Impact of Car Features

Project Description:

This project aims to address the business problem faced by car manufacturers regarding optimizing pricing and product development decisions to maximize profitability while meeting consumer demand. The dataset "Car Features and MSRP" from Kaggle by Cooper Union serves as the primary source of data for this analysis. With over 11,000 car models and 16 variables, including make, model, year, fuel type, engine power, transmission, and pricing information, this dataset provides a comprehensive overview of the automotive industry.

Drive: https://drive.google.com/drive/folders/1LdLIuiZk6qQwvzcwNFEES4ZoaaZQ-WY7?usp=sharing

LOOM: https://www.loom.com/share/d66504b882d1412186d64f939bfb7b93?sid=3e39744b-f1b3-4ab5-8d2f-d969bd8f2565

Tasks: Analysis & Dashboards

- **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.

Row Labels	Average of Popularity	Count of Model
Crossover	1545.263063	1110
Crossover,Diesel	873	7
Crossover,Exotic,Luxury,High-Performance	238	1
Crossover,Exotic,Luxury,Performance	238	1
Crossover,Factory Tuner,Luxury,High-Performance	1823.461538	26
Crossover,Factory Tuner,Luxury,Performance	2607.4	5
Crossover,Factory Tuner,Performance	210	4
Crossover,Flex Fuel	2073.75	64
Crossover,Flex Fuel,Luxury	1173.2	10
Crossover,Flex Fuel,Luxury,Performance	1624	6
Crossover,Flex Fuel,Performance	5657	6
Crossover,Hatchback	1675.694444	72
Crossover,Hatchback,Factory Tuner,Performance	2009	6
Crossover,Hatchback,Luxury	204	7
Crossover,Hatchback,Performance	2009	6
Crossover,Hybrid	2563.380952	42
Crossover,Luxury	884.5487805	410
Crossover,Luxury,Diesel	2149.411765	34
Crossover,Luxury,High-Performance	1037.222222	9
Crossover,Luxury,Hybrid	630.9166667	24
Crossover,Luxury,Performance	1344.849558	113
Crossover,Luxury,Performance,Hybrid	3916	2
Crossover,Performance	2585.956522	69
Diesel	1730.904762	84
Diesel,Luxury	2275	51
Exotic,Factory Tuner,High-Performance	1046.380952	21
Exotic,Factory Tuner,Luxury,High-Performance	517.5384615	52
Exotic,Factory Tuner,Luxury,Performance	520	3
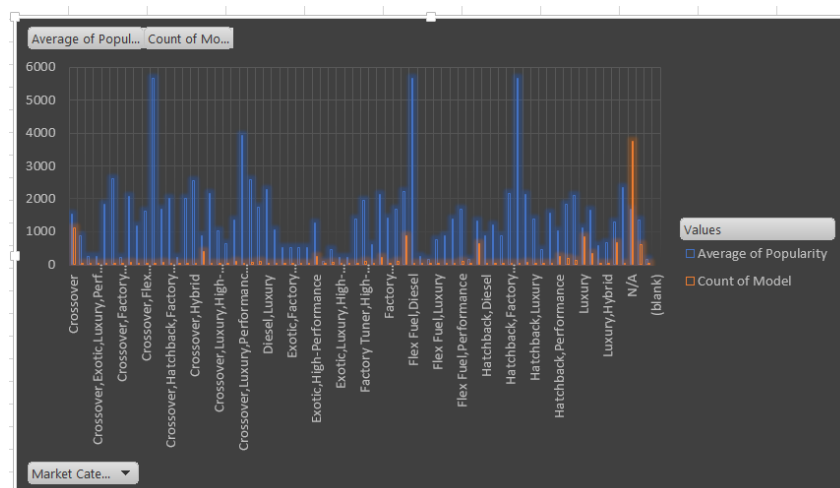
Insight Required: What is the relationship between a car's engine power and its price?
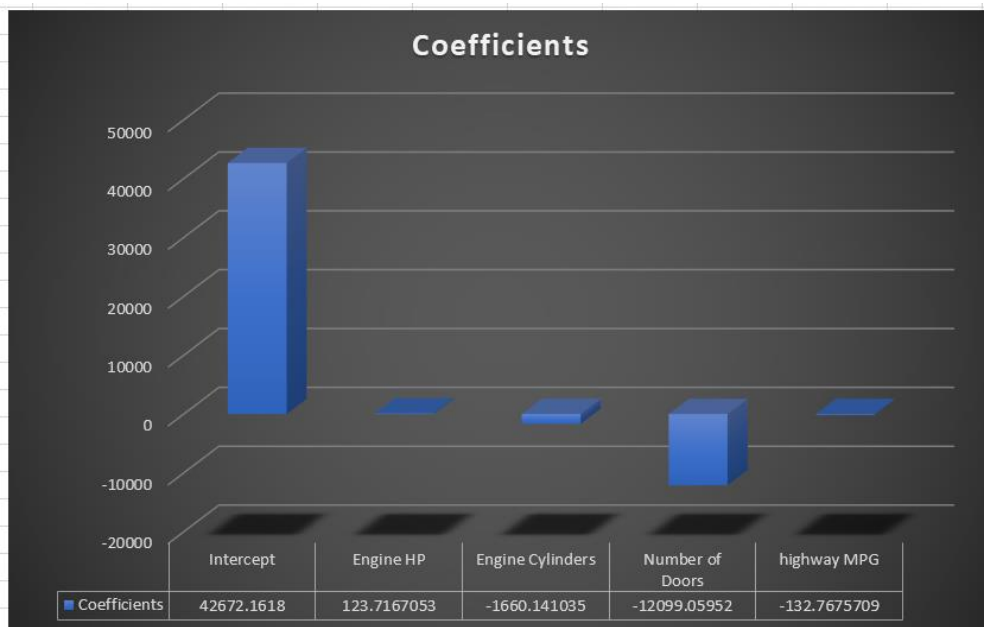
- **Task 2:** Create a scatter chart that plots engine power on the x-axis and price on the y-axis. Add a trendline to the chart to visualize the relationship between these variables.

