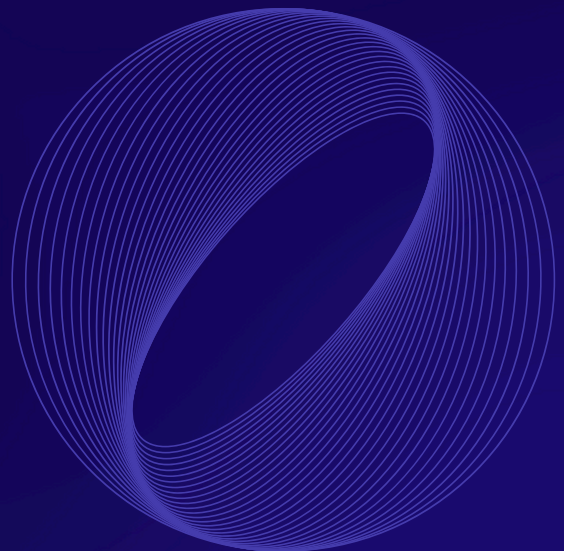# Lump Sum vs DCA Investing: A Performance Analysis

Lump Sum vs DCA Investing: A Performance Analysis

Kiran Mika | Portfolio Jay Research

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Abstract

If one were to suddenly receive a substantial sum of money, such as through a bonus, inheritance, or windfall, the question of whether to invest it all at once or spread it out over time becomes a pivotal consideration.

The following report analyzes the relative performances of a lump-sum investing strategy against a monthly dollar cost averaging (DCA) investment strategy in the S&P 500 across various time frames.

Historical data for the S&P 500 is used. We assume a $2000 monthly contribution for the DCA strategy, and a lump-sum initial investment that is equivalent to the total contribution of the DCA strategy. As such, total principal investment is the same for both strategies.

The findings indicate that lump-sum investing generally outperforms DCA in the majority of scenarios, with the margin of outperformance increasing as the investment horizon lengthens. In certain volatile periods, DCA may outperform. However, in our tests for long time horizons exceeding 20 years, the lump sum strategy nearly always achieves higher compound annual growth rates (CAGR).

Process

The analysis was conducted using Python, leveraging its ecosystem of libraries to efficiently retrieve and analyze financial data. The yfinance library by Yahoo Finance was employed to access 75 years of daily S&P 500 data, ranging from March 1950 to March 2025. This dataset included closing prices, which were used to calculate key metrics such as CAGR.

Aggregate Performance

Parameters:
- Random investment time period (1-20 years)
- 5000 samples taken

The following process involves retrieving 75 years of historical S&P 500 data, selecting random time frames between 1 and 20 years, and randomly picking valid start dates. For each period, the Lump Sum strategy invests the full amount upfront, while the DCA strategy spreads the invested principal to ensure equal monthly contributions across the period.

Final portfolio values are used to calculate compound annual growth rates (CAGR) for both strategies, and the differences are recorded. This is repeated across 5000 samples.

The lump sum strategy's outperformance against DCA is calculated as:
Lump sum outperformance = CAGR of lump sum strategy - CAGR of DCA strategy

In instances where DCA exhibits a higher return, the lump sum outperformance metric is negative. The plot below visualizes the results.
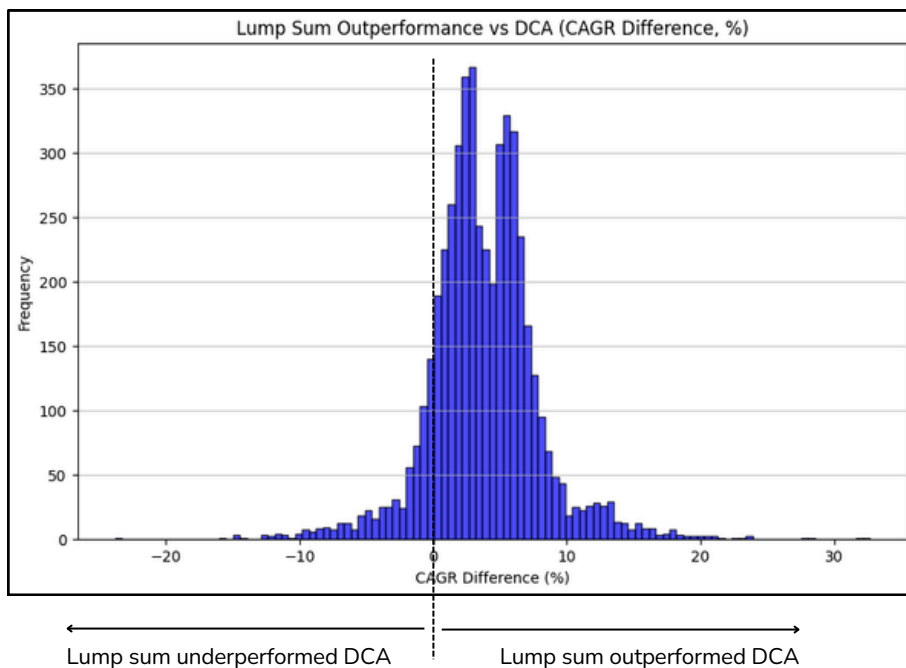

