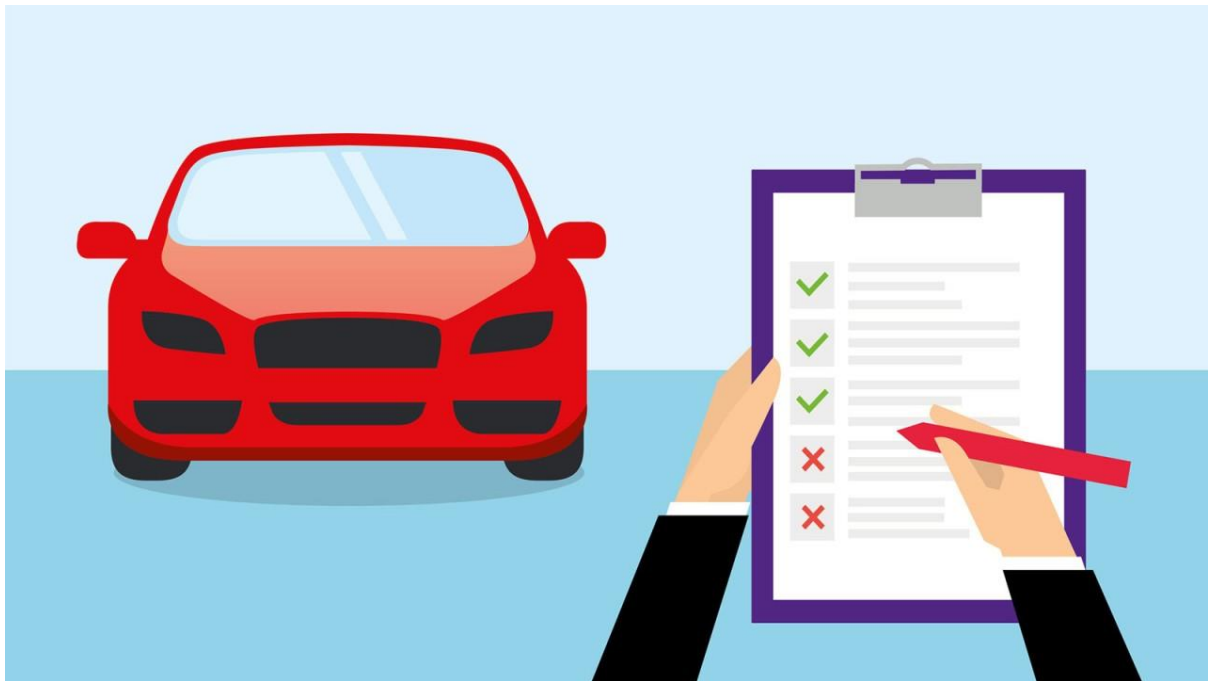


# Analysing the Impact of Car Features on Price and Profitability

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- Samruddhi Pawar

## Project Description:

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The automotive industry has been rapidly evolving over the past few decades, with a growing focus on fuel efficiency, environmental sustainability, and technological innovation. With increasing competition among manufacturers and a changing consumer landscape, it has become more important than ever to understand the factors that drive consumer demand for cars.

In recent years, there has been a growing trend towards electric and hybrid vehicles and increased interest in alternative fuel sources such as hydrogen and natural gas. At the same time, traditional gasoline-powered cars remain dominant in the market, with varying fuel types and grades available to consumers.

In this Project, the client has asked How can a car manufacturer optimize pricing and product development decisions to maximize profitability while meeting consumer demand? As a Data Analyst, our work is about analyzing patterns in the various Car features to understand the factors that drive consumer demands for Cars. These insights will be helpful for Car manufacturers, dealers, and other stakeholders to determine the important factors to boost sales of Cars.

## Approach:

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The goal of this project is to help a car manufacturer optimize pricing and product development decisions to maximize profitability while meeting consumer demand. The project involves analysing the relationship between car features, market categories, and pricing to identify the most popular and profitable features and categories among consumers. Different approaches have been used to analyse the given dataset for the present project. Results based on the analysis have been listed along with the respective questions to make the inferences. The dataset provided with the project mainly deals with the different features like vehicle type, drive type, and different parameters like Highway MPG and car's HP for different Make.

In this project, I have used Python and Tableau. After reading the data, I did some cleaning and replaced certain values. I chose Tableau because it allows me to build attractive dashboards with a variety of charts to see trends, patterns, and analyses. The modeling techniques I have used are pivot tables and data visualization.

## Tech Stack Used:

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- **Python** - The programming language used for Data Pre-processing.
- **Google Colab** - Interactive platform to write and execute codes in various programming languages (in this case Python).
- **Microsoft Excel** - A spreadsheet editor software used mainly by professionals to enter data in table format, perform computations, plot graphs, etc.

- **Tableau** - A visualization tool to represent data in graphs and plots. Mainly used to create a Dashboard

## Dataset Overview:

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### **Source of Data:**

<https://docs.google.com/spreadsheets/d/1SNoedxnbWsQHBCSzUgYU35WKam3lzQvy1kzkuU52H4Y/edit?usp=sharing>

The dataset provides details about the various car features like the Company, Year of Manufacture, Engine Type and Power, etc.

The Dataset details are:

- Number of Data Points: 11,914
- Number of Features: 16
- Column Details:
  1. Make: Manufacturer of the Car
  2. Model: Model name of the Car
  3. Year: Year of launch of the Car
  4. Engine Fuel Type: The type of Fuel that the Car uses
  5. Engine HP: Horsepower of the Car
  6. Engine Cylinders: Number of cylinders in the Car's engine
  7. Transmission Type: Transmission type of the Car
  8. Driven\_Wheels: Which wheels does the engine transfer power to
  9. Number of Doors: Number of doors in the Car
  10. Market Category: Market categories the Car can be classified into
  11. Vehicle Size: Size category of the Car
  12. Vehicle Style: Style category of the Car
  13. Highway MPG: Mileage of the Car in highways
  14. City mpg: Mileage of the Car in cities
  15. Popularity: Popularity score of the Car
  16. MSRP: Price of the Car

## Data Pre-Processing

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### **Handling Duplicate Values**

Found duplicate rows on analysis. Except for the first instance, dropped all other duplicate rows.

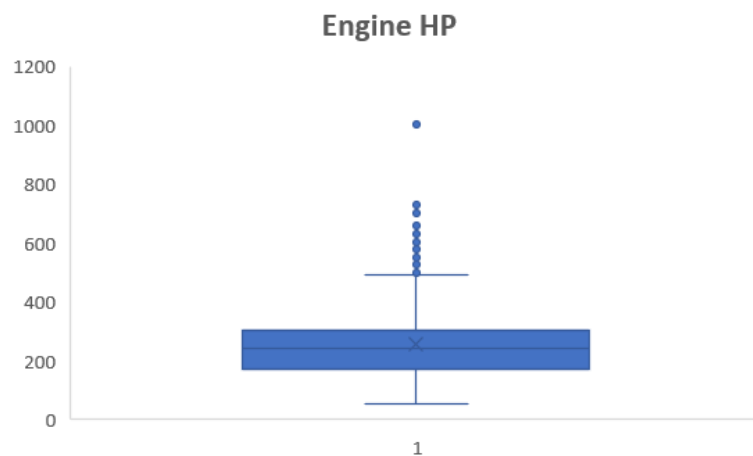
### **Handling Null Values**

- For Null values in the Engine HP column, we searched the value of Engine HP by searching for rows with the same Make, Model, and Year. If found then replace the null value with the mode of Engine HP value of all the matching rows.

