Housing Prices in Canada: Economic Forces Shaping Affordability*

Analyzing Predictors againts the New Housing Price Index

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This study examines indicators influencing Canadian housing prices through the New Housing Price Index (NHPI) and key predictors: newly constructed homes, housing absorption, GDP, CPI, and interest rates. Linear regression shows GDP and CPI as the most significant predictors, with housing absorption and interest rates playing secondary roles

1 Introduction

1.1 Overview

This analysis examines what pushes the cost of homes in Canada, focusing on supply, demand, inflation, and borrowing costs. These indicators are recognized as central influences on housing prices, but their exact roles and interactions are often debated. By organizing and cleaning data from Statistics Canada, this research aims to create a clear picture of how these indicators collectively shape housing affordability. This approach provides an important look into the forces driving one of the most important components of Canada's economy.

A central goal of this analysis is to understand how changes in supply, demand, inflation, and borrowing costs impact home prices. In the current economic climate, there is a popular belief that reducing the number of buyers in the housing market could significantly increase the availability of homes, thereby lowering prices. This assumption relies on the idea that fewer buyers create less competition, weakening sellers' ability to demand higher prices. Key indicators influencing this dynamic, such as higher borrowing costs discouraging potential buyers or shifts in demand due to economic uncertainty, play a vital role in understanding housing affordability trends.

*Code and data are available at: https://github.com/DavidFJ207/CanadianHousingAnalysis

This research looks into these claims by examining how supply and demand, combined with economic pressures like inflation and interest rates, contribute to housing market fluctuations. By modeling the relationships between these variables, the study seeks to provide evidence based look into the housing market's behavior. Understanding these dynamics is important for policymakers, developers, and prospective homeowners, as it shows potential strategies to improve affordability and stabilize the housing market amidst economic challenges.

This paper is structured into several key sections to ensure a clear and logical presentation of the research. In the **Data** section (Section 2), we outline the datasets used, including their sources, variables, and measurements, and provide visualizations to explore trends and relationships. The **Model** section (Section 3) describes the goals, the steps taken to refine the model, and how it was evaluated for accuracy and reliability. The **Results** section (Section 4) highlights key findings, including the impact of different predictors on housing prices and the model's overall performance. In the **Discussion** section (Section 5), we go into the broader implications of these results, addressing housing affordability, economic trends, and policy suggestions while acknowledging the study's limitations and areas for future research. The **Appendix** (Section A) provides additional methodological details, such as data collection and sampling techniques, and explores the use of simulations to enhance the analysis. Finally, all references are compiled in the **References** section (Section B), ensuring proper attribution and a robust foundation for this study.

2 Data

2.1 Overview

We use the statistical programming language R (R Core Team 2023a) to analyze housing prices in Toronto. The data for this project was sourced from Statistics Canada Statistics Canada (2024f), including five datasets. These datasets provided information on the new housing price index, housing absorption, GDP, CPI, interest rates, and construction statistics. The data spans from 1997 to 2016 and is divided quarterly, yielding 76 entries. For this analysis, we are only using data from 1997 to 2016, as it represents the most complete and consistent period available. Rather than using this data to predict future housing prices, our focus is on understanding the relationships between the predictors and the response variable, providing findings into how these indicators interact and influence housing prices.

2.2 Measurement

2.2.1 Outcome Variable: New Housing Price Index

The New Housing Price Index (NHPI) data, provided by Statistics Canada (Statistics Canada (2024e)), is a way to measure how the prices of newly built houses in Canada change over time. It tracks the prices of new homes, like single-family houses and townhomes, while making sure that comparisons are fair by keeping the house features the same. This helps people understand if housing is becoming more expensive or affordable and why, considering indicators like construction costs and market demand. It's used by everyone from economists and policymakers to builders and homebuyers to make informed decisions about the housing market.

The graph labeled Figure 1 shows a steady upward trend in housing prices in Canada over time, with a notable increase from 2005 to 2008, stabilization around 2008-2010, and consistent growth post-2010.

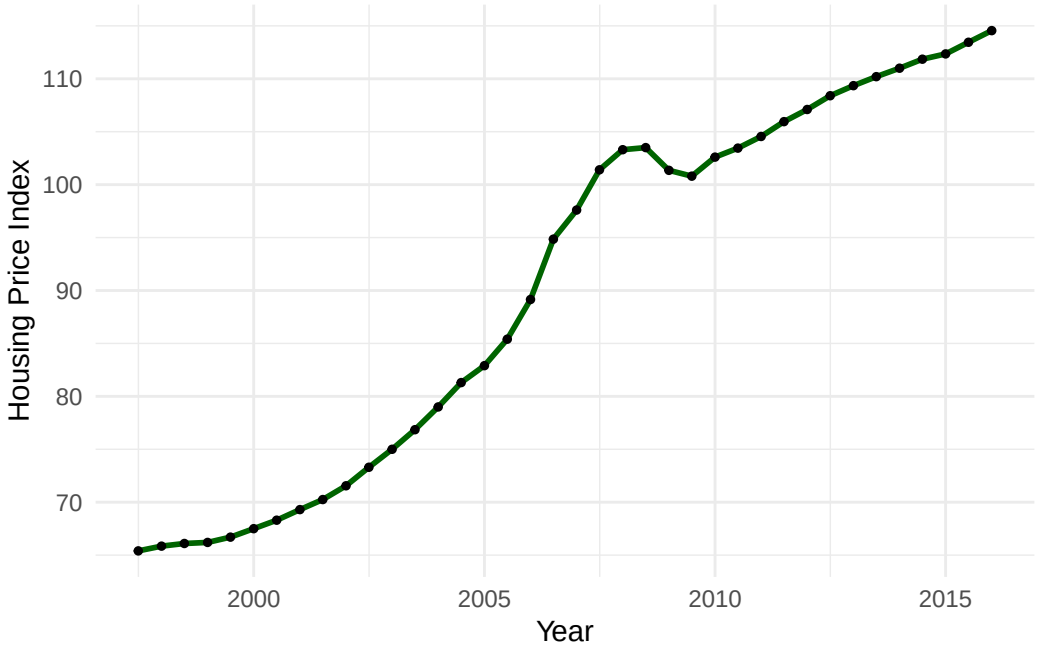

Figure 1: New Housing Price Index Trends

2.2.2 Predictor Variables

2.2.2.1 Housing Availability

The dataset from the Canada Mortgage and Housing Corporation (CMHC) provides detailed information about new homes in Canada, including the number of houses being built, completed, or under construction (Statistics Canada (2024b)). It also includes data on newly built but unoccupied homes, vacancy rates, and mortgage details.