Mean outperformance of lump sum strategy	3.76%
Median outperformance of lump sum strategy	3.51%
Number of samples where lump sum strategy beat DCA	4394/5000 (87.88%)

Fig 2. Summary statistics of sampling distribution

Fig 1. Sampling distribution of outperformance of the lump sum strategy

Evidently, in most instances, the lump sum strategy excels, exhibiting mostly positive outperformance over the DCA strategy. It should be noted that this is is an aggregate test combining samples from various time frames (1-20 years).

The following pages will zoom in on specific time periods as case studies.

Case study 1: Long-term Performance To Date

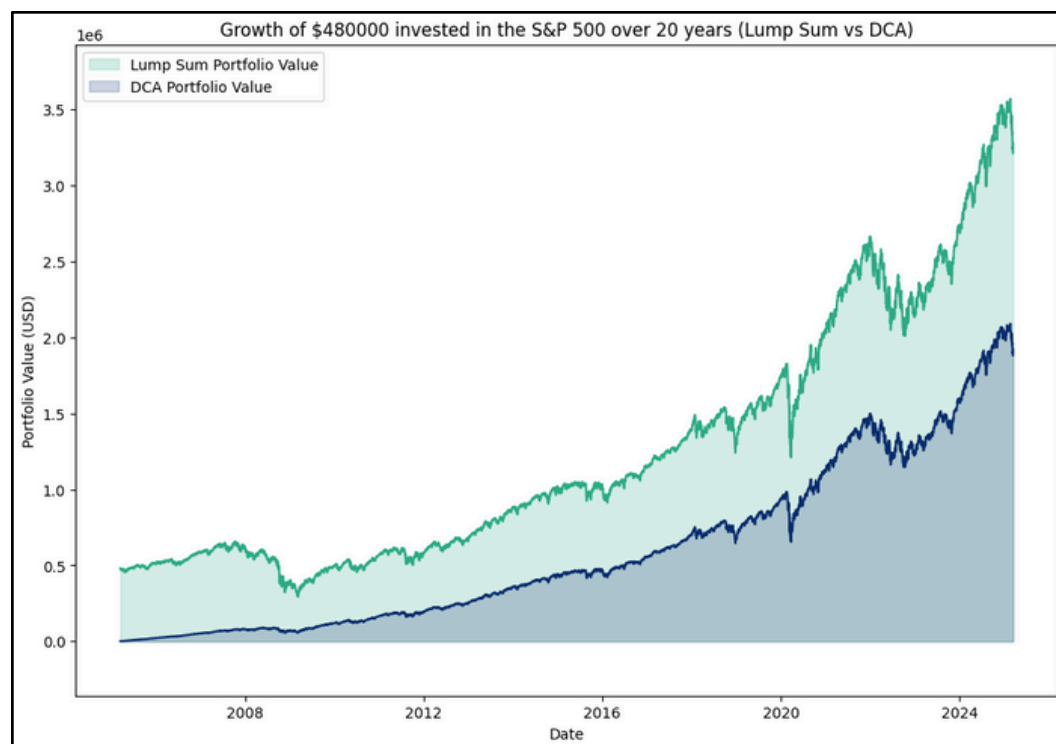Time period: 20 years (March 2000 - March 2025)

Fig 3. Performance of lump sum vs DCA investment strategy over past 20 years to date

It is evident from that in the 20 year time frame, lump sum investing in the S&P 500 has significantly outperformed monthly dollar-cost averaging (DCA). This outcome can be attributed to the remarkable performance of the S&P 500 over the past two decades, which includes periods of substantial growth, such as the post-2008 recovery and the bull market of the 2010s. By investing the entire amount upfront, the lump sum approach maximized exposure to the market's growth and benefited fully from the compounding returns over time.

