Bitcoin’s Potential Role in an Institutional Portfolio

By Gayatri Choudhury and Matthew Hougan
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This article examines the case for adding bitcoin to a diversified portfolio of stocks and bonds. Specifically, we consider the impact that different allocations to bitcoin would have had on a traditional portfolio consisting of 60 percent in equities and 40 percent in bonds (the traditional 60/40 portfolio) under myriad different market regimes, using data from January 2014 through December 2022. This period captures the considerable volatility that impacted bitcoin in 2022.

Bitcoin would have contributed positively to a diversified portfolio’s cumulative and risk-adjusted returns in 76 percent of one-year periods, 100 percent of two-year periods, and 100 percent of three-year periods since 2014, assuming quarterly rebalancing.

In addition, the size of that positive impact would have been significant: On average, assuming quarterly rebalancing, a 2.5-percent allocation to bitcoin would have boosted the three-year cumulative return of a traditional 60/40 portfolio by 13 percentage points.

This article builds on a significant body of literature examining bitcoin’s influence on portfolio returns. One criticism of prior papers is that the authors cherry-pick specific time periods, rebalancing strategies, or allocation amounts to highlight positive results. The question that lingers in the back of many potential investors’ minds is, “What if I didn’t allocate exactly this way?”

We aim to address this question by being comprehensive in all possible aspects. Specifically, we show how key portfolio metrics would have fared considering the following:

- Extensive price data running across multiple bull and bear markets, starting on January 1, 2014, and ending on December 31, 2022;
- A large number of time periods, using rolling-period analyses to examine every possible one-, two-, and three-year holding period within that history;
- A range of potential bitcoin allocations, from 0 percent to 10 percent of the portfolio; and
- Multiple rebalancing frequencies, including monthly, quarterly, annual, and no rebalancing.

The findings are robust across all these variables.

There is, of course, no guarantee that the relationships between a bitcoin allocation and key portfolio performance metrics will persist going forward; past performance is no guarantee of future returns. Still, the results of the study suggest bitcoin may have a role to play in institutional portfolios moving forward.

METHODOLOGY

We examined the impact of adding a bitcoin allocation to a traditional diversified portfolio of stocks and bonds, i.e., the traditional 60/40 portfolio. The traditional portfolio features a 60-percent allocation to the Vanguard Total World Stock ETF (VT) and a 40-percent allocation to the Vanguard Total Bond Market ETF (BND). VT holds a market-cap-weighted portfolio of global stocks covering 98 percent of the world’s market capitalization, and BND holds a market-value-weighted portfolio representing all taxable, investment-grade U.S. bonds. We used the total return track record of these funds, assuming all dividends are reinvested.

On average, assuming quarterly rebalancing, a 2.5-percent allocation to bitcoin would have boosted the three-year cumulative return of a traditional 60/40 portfolio by 13 percentage points.

In an effort to adopt the most conservative approach, the study used bitcoin’s price return and does not add in the value of hard forks or airdrops. In practice, an investor allocating to bitcoin could have achieved a meaningfully higher total return by capturing the value of these distributions during the study period.

The study used daily price data from January 1, 2014, through December 31, 2022. It excluded the period before 2014 because no investable bitcoin funds were available to professional investors before
that year. In addition, removing the first years of bitcoin’s existence makes the analysis more conservative because bitcoin’s price appreciated substantially before 2014. The study used both point-in-time and rolling analyses. We find rolling analyses useful because they eliminate concerns about cherry-picking time periods and provide a fuller view of the frequency and magnitude of the impact a bitcoin allocation can have on a portfolio under different market regimes.

For rolling analyses, instead of looking at arbitrary start and end dates, we fixed a certain holding period window, e.g., three years, two years, or one year, and analyzed all possible holding periods of that length from the available data.

Beyond cumulative and annualized returns, this analysis also examined key portfolio performance metrics, including the Sharpe ratio, standard deviation, and maximum drawdown, to evaluate the risk-adjusted impact on returns. We used a risk-free rate of 3.55 percent for our analysis.