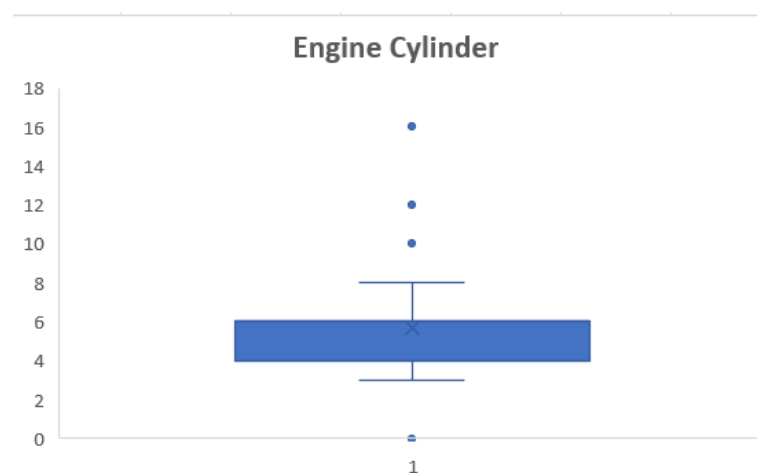
- For Null values in the Engine Cylinders column where the Engine Fuel Type is electric, we replaced them with 0 as on analysis we found that electric Cars have 0 Engine Cylinders which is logical.
- For Null values in the Market Category column,
  - Separated the Categories into different columns.
  - Searched for Market Categories of all rows of the same Car Make and Model in a non-null values data frame.
  - Found the mode of the Market Categories and replaced the null value with the mode.

### **Handling Outliers**

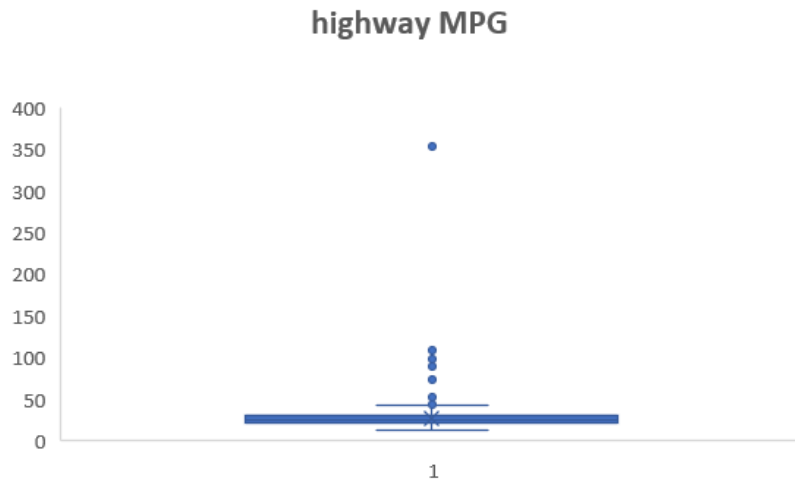
- For the Outliers in the Engine HP column, we checked the Market Category column for all rows with values higher than the 4th quartile mark of Engine HP. All cars are either Exotic or High-Performance or Luxury vehicles. So didn't change anything.



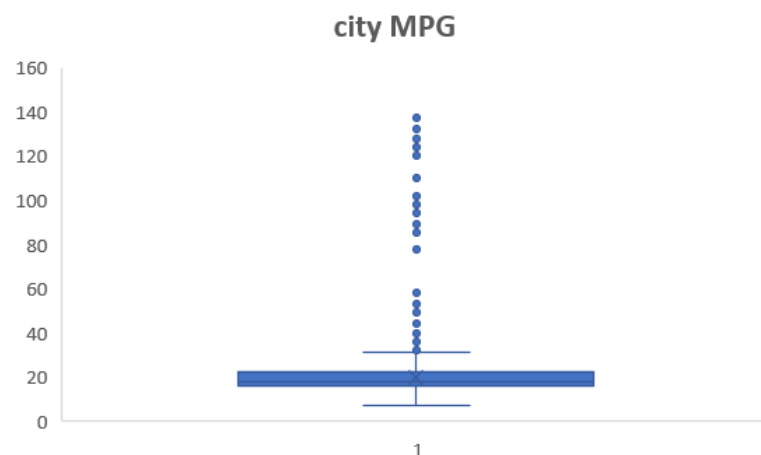
- For the Outliers in the Engine Cylinders column, we checked Engine Fuel Type for rows with 0 Engine Cylinders which are all electric which is logical. For Engine Cylinders greater than 8, we checked the Market Category and all cars were either Exotic, High-Performance, or Luxury. So didn't change anything.



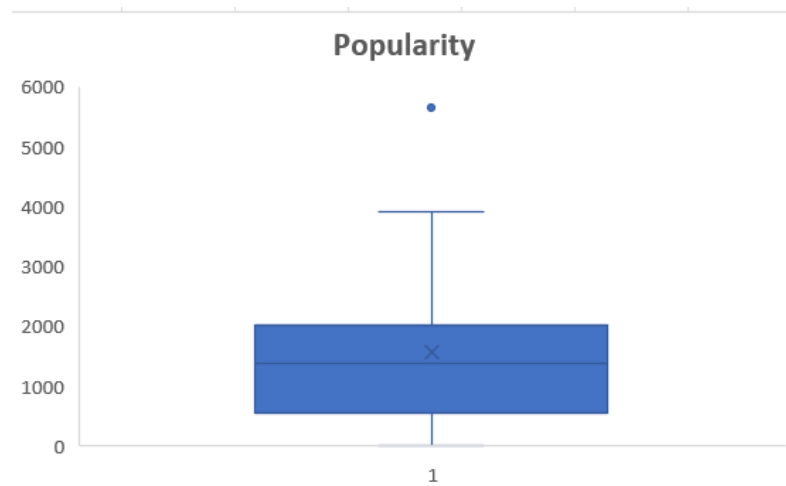
- For the Outliers in the highway MPG column, we plotted a box plot. Considering 42 as the threshold, we observed that a large percentage of vehicles with very high mileage are electric vehicles which is very logical. So didn't change anything.