The bar Figure 2 chart shows the number of available homes in Canada over six-month periods, highlighting fluctuations in housing construction activity. There is a noticeable peak in the mid-2000s, followed by a slight decline and stabilization in the availability of homes from 2010 onward, reflecting trends in construction and housing demand.

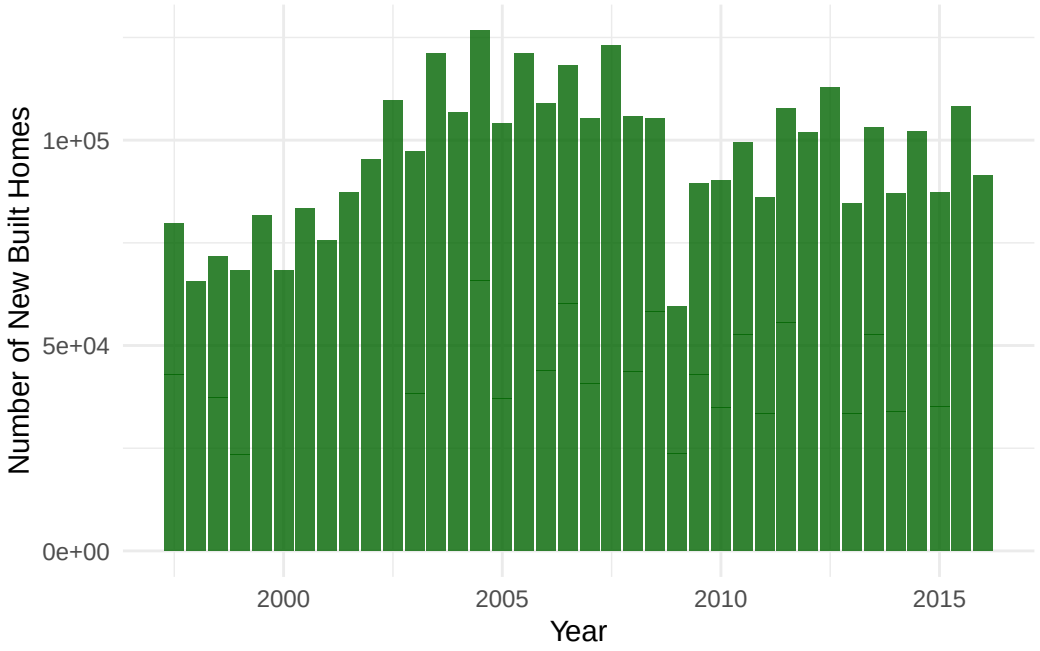

Figure 2: Availability of Homes Over Time

2.2.2.2 Housing Sales

The Canada Mortgage and Housing Corporation (CMHC) maintains an extensive database with over 14,000 housing series, offering monthly data on housing unoccupied newly built homes, vacancy rates, and mortgage details. These statistics, accessible via CANSIM, provide beneficial findings into residential availability and market dynamics. This data is provided under Statistics Canada (2024a).

Figure 3 illustrates the number of sold homes over time in six-month intervals, showing a peak in home sales around the early 2000s, particularly between 2000 and 2005. After this period, there is a gradual decline in the number of sold homes, with noticeable fluctuations, stabilizing at lower levels post-2010.

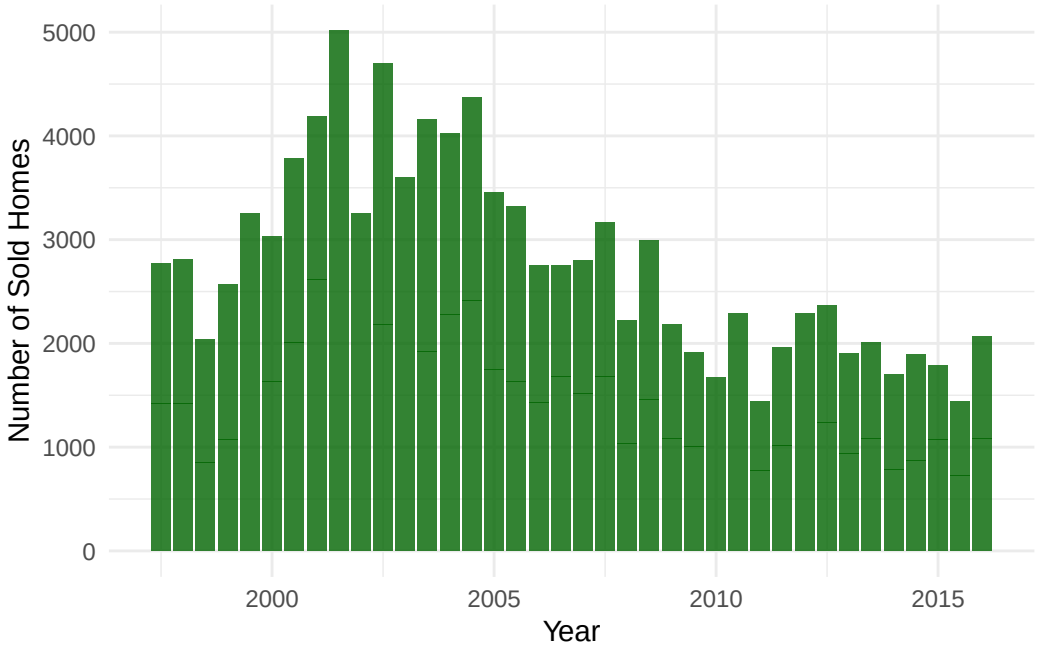

Figure 3: Sold Homes Over Time

2.2.2.3 Gross Domestic Proudct

Gross Domestic Product (GDP) measures the total value of all goods and services produced within Canada's borders, providing a snapshot of the country's economic activity. The term "gross" includes costs like depreciation of capital assets, while "domestic" focuses on activities within Canada. GDP data is categorized by industry, offering finding into how various sectors contribute to economic performance. This information, provided by Statistics Canada (Statistics Canada (2024d)), is essential for understanding economic trends, planning policies, and evaluating industrial performance on a monthly basis.

