

Used Cars R Us

Identifying Market Opportunities



Prepared By
Nichakamon Ek-aksorn (25241807)



- Used Cars R Us - Identifying Market Opportunities

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Introduction and Objectives

Company Overview:

- Used Cars R Us Pvt Ltd is a used car buying company based in Bangalore, India.

Business Focus:

- Specializes in purchasing used cars from individual sellers.
- Resells these cars to second-hand dealers.

Objective of Analysis:

- Identify undervalued cars in the market.
- Increase profitability by acquiring undervalued cars and reselling them at a higher price.



Data Analysis Overview

Example of Dataset:

year	kilometers	fuel_type_clean	transmission	selling_price	owner
2014	75000	Diesel	Manual	450,000.00	Second
2011	67000	Petrol	Manual	220,000.00	First
2019	37500	Petrol	Manual	799,000.00	First
2018	69000	Diesel	Manual	1,950,000.00	First
2017	73315	Petrol	Manual	675,000.00	First
2015	47000	Petrol	Automatic	1,898,999.00	Second
2017	75000	Diesel	Automatic	2,650,000.00	Second
2017	56000	Petrol	Automatic	1,390,000.00	First
2015	85000	Diesel	Manual	575,000.00	First
2017	20281	Petrol	Manual	591,000.00	First
2018	22541	Petrol	Manual	459,999.00	First
2019	30672	Petrol	Automatic	1,075,000.00	First
2019	20856	Diesel	Manual	1,695,000.00	First
2017	41417	Petrol	Automatic	944,999.00	First
2016	11471	Petrol	Automatic	569,000.00	First
2019	3583	Petrol	Manual	449,000.00	First
2018	21365	Petrol	Automatic	894,999.00	First

Statistic Summary:

	selling_price	kilometers	
Mean	1,666,575.82	Mean	54,511.08
Standard Error	53,378.82	Standard Error	1,297.81
Median	819,999.00	Median	50,000.00
Mode	425,000.00	Mode	65,000.00
Standard Deviation	2,385,382.55	Standard Deviation	57,996.38
Sample Variance	5,690,049,931,348.59	Sample Variance	3,363,580,550.89
Kurtosis	43.25	Kurtosis	660.28
Skewness	5.14	Skewness	20.92
Range	34,951,000.00	Range	2,000,000.00
Minimum	49,000.00	Minimum	-
Maximum	35,000,000.00	Maximum	2,000,000.00
Sum	3,328,151,907.00	Sum	108,858,626.00
Count	1,997.00	Count	1,997.00

Dataset Summary:

- **Records:** 1,997 entries
- **Key Fields:** year of manufacture, kilometers driven, fuel type, transmission type, owner, selling price.



Exploratory Analysis - Key Visualizations

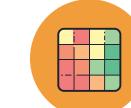
Introduce the types of visualizations used:



Scatter plots to examine age and mileage relationships.



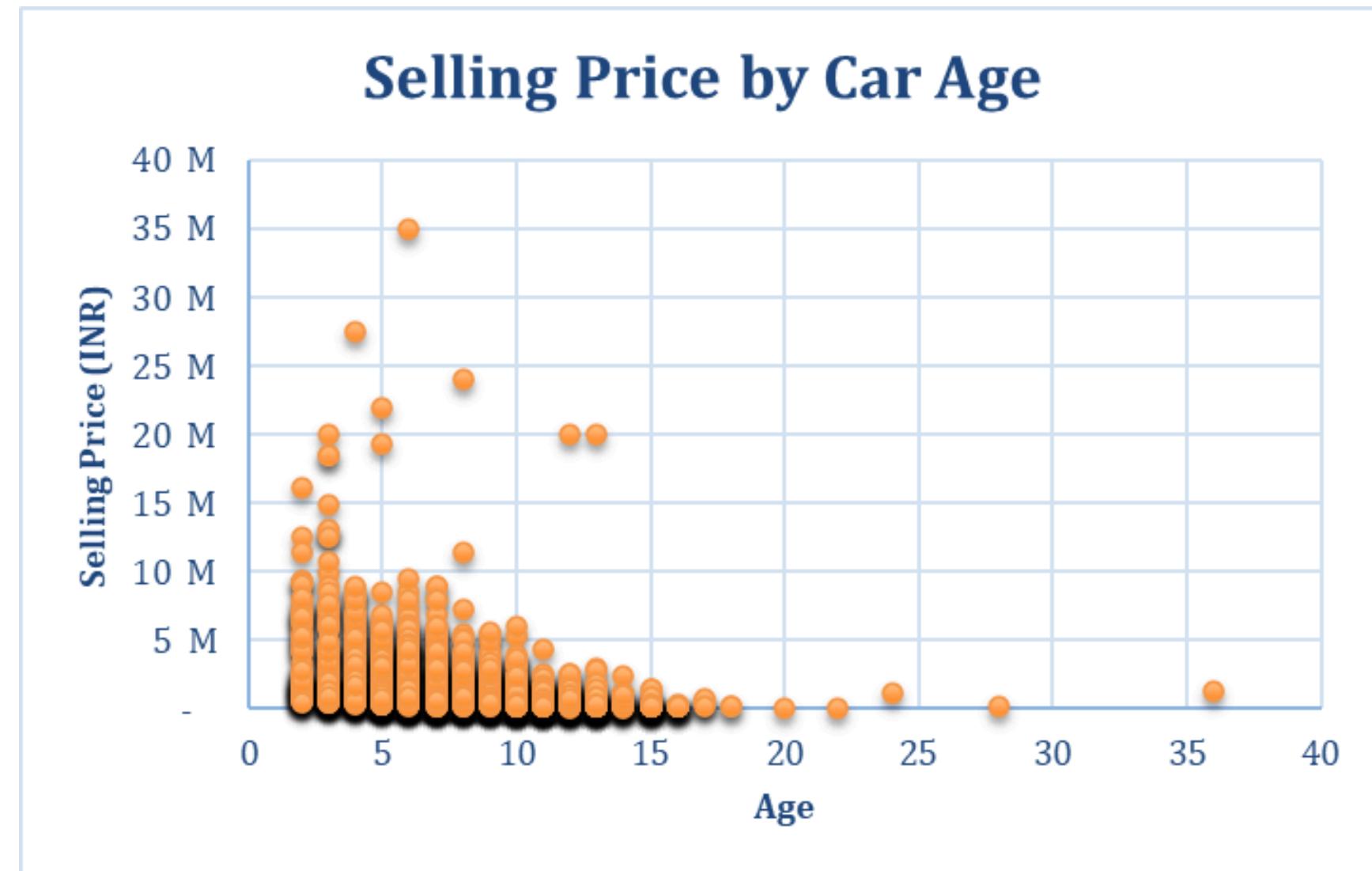
Bar Chart and Box plots for transmission and fuel type.



Correlation heatmap to evaluate relationships.

Key Visualization 1: Selling Price vs Car Age

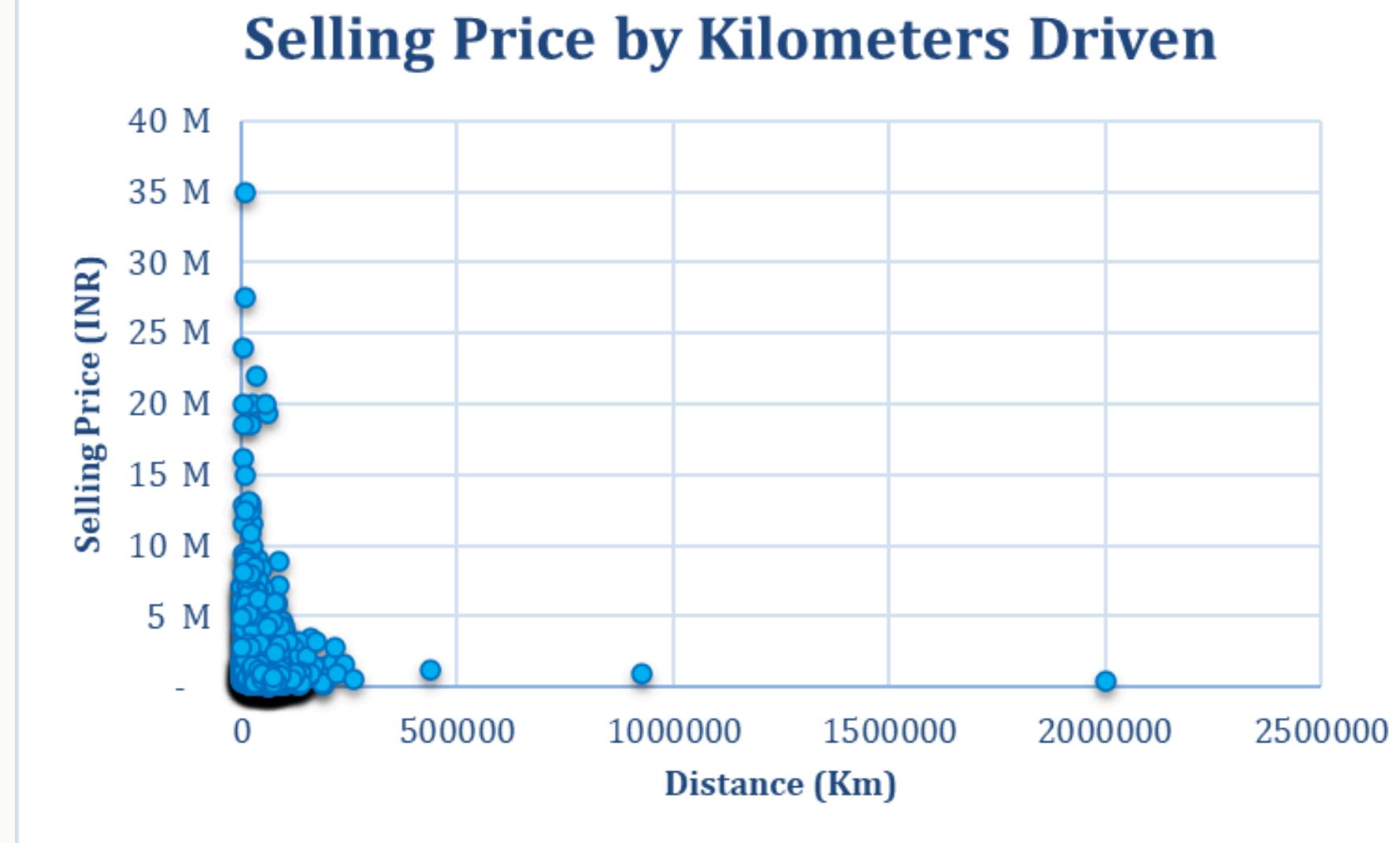
- Insight:** Newer cars generally have higher prices
- Notable Observation:** Some older cars (over 10 years) show high prices



