DCA+ : The machine-learning-powered risk averaging strategy that accumulates more while minimizing risk.

The Calculated Finance Foundation

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Abstract

Investing in cryptocurrencies is a high-risk, high-reward endeavor that has attracted a lot of attention in recent years. The extreme volatility of the cryptocurrency market can make it difficult to determine the best time to buy or sell, and many investors have experienced substantial losses after making decisions based on emotion or hype. The Dollar-Cost Averaging strategy aims to mitigate this risk, yet the favorable risk profile it offers comes at the cost of potential returns. This paper introduces DCA Plus, a machine-learning based investment strategy that offers the same risk mitigation benefits of traditional dollar-cost averaging while increasing the likelihood of positive returns. By leveraging a sophisticated algorithm, DCA Plus analyzes market trends and adjusts investments accordingly, averaging out risk over time. With its user-friendly interface and robust features, DCA Plus is an innovative solution for individuals looking to invest in digital assets in a more secure and consistent manner that doesn't require active management or monitoring.

Introduction

The emergence of cryptocurrency has brought about both excitement and trepidation for investors seeking high-risk, high-reward opportunities. However, the extreme volatility of this digital asset market can make it difficult to determine the best time to invest, leading to rash decisions and potential losses. To address these challenges, a new investment strategy: DCA Plus, has been developed. DCA Plus leverages machine learning technology to enable users to accumulate digital assets with a comparable risk profile to traditional DCA while also increasing the likelihood of positive returns. By analyzing market trends and adjusting investments accordingly, DCA Plus allows users to steadily build their digital asset portfolios without worrying about the volatility of the market. This paper will explore the mechanics of DCA Plus and its potential benefits for investors seeking to maximize returns without forgoing their risk tolerance.

Traditional Dollar Cost Averaging

Overview

Dollar-Cost Averaging (DCA) is a well-established investment strategy that involves investing a fixed amount of money at regular intervals, regardless of market conditions. This approach can help to smooth out the peaks and valleys of the market, reducing the risk of allocating too much capital at a price peak. DCA has been shown to be an effective strategy for traditional investments such as stocks and bonds, and there is evidence to suggest that it can be similarly effective for cryptocurrencies and digital assets.

The Downside

Investors who seek to minimize risk with DCA face an inherent trade-off: doing so entails foregoing *potential* gains. This is especially true for cryptocurrencies as they are known to exhibit extreme market fluctuations, with valuations potentially rising by 10-100x over short time periods, investors with limited exposure to the market may miss out on significant profit opportunities. While those who invested larger sums at earlier time points may benefit significantly, traditional DCA may represent a sub optimal investment strategy in the cryptocurrency market, especially in the lead up to bull runs.

DCA Plus: A Form Of Temporal Asset Allocation

Overview

DCA Plus thrives in the volatile markets of cryptocurrency by creating a buying strategy that increases potential gains relative to traditional DCA without sacrificing the favorable low-risk profile that traditional DCA offers. It assesses risk based on market conditions to dynamically determine the proportion of each investment with the aim of accumulating more assets with the same amount of starting capital.

How It Works

DCA Plus takes an array of data and processes it to establish a risk score. It then compares this risk score to the long-term average risk, and then uses this ratio to alter the ‘usual’ buy-amount. More formally, the dollar value (‘buy-amount’ from here onwards) of the purchase is calculated according to:

$$B = \dot{B}\frac{\hat{r}}{R}$$

Where R is the risk score, which is calculated as an exponentially weighted moving average over a variable number of days, X, set according to the user's desired strategy duration. The R value on any given day can be calculated as follows:

$$R = \sum_{0}^{X} \lambda^i * r_i$$

Where λ is a constant and r_i is the risk score generated by our algorithm on day i.

B-dot is the USD value of a purchase that would have been made according to a traditional DCA strategy:

$$\dot{B} = \frac{Total\ capital * interval}{duration}$$

And finally, r-hat is the long-term mean risk, which is determined empirically rather than a long-term average of algorithmically generated scores.

