



01

Python for Data Science and AI

BITCOIN AND ITS SO-CALLED MYSTERIES

March–September 2020 (Crisis)

January 2019 – February 2020 (Pre-crisis)

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What is the relationship between covid 19 and bitcoin market changes?

H0: The COVID-19 crisis has no positive impact on public mood toward semi-detached financial assets like Bitcoin.

Ha: The COVID-19 crisis has a positive impact on public mood toward semi-detached financial assets like Bitcoin.

How covid 19 crisis effect the Bitcoin market and public sentiment

H0: Bitcoin price does not increase with positive sentiment.

Ha: Bitcoin price increases with positive sentiment.



Bitcoin Price Data Collection

Source: CryptoCompare API

Defined three major phases for consistent comparison:

PRE_CRISIS_START_DATE: 2019-01-01

CRISIS_START_DATE: 2020-03-01

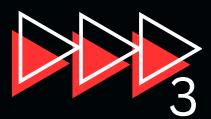
CRISIS_END_DATE: 2020-09-01

Frequency: Daily closing prices

610 rows and 1 columns

time	close
2019-01-01	3880.15
2019-01-02	3961.01
2019-01-03	3835.86
2019-01-04	3874.06
2019-01-05	3855.39
...	...
2020-08-28	11535.21
2020-08-29	11480.48
2020-08-30	11716.54
2020-08-31	11657.81
2020-09-01	11926.69

610 rows × 1 columns





GDELT Sentiment Data Collection

07

Source: GDELT (Google BigQuery public dataset)

Period Covered: Jan 2019 – Sep 2020

Filter used-

```
V2Themes LIKE '%TAX_DISEASE_PANDEMIC%' OR  
V2Themes LIKE '%UN_LOCKDOWN%' OR  
V2Themes LIKE '%WB_2028_PANDEMICS%'
```

display(sentiment_df)

sentiment	
event_date	
2019-01-02	-6.860502
2019-01-03	-4.430006
2019-01-04	-1.024554
2019-01-08	-1.143154
2019-01-10	-2.364920
...	...
2020-08-28	-6.279165
2020-08-29	-5.212617
2020-08-30	-2.266981
2020-08-31	-3.159517
2020-09-01	-3.890248

511 rows × 1 columns

V2Tone → Average daily news tone (positive or negative)
Focused exclusively on pandemic and lockdown-related news sentiment.



Data Integration

Both datasets were merged by date (YYYY-MM-DD).
The merged dataset covered 511 daily observations

```
display(combined_df)
```

	close	sentiment
2019-01-02	3961.01	-6.860502
2019-01-03	3835.86	-4.430006
2019-01-04	3874.06	-1.024554
2019-01-08	4040.75	-1.143154
2019-01-10	3668.15	-2.364920
...
2020-08-28	11535.21	-6.279165
2020-08-29	11480.48	-5.212617
2020-08-30	11716.54	-2.266981
2020-08-31	11657.81	-3.159517
2020-09-01	11926.69	-3.890248

511 rows × 2 columns

how='inner' → keeps only the dates that exist in both datasets.
.dropna() → removes any rows with missing data.

```
combined_df = btc_df.join(sentiment_df, how='inner').dropna()
```

Split the full dataset (combined_df) into two timeframes:
pre_crisis_df - all rows from Jan 1, 2019 to Feb 29, 2020
crisis_df - all rows from Mar 1, 2020 to Sep 1, 2020

```
pre_crisis_df = combined_df.loc[PRE_CRISIS_START_DATE:pre_crisis_end_date]  
crisis_df = combined_df.loc[CRISIS_START_DATE:CRISIS_END_DATE].copy()
```



Preprocessing Steps

Preprocessed Data

	close	sentiment	price_change	sentiment_diff
2020-03-02	8919.74	-3.151823	0.043320	0.251336
2020-03-03	8765.68	-3.155569	-0.017272	-0.003746
2020-03-04	8773.78	-3.110754	0.000924	0.044815
2020-03-05	9074.82	-3.048172	0.034311	0.062582
2020-03-06	9160.39	-3.002363	0.009429	0.045809
...
2020-08-28	11535.21	-6.279165	0.018020	-3.492290
2020-08-29	11480.48	-5.212617	-0.004745	1.066548
2020-08-30	11716.54	-2.266981	0.020562	2.945637
2020-08-31	11657.81	-3.159517	-0.005013	-0.892536
2020-09-01	11926.69	-3.890248	0.023064	-0.730731

184 rows × 4 columns

```
crisis_df['price_change'] = crisis_df['close'].pct_change()  
crisis_df['sentiment_diff'] = crisis_df['sentiment'].diff()  
analysis_df_h1 = crisis_df.dropna()
```

calculated the daily percentage change in Bitcoin's closing price and the daily change in sentiment score. Removed the first row, which will always have a “NaN” (missing value) because there's no previous day to compare for the first record.



