

Estimating the Impact of Mileage on Used Car Pricing in Indian Market

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Introduction



Car chip shortage across the globe along with unstable economic conditions and inflation caused the buyers attention shifting towards pre-owned cars.



Research Question

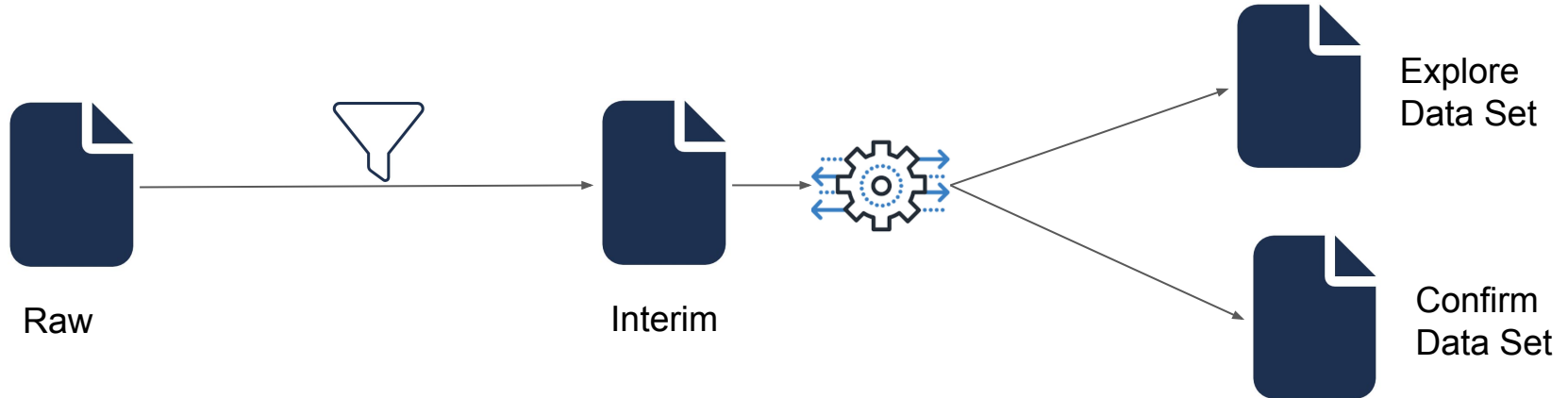
How much effect the mileage has on the used car valuation in Indian car market?

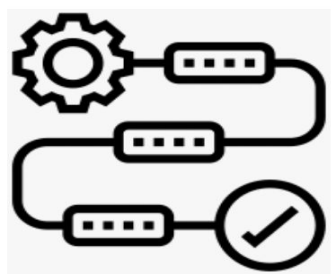




Data

- Public data set from Kaggle.
- Each row in the data set represents the market value of a pre-owned car in Indian market, aging between 2004 to 2021 in Indian Rupees (INR).
- 30% data used as exploration data set and remaining 70% records are used as the confirmation data set to generate the statistics in this report.



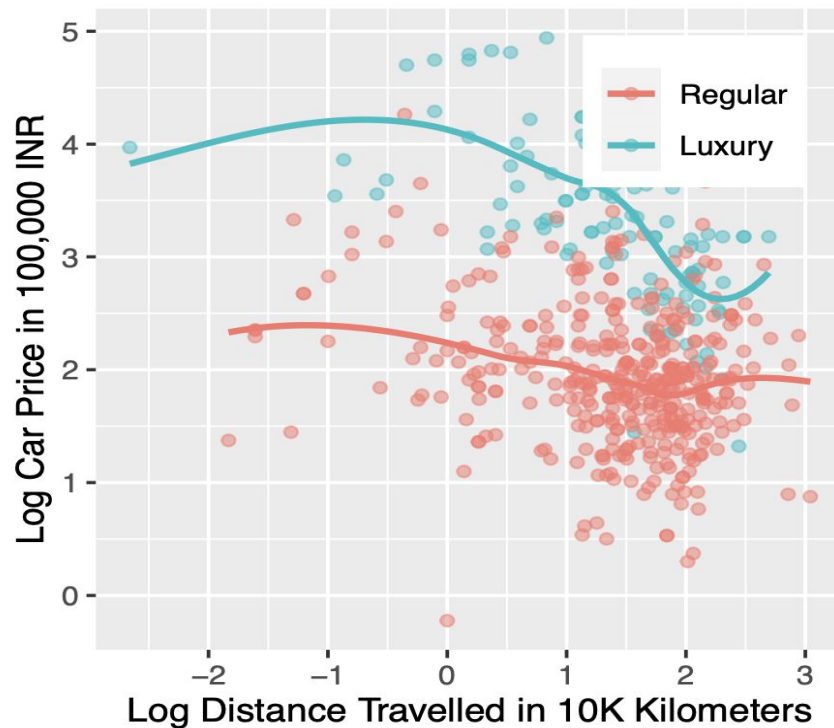
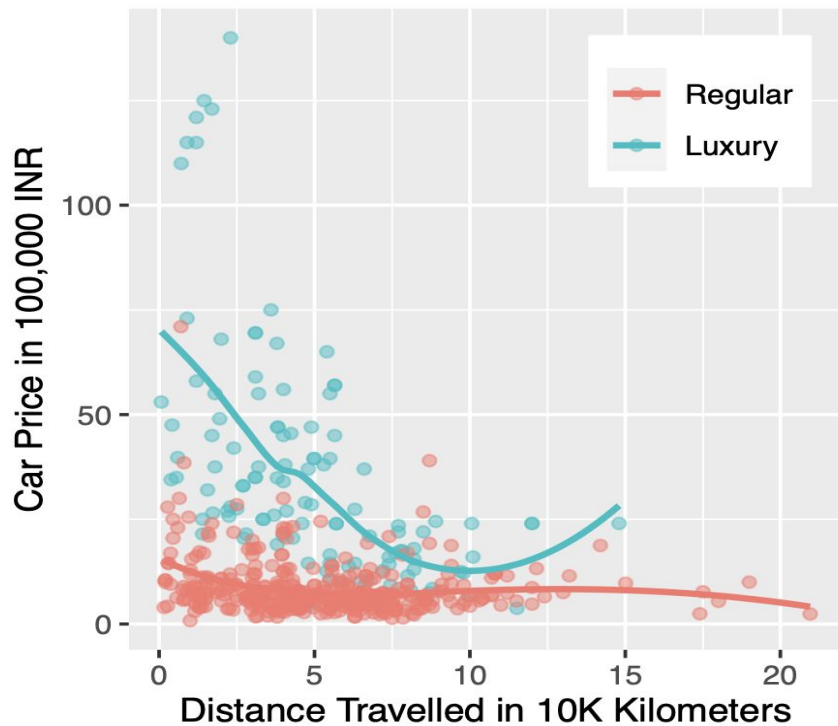


