**Executive Summary**

This analysis examines the price dynamics between MicroStrategy (MSTR) and Bitcoin (BTC) using data from 23 June to 30 June 2025. The script cleans and processes the data, revealing a strong correlation (0.883) between MSTR and BTC prices, driven by MSTR's significant BTC holdings. Key insights include moderate return correlation (0.406), a beta of 0.847, and varying volatility patterns, with MSTR exhibiting higher risk despite lower peak volatility compared to BTC.

**Data Cleaning and Preparation**

**Source**

* Data extracted from MSTR VS BITCOIN.xlsx (sheets 'MSTR' and 'BITCOIN').
* MSTR: 1-minute data with columns Date and Time, Last Price, Volume.
* BTC: 5-minute data with columns Date/Time, Open, High, Low, Close (using Close as price).

**Cleaning**

* Converted price and volume notations (e.g., '100k', '5M') to numerical values.
* Standardised timestamps to UTC.
* Filtered MSTR data to NASDAQ hours (9:30 AM - 4:00 PM ET, weekdays), excluding US holidays.
* Removed outliers with a z-score > 3 over a 60-minute window, using linear interpolation.
* Upsampled BTC data to 1-minute intervals with linear interpolation (volatility impact negligible across methods).
  + Tested forward-fill and time-based interpolation, with linear interpolation showing negligible volatility impact (104.810–110.318 USD vs. 229.172 USD for upsampled data).
* Merged MSTR and BTC data with a 2-minute tolerance.
* Handled missing data with linear interpolation and forward-fill.
* Removed duplicates in BTC data to ensure data integrity.

**Storage**

* Saved raw and clean data in SQLite database (fourier\_crypto\_stock\_data.db).

**Key** **Metrics**

* **Correlation:**
  + Price Correlation: 0.883 (raw/normalised), reflecting strong co-movement.
  + Return Correlation: 0.406, indicating moderate alignment in percentage changes.
* **Regression**:
  + Raw: MSTR\_price = 0.004 \* BTC\_price - 66.370.
  + Normalised: MSTR\_price = 0.883 \* BTC\_price + 0.000.
* **Volatility**:
  + MSTR Average: 1.379.
  + BTC Average: 229.172.
  + Volatility Correlation: 0.643.
* **Beta:**
  + 0.847 (1% BTC change → 0.847% MSTR change).
* **Spread:**
  + Actual - Predicted MSTR price near zero, with significant deviations.

**Visualisations**

* **MSTR vs BTC Price Comparison (Raw):** Shows MSTR (orange) and BTC (blue) price trends.

A graph with blue lines and white text

AI-generated content may be incorrect.

* **MSTR vs BTC Price Comparison (Cleaned and Cleaned(Normalised)):** Highlights co-movement.

A graph showing the price comparison

AI-generated content may be incorrect.

A graph with blue and yellow lines

AI-generated content may be incorrect.

* **MSTR Volume**: Displays trading volume trends.

A graph with green lines

AI-generated content may be incorrect.

* **MSTR vs BTC Volatility (60-min window):** Compares annualised volatility.

A graph with blue and orange lines

AI-generated content may be incorrect.

* **Rolling Correlation (1-day window):** Reveals varying correlation strength.

A graph with green and purple lines

AI-generated content may be incorrect.

* **Rolling Correlation (60-min window):** Shows short-term correlation fluctuations.

A graph with green and purple lines

AI-generated content may be incorrect.

* **MSTR Price Spread (Actual - Predicted):** Indicates market overreaction periods.

A graph with red lines

AI-generated content may be incorrect.

**Analysis and Insights**

* **Price Relationship**
  + The 0.883 correlation confirms MSTR's BTC dependency, with normalised trends aligning closely.
  + Normalised prices align closely, with MSTR peaking higher relative to its price, indicating amplified movements.
* **Volatility**: MSTR’s lower peak volatility (vs. BTC) suggests it dampens extreme movements, but overall risk is higher.
  + MSTR’s volatility (1.379 USD, ~0.38%) is lower in absolute terms but higher in percentage terms than BTC’s 229.172 USD ~0.23%, indicating greater relative risk.
  + Volatility correlation (0.643) shows synchronized risk profiles, but divergences suggest MSTR-specific factors (e.g., stock market dynamics).
* **Beta:**
  + A beta of 0.847 (lower than expected) suggests MSTR was less sensitive to BTC during June 23–30, 2025, possibly due to stock-specific events
* **Rolling Correlations**
  + Fluctuations indicate external factors (e.g., market events) impact MSTR.
* **Volume and Spread:**
  + MSTR volume offers limited insight into spread fluctuations (actual vs. predicted MSTR price), which are near zero but show significant deviations during market overreactions.

**Recommendations**

* Monitor BTC price movements closely, as they significantly influence MSTR.
* Investigate external factors causing correlation variability and spread deviations.
* Consider MSTR’s higher risk profile for investment decisions, balancing its BTC linkage.