

Introduction

In the realm of traditional finance studies, an intriguing observation known as the low volatility anomaly has emerged. This phenomenon suggests that stocks exhibiting lower volatility tend to produce superior risk-adjusted returns compared to their high-volatility counterparts. This discovery originated from the paper by Haugen and Heins (1975,1972). This anomaly has been well documented and studied in the equity markets, and has been attributed to various factors such as behavioral biases, liquidity constraints, and information asymmetry. Moreover, this phenomenon occurs in across regions (Ang et al., 2006; 2009; Peswani, 2017; Joshipura and Joshipura, 2016) and many asset classes (Frazzini and Pedersen, 2014).

As time goes by, the cryptocurrency market continues to mature, and investment strategies have also been evolving. In the early days of cryptocurrencies, investors mainly invested based on their optimism about the future potential of cryptocurrencies like Bitcoin. However, at that time, the market had not yet fully formed, and many investors lacked understanding of the cryptocurrency market, resulting in high investment risks.

In recent years, the cryptocurrency market, led by Bitcoin, has experienced multiple fluctuations, and investors gradually began to view it as an investment tool and make long and short-term investments based on market trends. At the same time, as the cryptocurrency market further matures, more and more investors and institutions are starting to include cryptocurrencies in their investment portfolios. For example, many companies specializing in digital asset management have begun to launch various cryptocurrency funds to make it more convenient for investors to enter the cryptocurrency market.

In addition, in recent years, some investors have combined cryptocurrencies with traditional investments, such as using cryptocurrencies as a hedging tool or looking for factors to explain cryptocurrency returns. Compared to pure cryptocurrency investment, this investment strategy can reduce risks, but it also requires more market knowledge and risk control capabilities.

Therefore, the main focus of this paper is to explore whether the low-volatility investment strategies applied in different assets and regions in the past can also be applied in the gradually maturing cryptocurrency market.

Data and Methodology

Coinmarketcap was the source of daily closing price data for the top 100 cryptocurrencies by market capitalization, quoted in reference to the USD, from December 26, 2013, to November 1, 2022. A total of 3,232 observations were recorded during this period. Furthermore, the portfolio is reviewed every two years to ensure that it consists of the top 100 cryptocurrencies by market capitalization for at least two years. The sample was cleaned to remove data errors, and series containing 100 or fewer data points were dropped. Lastly, cryptocurrencies that are closely tied to assets such as USDT, which is pegged to the US dollar, and other stablecoins with minimal volatility, are excluded from the portfolio. This ensures that the composition of the portfolio remains unchanged and unaffected by assets with strong correlation. After selecting the data, we removed the records that trading volume is less than 100. In order to ensure that the assets in the sample have sufficient liquidity and trading activity, such filtering can also reduce the impact of immature or fraudulent cryptocurrencies on the research results. Cryptocurrency returns are calculated based on the logarithmic first differences. Table 1 presents descriptive statistics for the complete sample, as well as for each quintile categorized by average volatility. According to the paper by Tobias Burggraf and Markus Rudolf (2021), they used data from April 28, 2013, to November 1, 2019. Following their approach, I also found that by removing cryptocurrencies with a market value of 0 to ensure sufficient liquidity, the data would start from December 26, 2013. However, from Table 1, we can observe that cryptocurrency groups with lower volatility tend to have relatively higher returns, while those in higher volatility groups have relatively lower average daily returns. Therefore, we expect that the low volatility anomaly may exist in this study, which considers market value, trading volume, and includes the recent cryptocurrency winter.

The study then constructed low volatility portfolios based on the methodology of (Jegadeesh and Titman, 2001), which involved ranking cryptocurrencies based on their past J-month volatilities and holding them for K months. The study chose cryptocurrencies based on their volatility over the past 3, 6, 9, and 12 months, and examined their performance over holding periods of 3, 6, 9, and 12 months. The cryptocurrencies were then sorted into ten equally-weighted portfolios based on their J-month past volatilities, and the top and bottom deciles were used to create a zero-cost portfolio.

Table1.

Descriptive statistics of daily logarithmic returns for the full sample and classified according to the volatility level .