In contrast, the DCA strategy, which spreads investments over monthly intervals, delays full market exposure. As portions of the investment remain unallocated during periods of strong market performance, the strategy sacrifices potential gains in favor of risk mitigation. While DCA can be effective in volatile or declining markets, the predominantly upward trajectory of the S&P 500 over the last two decades favors lump sum investing. This behavior is reflective of a market that rewarded early and prolonged exposure, making lump sum a naturally superior approach in this context. The analysis highlights the importance of market trends and timing in determining the effectiveness of an investment strategy.

Case study 2: Medium-term performance to date

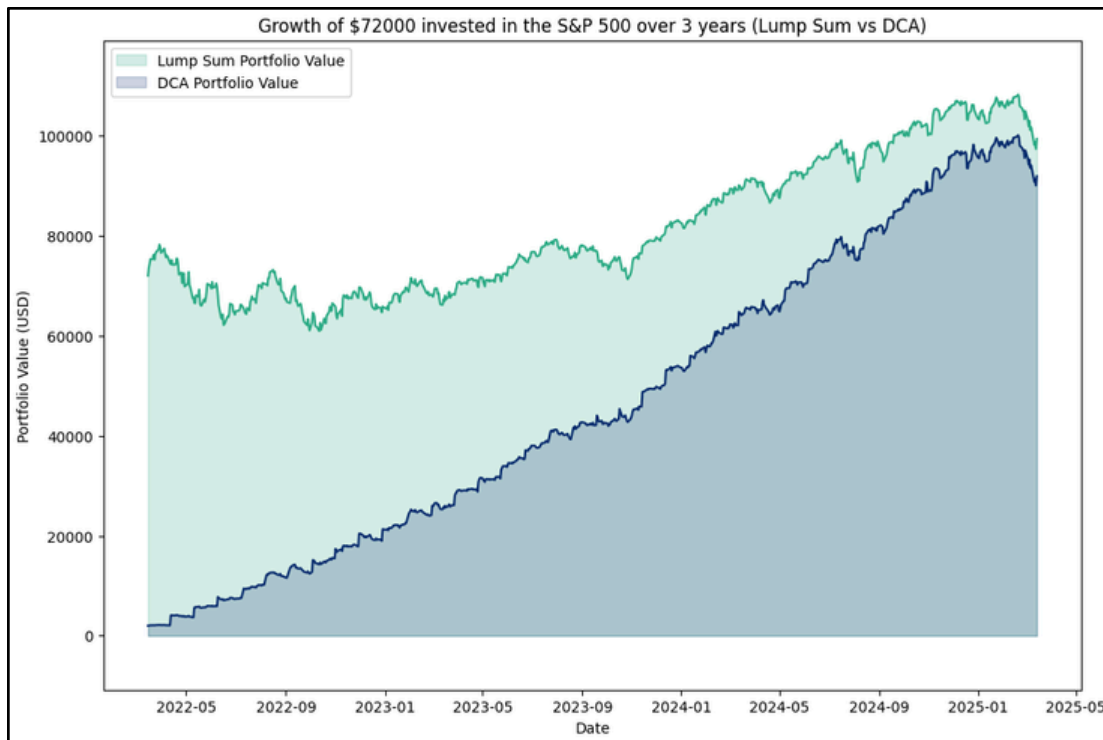Time period: 3 years (March 2022 - March 2025)

Fig 4. Performance of lump sum vs DCA investment strategy from March 2022 to March 2025

Over shorter timeframes, the performance gap between lump sum investing and dollar-cost averaging (DCA) is less pronounced. This is because compounding benefits from lump sum investments require more time to take effect, while DCA mitigates risks by spreading investments across intervals.

