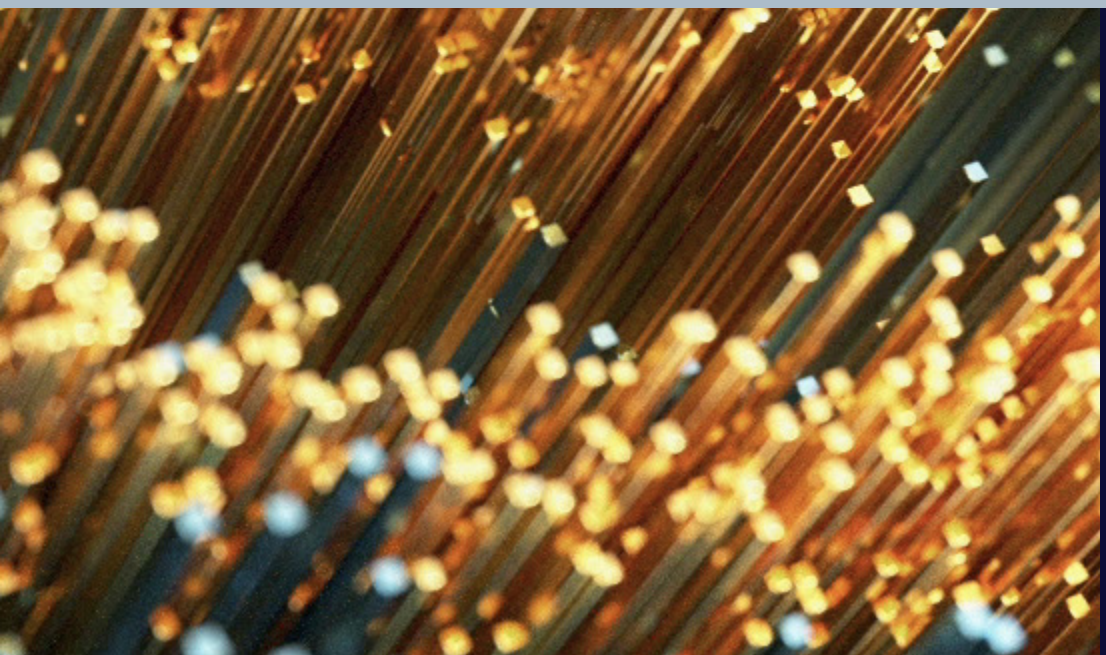
Portfolio Insights

November 2025

The Role of Bitcoin in a Portfolio



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Key Takeaways

- Bitcoin's historically distinct return and correlation profile offers potential diversification benefits when added to traditional multi-asset portfolios.
- Even small bitcoin allocations have shown the ability to shift portfolio risk and return characteristics, particularly in drawdown resilience and Sharpe ratio improvement under historical conditions.
- Frameworks like bootstrapping, mean-variance optimization, and risk budgeting provide investors with tools to evaluate bitcoin's role without relying solely on return forecasts.

Introduction

Since its inception in 2008, bitcoin has weathered intense scrutiny and repeated declarations of its demise. Fifteen+ years on, it remains not only alive but thriving. Its network is growing, use cases are expanding, and its relevance in the financial system is rising.

At WisdomTree, we have argued that digital assets are no longer a niche experiment. They are an emerging asset class. For asset allocators, our view is that the debate is no longer if crypto should be included in portfolios, but how much exposure may make sense given their specific considerations of potential risk and return.

This paper digs into that very question. We aim to help people build robust mental frameworks that they can use to analyze how a bitcoin allocation may impact portfolio risk and return. Using quantitative techniques, we explore the risk-reward dynamics of introducing bitcoin into multi-asset portfolios. While the allocation will depend on each investor's objectives and constraints, our findings indicate:

- Bitcoin's standalone volatility is high, but in a diversified portfolio, the added risk may be marginal.
- If we seek to analyze a hypothetical investment allocation, we can test a small ~1% allocation and look at the impact on overall portfolio volatility and drawdowns. We'd note that it's important to look at risk not simply as 'volatility' but from a variety of perspectives. Drawdowns are an example of a concept that can be quite illustrative in helping to set up our thinking within appropriate historical context.
- Looking ahead, one must always think in terms of potential assumptions. These assumptions may or may not prove accurate, but we can choose to set up scenarios to help us think about what may happen. We have seen the data consistently points to bitcoin having the potential to improve portfolio efficiency. Portfolio efficiency describes the balance between **risk and return.** An efficient portfolio is one that delivers the **highest expected return for a given level of risk,** or conversely, the **lowest risk for a given level of expected return.** Anything else—same risk with lower return, or same return with higher risk—is inefficient. Under different assumptions that we can detail, we can showcase the risk and return trade-offs with different levels of bitcoin exposure.

In the back half of 2025, many see a market defined by high correlations between asset classes[1]. This means, simply put, that many different asset classes may have a potential to move in the same direction at the same time. In this situation, it can be more difficult to create a diversified portfolio where different components of the portfolio are behaving differently at the same time. Also, particularly in U.S. equities, many see stretched valuations[2]. Bitcoin has historically displayed different correlation characteristics relative to traditional assets, which investors may consider in determining overall diversification considerations in potentially adding bitcoin to a portfolio.

[1] Source: Bloomberg, with data measuring returns over the period through October 2025.
[2] Source: Bloomberg, with valuation measured by the S&P 500 Index universe over the course of 2025 through the month of October.

Part 1 – A Relative Risk Approach to Bitcoin Allocation

We have identified critical takeaways for investors evaluating crypto's role within a 60/40 framework. When we say 60/40, we mean the widely cited starting point of 60% in equities and 40% in fixed income. In our opinion, the conclusions are telling:

1. **Crypto is already in the global market portfolio:** First, it's important to indicate what we mean by 'global market portfolio.' Here, we think through a reasonable array of different liquid asset classes, measured as of August 29, 2025, including broad global market equities[3], broad global market bonds[4], listed real estate[5], hedge funds[6], broad commodities[7], gold[8] and digital assets[9]. It is a reasonably complete list of different liquid assets that can be on an investor's overall menu. We can then look at the value of each in U.S. dollar terms and denote the percentages that each asset class represents of the total. Going by this approach, we see digital assets with a total value of $3,830 billion—1.7% of the total[10].
2. **Bitcoin has offered a unique return profile:** In May of 2010, 10,000 bitcoin was roughly the value of two large pizzas[11]. As of September 26, 2025, one bitcoin was trading at a value of $109,000-110,000[12]. It's important to balance the historical context of seeing essentially one of the best asset class returns over about 15-years ever with the fact that bitcoin's price movements can still be quite volatile and the asset class may still be subject to 'winters'—longer periods where the return stagnates or even trends downward.
3. **Volatility is real, but possible to manage:** In this paper, we are seeking to create frameworks to think about relatively smaller overall portfolio allocations to bitcoin, and we also consider how to think about rebalancing. For asset classes with the potential for higher volatility, it's important to consider approaches that may mean rebalancing more frequently or monitoring more closely.

We think that a comprehensive analysis can show that bitcoin has the potential to be additive in portfolio allocations.

[3] Refers to the MSCI ACWI IMI Index, with market cap sourced from Bloomberg.
[4] Refers to Bloomberg Multiverse Total Return Index, with market value sourced from Bloomberg.
[5] Refers to FTSE EPRA NAREIT Developed Total Return Index, with market cap sourced from Bloomberg.
[6] Source: Ion Analytics. (2025). *Hedge fund industry assets under management (Q2 2025).* BarclayHedge.
[7] Refers to the Bloomberg Commodity Total Return Index, with market value sourced from Bloomberg.
[8] Refers to LBMA Gold Price PM USD Index, with market value sourced from Bloomberg.
[9] Refers to MarketVector Digital Assets 100 Index, with market value sourced from Bloomberg.
[10] Source: MarketVector Indexes GmbH. (n.d.). *MarketVector™ Digital Assets 100 Index (MVDA).* MarketVector.
[11] Source: Hanyecz, L. (2010, May 22). *Pizza for bitcoins?* BitcoinTalk.
[12] Source: CoinGecko. (2025). *Bitcoin (BTC) price.*