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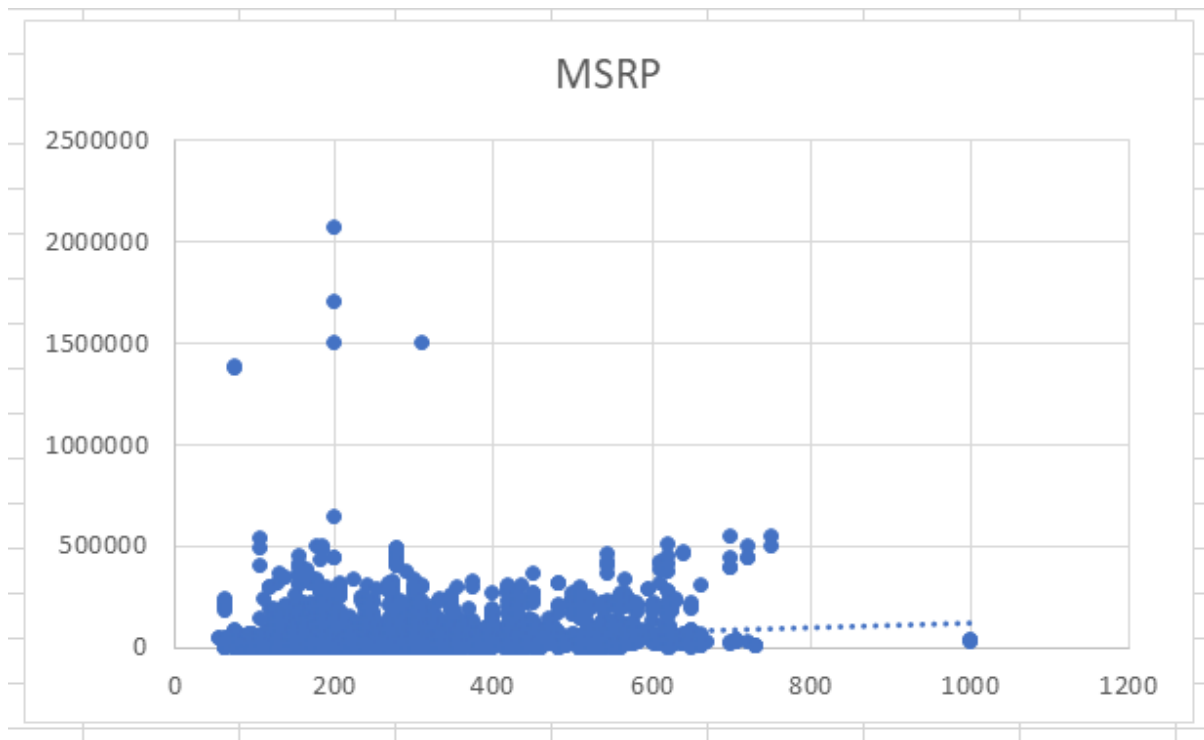
Insight Required: Which car features are most important in determining a car's price?

