Wildfire Smoke and Property Values in Hartford, CT

Introduction

Hartford, Connecticut, known for its rich history and vibrant neighborhoods, is an economic hub with real estate playing a significant role in its GDP (source). However, the city faces an emerging challenge: wildfire smoke. While wildfires are geographically distant from Hartford, their smoke travels vast distances, impacting air quality, public health, and the local economy. This study explores the relationship between wildfire smoke and property values in Hartford, aiming to provide actionable insights for policymakers and residents.

The research addresses two primary questions:

1. **How does wildfire smoke impact Hartford's property values?**
2. **What trends can we predict for the future?**

By answering these questions, we aim to inform urban resilience planning and ensure Hartford's economic stability in the face of growing wildfire threats.

Background/ Related Work

Numerous studies have established the connection between air quality and economic outcomes. Poor air quality is associated with reduced real estate demand, lower property values, and diminished transaction volumes (source). Research also indicates that wildfire smoke negatively affects public health, increasing hospital admissions and mortality rates (source). However, limited work has been done to understand the long-term economic impacts of wildfire smoke on urban property values.

For this study, we utilized the following datasets:

1. **Wildfire datasets (1961–2021):** Information on wildfire size, duration, and proximity to Hartford.
2. **Hartford real estate sales records:** Included property values, transaction volumes, and assessed values.
3. **Air Quality Index (AQI) data:** Captured daily air quality levels to contextualize the environmental impact.

This study builds on existing work by examining how historical wildfire smoke exposure correlates with Hartford's property values and forecasting future trends.

Methodology

My analysis combined statistical modeling with time series forecasting. The key steps included:

1. **Data Cleaning and Preprocessing:**
   ○ Converted dates to a common format for merging datasets.
   ○ Imputed missing values using forward-fill and median imputation.
   ○ Generated lagged variables for smoke exposure (1-month, 3-month, and 1-year lags).
2. **Regression Analysis:**
   ○ Used a regression model to quantify the relationship between smoke exposure, air quality, transaction volumes, and property values.
   ○ Included interaction terms to capture complex dynamics.
3. **Forecasting:**
   ○ Implemented ARIMA models to predict future trends in property values, accounting for key predictors like smoke exposure and transaction volumes.
4. **Human-Centered Considerations:**
   ○ Ensured data transparency by documenting data sources and methods.
   ○ Prioritized ethical data use, especially when working with sensitive economic and environmental data.

Findings

Finding 1: Smoke's Impact on Property Values

Wildfire smoke significantly reduces property values in Hartford. However, the impact is not immediate. Our analysis shows that property values respond most strongly to smoke exposure from 1–3 years prior. This lag highlights the long-term economic consequences of wildfire smoke, as seen in the declining median sale amounts during years following high smoke exposure.

Visual: Line graph showing smoke impact vs. property values.

Cumulative Smoke Impact Estimate vs Median Sale Amounts Per Year (2001 to 2020)
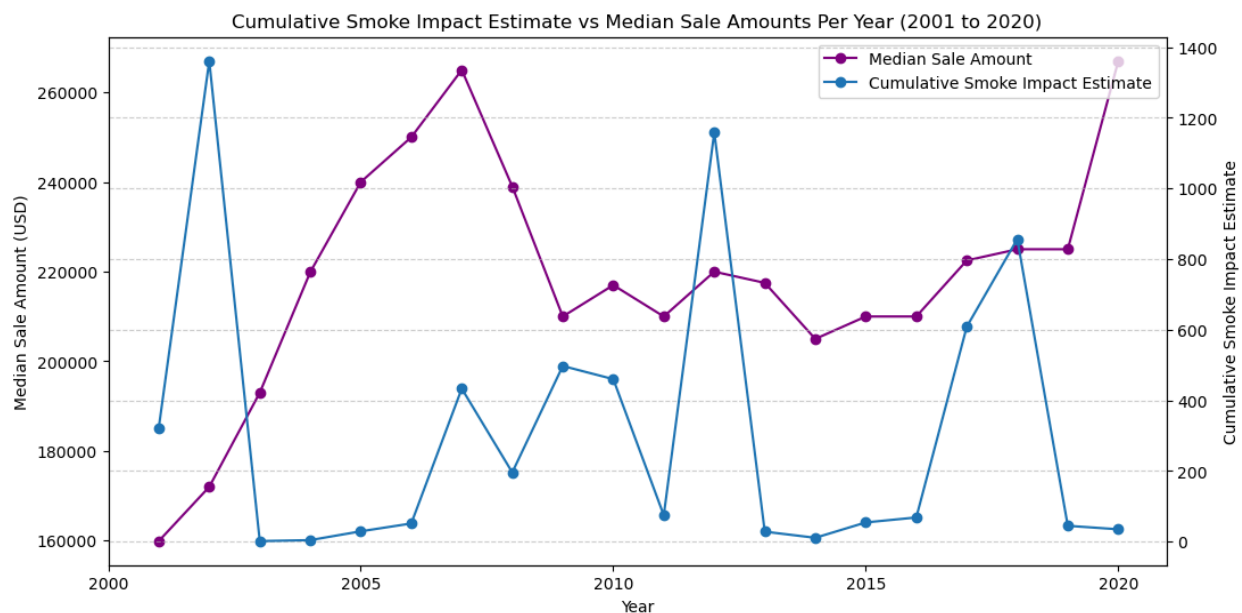
Finding 2: Air Quality and Transaction Volumes Matter

