	7	5657.000000
Hatchback,Hybrid	72	2121.250000
Hatchback,Luxury	46	1379.500000
Hatchback,Luxury,Hybrid	3	454.000000
Hatchback,Luxury,Performance	38	1566.131579
Hatchback,Performance	252	1039.646825
High-Performance	199	1821.447236
Hybrid	123	2105.569106
Luxury	851	1107.553467
Luxury,High-Performance	334	1668.017964
Luxury,High-Performance,Hybrid	12	568.833333
Luxury,Hybrid	48	724.687500
Luxury,Performance	673	1292.615156
Luxury,Performance,Hybrid	11	2333.181818
N/A	3734	1677.792448
Performance	584	1371.080479
Performance,Hybrid	1	155.000000
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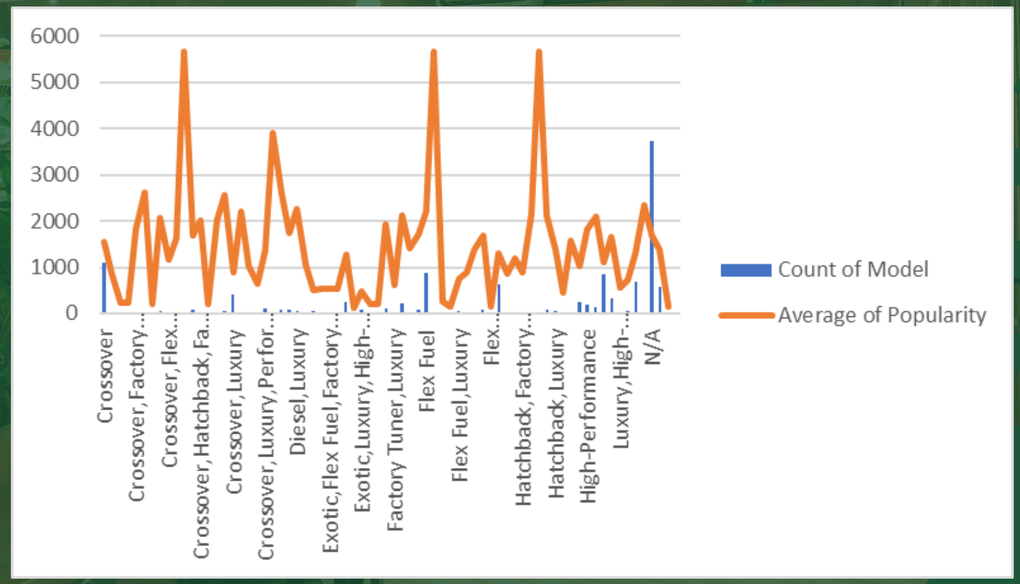
Grand Total	**11849**	**1557.45852**

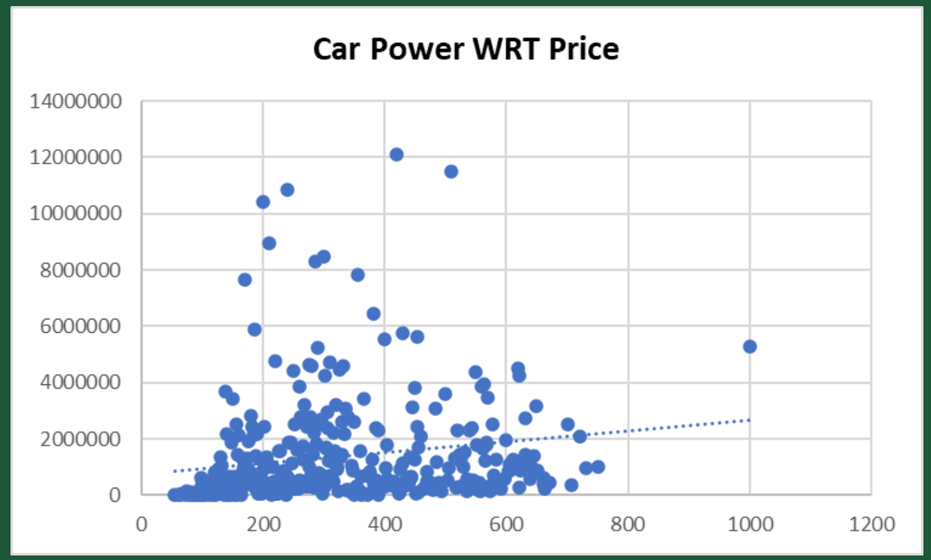
Task 1.B: Create a combo chart that visualizes the relationship between market category and popularity.

- Crossover, Flex Fuel, Performance: 6 models, high average popularity (5657).
- Flex Fuel, Diesel: 16 models, strong demand, high average popularity (5657).
- Hatchback, Flex Fuel: 7 models, consistent high average popularity (5657).
- Crossover, Luxury, Performance, Hybrid: 2 models, noteworthy popularity (3916).
- Factory Tuner, Luxury, High-Performance: 215 models, high average popularity (2133.37).
- Hybrid: 123 models, considerable popularity (2105.57).
- High-Performance: 199 models, notable average popularity (1821.45).
- Diesel: 84 models, consistent popularity (1730.90).



·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.