The upper-and lower-bounds of R are moderated by the accuracy of the risk assessments, but it ranges between 0 and 1, meaning that buy-amount is infinite to the upside and always

greater than 0. This is important because our research shows that skipping buys, even if markets look risky, runs a larger risk of missing out on a continued bull-run and further gains.

So, to summarize, according to the Risk Averaging formula, if risk (R) is lower than expected (r-hat), more is purchased. If it's higher than expected, less is purchased. Theoretically, 'risk averaging' could take on as many different forms as there are definitions of risk. The prospect that this capital allocation framework will open up new avenues for others to explore fruitful alternatives to the classic DCA strategy is exciting.

Assessing Risk

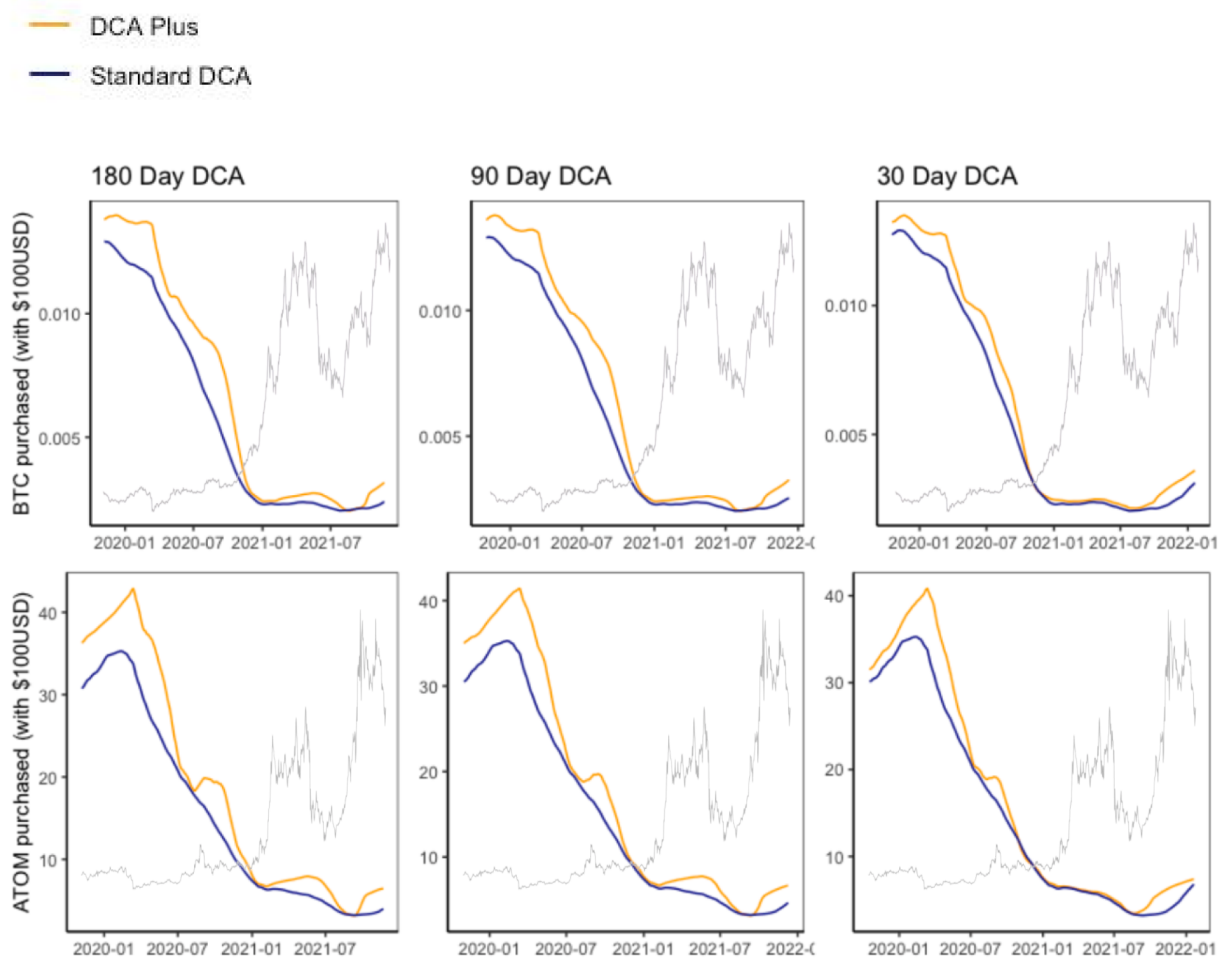
The performance of a risk averaging strategy can vary depending on how risk is defined. Our research has focused on identifying the most effective criteria for assessing risk, such as using the trailing volatility of BTC price or more traditional metrics like the CPI. However, given its complexity the actual risk assessment algorithm and data inputs will be discussed comprehensively in a further whitepaper.

