

The Evolution of the Wisconsin Housing Market: A Comprehensive Analysis of the Wisconsin Housing Market Over the Past 6 Years

The Wisconsin housing market is witnessing major alterations since seeing all-time high house sale prices and quantities directly following the pandemic. According to Houzeo.com, in May 2023, median home sale prices increased in Wisconsin by 6.0%, and at the same time the quantity of homes sold in May 2023 dropped by 20.9%. This disparity is creating a divide between buyers and sellers because homes are not selling as fast from sellers demanding prices buyers are not willing to pay. Coming from that, first time home buyers are having an increasingly tough time trying to find home within their budget. The analysis conducted throughout this paper gives buyers an inside look into the Wisconsin housing markets: historical, current, and future numbers to help paint a picture of the key elements that go into buying a home. Consumers will be able to dive into the Wisconsin housing market with confidence to always get a fair price on their prospective home no matter the economic outlook, geographical location, year, etc. In the end, the solution from this report will be a prediction for the 2024 Wisconsin housing market.

Our analysis leverages data from the State of Wisconsin Department of Revenue, Realtor.com, and the Federal Reserve Economic Data (FRED) database. These sources were selected for their comprehensive coverage of real estate transfer data, housing market statistics, unemployment rates, and labor force participation rates.

The State of Wisconsin Department of Revenue was utilized throughout all of the analysis/visualizations. Furthermore, Real Estate Transfer data were the datasets obtained from the sources. The datasets record every house purchase throughout the state of Wisconsin from 2018 to 2023 and uses a monthly aggregation. Together the data has 1,362,989 different values (rows/transactions) and 90 different variables (characteristics of house or transfer). The variables incorporate Year Transferred, Property Type, Total Acres, Transfer Fee, Zip Code, City, etc. This dataset was used to generate the geographical change in median house price by zip code, key summary statistics to compare to the U.S. housing market, run a correlation analysis with the unemployment rate and labor participation rate, and run a regression analysis to generate a model to predict the median housing market value.

[Link to Wisconsin Department of Revenue Data Source](#)

[Link to PDF with Variable Definition for Real Estate Transfer Data](#)

The Realtor.com dataset utilized in the analysis is the historical monthly inventory of key statistics of the US housing market from the time period of 2018 to 2023. After processing the data, there were 70 values (each month from the 6-year period) and 39 variables. The variables of interest for the analysis revolve around summary statistics: median housing sale price, days on the market, etc. This data was utilized to conduct a comparative analysis of the average housing market statistics of Wisconsin with the overall US housing market.

[Link to the Realtor.com Data Source](#)

[Link to FRED Unemployment Rate for Wisconsin](#)
[Link to FRED Labor Force Participation for Wisconsin](#)

Change % in Median Prices in Wisconsin Counties from 2018 - 2023

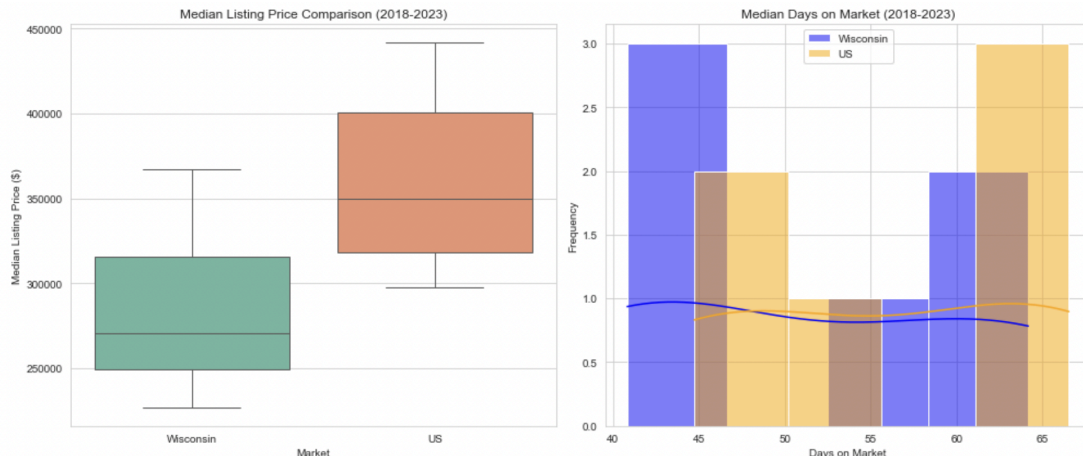
A map of Wisconsin divided into its 9 counties, each labeled with its name and a percentage representing the proportion of the population aged 65 and over. The colors range from dark red (highest percentage) to light yellow (lowest percentage).

