A Decade of Global Housing Rollercoaster (2015-2024)

Objective

The objective of this project was to analyze the global housing market dynamics over the last decade (2015–2024). Using a dataset of 200 economic records across 20 major nations, this report employs data cleaning, statistical analysis, and advanced visualization techniques to explore trends in price appreciation, affordability ratios, and the decoupling of rental markets from purchase markets.

Introduction

This dataset explores the macroeconomic factors driving real estate trends. It contains 200 records with attributes describing housing costs and economic health. The attributes include Country, Year, Price_Index, Rent_Index, Affordability_Ratio, Mortgage_Rate, Inflation, GDP_Growth, and Urbanization_Rate. Additionally, derived features such as the Price_to_Rent_Ratio were calculated to provide deeper insight into market bubbles. Each attribute captures a specific economic dimension, allowing for a comprehensive analysis of how global events (such as the post-pandemic boom) impacted local housing stability.

The dataset used for this analysis was obtained from Kaggle and is titled "Global Housing Market Analysis (2015-2024)."

Method

The analysis was conducted following a structured methodology to ensure data integrity and the clarity of findings. The process involved rigorous data preparation and a visualization-based analytical strategy.

The initial step involved assessing the quality of the dataset. An investigation for missing values and duplicate entries was performed, and it was confirmed that the dataset contained no missing values or duplicated rows. Data validity checks were run to ensure no logical errors existed (e.g., negative mortgage rates). Column names were standardized (e.g., changing "House Price Index" to "Price_Index") for coding efficiency. Furthermore, a new variable, Price_to_Rent_Ratio, was engineered to quantify the gap between buying and renting costs.

The analysis was conducted using the Python programming language with the Pandas library for data manipulation, and the Matplotlib, Seaborn, and Plotly libraries for static and interactive visualization. The methodology included descriptive statistics to summarize global averages, correlation analysis via a heatmap, and a series of univariate, bivariate, and multivariate visualizations. These visualizations were employed to explore the "boom and bust" cycles and investigate the relationships between economic supply (construction) and market prices.

Storytelling: Data Visualization and Interpretation

a) Establishing the Macroeconomic Baseline

To understand the housing market, it is first necessary to establish the economic environment in which these trends occurred.

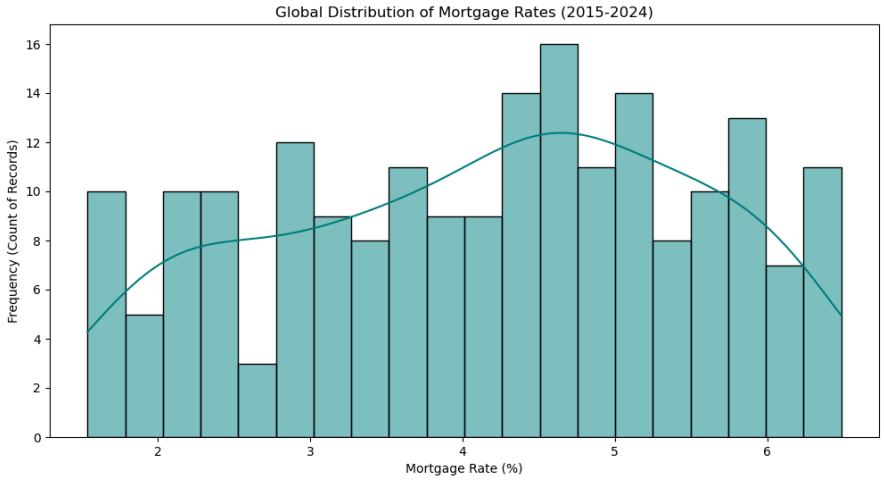

Figure 1: Global Distribution of Mortgage Rates (2015-2024)

The histogram displays a bimodal distribution of interest rates. While the most frequent rates cluster around the 4.0% - 5.5% range (typical for stable economies), there is a distinct cluster of low rates (1.5% - 2.5%). This establishes a critical baseline: for much of this decade, cheap credit was available in key markets, acting as a potential catalyst for price inflation.