Key Visualization 2: Selling Price vs Kilometers Driven

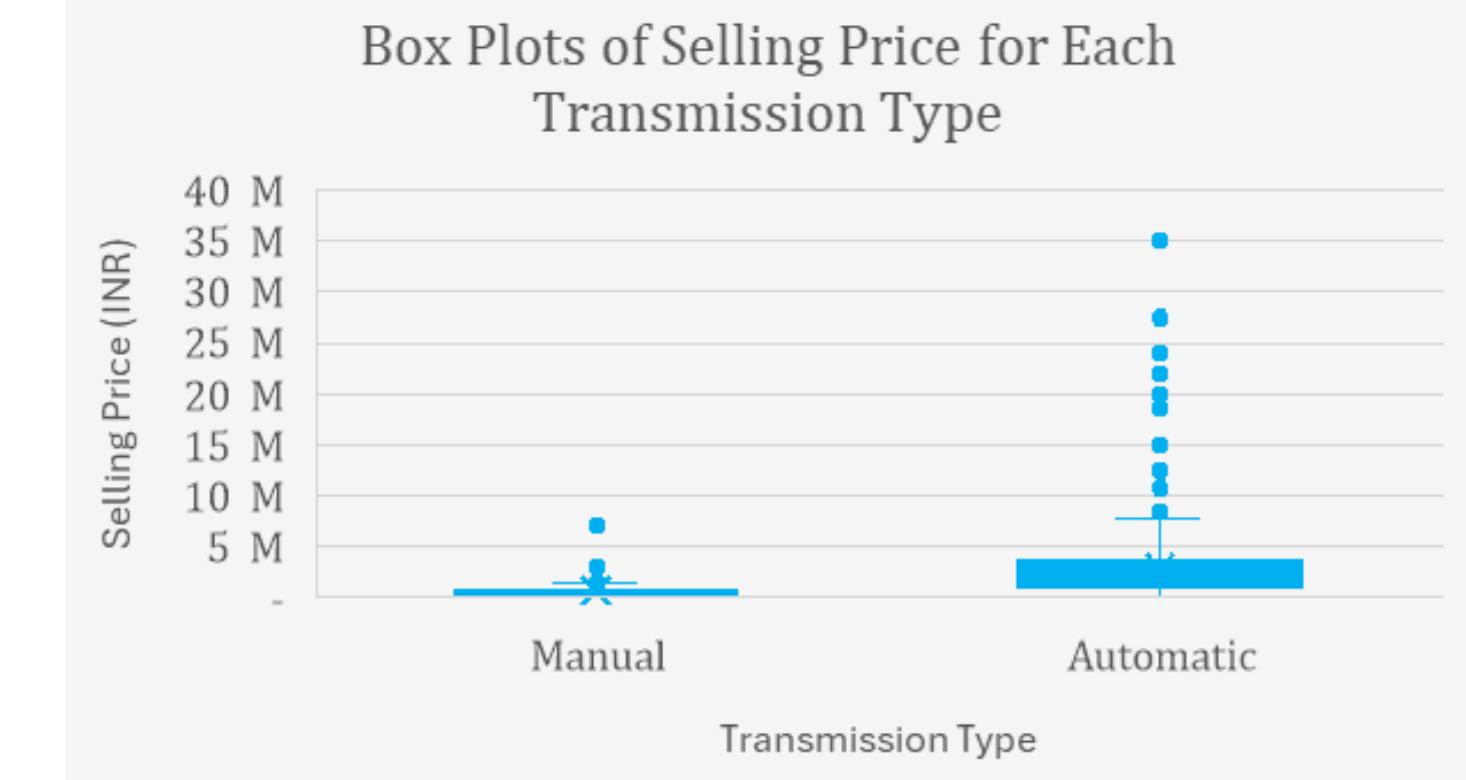
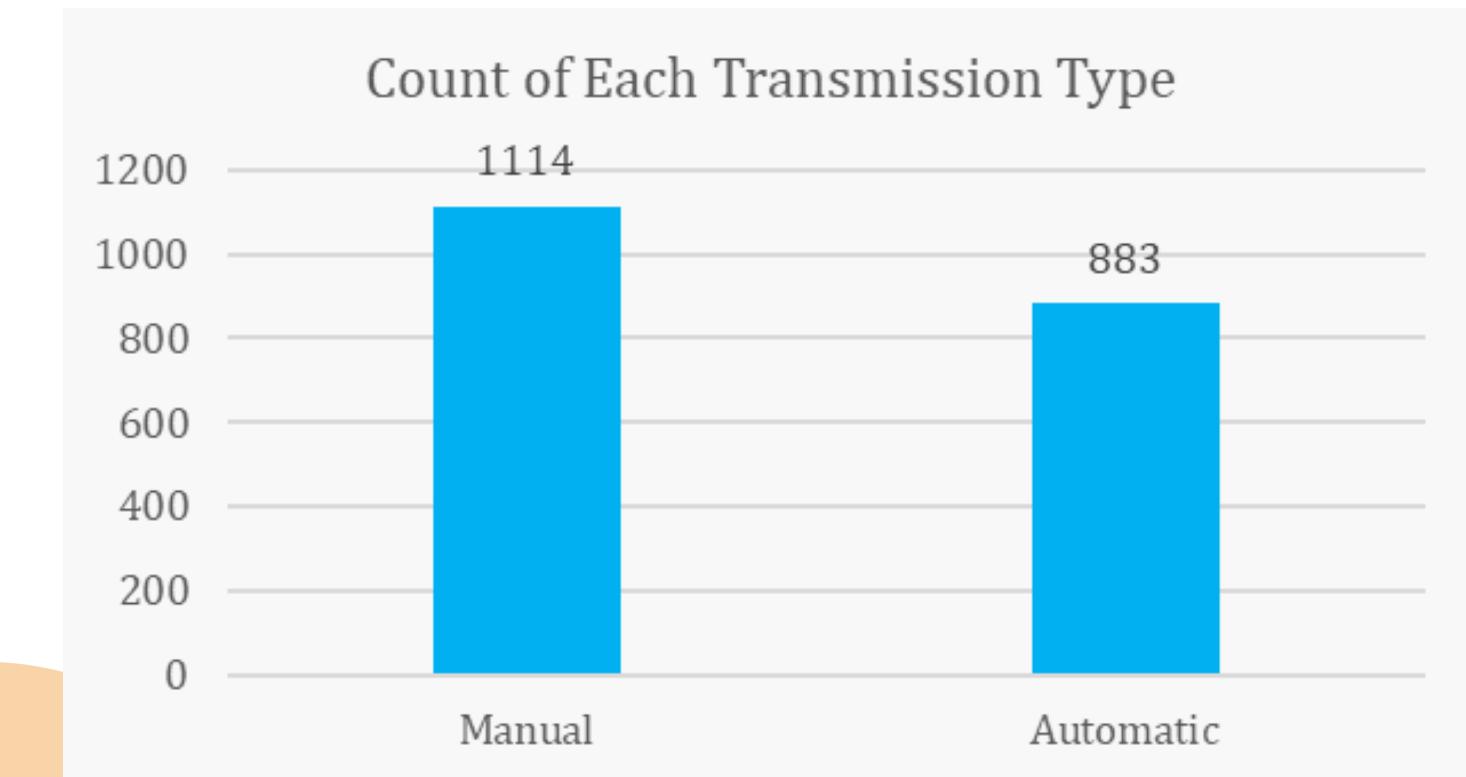


- Insight:** Selling price tends to decrease as mileage increases.
- Notable Observation:** Some cars with mileage up to 2 million kilometers, positioned as distant outliers.