County	Percentage (%)
Burnett	81.8%
Douglas	52.3%
Bayfield	60.0%
Ashland	15.1%
Ron	16.6%
Vilas	108.3%
Sawyer	33.8%
Price	36.2%
Oneida	4.5%
Florence	31.9%
Forest	34.4%
Polk	70.6%
Washburn	49.6%
Barron	69.4%
Rusk	123.0%
Taylor	9.4%
Lincoln	92.8%
Langlade	37.5%
Marinette	66.7%
St. Croix	84.1%
Dunn	53.6%
Chippewa	88.5%
Eau Claire	63.5%
Clark	40.0%
Menominee	251.9%
Oconto	41.3%
Percé	76.2%
Pepin	80.0%
Shawano	62.3%
Door	24.9%
Buffalo	42.8%
Trempealeau	25.0%
Jackson	46.0%
Wood	55.1%
Portage	40.1%
Waupaca	50.1%
Outagamie	66.7%
Brown	58.2%
Kewaunee	30.0%
Manitowoc	111.5%
La Crosse	46.7%
Monroe	22.1%
Juneau	39.6%
Adams	42.5%
Waushara	91.8%
Winnebago	68.8%
Calumet	65.9%
Sheboygan	81.8%
Marquette Lake	28.9%
Green Lake	72.0%
Fond du Lac	49.6%
Vernon	55.8%
Crawford	116.6%
Richland	10.2%
Sauk	196.3%
Columbia	78.9%
Dodge	53.0%
Washington	64.3%
Ozaukee	52.0%
Iowa	93.7%
Dane	59.5%
Jefferson	53.8%
Waukesha	67.6%
Milwaukee	67.5%
Lafayette	13.6%
Green	75.4%
Rock	66.5%
Walworth	32.6%
Racine	45.4%
Kenosha	64.8%

Areas of particular interest to me are the Northwest of Madison/Dane County, where there was a lot more growth than inside of Dane County itself, and Northern Wisconsin, where there was generally limited growth compared to the rest of the state.

Visualization 2: Summary of key statistics that compared to the overall United States housing market

These visual tools were selected for their clarity and accessibility, favoring intuitive graphic representations over complex statistical tables and catering to an audience that may not possess extensive experience in statistical analysis.



The box plot illustrates the distribution of median listing prices in Wisconsin's median prices are consistently lower than the US median, suggesting more affordable housing options within the state. The spread of prices in the US, as indicated by the boxplot's range, is wider than Wisconsin's, implying a more varied market that likely includes both very high and very low-priced listings. The presence of outliers or extreme values in the US data could also indicate significant variations in housing prices, possibly due to luxury markets or areas with highly depressed prices.

The lower median listing price in Wisconsin points to a more accessible housing market, which might be attractive to homebuyers who are looking for affordability. However, the gradual increase in prices over the years should be noted, as this trend could lead to a narrowing of the affordability gap.

The histogram displays the distribution of the median number of days that listings are on the market before being sold. Both Wisconsin and the US show a similar distribution shape, but Wisconsin's histogram is slightly shifted to the left, indicating a quicker sale of properties. The median days on the market for Wisconsin are less than the US average, which might suggest higher demand or more efficient turnover in the real estate market in Wisconsin.