For the purpose of this paper, it will suffice to say that statistical tools and machine learning techniques are becoming increasingly powerful and there is a growing body of literature demonstrating their effectiveness in identifying patterns in asset markets and forecasting certain trends.

Results

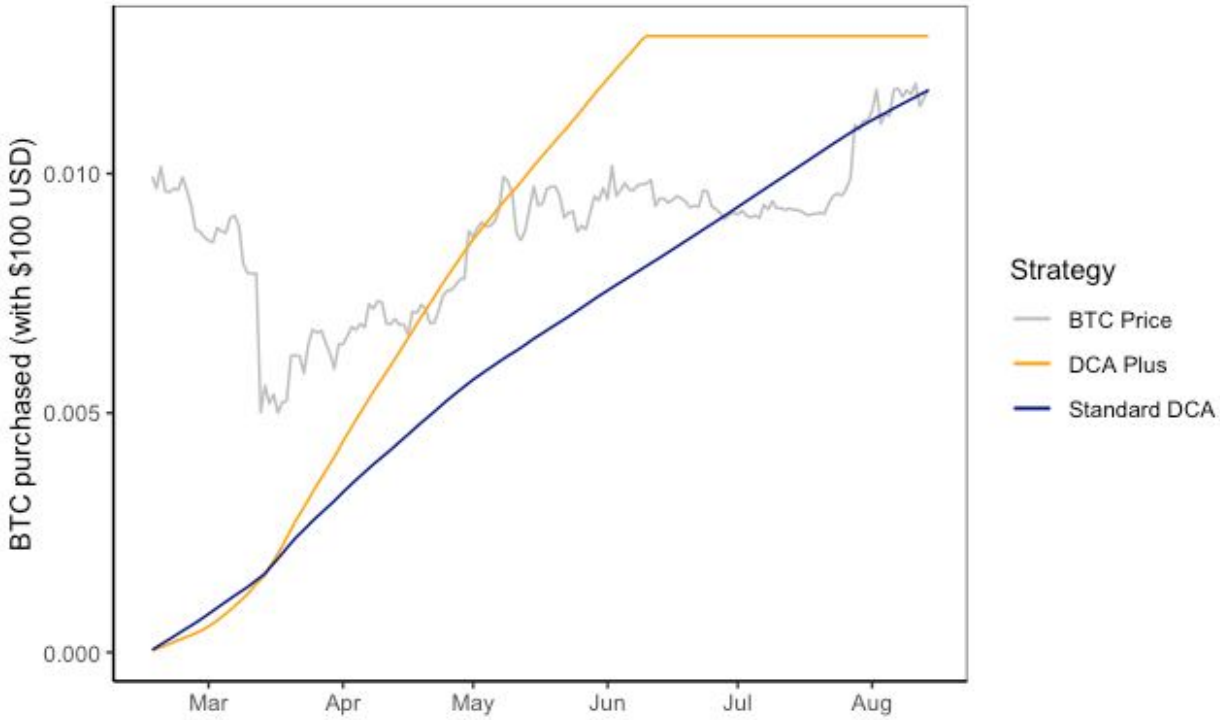
Throughout the duration of the backtesting window (on 'unseen' data), the DCA Plus strategy was consistently able to accumulate more tokens than its traditional DCA counterpart.