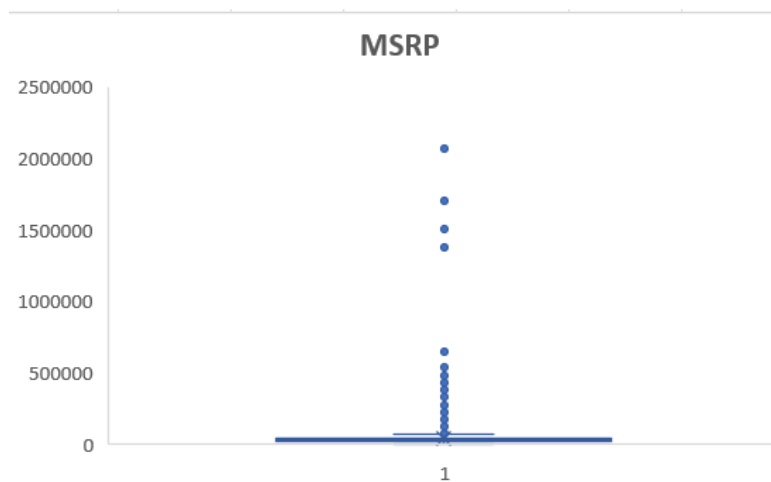
- For the Outliers in the city mpg column, we plotted the box plot. Considering 31 as the threshold, we observed that a large percentage of vehicles with very high mileage are electric vehicles which is very logical. So didn't change anything.



- For the Outliers in Popularity column, we plotted a box plot. Considering 3960 as the threshold, we observed that the distribution of the ratio of MSRP (Car Price) and Engine HP for cars whose popularity was above and below 3960 is almost the same. Also with 3960 as a threshold value, we observed that the distribution of MSRP (Car Price) and Engine Cylinders for cars whose popularity was above and below 3960 was almost the same. Also, the cars whose popularity was above 3960 are all from Ford which implies that Ford cars are very popular in the region. So didn't change anything.



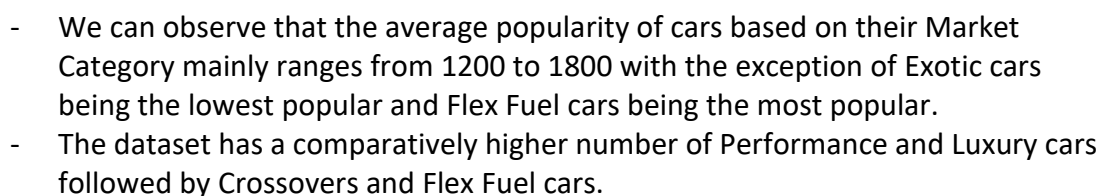
- For the Outliers in the MSRP column, we plotted the box plot. Considering 100000 as the threshold, we observed that the cars with prices above 100000 are all Exotic or Performance or Luxury cars. So didn't change anything.



## Insights:

- 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.  
**Result:**

Hatchback,Luxury	45	1323.133333
Hatchback,Luxury,Hybrid	3	454.000000
Hatchback,Luxury,Performance	36	1632.250000
Hatchback,Performance	342	1684.763158
High-Performance	475	1613.143158
Hybrid	223	1930.062780
Luxury	819	1079.214896
Luxury,High-Performance	334	1668.017964
Luxury,High-Performance,Hybrid	12	568.833333
Luxury,Hybrid	54	699.981481
Luxury,Performance	659	1293.062215
Luxury,Performance,Hybrid	11	2333.181818
Performance	943	1537.537646
Performance,Hybrid	121	596.702479

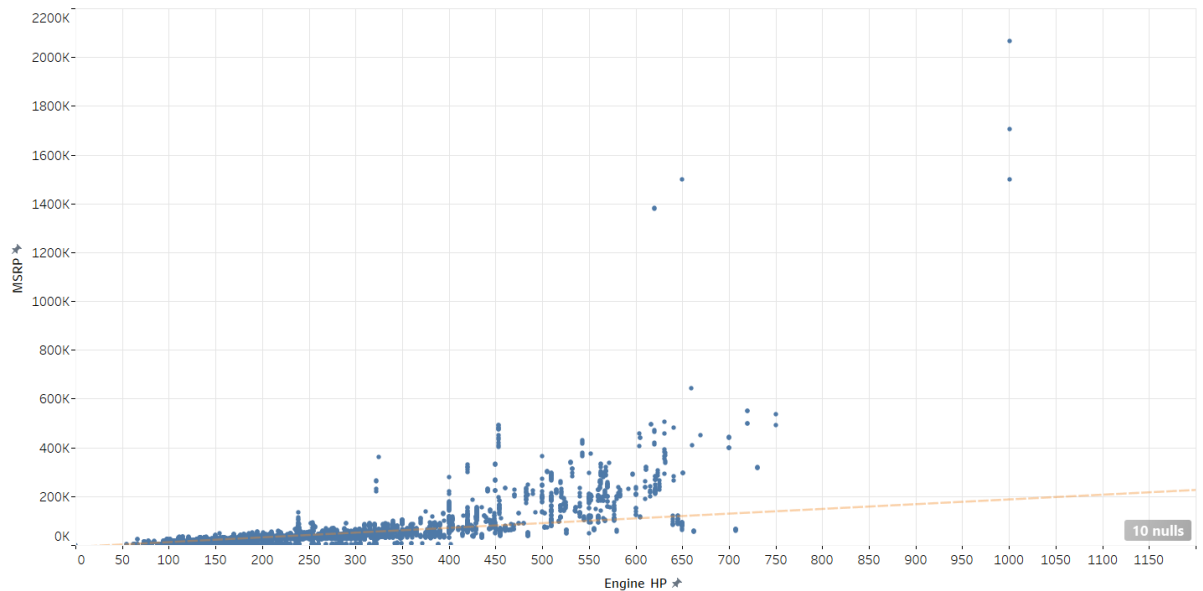


2. What is the relationship between a car's engine power and its price?

**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.

**Result:**

Engine HP vs MSRP



- We can observe that the relationship is positive as the trendline has a positive slope. This is logical as higher Engine HP requires a more complex level of design and engineering and more expensive sub-parts. Also, cars with higher Engine HP are mostly Performance cars.

3. 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.