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

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.99246
R Square	0.984976
Adjusted R	0.983611
Standard E	2361.868
Observatio	49

ANOVA

	df	SS	MS	F	ignificance F
Regression	4	1.61E+10	4.02E+09	721.1807	1.76E-39
Residual	44	2.45E+08	5578422		
Total	48	1.63E+10			

	Coefficients	andard Err	t Stat	P-value	Lower 95%	Upper 95%	ower 95.0%	Upper 95.0%
Intercept	42672.16	11954.24	3.569625	0.000879	18579.97	66764.36	18579.97	66764.36
Engine HP	123.7167	10.91711	11.33236	1.23E-14	101.7147	145.7187	101.7147	145.7187
Engine Cyli	-1660.14	782.3076	-2.12211	0.039495	-3236.78	-83.5037	-3236.78	-83.5037
Number of	-12099.1	973.6612	-12.4264	5.48E-16	-14061.3	-10136.8	-14061.3	-10136.8
highway M	-132.768	221.2607	-0.60005	0.551551	-578.689	313.154	-578.689	313.154

Coefficients

	Intercept	Engine HP	Engine Cylinders	Number of Doors	highway MPG
■ Coefficients	42672.1618	123.7167053	-1660.141035	-12099.05952	-132.7675709

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.

Top 10 Cars

Row Labels ▼	Average of MSRP
Aston Martin	197910.3763
Bentley	247169.3243
Bugatti	1757223.667
Ferrari	238218.8406
Lamborghini	331567.3077
Maserati	114207.7069
Maybach	546221.875
McLaren	239805
Rolls-Royce	351130.6452
Spyker	213323.3333
Grand Total	**256767.5941**

Bottom 10 Cars

Row Labels ▼	Average of MSRP
Dodge	22390.05911
FIAT	22670.24194
Mazda	20039.38298
Mitsubishi	21240.53521
Oldsmobile	11542.54
Plymouth	3122.902439
Pontiac	19321.54839
Scion	19932.5
Suzuki	17907.20798
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Grand Total	**19268.58895**
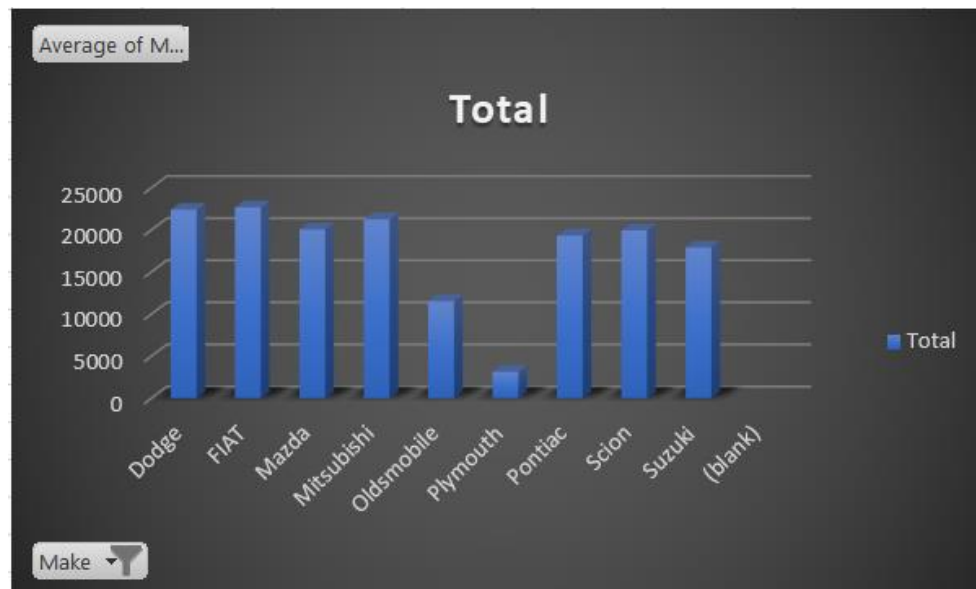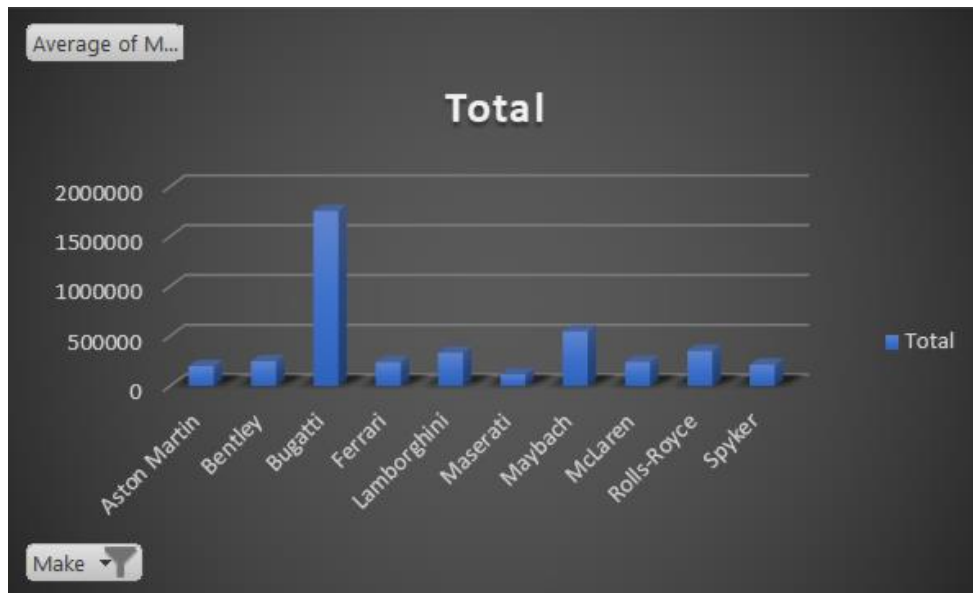
Insight Required: What is the relationship between fuel efficiency and the number of cylinders in a car's engine?