- High-Performance Segment: Engine power of 98 to 200 correlates with high MSRP, indicating a premium market segment.
- Diverse Mid-Range Pricing: Engine power between 80 and 120 shows varied pricing, reflecting different market strategies.
- Outlier Alert: Engine power of 1001 corresponds to a notably high MSRP, signaling a potential specialty or luxury vehicle.
- Premiumization Opportunity: Consider exploring opportunities to introduce or enhance high-performance models for premium market positioning.
- Flexible Pricing Strategies: Mid-range engine power offers flexibility in pricing strategies to cater to a wide range of consumer preferences.

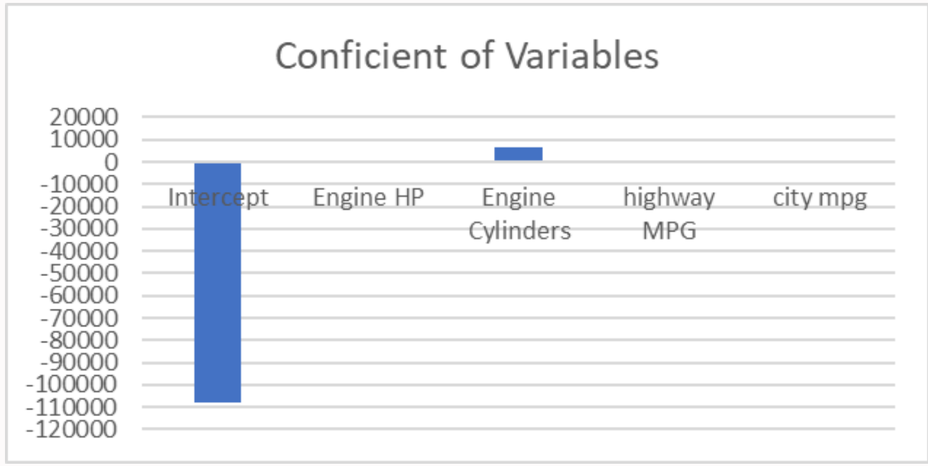


·Task 3: Use regression analysis to identify the variables that have the strongest relationship with a car's price. Then create a bar chart that shows the coefficient values for each variable to visualize their relative importance.

	Coefficients
Intercept	-108204.2349
Engine HP	321.1957965
Engine Cylinders	6653.263195
highway MPG	665.2719975
city mpg	695.5031754

- Intercept: The base price is -$108,204, suggesting a potential issue or anomaly.
- Engine HP Coefficient: A one-unit increase in engine horsepower correlates with a $321.20 increase in car price.
- Engine Cylinders Coefficient: Each additional cylinder adds $6,653.26 to the car price, reflecting a positive relationship.
- Highway MPG Coefficient: Higher highway miles per gallon contribute $665.27 to the car price, emphasizing fuel efficiency.
- City MPG Coefficient: Improved city miles per gallon positively impact the price, with a $695.50 increase per unit.

These coefficients guide pricing decisions, emphasizing the importance of engine specifications and fuel efficiency in determining car prices.

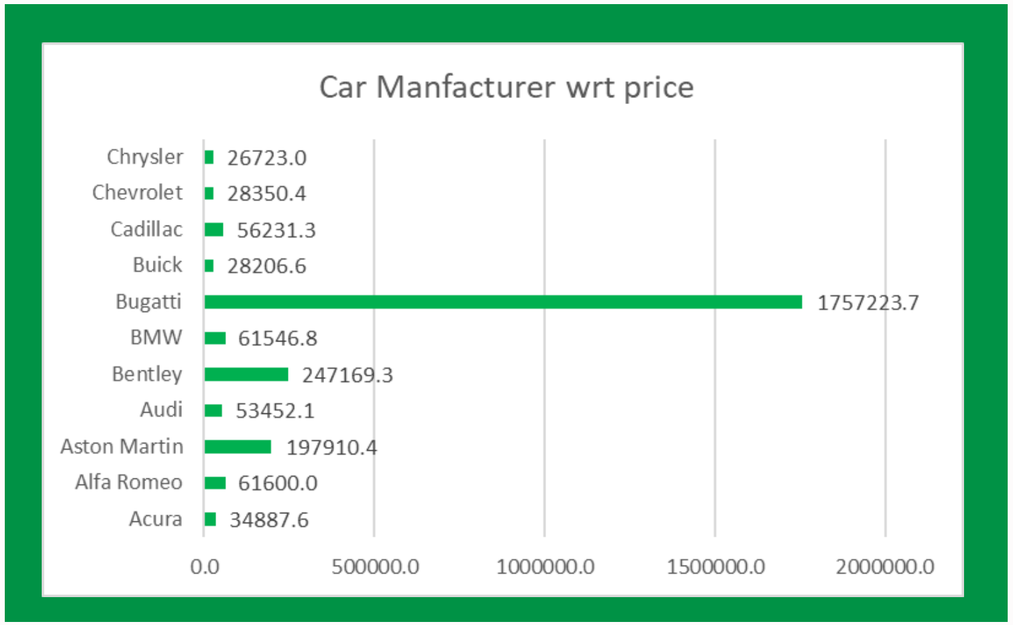


·Task 4.A: Create a pivot table that shows the average price of cars for each manufacturer.