Figure 4 shows a steady increase in Gross Domestic Product (GDP) over time, reflecting consistent economic growth. The upward trend suggests a strengthening economy, with noticeable stability and gradual increments throughout the observed years.

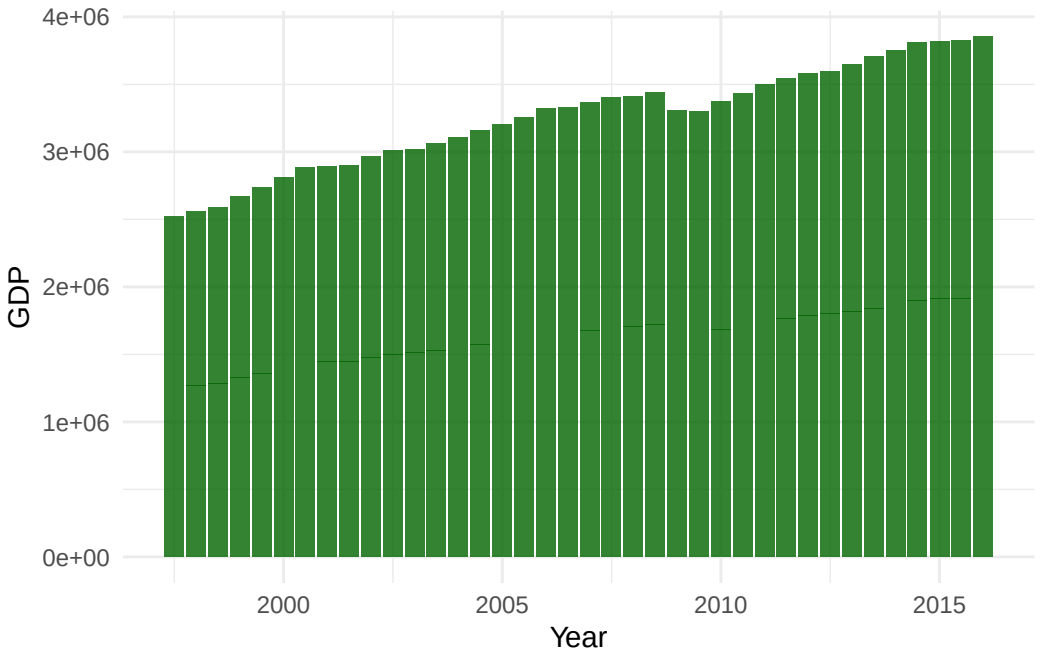

Figure 4: Gross Domestic Product

2.2.2.4 Interest Rates

Bank interest rates represent the cost of borrowing money or the reward for saving it, as set by financial institutions and influenced by the Bank of Canada. These rates play an important role in financial markets and the economy by affecting loans, mortgages, and savings, helping regulate economic activity. Data on interest rates, financial institutions, and market activities are compiled by the Bank of Canada and detailed in (Statistics Canada (2024g)).

Figure 5 shows fluctuations in bank interest rates over time, with a peak around the early 2000s, followed by a significant decline after 2008. The rates remained relatively low and stable in the years following the financial crisis.

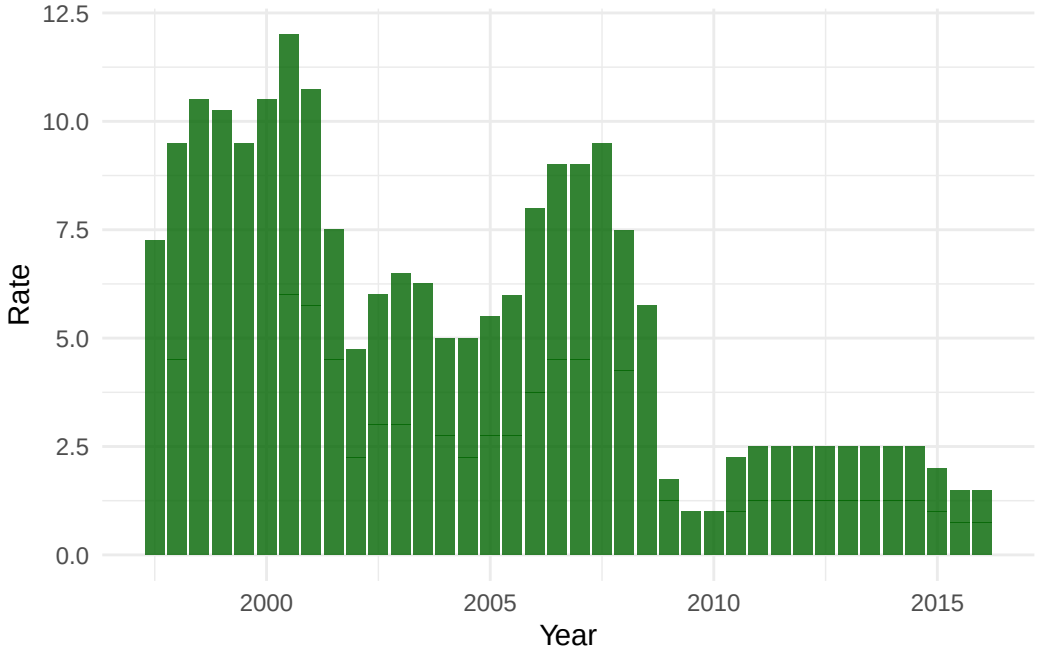

Figure 5: Interest Rate Trends and Hikes

2.2.2.5 Consumer Price Index

The Consumer Price Index (CPI) measures changes in the cost of a fixed basket of goods and services purchased by Canadian households, allowing Canadians to track inflation and its impact on purchasing power. It reflects price changes over time while keeping the quality and quantity of items in the basket consistent, ensuring that only "pure" price changes are measured. The CPI is widely used to adjust payments like wages and pensions, evaluate economic trends, and monitor the effects of inflation on financial stability. For further details, see Statistics Canada Statistics Canada (2024c).