**Result:**

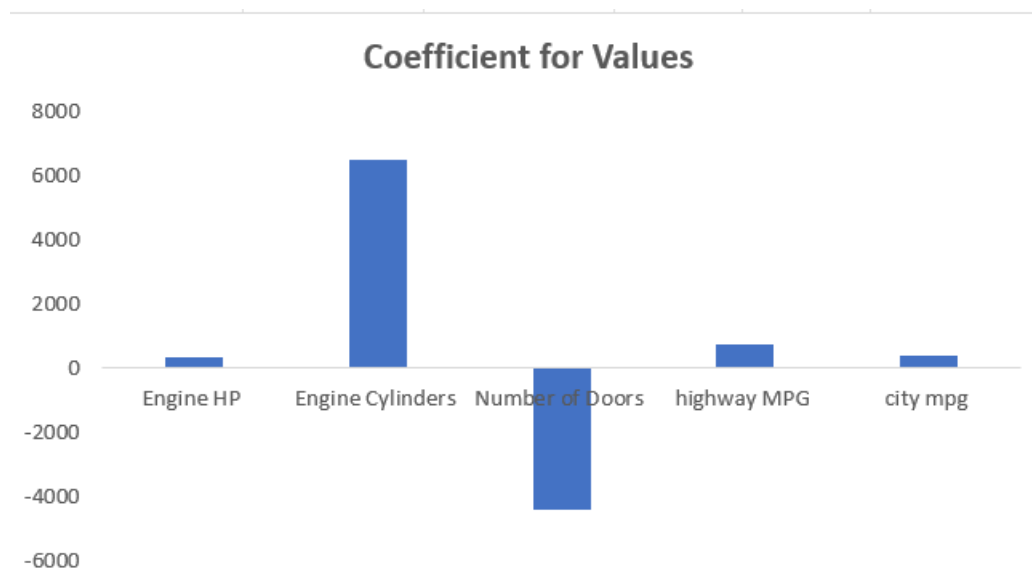
Regression Statistics								
Multiple R	0.674464809							
R Square	0.454902778							
Adjusted R Square	0.454659279							
Standard Error	45441.90259							
Observations	11199							

ANOVA								
	df	SS	MS	F	Significance F			
Regression	5	1.92888E+13	3.86E+12	1868.19	0			
Residual	11193	2.31132E+13	2.06E+09					
Total	11198	4.24019E+13						

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	-86836.97989	3537.319813	-24.5488	1.2E-129	-93770.74912	-79903.2	-93770.74912	-79903.21067
Engine HP	315.5444981	6.293354862	50.13931	0	303.2084153	327.8806	303.2084153	327.880581
Engine Cylinders	6500.107179	447.8196167	14.51501	2.62E-47	5622.301937	7377.912	5622.301937	7377.912422
Number of Doors	-4400.346468	498.3331605	-8.83013	1.2E-18	-5377.167144	-3423.53	-5377.167144	-3423.525792
highway MPG	749.0100565	107.5953928	6.961358	3.56E-12	538.1041553	959.916	538.1041553	959.9159578
city mpg	368.4066424	101.5244739	3.628747	0.000286	169.4008103	567.4125	169.4008103	567.4124745



- Using regression analysis, we found the top columns.
- We can observe that the R-squared score is 0.45 which can be counted as a good score.



- We can observe that the highest coefficient value is that of Engine Cylinders
- This shows that the Engine Cylinders have a very important relationship with Engine HP.

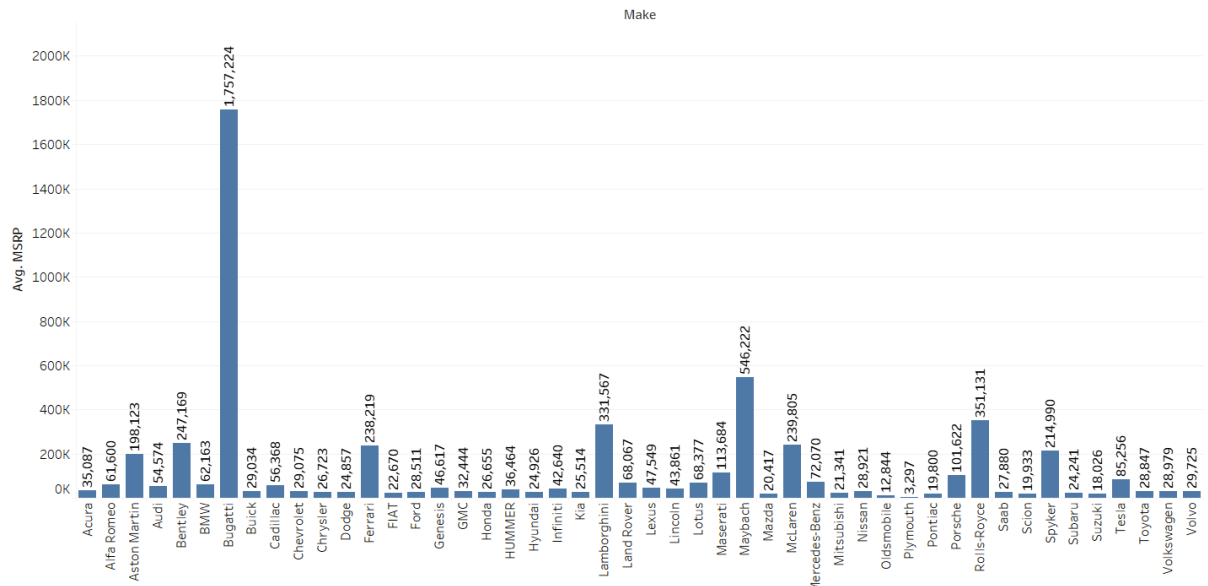
**4. How does the average price of a car vary across different manufacturers?**

**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 the manufacturer and the average price.

**Result:**

Make		Kia	25513.76
Acura	35087.49	Lamborghini	331567.31
Alfa Romeo	61600.00	Land Rover	68067.09
Aston Martin	198123.46	Lexus	47549.07
Audi	54574.12	Lincoln	43860.82
BMW	62162.56	Lotus	68377.14
Bentley	247169.32	Maserati	113684.49
Bugatti	1757223.67	Maybach	546221.88
Buick	29034.19	Mazda	20416.62
Cadillac	56368.27	McLaren	239805.00
Chevrolet	29074.73	Mercedes-Benz	72069.53
Chrysler	26722.96	Mitsubishi	21340.56
Dodge	24857.05	Nissan	28921.15
FIAT	22670.24	Oldsmobile	12843.80
Ferrari	238218.84	Plymouth	3296.87
Ford	28511.31	Pontiac	19800.04
GMC	32444.09	Porsche	101622.40
Genesis	46616.67	Rolls-Royce	351130.65
HUMMER	36464.41	Saab	27879.81
Honda	26655.15	Scion	19932.50
Hyundai	24926.26	Spyker	214990.00
Infiniti	42640.27	Subaru	24240.67
		Suzuki	18026.42
		Tesla	85255.56
		Toyota	28846.56
		Volkswagen	28978.52
		Volvo	29724.68