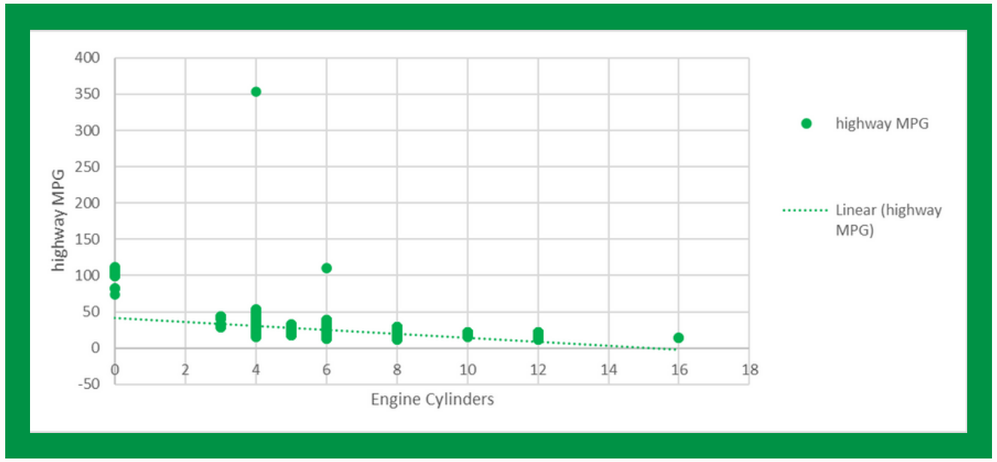
Manfacturer	Average price
Acura	34887.6
Alfa Romeo	61600.0
Aston Martin	197910.4
Audi	53452.1
Bentley	247169.3
BMW	61546.8
Bugatti	1757223.7
Buick	28206.6
Cadillac	56231.3
Chevrolet	28350.4
Chrysler	26723.0
Dodge	22390.1
Ferrari	238218.8
FIAT	22670.2
Ford	27399.3
Genesis	46616.7
GMC	30493.3
Honda	26674.3
HUMMER	36464.4
Hyundai	24597.0
Infiniti	42394.2
Kia	25112.4
Lamborghini	331567.3
Land Rover	67823.2
Land Rover	67823.2
Lexus	47549.1
Lincoln	42494.4
Lotus	69188.3
Maserati	114207.7
Maybach	546221.9
Mazda	19660.4
McLaren	239805.0
Mercedes-Benz	71537.8
Mitsubishi	21240.5
Nissan	28513.4
Oldsmobile	11542.5
Plymouth	3122.9
Pontiac	19321.5
Porsche	101622.4
Rolls-Royce	351130.6
Saab	27413.5
Scion	19932.5
Spyker	213323.3
Subaru	24827.5
Suzuki	17901.0
Toyota	28974.2
Volkswagen	28102.4
Volvo	28541.2

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

- Bugatti Dominates: Bugatti leads with an average price of $1,757,223.7, reflecting its exclusive and high-end positioning.
- Luxury Brands Triumph: Maybach, Rolls-Royce, and Lamborghini follow Bugatti, showcasing the dominance of luxury brands in higher price segments.
- Bentley and McLaren Presence: Bentley and McLaren maintain a strong presence, indicating a balance of luxury and performance.
- Mainstream Luxury Brands: Mercedes-Benz, BMW, and Audi represent mainstream luxury, offering competitive average prices in the market.
- Insight for Strategy: Manufacturers can leverage these insights for strategic pricing decisions, aligning with brand positioning.



·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.



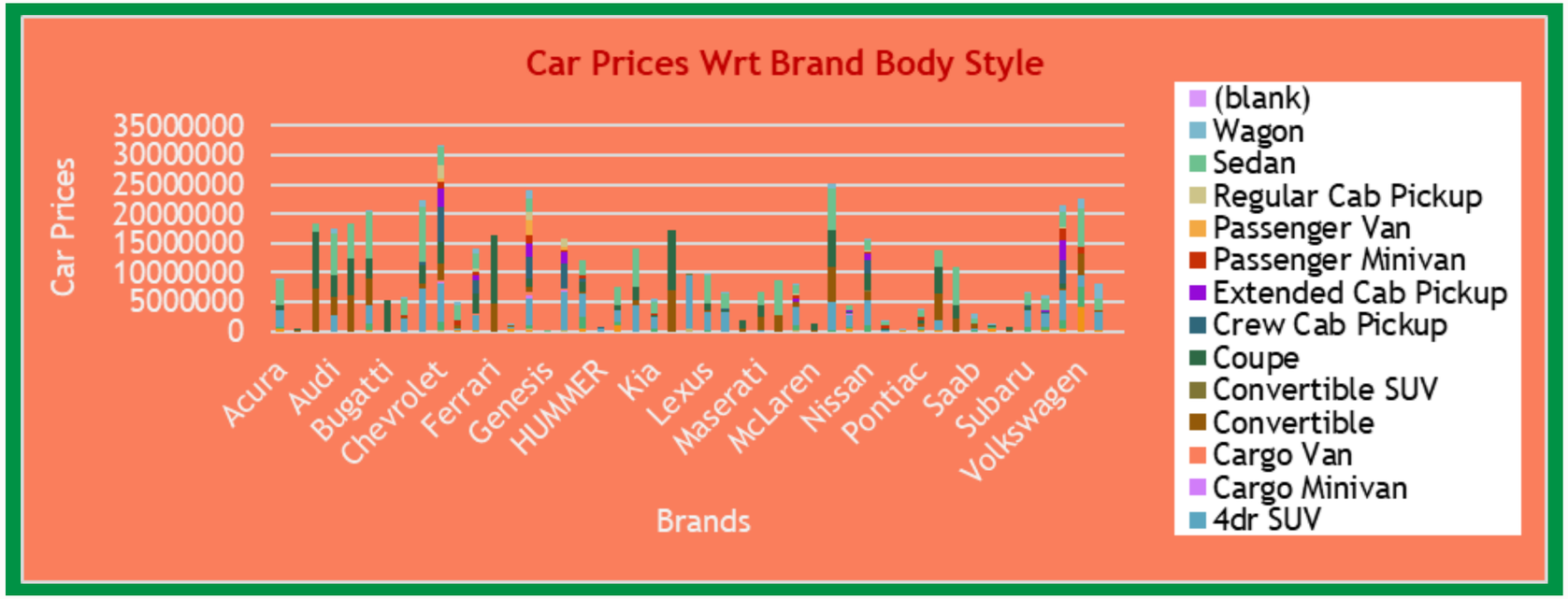
1. ·Task 5.B: Calculate the correlation coefficient between the number of cylinders and highway MPG to quantify the strength and direction of the relationship.