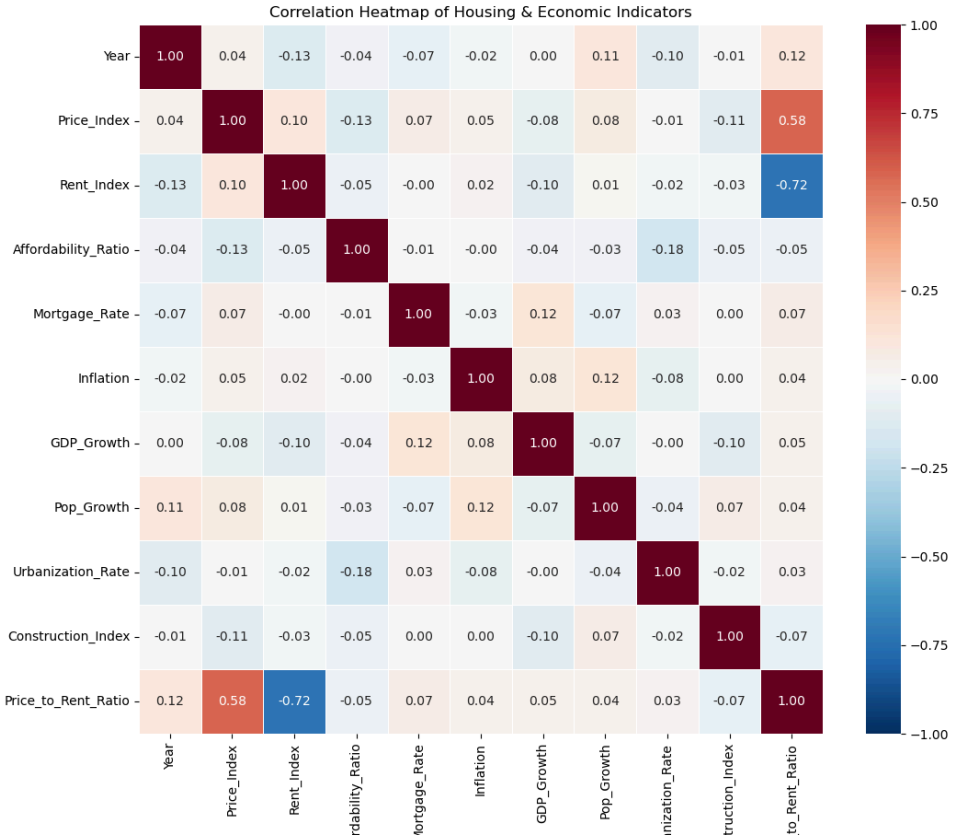

Figure 2: Correlation Heatmap of Housing & Economic Indicators

The heatmap reveals a surprising lack of strong correlations between general economic metrics (GDP, Inflation) and housing prices. However, it highlights a strong negative correlation (-0.72) between the Rent_Index and the Price_to_Rent_Ratio. This suggests that changes in market "heat" were driven more by speculative asset appreciation (buying) than by the fundamental rental value of the property.

b) The "Boom" and The Bubble

With the baseline established, we analyze the specific growth of housing costs compared to rental costs.