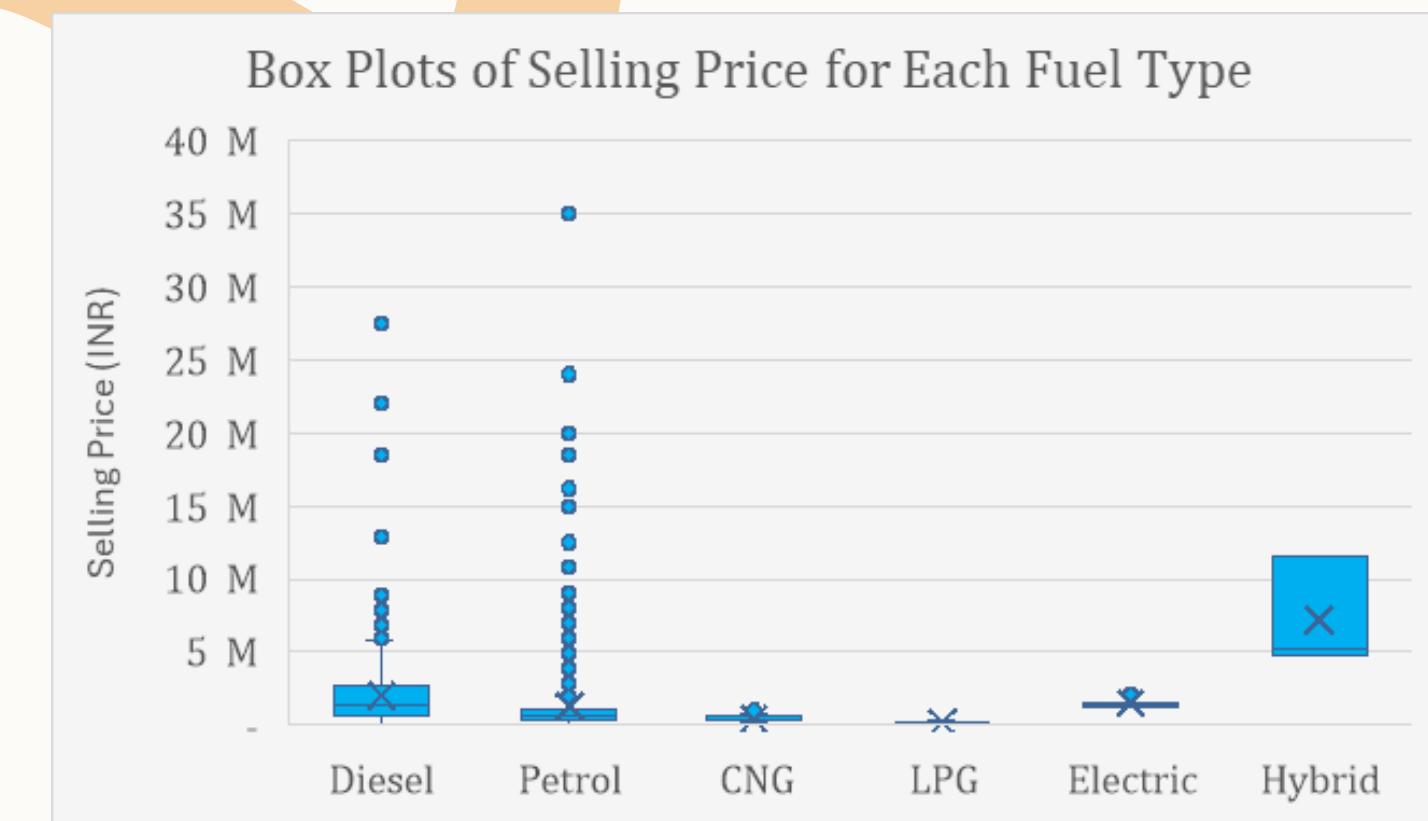
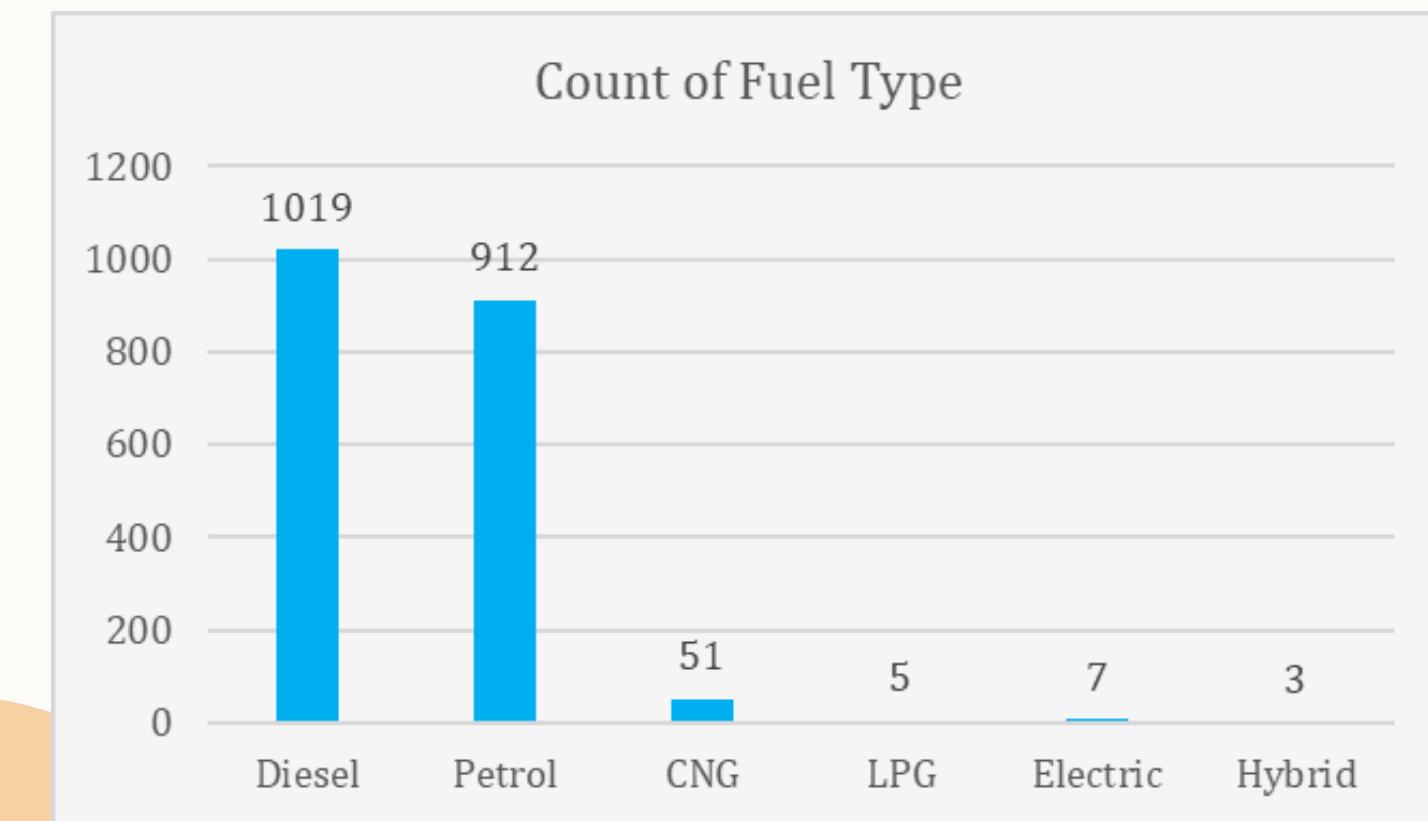
Selling Price by Transmission Type

- **Finding:** Automatic cars generally have higher selling prices.
- **Range:** Automatic cars show a wider price range with high-value outliers, while manual cars have a narrower range.



Selling Price by Fuel Type

- **Main Insight:** Diesel and petrol cars dominate with broad price ranges and some high-value outliers.
- **Alternative Fuels:** CNG, LPG, and electric cars generally have lower prices.
- **Hybrid Cars:** Notably higher price range, likely due to newer technology and market demand.



Correlation Heatmap ✨

Key Correlations:

- **Negative:** Age and kilometers driven.
- **Positive:** Transmission type (automatic) and certain fuel types (like hybrid).

	<i>selling_price</i>
<i>selling_price</i>	1
Age (2024-year)	-0.321039074
kilometers	-0.148531809
transmission_Binary	0.47413127
fuel_type_CNG	-0.08316047
fuel_type_Diesel	0.173640999
fuel_type_Electric	-0.004196009
fuel_type_Hybrid	0.089457888
fuel_type_LPG	-0.030600192
fuel_type_Petrol	-0.151310475
owner	-0.072725391



Regression Analysis



Objective:

- Build a model to estimate selling price based on key factors affecting car value.



Approach:

- **Log Transformations:** Applied to Selling Price and Kilometers Driven to normalize skewed data.
- **Primary Predictors:** Age, Kilometers Driven (log), Transmission Type, Fuel Type, and Number of Owners.

Model Variables and Structure

- **Selling price:** Log-transformed for normalized distribution.
- **Kilometers Driven:** Log-transformed for normalized distribution.
- **Age:** Calculated as 2024 - Year of Manufacture
- **Fuel Type:** Five dummy variables (CNG, Diesel, Electric, LPG, Petrol) with one as the reference category.
- **Transmission:** Binary variable (1 for automatic, 0 for manual).
- **Number of Owners:** Captures prior ownership history.

selling_price_log	Kilometers_log	Age	fuel_type_CNG	fuel_type_Diesel	fuel_type_Electric	fuel_type_LPG	fuel_type_Petrol	transmission_Binary
13.02	11.225244	10	0	1	0	0	0	0
12.30	11.112448	13	0	0	0	0	0	1
13.59	10.532096	5	0	0	0	0	1	0
14.48	11.141862	6	0	1	0	0	0	1
13.42	11.202521	7	0	0	0	0	0	1
14.46	10.757903	9	0	0	0	0	1	1
14.79	11.225244	7	0	1	0	0	0	1
14.14	10.933107	7	0	0	0	0	1	1
13.26	11.350407	9	0	1	0	0	0	0
13.29	9.9174403	7	0	0	0	0	1	0
13.04	10.023092	6	0	0	0	0	1	0
13.89	10.331106	5	0	0	0	0	1	1
14.34	9.9453974	5	0	1	0	0	0	0
13.76	10.631447	7	0	0	0	0	1	1
13.25	9.3475783	8	0	0	0	0	1	1
13.01	8.1839585	5	0	0	0	0	1	0