	Engine Cylinders	*h*
Engine Cylinders	1	
highway MPG	-0.612279101	
Correlation coefficient	**-0.612279101**	

- Negative Correlation: The correlation coefficient of -0.61 between engine cylinders and highway MPG suggests an inverse relationship.
- Fuel Efficiency Impact: As engine cylinders increase, highway miles per gallon tend to decrease, highlighting the trade-off between power and fuel efficiency.
- Consideration for Design: Manufacturers should balance cylinder count for performance while addressing fuel efficiency concerns.

DASHBOARD TASKS

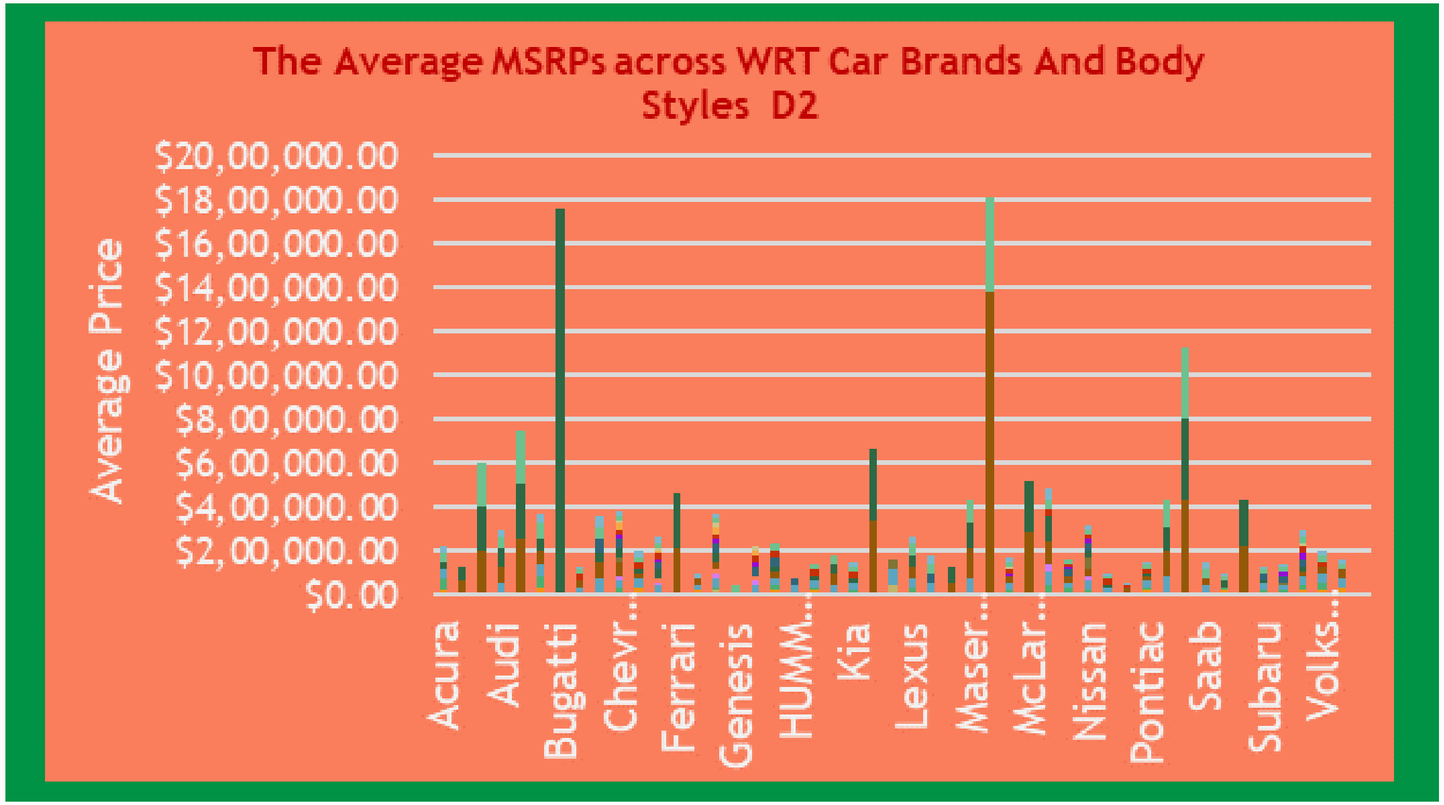
Task 1: How does the distribution of car prices vary by brand and body style?
·Hints: Stacked column chart to show the distribution of car prices by brand and body style. Use filters and slicers to make the chart interactive. Calculate the total MSRP for each brand and body style using SUMIF or Pivot Tables.