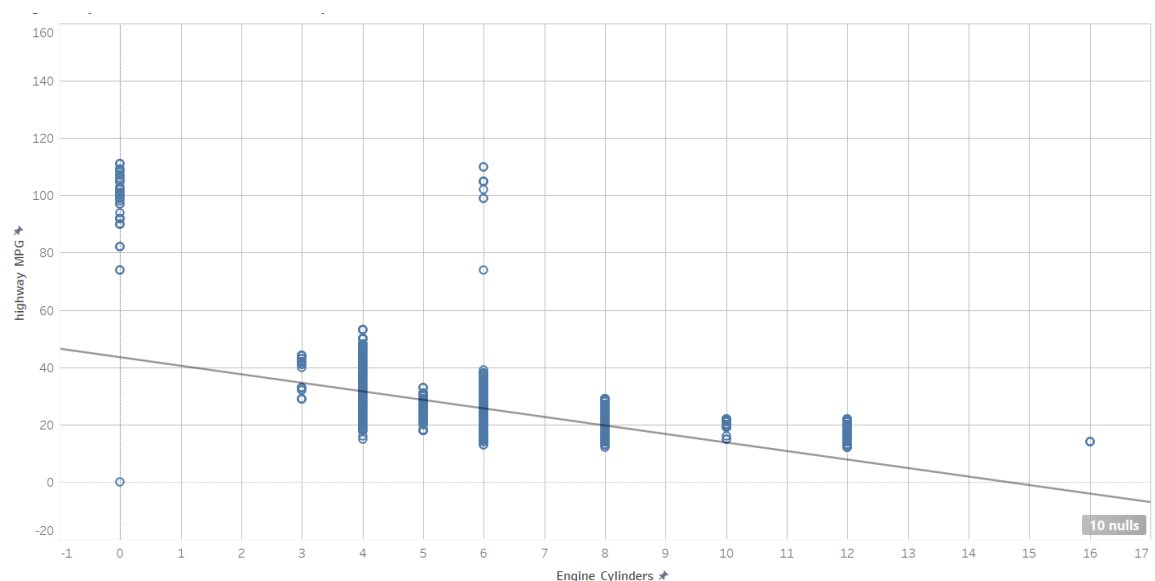
- We can observe that the most expensive cars are that of the Bugatti brand followed by Maybach, Rolls-Royce, Lamborghini etc. All these cars' brands are High-Performance and Luxury brands.

##### 5. 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.

**Result:**



Correlation between Engine Cylinders and highway MPG: **-0.62294**

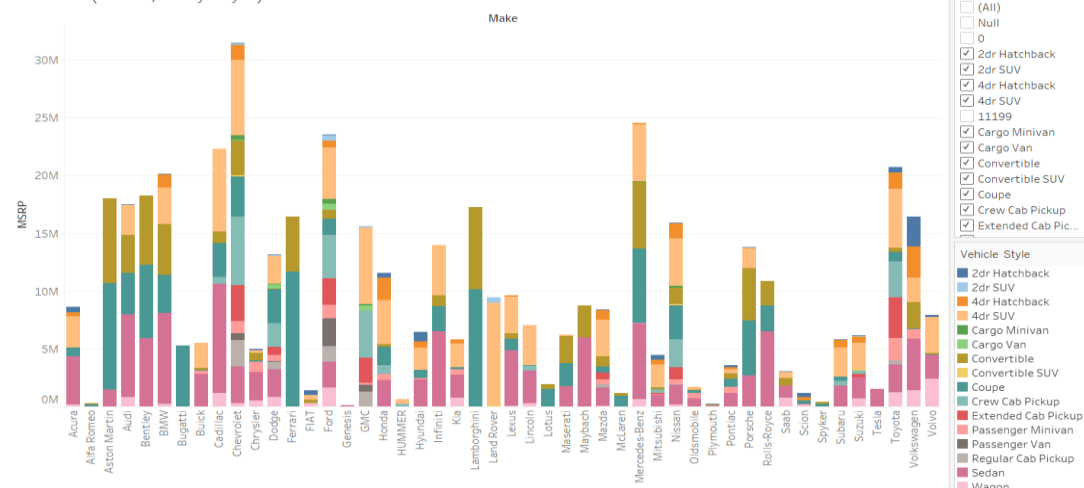
- We can observe that the plot between highway MPG and Engine Cylinders has a negative slope.
- The correlation coefficient is also Negative with a value of -0.62294.
- This is logical because as the number of Engine Cylinders increases, the amount of fuel to be burnt also increases, thus decreasing the mileage (highway MPG).

## 6. How does the distribution of car prices vary by brand and body style?

**Result:**

Sum of MSRP	Column Labels																	
Manufacturers	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	Grand Total	
Acura		480917		357440	2663505					793748					4134552	201360	8631522	
Alfa Romeo							129800		178200								308000	
Aston Martin							7321655		9258845						1448735		18029235	
Audi	4000			2674900			3291405		3556290						7144348	847350	17518293	
Bentley							6012870		6356760						5920900		18290530	
BMW	80097		1103100	3160950			4403171		3304051						7829700	259600	20140669	
Bugatti									5271671								5271671	
Buick				2141770			179325		18534			330065			2838590	8212	5516496	
Cadillac				7182555			985607		2953574	599150					9416847	1184100	22321833	
Chevrolet	8000	193310	1287260	6509468	420150	74688	2953245	106300	3504525	5927617	3117951	1047240	599670	2280032	3177797	300675	31487928	
Chrysler	98805			250545			630105		114510			922295			2479859	501075	4997194	
Dodge	38000	12000	16000	2462875	60520	338497	6000		2973842	2072780	684682	557425	70708	653408	2409585	793055	13149377	
Ferrari							4723811		11713289								16437100	
FIAT	420715			369305			327965									287570	1405555	
Ford	24000	467873	567615	4482771	415630	556351	730007		1398144	3782518	2285584	1179285	2429898	1299240	2279348	1623565	23521829	
Genesis																139850		
GMC		128319		6633919	142750	460085				4062482	2175866	150630	599670		1284328		15638049	
Honda	413200		1919260	3800589			252135		1588705	750215		553185			2264390		11541679	
HUMMER				377490						242405							619895	
Hyundai	789650		528880	1994390				980050	685920			133075			2323987		6455902	
Infiniti				4340200					2175750						6490009		13986009	
Kia			406960	2049645					142630					494650		1976360	772405	5842650
Lamborghini							7064450		10177050								17241500	
Land Rover		476394		8839200				145731									9461325	
Lexus			94700	3152974			472065		1016472						4837596	31105	9604912	
Lincoln				3422570					17342	453260					2854855	269705	7017732	
Lotus							413260		1501300								1914560	
Maserati				155000			2342963		1972284								1782400	6252647
Maybach							2762750								5976800		8795550	
Mazda	18000	12000	853180	3175515			870505		541879			580033		443130	265486	1618571	33350	8411649
McLaren							280225		918800								1159025	
Mercedes-Benz			122800	4974610	28950		5753964		6473107					32500	6543743	646035	24575709	
Mitsubishi	370169		403835	2009807	2000		208993			240210		134360		2000	8000	1058563	4438837	
Nissan	14683		1347320	4149630	128620		1406552	131075	2937632	2422300	1026379			413320	19914	1763130	175000	15935555
Oldsmobile				238150			2000		276015					492055	667161	20000	1695381	
Plymouth	40000		14000				85631		8000					31688	38759	16000	234078	
Pontiac	163505		162975	401550			473481		663715					541192	1156535	20855	3583808	
Porsche	28827			1815200			4504586		4758533						2713500		13820646	
Rolls-Royce							2141365		2204675						6539010		10885050	
Saab	12000		34586	541905			632628								1066500	751280	3038899	
Scion	366325		282470						330210						32500	184445	1195950	
Spyker							219990		209990								429980	
Subaru	12000		678060	2539900					354476	365975					1833110	10000	5793521	
Suzuki	44496	12000	584387	2303493					120194	304131		259659			1852967	683707	6165034	
Tesla															1534600		1534600	
Toyota	473750		1397750	5106450			386668		811995	3131895	3491424		1952518		369446	2380826	1237955	20740677
Volkswagen	2606540		2695540	2084955			2296916		6000						4434595	1424825	16459801	
Volvo	157550			3131700			121600		6000						2072945	2416971	7906766	
Grand Total	6665229	1301896	14862218	99137486	1198620	1429621	65368643	503300	91174463	24354938	13755938	10182683	3699946	6159854	11503523	14700020	469528458	