Estimating the Impact of a Small Allocation to Bitcoin in a Portfolio Using the Bootstrapping Technique

What is Bootstrapping? Bootstrapping is a simulation technique that uses actual historical data to estimate what the future might look like without assuming that returns follow a neat mathematical distribution. Instead of creating synthetic returns, as in traditional Monte Carlo models, bootstrapping resamples with replacement from the observed history of returns, building thousands of possible future paths. Because it is based on real data, bootstrapping naturally reflects features like fat tails or volatility spikes that theory often smooths over. The trade-off is that it cannot imagine scenarios outside of what has already happened, though variations like block bootstrapping help capture patterns such as streaks or momentum. In practice, it offers investors a grounded way to test how portfolios might behave under many different combinations of past market conditions.

The key distinction between Bootstrapping and Monte Carlo Simulations lies in how return paths are created:

- **Monte Carlo** Simulations that model investment returns often rely on statistical assumptions to generate large numbers of hypothetical outcomes. The most common approach is to assume that returns follow either a normal distribution—a symmetric, bell-shaped curve centered around an average—or a log-normal distribution, which skews to the right and ensures that returns cannot drive prices below zero. In practice, this means we input parameters like the average return, the volatility of returns, and the correlations among assets, and the model produces thousands of possible paths that could unfold in the future. The normal distribution assumption captures the idea of returns clustering around the mean with both positive and negative swings, while the log-normal version reflects the compounding nature of returns, where prices can rise dramatically but cannot go below zero. This framework makes simulations powerful tools, but it also means their accuracy depends on how well the assumed distribution matches the messy, irregular patterns of real-world markets.
- **Bootstrapping** takes a very different approach from Monte Carlo because it does not rely on theoretical distributions or parameter estimates. Instead, it builds simulated return paths by directly resampling from the actual historical data we already have. Each bootstrapped scenario is composed of real returns—just reordered or repeated in different sequences—so the outcomes remain anchored in what markets have actually delivered. This makes the results intuitive, since every data point comes from observed history, but it also limits the technique to replaying past conditions rather than imagining new ones. In short, bootstrapping trades off the flexibility of assumed distributions for the realism of sticking closely to empirical evidence.

By doing so, bootstrapped samples preserve the empirical characteristics of the original dataset – including fat tails, skewness, and volatility clustering – offering a more realistic, data-driven view of possible future outcomes. It allows investors to estimate the distribution of performance metrics (for example, returns, volatility, drawdowns) under a wide range of plausible scenarios.

To deepen our analysis of bitcoin's role in a traditional 60/40 portfolio, we applied a bootstrapping technique to estimate how a small allocation to bitcoin might perform over typical investment horizons. This method allows us to simulate thousands of realistic three-year investment periods using actual historical data – offering a more comprehensive, probabilistic perspective on risk and return. We note that there is no way to accurately forecast forward-looking returns and that is not what we are seeking to do here—rather, we are looking to create a framework to help people think with higher resolution about what may happen when considering bitcoin within an asset allocation. Past performance is not indicative of future results.

Methodology

We constructed our analysis by resampling historical monthly returns into 36-month simulated return series, spanning equities, bonds, and bitcoin, drawing monthly returns with replacement. In simple terms, "with replacement" means that once a period of monthly returns is selected, it goes back into the pool and can be chosen again in a later draw—much like pulling a card from a deck, recording its value, and then putting it back before the next draw. This approach allows some historical periods to appear multiple times across different simulated paths, while others may not appear at all. The end result is a set of plausible scenarios that remain grounded in actual historical behavior but shuffled in ways that highlight the range of potential outcomes. We then built the following portfolios:

- A classic 60/40 equity-bond portfolio rebalanced semi-annually. 60% equity is represented by the MSCI ACWI Index and the 40% fixed income is represented by the Bloomberg Multiverse Index.
- Portfolios with 1% allocated to bitcoin and 99% to the 60/40 portfolio, rebalanced to maintain that 1% weighting every 1, 3, or 6 months.