Figure 6 shows a steady upward trend in the Consumer Price Index (CPI) over time, indicating a consistent increase in the overall prices of goods and services in Canada. This reflects gradual inflation and changes in the cost of living from the late 1990s to 2016.

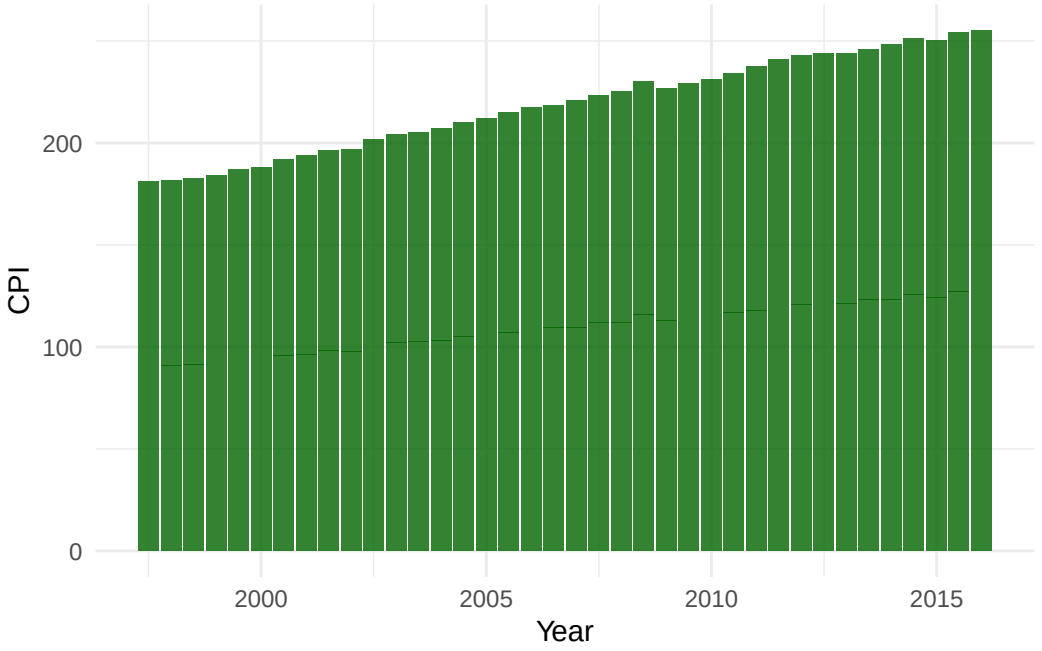

Figure 6: CPI

2.3 Summary

The data has been prepared for analysis through cleaning, transformation, and visualization. Each variable has been integrated into a cohesive dataset that will allow us to investigate how supply, demand, and economic indicators impact housing prices in Canada. Our initial analysis shows how housing prices in Toronto from 1997 to 2016 were shaped by various causes. The New Housing Price Index showed a steady rise, with notable growth from 2005 to 2008, a pause during the 2008 financial crisis, and consistent increases afterward. Construction peaked in the mid-2000s and stabilized post-2010, while home sales peaked earlier, around 2000-2005, before gradually declining. Economic growth and inflation, reflected in GDP and CPI, steadily increased, while interest rates peaked in the early 2000s and fell significantly after 2008. These patterns highlight the complex interaction between supply, demand, and economic conditions in influencing housing prices.

3 Model

3.1 Goal of the Model

We want to analyze house prices based on economic indicators like interest rates, GDP, and absorption. To do this, we created a model that looks at the relationships between these indicators and house prices, ensuring it's both accurate and easy to interpret.

3.1.1 Exploration and Refinement

1. Exploring the Data:
   We looked at the relationships between each indicator and house prices using scatterplots. For example:
   - Interest Rate: A clear negative relationship—higher rates are linked to lower house prices. Figure 7

- GDP and CPI: Both show strong positive relationships with house prices. Figure 8
- Absorption: Also negatively linked to house prices, but with more variability. Figure 9