- **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.

Row Labels	Average of highway MPG
0	48.08928571
3	32.4
4	30.16308923
5	27.63555556
6	24.75050123
8	22.52141802
10	25.75
12	20.3826087
16	40
Grand Total	**26.64279704**

Column 1	Row Labels	Average of highway MPG
Row Labels	1	
Average of highway MPG	-0.299788635	1

Building the Dashboard:

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.

Sum of MSRP	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
Acura	480917		357440	2663505					793748						4294702	201360
Alfa Romeo							129800		178200							
Aston Martin							7321655		9635275						1448735	
Audi	4000			2674900			3291405		3556290						7158348	847350
Bentley							6012870		6356760						5920900	
BMW	80097		1144950	3160950			4502671		3419051						7989300	259600
Bugatti									5271671							
Buick				2141770			179325		18534			330065			2850590	8212
Cadillac				7182555			985607		2953574	599150					9418847	1184100
Chevrolet	8000	213310	1287260	6569568	420150	78688	2953245	106300	3504525	5927617	3117951	1178515	607670	2260032	3303977	300675
Chrysler	98805			250545			630105		114510			922295			2479859	501075
Dodge	48000	44000	18000	2572405	60520	338497	12000		3264627	2235775	864172	557425	70708	719408	2417585	793055
Ferrari							4723811		11713289							
FIAT	420715			369305			327965									287570
Ford	36000	479873	567615	4482771	702400	566351	730007		1398144	3812353	2285584	1411605	2431898	1299240	2299348	1635565
Genesis															139850	
GMC			144319	6641919	142750	468085				4062482	2183866	150630	603670	1306328		
Honda	413200		2088520	3953209			252135		1588705	787720		553185			2340105	
HUMMER				377490						242405						
Hyundai	1038050		528880	2128890					724070			133075			2899937	
Infiniti				4340200			980050		2175750						6494090	
Kia			406960	2049645					142630			494650			1980360	772405
Lamborghini							7064450		10177050							
Land Rover		476394		9076595				145731								
Lexus			94700	3152974			472065		1016472						4837596	31105
Lincoln				3422570					25342	453260					2854855	269705
Lotus							413260		1593200							

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.

