Value Determinant Visualization Tool

US Housing Market

Team 74

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Introduction

The price of purchasing a home today has become increasingly unaffordable as the housing market trends upwards annually, historically outpacing inflation rates. Current tools, such as applications available on Zillow and Redfin, are only able to return the listing price.

Can we deconstruct the pricing of homes into various features to allow homebuyers to make more informed decisions?

Our tool generates a comprehensive visual analysis of the correlation of economic features. Each feature shown is determined to have a notable impact on the valuation of homes in a selected region. Our tool will also allow users to forecast the correlation values by analyzing historical data.

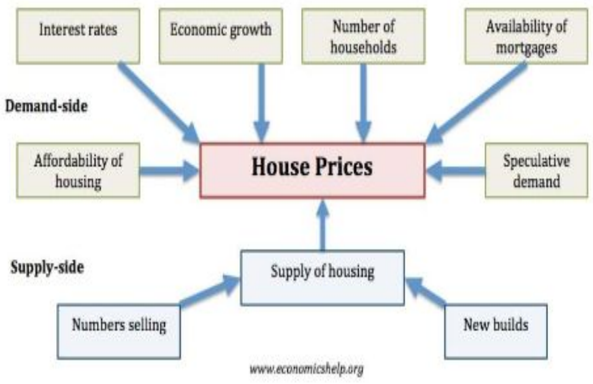

Figure 1: Common Factors Contributing to Housing Prices
https://www.economicshelp.org/

Dataset

Our tool leverages downloaded data at both the federal and state level from multiple sources. The total size of our input data for a given instance tends to average around 100,000 rows; approximately 15 MB. Our top data sources include Nasdaq, FHFA, US Census & FRED

Approach and Methodology

Dynamic Parameter Inputs - The majority of the literature we reviewed hyper-focused on a small geographic location when performing their analysis. While this enables the analysis to be very detailed, it also means the results can only be applied to that local area. Our analysis plans to expand across multiple years, and a multitude of different regions in the US, that can be selected at the user's discretion, at both the federal and state level.

Figure 2: Line Chart In-Depth

House Price Index Forecasting - Implementing an autoregressive integrated moving average (ARIMA) model using existing data from state and federal housing price index to evaluate trends. The model will forecast the HPI value for up to ten years, allowing users to anticipate shifts in the housing market. Though housing price prediction may be impacted by other factors, the ARIMA model is one option to make informed purchasing and selling decisions.

Feature Selection - The incorporation of a regression model when selecting the region and time span we want to investigate also will allow us to perform feature selection. Instead of trying to squeeze 10-20 features that predict housing prices onto a cluttered graph, this step allows us to dynamically show only the most important features that affect housing prices for a given set of inputs.

Figure 3: Feature Selection Overview

Experimentation and Design Evaluation

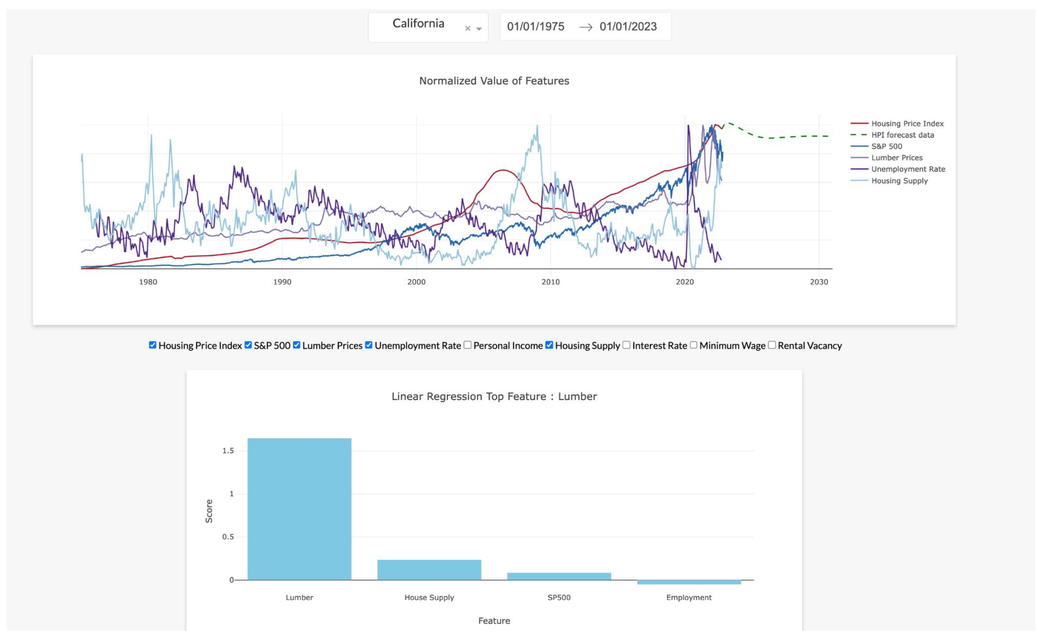

Figure 4: Visualization Output for California

To improve the overall readability of our visualization, we tested the output of our design iterations against common design rules, including those found below:

Rule	Implementation
Incorporate senses other than just sight, like touch (mouse-over animations) or hearing (pleasant sounds on clicks)	Incorporated tooltips on mouseover for the line and bar chart
Reduce the amount of 'aesthetic ink' used. Reduce the number of colors and shapes we have that are solely dedicated to design and not data	Changed darker backgrounds originally used to white or light gray.
Order colors of visualization from lightest to darkest, either left to right or top to bottom	Adjusted colors of line chart based on the order they are presented on the y-axis, from top to bottom
Adjust the color palette to improve readability	Utilized open-source color palette generator to change visualization color scheme where necessary: https://colorbrewer2.org/#type=sequential&scheme=BuGn&n=3

Table 1: Subset of Design Rules

Results and Conclusion

Our tool consistently identified lumber prices to have the strongest correlation to housing prices across all input ranges. Our tool also projects home prices in the majority of locales to stagnate over this next decade.

Further Research Ideas:

- Add statistical method to identify correlation vs causation for input features
- Replace software stack of Python & Plotly with JavaScript & D3 for customization and speed

Key References

1. Charles A Calhoun. "OFHEO house price indexes: HPI technical description". In: Office of Federal Housing Enterprise Oversight 20552 (1996), pp. 1–15.
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3. Sabyasachi Tripathi. ""Macroeconomic Determinants of Housing Prices: A Cross Country Level Analysis" Real Estate Finance, 36:4 (2020), 229-238, Wolters Kluwer." In: (Feb. 2020).

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