Model Summary Output

SUMMARY OUTPUT							
Regression Statistics							
Multiple R	0.829406131						
R Square	0.68791453						
Adjusted R Square	0.686500958						
StandardError	0.545514684						
Observations	1997						
ANOVA							
	df	SS	MS	F	Significance F		
Regression	9	1303.381919	144.8202133	486.6495114	0		
Residual	1987	591.30392	0.297586271				
Total	1996	1894.685839					
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%
Intercept	15.87369565	0.347790605	45.64153094	-	15.19162312	16.55576818	15.19162312
Kilometers_Log	-0.090954509	0.01588303	-5.726521391	0.00000	-0.122103648	-0.059805369	-0.122103648
Age	-0.108505721	0.004548984	-23.85273636	0.00000	-0.117427001	-0.099584442	-0.117427001
fuel_type_CNG	-1.189762841	0.325350767	-3.656861957	0.00026	-1.827827294	-0.551698389	-1.827827294
fuel_type_Diesel	-0.457472634	0.316197638	-1.446793331	0.14811	-1.07758635	0.162641082	-1.07758635
fuel_type_Electric	-1.486897142	0.376450235	-3.949784073	0.00008	-2.225175756	-0.748618528	-2.225175756
fuel_type_LPG	-1.259340701	0.400656537	-3.1431927	0.00170	-2.045091712	-0.47358969	-2.045091712
fuel_type_Petrol	-1.04998903	0.316163018	-3.321036839	0.00091	-1.670034851	-0.42994321	-1.670034851
transmission_Binary	1.040008498	0.025874694	40.19404008	0.00000	0.989264119	1.090752878	0.989264119
owner	0.000289303	0.02673139	0.010822601	0.99137	-0.052135192	0.052713798	-0.052135192

- **R-squared:** **68.8%** - Indicates a good model fit.
- **Significant Predictors:**
 - a. **Kilometers Driven (log):** Coefficient of **-0.091** ($p < 0.0001$).
 - b. **Age:** Coefficient of **-0.109** ($p < 0.0001$).
 - c. **Transmission:** Coefficient of **1.04** for automatic transmission ($p < 0.0001$).



Conclusion: Key Drivers of Selling Price



- Age, Kilometers Driven, Transmission Type, and Fuel Type **significantly influence** used car prices.
- **Negative influence:** Age, Kilometers Driven, CNG, Electric, LPG, and Petrol fuel types.
- **Positive influence:** Automatic transmission.





Identifying Undervalued Cars

Identify cars listed below estimated market value using the regression model.

Opportunity:
Buy undervalued cars at a discount and resell for profit.

 Use model to predict selling prices and identify substantial undervaluation.

Methodology: Calculating Predicted Selling Price

Step 1: Calculate Predicted log of Selling Price:

- Formula: Predicted log(selling price) = 15.87 + (-0.0909) * Kilometers_Log +
(-0.1085) * Age + (1.04) * Transmission_Binary + ...

Step 2: Transform to Original Scale:

- Apply exponential function to predicted log(selling price):
$$\text{Predicted Selling Price} = e^{\text{Predicted log(selling price)}}$$

Comparing with Actual Selling Price



Step 3: Calculate the Difference:

- Formula:** Difference = Predicted Selling Price - Actual Selling Price.
- A positive difference** indicates the car is listed below its estimated value, marking it as potentially undervalued.

selling_price	Step1: Predicted log(selling price)	Step2: Predicted Selling Price	Step3: Difference
450,000.00	13.31	603,654.87	153,654.87
220,000.00	12.40	243,456.68	23,456.68
799,000.00	13.32	611,411.60	-187,588.40
1,950,000.00	13.75	938,534.99	-1,011,465.01
675,000.00	13.05	463,024.90	-211,975.10
1,898,999.00	13.91	1,098,287.21	-800,711.79
2,650,000.00	14.68	2,364,988.14	-285,011.86
1,390,000.00	14.11	1,342,506.55	-47,493.45
575,000.00	13.41	665,031.82	90,031.82
591,000.00	13.16	520,434.84	-70,565.16
459,999.00	13.26	574,534.96	114,535.96
1,075,000.00	14.38	1,761,744.67	686,744.67
1,695,000.00	13.97	1,166,367.74	-528,632.26
944,999.00	14.14	1,379,851.36	434,852.36
569,000.00	14.15	1,391,307.16	822,307.16
449,000.00	13.54	756,985.51	307,985.51
894,999.00	14.31	1,633,439.10	738,440.10
699,000.00	14.49	1,963,050.21	1,264,050.21
740,000.00	12.96	422,975.81	-317,024.19
470,000.00	14.73	2,498,663.70	2,028,663.70

Setting Undervaluation Thresholds

Threshold 1: Percentage Difference

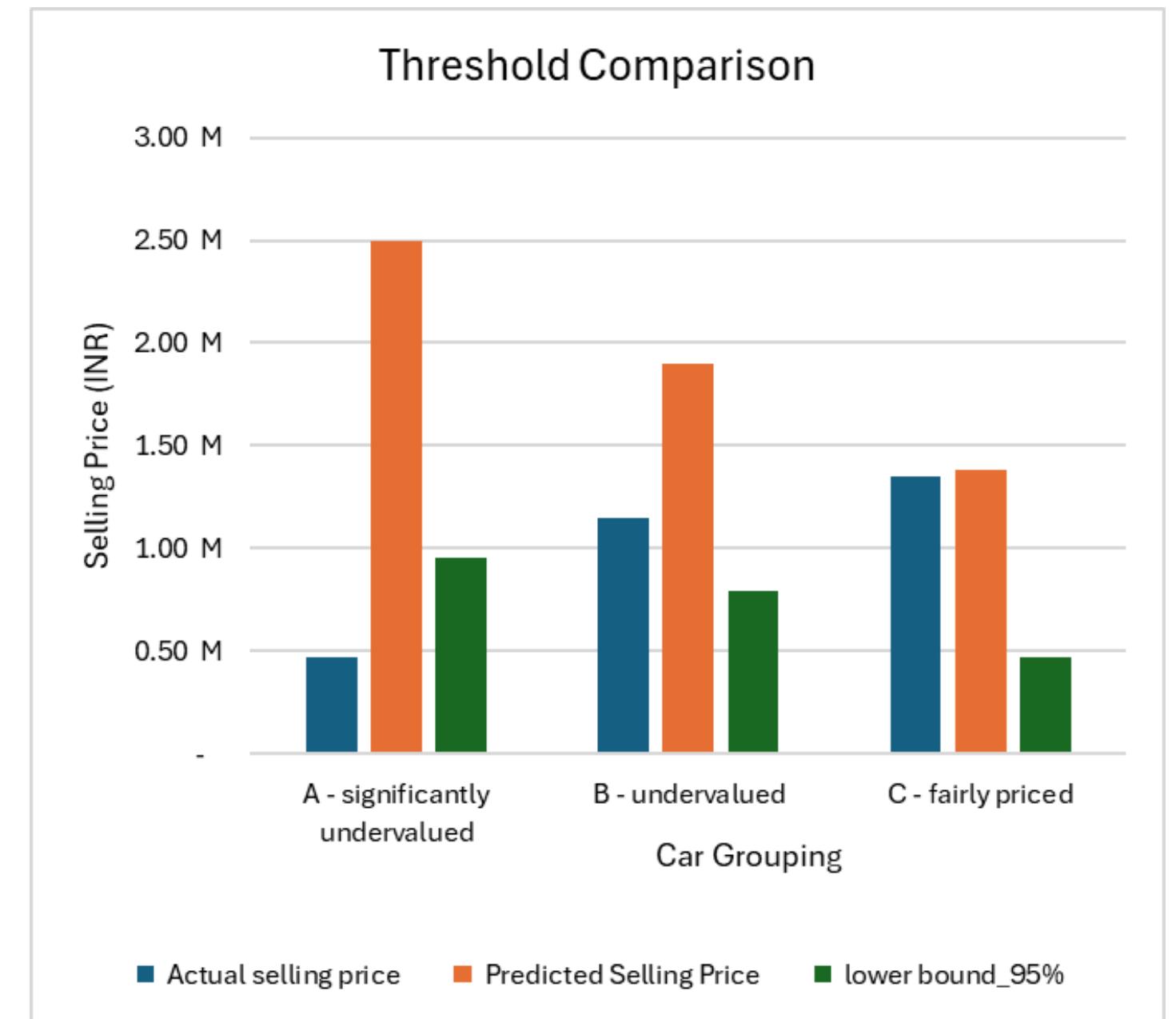
- Flagged as undervalued if the **actual price is at least 20% below predicted price**.
- Purpose:** Focus on cars with substantial markdowns relative to predicted value.