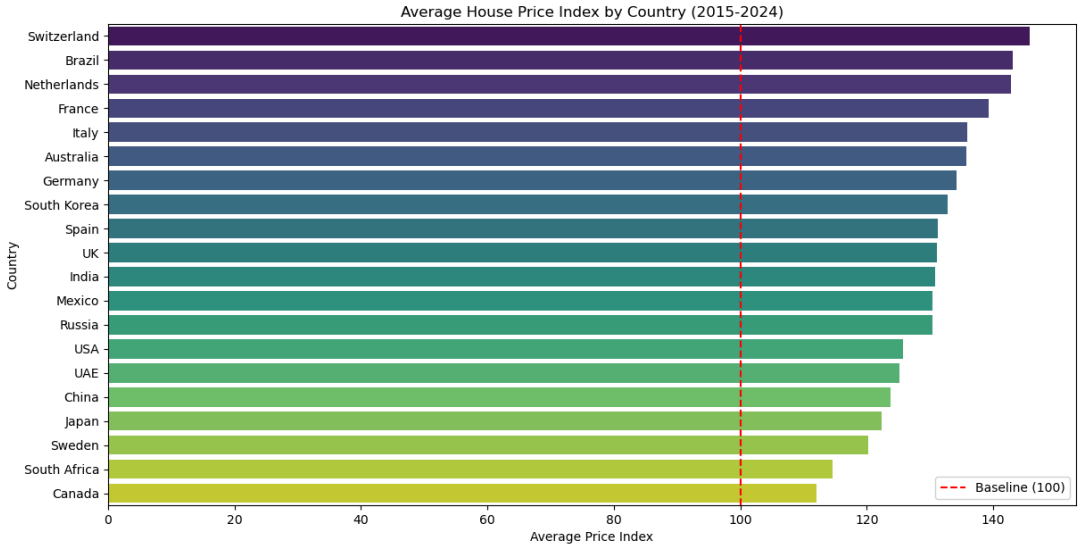

Figure 3: Average House Price Index by Country

The chart ranks countries by their average price inflation over the decade. Switzerland, Brazil, and the Netherlands lead the pack, showing sustained upward pressure. Crucially, every single country sits above the 100-point baseline, confirming that real estate inflation was a universal global phenomenon, not limited to specific regions.

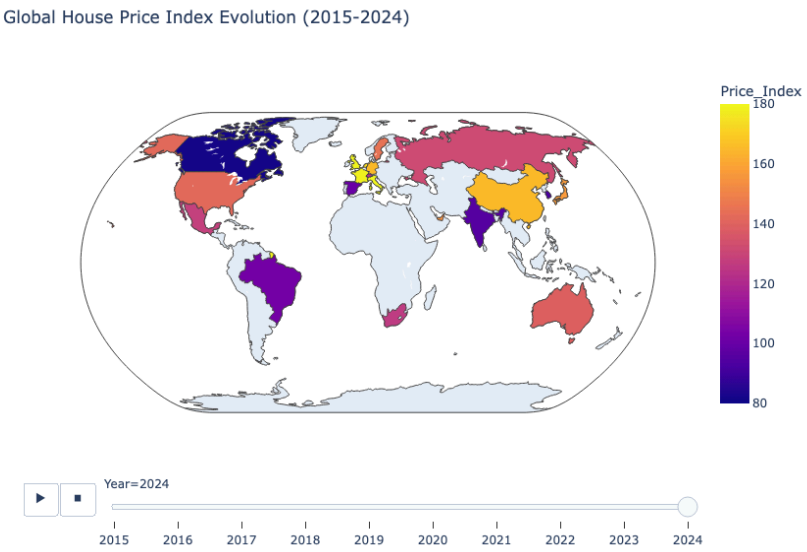

Figure 4: Global House Price Index Evolution (Geo Map)

To visualize the geographic spread of housing inflation, we mapped the Price Index over time. The map reveals distinct regional clusters of high appreciation, particularly in Europe (Switzerland, Germany) and South America (Brazil). The animation of this map over the decade highlighted a "flickering" effect. Countries shifted rapidly from cool (purple) to hot (yellow) colors and back again. This visualizes the synchronized global volatility: a massive wave of "heat" (inflation) swept across the globe in 2021, followed by a visible cooling in 2022, and a resurgence in 2024.