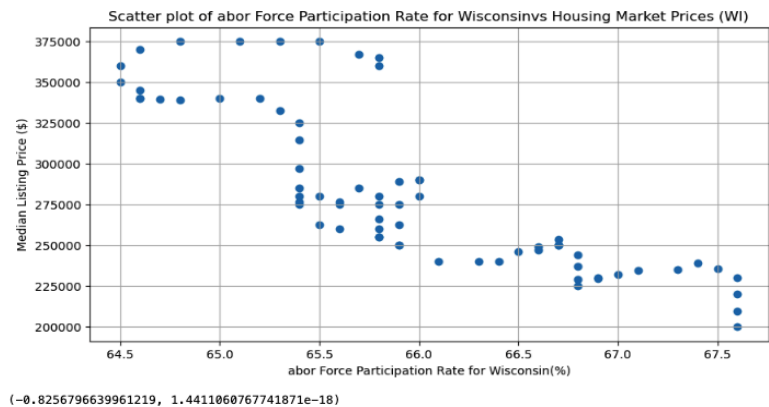
The quicker turnover of properties in Wisconsin, as shown by the median days on market being lower than the US average, indicates a robust housing market. It could be due to a variety of factors, such as economic growth in certain areas, a strong job market attracting new residents, or possibly a lower inventory of available homes creating a seller's market.

The synthesis of these visualizations provides a narrative on the Wisconsin housing market's position and trajectory, offering a foundation for policy advocacy and strategic decision-making.

Visualization 3: Correlation analysis between the unemployment rate, federal funds Effective Rate and labor participation with the strength of the housing market in Wisconsin

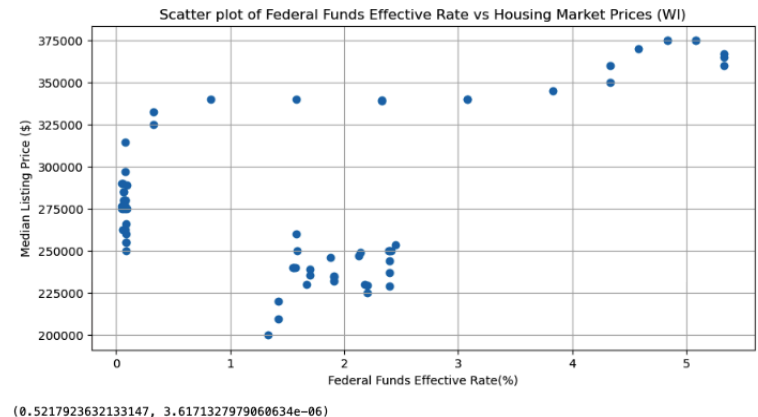
The first scatter plot looks at the relationship between labor force participation and the median home listing price. The Pearson correlation coefficient of -0.82 indicates a strong negative relationship between labor force participation and the median home listing price. This indicates that as the labor force participation rate rises, the median home listing price tends to fall.

Nonetheless, the obtained p-value is very small (about $1.4e-18$), implying that the likelihood of seeing such a correlation by chance is extremely low. As a result, this correlation is statistically significant. The observed -0.82 Pearson correlation coefficient between labor force participation rate and median home listing price could be influenced by a variety of economic factors. One plausible explanation is that a higher labor force participation rate often implies that more people are entering the labor force, which can lead to higher household income at the bottom of the income distribution. As newly employed individuals look to rent or buy their first homes, this economic activity may stimulate demand for more affordable housing. However, if increased labor supply puts downward pressure on wages or if job growth is concentrated in lower-paying sectors, the population's overall ability to afford higher-priced homes may decline, lowering the median home listing price.



