

DCA-Based BTC Market Analysis (2016–2024)

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1. Introduction

Dollar-Cost Averaging (DCA) is a long-term investment strategy in which a fixed amount of capital is invested at consistent intervals, regardless of market volatility. This approach reduces emotional decision-making, avoids market timing, and smooths the entry price of an asset over time.

The purpose of this analysis is to understand how a 4-year DCA strategy performs across different Bitcoin market cycles, particularly around halving events, and to extract practical insights about return patterns, peak ROI timings, and the effect of investment scaling. While the focus is on long-horizon 4-year DCA, we also compare it with 1-year DCA to highlight differences in variance, sensitivity to entry timing, and overall risk–return behavior.

2. Methodology Overview

This analysis is based on daily Bitcoin close-price data, on top of which I ran a series of DCA simulations. The procedure is straightforward: starting from a selected date, a fixed USD amount is invested in Bitcoin every day at that day's BTC/USD exchange rate. This process continues for four years, at which point all accumulated BTC is sold back into USD. Using the total amount paid and the final USD value, both profit and ROI

To evaluate how investment size and scaling behavior affect long-term returns, multiple configurations were tested. Daily investment amounts ranged from 0.5 USD to 100 USD, and additional yearly multipliers between 0.9 and 1.2 were applied—meaning that after each investment year, the daily investment amount was multiplied by a chosen factor. This allowed the analysis to measure whether increasing or decreasing contributions over time has any practical impact on overall performance.

3. Key Insights

3.1. Long-Term DCA Yields More Stable and Consistently Positive Returns

One of the most striking observations from this comparison is that the first quartile (Q1) of the 4-year DCA results is higher than the third quartile (Q3) of the 1-year results. This clearly indicates that long-term DCA provides substantially better performance than short-term DCA, even in unfavorable market conditions.

This advantage comes from what can be described as a *volatility shield effect*. By investing consistently over a long period, high and low price points are naturally averaged out. During price declines, the cost basis drops as new, cheaper BTC units are accumulated, which prevents the portfolio value from falling as sharply as it would during a short-term strategy.

Another notable point is that the 4-year distribution stays entirely above zero—its Q1 is strictly positive—while the 1-year distribution contains nearly 25% negative outcomes. In other words, even in the worst quartile of cases, long-term DCA remains profitable, whereas short-term DCA carries a meaningful chance of loss.

These differences highlight how increasing the investment horizon significantly reduces risk while improving consistency and reliability of returns.

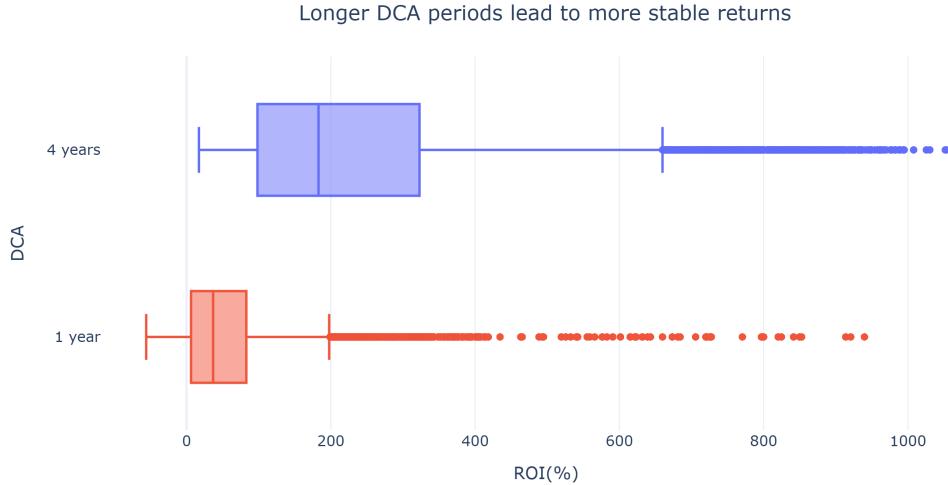


Figure 1: 4 years vs. 1 year box plots

3.2. ROI Distribution is Right-Skewed with Rare Extreme Outliers

The ROI distribution for the 4-year DCA simulations is strongly right-skewed. This means that while a few rare periods generate extremely high returns, the majority of outcomes cluster in a more moderate range. Most simulations fall between 50% and 200% ROI, indicating that long-term DCA tends to produce stable and positive outcomes for typical historical market conditions.

Because of the right-skewness, the mean ROI is noticeably higher than the expected or “typical” result. Although returns above 800% are indeed possible, such extreme outcomes represent only a small fraction of all simulated start dates. These outliers pull the average upward but are not representative of what most long-term DCA investors historically experienced.

