

Bitcoin Analytics – Project Information

Data Source

Data Frame	Source	Explantion
btcusd_1-min_data.csv	Kaggle	I need current Bitcoin price data to conduct financial analysis. The Kaggle data set gives me the entire price history.
DGS10.csv	FRED	Market Yield on U.S. Treasury Securities at 10-Year Constant Maturity. I want to conduct analyses on the US 10-Year bond, for instance its correlation to the Bitcoin price.
geoMap.csv	Google Trends	I want to conduct analyses on the regional interest on Bitcoin, using Google Trends.
M2_Seasonally_Adjusted.csv	FRED	It can be found that the Bitcoin price is correlated with the money supply. I want to check that.
SP500.csv	FRED	S&P 500 is the most important stock index in the world. I want to conduct analyses on ist correlation with the bitcoin price.

Data Profile

Data cleaning

- I needed to make sure that all timestamps are in the correct datetime format. I also checked for missing values and duplicates.

Data limitations

- Most data has been collected only during the weekdays. Bitcoin data is 24/2. Therefore, I need to impute values for the weekends. I chose to impute the last value before the weekend / public holiday.

Limitations and Ethical Considerations

Limitations

Temporal Coverage & Frequency

Bitcoin price data is continuous (7 days a week), while macroeconomic indicators like Treasury yields or M2 money supply are reported only on business days or monthly. Resampling or interpolation to align these series can introduce artificial patterns.

Volatility & External Shocks

Bitcoin prices are highly volatile and influenced by sudden events (e.g., regulation changes, exchange hacks), which are not captured in the datasets. This limits the explanatory power of the analysis.

Google Trends Data

Trends data reflect relative search interest (0–100 index), not absolute search volumes, and may be strongly influenced by media coverage or short-term hype.

Data Quality

Missing values in Treasury yields or other sources must be imputed carefully. Errors in data cleaning or type conversion can affect downstream analyses.

Correlation vs. Causation

Observed correlations (e.g., between M2 money supply and Bitcoin price) do not imply causal relationships and should not be interpreted as predictive.

Ethical Considerations

Investment Risk

Analyses on cryptocurrency data could be misinterpreted as financial advice. It should be clearly stated that this project is exploratory and academic in nature, not investment guidance.

Data Source Transparency

All datasets (FRED, Google Trends, Yahoo Finance) are publicly available, but Google Trends employs sampling and normalization methods that are not fully transparent.

Reproducibility

Google Trends data can change over time due to sampling, which may affect reproducibility.

Bias & Representation

Trends data primarily reflect regions where Google dominates; cultural and geographic biases may exist.

Privacy

All data are aggregated and anonymized; no personally identifiable information is included.

Questions to explore

1. Bitcoin Price Dynamics

- How has the Bitcoin closing price evolved over time?
- Does the Bitcoin price exhibit any patterns consistent with a **power law** or other scaling behavior?

- How volatile is Bitcoin on daily, weekly, and monthly scales?

2. Macroeconomic Influences

- Is there a correlation between Bitcoin prices and 10-Year Treasury yields?
- How does M2 Money Supply relate to Bitcoin prices over time?
- Does the S&P 500 index correlate with Bitcoin price movements, and if so, during which periods?

3. Sentiment & Public Interest

- How does public interest in Bitcoin (as measured by Google Trends) relate to its price changes?
- Are spikes in Google search activity followed by significant price movements?

4. Interactions Between Variables

- Which combination of macroeconomic indicators (Treasury yields, M2, S&P 500) best explains Bitcoin price movements?
- Can we detect lagged relationships, where changes in macroeconomic variables precede Bitcoin price changes?

5. Robustness & Data Considerations

- Do results differ depending on whether missing values are forward-filled or dropped?
- How sensitive are correlations to extreme events, such as market crashes or sudden spikes in search interest?

Exercise 2

- How has the Bitcoin closing price evolved over time?

The bitcoin price can be described by a lot of volatility. Huge price swings are normal. In the future I might put the volatility to a test: My hypothesis is, that volatility is shrinking.

- How does M2 Money Supply relate to Bitcoin prices over time?

There is a strong positive correlation between Bitcoin price and M2 money supply. But after conducting a Granger-causality test causation cannot be attested.

- Does the S&P 500 index correlate with Bitcoin price movements, and if so, during which periods?

Also the S&P 500 correlates strongly with the Bitcoin price

- Which combination of macroeconomic indicators (Treasury yields, M2, S&P 500) best explains Bitcoin price movements?

This is a question to explore in future analyses. I did a categorical analysis about the treasury yields with color gradings.

- Can we detect lagged relationships, where changes in macroeconomic variables precede Bitcoin price changes?

This also shall be tested in the future. Moreover, I would like to find factors causing Bitcoin price movement, not just correlations.