Methodology

- A. We have excluded data based on our data understanding.
- B. We have transformed our remaining data set.
- C. We have operationalized our business question using our data set.



Plot



I am interested in the difference in value between two counterfactuals: used car's market valuation with distance traveled, and used car's market valuation for luxury vs regular car.



Explanatory Models



I created a base regression model using car price and mileage to see the effect of mileage on the price. I also built few other regression models to see the effects of other factors like fuel type, luxury vs regular car, car age and car manufacturers and region.

Z is a row vector of additional covariates and γ is a column vector of coefficients.

$$\widehat{\log(\text{price in } 100k)} = \beta_0 + \beta_1 \cdot \log(\text{distance in } 10k \text{ km}) + \mathbf{Z}\gamma$$

$$\widehat{\log(\text{price in } 100k)} = \beta_0 + \beta_1 \cdot \log(\text{distance in } 10k \text{ km}) + \beta_2 \cdot \text{petrol} + \beta_3 \cdot \text{regular} + \mathbf{Z}\gamma$$

$$\widehat{\log(\text{price in } 100k)} = \beta_0 + \beta_1 \cdot \log(\text{distance in } 10k \text{ km}) + \beta_2 \cdot \text{petrol} + \beta_3 \cdot \text{regular} + \beta_4 \cdot \text{car age} + \mathbf{Z}\gamma$$

$$\widehat{\log(\text{price in } 100k)} = \beta_0 + \beta_1 \cdot \log(\text{distance in } 10k \text{ km}) + \beta_2 \cdot \text{petrol} + \beta_3 \cdot \text{regular} + \beta_4 \cdot \text{car age} + \beta_5 \cdot \text{manufacturer} + \mathbf{Z}\gamma$$

$$\widehat{\log(\text{price in } 100k)} = \beta_0 + \beta_1 \cdot \log(\text{distance in } 10k \text{ km}) + \beta_2 \cdot \text{petrol} + \beta_3 \cdot \text{regular} + \beta_4 \cdot \text{car age} + \beta_5 \cdot \text{manufacturer} + \beta_6 \cdot \text{region} + \mathbf{Z}\gamma$$



Results

Table 4: Estimated Car Market Value

	Outcome Variable: Log Car Price in 100K INR				
	(1)	(2)	(3)	(4)	(5)
Log Distance in 10K Km.	−0.19*** (0.03)	−0.34*** (0.02)	−0.03 (0.03)	−0.01 (0.02)	−0.01 (0.02)
Petrol		−0.58*** (0.04)	−0.32*** (0.03)	−0.21*** (0.03)	−0.21*** (0.03)
Regular		−1.09*** (0.04)	−1.24*** (0.03)	−1.45*** (0.09)	−1.43*** (0.08)
Car Age			−0.13*** (0.01)	−0.13*** (0.005)	−0.13*** (0.005)
Constant	2.59*** (0.05)	3.87*** (0.05)	4.27*** (0.04)	4.32*** (0.08)	4.30*** (0.08)
Car Manufacturer				✓	✓
Region					✓
Observations	1,200	1,200	1,200	1,200	1,200
R ²	0.03	0.56	0.70	0.83	0.83
Residual Std. Error	0.86 (df = 1198)	0.58 (df = 1196)	0.48 (df = 1195)	0.37 (df = 1168)	0.37 (df = 1164)

Note:

*p<0.05; **p<0.01; ***p<0.001

HC₁ robust standard errors in parentheses.



Limitations

- A. IID Violations?
 - i) Geographic Clustering
 - ii) Temporal autocorrelation
- B. Unique BLP?
 - i) Skewed distributions
 - ii) Outliers
- C. Normal Distribution violation?
 - i) Skewed distributions
- D. Omitted Variable Bias
 - i) Accident History
 - ii) Maintenance
 - iii) Car Usage
 - iv) Frequent car ownership change



Conclusions

- ❖ We notice that in Indian car market, petrol cars have lesser depreciation compared to diesel cars.
- ❖ Similarly, luxury cars depreciate much faster than regular economy cars.
- ❖ Although, more car mileage causes the car depreciate faster, we see the mileage effect fades off while other factors like car fuel type and car manufacturer etc. are considered.

So, while determining the price of the used cars, more emphasis should be put on the car manufacturer, car type, and car fuel type, rather than just the number of miles a car has been driven.



Questions?