All returns calculated in this study are daily and normalized for official market trading days, i.e., bitcoin returns during the weekend or market holidays are accounted for on the following trading session and bitcoin’s daily prices are captured at 4 p.m. EST, which is the traditional market close time. All annualized calculations are computed using 252-day periods.

**BITCOIN’S IMPACT ON A 60/40 TRADITIONAL PORTFOLIO IMPACT ON RETURNS**

We start our analysis by examining the returns of a traditional 60/40 portfolio without a bitcoin allocation. During the study period, this portfolio returned 50.8 percent, assuming quarterly rebalancing; on an annualized basis, this is a 4.7-percent return.

Figure 1 and table 1 show that a modest allocation to bitcoin would have significantly improved these returns.

For instance, adding a 2.5-percent bitcoin allocation with quarterly rebalancing would have improved the cumulative return of the portfolio to 82.0 percent from the 50.8 percent achieved without a bitcoin allocation. This result would have been achieved without much change in either the portfolio’s volatility (11.0 percent with bitcoin, up from 10.7 percent without) or its maximum drawdowns (24.3 percent with bitcoin, up from 22.7 percent without). The portfolio’s Sharpe ratio, which measures excess returns per unit of risk (measured as standard deviation), would have improved by 188 percent. Naturally, bitcoin’s portfolio impact scales with the size of the allocation: A 5-percent allocation to bitcoin would have boosted the cumulative return of the portfolio to 117.4 percent, more than doubling the total return of the traditional portfolio.

It is fair to note that the price of bitcoin rose sharply during this period, from $755 at the start of 2014 to $16,548 on December 31, 2022. A natural follow-up question is, “How would allocating to bitcoin impact a portfolio during more variable market conditions?”

**CUMULATIVE RETURNS: TRADITIONAL PORTFOLIO WITH AND WITHOUT QUARTERLY-REBALANCED BITCOIN ALLOCATIONS**

January 1, 2014–December 31, 2022

- 1.0% Bitcoin allocation
- 2.5% Bitcoin allocation
- 5.0% Bitcoin allocation
- Traditional portfolio

**PORTFOLIO PERFORMANCE METRICS: ASSUMING QUARTERLY REBALANCING**

January 1, 2014–December 31, 2022

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Cumulative Return</th>
<th>Annualized Return</th>
<th>Volatility (Annualized Std. Dev.)</th>
<th>Sharpe Ratio</th>
<th>Sortino Ratio</th>
<th>Maximum Drawdown</th>
<th>Up Capture</th>
<th>Down Capture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional Portfolio (TD)</td>
<td>50.84%</td>
<td>4.68%</td>
<td>10.68%</td>
<td>0.102</td>
<td>0.013</td>
<td>22.67%</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>TD + 1.0% BTC</td>
<td>62.81%</td>
<td>5.57%</td>
<td>10.74%</td>
<td>0.182</td>
<td>0.020</td>
<td>23.31%</td>
<td>100.81%</td>
<td>99.27%</td>
</tr>
<tr>
<td>TD + 2.5% BTC</td>
<td>82.00%</td>
<td>6.89%</td>
<td>10.98%</td>
<td>0.294</td>
<td>0.029</td>
<td>24.26%</td>
<td>102.02%</td>
<td>98.20%</td>
</tr>
<tr>
<td>TD + 5.0% BTC</td>
<td>117.38%</td>
<td>9.02%</td>
<td>11.72%</td>
<td>0.451</td>
<td>0.043</td>
<td>25.87%</td>
<td>104.00%</td>
<td>96.49%</td>
</tr>
</tbody>
</table>

Three Key Factors for a Successful Bitcoin Allocation

Investors must consider three key factors when allocating to bitcoin: holding period, rebalancing policy, and allocation size.

Impact of Holding Periods

A key question that investors allocating to bitcoin must ask themselves is, “How long does one need to hold it to capture its positive attributes?” Bitcoin is a

Generalizing Bitcoin’s Portfolio Impact Through Rolling Analyses

It is possible to have a fuller understanding of the impact of adding bitcoin to the traditional portfolio by looking at rolling return periods rather than picking arbitrary start and end dates.

