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Co-Movement and Market Integration of Bitcoin and Ethereum: An Empirical Correlation Analysis

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Abstract

The rising relevance of cryptocurrencies as investments has drawn attention to the analysis of how the values of such investments correlate with each other. In particular, this research paper studies BTC/ETH co-movement and evaluates the strength of the relationship between Bitcoin and Ethereum as well as the consequences for portfolio diversification. To investigate co-movement, daily prices of BTC and ETH are collected from Yahoo Finance for the period from January 2018 to December 2024. This dataset is made up of 2,557 observations for each cryptocurrency. Descriptive statistics, graph analysis and Pearson correlation analysis are used to study BTC and ETH prices. The results have shown that there is a very strong positive co-movement between BTC and ETH (Pearson coefficient = 0.9036 (CI 95%: 0.8962 - 0.9104; *p* < .001)). The positively skewed distributions of Bitcoin and Ethereum were observed. Besides, Bitcoin had larger dispersion and higher kurtosis than Ethereum. Normalised prices showed the general similarity of the two cryptocurrencies' price behavior with the exception that the 2021 rally was more successful for Ethereum and the 2024 growth was more significant for Bitcoin. Nevertheless, because the study uses price levels as the basis for the test, it becomes necessary to conduct further tests using correlation measures based on returns in order to measure their market integration.

Keywords: *Bitcoin, Ethereum, correlation, co-movement, market integration, diversification, cryptocurrency*

1. Introduction

Blockchain technology has produced one of the most significant shifts in modern finance. Between 2018 and 2024 the cryptocurrency market moved from a largely speculative, retail-driven phase towards a structured asset class connected to global capital markets. The period includes the 2018 “Crypto Winter”, the liquidity surge of 2020, the institutional rally of 2021, the 2022 downturn, and the approval of spot exchange-traded funds in 2024. This sequence of boom and bust provides a rich setting for studying how the two leading assets relate to each other.

Bitcoin, introduced by Nakamoto (2008), is a first-generation blockchain asset whose supply is capped at 21 million coins and whose issuance halves roughly every four years. It is widely described as “digital gold” and has increasingly been used as a macro-hedging instrument and a corporate treasury asset. Ethereum, proposed by Buterin (2014), is a second-generation platform that supports smart contracts and decentralised applications, underpinning decentralised finance (DeFi) and non-fungible tokens. Its transition from Proof-of-Work to Proof-of-Stake in September 2022 (“The Merge”) changed its economic and technical structure and created the possibility of a divergence from Bitcoin.

Because the two assets serve different functions, it is not obvious that they should move together. If they behave as independent instruments, combining them can reduce portfolio risk; if they are tightly coupled, holding both adds little diversification. This study therefore measures the strength and significance of the Bitcoin–Ethereum relationship over a seven-year window that spans several distinct market regimes.

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2. Literature Review

Existing comparisons of Bitcoin and Ethereum are mostly technical or qualitative. Anwar et al. (2020), Mahato et al. (2022), Chandey (2022) and Fekkes (2018) contrast the two networks in terms of architecture, consensus mechanisms, block times and scripting capability. They broadly agree that Bitcoin is a secure, decentralised store and transfer of value, whereas Ethereum is a programmable platform that is faster and more versatile but more complex and therefore exposed to greater security risk.

A second group of studies addresses market and adoption behaviour. Bhosale and Mavale (2018) compare the volatility of Bitcoin, Ethereum and Litecoin and stress that high potential returns come with extreme price risk. Abdulla and Salman (2025) find that the post-COVID-19 period increased interest in dApp-based platforms such as Ethereum relative to "pure" cryptocurrencies. Kazemikhasragh (2025) shows that Bitcoin is treated as a regulation-resilient inflation hedge by corporate treasuries, while Ethereum adoption is narrower and more sensitive to regulatory clarity.

Although these studies establish that the two assets differ in design and use, few of them quantify how closely their market prices move together over a long period. This study addresses that gap with a statistical correlation analysis covering 2018–2024.

3. Objectives of the Study

The following are the objectives of the study

1. To analyse the price trends and descriptive characteristics of Bitcoin and Ethereum from 2018 to 2024.
2. To examine the strength and statistical significance of the relationship between Bitcoin and Ethereum using correlation analysis.
3. To identify periods of divergence in their price movements and assess the implications for portfolio diversification.

The scope is limited to Bitcoin and Ethereum, selected because they are the largest cryptocurrencies and represent the two main blockchain types (money and platform). The study covers daily data from 1 January 2018 to 31 December 2024 and treats the cryptocurrency market as a single global market, using aggregated global prices rather than individual exchanges or countries.

4. Research Methodology

The study follows a descriptive and analytical design. It is descriptive because it summarises the statistical properties of the two series, and analytical because it applies correlation analysis to evaluate the relationship between them. The study relies entirely on secondary data: daily closing prices of Bitcoin and Ethereum were obtained from Yahoo Finance for 2018–2024, yielding 2,557 observations per asset.

