Key Factors That Influence Housing Market in Boston, MA

Introduction:

Among all critical economic pointers, house prices top the list because they directly influence the quality of life and investment decisions along with the course of urban development. Housing is usually the single largest financial investment that every individual or family makes, and thus any change in housing prices will significantly affect personal wealth and economic stability. The better understanding of the variables influencing housing prices will help

- *Homebuyers* understand what makes properties in some neighborhoods more valuable than others.
- *Real Estate Investors* who are looking for profitable investment opportunities based on emerging trends in property prices.
- *Urban Planners* to address disparities in housing affordability and guide development projects.
- *Policymakers* address socioeconomic disparities by targeting crime reduction, educational improvements, and infrastructure development.

Problem Statement:

While Boston Housing data had many variables, we will explore

"How factors like crime rate, proximity to the Charles River, and highway access affect Boston housing prices?"

How do we address this problem statement:

- *Data Collection:* Used a primary data dataset "Boston Housing data" with a focus on key attributes influencing housing prices
- *Data Cleaning:* Handled missing or incomplete data by applying removing irrelevant entries, creating new variables, renaming the column names
- *Feature Selection:* Identified the predictors of housing prices and used statistical techniques to eliminate redundant or irrelevant features.
- *Analysis of 3 variables:* Summarized the data through a combination of descriptive statistics, group aggregations, and visualizations.
- *Exploratory Data Analysis:* Conducted EDA to understand the distribution of housing prices and identify trends, patterns, and correlations between features. Also, visualized

relationships between variables using Scatter Plots, Box Plots, Line Plots, Histograms and Tables with Summary Statistics.

- *Data Modeling:* Built Multivariable regression model to estimate housing prices based on features, Crime rate, proximity to the Charles River, and highway access and evaluated model performance using metrics

Analysis / Interesting insights:

- *Crime Rate:* The average crime rate is around 3.65. The median crime rate is lower at 0.26. The data was skewed which means most areas have a low crime rate, but there are a few with very high crime rates. The high standard deviation of 8.64 suggests the idea of outliers with exceptionally high crime rates. The lowest crime rate is 0.00632 and the maximum is 88.9762, which may be the outliers affecting the mean.
- *Charles River:* There are 35 homes and only a small proportion of 6.9% of homes are located near the Charles River and 466 homes and the majority of homes (93%) are situated away from the river. The box plot showed that the proximity to the Charles River has a positive influence on housing prices. And there is more variability in prices for homes near the river, possibly due to different property types or amenities.
- *Highway Access:* The scatter plot with a trend line shows a weak negative relationship between highway access level and median housing price, suggesting that homes closer to major highways tend to have slightly lower prices. However, the wide scatter of points indicates that this alone is not a strong predictor of housing prices, and other factors likely influence the variability observed.
- *Multivariable regression model:* The regression model suggests that housing prices are negatively impacted by both highway access and crime rate, meaning higher values for these predictors generally correspond to lower housing prices. Housing prices are positively impacted by proximity to the Charles River, which aligns with expectations for desirable waterfront locations.

Implications to the consumer (target audience):

- Most neighborhoods have low crime rates, which is reassuring for consumers prioritizing safety. However, a few areas have significantly higher crime rates, which raises potential safety concerns. Since high-crime areas skew the average, homebuyers may want to focus on the median crime rate as a more typical indicator.
- Only a small percentage of homes are located near the Charles River, making this location a unique selling point. The positive impact of river proximity on prices indicates consumers seeking a waterfront location should be prepared for potentially higher prices and a competitive market.
- While highway access offers convenience for commuting, the slight negative impact on prices suggests that consumers might associate it with drawbacks like noise and

pollution. For buyers, this means that homes closer to highways could be more affordable. Those prioritizing a quiet environment may consider neighborhoods further away from major highways.

- The regression analysis confirms that factors like crime rate and highway access can lower housing prices, while proximity to the Charles River raises them. This means that homebuyers should weigh these factors based on their priorities and make decisions aligned with their preferences, budget, and investment goals.

Limitations:

- The Boston Housing dataset was collected in the 1970s, hence this dataset may not reflect the current real estate landscape, limiting the applicability for today's consumers.
- Since the dataset focuses exclusively on the Boston metropolitan area, the insights may not generalize to other cities or regions with different urban, economic, and cultural characteristics.
- The crime rate variable has a high variance with potential outliers, which may skew results.
- Variables like highway access and crime rate impact prices, but doesn't fully capture buyer preferences or subjective perceptions
- The adjusted R-squared value is relatively low, suggesting that the model explains only a modest portion of the variance in housing prices. This indicates that other, unmeasured factors play a significant role in determining prices, limiting the model's ability to predict housing values accurately.

Additional steps to improve or build on this analysis:

To improve or build on this analysis, additional steps could provide deeper insights and address some of the existing limitations:

- Using an updated and more comprehensive data set
- Using Advanced Modeling Techniques
- Exploring Multivariate Relationships
- Handling Outliers and Skewed Data
- Geographically Weighted Analysis
- Applying cross-validation techniques

Concluding Remarks:

This analysis underscores the value of data in supporting strategic decisions in the housing market.

- Policies aimed at creating attractive, safe, and accessible neighborhoods can directly influence housing demand and boost local property markets.
- Lower crime rates correlate strongly with higher property values, suggesting safety as a top priority for homebuyers.
- Proximity to the Charles River emphasizes the importance of natural amenities.
- Proximity to highways shows a slight negative impact on housing prices, hinting that accessibility is balanced by preferences for quieter surroundings.

Moving forward, future projects could enrich this analysis by incorporating additional steps listed above which opens pathways for further exploration.