Threshold 2: Lower Bound of Prediction Interval

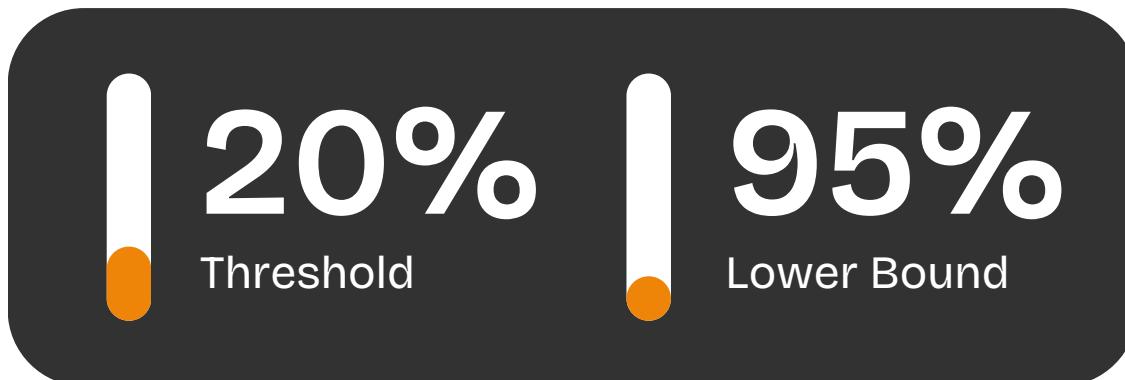
- To account for model uncertainty, set a conservative **lower bound**:

$$\text{Lower Bound} = e^{\text{Predicted log(selling price)} - 1.96 \times \text{Standard Error}}$$

- Cars priced below this lower bound are **significantly undervalued** and represent lower-risk acquisitions.



Summary of Undervaluation Criteria

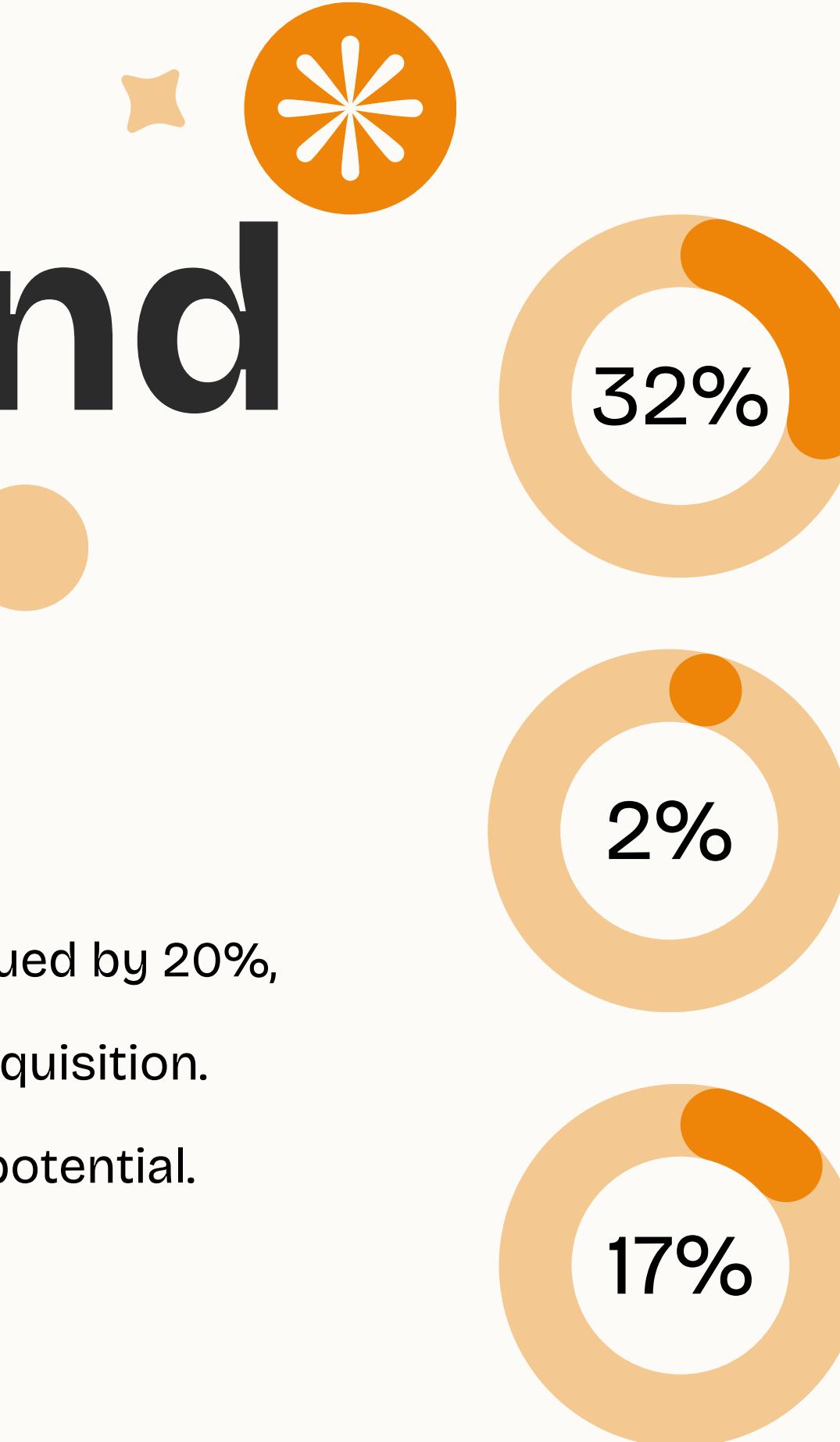


- Key Takeaways:
 - **Positive Difference** between predicted and actual price indicates undervaluation.
 - **20% Threshold** flags cars well below estimated value for targeted acquisition.
 - **Lower Bound Threshold** provides a conservative measure to ensure only significant undervaluation is flagged.
- Impact:
 - Enables strategic acquisition of undervalued cars with a high resale margin.

Results and Findings

Key Outcome:

- **688 cars**, a large segment of cars are undervalued by 20%, presenting clear opportunities for profitable acquisition.
- **47 cars** offer high-margin, low-risk acquisition potential.

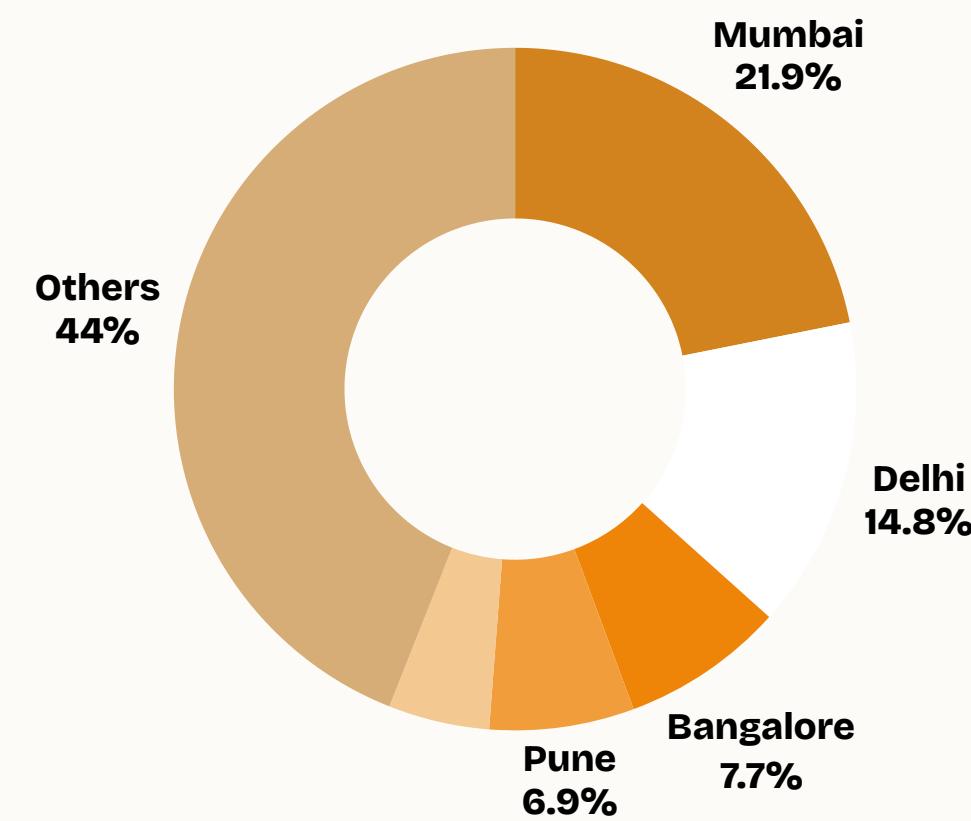


- Identified as undervalued based on the **20% threshold**.
- Identified as significantly undervalued based on the **95% lower bound threshold**.
- Identified as fairly priced or **slightly undervalued**.