Average of MSRP	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	Sed
Acura	17175.60714		51062.85714	42959.75806					39687.4						33
Alfa Romeo							64900		59400						
Aston Martin							203379.3056		192705.5						20
Audi	2000			48634.54545			70029.89362		93586.57895						44
Bentley							250536.25		254270.4						
BMW	26699		54521.42857	58536.11111			63417.90141		51803.80303						70
Bugatti									1757223.667						
Buick				33996.34921			25617.85714		2059.333333			30005.90909			27
Cadillac				72551.06061			70400.5		45439.6	66572.22222					50
Chevrolet	2000	8887.916667	18930.29412	32046.67317	20007.14286	7153.454545	62835	17716.66667	38939.16667	39255.74172	24170.16279	24552.39583	24306.8	19824.84211	20
Chrysler	32935			35792.14286			24234.80769		19085			29751.45161			26
Dodge	2000	2000		2000	30992.83133	20173.33333	12536.92593		2000	45980.66197	31052.43056	13938.25806	25337.5	14141.6	9342.961039	21
Ferrari							214718.6818		249176.9149						
FIAT	21035.75			24620.33333			23426.07143								
Ford	2000	13710.65714	19572.93103	41507.13889	21284.84848	17698.46875	34762.2381		34101.07317	41438.61957	23808.16667	23526.75	32425.30667	17797.80822	21
Genesis															46
GMC		5550.730769		36695.68508	23791.66667	18723.4				39062.32692	26632.5122	25105	26246.52174	21069.80645	
Honda	17216.66667		26106.5	28855.54015			36019.28571		21763.08219	34248.69565		36879			26
HUMMER				34629.28571						34629.28571					
Hyundai	18536.60714		17629.3333						20687.71429			26615			27
Infiniti							46669.04762		40291.66667						4
Kia			19379.04762						20375.71429			32976.66667			23
Lamborghini							336402.381		328291.9355						
Land Rover		39699.5		70910.89844				48577							
Lexus			31566.66667	45042.48571			52451.66667		50823.6						48
Lincoln				50331.91176					2111.833333	41205.45455					42
Lotus							51657.5		75866.66667						

Note overlay: Average of MSRP / Value: 26106.5 / Row: Honda / Column: 4dr Hatchback
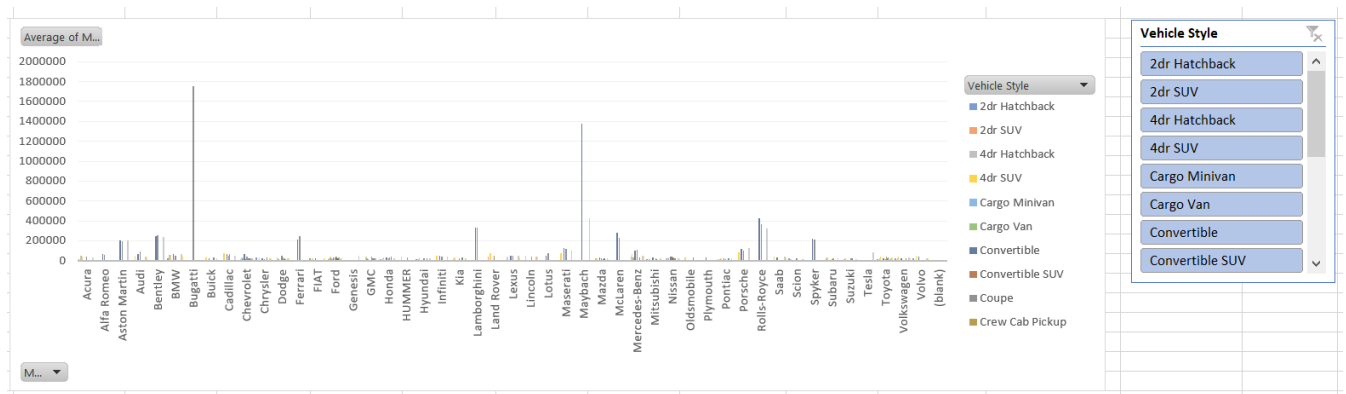
Task 3: How do the different feature such as transmission type affect the MSRP, and how does this vary by body style?