Air quality plays a critical role in property value trends. Poor air quality correlates with declining property values, underscoring its importance as a predictor. Additionally, transaction volume is a strong indicator of future trends. High transaction volumes in smoke-heavy years provide insights into economic resilience and recovery.

Visual: Bar chart comparing transaction volumes in high vs. low smoke years.
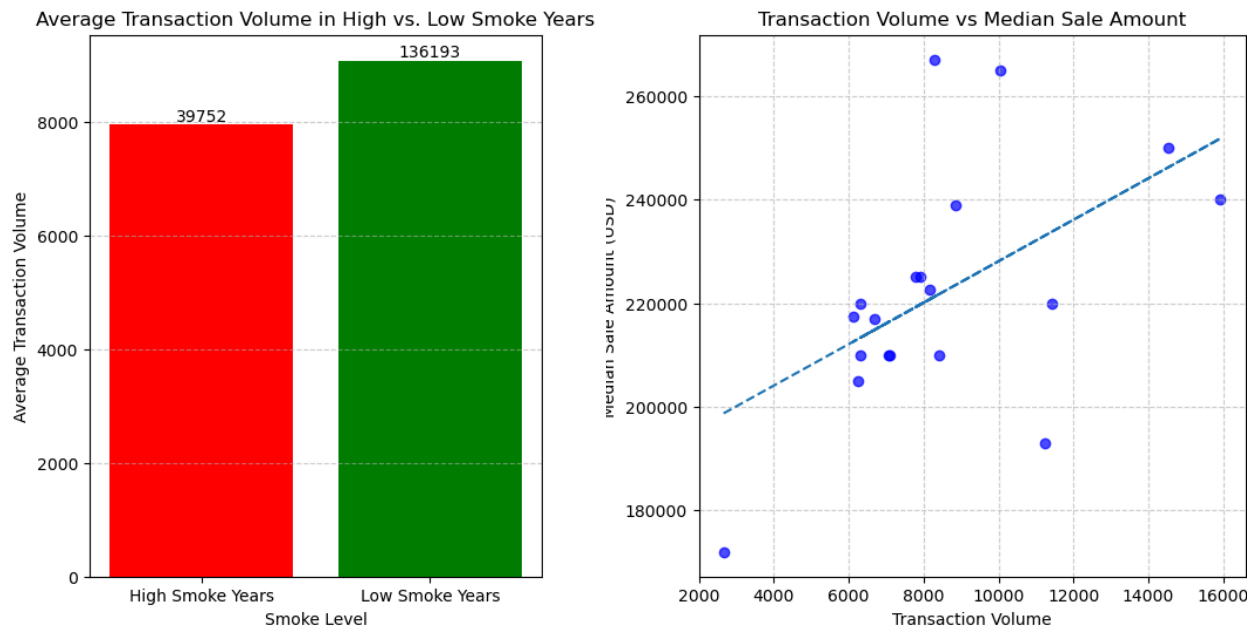
Forecast: Property Value Trends

Our forecast predicts stable property values in Hartford over the next decade, with occasional dips during high-smoke years. These predictions provide a roadmap for city planners to anticipate and mitigate economic impacts.