This structure highlights an important characteristic of Bitcoin: exceptional bull phases exist, but they are infrequent, and long-term DCA returns are primarily driven by the broad central mass of the distribution rather than rare explosive periods.

Distribution is highly right-skewed: a few rare periods generate exceptional returns

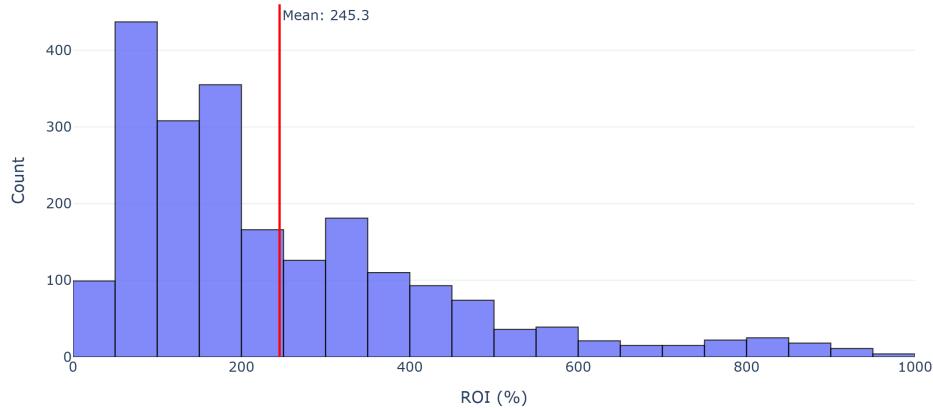


Figure 2: ROI Distribution

3.3. Lower Multipliers Outperform Because They Allocate More Capital Earlier

The comparison between the 0.9 and 1.1 yearly multipliers shows that the lower multiplier consistently produces higher returns throughout the entire period. This effect is largely driven by Bitcoin's long-term upward trend: investing more aggressively in the earlier years means purchasing BTC at significantly lower prices.

When the daily investment amount is reduced each year (multiplier = 0.9), a larger portion of the total capital is deployed near the beginning of the DCA window, when BTC prices were historically much cheaper. In contrast, using a higher multiplier like 1.1 shifts more of the total investment toward later years, resulting in higher average entry prices and therefore lower overall ROI.

This demonstrates that in long-term upward-trending markets, allocating more capital earlier yields better performance, while delaying investment leads to systematically weaker outcomes.



Figure 3: x0.9 vs. x1.1 ROI

3.4. Early-Cycle DCA Entry Produces the Strongest Multi-Year Returns

This chart clearly shows that the most profitable long-term DCA outcomes occur when the strategy begins early in a new market cycle, before upward momentum accelerates. The best

example is the 1000% ROI achieved by starting DCA shortly before the 2017 bull run—an entry timing that allowed most purchases to occur at relatively low prices prior to the explosive market expansion.

In contrast, beginning DCA late in the cycle, or during a weak and extended bear phase, leads to significantly smaller gains. Even over multiple years, such late-cycle entries can result in modest performance, with the worst cases in this period yielding returns of only around 33%.

Overall, these results highlight the importance of cycle positioning. Small daily investments grow dramatically when initiated before a broad market uptrend, but they deliver far smaller benefits when most of the major price appreciation has already occurred.

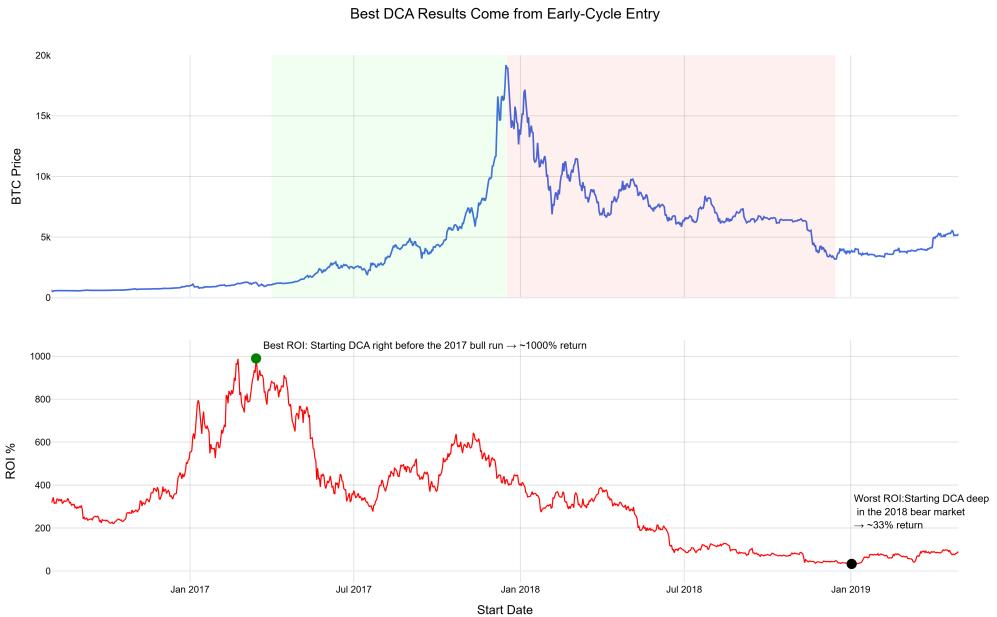


Figure 4: ROI vs. BTC

3.5. Post-Halving ROI Peaks Occur Within 7–8 Months in Both Cycles

Note: The Y-axis scales of the two charts are intentionally different. In this comparison, the timing of the peaks matters more than the absolute ROI values.