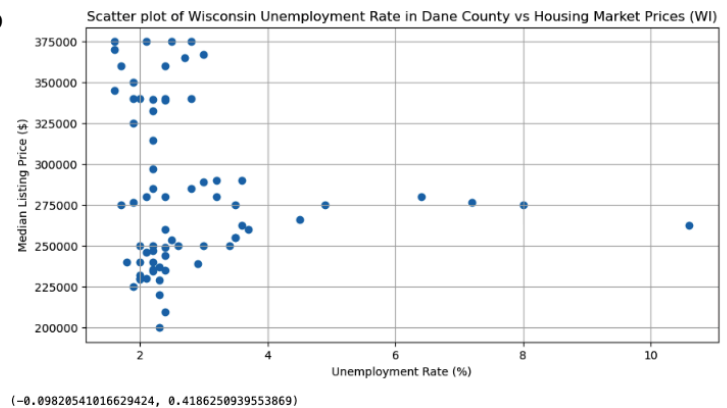
This scatter plot reveals a moderately positive correlation between the Federal Funds Effective Rate and median housing market prices in Wisconsin, with a Pearson correlation coefficient of 0.5217. This coefficient indicates that as the Federal Funds Rate increases, there is a tendency for the median listing prices of houses to also increase. The correlation is supported by a p-value of $3.62e-06$, which is significantly lower than the conventional threshold of 0.05, suggesting that the relationship between the two variables is statistically significant.

Despite the moderate strength of this correlation, the causality cannot be inferred, and there may be other contributing factors influencing housing prices that are not accounted for in this scatter plot. The scatter plot shows a moderately positive relationship between the Federal Funds Effective Rate and the median price of a home in Wisconsin. The data points are mostly grouped between the 1% rate and the 1-3% rate range. This can be understood in terms of monetary policy and the housing market. If monetary policy is more loose, the Federal Funds Rate is likely to be lower, around 1% to 3%. Loans and spending, like

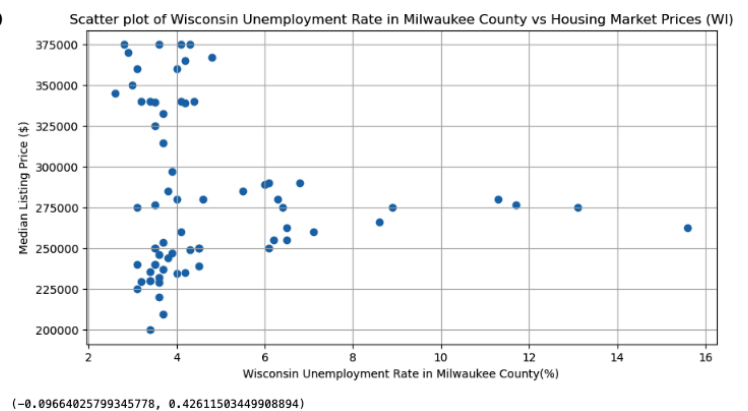


buying a house, are more likely to happen when interest rates are low. When mortgages get cheaper, more people buy homes, which drives up prices. The cluster in this range shows that steady buying during times of low interest rates drove up the median listing price because of higher demand. The high number of data points at 1% could mean that interest rates were low for a while. This could have been in response to a downturn in the economy or as an attempt to get things going again. Because bond returns are lower, it's cheaper for people to borrow money to buy a home, and investors may buy real estate as an investment. As more people want to buy homes, prices may go up.

The scatter plot examining the relationship between the unemployment rate in Dane County, Wisconsin, and the median listing prices of houses indicates a very weak and statistically insignificant correlation. The Pearson correlation coefficient of -0.0982 suggests a negligible inverse relationship, meaning that as the unemployment rate marginally increases, the median housing prices slightly decreases. However, the value is so close to 0 that it denotes an almost non-existent linear relationship. Furthermore, the p-value of 0.4186 far exceeds the standard significance level of 0.05, reinforcing that the correlation observed is not statistically significant. Therefore, based on this data, there is no substantial evidence to suggest that variations in the unemployment rate have a meaningful impact on the housing market prices within Dane County.



The scatter plot examining the relationship between the unemployment rate in Milwaukee County, Wisconsin, and the median listing prices of houses indicates a very weak and statistically insignificant correlation. The Pearson correlation coefficient of -0.0982 suggests a negligible inverse relationship, meaning that as the unemployment rate marginally increases, the median housing price slightly decreases. However, the value is so close to 0 that it denotes an almost non-existent linear relationship. Furthermore, the p-value of 0.4186 far exceeds the standard significance level of 0.05, reinforcing that the correlation observed is not statistically significant. Therefore, based on this data, there is no substantial evidence to suggest that variations in the unemployment rate have a meaningful impact on the housing market prices within Milwaukee County.