First, we will consider the impact of a 2.5-percent bitcoin allocation using a three-year rolling period and a quarterly rebalancing frequency. Later, we will analyze the impact of different allocation sizes, holding periods, and rebalancing frequencies.

We found, for example, that adding a 2.5-percent allocation of bitcoin to a traditional portfolio would have contributed positively to its cumulative three-year return for every possible start date since 2014.

Figure 2 details this impact, showing all possible three-year holding periods during our study period. The first data point includes returns between January 1, 2014, and January 1, 2017, and the last data point refers to returns between December 31, 2019, and December 31, 2022. The other data points in between represent all three-year windows between these two. The yellow line represents the three-year rolling returns of the traditional portfolio, and the blue shading shows the positive contribution that a bitcoin allocation delivered.

Although the size of the impact ebbs and flows throughout the study period, the median contribution is 13.0 percent points, which is notable for a 2.5-percent allocation.

But the positive contribution from a bitcoin allocation does not come at the expense of excess volatility.

Figure 3 shows the improvement to a traditional portfolio’s Sharpe ratio during rolling three-year windows. As with cumulative returns, a bitcoin allocation had a positive impact on the traditional portfolio’s accumulated Sharpe ratio for every possible three-year period in our study.

In this case, the median result boosts the Sharpe ratio by 29 points, with a range of 2 points to 109 points. This shows that the small increase in annualized volatility bitcoin added to the traditional portfolio during our study was more than compensated for by excess returns.

Three Key Factors for a Successful Bitcoin Allocation

Investors must consider three key factors when allocating to bitcoin: holding period, rebalancing policy, and allocation size.
CONTRIBUTION OF A 2.5% BITCOIN ALLOCATION TO A TRADITIONAL PORTFOLIO USING QUARTERLY REBALANCING

<table>
<thead>
<tr>
<th>Rolling Cumulative Return Analysis</th>
<th>1 Year</th>
<th>2 Years</th>
<th>3 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>16.68pp</td>
<td>20.23pp</td>
<td>22.31pp</td>
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<tr>
<td>Median</td>
<td>3.47pp</td>
<td>8.48pp</td>
<td>12.95pp</td>
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<tr>
<td>Minimum</td>
<td>−2.98 pp</td>
<td>0.41pp</td>
<td>1.84pp</td>
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<tr>
<td>Win Rate</td>
<td>76.35%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Loss Rate</td>
<td>23.65%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rolling Sharpe Ratio Analysis</th>
<th>1 Year</th>
<th>2 Years</th>
<th>3 Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum</td>
<td>2.15</td>
<td>1.09</td>
<td>0.73</td>
</tr>
<tr>
<td>Median</td>
<td>0.38</td>
<td>0.29</td>
<td>0.26</td>
</tr>
<tr>
<td>Minimum</td>
<td>−0.31</td>
<td>0.02</td>
<td>0.07</td>
</tr>
<tr>
<td>Win Rate</td>
<td>81.64%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Loss Rate</td>
<td>18.36%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>


Volatile asset, after all, and it has experienced significant short-term drawdowns.

To examine the most appropriate holding period, we reran the rolling cumulative return and Sharpe ratio exercise for holding periods varying from one to three years, using a 2.5%-percent bitcoin allocation and quarterly rebalancing as the base case.

This analysis shows that bitcoin’s generally positive contribution to a portfolio’s returns remained strong during these time periods. Specifically, bitcoin had a positive impact in 76 percent of the one-year periods studied, 100 percent of the two-year periods studied, and 100 percent of the three-year periods studied.

The contribution to the traditional portfolio’s rolling Sharpe ratio was similar, as shown in table 2.

Investors can use the win rates and average contribution statistics as a guide to minimum holding periods. At a two-year holding period, the historical evidence for including a bitcoin allocation is very compelling, and as you shorten the time horizon, you take on more risk of a negative impact.

