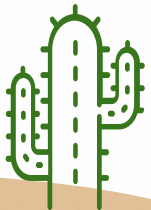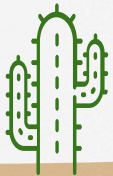# Wildfires Impact in Peoria, AZ

- Wildfires in general are increasing in frequency and intensity due to climate change, with far-reaching consequences.

- Peoria, AZ, is particularly vulnerable due to its proximity to wildfire-prone regions.

- Wildfire smoke not only impacts air quality but also has potential economic implications for local businesses.

Author: Amit Peled

My Focus: Local Economic Impact

Research Question: How does wildfire smoke impact air quality and the economic performance of companies in Peoria, AZ, and how can we predict future trends in both smoke impacts and economic outcomes?

Objective 1: Quantify wildfire **smoke impacts** in Peoria using historical data.

Objective 2: Explore how smoke impacts affect **stock performance** of local companies.
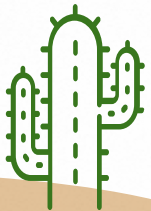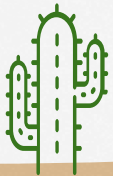
Data Sources

- **USGS Wildfire Dataset**: Fire size and distance to Peoria.
    - **Fire Year**: The year the wildfire occurred.
    - **GIS Acres**: Total area burned by the fire, measured in acres.

- **EPA AQI Dataset**: Air quality trends over 80 years.
    - **Year**: Year of data collection.
    - **AQI**: Air Quality Index value, indicating the air quality on that day

- **Alpha Vantage API**: Monthly stock prices for Peoria companies (Hand Picked).
    - **Ticker**: Stock symbol representing a company (e.g., AMKR, WAL).
    - **Date**: The specific trading date.
    - **Close**: The stock's closing price on a given date.
    - **S&P 500 Close**: The S&P 500 closing price on the same day for market trend comparison.

How Wildfire Smoke Trends Over Time

Measuring Smoke Impact:
- Calculated using:
  - Fire size (acres burned).
  - Distance to Peoria.
  - Seasonal occurrence (May–October).

Smoke Impact = Acres Burned / (Distance^2)

Smoke Impact Findings:
- Increased since the 1960s.
- Correlation observed between smoke impact and average air quality (AQI).
- Smoke from nearby wildfires worsens local air quality. (Peak smoke years align with AQI spikes.)
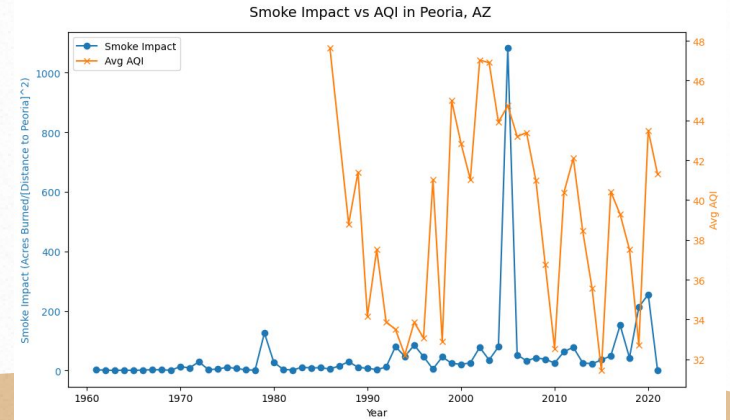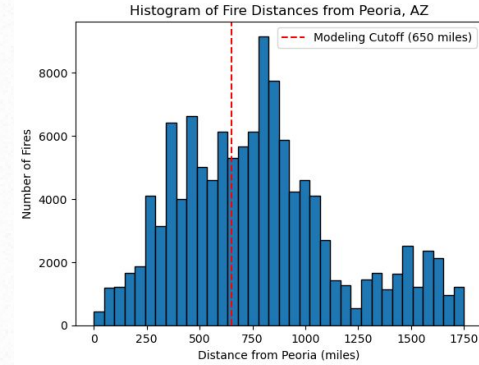
Predicting Future Smoke Impact

Model Used: Simple **Linear regression** to project trends through 2050.