In conclusion, in Wisconsin, an analysis of economic indicators suggests a complex interaction with housing market dynamics. A strong negative correlation between labor force participation and median home prices implies that higher employment may lead to more demand for affordable housing, thereby decreasing median prices. In contrast, the Federal Funds Rate

shows a moderate positive correlation, indicating that higher interest rates, often associated with economic growth, may elevate home prices. Unemployment rates in Dane and Milwaukee counties, however, demonstrate a negligible inverse correlation with housing prices, indicating a minimal impact. These findings highlight the multifaceted and nuanced influences on housing markets, where factors like labor participation and interest rates have statistically significant correlations with housing prices, while unemployment rates do not exhibit a substantial relationship in the studied counties.

Visualization 4: Regression Analysis to construct the best-fit model for predicting medium home sale price

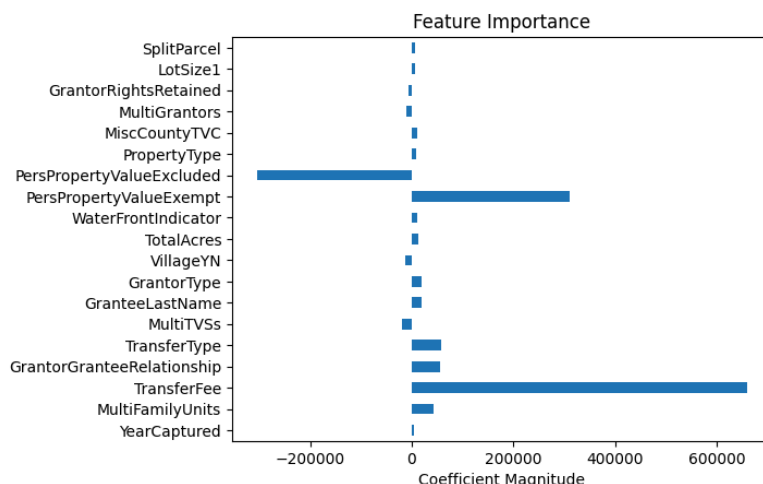
In this part of the analysis, a multiple linear regression model was generated to help predict future years median house sale prices. This type of regression was efficient for predicting housing values because numerous variables are usually required when obtaining a predicted housing price, and OLS (multiple linear regression) is one of the most suitable models when dealing with a lot of independent variables. The OLS model was generated in accordance with the variable selection methods of forward and backward selections, and this was presented with the final model equation and the bar graph of feature importance to showcase each coefficient used within the model and its corresponding variable name. Lastly, a r-squared value, scatter plot, and residual plot were created to evaluate the model and showcase its strength.

Model Equation and Feature Importance Bar Graph:

Model Equation:

```
y = 254849.3645 + 5381.0984 * YearCaptured + 42428.4667 * MultiFamilyUnits + 660530.3222 * TransferFee + 56324.9560 * GrantorGranteeRelationship + 58204.0786 * TransferType + -18549.2773 * MultiTVSs + 20290.2271 * GranteeLastName + 18327.5635 * GrantorType + -12910.0692 * VillageYN + 12911.9864 * TotalAcres + 11296.0263 * WaterFrontIndicator + 310547.6696 * PersPropertyValueExempt + -305007.9821 * PersPropertyValueExcluded + 9686.5846 * PropertyType + 9977.9099 * MiscCountyTVC + -10217.8112 * MultiGrantors + -6903.7573 * GrantorRightsRetained + 6676.6231 * LotSize1 + 6717.2073 * SplitParcel
```