Cars Undervalued by at least 20% Threshold

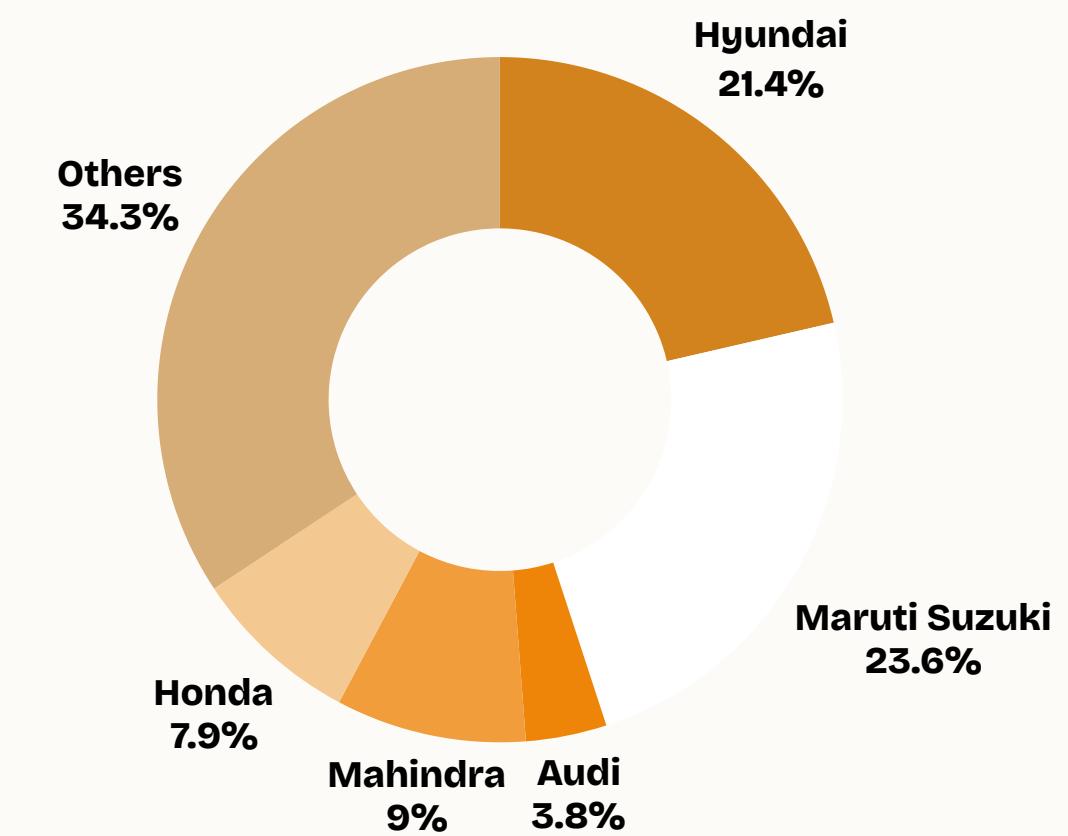
688 Cars

	Million INR	Profit Margin
ACTUAL VALUE	529.54	
MARKET VALUE (Predicted)	915.66	
GAIN/ PROFIT	386.11	73%



Summarized Possible Profitability

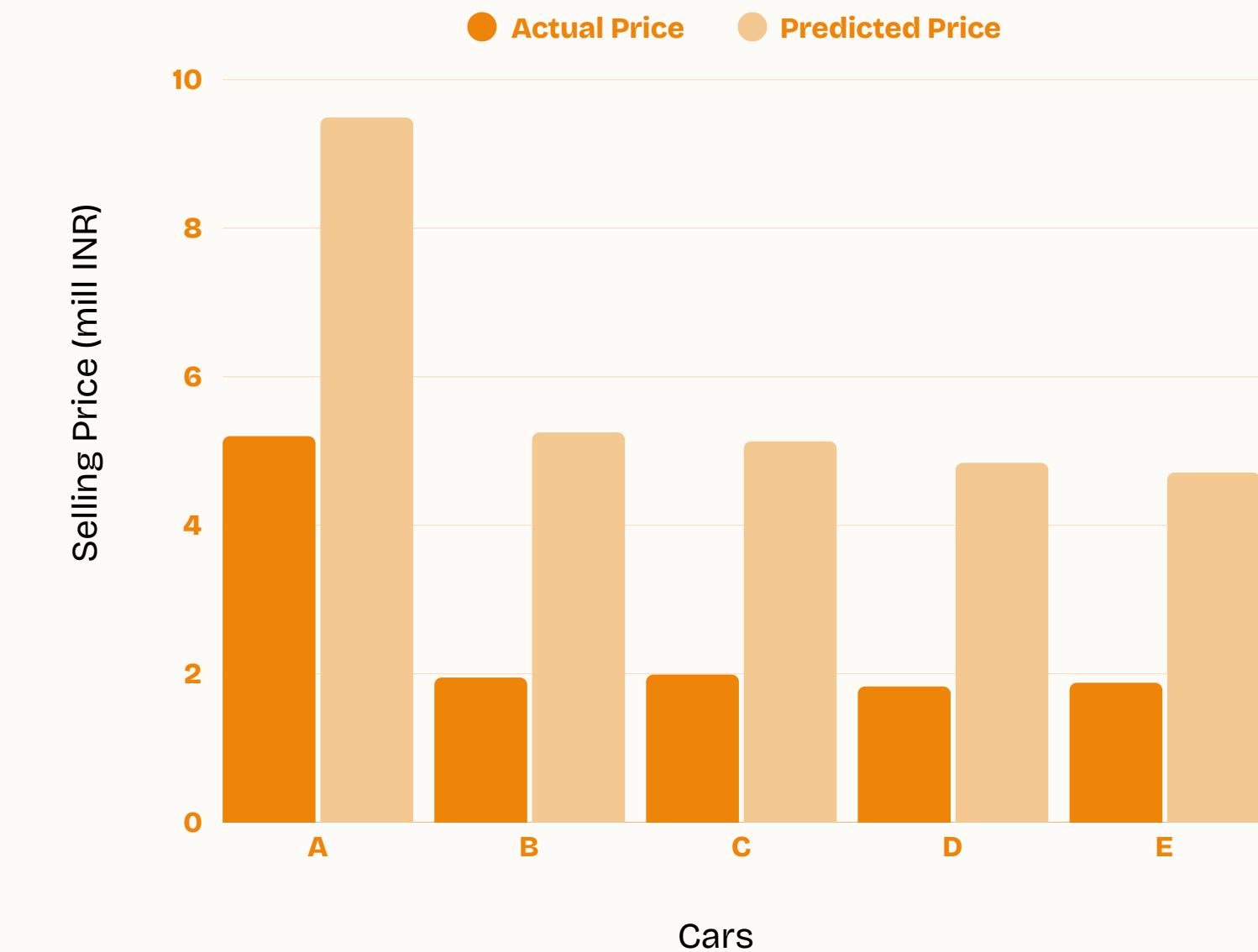
Top 5 Profitability by Location



Top 5 Profitability by Maker

Example: Cars Undervalued by 20% Threshold

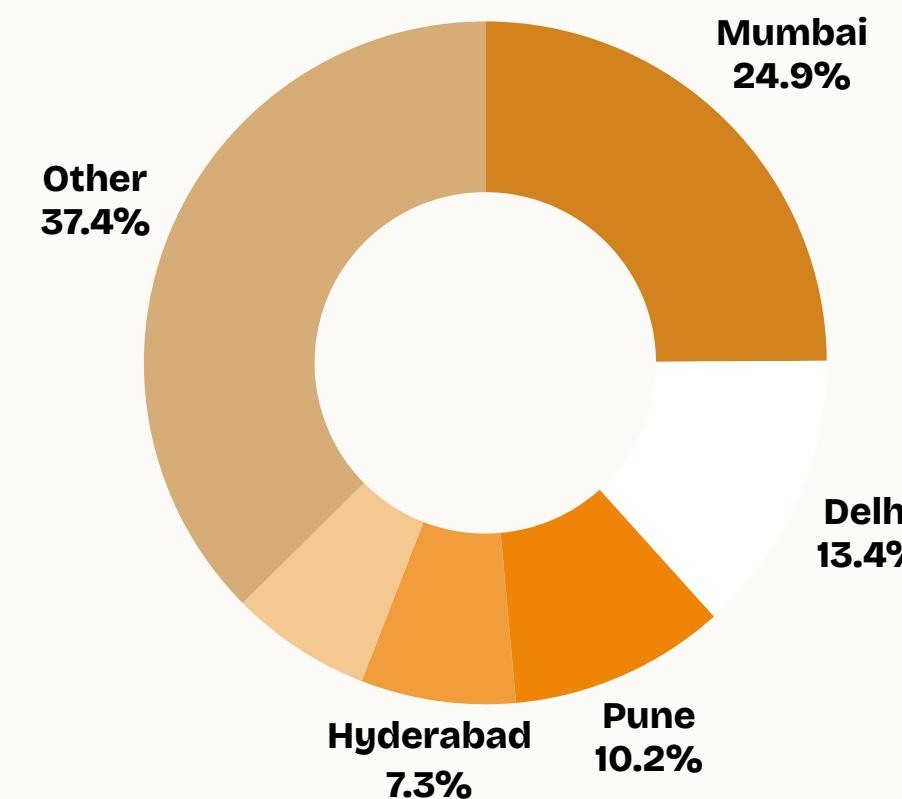
Car	Maker	Location	Actual Price	Predicted Price	Difference between Predicted and Actual	Percentage Difference
in million INR						
A	MINI	Ahmedabad	5.20	9.49	4.29	82%
B	Mahindra	Ludhiana	1.95	5.25	3.30	169%
C	Hyundai	Surat	1.99	5.13	3.14	158%
D	Mahindra	Mumbai	1.83	4.84	3.03	165%
E	Mahindra	Delhi	1.88	4.71	2.83	151%



Significantly Undervalued Cars (Lower Bound Threshold)