Task 1 involved creating a stacked column chart using Pivot Tables to showcase the distribution of car prices by brand and body style. The chart is interactive, allowing users to explore specific brands or body styles. This visualization aids in understanding pricing dynamics and supports data-driven decision-making.

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

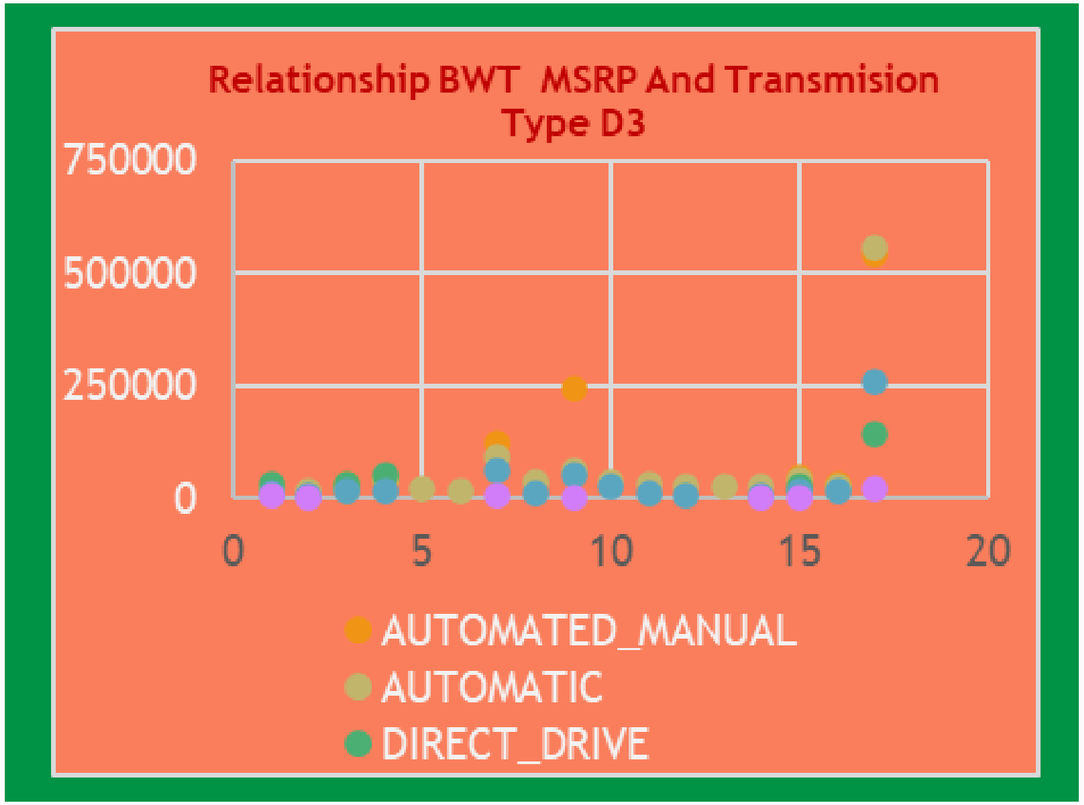
·Hints: Clustered column chart to compare the average MSRPs across different car brands and body styles. Calculate the average MSRP for each brand and body style using AVERAGEIF or Pivot Tables.



this task involves evaluating the average MSRPs for various car brands and their variations by body style. A clustered column chart was created using AVERAGEIF or Pivot Tables to display this comparison visually. The chart enables a quick assessment of which brands and body styles command the highest and lowest average prices, providing valuable insights into pricing trends within the dataset for informed decision-making.

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

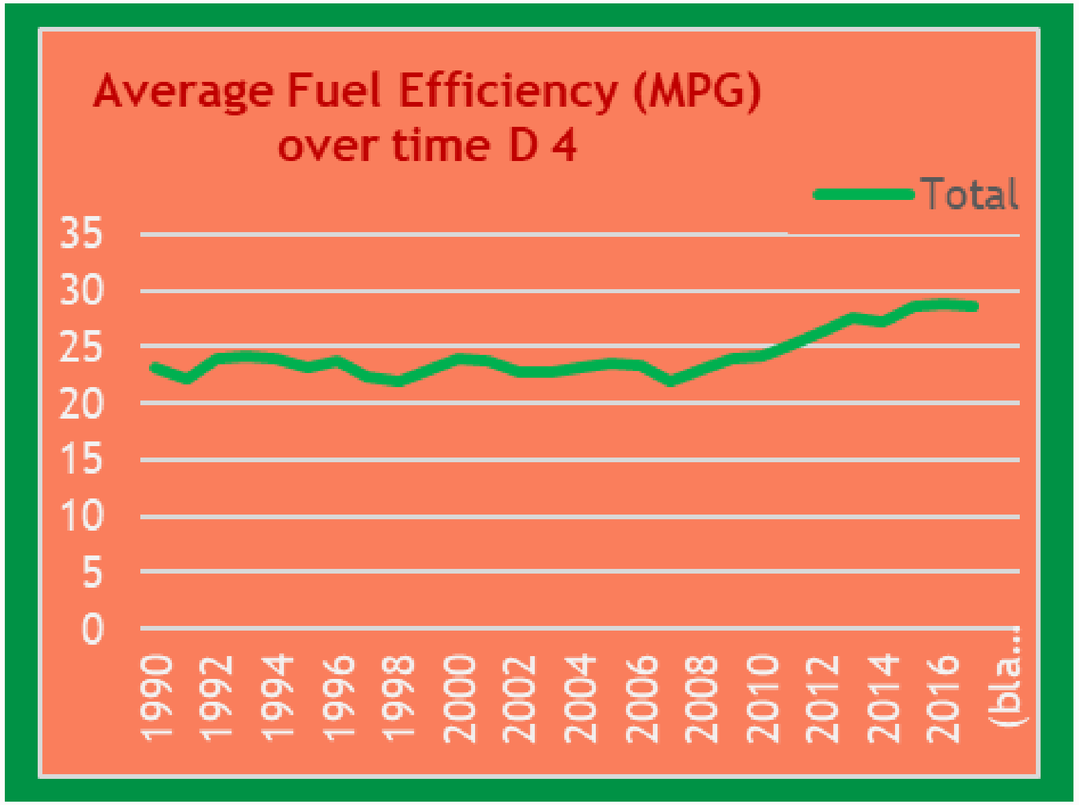
·Hints: Scatter plot chart to visualize the relationship between MSRP and transmission type, with different symbols for each body style. Calculate the average MSRP for each combination of transmission type and body style using AVERAGEIFS or Pivot Tables.



