Beyond Returns: A Candlestick-Based Approach to Spot Covariance Estimation*

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Abstract

Spot covariance estimation is commonly based on high-frequency open-to-close return data over short time windows, but such approaches face a trade-off between statistical accuracy and localization. In this paper, I introduce a new estimation framework using high-frequency candlestick data, which include open, high, low, and close prices, effectively addressing this trade-off. By exploiting the information contained in candlesticks, the proposed method improves estimation accuracy relative to the return-based approach while preserving local structure. I further develop a test for spot covariance inference based on candlesticks that demonstrates reasonable size control and a notable increase in power, particularly in small samples, compared to the test built on returns. Motivated by recent work in the finance literature, I empirically test the market neutrality of the iShares Bitcoin Trust ETF (IBIT) using 1-minute candlestick data for the full year of 2024. The results show systematic deviations from market neutrality, especially in periods of market stress. An event study around FOMC announcements further illustrates the new method's ability to detect subtle shifts in relatively mild information events.

Keywords: Covariance estimation, high-frequency data, candlesticks, spot beta.

JEL Codes: C13, C32, C58, G11.

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