**IMPACT OF REBALANCING FREQUENCY**

Another question investors face when allocating to any asset is how frequently to rebalance their portfolios. This decision carries extra weight, however, when dealing with an asset with bitcoin’s historical level of volatility. Absent rebalancing, even a small allocation to bitcoin can grow to dominate a portfolio’s risk-return characteristics.

We now compare the cumulative and risk-adjusted returns of the traditional portfolio enhanced with a bitcoin allocation under four different rebalancing strategies: no rebalancing, monthly, quarterly, and annual rebalancing.

Figure 4 shows the substantial impact that a rebalancing strategy would have on bitcoin inside a portfolio. As might be expected with a highly volatile but upwardly biased asset such as bitcoin, the absence or lower frequency of rebalancing leads to higher volatility, higher cumulative returns, and significantly higher maximum drawdowns. Conversely, a rebalancing strategy dampens both the volatility and return impact.

There is a clear relationship between cumulative returns and volatility. The no-rebalancing strategy led to a jump in portfolio volatility (from 11.5 percent to 20.7 percent) and a large uptick in maximum drawdown (from 23.9 percent to 51.4 percent). Adding any rebalancing strategy, however—monthly, quarterly, or annually—significantly reduces the portfolio’s volatility and maximum drawdown.

Table 3 provides more detail on the impact that different rebalancing
strategies would have had on returns, risk, and drawdowns. The impact of portfolio rebalancing becomes more apparent when looked at through the lens of a rolling analysis.

The contribution of a bitcoin allocation to the diversified portfolio’s three-year rolling Sharpe ratio is positive 83 percent of the time when not rebalanced versus 100 percent with any sort of rebalancing. Also, the median contribution is significantly lower for the non-rebalanced portfolio.

**IMPACT OF POSITION SIZING**

Perhaps the most important question when allocating to crypto is, “How big a position should an investor have?”

Figures 5 and 6 show how the portfolio performance metrics we’ve been looking at would have varied with different bitcoin allocations.

Each vertical dotted line represents all the rolling three-year windows between January 1, 2014, and December 31, 2022, for a certain bitcoin allocation. Therefore, each vertical line represents 24,090 dots, with each dot representing a simulation for each day; darker regions represent heavier concentrations of dots.

The green lines represent the average for each bitcoin allocation size.

In figures 5 and 6, the leftmost vertical dotted line shows the traditional portfolio, i.e., bitcoin allocation of 0 percent, and the vertical lines to the right represent bitcoin allocations increasing in 1-percent increments up to 10 percent. Bear in mind that there is no chronological relationship among the lines as we move to the left or to the right; different lines represent different bitcoin allocations only.

Figures 5 and 6 show that larger allocations to bitcoin consistently increase the traditional portfolio’s cumulative returns.

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**PORTFOLIO PERFORMANCE METRICS**

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Cumulative Return</th>
<th>Annualized Return</th>
<th>Volatility (Annualized Std Dev)</th>
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<th>Maximum Drawdown</th>
<th>Up Capture</th>
<th>Down Capture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional Portfolio (no rebalancing)</td>
<td>50.15%</td>
<td>4.63%</td>
<td>11.47%</td>
<td>0.091</td>
<td>0.013</td>
<td>23.92%</td>
<td>100.00%</td>
<td>100.00%</td>
</tr>
<tr>
<td>No rebalancing</td>
<td>100.78%</td>
<td>8.07%</td>
<td>20.67%</td>
<td>0.211</td>
<td>0.027</td>
<td>51.37%</td>
<td>116.99%</td>
<td>110.20%</td>
</tr>
<tr>
<td>Yearly rebalancing</td>
<td>108.78%</td>
<td>8.54%</td>
<td>11.50%</td>
<td>0.419</td>
<td>0.041</td>
<td>24.72%</td>
<td>96.86%</td>
<td>90.08%</td>
</tr>
<tr>
<td>Quarterly Rebalancing</td>
<td>81.83%</td>
<td>6.88%</td>
<td>10.98%</td>
<td>0.293</td>
<td>0.029</td>
<td>24.26%</td>
<td>95.99%</td>
<td>91.95%</td>
</tr>
<tr>
<td>Monthly Rebalancing</td>
<td>70.30%</td>
<td>6.10%</td>
<td>10.97%</td>
<td>0.225</td>
<td>0.023</td>
<td>24.17%</td>
<td>95.48%</td>
<td>92.69%</td>
</tr>
</tbody>
</table>