Period	Quintile	Return	STD	Skewness	Kurtosis	Max	Min	SR
Full sample		0.00035	0.0872	1.1688	125.8741	5.0080	-4.5718	0.0040
Low volatility	1	0.00049	0.062	0.6539	0.4052	1.0273	-0.5671	0.0079
	2	0.00032	0.073	-0.7028	-0.1422	1.4442	-0.5506	0.0043
	3	-0.00001	0.081	-0.2158	-0.8787	1.5163	-0.6701	-0.0001
	4	-0.00021	0.089	-3.0258	11.5889	1.5544	-0.7152	-0.0023
High volatility	5	-0.00012	0.118	-2.1543	6.5650	5.0080	-1.1382	-0.0010

Note: The table provides descriptive statistics for the daily returns of 100 cryptocurrencies during the period from April 28, 2013, to November 1, 2022. Quintile 1 represents descriptive statistics for the least volatile cryptocurrencies, while quintile 5 represents the most volatile cryptocurrencies in our sample. All statistics are calculated based on the cryptocurrency return data. "Return" refers to the daily return, "STD" represents the daily sample standard deviation, "SR" indicates the Sharpe ratio, "skewness" measures the skewness, and "kurtosis" represents the kurtosis. For all cryptocurrencies, the Jarque-Bera test of normality, which examines the null hypothesis that skewness and excess kurtosis are equal to zero, is rejected at the 1% significance level.

Experiment & Results

Table 2 displays the annualized logarithmic average returns and T-statistics of this trading strategy. From the table, it can be observed that holding cryptocurrencies for the long term yields significant positive returns, both in high and low volatility conditions. Moreover, it is noteworthy that the buy-low-volatility and short-high-volatility strategy also generates significant positive returns. This indicates that relatively low-volatility assets among the top 100 cryptocurrencies by market capitalization offer higher returns. The table2 also illustrates that the longer the measurement period (J months) or the longer the holding period (K months), the more significant the returns obtained. The 12-month/12-month Buy-Sell strategy exhibits the highest return (0.2026) and the highest T-statistic (4.613). However, over the nine-year data period, it seems that buying low-volatility cryptocurrencies and adopting a long-term holding strategy is a relatively better choice. This result is also evident in Figure 1, where even only the 3-month/3-month, 3-month/6-month, 12-month/6-month, and 12-month/12-month Buy-Sell strategies outperform holding the top 10% high-volatility cryptocurrencies by market capitalization. Therefore, in subsequent robustness tests, I will extend the overall data period to 2018/11/1~2022/11/1, covering a complete four-year period, capturing the first major cryptocurrency market crash, to examine the impact of this Buy-Sell strategy's returns during severe market fluctuations. The results, shown in Table 3, are consistent with the previous findings: low-volatility cryptocurrencies yield higher returns. Additionally, during this period of high volatility, the majority of the top 10% most volatile cryptocurrencies exhibit negative returns. Only the 12-month/12-month short position in high-volatility cryptocurrencies yields a positive return of 1.24%, which is still lower than the positive returns of long positions. Similar situations occur in the 6-month/3-month long positions, where a low-volatility long position incurs a negative return of -5.6%, while the high-volatility short position results in a negative return of -20.4%. Nevertheless, this trading strategy continues to maintain positive returns. To further validate the effectiveness of this strategy, we compared it with Bitcoin, which serves as the benchmark for the cryptocurrency market, and the best-performing strategy from Table 2, which is the 12-month/12-month long-short strategy. As shown in Figure 3, the long-term annualized returns of this trading strategy are approximately 0.3% higher than Bitcoin, with no significant difference. However, after employing this long-short strategy to diversify market risk, the risk-adjusted annualized returns of the 12-month/12-month long-short strategy outperform holding Bitcoin by nearly 4%. This once again demonstrates the effectiveness of this strategy.

Table2.
Low volatility portfolio returns

	J	K=3	K=6	K=9	K=12
3	Buy	0.1644 (1.5092)	0.145 (1.7978)	0.190133 (2.7088)	0.2428 (3.8607)
3	Sell	0.0448 (0.3493)	0.057 (0.6621)	0.116667 (1.6221)	0.1274 (2.1367)
3	Buy-Sell	0.1192 (1.7935)	0.0878 (1.8280)	0.073467 (1.7597)	0.1154 (2.8958)
6	Buy	0.1624 (1.4471)	0.1528 (1.8837)	0.213333 (2.9057)	0.2479 (3.6868)
6	Sell	0.0912 (0.7007)	0.1046 (1.2576)	0.139067 (1.8902)	0.1271 (2.2510)
6	Buy-Sell	0.0712 (0.9292)	0.0482 (1.1145)	0.074133 (1.6203)	0.1208 (2.7429)
9	Buy	0.23 (1.9784)	0.2428 (2.8176)	0.287867 (3.6586)	0.3082 (4.4745)
9	Sell	0.1388 (1.0287)	0.1246 (1.4553)	0.147467 (2.0694)	0.1466 (2.8544)
9	Buy-Sell	0.0912 (1.2906)	0.1182 (2.6000)	0.140267 (3.1451)	0.1615 (3.9801)
12	Buy	0.2876 (2.3946)	0.2696 (2.9807)	0.305733 (3.7363)	0.3246 (4.3757)
12	Sell	0.1852 (1.3894)	0.105 (1.2733)	0.150933 (2.1909)	0.1220 (2.4344)
12	Buy-Sell	0.1024 (1.4145)	0.1646 (3.6645)	0.1548 (3.7231)	0.2026 (4.6130)