- Forecasted smoke impacts show a gradual **upward** trend (orange dashed line).
- Reflects increasing **wildfire frequency and intensity** in future years.
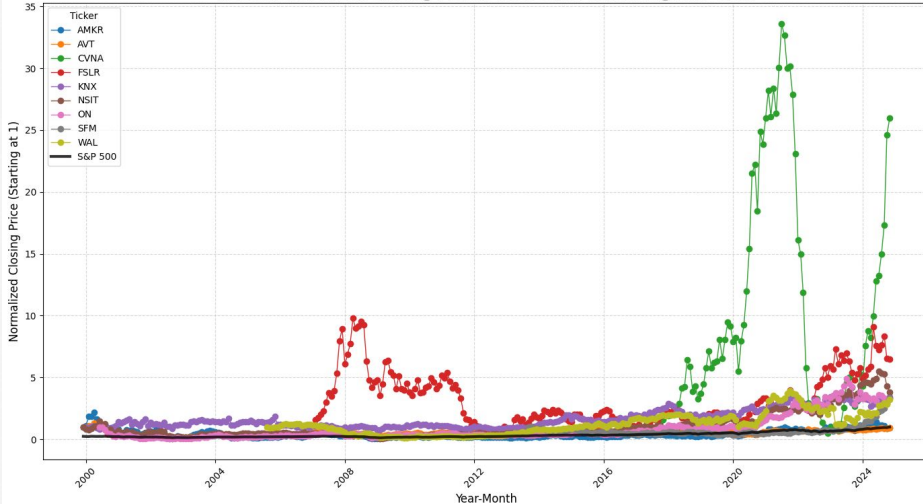
Highlights need for **enhanced** wildfire mitigation strategies and potential economic consideration.

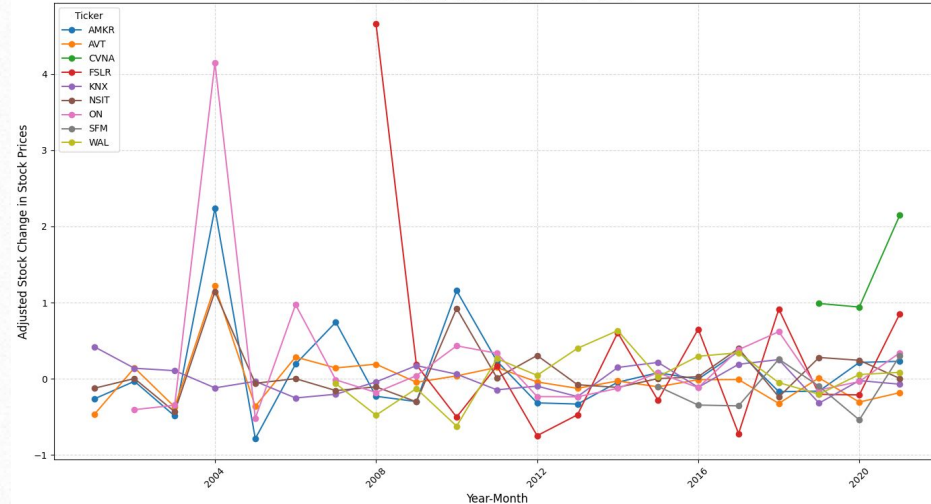Forecasted Wildfire Smoke Impact for Peoria, AZ (2025-2050)
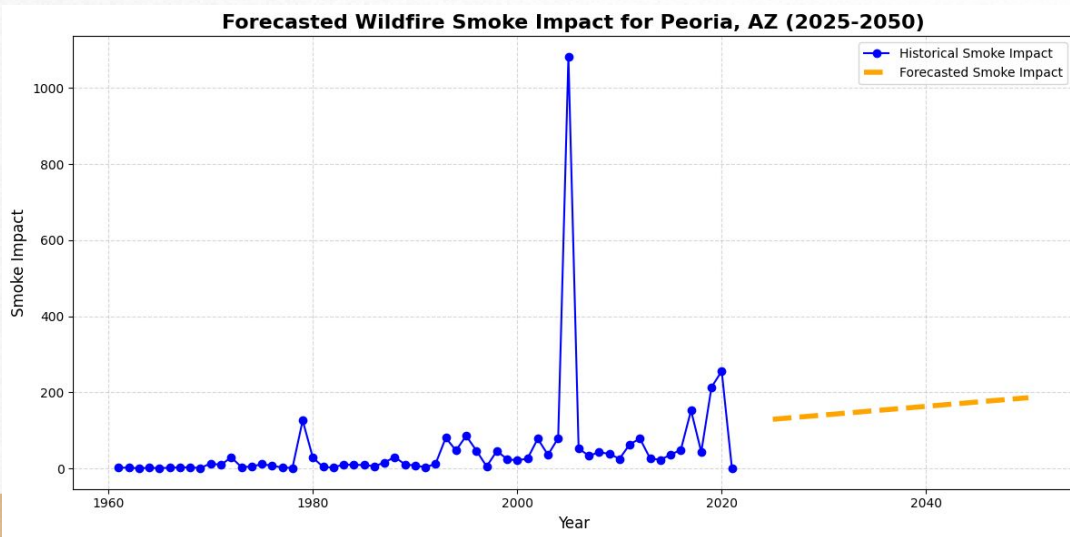
Does Smoke Impact the Economy?