*Source: Bitwise Asset Management. Data from January 1, 2014, to December 31, 2022.*

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**THREE-YEAR ROLLING CUMULATIVE RETURN BY BITCOIN ALLOCATION, ASSUMING QUARTERLY REBALANCING**

*Source: Bitwise Asset Management*

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**THREE-YEAR ROLLING SHARPE RATIO BY BITCOIN ALLOCATION, ASSUMING QUARTERLY REBALANCING**

*Source: Bitwise Asset Management*
and Sharpe ratio for every three-year holding period between January 1, 2014, and December 31, 2022. The shapes of the curves are different; however, cumulative returns trend consistently up and Sharpe ratio improvements start to stabilize at about a 4-percent bitcoin allocation.

It is not the case, however, that a bigger bitcoin allocation monotonically improves all key portfolio performance metrics. Figures 7 and 8 show the same analysis applied to standard deviation and maximum drawdown. Bear in mind that higher levels of standard deviation (taken as a proxy for risk) and maximum drawdowns typically are undesirable, so for figures 7 and 8 lower generally means “better.”

The portfolio’s volatility (measured by the standard deviation) increases mildly until bitcoin allocations of around 3 percent and then increases more sharply thereafter, meaning higher allocations to bitcoin have larger impacts on portfolio volatility.

Similarly, a bitcoin allocation would have had very little impact on maximum drawdowns at allocations below 4 percent and a larger impact above that level. This may suggest that allocations below 4 percent are more comfortable for investors than allocations above this level.

**CONCLUSION**

We examined the impact of adding bitcoin to a traditional portfolio of stocks and bonds. We aimed to take a comprehensive approach, looking at a long range of data (January 2014–December 2022) stretching across multiple bull and bear markets for bitcoin; using rolling period analyses to avoid cherry-picking data; and considering various rebalancing strategies, allocation sizes, and holding periods.

The results show that, historically, adding bitcoin to a portfolio would have boosted both absolute and risk-adjusted returns for all two- and three-year holding periods since 2014, assuming a rebalancing strategy was in place. The impact was more variable for one-year periods.

The study highlights three key factors investors should consider when making a bitcoin allocation: time frame, rebalancing frequency, and position size. These are by and large personal judgment calls, but we note some interesting historical patterns below:

**Time frame.** Bitcoin is a volatile asset, and its short-term outlook is extremely difficult to predict. It has experienced multiple 50-percent-plus drawdowns in its history and may experience more in the future. Our study shows that a holding period of at least two or three years is important to maximizing the likelihood of success.

**Rebalancing frequency.** Adding an asset with a significant degree of volatility in a portfolio makes rebalancing critical. We found that a disciplined rebalancing strategy was critical to maximizing bitcoin’s risk-adjusted impact on the portfolio.

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**Position size.** Adding larger and larger allocations to bitcoin would have monotonically increased cumulative returns during three-year periods, assuming quarterly rebalancing. Our study showed that the impact on Sharpe ratios, however, generally started to level off at the 4-percent allocation level. We also found that the impact on maximum drawdowns began to increase rapidly at allocations above 4 percent. This may make it uncomfortable for investors allocating above this level.

Although past performance is no guarantee of future returns, these results suggest that—used properly—bitcoin may have a valuable role to play in diversified portfolios.

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Matthew Hougan is chief investment officer for Bitwise Asset Management and was the former chief executive officer of ETF.com and Inside ETFs. He is co-author of two publications for the CFA Institute Research Foundation: A Comprehensive Guide to Exchange-Traded Funds and “Cryptoassets: The Guide to Bitcoin, Blockchain and Cryptocurrencies for Professional Investors.” Contact him at matt@bitwiseinvestments.com.

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