Note: The table displays the average annual returns of portfolios with low volatility, which consist of a sample of 100 cryptocurrencies, covering the period from December 26, 2013, to November 1, 2019. These portfolios were constructed immediately after the portfolio formation period.

Fig.1. . The average returns of low volatility J-K portfolios. The figure illustrates the portfolio returns for portfolios formed immediately after the portfolio formation period.

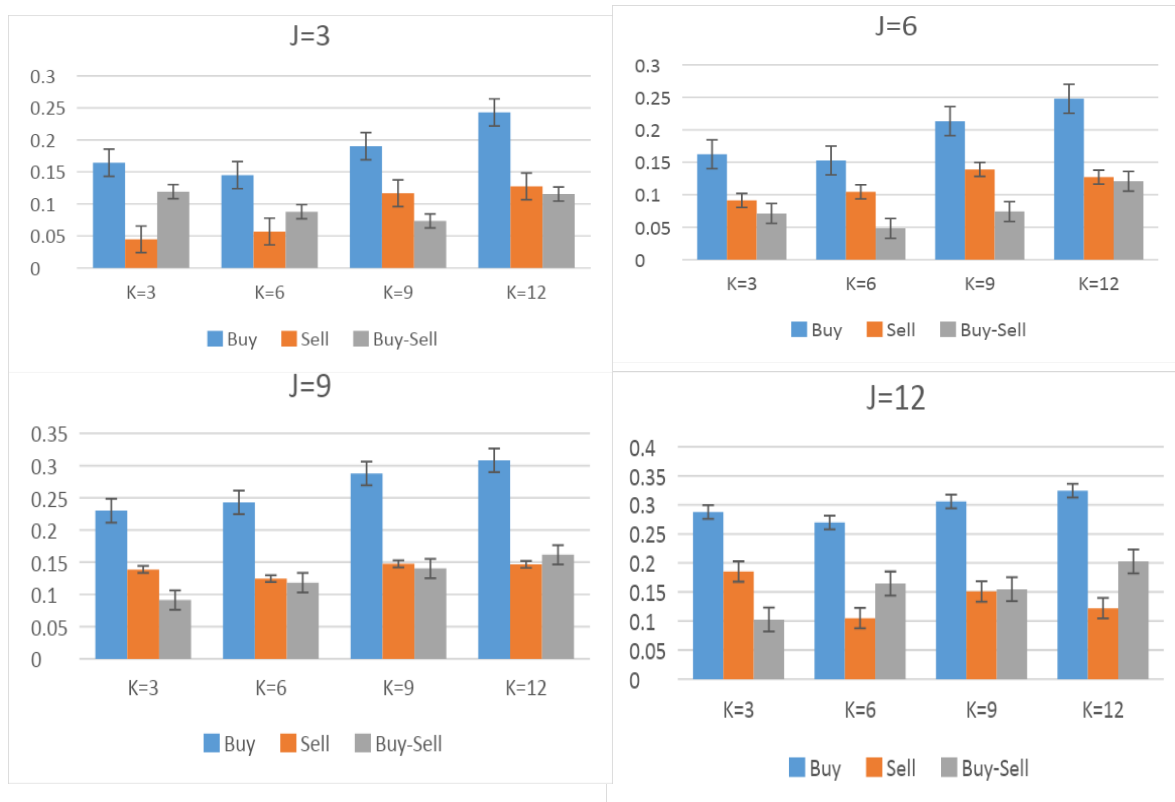


Fig.2. . The annualized return of a 12-month/12-month long-short strategy compared to the annualized return of holding Bitcoin, as well as the risk-adjusted returns.