Tokens Accumulated By DCA Plus



This figure compares the amount of Bitcoin and ATOM accumulated by DCA Plus and traditional DCA for over seven hundred 'trials' throughout the backtesting window between 2020–2022. The gold lines represent performance of the DCA Plus strategy and the blue lines represent results of traditional DCA. The figure displays performance of the DCA Plus algorithm over varying DCA durations, with longer time periods (180 day DCA duration) yielding the best returns compared to traditional DCA and shorter durations (30 day DCA) yielding the smallest difference. The horizontal axis represents the day that the strategy commenced, with points on the line showing the final amount bought for the strategy that played out over the following 180/90/30(+/-) days.

A Bitcoin Accumulation Comparison

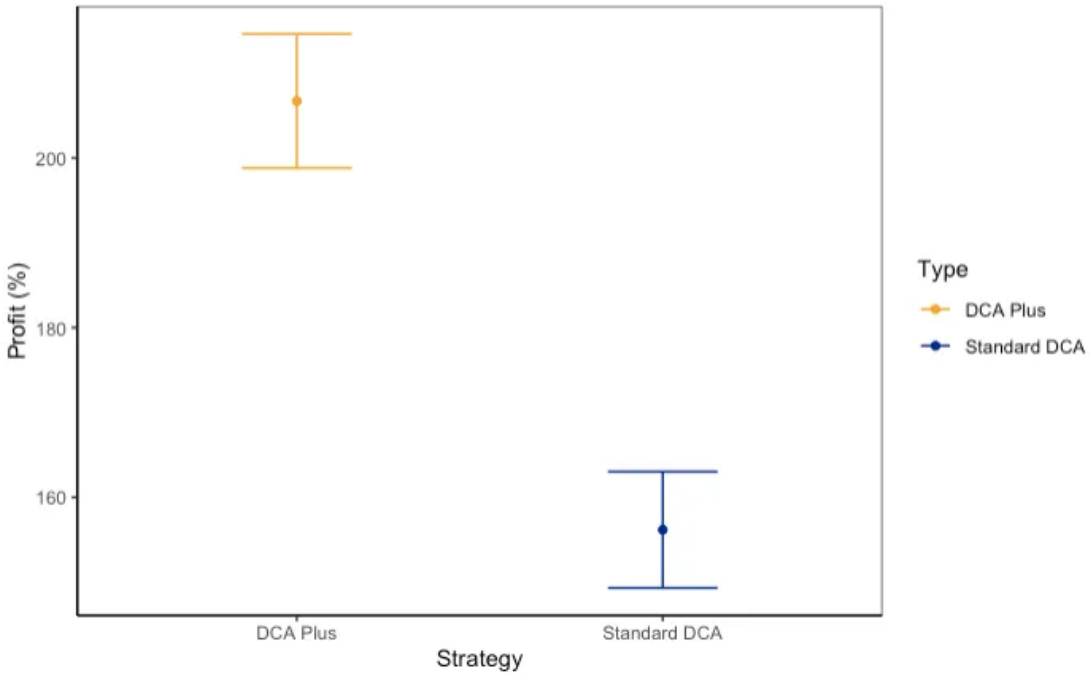


This figure compares the amount of BTC accumulated by DCA Plus and traditional DCA. You can see that the DCA Plus strategy dynamically accumulated more BTC during the price dip when the risk of a future crash was comparatively lower and as a result ended before the traditional DCA strategy. Comparing the total BTC accumulated you can see that DCA Plus well out-performed traditional DCA.