Both the 2016 and 2020 cycles show a remarkably similar pattern: DCA returns reached their maximum roughly 7–8 months after each halving. This indicates that the early post-halving expansion phase historically contains the strongest price appreciation, and that starting a long-term DCA immediately after a halving captures the most favorable part of the cycle.

Conversely, delaying the start of a DCA plan reduces potential gains, as the majority of the upward movement has already occurred by the time later entries take place. The alignment of these peak timings across two separate cycles suggests a recurring behavioral structure in Bitcoin's halving-driven market dynamics.

As for the 2024 halving, it does not appear in this analysis because we are evaluating 4-year DCA windows. The latest possible start date in the dataset is 2021-11-24, meaning a full 4-year period following the 2024 halving is not yet available.



Figure 5: ROI after halvings

3.6. Scaling the Daily Investment Preserves the Distribution Shape

This comparison shows that increasing the daily investment amount from \$1 to \$10 simply scales the entire profit distribution by a factor of ten. The interquartile range (IQR) of the \$10 results is exactly ten times the IQR of the \$1 results, meaning that the underlying return profile remains unchanged.

In other words, the distribution does not shift toward better or worse outcomes when the daily contribution increases. The strategy behaves proportionally: investing more yields proportionally higher profits, without altering the relative performance or risk characteristics. In this case, the conclusion is straightforward — the more you invest, the more you earn, with no structural advantage or disadvantage introduced by the investment size itself.

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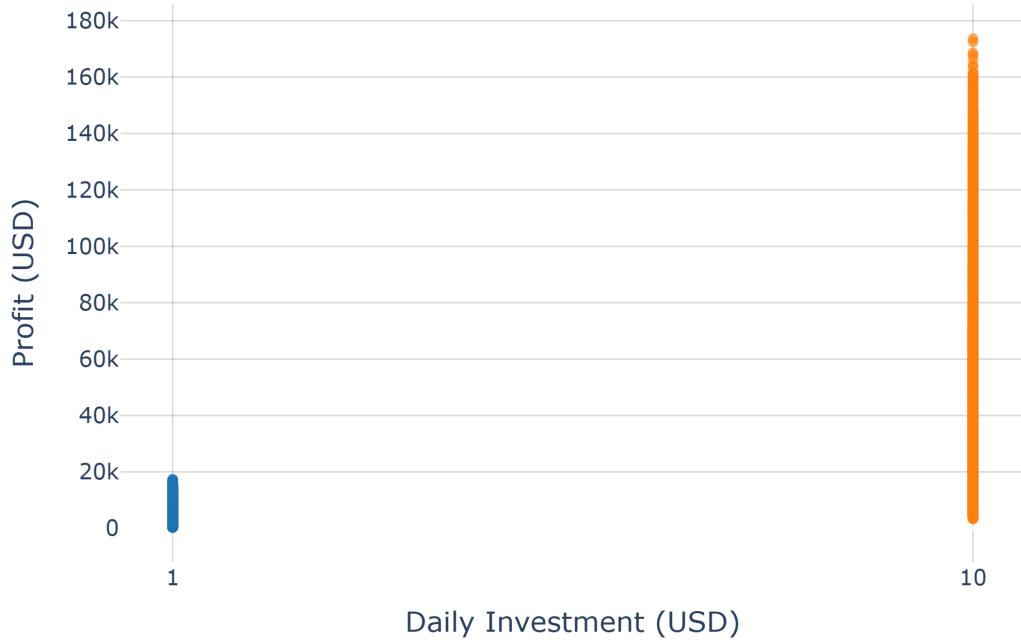


Figure 6: 1\$/day vs. 10\$/day

4. Conclusion

This analysis demonstrates that DCA is a robust and cycle-resilient strategy for Bitcoin investment. Key trends, such as early post-halving return peaks, scaling invariance, and reduced long-term variance, support the practicality of DCA for investors seeking steady exposure without market-timing stress.

The findings also highlight that while market sentiment affects short-term volatility, it does not reliably predict DCA performance. Ultimately, consistent contribution and long horizons remain the strongest factors behind favorable DCA outcomes.