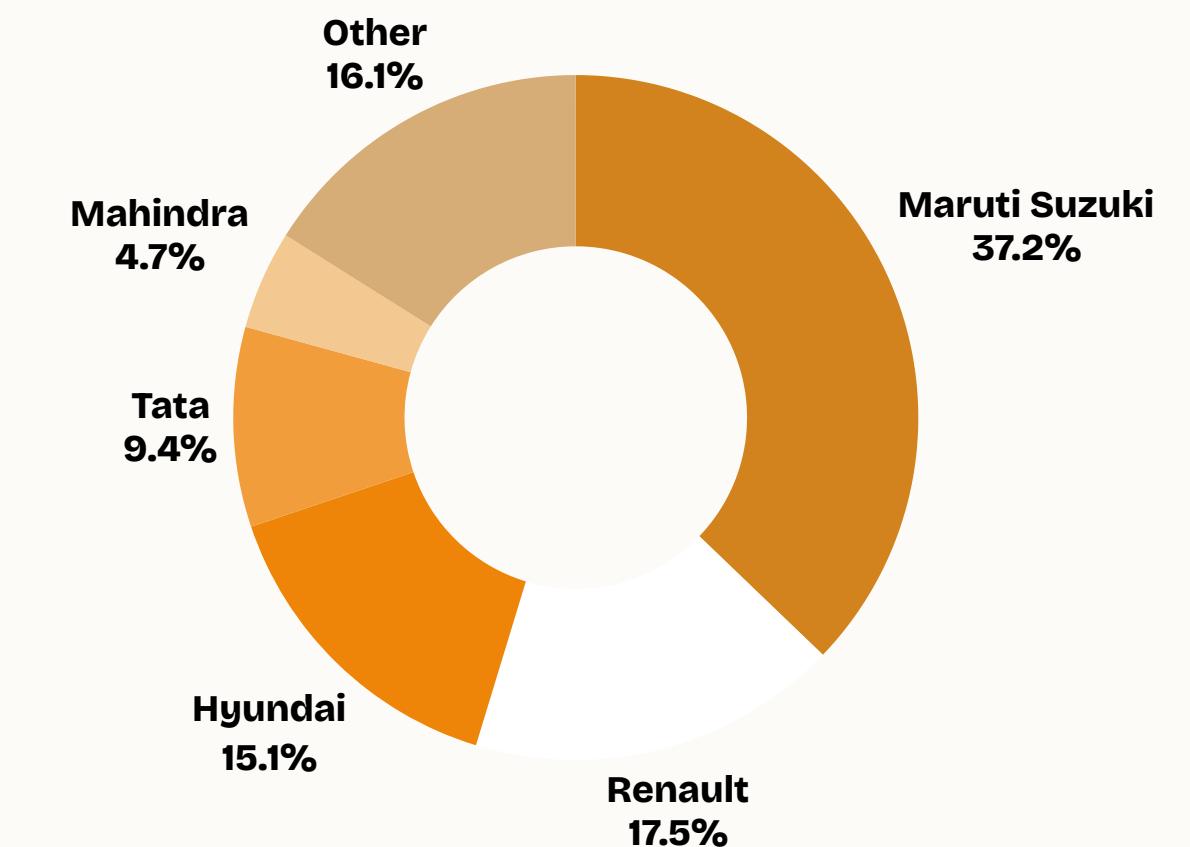
47 Cars

	Million INR	Profit Margin
ACTUAL VALUE	27.00	
MARKET VALUE (Predicted)	93.28	
GAIN/ PROFIT	66.29	246%



Summarized Possible Profitability

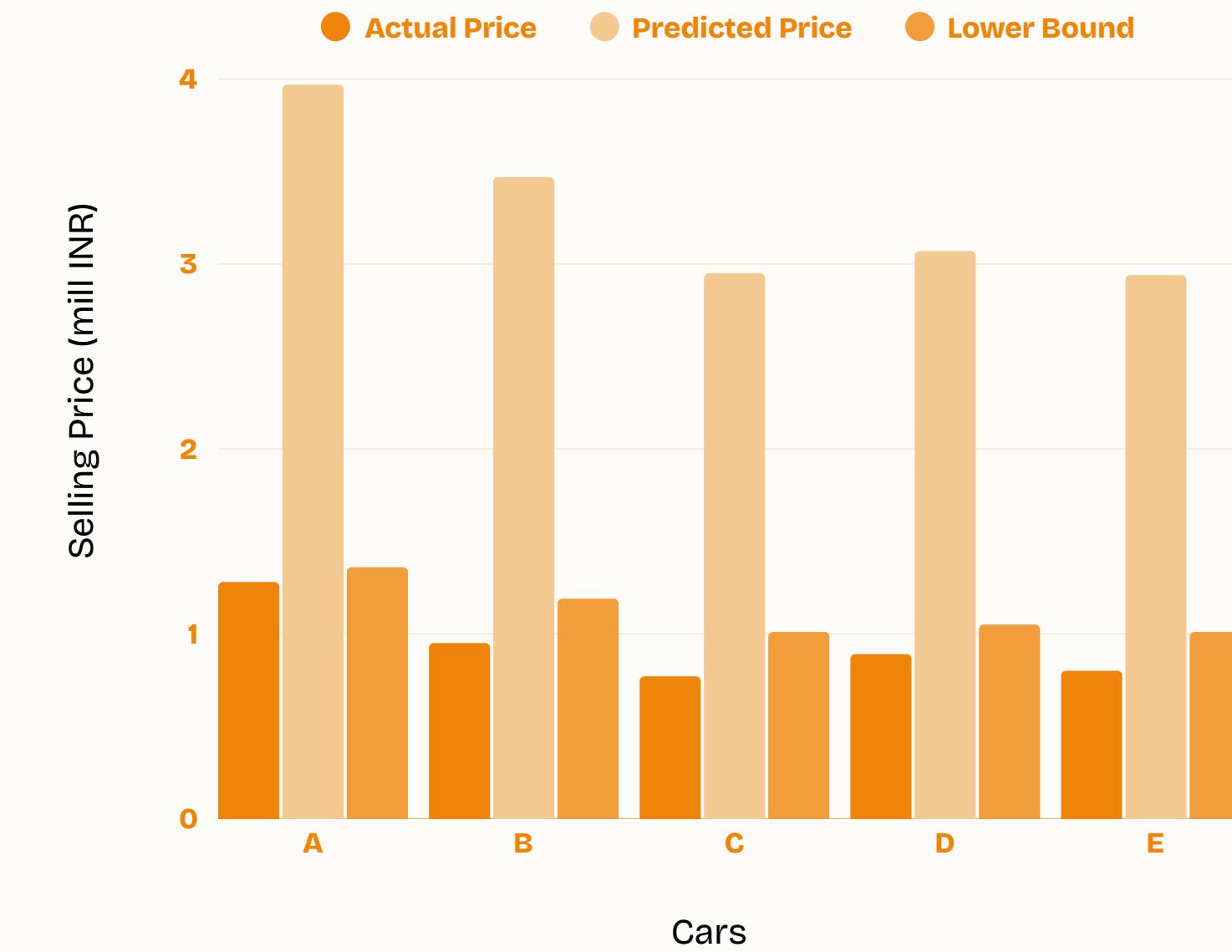
Top 5 Profitability by Location



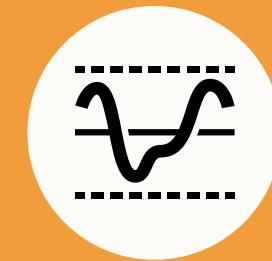
Top 5 Profitability by Maker

Example: Significantly Undervalued Cars

Car	Maker	Location	Actual Price	Predicted Price	Difference between Predicted and Actual	Lower Bound	Difference from Lower Bound
in million INR							
A	Kia	Mohali	1.28	3.97	2.69	1.36	-6%
B	Honda	Ludhiana	0.95	3.47	2.52	1.19	-20%
C	Maruti Suzuki	Pune	0.77	2.95	2.18	1.01	-24%
D	Maruti Suzuki	Mumbai	0.89	3.07	2.18	1.05	-15%
E	Hyundai	Kanpur	0.80	2.94	2.14	1.01	-21%

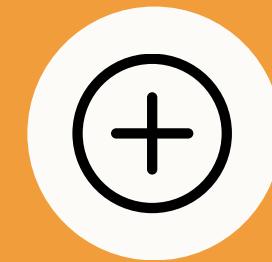


Target Criteria for Acquisition



Undervaluation Thresholds:

- **Primary Target:** Cars with actual price at least 20% below predicted market value.
- **Secondary Target:** Cars priced below the lower bound of the 95% prediction interval.



Additional Criteria:

- **Age and mileage limits** (e.g., cars within a reasonable age and mileage range to ensure resale value).
- **Preferred fuel types and transmission types** based on demand insights (e.g., focusing on automatic transmissions for higher resale value).



Target Criteria for Acquisition

Table: Cars with undervaluation

Maker	Fuel_type	Transmission	Location	Age	Kilometers	Selling Price	Predicted Selling P.
MINI	Petrol	Automatic	Ahmedabad	2	-	5,200,000.00	9,488,249.23
Mahindra	Diesel	Automatic	Ludhiana	2	4,500	1,950,000.00	5,253,552.47
Hyundai	Diesel	Automatic	Surat	2	5,800	1,989,999.00	5,133,676.51
Mahindra	Diesel	Automatic	Mumbai	2	11,000	1,825,000.00	4,843,355.97
Mahindra	Diesel	Automatic	Delhi	2	15,000	1,875,000.00	4,708,634.24
Kia	Diesel	Automatic	Mumbai	3	13,000	1,485,000.00	4,279,806.65
Kia	Diesel	Automatic	Mohali	3	30,000	1,275,000.00	3,966,354.23
Hyundai	Diesel	Automatic	Hyderabad	2	8,000	2,400,000.00	4,985,694.12
Kia	Diesel	Automatic	Mumbai	3	22,000	1,499,000.00	4,079,838.16
Mahindra	Diesel	Automatic	Yamunanagar	3	14,000	1,700,000.00	4,251,055.83
Honda	Diesel	Automatic	Ludhiana	4	39,000	950,000.00	3,474,596.71
Toyota	Diesel	Automatic	Agra	2	11,000	2,425,000.00	4,843,355.97
Kia	Diesel	Automatic	Delhi	3	21,000	1,875,000.00	4,097,137.36
Maruti Suzuki	Diesel	Automatic	Pune	5	72,040	770,000.00	2,948,090.21
Maruti Suzuki	Diesel	Automatic	Mumbai	5	46,000	894,999.00	3,070,860.92
Hyundai	Petrol	Automatic	Kanpur	2	4,000	795,000.00	2,936,155.25
Mahindra	Diesel	Automatic	Delhi	2	18,000	2,540,000.00	4,631,195.02
Audi	Petrol	Automatic	Delhi	2	1	4,151,000.00	6,235,682.85
Maruti Suzuki	Diesel	Automatic	Mumbai	6	43,000	699,000.00	2,772,047.78
Tata	Diesel	Automatic	Mumbai	2	38,000	2,275,000.00	4,326,904.74
Maruti Suzuki	Petrol	Automatic	Mumbai	4	2,169	470,000.00	2,498,663.70