The model equation is the most proficient model to predict the housing values of houses in Wisconsin given all of the variables within the Wisconsin housing dataset. Using forward and backward stepwise for variable selection, the most efficient model was garnered because only variables with a significant p-value were kept within the model. Then a corresponding coefficient was calculated to generate the model to help users craft an estimated home sale price for their prospective house. Next, the feature importance graph has the coefficient magnitude for each variable retained within the model equation. The larger the bar showcases larger importance within the model because one incremental increase in the variable will report a higher increase in the overall home sale price. Lastly, if the bar in the bar plot is right in direction correlates with a positive impact on the

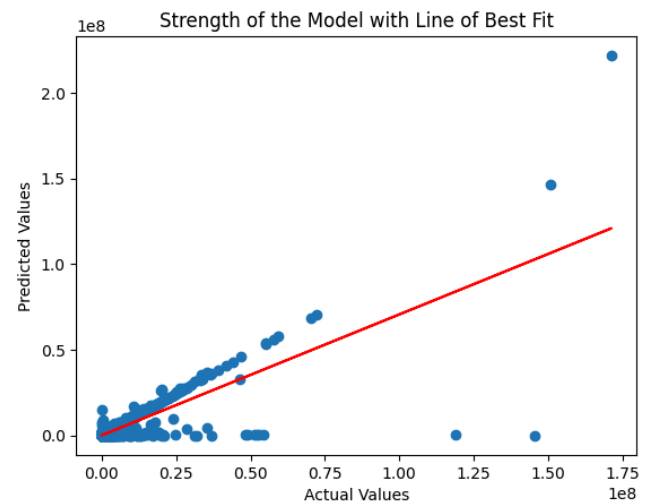
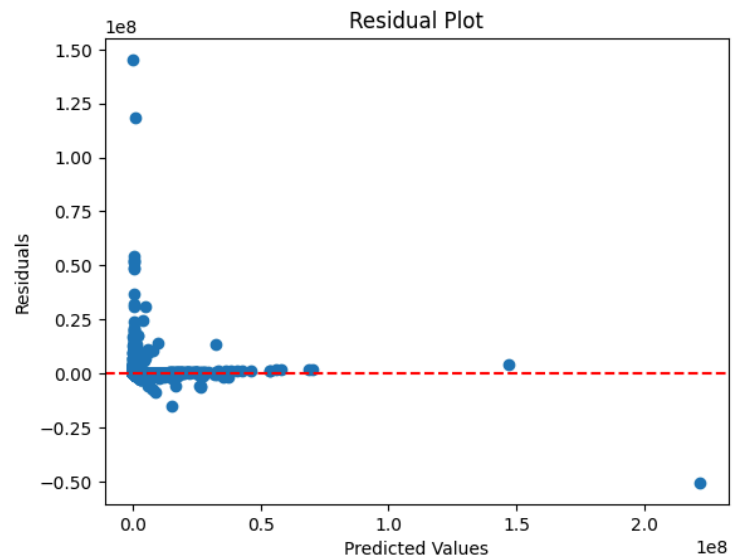


equation, and the left direction correlates with a negative impact on the equation. One key observation is that the value of the TransFee is heavily associated with a positive impact on the model generated.

R-Squared, Scatter Plot, and Residual Plot:

R-Squared: 0.6618

A 0.6618 r-squared says that 66.18% of the variance in the predicting of the home sale price model is explained by the predictor variables. This means that there is a moderate amount of the variance explained within the model, however; with the housing data being vastly complex and combining 90 variables together, producing a model with over 60% explanation of variance shows sufficient ability in the model to predict the home sale price of a house. This test was conducted on a test set from the overall data set with a split parameter of 0.20 (20% went into the testset). Coming from that, the scatter plot visualizes this r-squared value to show how well the model was at predicting the home sale prices in relation to the actual values recorded. At the same time, the evidence of moderate strength is present because the points are somewhat spread around the line of best fit showing there is presence of structure. The residual plot shows the distances between observed values and predicted model values. First, randomness/no clear path are aspects of a residual plot to show that the errors are not systematically in correlation with the predicted values, and this is not very strong within the plot because a subtle pattern can be seen within the data points around the zero line. Second, constant variance helps strengthen against the notion of heteroscedasticity (varying variance within the errors), and this is evident in the plot with the data point revolving around the zero line at roughly the same distances.