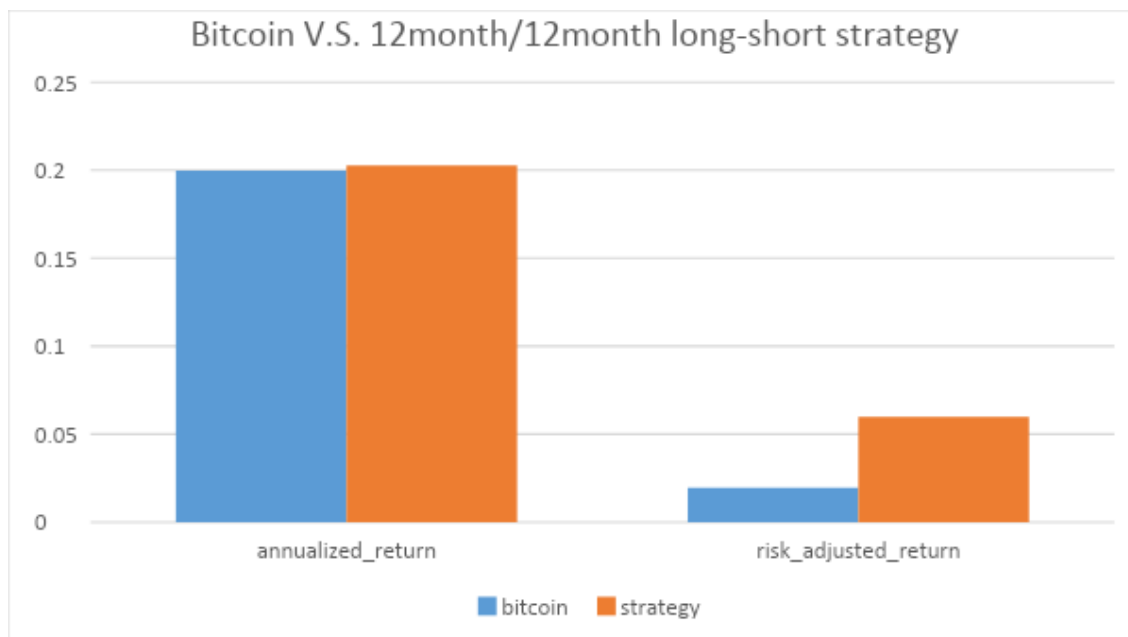


Table3.

Robustness test – low volatility portfolio returns for different sample period
(2018/11~2022/11).

	J	K=3	K=6	K=9	K=12
3	Buy	0.0712 (0.4874)	0.0364 (0.3191)	0.0980 (0.9931)	0.1712 (1.9508)
3	Sell	-0.1560 (-0.826)	-0.2210 (-1.944)	-0.1530 (-1.490)	-0.0950 (-0.944)
3	Buy-Sell	0.2272 (2.4288)	0.2572 (5.6754)	0.2512 (7.7607)	0.2662 (7.6491)
6	Buy	-0.056 (-0.383)	0.0176 (0.1517)	0.1151 (1.0460)	0.1847 (1.9300)
6	Sell	-0.2040 (-1.045)	-0.2190 (-1.861)	-0.1560 (-1.325)	-0.0857 (-0.791)
6	Buy-Sell	0.1484 (1.4518)	0.2366 (7.1916)	0.2712 (7.1455)	0.2705 (6.9986)
9	Buy	0.0964 (0.5999)	0.1782 (1.3096)	0.2591 (2.0535)	0.2705 (2.9408)
9	Sell	-0.1530 (-0.741)	-0.1880 (-1.450)	-0.111 (-0.913)	-0.0167 (-0.159)
9	Buy-Sell	0.2492 (2.3758)	0.3680 (10.699)	0.3699 (9.6548)	0.3378 (11.269)
12	Buy	0.2100 (1.2026)	0.2536 (1.6624)	0.3229 (2.3524)	0.3803 (2.9985)
12	Sell	-0.034 (-0.148)	-0.1420 (-0.967)	-0.039 (-0.301)	0.0124 (0.1073)
12	Buy-Sell	0.2444 (2.2702)	0.3960 (7.6413)	0.3630 (8.4548)	0.3678 (8.5833)

Note: The table displays the average annual returns of low volatility portfolios consisting of a sample of 100 cryptocurrencies from November 1, 2018, to November 1, 2022. These portfolios were constructed immediately after the portfolio formation period.