here i explored the impact of transmission types on MSRP, varying across body styles. A scatter plot chart, enriched by Pivot Tables, vividly illustrates the relationship. Each point signifies a car model, differentiated by transmission type, and color-coded for body style. This dynamic visualization unveils pricing patterns, facilitating a nuanced understanding of how transmission types influence MSRP within distinct body styles.

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.



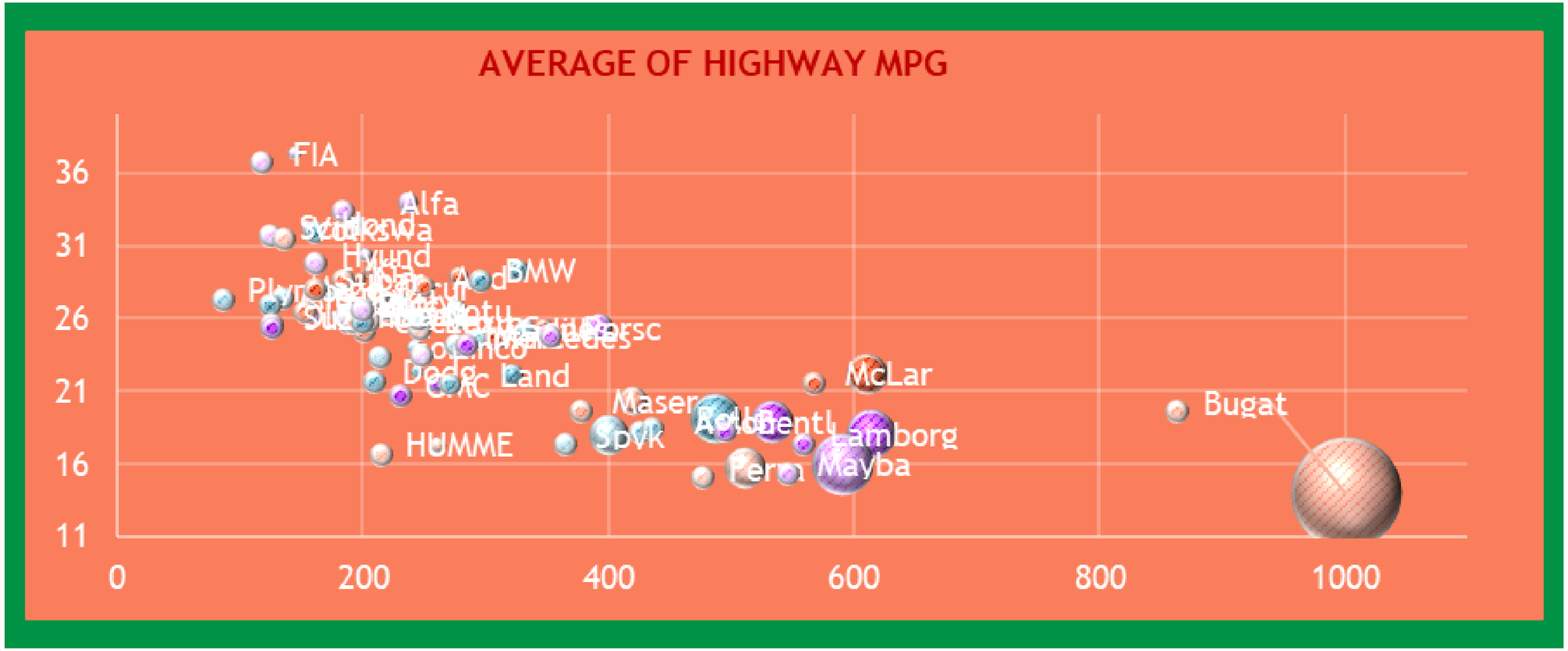
This line chartdelves into the evolution of fuel efficiency (MPG) across various body styles and model years. Employing Pivot Tables, a dynamic line chart illustrates MPG trends over time for each body style. With model years on the x-axis, the chart showcases how fuel efficiency has evolved within distinct body styles, providing valuable insights into the changing landscape of car efficiency and aiding in strategic decision-making.

Task 4: Calculate the average MPG for each combination of body style and model year using AVERAGEIFS or Pivot Tables.