It is clear that the DCA Plus strategy performs particularly well preceding the run up of a bull market, since the algorithm has suggested higher buy-amounts compared to traditional DCA when perceived risk was low. This is true for all DCA durations, however the outperformance magnitude relative to traditional DCA is greatest for longer DCA durations (>90 days). For 180 day-long strategies beginning in the window 2020–2021, DCA Plus provided, on average, a 50% higher return than traditional DCA*. At its best, DCA Plus outperformed traditional DCA by over 100%.

** returns were calculated at time t + 2x, where t is the start date of the DCA strategy and x is the 'expected' duration of the DCA strategy*

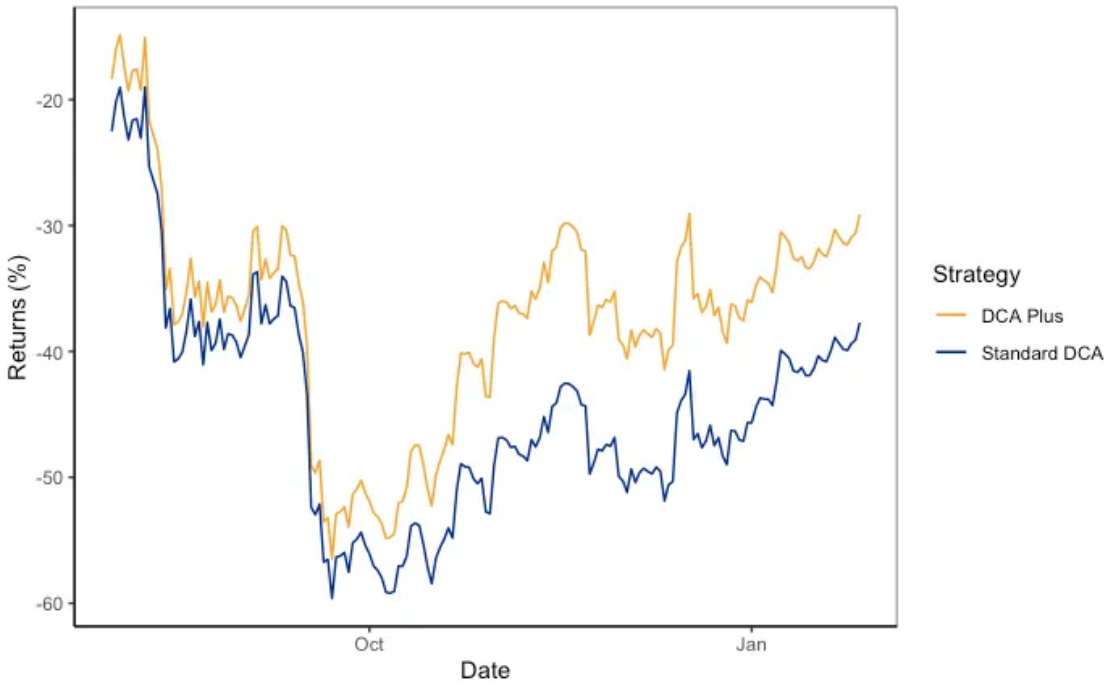
Consistency of Returns



This figure shows mean and standard error for returns (%) of 365 comparisons of 180-day DCA plus vs traditional DCA over the year 2020–2021. Profits were, on average, 50% higher for the DCA Plus strategy when compared to traditional DCA strategy.

Similarly, DCA Plus is able to outperform when leading into the bear market, since risk is correctly perceived as 'high' by the algorithm and subsequently less capital is deployed at the top. The figure below compares the two approaches for trials beginning in the six month window between August 2021 and February 2022.