- **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.
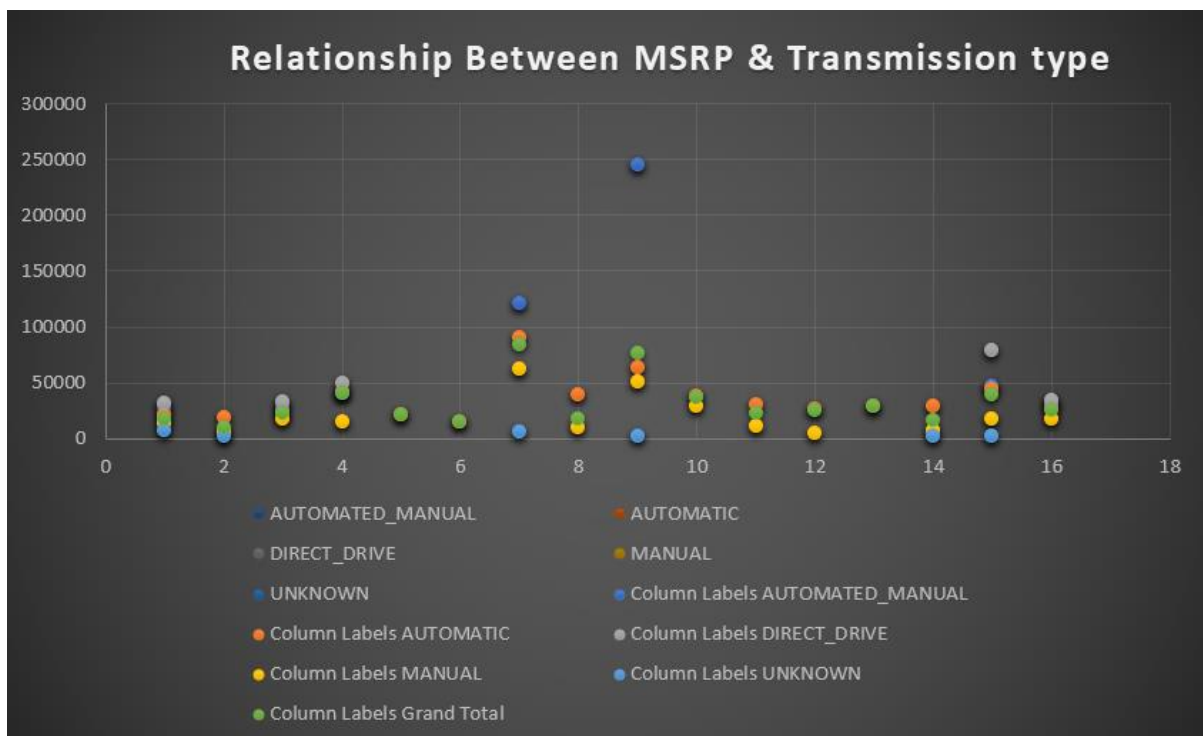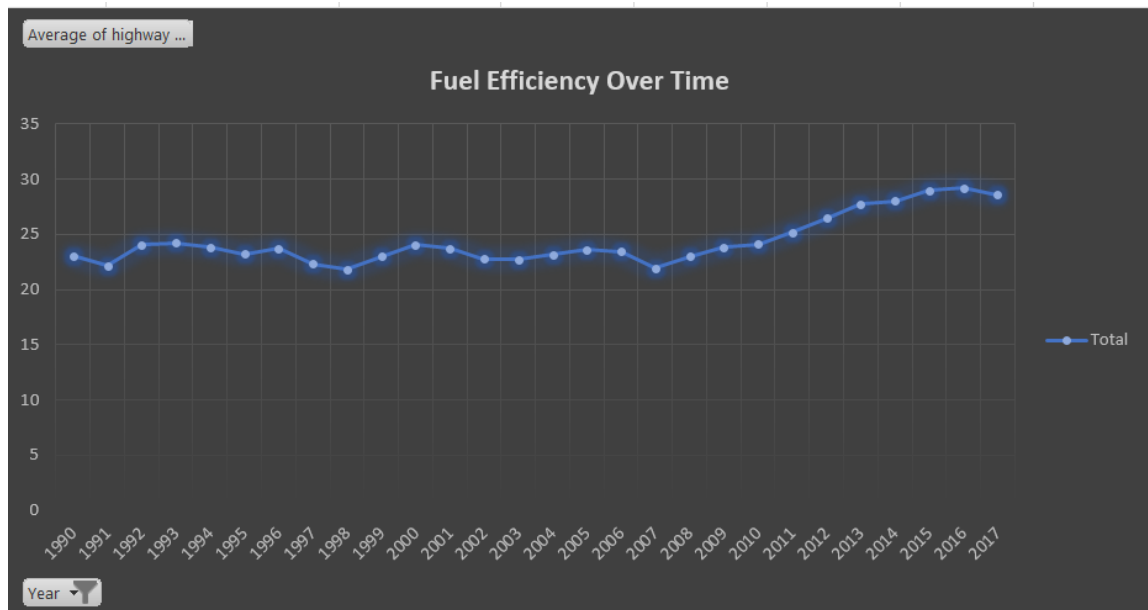
Average of MSRP	Column Labels					
Row Labels	AUTOMATED_MANUAL	AUTOMATIC	DIRECT_DRIVE	MANUAL	UNKNOWN	Grand Total
2dr Hatchback	27180.96491	20926.464	31800	13353.65831	7361.5	16867.71344
2dr SUV		18615.20455		6303.811111	2371	10115.18841
4dr Hatchback	29249.07407	23833.67898	32799.72973	17594.41313		22420.8661
4dr SUV	40451.15385	41535.60646	49800	15426.46226		40421.87178
Cargo Minivan		20920.98592				20920.98592
Cargo Van		15280.22105				15280.22105
Convertible	121256.6444	90637.3869		62357.75625	5783.5	84224.28499
Convertible SUV		38925.5		9233.142857		17424.13793
Coupe	245977.4252	63371.81076		50484.37241	2000	76248.32205
Crew Cab Pickup		37744.07154		28360.52632		37220.46696
Extended Cab Pickup		30637.34973		10884.19455		22488.77689
Passenger Minivan		26412.68159		4405.333333		25621.05036
Passenger Van		29015.20313				29015.20313
Regular Cab Pickup		28536.8239		7557.773333	2000	15953.70918
Sedan	47498.70813	43769.1165	79512.25	17119.23374	2000	39270.68963
Wagon	31985.27778	27613.19169	34250	17844.13971		25557.93919
Grand Total	99508.37061	41110.33172	47351.25	26663.64429	3040.736842	40594.73703