Filter the table to narrow down for more specific criteria

Criteria:

- Age:** ≤ 10 years
- Mileage:** ≤ 150,000 km
- Fuel Type:** Diesel or Petrol
- Transmission:** Automatic preferred

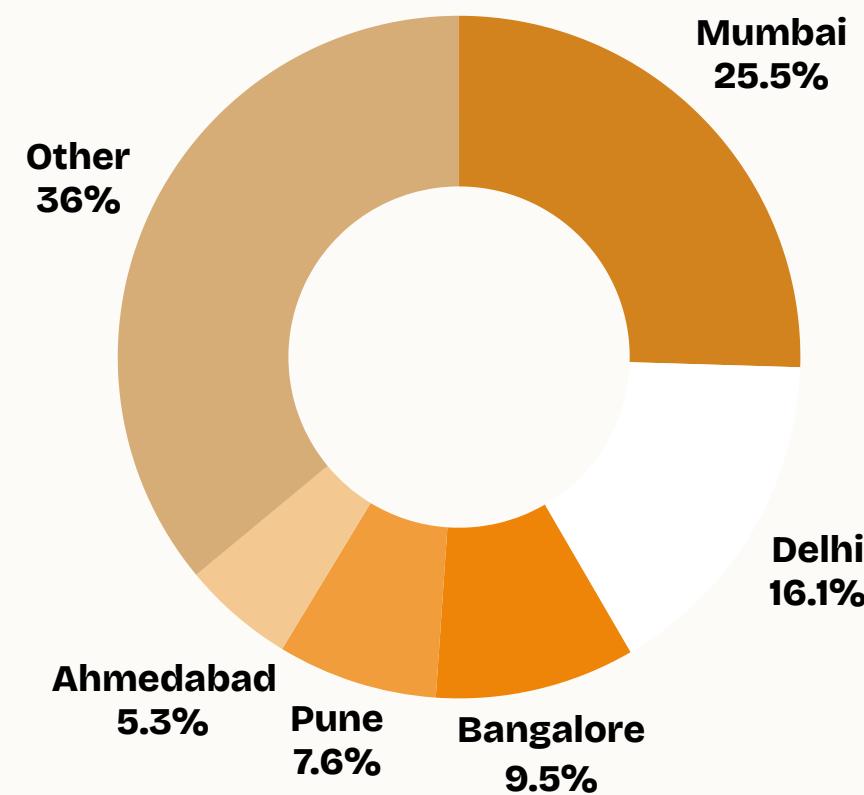
290 cars remain out of 688

Summary Target Cars for acquisition

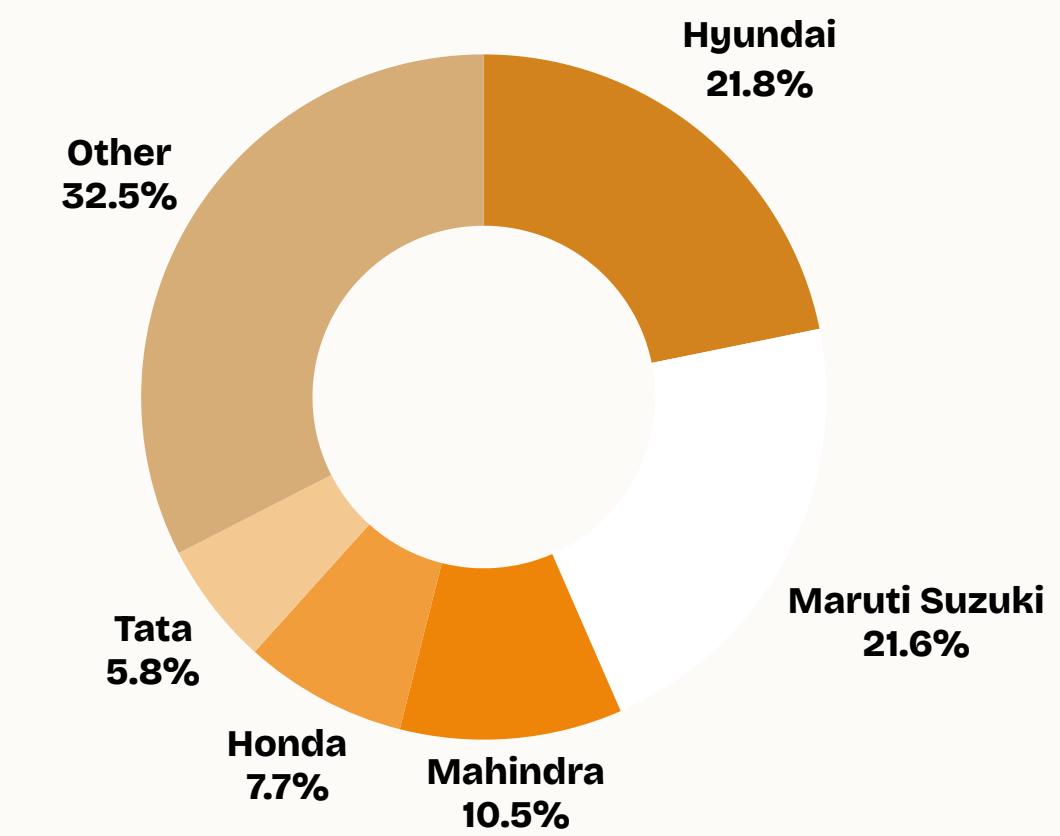
290 Cars

	Million INR	Profit Margin
ACTUAL VALUE	347.33	
MARKET VALUE (Predicted)	640.46	
GAIN/ PROFIT	293.13	84%

Summarized Profitability



Top 5 Profitability by Location

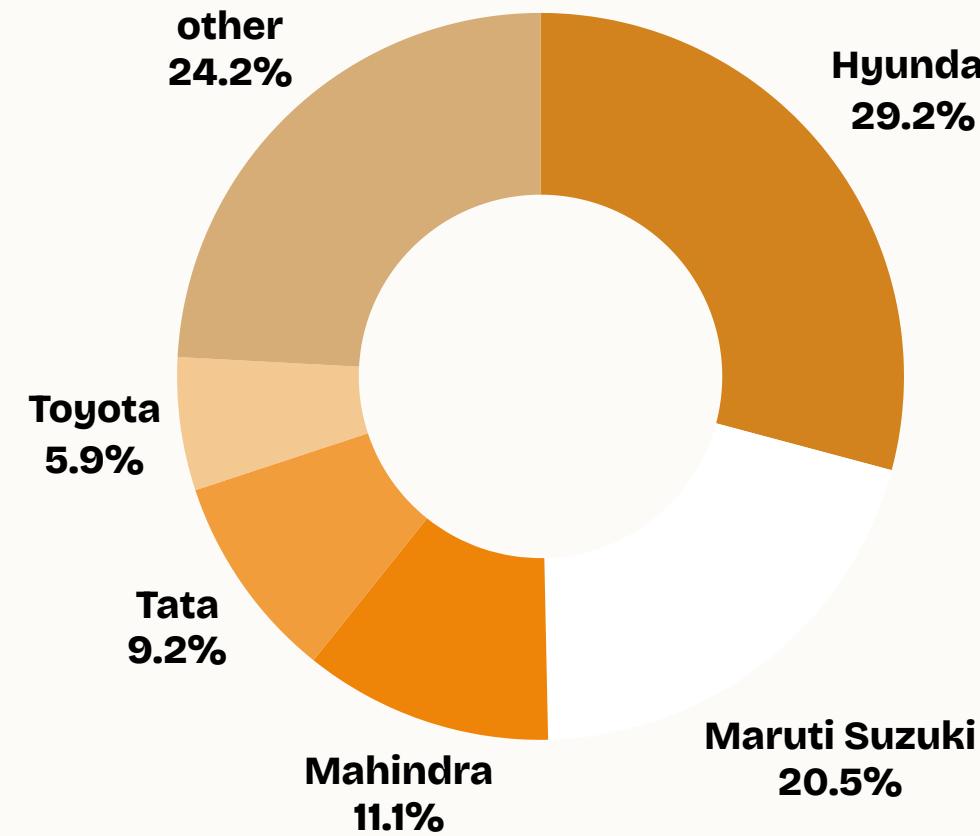


Top 5 Profitability by Maker

Summary Target Cars for acquisition in Bangalore

33 cars

	Million INR	Profit Margin
ACTUAL VALUE	40.16	
MARKET VALUE (Predicted)	67.90	
GAIN/ PROFIT	27.75	69%



Summarized Profitability

Top 5 Profitability
by Maker

Criteria:

- **Age:** \leq 10 years
- **Mileage:** \leq 150,000 km
- **Fuel Type:** Diesel or Petrol
- **Transmission:** Automatic preferred

Acquisition Process for Selected Cars



Outreach and Negotiation

Contact individual sellers and negotiate acquisition prices.



Inspection and Due Diligence

Perform a thorough inspection of each car to verify condition and ensure it meets resale standards.



Secure Purchase

Finalize the purchase agreements and complete ownership transfer for each car.



Preparation for Resale

Complete any necessary maintenance or minor improvements to maximize resale value.



Thank You