Comparative Risk



This figure shows percentage returns on an initial investment when following either the DCA Plus or traditional DCA strategy. It shows the results of over 180 trials commencing between 08/21 and 02/22. Returns were consistently negative for both strategies as trials commenced during the peak bull market, however it is clear that DCA Plus is able to reduce the impact of the price drop throughout 2022 by buying less at the top.

Performing a comparative analysis of risk, the graph depicted above illustrates that the maximum loss incurred by employing a traditional DCA strategy was almost 60%. In contrast, the maximum loss observed through the utilization of the DCA Plus strategy was 56.4%, indicating that even during extended market depressions DCA Plus may be a less risky approach to investing.

Approach

While machine learning algorithms are exceptional at pattern recognition, there is inherent uncertainty as they are limited in their ability to predict large-scale hidden fraud or regulatory intervention by entities such as the SEC. However, this does not render the algorithmic predictions useless. Instead, it is important to assess the level of uncertainty or confidence and utilize it as a crucial metric in moderating the buy-amount. In DCA Plus, confidence in algorithmic assessments was defined using a 50:50 test/train data split. This means that the accuracy of risk assessment was determined by testing it on ~4 years of 'unseen' data. Even though prediction accuracy may well be higher in the trained algorithm that has 'seen' the entire dataset, a conservative approach was taken when presenting the above results in this paper.

Application

A Direct To Consumer On-chain Offering

DCA Plus will be offered as a non-custodial, decentralized product on the Calculated Finance DeFi protocol. This allows users to set up strategies on-chain paired with features such as auto-staking. It also has the option of offering a unique value proposition for goal- or savings-based accumulation products.

As An Indicator For Risk

DCA Plus, or the machine learning risk assessment algorithm more specifically, can publish the daily risk score to support apps that want to leverage the algorithm's risk assessment with the possibility to monetize the service as an API endpoint.

Timeframes

The protocol will initially restrict the minimum investment duration to 30 days. This is because, in keeping with the goal — to assist long term wealth generation — the model has been tailored to perform well across a range of market conditions. The kind of timeframes over which a market switches from bear markets to bull markets are measured in weeks to months, and this is therefore the kind of time horizon on which the model has been fine-tuned to provide its most accurate assessments of risk. The goal was to develop a strategy that users would not have to change when the market turns. DCA Plus is designed to be a truly set-and-forget strategy for the whole market cycle.

Fees

As with all sustainable products, a fee model needs to drive revenue back to the treasury for funding future growth and development. In an effort to ensure alignment of incentives DCA Plus will only charge a performance fee, no operation or use fee. This means that both parties win when DCA Plus outperforms traditional DCA and if not, no fees will be charged.

Given the dynamic investment allocation of DCA Plus, a strategy may end before or after a traditional DCA strategy that had started on the same day. Due to this, it’s difficult to draw a pair-for-pair comparison however to combat this difficulty, an escrow model of 5% of swapped

assets will be introduced and upon completion the correct performance fee will be deducted from the escrow and the rest will be returned in full. It's a bold fee model but one that correctly aligns positive outcomes for all parties involved.

Conclusion

This paper presents Calculated Finance's DCA Plus, a decentralized 'risk-averaging' product that when compared to traditional DCA, helps users accumulate more assets while maintaining a comparable risk profile. The DCA Plus simplicity and robustness makes it a fitting answer to investing in volatile cryptocurrency assets for those that want exposure to the potential upside that the asset class offers without the elevated probability of substantial losses over short term periods. It's the perfect product to accelerate crypto adoption and introduce users into the ecosystem for the first time without exposing them to unnecessary levels of risk.

References

"Dollar-cost averaging: The time-weighted and performance effects of equal and unequal investment amounts" by Ravi Dhar and William Goetzmann, published in the Journal of Financial Planning in 2005.

"Dollar-cost averaging just means taking risk later" by Ben Carlson, published on the A Wealth of Common Sense blog in 2014.