During the 2022 bear market, DCA performed better as it allowed investors to buy shares at lower prices during the market downturn, reducing the overall average cost of investment. In contrast, lump sum investing exposed the entire capital to the immediate impact of market declines. In such volatile periods, DCA's gradual approach provided better downside protection, narrowing the performance difference.

Case Study 3: Instance when DCA outperformed

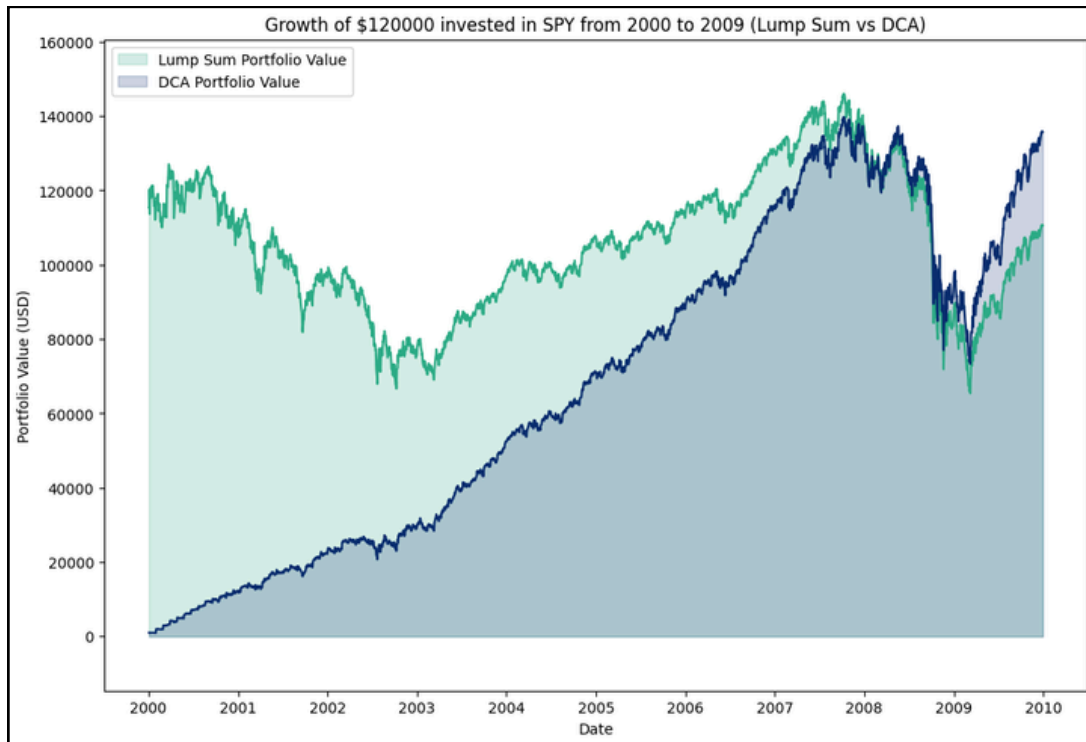Time period: "The lost decade" (Jan 2000 - Dec 2009)

Fig 5. Performance of lump sum vs DCA investment strategy from Jan 2000 to Dec 2009

During the "lost decade" of the 2000s, dollar-cost averaging (DCA) outperformed lump sum investing due to the tumultuous market environment, which included the early 2000s dot-com crash and the 2008 financial crisis. The S&P 500 experienced significant volatility and two major downturns during this period, making the timing of investments critically important.

Lump sum investing, which allocates the entire investment amount at the beginning, suffered greatly from adverse market conditions. For example, the dot-com bubble burst led to a sharp decline in stock prices from 2000 to 2002, erasing substantial value from a lump sum investment made at the start of the decade. While markets recovered in subsequent years, the 2008 financial crisis caused another devastating downturn, dragging the lump sum portfolio value down significantly again.

In contrast, DCA, which spreads investments evenly over time, mitigated the impact of these market crashes. By regularly investing fixed amounts each month, DCA allowed investors to purchase more shares when prices were low during the downturns.

The steady, methodical approach of DCA provided a buffer against the sharp declines experienced by lump sum investors. By taking advantage of market lows, DCA not only reduced the overall impact of volatility but also positioned investors to capitalize on eventual recoveries, leading to superior performance during this challenging decade.

Win Rate

This test examines the win rate of Lump Sum over Dollar-Cost Averaging (DCA) investment strategies over various time horizons using 75 years of S&P 500 data.