- Analyzed stock data for 10 Peoria companies across sectors.
- Adjusted stock changes calculated relative to S&P 500 trends.
- Observed that environmental disruptions may affect market confidence.
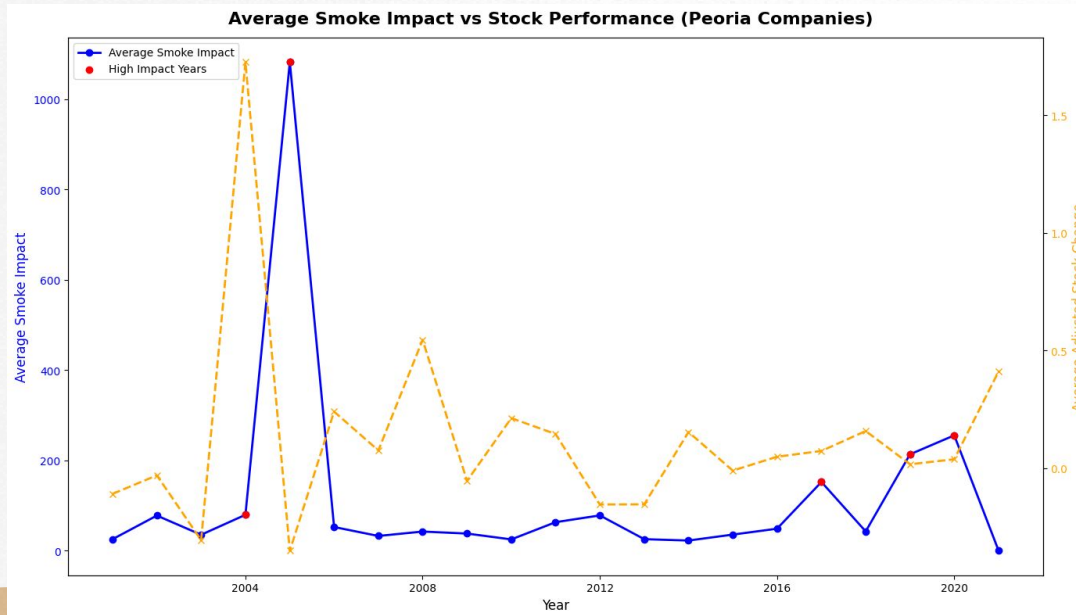

Stock performance fluctuates alongside local challenges.

Connecting Smoke to Market Behavior

- Years with high smoke impact show notable dips in stock performance.

- Adjusted stock changes account for market-wide trends, isolating local effects.

Average Smoke Impact vs Stock Performance (Peoria Companies)

2005 - Cave Creek Complex Fire
2017- Boundary Fire
2019 - Woodbury Fire
2020 - August Complex

Can We Predict the Future?

- Models tested
  - Gradient Boosting: Captures nonlinear relationships.
  - LSTM: Accounts for sequential trends in time-series data.