MSRP vs (Brand, Body Style)



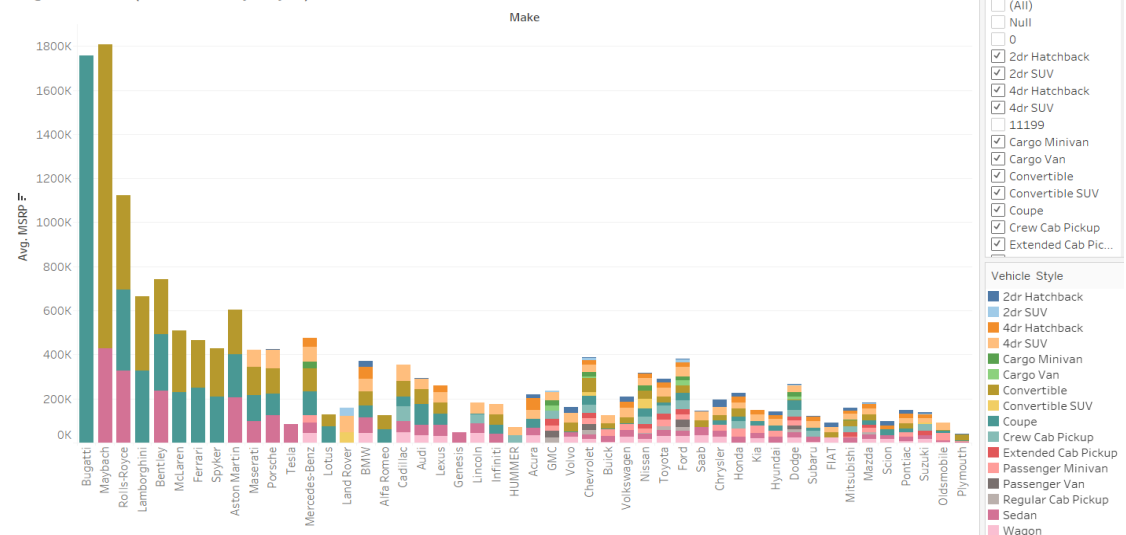
- The sum of the MSRP of the Ferrari Coupe as a vehicle style is the highest of all according to the dataset. This suggests that this is the highest-purchased luxury car.
- The sum of the MSRP of the Audi 2dr Hatchback as a vehicle style is the lowest of all according to the dataset. This model is of the years 1990-1991, during that time prices were comparatively lower than today. Although it's a luxury car due to the time difference it has the lowest sum of MSRP.

## 7. Which car brands have the highest and lowest average MSRPs, and how does this vary by body style?

### Result:

Average of MSRP	Vehicle Style		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	Grand Total	
Plymouth		2000.00			2000.00				28543.67		2000.00							2768.50	2000.00	3296.87
Oldsmobile						34021.43			2000.00		10615.96			32803.67			9139.19	2000.00	12843.80	
Suzuki		7416.00	2000.00		16696.77	21132.96				7512.13		2768.27	21638.25				17989.97	15538.80	18026.42	
Pontiac		18167.22			18108.33	25096.88			22546.71		16188.17						20652.41	6951.67	18000.04	
Scion		20351.39			15692.78						27517.50						16250.00	18444.50	19932.50	
Mazda		2000.00	2000.00		20805.27	27141.15			28080.81		20841.50			11600.66	23322.63			16675.00	20416.62	
Mitsubishi		12764.45			13923.34	26101.39	2000.00		29984.71			26690.00	19194.29			9154.69	2000.00	21340.56		
FIAT		21035.75				24620.31			23426.07									24058.25	22120.77	
Subaru					21189.38	28538.20					16112.55	24398.33					26187.29	2000.00	22670.34	
Dodge		2000.00	2000.00		2000.00	31175.63	20173.33	12536.93	2000.00		45058.21	31405.76	16301.95	25337.50	14141.60	14850.18	22519.49	24782.97	24857.05	
Hyundai		18363.95			17629.33	30218.03					22126.45						27666.51		24926.26	
Kia					19379.05	31533.00					20375.71						32976.67		25513.76	
Honda		17216.67			26656.39	28575.86			36019.29		21763.08	34100.68					26027.47		26655.15	
Chrysler		32935.00				35792.14			24234.81								26103.78	26372.37	26722.96	
Saab		2000.00			2034.47	41685.00			28755.82								36775.86	34149.09	27879.81	
Ford		2000.00	16133.55		19572.93	41507.14	19791.90	20605.59	34762.24		34101.07	41566.13	23808.17	23123.24	32836.46		17797.81	30066.02	28511.31	
Toyota		18950.00			22186.51	40851.40			25777.87		15615.29	36845.82	26251.31	30038.74			17592.67	24800.27	28346.56	
Nissan		2897.97			24059.29	34294.46	21436.67		39070.89	43691.67	35393.16	32733.78	20527.58	22962.22			2212.67	22604.23	28921.15	
Volkswagen		24134.63			28416.21	41699.10			27673.69		2000.00			29239.68			30795.80	26385.65	28978.52	
Buick					33996.35				25617.86		2059.31			30005.91			29568.65	2053.00	29034.19	
Chevrolet		2000.00	13807.86		18930.29	33553.96	20007.14	8298.67	62835.00	17716.67	38393.17	39255.74	24170.16	24934.29	28555.71		19824.84	20635.05	29074.73	
Volvo		26258.33				45386.96			40533.33		2000.00						22289.73	26271.42	29724.68	
GMC			7128.83			37479.77	23791.67	21908.81				39062.33	27895.72	25105.00	28555.71	25182.90			32444.09	
Acura		17175.61			51062.86	42959.76					39687.40						33614.24	33560.00	35087.49	
HUMMER						37749.00						34629.29							36464.41	
Infiniti						45686.32			46669.05		40291.67						41076.01		42840.27	
Lincoln						50331.91					2167.75	41205.45						44950.83	43860.83	
Genesis									52451.67			50823.60					46616.67		46616.67	
Lexus					31566.67	49049.49			70029.89			93586.58					48864.61	31105.00	47549.07	
Audi		2000.00				48634.55			70400.50		45439.60	66572.22					46391.87	33894.00	54574.12	
Cadillac						72551.06			64900.00								51178.52	47364.00	56368.27	
Alfa Romeo									59400.00										61600.00	
BMW		26699.00			55155.00	58536.11			63814.07		52445.25						71832.11	43266.67	62162.56	
Land Rover			39699.50			71283.87				48577.00									68067.09	
Lotus									51657.50		75065.00								68377.14	
Mercedes-Benz					40933.33	68145.34	28950.00		104617.53		109713.68			32500.00			48833.90	43069.00	72069.53	
Tesla																	85255.56		85255.56	
Porsche		5785.40			82509.09				115502.21		99136.10						123140.91		101822.40	
Maserati						77500.00			130164.61		116016.71						99022.22		113684.49	
Aston Martin									203379.31		192892.60								198123.46	
Spyker									219990.00		209990.00								214990.00	
Ferrari									214718.68		249218.91								238218.84	
McLaren									280225.00		229700.00								239805.00	
Bentley									250536.25		254270.40								247169.32	
Lamborghini									336402.38		328291.94								331567.31	
Rolls-Royce									428273.00		367445.83								351130.65	
Maybach									1381375.00										546221.88	
Bugatti											1757223.67								1757223.67	
Grand Total		16177.74	14306.55	22416.47	40730.27	20315.59	17019.30	88216.79	17975.00	17595.29	37183.11	23041.77	26176.56	30578.07	17854.65	40462.02	26154.94	41925.93		