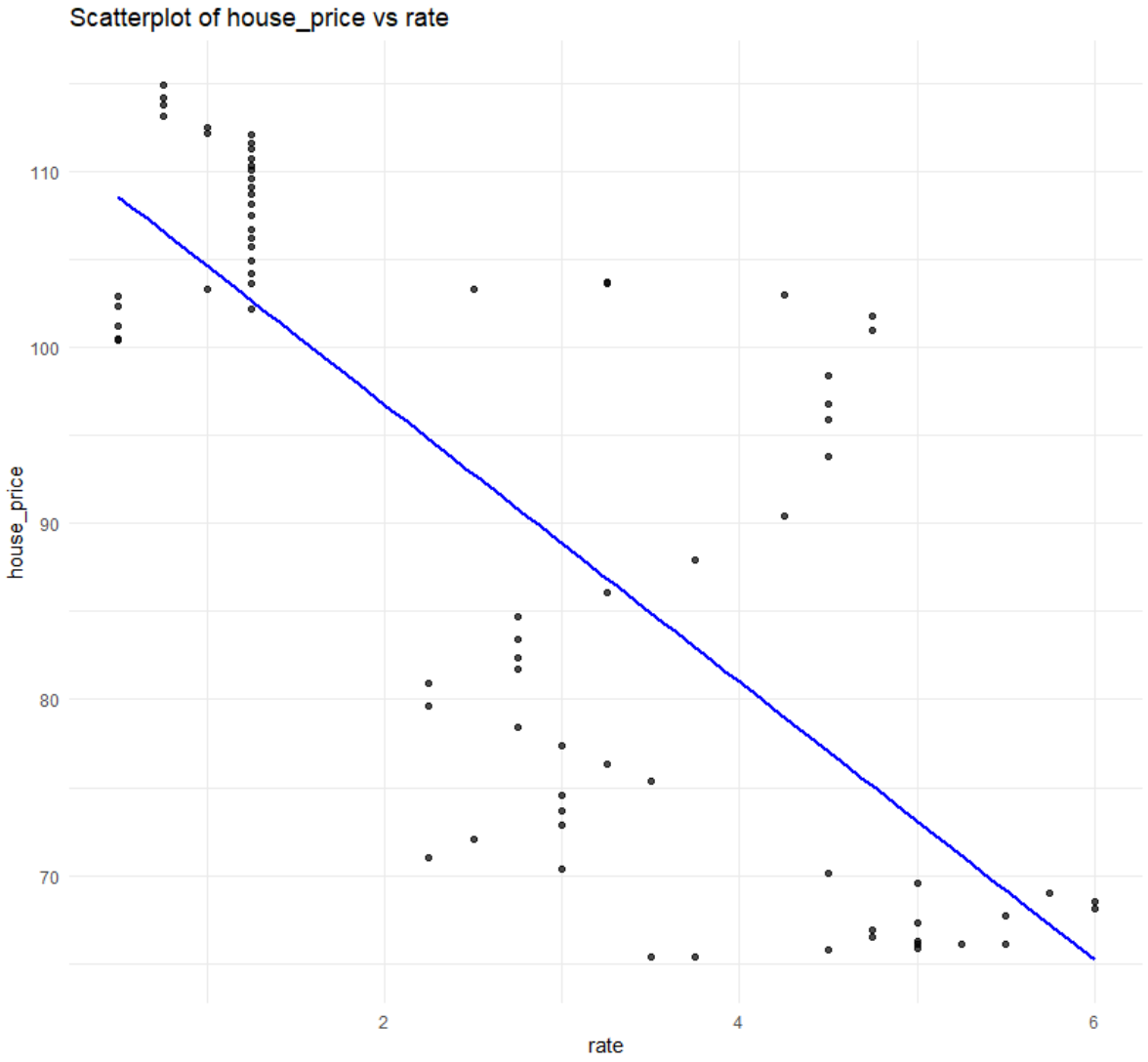

Figure 7: House Price vs Rates

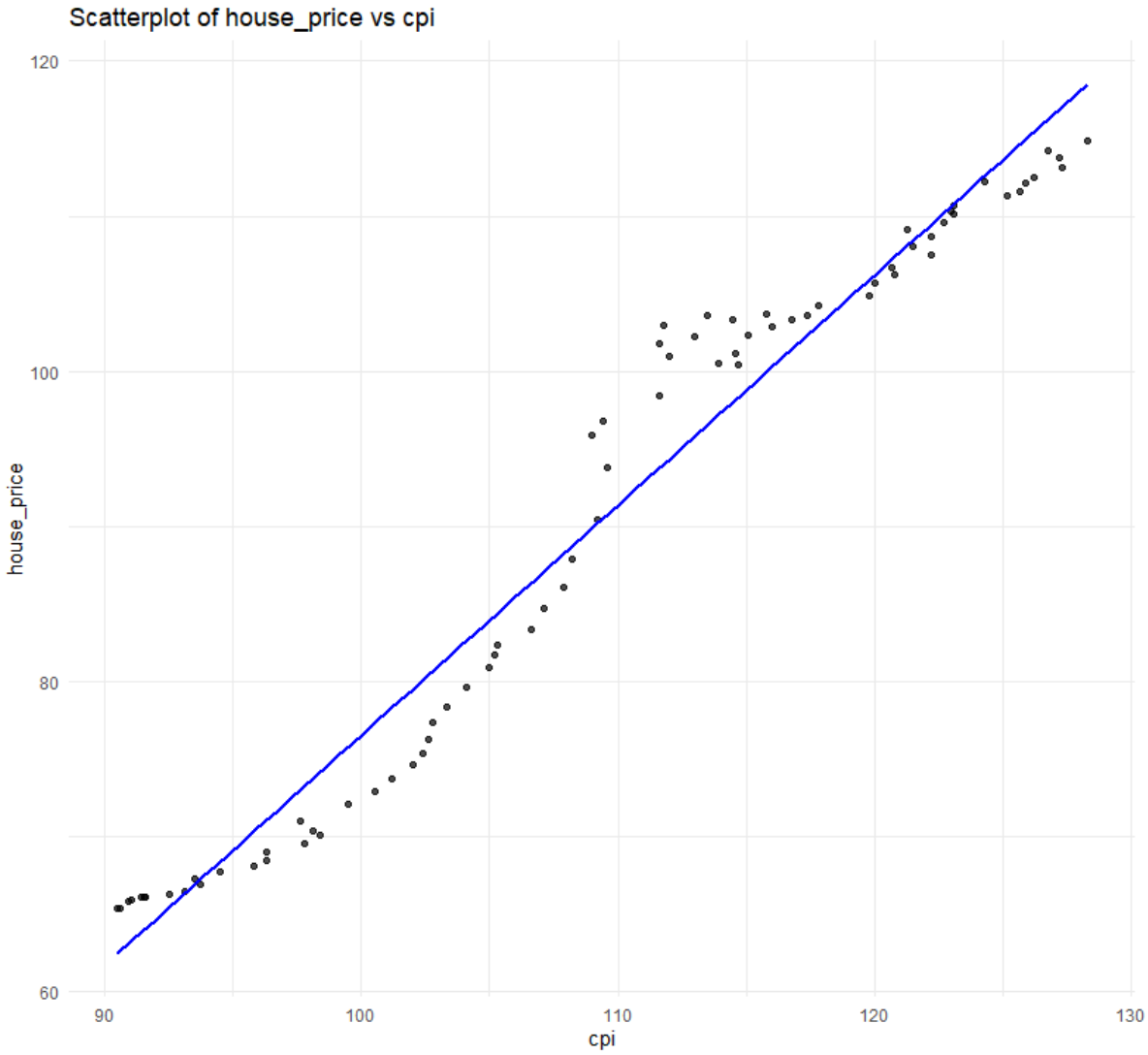

Figure 8: House Price vs Rates

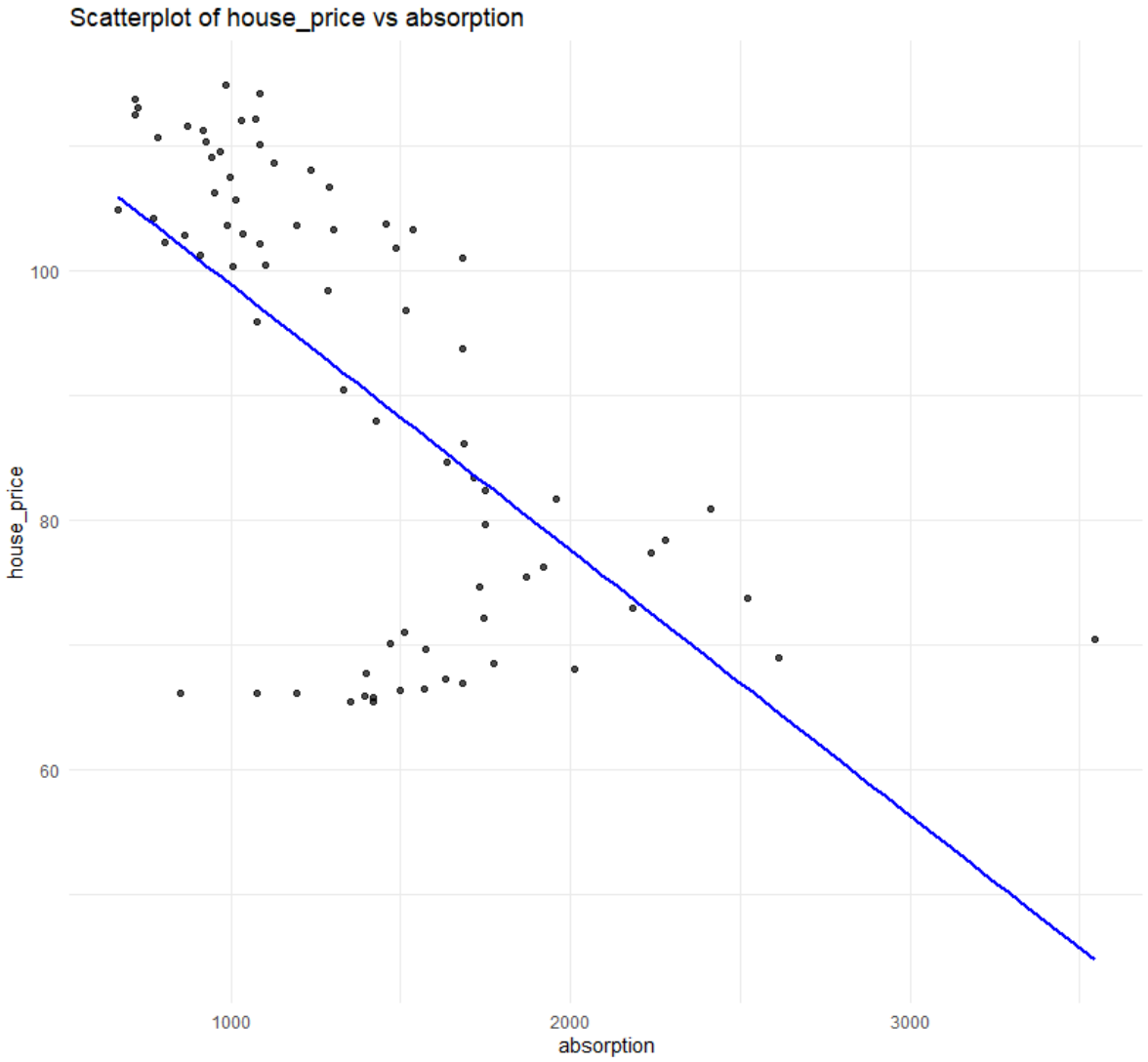

Figure 9: House Price vs Rates

To ensure these indicators don't overlap too much in their information (a problem called "multicollinearity"), we used a tool called the Variance Inflation indicator (VIF). This told us that GDP and CPI were too similar to both be useful, so we removed GDP to simplify the model.

2. Checking Assumptions:
   For our model to work well, it needs to satisfy certain assumptions:

   - Linearity: The relationships between indicators and house prices should follow straight lines.
   - Consistent Variance: The errors in our predictions (residuals) should spread out evenly.
   - Normal Distribution: The residuals should follow a bell-shaped curve.

We checked these assumptions using plots: - Residuals vs. Fitted: Showed some patterns, suggesting the need for possible tweaks. - Scale-Location Plot: Slight inconsistencies in error spread, indicating minor heteroscedasticity (unequal spread of errors). - Normal Q-Q Plot: Mostly aligned with expectations, except for a few extreme points (outliers).

3. Refining the Model:
   We used step-by-step selection to find the most important indicators. The final model kept:

