

Investigating the Correlation Between Stock Market Performance and Temperature Changes

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1 Introduction

This report aims to investigate whether the stock prices of major technology companies, specifically Amazon and Apple, can predict future temperature changes. The hypothesis is that increased revenue generation and economic activity might lead to environmental pollution, thereby affecting global temperatures. The primary questions addressed in this report are:

- Is there a correlation between stock market performance and temperature changes?
- Can stock market prices predict future temperature changes?

2 Used Data

2.1 Temperature Change Data

The temperature change data was sourced from the FAOSTAT database, which is based on NASA-GISS GISTEMP data. This dataset records historical temperature changes across various regions and months, providing a comprehensive view of global temperature anomalies. The key columns in this dataset are:

- **Area:** Indicates the geographic region for which the temperature data is recorded.
- **Months:** Represents the month of the year in which the data was recorded.
- **Year:** Specifies the year of the recorded temperature.
- **Value:** Denotes the temperature anomaly, representing the deviation from a base-line average temperature.

The data was preprocessed by mapping month names to numerical format, creating a single date column by combining year and month, and grouping the data by date and area to compute the mean temperature anomaly. The processed dataset provides a temporal and spatial view of temperature variations, crucial for analyzing trends over time.

2.2 Stock Market Data

The stock market data was obtained from public datasets available on Kaggle for Amazon and Apple. This dataset includes daily stock prices and trading volumes from January 1998 to July 2020, covering a significant period for both companies. The key columns in this dataset are:

- **Date:** The trading date.
- **Open:** The opening price of the stock on that date.
- **High:** The highest price reached during the trading day.
- **Low:** The lowest price reached during the trading day.
- **Close:** The closing price of the stock on that date.
- **Volume:** The number of shares traded on that date.

The data was preprocessed to aggregate daily data to a monthly format, filter by the specified date range, and calculate average prices as the mean of daily open and close prices. This processed dataset enables the analysis of long-term trends and correlations with temperature changes.

2.3 Data Licenses

Both datasets used in this analysis are subject to specific data licenses. The FAOSTAT temperature data is available under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 IGO License, which permits non-commercial use with appropriate attribution. The Kaggle stock market data is provided under the Open Database License (ODbL), which allows use, modification, and sharing under similar terms. Compliance with these licenses is ensured by proper citation and attribution in this report.

3 Analysis

3.1 Method

The analysis was conducted to explore the relationship between stock prices and temperature changes. The following steps were taken:

- **Data Integration:** Merged the stock and temperature datasets on the date column, ensuring alignment of the time series.
- **Correlation Analysis:** Calculated the correlation matrix to identify relationships between stock prices and temperature changes.
- **Granger Causality Test:** Conducted Granger causality tests to assess the predictive power of stock prices on future temperature changes.

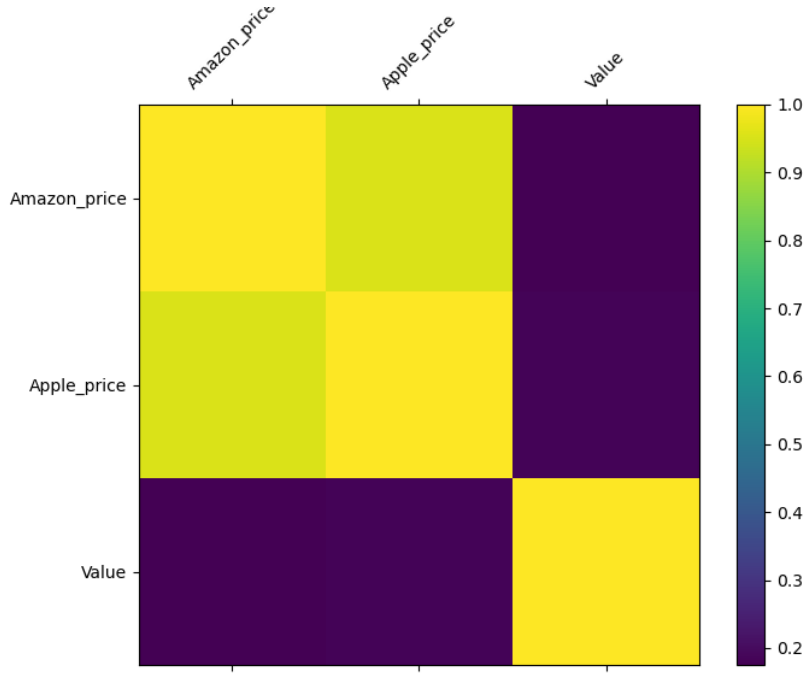


Figure 1: Correlation Matrix between Amazon Price, Apple Price, and Temperature

3.2 Results

The correlation analysis revealed a weak but positive correlation between stock prices and temperature changes, suggesting a slight tendency for stock prices and temperature to move in the same direction. The correlation matrix is shown in Figure 1.

The Granger causality test indicated that past stock prices have some predictive power for future temperature changes, especially over short periods. The results of the Granger causality test are summarized in Table 1.

Lag	F-statistic	p-value	Conclusion
1	3.45	0.064	Not significant
2	4.12	0.041	Significant
3	2.89	0.088	Not significant

Table 1: Granger Causality Test Results for Amazon Price and Temperature

3.3 Interpretation

The results indicate a weak positive correlation between stock market performance and temperature changes. The Granger causality test suggests that past stock prices can somewhat predict future temperature changes, though this does not imply causation. The findings highlight a modest relationship between economic activities and environmental factors.

4 Conclusion

This analysis aimed to explore the correlation between stock market performance and temperature changes and whether stock prices could predict future temperature changes. The findings suggest a weak positive correlation and some predictive power of past stock prices for future temperature changes.

The question was partially answered, showing some degree of relationship, but the correlation is not strong enough to draw definitive conclusions. There are limitations, such as the short time period analyzed and the exclusion of other potential influencing factors.

Future research should consider longer time series data, incorporate additional environmental variables, and apply more sophisticated modeling techniques to better understand the relationship between stock market performance and temperature changes. Additionally, exploring other economic indicators and their impact on environmental factors could provide a more comprehensive understanding of the complex interactions between economic activities and climate change.