

A Comparative Analysis of Risk and Return:**Bitcoin vs. the S&P 500**Author: Ricky Seferian¹*Affiliation:*

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Abstract:

This research compares Bitcoin and the S&P 500 in terms of return and risk. The study uses daily data from January 2021 until December 2024. The main measures used are average daily return, standard deviation, minimum and maximum returns, and correlation. The results show that Bitcoin had a higher average daily return than the S&P 500 during this period. However, Bitcoin was also much more volatile. Its standard deviation was 3.96%, compared with 1.04% for the S&P 500. The correlation between Bitcoin and the S&P 500 was 0.36, showing a positive but not very strong relationship. The results show that Bitcoin had higher returns during the period studied, but it also had much higher risk.

Keywords:

Bitcoin, S&P 500, risk and return, cryptocurrency volatility, stock market correlation, financial risk analysis, standard deviation, daily logarithmic return, investment risk

Introduction:

Bitcoin has become a popular investment in recent years. Many investors are interested in Bitcoin because its price can increase significantly. However, Bitcoin can also experience large price decreases, which makes it a risky investment.

The S&P 500 is an index that represents 500 large companies in the United States. It is commonly used to represent the performance of the U.S. stock market. Comparing Bitcoin with the S&P 500 can therefore help us understand the differences between cryptocurrency and a traditional stock market investment.

Risk and return are important concepts in finance. Investors are interested in earning returns, but they also need to understand the amount of risk they are taking. An investment with higher potential returns may also have larger price movements and greater risk.

The main purpose of this research is to compare Bitcoin and the S&P 500 in terms of risk and return.

The research questions are:

1. How do Bitcoin returns compare with S&P 500 returns?
2. Which one has higher volatility?
3. Is there a relationship between Bitcoin and S&P 500 returns?

The objectives are to compare the returns of Bitcoin and the S&P 500, measure their volatility, and examine the correlation between them.

Literature Review:

Several researchers have studied Bitcoin and compared it with traditional financial markets.

Nzokem and Maposa (2024) compared Bitcoin with the S&P 500 using daily returns and financial risk measures. Their results showed that Bitcoin had more extreme daily returns and substantially greater tail risk than the S&P 500.

Baur and Dimpfl (2021) studied Bitcoin's volatility and found that it was extremely high compared with major exchange rates. This is important because investors should consider Bitcoin's volatility and not only its possible returns. However, in times of crisis, Bitcoin was used as a method for investors to protect their savings when currency depreciate (El-Chaarani et al., 2025), this was specifically the case during the Lebanese financial crisis (Aoun et al., 2026).

Bouri, Kristoufek, and Azoury (2022) studied the relationship between Bitcoin and the S&P 500. They found that the connection was very weak or almost nonexistent before 2018, but became more noticeable from 2018 onward, especially from 2019. Their study shows that the relationship between Bitcoin and the stock market can change over time. While Beainy and Kamel (2026) discussed how Bitcoin has become similar to Gold, as a hedging instrument instead of being a purely speculative asset. Trust and sentiments remain an important factor in Bitcoin pricing (Khalife et al., 2025).

These studies show that Bitcoin is generally more volatile than traditional stock investments. They also show that Bitcoin and the stock market can be related, but the relationship is not always strong

or constant. Even though Bitcoin is being increasingly used, Beainy et al. (2025) examined the global dependency on the US dollar.

Methodology:

This research uses a quantitative method to compare Bitcoin with the S&P 500.

The data cover the period from January 2021 until December 2024. Bitcoin is represented by its price in U.S. dollars, while the S&P 500 is used to represent the U.S. stock market. The Bitcoin data were obtained from Coinbase through FRED (Coinbase, n.d.), while the S&P 500 data were obtained from S&P Dow Jones Indices through FRED (S&P Dow Jones Indices LLC, n.d.).

Bitcoin trades every day, while the stock market does not. For this reason, the two datasets were matched by date and only dates with an available S&P 500 value were kept. After matching the data, there were 1,005 price observations, which gave 1,004 daily return observations.

Daily returns were calculated using a simple logarithmic return formula:

$$\text{Return} = \ln(\text{Current Price} / \text{Previous Price}) \times 100$$

This formula measures the daily logarithmic return in percentage terms.

Average return shows the average daily performance.

Standard deviation measures volatility. A higher standard deviation means that returns change more and the investment is more volatile.

Minimum and maximum returns show the largest daily decrease and increase during the period.

Correlation measures how Bitcoin and the S&P 500 move in relation to each other. Correlation ranges from -1 to +1. A positive correlation means they have some tendency to move in the same direction.

These measures were chosen because they provide a simple way to compare the risk and return of the two investments without using complicated financial models.

Results:

The analysis shows clear differences between Bitcoin and the S&P 500.

Table 1. Bitcoin and S&P 500 Daily Return Results

Measure	Bitcoin	S&P 500
Average daily return	0.107%	0.046%
Standard deviation	3.961%	1.040%
Minimum daily return	-26.336%	-4.420%
Maximum daily return	19.574%	5.396%
Observations	1,004	1,004

Bitcoin had a higher average daily return. Its average was approximately 0.107%, while the S&P 500 had an average daily return of approximately 0.046%.

However, Bitcoin also had much higher volatility. Bitcoin's standard deviation was approximately 3.96%, compared with 1.04% for the S&P 500. This means Bitcoin's daily returns changed much more than S&P 500 returns.

The minimum and maximum returns also show this difference. Bitcoin's largest daily decrease was approximately -26.34%, while its largest daily increase was approximately 19.57%. For the S&P 500, the minimum was approximately -4.42% and the maximum was approximately 5.40%.