Visual: Line graph of historical vs. predicted property values.

Historical and Forecasted Median Sale Amount
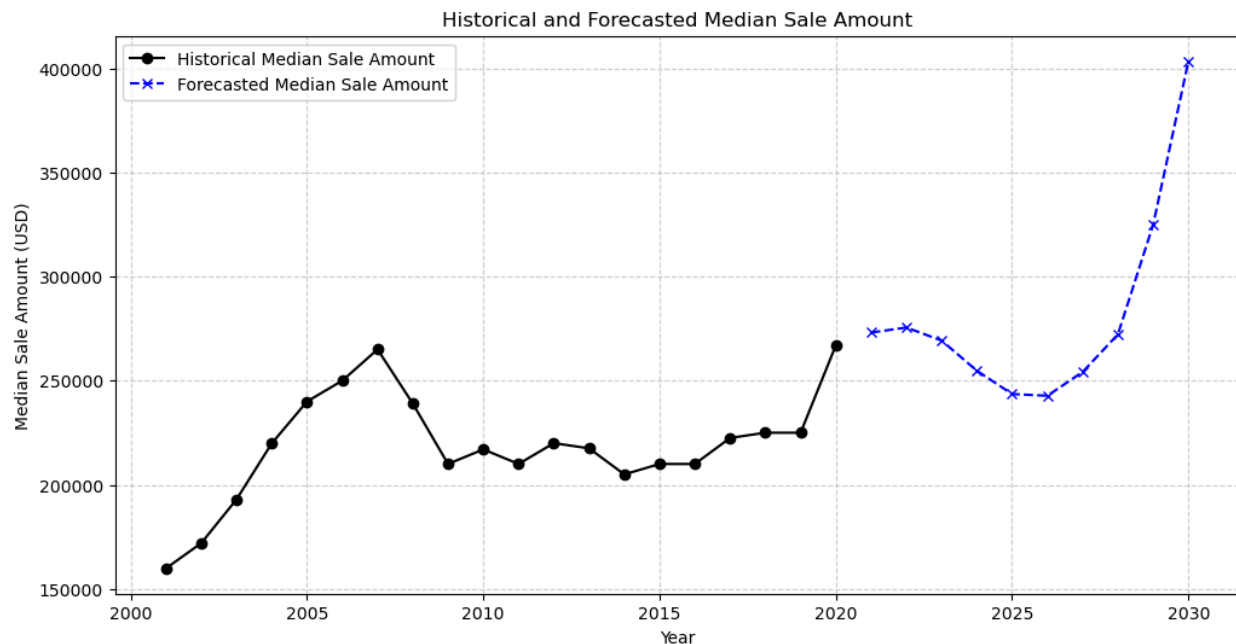
Discussion/ Implications

The findings of this study have significant implications for Hartford:

1. **For Policymakers:** Prepare for fluctuations in property tax revenues during high-smoke years. Consider introducing policies to mitigate the economic impacts of wildfire smoke.
2. **For City Managers:** Invest in air quality monitoring systems to better predict and respond to smoke events.
3. **For Residents:** Enhance public awareness and resilience through education and disaster preparedness.

By taking proactive steps, Hartford can protect its economy and community from the growing threat of wildfire smoke.

Limitations

Despite its insights, this study has several limitations:

1. **Data Limitations:** Some data points, such as precise wildfire smoke exposure in Hartford, relied on estimations and proxies.
2. **Model Assumptions:** The regression and ARIMA models assume linear relationships and stationarity, which may not fully capture the complexities of real-world trends.
3. **Generalizability:** Findings are specific to Hartford and may not apply to other cities with different economic or environmental conditions.

Future work should focus on improving data granularity and exploring non-linear modeling techniques.

Conclusion

This study sought to uncover the relationship between wildfire smoke and property values in Hartford, CT. We found that smoke exposure reduces property values, with delayed effects lasting years. Air quality and transaction volumes emerged as critical predictors of future trends. By addressing these challenges proactively, Hartford can safeguard its economic stability and quality of life.

References

Research papers on air quality and property values.
Studies on wildfire smoke and economic impacts.
Methodology and data analysis resources.

Data Sources

Wildfire Datasets: [Link to source]
Hartford Real Estate Sales Records: [Link to source]
Air Quality Index (AQI) Data: [Link to source]