Avg MSRP vs (Brand, Body Style)



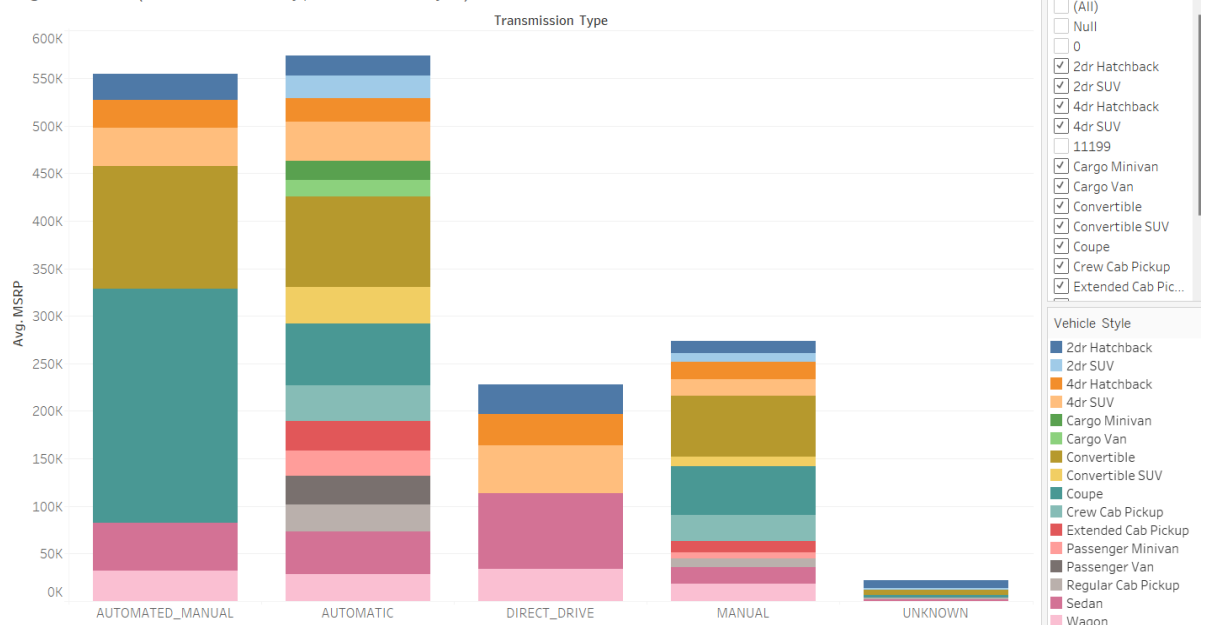
- The first graph is a heatmap. It shows the average MSRP of vehicles according to Manufacturer and Vehicle style. In that, Plymouth, Oldsmobile has the lowest Average MSRP of \$2000.
- The stacked graph also shows that highest average MSRP is of Bugatti Coupe and then followed by Maybach convertible.

## 8. How do the different features such as transmission type affect the MSRP, and how does this vary by body style?

### Result:

Average of MSRP	Vehicle Style														
Transmission Type	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
AUTOMATED_MANUAL	27470	24154	29347	40451			129082	245977							50385
AUTOMATIC	20784	24154	23889	41638	20316	17019	95153	38926	64523	37719	30711	26590	30578	28537	44671
DIRECT_DRIVE	31800		32800	49800											79512
MANUAL	12841	9173	17500	17422			64794	9595	50901	28233	11553	6510		8759	17557
UNKNOWN	7362	2371					5784		2000					2000	2000
Grand Total	16178	14307	22416	40730	20316	17019	88217	17975	77595	37183	23042	26177	30578	17855	40462

Avg MSRP vs (Transmission Type, Vehicle Style)