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.


Fuel Efficiency Over Time

Average of highway MPG	Column Labels															
Row Labels	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
2dr Hatchback	30.4	30.06666667	29.6969697	28.53333333	27.35	30.14285714	29	26.11111111	23.2	30.33333333	30.41666667	29	25.25	29.75	29.71428571	30.33333333
2dr SUV	20	16.25	17.47058824	18.47368421	18.42857143	16	20	22	26	18.75	18.75	18.66666667	19	18.75	18.75	18.66666667
4dr Hatchback	31		28.375	27.3	27.14285714	27.66666667	26.125	26.5	24.5						34	30.6
4dr SUV		19.33333333	21.33333333	21	20		21.6	19.7	22.11111111	18.3	17.73333333	18.72727273	19.79411765	19.22857143	19.04081633	19.33333333
Cargo Minivan	20				21	21.5	23	21				22	21	20.66666667	19.6	20.85714286
Cargo Van				19.33333333	19	14.55555556	17.125	17.2	16.66666667	16.4	15.8	14.6	15			
Convertible	23.5	22.625	25.5	24.46153846	26	24.5	23.8	25.28571429	23.66666667	21.5	25.28571429	23.4375	24.07142857	20.23076923	20.1	20.72727273
Convertible SUV				26	26	26	24	20.66666667	24			23.28571429	23.4			
Coupe	24.5	26.15789474	27.28571429	28.25925926	27.29166667	25.67741935	26.72727273	27.20689655	26.26666667	27.55555556	24.16666667	20.29411765	23.6	23.87878788	25.26666667	26
Crew Cab Pickup													17	18	22	23
Extended Cab Pickup	22	15.83333333	15.6	16.71428571	20.28571429	20	20	18.35714286	18.625	18.42307692	20.5	19	20.22222222	20.77777778	17.75	
Passenger Minivan	18.85714286	18			21	20.08333333	20.77777778	20.55555556	23.4	22.33333333	23.16666667	21.2	21.6875	22.2972973	22.2	21.88888889
Passenger Van					16.4	15	15	17	17		14.5	15	15			
Regular Cab Pickup	22.23076923	16.95238095	17.88235294	17.64705882	21.66666667	21.2	22.2	18.78571429	19.15151515	18.42857143	20.83333333	23	22.06666667	24.08333333	18.46153846	18
Sedan	24	24.2195122	24.52083333	25.32758621	25.22727273	24.06451613	25.72727273	25.31818182	27.12	27.40540541	26.84444444	27.37735849	26.14	27.05769231	26.36231884	25.75409836
Wagon	24.13333333	22.57142857	24.26666667	24.46153846	23.83333333	24.1	24.66666667	24.4	23		31	30.625	28.88888889	24	22.8	24.27777778
Grand Total	23.07317073	22.15131579	24.05084746	24.21052632	23.86503067	23.22962963	23.72519084	22.30857143	21.85064935	22.975	24.04237288	23.70833333	22.76585366	22.73529412	23.14893617	23.58685446

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.