How did daily sentiment changes during the COVID-19 pandemic relate to Bitcoin's price behavior?

01

HO:BITCOIN PRICE DOES NOT INCREASE WITH POSITIVE SENTIMENT.

02

REASONS:

- DURING COVID-19, THE MARKET WAS VOLATILE – DID SENTIMENT ACTUALLY DRIVE PRICE
- UNDERSTANDING THIS HELPS US SEE IF BITCOIN REACTS EMOTIONALLY LIKE OTHER ASSETS OR STAYS INDEPENDENT OF PUBLIC MOOD.





Purpose: To confirm the reliability of the data before hypothesis testing.

```
--- ADF Test Results for: Price Change (Returns) ---  
Test Statistic           -5.383015  
p-value                 0.000004  
#Lags Used             12.000000  
Number of Observations Used 171.000000  
dtype: float64  
Conclusion: Stationary (reject H0)
```

```
--- ADF Test Results for: Sentiment Change (Differenced) ---  
Test Statistic           -7.342024e+00  
p-value                 1.059062e-10  
#Lags Used             8.000000e+00  
Number of Observations Used 1.750000e+02  
dtype: float64  
Conclusion: Stationary (reject H0)
```

Sentiment data and Bitcoin returns are both stationary, which means that their variance and mean statistical characteristics don't change over time.

This demonstrates that the data is appropriate for t-test and correlation analysis.

The ADF test verifies that subsequent relationships—or the absence of them—are real and not the product of fictitious patterns.



First Hypothesis (H_1): Public Attitude Throughout the Crisis

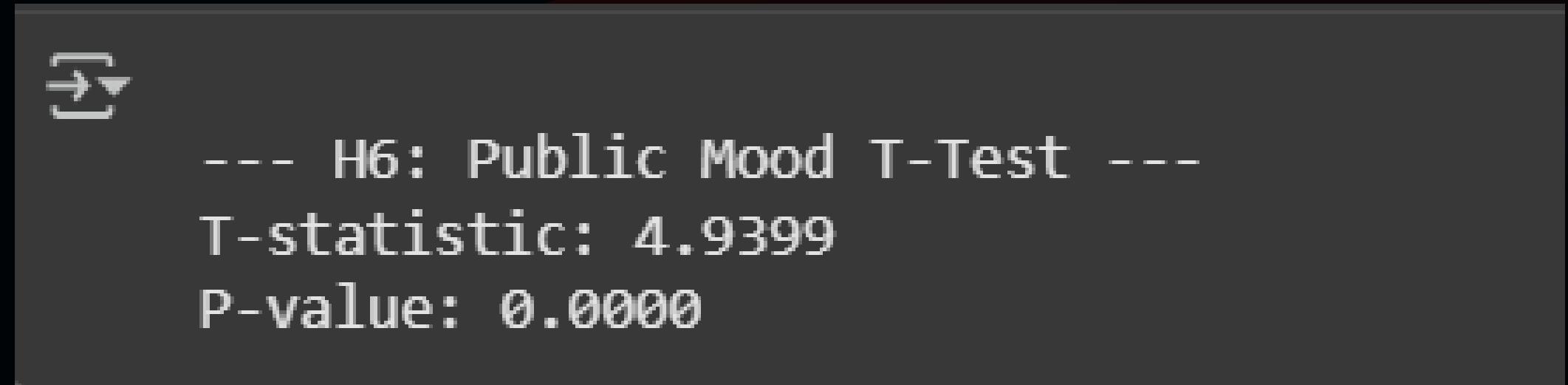
The public's perception of Bitcoin has improved as a result of the COVID-19 pandemic.

Findings:

Average sentiment before to the crisis: -2.4961

Average sentiment during a crisis: -3.3912

4.9399 t-statistic, p-value < 0.001



A discrepancy that is statistically significant. Instead of being more positive, sentiment grew more negative.

In conclusion, H_1 is rejected since public perception of Bitcoin did not improve as a result of the COVID-19 incident.

The t-test shows that general sentiment deteriorated throughout the epidemic, despite the ADF test confirming the data's reliability.