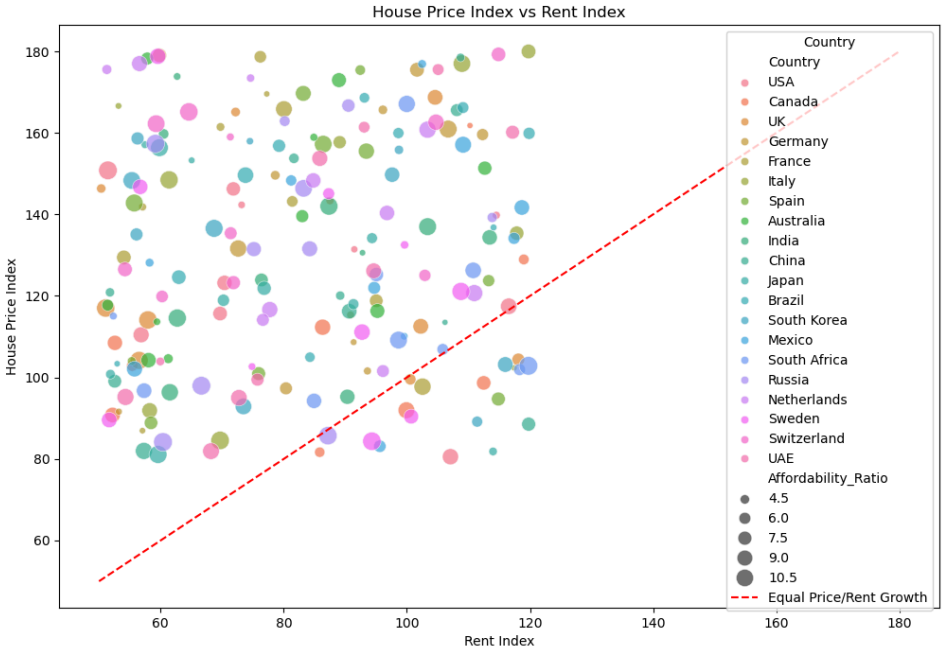

Figure 5: House Price Index vs. Rent Index (Bubble Detection)
This scatter plot is perhaps the most telling visualization in the report. Almost all data points lie above the red dashed "equilibrium" line. This indicates that globally, the cost of purchasing a home has appreciated much faster than the cost of renting one. The cluster of points in the top-left quadrant (High Price, Low Rent) serves as a visual indicator of potential asset bubbles, where prices are disconnected from rental yields.

c) The Affordability Crisis
Next, we examine the human impact of these price increases by analyzing the Affordability Ratio (where a lower number is better).

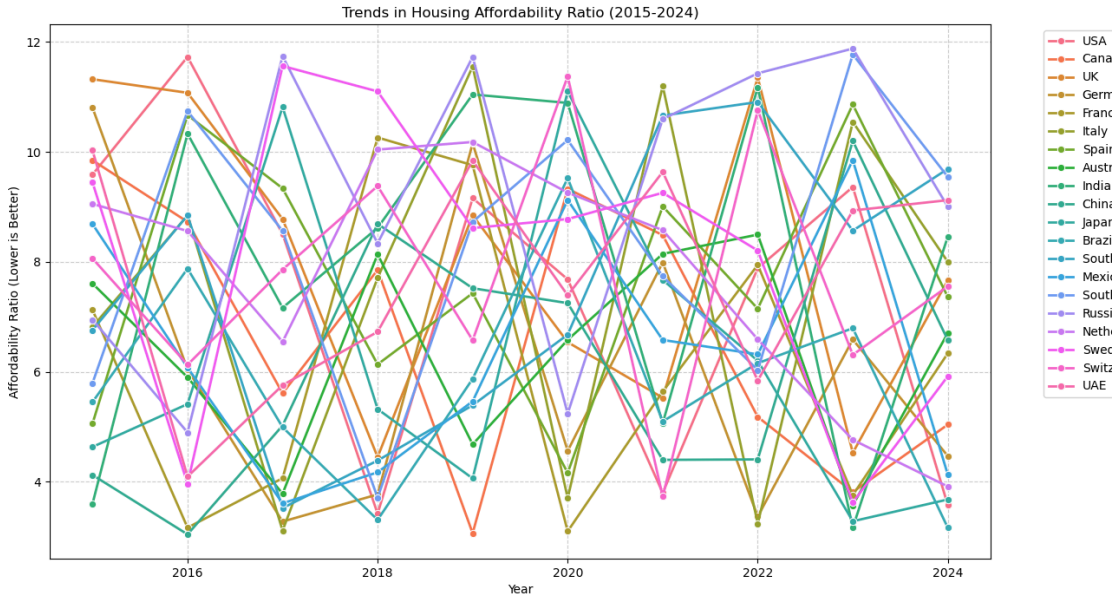

Figure 6: Trends in Housing Affordability Ratio

The line chart demonstrates extreme volatility with the "zig-zag" effect. Rather than a smooth trend, affordability spiked and dipped sharply in response to economic shocks. A noticeable divergence occurs in 2023-2024: while some markets cooled, others (like Russia and parts of Europe) saw affordability worsen significantly, spiking toward a ratio of 10-12.