	The Average MPG For Each Combination Of Body Style And Model Year																	
Average of highway MPG	Column Labels																	
Row Labels	2dr Hatchback	2dr SUV	4dr Hatchback	4dr SUV	Cargo Minivan	Cargo Van	Convertible	Convertible SUV	Coupe	Crew Cab Pickup	Extended Cab Pickup	Passenger Minivan	Passenger Van	Regular Cab Pickup	Sedan	Wagon	(blank)	Grand Total
1990	30	20	31		20		24		25		22	19		22	24	24		23
1991	30	16		19			23		26		16	18		17	24	23		22
1992	30	17	28	21			26		27		16			18	25	24		24
1993	29	18	27	21			24	26	28		17			18	25	24		24
1994	27	18	27	20	21	19	26	26	27		20	21	16	22	25	24		24
1995	30	16	28		22	19	25	26	26		20	20	15	21	24	24		23
1996	29	20	26	22	23	15	24	24	27		20	21	15	22	26	25		24
1997	26	22	27	20	21	17	25	21	27		18	21	17	19	25	24		22
1998	23	26	25	22		17	24	24	26		19	23	17	19	27	23		22
1999	30	19		18		17	22		28		18	22		18	27			23
2000	30	19		18		16	25		24		21	23	15	21	27	31		24
2001	29	19		19	22	16	23		20		19	21	15	23	27	31		24
2002	25	19		20	21	15	24	23	24	17	20	22	15	22	26	29		23
2003	30	19		19	21	15	20	23	24	18	21	22		24	27	24		23
2004	30	19	34	19	20		20		25	22	18	22		18	26	23		23
2005	30	19	31	19	21		21		26	23		22		18	26	24		24
2006	27		29	20	23		23		24	19		23		18	25	25		23
2007	26		28	21	23		23		25	18	18	23		20	25	25		22
2008	27		29	21	23		24		25	18	19	23		18	27	25		23
2009	29		31	23			24		24	19	20			22	27	27		24
2010	28		30	23			25		24	19	21	24		21	26	28		24
2011	28		29	24			24		23	21	22	25		27	27	29		25
2012	31		33	24		17	24	22	22	21	23	25	15	24	28	31		26
2013	32		33	24		17	23	22	25	21		28	15		30	30		28
2014	35		42	24		17	27	22	23	19	17	26	16		30	29		27
2015	35	30	40	26	28	17	28		26	22	22	26	18	23	32	31		29
2016	36	30	41	26	28	16	28		27	22	22	26	18	23	32	30		29
2017	37	29	40	26	27		28	28	28	22	21	26	19	23	33	31		29
(blank)																		
Grand Total	31.37549407	19.11594203	36.64450867	24.45110664	24.47887324	16.61052632	25.78814628	23.72413793	25.76362112	21.05726872	20.13643366	23.56115108	17.1796875	20.61989796	29.82941371	27.81260647		26.43227277

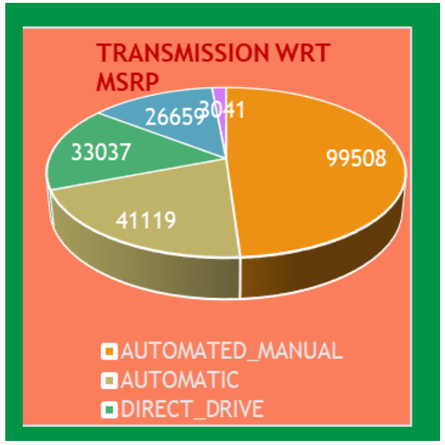
In Task 4, the pivot table showcase the dynamic trends in fuel efficiency (MPG) across diverse body styles and model years. Each line represents a body style, depicting the average MPG evolution over time. The chart provides a comprehensive visual understanding of how fuel efficiency has changed, enabling stakeholders to discern patterns and make informed decisions regarding the development and positioning of cars within specific body styles across various model years.

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.



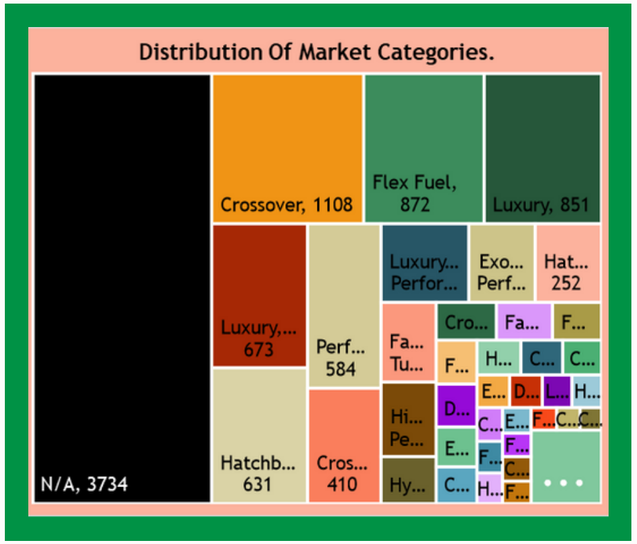
The Bubble chart investigated the interplay of horsepower, MPG, and price across diverse car brands. Utilizing Pivot Tables, a dynamic bubble chart visually represents this relationship. Each bubble, colored by brand, reflects a car model and is labeled with its name. This interactive dashboard provides a comprehensive overview of how car attributes vary among brands, aiding stakeholders in strategic decision-making based on key performance indicators.