Results/Solution:

Prediction of the Median Home Sale Price in 2024 (Based on Average Values of Variables in the Model During August 2023):

\$305,582.91

The analysis's multiple linear regression model generated the price point. This showcases that the current trend of subtle increases year over year are expected to continue. All in all, potential consumers entering the housing market in Wisconsin should highly consider making their first home purchase in Wisconsin due to the prediction not showing any massive imbalances making the median home price shoot up more than usual. But at the same time, potential buyers should dive deep into their personal desires when looking to buy a house. All of the evidence and variable selection in the model can be quickly skewed if someone's desires to select altering variables for their ideal house would differ from the model's variables.

Top 5 Counties for First Time Home Buyers:

- Wood County
- Winnebago County
- Waushara County
- Waupaca County
- Waukesha County

County Name	Median Household Income	Unemployment Rate Percentage	Percentage Change in Median House Price	Composite Score
Wood County	55141	3.40	55.1	1.000000
Winnebago County	55139	2.58	68.8	0.985714
Waushara County	55137	3.36	91.8	0.971429
Waupaca County	55135	2.96	50.1	0.957143
Waukesha County	55133	2.57	67.6	0.942857

After conducting a spatial analysis on the change in median house sale price, a composite score was calculated in relation to the counties median household income, unemployment rate, and percentage change in median house price. Coming from this, all variables were weighted the same. In the end, the top 5 recommended counties for first time home buyers to look at as potential landing spots are Wood, Winnebago, Waushara, Waupaca, and Waukesha county.

Conclusion:

The comprehensive examination of the Wisconsin housing market over the preceding six-year period has elucidated a complex interplay of economic forces. Amidst global uncertainties and the recalibration of the market in the post-pandemic era, the Wisconsin housing sector has exhibited notable resilience and adaptability. The results of this study show that even though median listing prices are going up, Wisconsin is still more affordable than the rest of the country. This makes it a better place to live and invest. The expedited turnover of properties, as evidenced by the median duration on the market, is indicative of a vigorous and dynamic market, suggesting sustained demand and a potentially flourishing local economy.

Aside from that, the correlation analyses done for this study show how the housing market is closely linked to bigger economic indicators like unemployment rates and the number of people working. Although the correlation between unemployment rates and housing prices emerged as statistically non-significant, the pronounced negative correlation with labor force participation rates reveals a complex economic tapestry that necessitates a nuanced and strategic policy response.

The employment of a multiple linear regression model advances our comprehension by forecasting future housing market valuations. With projections indicating a consistent increase in median house sale prices, it becomes imperative for market participants to approach with optimism that Wisconsin is not at fear of substantial increase in the median home sale price like many states are witnessing and can be seen as a strong economy for the future.

This white paper serves as a testament to the power of data-driven analysis in deciphering complex market trends. As we continue to monitor the Wisconsin housing market, it is crucial to remain cognizant of the delicate balance between growth and affordability, ensuring that the housing market remains a cornerstone of a thriving, inclusive economy.

References:

Houzeo (2023, November 8). *Wisconsin real estate market: Will it crash in 2023?*. Houzeo Blog. <https://www.houzeo.com/blog/wisconsin-real-estate-market/>

Realtor.com. (2023, November 9). *Residential Data*. Realtor.com Economic Research. <https://www.realtor.com/research/data/>

State of Wisconsin. (2023). *Real Estate Transfer Data*. DOR Real Estate Transfer Data. <https://www.revenue.wi.gov/Pages/ERETR/data-home.aspx>

U.S. Bureau of Labor Statistics. (2023b, October 20). *Labor force participation rate for Wisconsin*. FRED. <https://fred.stlouisfed.org/series/LBSSA55>

U.S. Bureau of Labor Statistics. (2023a, October 24). *Unemployment rate in Wisconsin*. FRED. <https://fred.stlouisfed.org/series/WIUR>