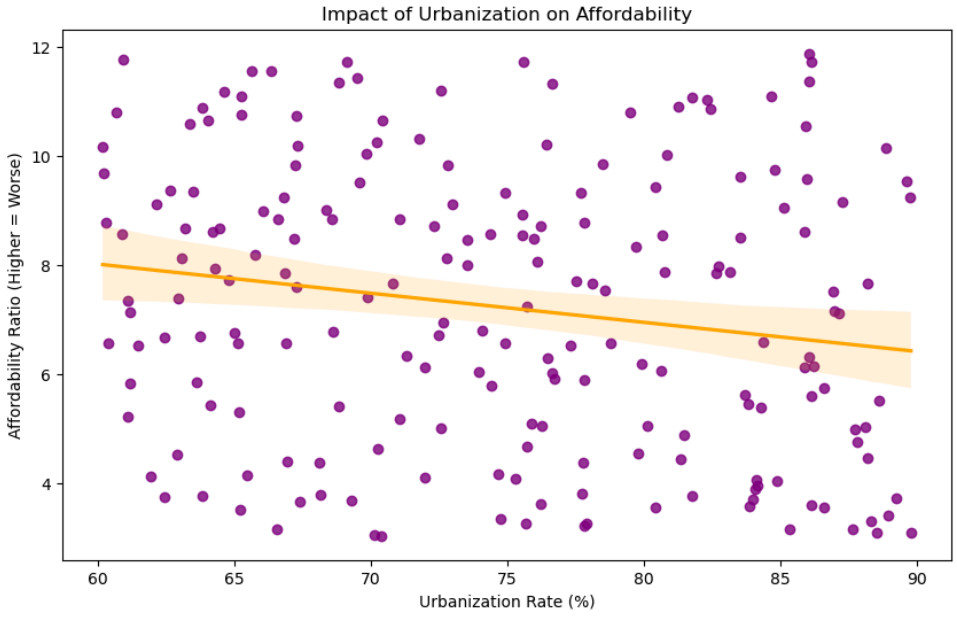

Figure 7: Impact of Urbanization on Affordability

Surprisingly, the regression line shows a slight negative slope. This contradicts the common assumption that highly urbanized countries are always less affordable. The data suggests that while city homes are

expensive, the higher wages in urbanized nations (like Germany) help maintain better affordability ratios compared to less urbanized but lower-income nations.

d) Volatility and Market Shocks

To conclude the analysis, we investigated the stability of these markets by looking for extreme outlier events.

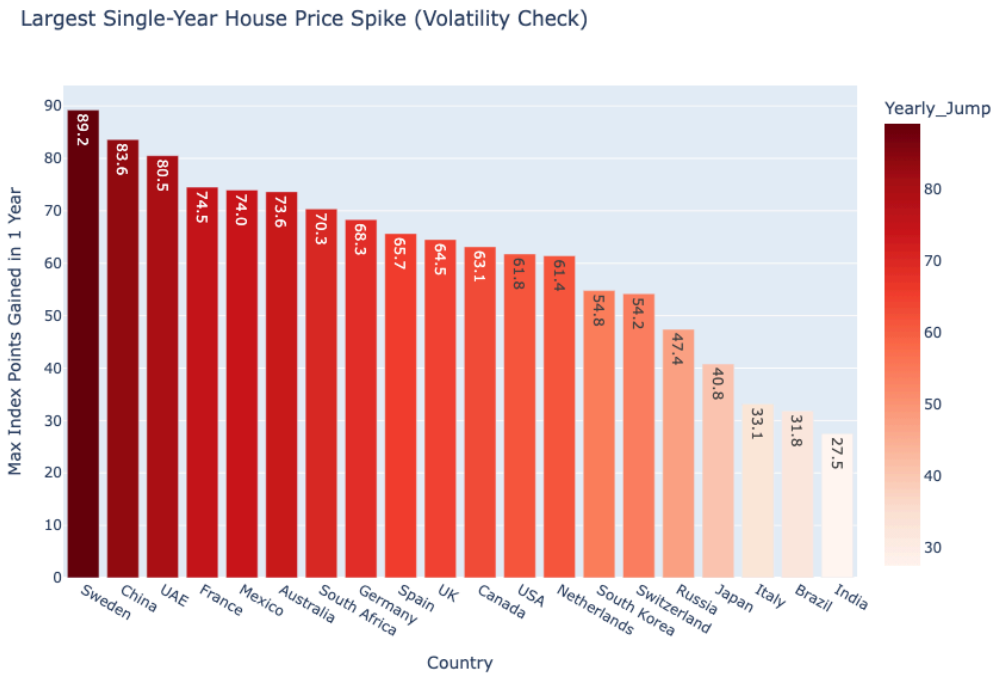

Figure 8: Largest Single-Year House Price Spike (Volatility Check)

This chart reveals the extent of market instability. Sweden and China experienced massive single-year shocks, with their indexes jumping by over 80 points in a single year. This confirms that the global averages hide pockets of extreme mania and volatility.