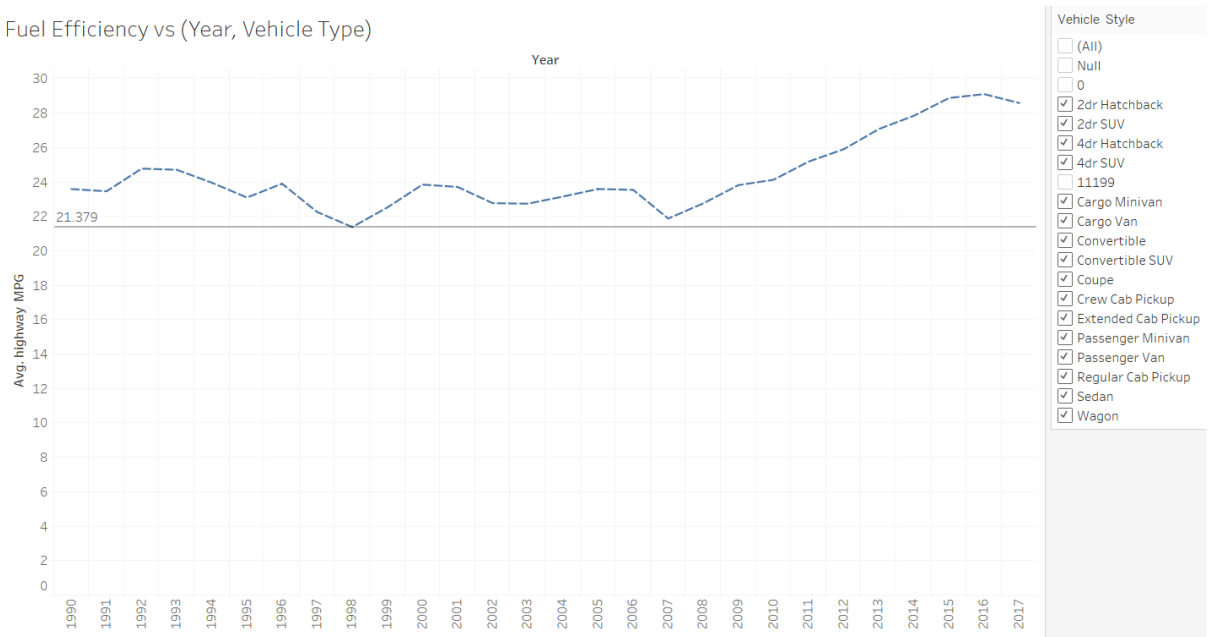
- The stacked graph shows the average MSRP vary across Transmission type and vehicle style. The lowest MSRP is of Passenger Minivan Manual with price of \$6510. As this is a basic commercial vehicle model, it's pretty significant that the price will be low.
- The highest MSRP is of Convertible Automated Manual with price of \$129082. As this is an advanced SUV vehicle model, it's pretty significant that the price will be high.

## 9. How does the fuel efficiency of cars vary across different body styles and model years?

**Result:**

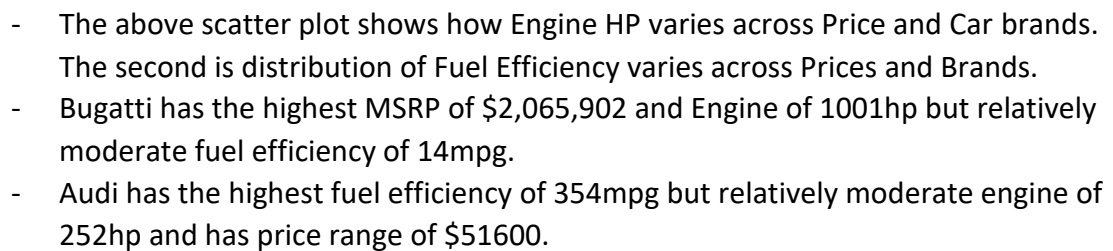
Average of highway	Vehicle Style	2dr SUV	4dr Hatchback	4dr SUV	Cargo Minivan	Cargo Van	Convertible	Convertible SUV	Coupe	Crew Cab Pickup	Extended Cab Pickup	Passenger Minivan	Passenger Van	Regular Cab Pickup	Sedan	Wagon	Grand Total
Year	2dr Hatchback																
1990	30	20	31	20	20		24		24		22	20		22	24	24	24
1991	30	16		20			23		26		16	18		17	24	23	23
1992	29	18	28	21			24		28		15			18	24	24	25
1993	28	19	28	21			24		26		17			18	25	24	25
1994	27	18	27	20	21	19	26		26		20	21	16	21	25	24	24
1995	29	16	28	22	22	18	25		26		20	20	15	20	24	24	23
1996	29	20	26	21	23	15	24		24		21	21	15	22	26	25	24
1997	26	22	27	20	21	17	25		21		18	21	17	19	25	24	22
1998	23	26	25	22	17	17	24		24		19	23	17	19	26	23	21
1999	30	19	18	19	20	17	22		27		18	22		18	27		23
2000	30	19	18	18	16	16	25		24		21	23	15	21	27	31	24
2001	29	19	19	19	22	16	23		20		19	21	15	23	27	31	24
2002	25	19	20	21	15	15	24		23		20	22	15	22	26	29	23
2003	30	19	19	19	21	15	20		23		18	21	22	24	27	24	23
2004	30	19	34	19	20	20	20		25		22	22	22	18	26	23	23
2005	30	19	31	19	21	21	21		26		23	22	22	18	26	24	24
2006	27	29	20	23	23	23	23		19		18	22	22	18	25	25	24
2007	25	27	20	23	23	23	23		18		18	23	23	20	25	25	22
2008	26	28	21	23	23	23	23		18		19	23	23	18	27	25	23
2009	29	31	23				24		19		20			22	27	27	24
2010	27	30	23				24		19		21	24		21	26	28	24
2011	28	29	24				24		21		22	25		27	27	29	25
2012	30	32	24		17	17	24	22	21		23	25	15	24	28	30	26
2013	32	33	24		17	17	23	22	21		28	26	15	29	29		27
2014	35	45	24		17	17	26	22	19		17	26	16	32	29		28
2015	36	30	42	26	28	17	27	26	22		22	26	18	23	33	33	29
2016	36	30	42	26	27	16	28	27	22		22	26	18	23	33	33	29

Fuel Efficiency vs (Year, Vehicle Type)



- The line graph shows the fuel efficiency varied across Years and Vehicle Styles. Overall, the graph has been steady since the year 2007.
- The fuel efficiency has been in the year 1998 with 21 MPG and highest in 2015 with 29 MPG.

**Result:**

[illegible]

## Summary:

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- In the crossover market category, a high number of models are built, which means people are liking the crossover category more.
- The F150 model has high popularity amongst customers.
- The Ford manufacturing company has high popularity amongst customers.
- Fewer engine cylinders give more highway MPG, which can attract customers to buy the car.
- Sedan, 4-door SUV, and coupe vehicle styles have high popularity and high MRP, which we can use to make the car profitable.
- Direct drive and automatic manual transmissions are loved by customers and can be priced high. From insights, we can see that people are continuously buying them despite their high price, which can be used to make our cars profitable.
- New models have high MPG due to modifications and improvements made based on customer feedback.
- Sedans and hatchbacks give higher average MPG.
- Engines with 200,250 HP have high popularity, which can help reduce the cost of the car.
- The number of doors has the strongest relationship with the price.

By utilizing the insights and dashboard provided, we can make data- driven decisions to optimize the cost and profitability of our cars, as well as establish our position in the car market. This will help us create more appealing and competitive models that attract customers and increase sales.

## Conclusion:

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- Through this project, I was able to understand the importance of Data Analytics in Car Feature Analysis as it provides valuable insights that help in making Data-Driven Decisions.
- This project has helped in get hands-on experience with real-life data sets and how we clean, manipulate, visualize, and draw insights from the data The questions asked in the data set have been answered to the best knowledge, and tried to plot the required graphs and chat as per requirement and my understanding.
- In this project I was able to get insights like which features affect Car Price, the relationship between Engine Cylinders and fuel efficiency, etc. I also have experience in Data Preprocessing Data Cleaning, handling Outliers, Feature Engineering, etc. in this project which can be communicated to relevant stakeholders as per the requirements.