This finding also differs from previous research. In this study, in addition to considering the liquidity of cryptocurrencies, it also includes higher market capitalization cryptocurrencies and higher trading volumes, making the returns of the trading strategy more stable. The main reason for this difference may lie in the fact that Tobias Burggraf and Markus Rudolf (2021) used a sample of 1,000 cryptocurrencies as investment targets for the trading strategy. However, in reality, not all periods on the CoinMarketCap website have 1,000 cryptocurrencies listed, and the cryptocurrencies with lower rankings in the top 1,000 often have insufficient trading volume, leading to liquidity issues. Therefore, when applying this trading strategy to the top 1,000 cryptocurrencies by market capitalization, there is a possibility of including high-volatility short positions for rapidly rising high-cap cryptocurrencies. The anomaly of low volatility exists within the realm of cryptocurrencies. Therefore, we further refined the selection criteria and focused only on the top 30 cryptocurrencies by market capitalization for the long-short trading strategy. The results are presented in Table 4, where it can be observed that this trading strategy consistently maintains positive returns, generally significant at the 1% level. However, it is worth noting that none of the strategies outperformed the buy-and-hold strategy in the long run. While the returns of some strategies may fall short of expectations, such as the 9-month/3-month long-short trading strategy with an annualized return of less than 1% and the 12-month/3-month long-short trading strategy with an annualized return of around 4%, the overall consistency of the results is maintained.

This result is likely attributed to investor behavioral biases. According to Shefrin and Statman (2000) in behavioral portfolio theory, investors can be categorized into two cognitive frameworks when making investment decisions. The first framework is aimed at avoiding poverty, while the second framework focuses on pursuing wealth. In the first framework, known as risk-averse behavior, investors make rational choices to minimize risk. However, within certain asset classes, individuals may become risk-neutral or even risk-seeking. However, when it comes to cryptocurrencies, investors tend to overinvest in high-risk cryptocurrencies because they perceive them to be similar to lottery tickets. Buying an excessive amount of these high-risk assets can diminish their upside potential, while holding a small portion of high-risk cryptocurrencies allows for the preservation of upside potential. Furthermore, many cryptocurrency investors overlook the concept of diversifying risk through holding multiple currencies, leading to deviations from risk-averse behavior. Consequently, high-risk cryptocurrencies may be overvalued while low-risk cryptocurrencies are undervalued. Cryptocurrencies have experienced significant events such as China's ban on cryptocurrency trading in 2017, the investigation and regulation of Initial Coin Offerings (ICOs) by the U.S. Securities and Exchange Commission (SEC) in 2018, the market

downturn and panic caused by the COVID-19 pandemic in 2020, and the collapse of major exchanges like FTX in 2022, which triggered a wave of investor panic and fund withdrawals. These significant events have also caused many highly volatile cryptocurrencies to disappear from the market.

Table4.

Robustness test – low volatility portfolio returns for top 30 cryptocurrencies .

	J	K=3	K=6	K=9	K=12
3	Buy	0.3688 (2.8239)	0.2922 (3.4658)	0.3169 (4.2059)	0.3542 (5.0994)
3	Sell	0.1136 (0.7641)	0.1222 (1.2918)	0.1757 (2.5454)	0.1641 (2.6711)
3	Buy-Sell	0.2548 (3.0335)	0.1700 (2.7123)	0.1411 (2.7048)	0.1901 (3.9311)
6	Buy	0.2756 (2.4582)	0.2272 (3.0556)	0.2699 (4.2704)	0.3255 (5.0585)
6	Sell	0.0964 (0.6172)	0.1362 (1.3928)	0.1852 (2.4595)	0.1616 (2.7042)
6	Buy-Sell	0.1792 (1.8174)	0.0908 (1.2070)	0.0847 (1.5640)	0.1639 (3.4259)
9	Buy	0.294 (2.4361)	0.2506 (3.0863)	0.2711 (3.8193)	0.3291 (4.8261)
9	Sell	0.2848 (1.5944)	0.1976 (1.9408)	0.1728 (2.2792)	0.1460 (2.1871)
9	Buy-Sell	0.0088 (0.0743)	0.0530 (0.7231)	0.0981 (1.7129)	0.1831 (3.7365)
12	Buy	0.2440 (2.4915)	0.2576 (3.1528)	0.2817 (3.9056)	0.3430 (5.2971)
12	Sell	0.2040 (1.2316)	0.1636 (1.7825)	0.1451 (1.9303)	0.1133 (1.8668)
12	Buy-Sell	0.0400 (0.3016)	0.094 (1.3072)	0.1367 (2.5522)	0.2296 (4.4645)

Note: The table displays the average annual returns of low volatility portfolios consisting of a sample of 30 cryptocurrencies from December 26, 2013, to November 1, 2022. These portfolios were constructed immediately after the portfolio formation period.