- Models trained on lagged features (e.g., smoke impact and prior stock changes).
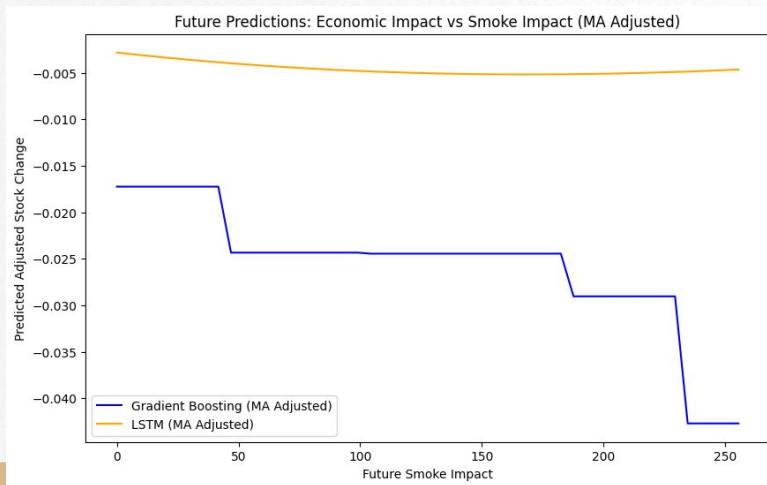
Gradient Boosting Model – MSE: 0.0014, R^2: 0.4790

Adjusted LSTM Model – MSE: 0.0034, R^2: 0.008

Looking Ahead: 2025–2050

- Forecasts show **rising smoke impacts** over time.
- Predicted economic effects include stock **underperformance** during high smoke years.
- Highlights the **need** for proactive mitigation strategies.

Forecasted Wildfire Smoke Impact and Economic Impact (2025-2050)
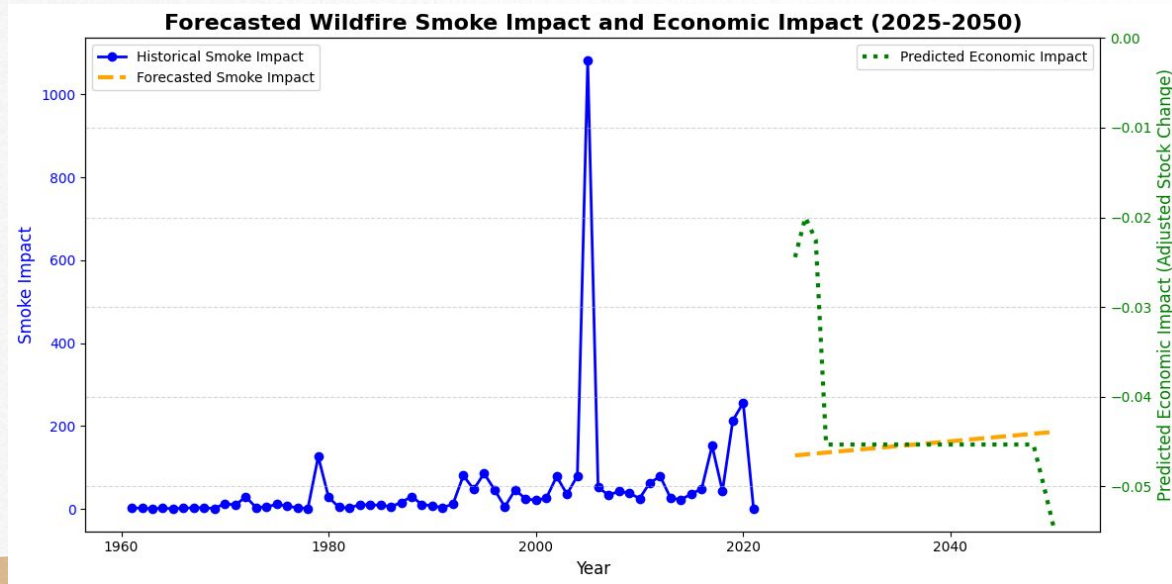
Implications and Future Improvements

Key Takeaways:

Wildfire smoke degrades air quality and **impacts the economy.**
Conduct detailed hyperparameter tuning to optimize model performance. Sector-specific stock performance to identify industries most affected by wildfire smoke.

Predictive models **can guide** business and policy planning.
Collaborate with policymakers to integrate predictive outputs into emergency response frameworks. Tailor models to simulate specific scenarios for local industries and infrastructure planning.

Investments in climate resilience **benefit** communities and markets alike.
Identify key resilience investments (e.g., improved air filtration systems, adaptive infrastructure) and assess their economic returns over time.