Hypothesis (H_2): Bitcoin Value vs Attitude

The price of bitcoin rises when sentiment improves, according to the hypothesis.

Findings:

-0.0429 is the Pearson correlation (r).

p-value: 0.5635



--- H1: Correlation Analysis ---
Pearson Correlation (r): **-0.0429**
P-value: **0.5635**

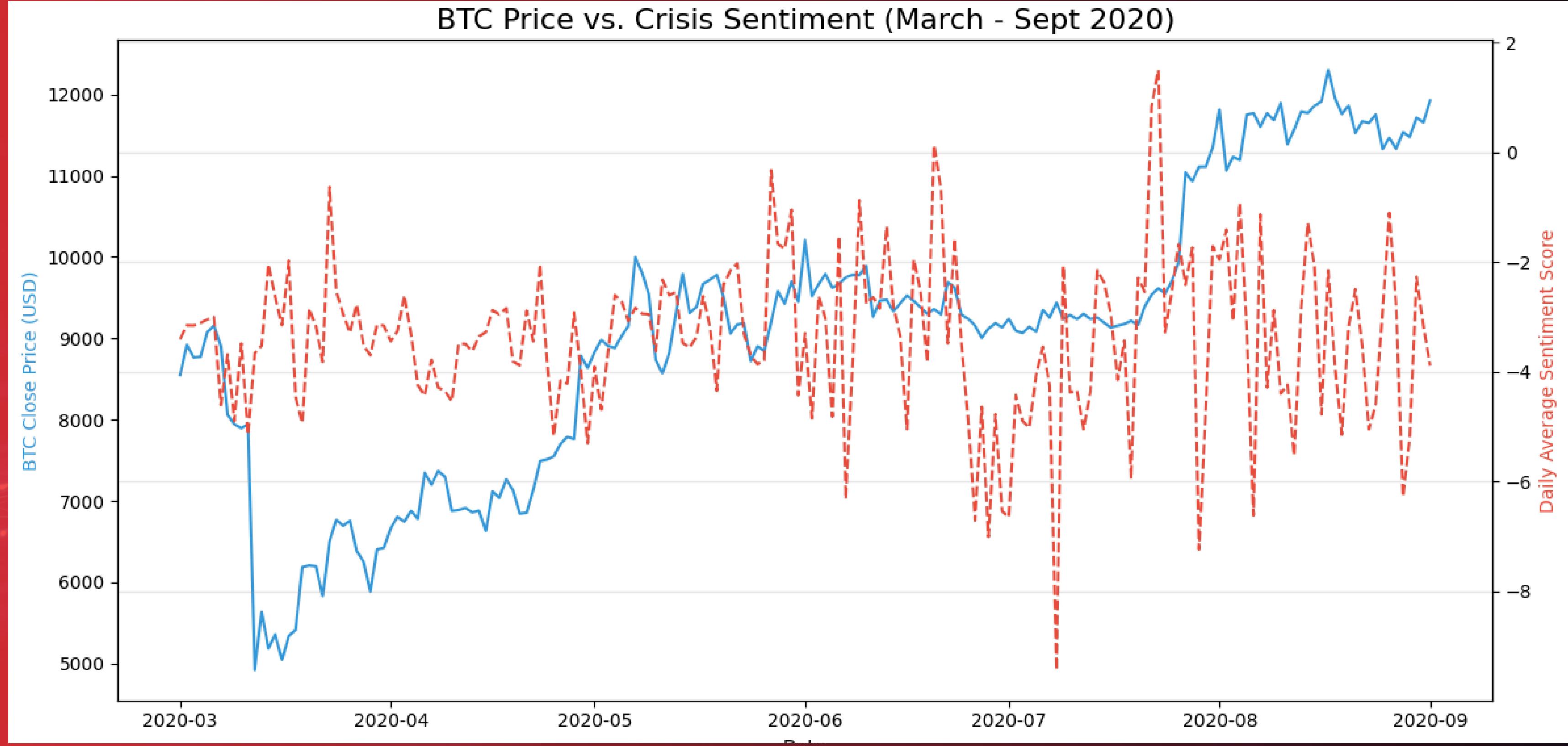
There is no discernible linear correlation between Bitcoin performance and sentiment. Data validity was validated by ADF, indicating that this lack of correlation is real.

In conclusion, H_2 is rejected because daily sentiment has little bearing on Bitcoin's price changes.