Data were cleaned and organised in Microsoft Excel, where a daily series was derived from the closing prices, and were checked for missing values, inconsistencies and date alignment. Statistical analysis was carried out in R (RStudio). Mean and standard deviation measure central tendency and dispersion; skewness and kurtosis describe distributional shape (kurtosis is reported in its non-excess form, with a normal benchmark of 3). The Pearson correlation coefficient measures the strength and direction of the linear relationship between the two assets, and a correlation test examines whether it differs significantly from zero. Time-series plots, a scatter plot and a normalised price chart (each price divided by its value on 1 January 2018) support the numerical results.

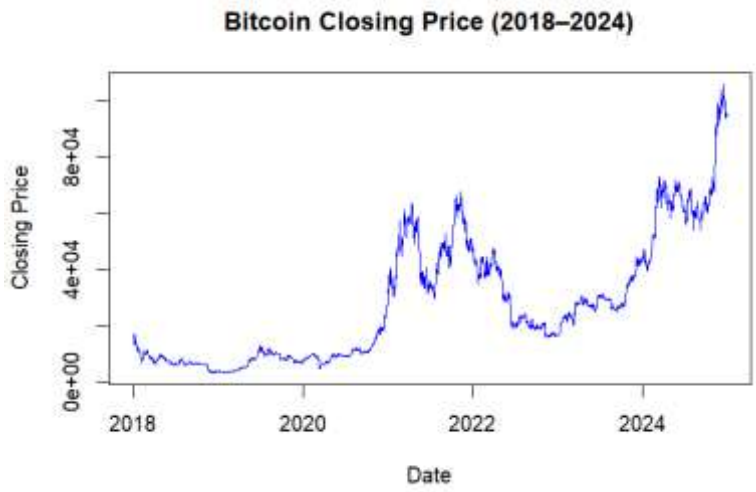
5. Results and Discussion

5.1 Price Trends

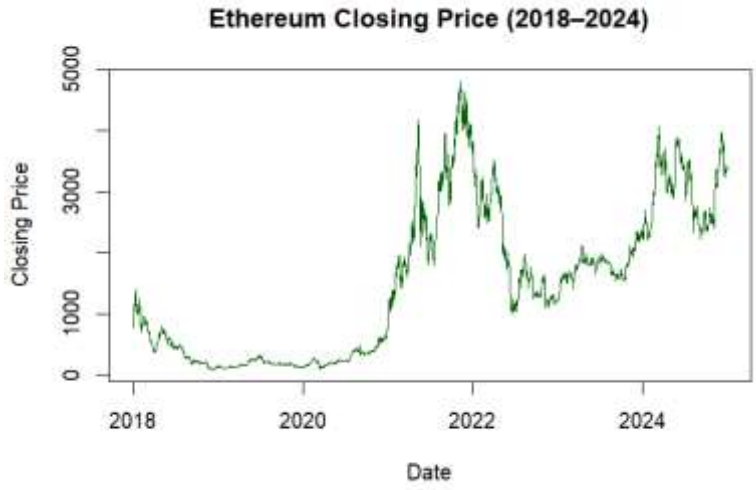
Figure 1 shows the closing prices of the two assets. Both fall through 2018 and stay low until 2020, rise sharply during 2020–2021, correct through 2022, and recover from 2023. Bitcoin's closing price reached a maximum of about USD 105,800 in late 2024, while Ethereum peaked at about USD 4,812 in late 2021 and remained below that level at the end of the sample. Both series display the high volatility and cyclical behaviour that are characteristic of cryptocurrency markets.

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(a) Bitcoin closing price, 2018–2024



(b) Ethereum closing price, 2018–2024

Figure 1: Closing price trends of Bitcoin and Ethereum

5.2 Descriptive Statistics

Table 1 summarises the derived daily series for each asset. Bitcoin has a much larger mean and standard deviation than Ethereum, reflecting its higher price magnitude and wider range of fluctuation. Both series are positively skewed (Bitcoin 0.936; Ethereum 0.516), meaning that most observations lie at lower values with a long tail of high values corresponding to the 2021 and 2024 rallies. Bitcoin's kurtosis (3.19) is slightly above the normal benchmark of 3, indicating marginally heavier tails, whereas Ethereum's kurtosis (2.12) is below it, indicating a flatter distribution with fewer extreme observations.