Row Labels	Average of Engine HP	Average of highway MPG	Average of MSRP
Acura	243.8244898	28.11111111	34887.5873
Alfa Romeo	237	34	61600
Aston Martin	312.4623656	18.89247312	197910.3763
Audi	253.9207317	28.82317073	53452.1128
Bentley	447.3513514	18.90540541	247169.3243
BMW	293.815534	29.24550898	61546.76347
Bugatti	200	14	1757223.667
Buick	243.4387755	26.94897959	28206.61224
Cadillac	315.9748111	25.23677582	56231.31738
Chevrolet	262.3784506	25.81567231	28350.38557
Chrysler	261.5828877	26.36898396	26722.96257
Dodge	254.571885	22.34504792	22390.05911
Ferrari	379.2318841	15.72463768	238218.8406
FIAT	156.0967742	37.33870968	22670.24194
Ford	250.4029512	24.00681044	27399.26674
Genesis	563.3333333	25.33333333	46616.66667
GMC	257.6346555	21.4038835	30493.29903
Honda	189.7616927	32.57461024	26674.34076
HUMMER	218.8235294	17.29411765	36464.41176
Hyundai	236.7326733	30.39273927	24597.0363
Infiniti	298.8575758	24.77878788	42394.21212
Kia	215.5021645	30.65367965	25310.17316
Lamborghini	356.9230769	18.01923077	331567.3077
Land Rover	271.5664336	22.12587413	67823.21678
Lexus	228.1980198	25.87623762	47549.06931
Lincoln	225.2331288	24.48780488	42839.82927
Lotus	276.137931	26.55172414	69188.27586
Maserati	298.0344828	20.29310345	114207.7069
Maybach	506.1875	16	546221.875
Mazda	196.2104019	27.85106383	20039.38298

Average of highway MPG
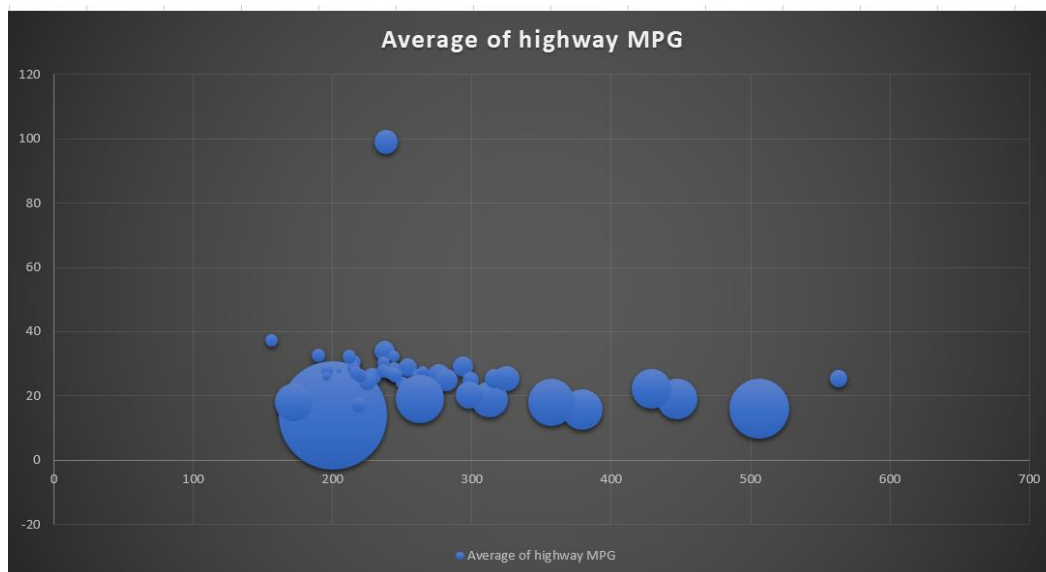
Approach:

The analytical methods employed in this project include descriptive statistics, visualization, and regression analysis. We aim to identify the key factors influencing consumer demand and pricing in the automotive market. By analyzing the relationship between car features, market categories, and pricing, we can develop insights to inform pricing strategies and future product development efforts.

Tech-Stack Used:

The primary tool used for this analysis is Microsoft Excel, leveraging its functionalities for data manipulation, visualization, and dashboard creation. Additional tools and techniques may include regression analysis in Excel and statistical analysis using built-in functions.

Insight:

Key insights from the analysis include:

- Understanding the distribution of car prices by brand and body style.

- Identifying the brands with the highest and lowest average MSRPs across different body styles.

- Analyzing the impact of car features such as transmission type on MSRP, considering variations by body style.

- Examining the trends in fuel efficiency across different body styles and model years.

- Exploring the relationship between car horsepower, MPG, and price across different brands.

Result:

The analysis will culminate in the creation of an interactive dashboard in Excel, allowing stakeholders to explore the insights visually. The dashboard will facilitate decision-making by providing actionable insights into pricing and product development strategies.

Conclusion:

By leveraging data analysis techniques, car manufacturers can optimize pricing and product development decisions, thereby enhancing competitiveness and profitability in the automotive market. This project demonstrates the value of data-driven approaches in addressing complex business challenges.