SOME ADDITIONAL CHARTS



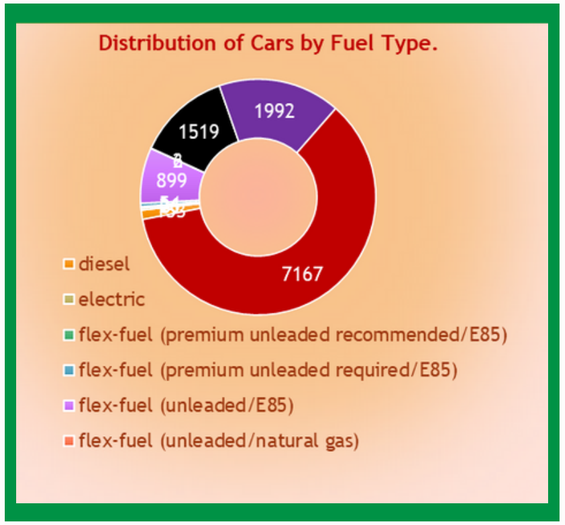
Pie Chart (Transmission Type Distribution):

- This pie chart visually dissects the dataset by transmission type, providing a clear depiction of the distribution of cars. It enables quick insights into the prevalence of automatic and manual transmissions, aiding in understanding consumer preferences and market trends.



Treemap (Market Category Distribution):

- The treemap graphically represents the count of cars in each market category. Its hierarchical structure offers an intuitive view of the market landscape, showcasing the relative sizes of different categories. This visualization assists in identifying dominant market segments and potential areas for product development.



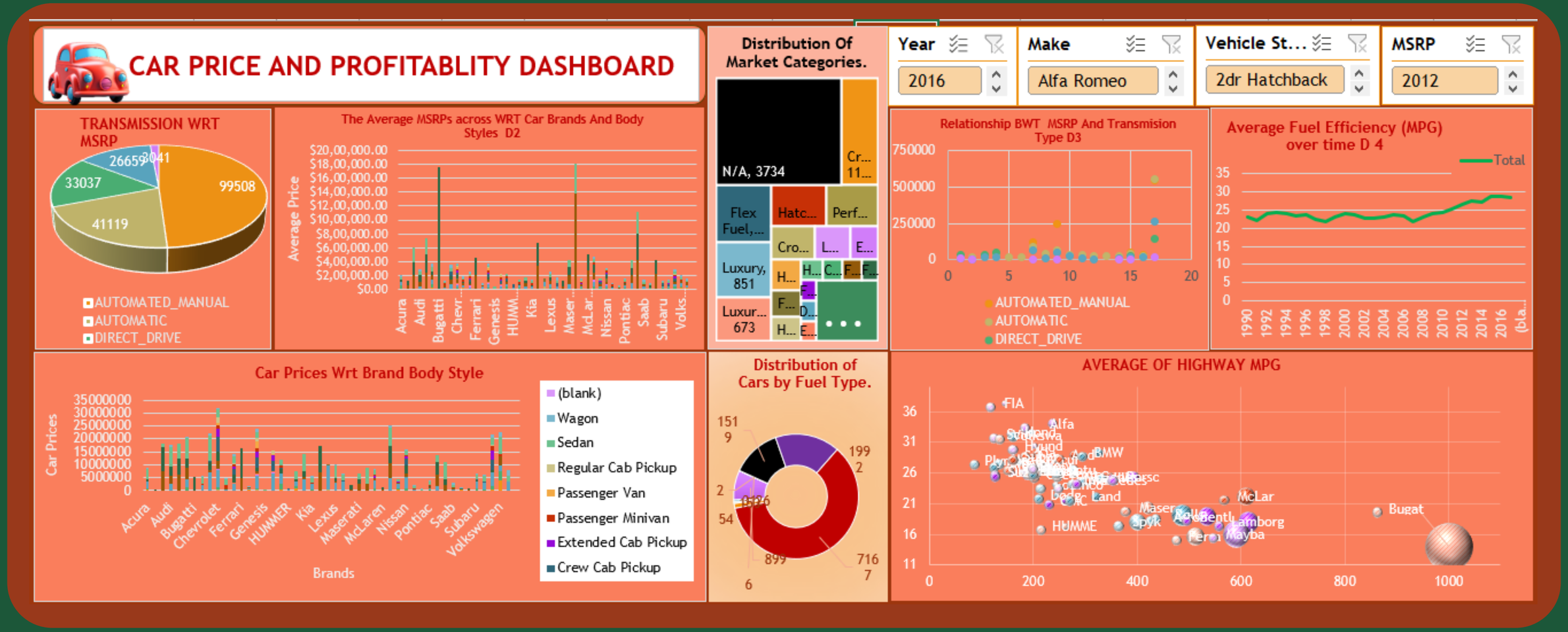
Donut Chart (Fuel Type Distribution):

- Utilizing a donut chart, the distribution of cars by fuel type is highlighted. The concentric rings showcase the proportional representation of gasoline, diesel, electric, and other fuel types. This chart facilitates a quick overview of the industry's fuel diversity, supporting strategic decisions aligned with environmental and market trends.

DASDBOARD

Impact of Car Features on Price and Profitability

In this comprehensive dashboard project, I meticulously analyzed diverse aspects of the automotive industry. The five dashboards visually represent trends in car prices, engine power, influential features, manufacturer comparisons, and fuel efficiency over time. Additionally, I incorporated three insightful charts—pie, treemap, and donut—to enhance the presentation. These visualizations collectively empower stakeholders with nuanced insights, facilitating strategic decision-making in pricing, product development, and market positioning within the dynamic automotive landscape.



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