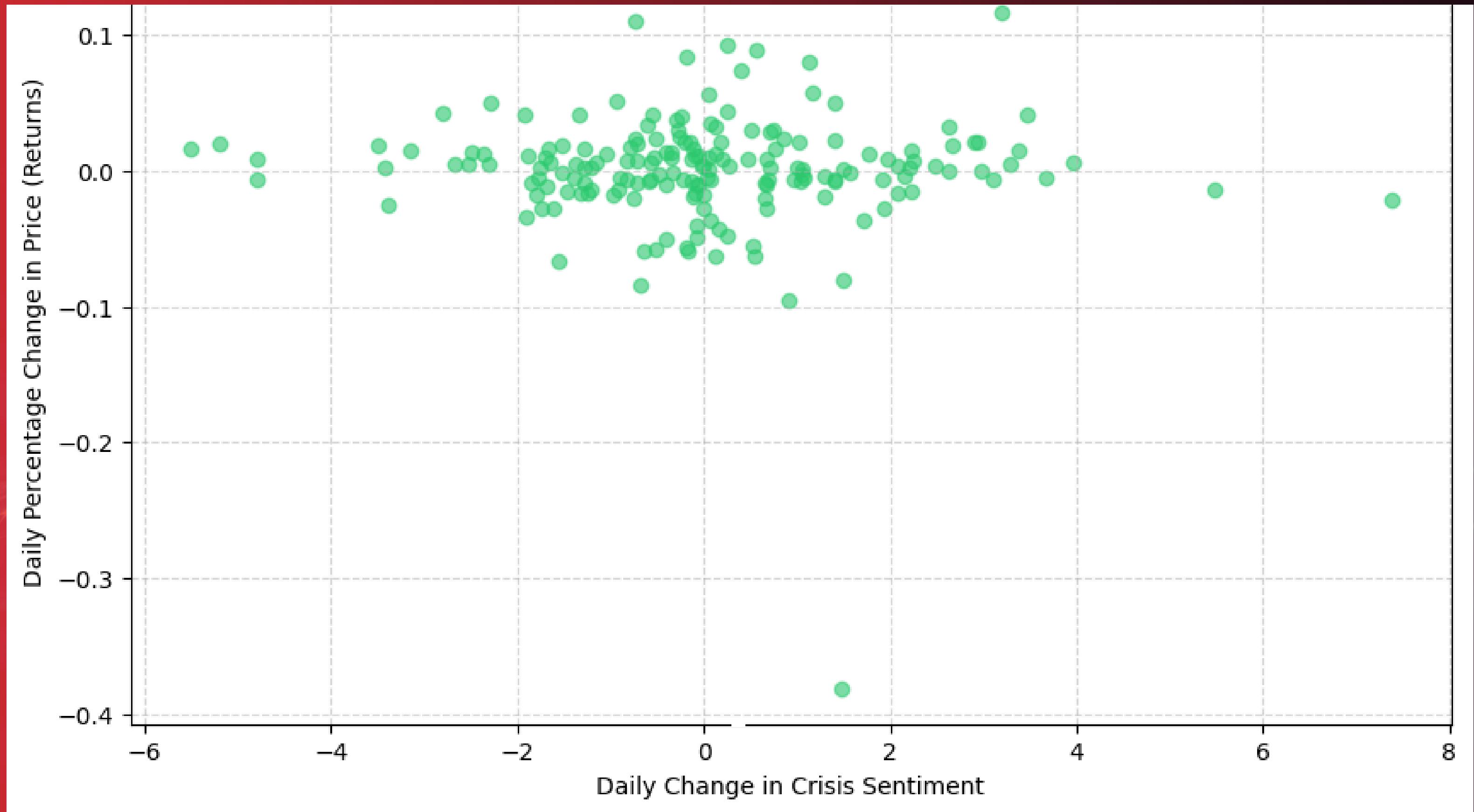
This shows that internal crypto market dynamics, rather than the overall emotional climate of the world, most likely drove Bitcoin's behavior throughout the crisis.