Table 1: Descriptive statistics, 2018–2024

Statistic	Bitcoin	Ethereum
Observations	2,557	2,557
Mean	28,059.38	1,509.34
Standard deviation	22,145.55	1,230.11
Minimum	0.00*	0.00*
Maximum	105,799.00	4,811.09
Skewness	0.936	0.516
Kurtosis	3.191	2.115

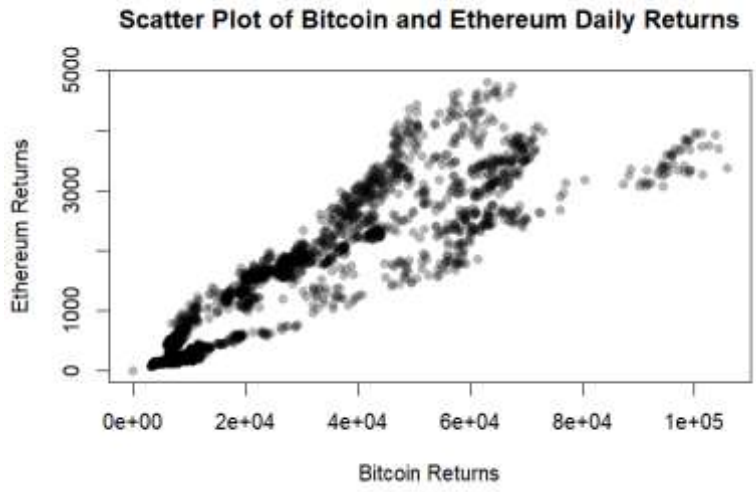
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**The first observation of each series is initialised at zero.*

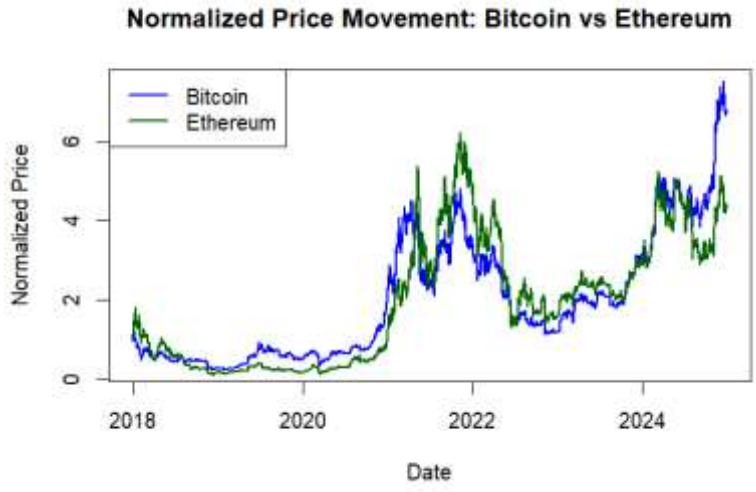
5.3 Correlation Analysis

The scatter plot in Figure 2(a) shows a clear upward-sloping pattern: higher Bitcoin values are generally accompanied by higher Ethereum values. The Pearson correlation coefficient is 0.9036, a very strong positive relationship. The correlation test gives $t = 106.6$ with 2,555 degrees of freedom and $p < 2.2 \times 10^{-16}$, so the null hypothesis of zero correlation is rejected at the 1% level. The 95% confidence interval of 0.8962 to 0.9104 is narrow, which indicates that the estimate is precise.

The normalised price chart in Figure 2(b) confirms this co-movement over time. The two assets share the same phases of decline, expansion, correction and recovery.



(a) Scatter plot of Bitcoin and Ethereum daily series



(b) Normalised price movement (base: 1 Jan 2018)

Figure 2: Relationship between Bitcoin and Ethereum

5.4 Periods of Divergence

Despite the strong overall association, the normalised chart shows that the two paths are not identical. Ethereum rose more strongly during the 2021 cycle, reaching a normalised value of about 6 against roughly 4.5 for Bitcoin. In 2024 the pattern reversed: Bitcoin climbed to a normalised value of about 7.5 while Ethereum remained near 4.5. The scatter plot shows a corresponding spread of points below the main diagonal band at high Bitcoin values, so the relationship is not constant across the sample. These differences are consistent with the contrasting roles of the two assets in the literature, namely Bitcoin as a macro-hedging store of value and Ethereum as a platform whose value depends on

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network utility. The 2022 Merge and the 2024 spot ETF approvals fall within these periods, but this study does not test their effects formally.

6. Conclusion

This study examined the relationship between Bitcoin and Ethereum using 2,557 daily observations from 2018 to 2024. The Pearson correlation of 0.9036 is very strong and statistically significant at the 1% level, which indicates substantial co-movement and a high degree of market integration between the two leading cryptocurrencies. Both assets follow the same market cycles, and both show positive skewness, with Bitcoin showing greater dispersion and slightly heavier tails.

For investors, the findings imply that holding Bitcoin and Ethereum together offers limited diversification benefit, because their values tend to move in the same direction in both bullish and bearish conditions. Investors seeking risk reduction may need assets outside the cryptocurrency market. For researchers, the findings support treating the two assets as part of a common market segment, while the divergences in 2021 and 2024 show that their relative performance can differ substantially.

Limitations and future research. The correlation reported here is computed on a daily series that tracks the level of closing prices rather than percentage changes. Because both prices trend strongly, level-based correlations can be high even when short-term movements are less tightly linked, so the coefficient should be read as evidence of shared long-run cycles. Future work should replicate the analysis using percentage returns, test for stationarity, examine sub-periods before and after the 2022 Merge and the 2024 ETF approvals, use rolling correlations, and include macroeconomic variables.

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