   - Interest Rate: Lower rates are linked to higher house prices.
   - GDP: A major positive influence.
   - Absorption: Significant but negatively linked, meaning more market activity tends to reduce prices.

We removed construction because it wasn't contributing much.

3.1.2 Final Model Performance

1. Key findings:

   - The model explains 97% of the variation in house prices, showing it's highly accurate.
   - It performs well on both the training and test data, proving it's reliable for predicting unseen scenarios.

2. Metrics:

   - RMSE (typical error): 3.71
   - MAE (average error): 2.7
   - (R^2) (accuracy): 0.97%

4 Results

Our results are summarized in Table 1.

Table 1: Summary of NHPI Model Results

indicator	Effect_on_NHPI
Bank Interest Rate	0.99 per unit increase
CPI	1.53 per unit increase
Housing Absorption	-0.003 per unit increase

Our analysis shows beneficial findings into how economic indicators influence the New Housing Price Index (NHPI). A 1% increase in bank interest rates corresponds to a 0.99 increase in the NHPI, while inflation, as measured by CPI, has a significant positive effect on housing prices, with a one-unit increase in CPI leading to a 1.53-unit rise in the NHPI. Interestingly, housing absorption, which tracks how many new houses are sold, shows a slightly negative relationship, with each additional house sold decreasing the NHPI by 0.003.