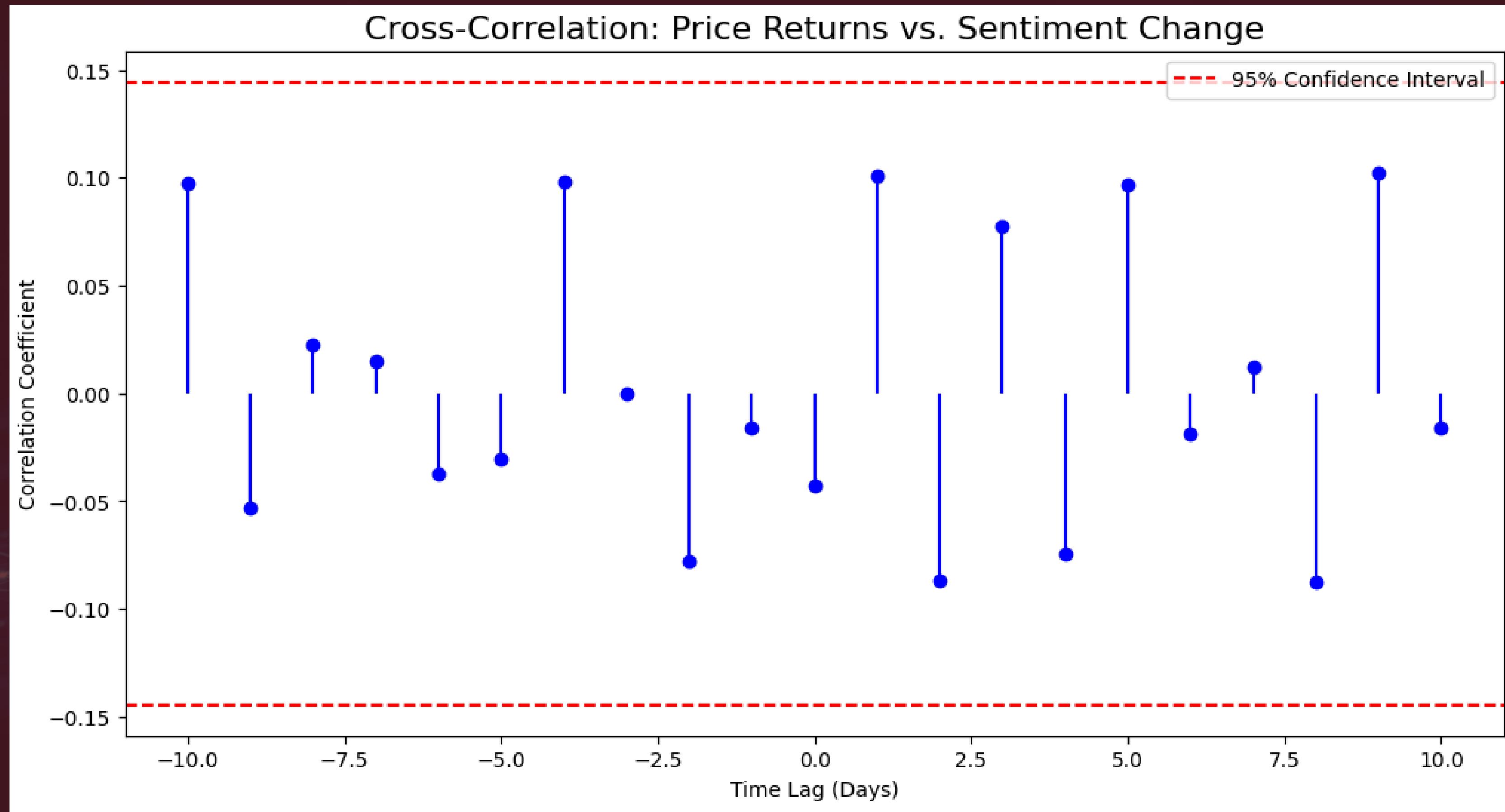
This line graph compares the Bitcoin closing price (blue line) with the daily average sentiment score (red dashed line) during the COVID-19 crisis period.



This scatter plot shows the relationship between daily Bitcoin price changes and daily sentiment changes during the COVID-19 crisis (Mar–Sep 2020).



This graph shows whether changes in sentiment predicted Bitcoin price movements after a few days (lag effect).





Final Analysis

Both datasets were verified to be stationary and appropriate for statistical analysis by ADF tests.

During the crisis, public sentiment drastically changed and grew more pessimistic.

The price of bitcoin did not correlate with sentiment, demonstrating its independence from the mood of the world's emotions.

Driven more by internal market activity than by sentiment in the media, Bitcoin acted as a sentiment-resistant or semi-detached asset.



REFERENCES

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2. The underlying dataset: The GDELT Project. (n.d.). Global Database of Events, Language, and Tone (GDELT) [Dataset]. Retrieved [Date you accessed it], from <https://www.gdeltproject.org/data.html>
3. CryptoCompare Ltd. (n.d.). CryptoCompare API: Cryptocurrency market data [Web API]. Retrieved October 18, 2025, from <https://min-api.cryptocompare.com/documentation/>
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