The correlation between Bitcoin and S&P 500 daily returns was approximately 0.36. This is a positive correlation, meaning that the two investments had some tendency to move in the same direction. However, the relationship was not very strong.

Table 2. Correlation Between Bitcoin and the S&P 500

Measure	Result
Bitcoin-S&P 500 correlation	0.362

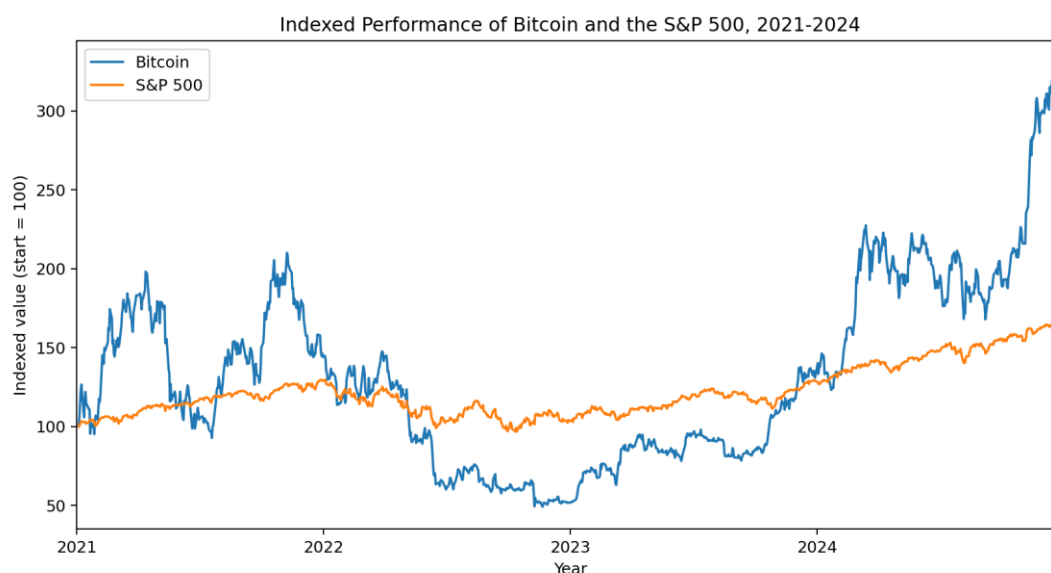


Figure 1. Indexed Performance of Bitcoin and the S&P 500, 2021-2024

The graph starts both investments at 100 so their performance can be compared more easily. Bitcoin shows much larger movements than the S&P 500.

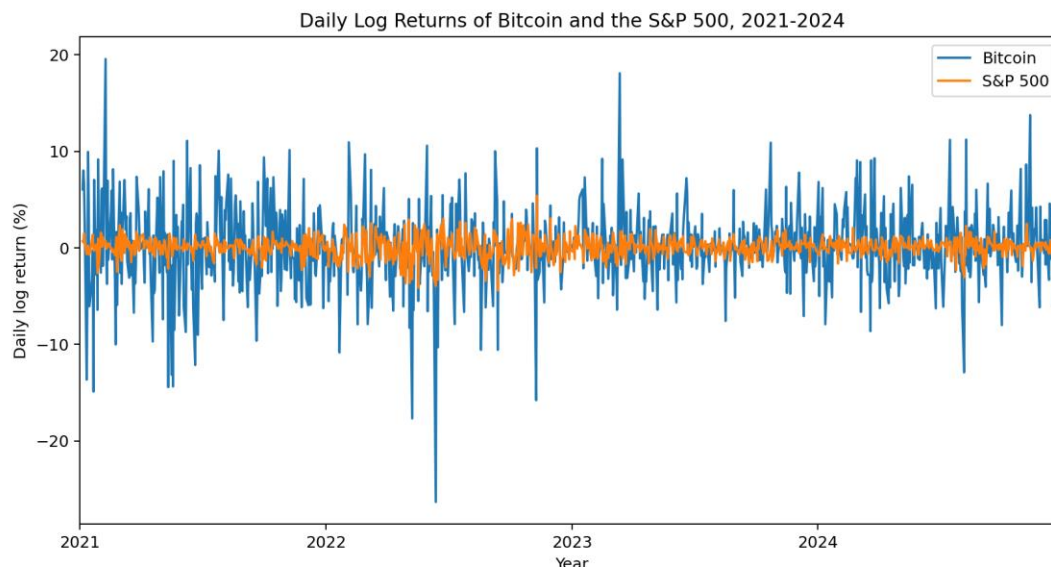


Figure 2. Daily Log Returns of Bitcoin and the S&P 500, 2021-2024

The second graph shows the daily returns of both investments. Bitcoin has much larger positive and negative movements, which supports the result that Bitcoin has higher volatility.

Overall, the results show that Bitcoin had a higher average return during the period, but it also had much higher risk and volatility than the S&P 500.

Discussion and Conclusion:

This research compared Bitcoin and the S&P 500 from 2021 to 2024.

The results show that Bitcoin had a higher average daily return than the S&P 500. However, Bitcoin also had much higher volatility. Its standard deviation was 3.96%, compared with 1.04% for the S&P 500. Bitcoin also experienced much larger daily gains and losses.

The correlation between Bitcoin and the S&P 500 was approximately 0.36. This means that there was a positive relationship between them, but the relationship was not very strong.

These results are important for investors because they show that higher returns can also come with higher risk. During the period studied, Bitcoin provided higher returns, but investors had to accept much larger changes in its value.

This research has some limitations. It only compares Bitcoin with the S&P 500 and only covers the period from 2021 to 2024. Also, the S&P 500 series used is a price index, so it does not include dividends. Future research could use a longer period or compare Bitcoin with other investments such as gold, bonds, or Ethereum.

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