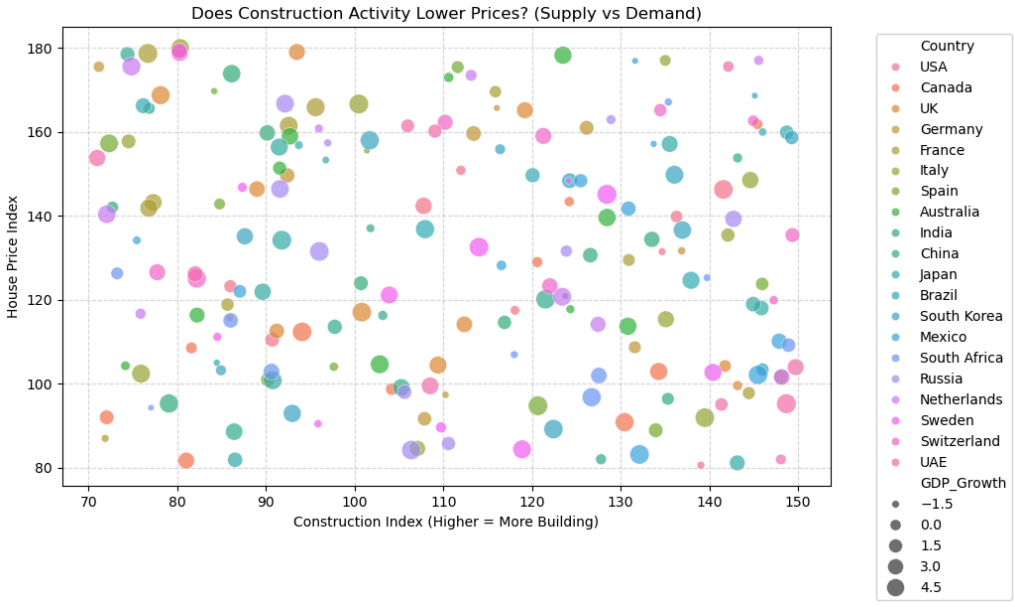

Figure 9: Construction Activity vs. Price Index

Finally, this plot explores the supply-side theory. The random scatter indicates no correlation between high construction activity and lower prices. This suggests that in this decade, new supply was often reactive (chasing high prices) rather than preventative, failing to cool down overheated markets.

Conclusion

This analysis of 20 global economies has demonstrated a clear and concerning trend of volatility in the real estate sector. The "Global Housing Rollercoaster" was characterized by a synchronized boom in 2021, a brief correction in 2022, and a resurgence in 2024.

The data provides compelling evidence of a "decoupling" between the buy and rent markets, with purchase prices inflating far beyond rental values. This, combined with the extreme single-year spikes seen in nations like Sweden and China, points to a market driven heavily by speculation and monetary policy rather than simple supply and demand. In summary, while real estate remains a primary wealth vehicle, the last decade has proven it to be a highly volatile asset class subject to rapid shifts in affordability.

References

Soundankar, Atharva. (2024). Global Housing Market Analysis (2015-2024) [Data set]. Kaggle. Retrieved from https://www.kaggle.com/datasets/atharvasoundankar/global-housing-market-analysis-2015-2024

Acknowledgements

I would like to express my sincere gratitude to my professor, Dr. Meenakshi Nerolu, for her invaluable guidance and mentorship throughout this project. Her insightful feedback and structured framework were instrumental in shaping the direction and quality of this analysis.

I also wish to extend my appreciation to Atharva Soundankar for making the "Global Housing Market Analysis" dataset publicly available on Kaggle, without which this research would not have been possible. Furthermore, I am grateful to the Department of Mathematics at Howard University for providing the resources and academic environment necessary to complete this work.

Finally, I would like to thank my peers and classmates for the engaging discussions and collaborative learning environment. I am also grateful to my family and friends for their unwavering support and encouragement throughout my academic endeavors.