It is important to note that these changes do not occur in isolation. As this is a linear regression model, the effects of interest rates, CPI, and housing absorption are interdependent and influence each other to produce these figures. Individually, these relationships might seem counterintuitive or incomplete. However, taken together, they paint a cohesive picture. The analysis suggests that the strongest impact on housing prices occurs when both interest rates and CPI are decreased simultaneously, signaling a robust economy and leading to a decline in housing prices. Meanwhile, housing absorption has a relatively minor impact on price fluctuations, indicating that supply-demand dynamics play a less significant role compared to broader economic indicators. This interconnected understanding highlights the complexity of housing market dynamics and the importance of considering multiple indicators in economic analysis.

5 Discussion

5.1 Diverse Opinions on Housing Affordability

Housing affordability has become an important issue, sparking widespread debate on how best to address the crisis. Solutions range from increasing housing supply to implementing demand-side policy measures. This paper aims to contribute to the discourse by assessing the effectiveness of these solutions using data based findings. By analyzing the relationships between key economic indicators and the New Housing Price Index (NHPI), this study identifies impactful levers to improve affordability.

Andrew Crosby's article Crosby (2024) highlights a balanced approach to tackling rising housing costs, emphasizing both supply-side measures—such as building affordable housing, protecting existing stock, and investing in public housing—and demand-side interventions, including tenant protections, rent controls, and reducing speculative real estate practices. The article calls for stricter regulations on financialized landlords, long-term affordability commitments, and collaborative efforts between governments and developers to resist gentrification and ensure housing accessibility for marginalized communities.

In line with these recommendations, the Canadian government recently announced a two-year extension to the ban on foreign ownership of residential housing Department of Finance Canada (2024) , now set to expire in 2027. This initiative, part of a broader strategy to address affordability, aims to prioritize housing for Canadian families. Complementary measures include accelerating housing construction, enhancing affordability, and supporting vulnerable populations through significant federal investments and policy reforms.

5.2 Housing Demand

Housing demand is often cited as a major driver of prices, especially in high-demand areas with limited supply. Economic growth can also increase construction costs, which builders pass on to buyers, further inflating prices. However, the data suggest that demand is not as significant a contributor to housing prices as other economic indicators.

Interestingly, housing absorption—the rate at which new homes are sold—shows an inverse relationship with the NHPI. For every additional house sold, the NHPI decreases by 0.0003. This finding implies that higher absorption rates often reflect increased supply, competitive pricing strategies by builders, or both. Simply put, a busy housing market can lead to lower prices due to greater availability.

5.3 True Impact on Housing Prices

The analysis shows that inflation and interest rates exert a significantly greater influence on housing prices than demand. As highlighted by Bayan Yousef Farhan in Farhan (2024) , rising Canadian house prices are strongly impacted by inflation and increasing bank interest rates, which raise mortgage costs and reduce purchasing power, thereby exacerbating affordability challenges.

5.4 Weaknesses and Next Steps

While this study provides an important observation, it is not without limitations. A key weakness is the reliance on aggregated data, which may obscure regional disparities. For example, housing market dynamics in metropolitan areas like Toronto may differ substantially from those in smaller cities or rural regions. Future research should incorporate more granular data to capture these variations.

5.4.1 Incorporating Additional Predictors

Another limitation is the exclusion of indicators such as population growth, zoning regulations, and international investment trends. Including these variables in future models would provide a more complete understanding of the drivers of affordability.

5.4.2 Addressing Policy Implications

The study emphasizes the importance of coordinated policy interventions. While interest rate adjustments, economic growth management, and supply-side strategies each affect affordability, their combined impact may be more significant. Policymakers should consider integrated approaches that balance demand- and supply-side measures to achieve long-term housing affordability.

5.5 Conclusion

This paper underscores the complexity of addressing housing affordability through a data based approach. By analyzing the NHPI and its key predictors, it identifies actionable criteria into the economic indicators shaping housing markets. The findings highlight the roles of interest rate policies, economic growth alignment, and efficient housing production in improving affordability. Looking ahead, addressing regional disparities, incorporating additional predictors, and adopting multi-faceted strategies will be essential for developing sustainable solutions to the housing crisis.

A Appendix

A.1 Appendix: Methodological Exploration of Data Collection and Sampling

This Appendix explores the methodologies used in the collection and analysis of the datasets utilized in this study, particularly focusing on the reliability and representativeness of the New Housing Price Index (NHPI) and associated economic indicators. By examining the methods of data collection, sampling techniques, and potential biases, we aim to contextualize our findings within the broader field of housing market analysis.

A.1.1 Data Collection Methodology

The New Housing Price Index (NHPI) is collected through monthly builder surveys that track the prices of new single, semi-detached, and townhomes across 27 Canadian cities. Builders report separate prices for the house and land to ensure consistency, and adjustments are made for changes in quality, like size or features, to measure "pure" price changes. However, the exclusion of custom-built homes and limited regional coverage may underrepresent certain housing trends. This structured approach ensures reliable data for understanding housing market dynamics.

Other economic indicators, such as GDP, CPI, and interest rates, are derived from a mix of data sources including Statistics Canada surveys, government administrative records, and financial institutions. GDP data relies on monthly estimates projected from annual Supply and Use Tables using indicators like real output and employment. CPI is collected through surveys of retail prices across various goods and services to measure inflation, while interest rates are monitored directly from financial markets and reported by institutions. Aggregation processes, like deflation and index chaining, ensure consistency and accuracy, while no direct sampling is used for interest rate data.

The NHPI survey employs a multi-stage sampling approach, ensuring consistent coverage across 27 Canadian cities by focusing on builders with significant market activity. This method aligns with the principles of stratified sampling by stratifying builders geographically to represent regional trends. A key strength of this approach is its ability to maintain consistency over time by tracking prices for comparable house models. However, the exclusion of custom-built homes and regions with lower construction activity limits the dataset's extensive, potentially underrepresenting smaller markets and unique housing segments.