A 'win' for the lump sum strategy is defined as:
Lump sum 'win' = CAGR of lump sum strategy > CAGR of DCA strategy
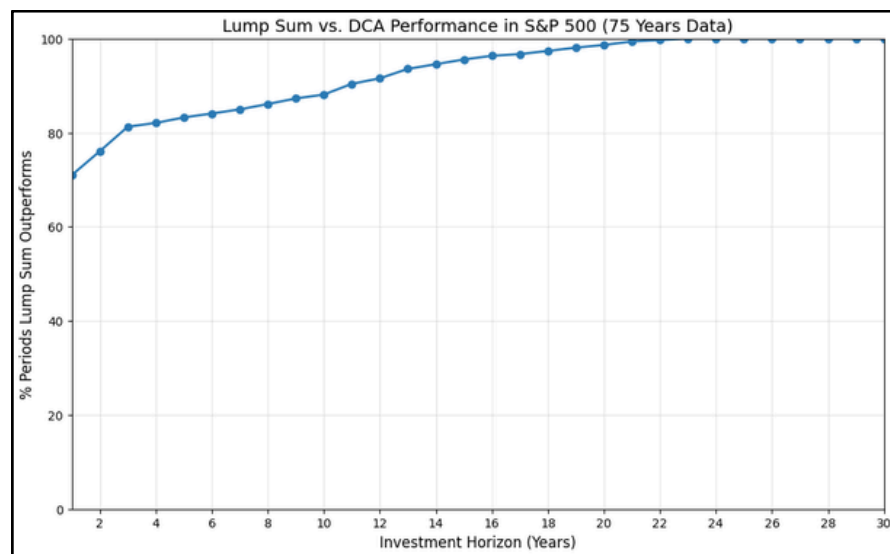

Fig 6. Scatter plot of win rate of lump sum strategy

The results of the win rate test reveal a clear advantage for lump sum investing over dollar-cost averaging (DCA) as the investment horizon increases. For shorter periods, such as 2 years, lump sum investing outperforms DCA in approximately 80% of cases. This advantage steadily grows with longer horizons, reaching near certainty—close to 100%—for investment durations of 20 years or more.

This analysis underscores the importance of time in maximizing the benefits of lump sum investing, as the strategy's outperformance becomes more pronounced with longer time horizons. For investors with the capacity to tolerate short-term market volatility and maintain a long-term perspective, lump sum investing is statistically more likely to deliver superior returns compared to DCA. These findings highlight the relationship between investment duration and strategy effectiveness, offering valuable insights for long-term financial planning.

Investment Horizon (Years)	Lump Sum Win Rate
1	71.0%
2	76.1%
3	81.3%
4	82.1%
5	83.2%
6	84.1%
7	84.9%
8	86.1%
9	87.3%
10	88.1%
11	90.4%
12	91.5%
13	93.6%
14	94.5%
15	95.6%
16	96.3%
17	96.7%
18	97.4%
19	98.1%
20	98.6%
21	99.4%
22	99.7%
23 - 30	100.0%

Fig 7. Table of lump sum win rates for various time horizons

Takeaways

Lump sum investing generally tends to outperform because it allows the entire investment to remain in the market for a longer period, fully benefiting from growth and compounding. This makes it particularly effective in consistently rising markets like the S&P 500 in recent decades. However, it will suffer in the short to medium term if markets decline soon after the investment is made.

DCA, in contrast, spreads investments over time, reducing the risk of fully entering the market at an unfavorable moment. This strategy excels in volatile or declining markets, enabling investors to purchase shares at lower prices and take advantage of a reduced cost basis during recovery. That said, in a market that rises overall, it is expected to lose out to lump sum investing.

References

Ranaroussi. (n.d.). GitHub - ranaroussi/yfinance: Download market data from Yahoo! Finance's API. GitHub. https://github.com/ranaroussi/yfinance

S&P 500®. (n.d.). S&P Dow Jones Indices. https://www.spglobal.com/spdji/en/indices/equity/sp-500/#overview

Analyst

This report was produced by Kiran Mika, a business student in Nanyang Technological University.
Email: kiranmika8@gmail.com
LinkedIn: https://www.linkedin.com/in/kiran-mika-km24

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