A.1.2 Sampling Considerations

The NHPI targets new single, semi-detached, and townhomes in 27 Canadian cities, focusing on regions with significant construction activity. This population of interest is not fully representative of the entire housing market, as it excludes rural areas and custom-built homes.

Custom-built homes often differ significantly in design and cost, and their exclusion may result in an incomplete understanding of housing price trends. Furthermore, by prioritizing urban areas with higher construction activity, the NHPI may overemphasize trends in larger markets while underrepresenting housing dynamics in smaller or rural regions.

The NHPI employs a multi-stage sampling approach, with stratification by city to ensure geographic representation. Builders are selected based on their residential building permit values, ensuring that the sample reflects active market participants. While this stratified method enhances consistency and reliability, potential biases remain. For instance, reliance on self-reported data from builders may introduce inaccuracies, and the exclusion of lower-activity regions could skew national estimates. Although adjustments such as weighting are applied to improve representativeness, the dataset's urban focus limits its ability to capture the diversity of housing trends across Canada.

A.1.3 Bias and Measurement Errors

The NHPI data is susceptible to several biases and errors that could affect the validity of analysis. Builder surveys may introduce bias, as builders might have incentives to report lower prices to appear competitive or overreport quality adjustments to justify price changes. While inflation and cost change adjustments are applied to maintain data consistency, their robustness depends on the accuracy of the reported data, leaving room for error. Economic indicators like CPI and GDP, which involve complex calculations and data integration, may face issues such as data lags or misclassification of economic activities, potentially impacting their reliability as explanatory variables. Additionally, the NHPI's urban-focused sampling could lead to sampling bias, skewing conclusions toward trends in larger markets and underrepresenting rural housing dynamics. Mitigating these biases requires stricter validation processes for builder-reported data, cross-verification with independent market surveys, and more inclusive sampling strategies that account for diverse market conditions.

A.1.4 Simulation of Idealized Data

In simulation was designed to generate an idealized dataset representing potential housing market trends under different economic conditions, including broader geographic diversity and adjusted predictor distributions. Compared to the observed data, the simulated dataset Figure 10 shows higher variability in predictors like absorption and construction, reflecting hypothetical rural inclusion and varying economic environments. For instance, simulated values for GDP and CPI exhibit a wider range, which may capture conditions not fully represented in the observed urban-focused data. The results suggest that observed data may underrepresent variability in house prices associated with broader economic indicators, potentially leading to an overestimation of price stability. These findings highlight the importance of addressing the disparities of geographic and economic coverage, with implications for more accurate housing policies and market analyses.

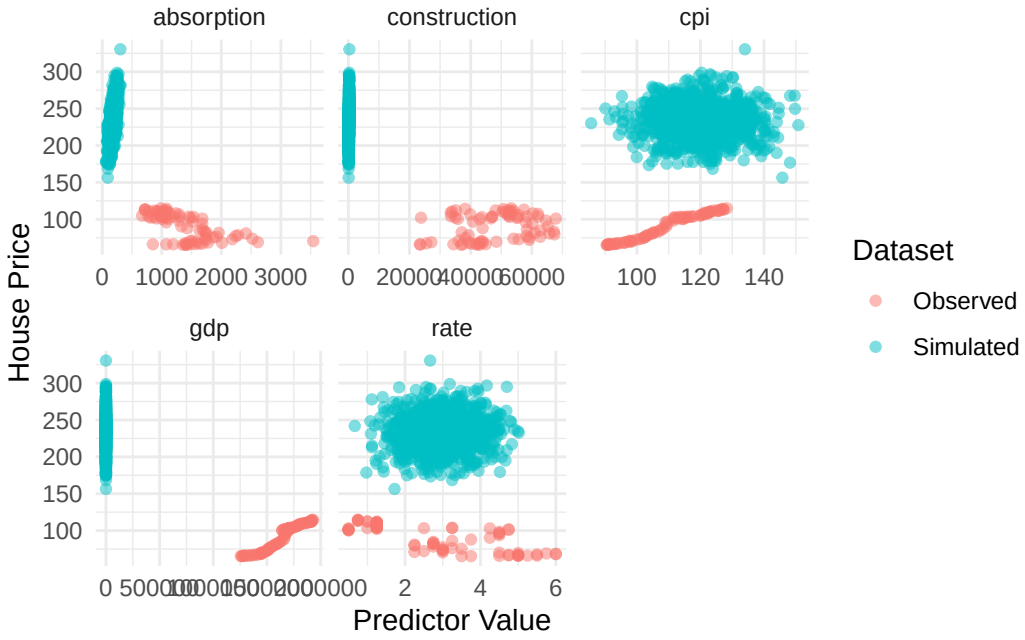

Figure 10: Simulated Data

A.1.5 7. Conclusion

This Appendix emphasizes the strengths and limitations of the NHPI and related economic indicators in analyzing housing trends. While the NHPI provides a reliable measure of urban housing markets, its exclusion of rural areas and custom-built homes limits its representativeness at the national level. Simulations revealed greater variability in an idealized dataset, suggesting that observed data may underrepresent broader economic conditions and housing trends. These observations underscore the importance of cautious interpretation when drawing conclusions from urban-focused datasets and highlight the value of incorporating additional data sources to improve representativeness and robustness in housing market analysis.

B References

I would thank to the developers and contributors of the R programming language and the ecosystem of R packages, including Wickham (2024), Kuhn (2023), Fox and Weisberg (2023), Wei and Simko (2023), Richardson, Korn, and Dunnington (2024), Wickham and Hester (2023b), Müller (2020), Blondel (2023), Wickham (2023), Grolemund and Wickham (2023), Wickham and Hester (2023a), Wickham et al. (2023), Zhu (2023),R Core Team (2023b) and Xie (2023). These tools helped with the data analysis, visualization, and statistical modeling

necessary for this study. Their capabilities have enabled a seamless workflow and enhanced the rigor of this research.

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