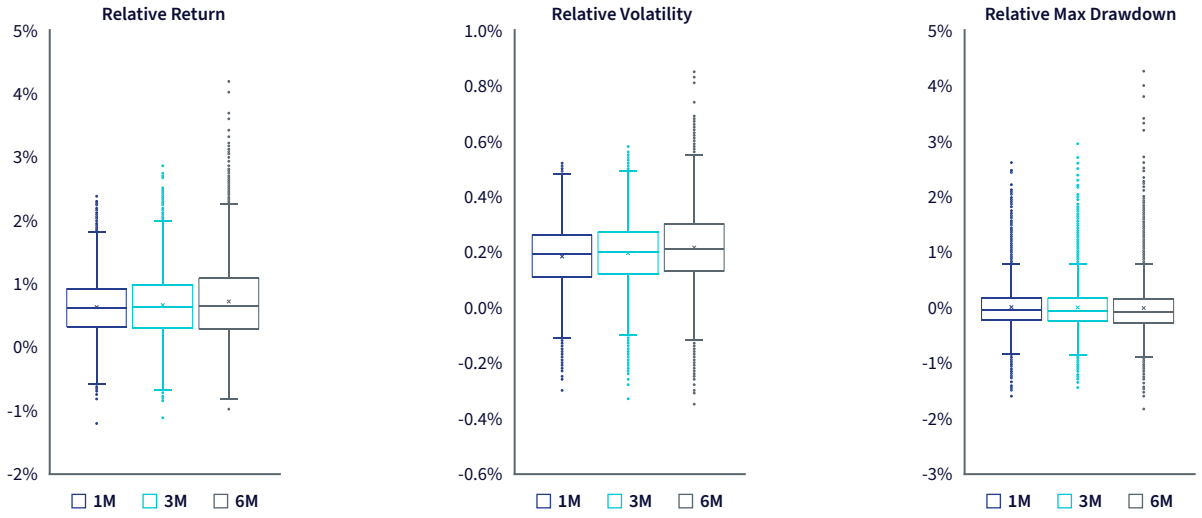
Figure 1 presents the distribution of outcomes from the bootstrapping analysis across three dimensions: return, volatility, and maximum drawdown. Each boxplot shows the central tendency and spread of outcomes of simulated portfolio paths, where the **box represents the middle 50% of the results** (the interquartile range), **the horizontal line inside the box marks the median outcome,** and the **whiskers extend to capture the broader range of values, excluding extreme outliers.** The dots beyond the whiskers represent individual outliers, highlighting the presence of more extreme but less likely scenarios. Looking first at relative returns, the boxes suggest that most outcomes cluster around modestly positive values, with longer rebalancing periods(e.g., six months) producing slightly wider distributions, indicating greater variability in results. The overall takeaway is that resampling real history generates a range of plausible returns, with the majority being positive but with occasional paths showing meaningful underperformance.

Turning to volatility and drawdowns, the boxplots reveal a consistent pattern of higher dispersion as the rebalance period increases, showing that waiting longer to rebalance generates a broader mix of outcomes. In the volatility panel, the central boxes sit comfortably above zero, confirming that most simulated paths deliver meaningful levels of increased volatility, but the whiskers and outliers illustrate that some paths

experience unusually high or low volatility relative to the 60/40 portfolio. For maximum drawdowns, the distributions cluster near zero but with meaningful outliers extending to losses of 1–2% relative to the 60/40 baseline, which demonstrates that the resampled histories can recreate crisis-like conditions even though the bulk of paths are less severe. Notably, the distribution of relative drawdowns was also positively skewed, meaning many outcomes saw improved drawdown figures, reinforces bitcoin's role as a potential diversifier. The contrast between the concentrated middle and the long tails is key: most investors would expect median experiences, but the tails remind us that history occasionally delivers sharp and painful shocks. Rebalancing more often can help to mitigate the impact of some of the extremes. Taken together, the three panels underscore how bootstrapping offers a grounded but wide-ranging view of risk and return, combining common market outcomes with the possibility of extreme scenarios.

These results are summarized in figure 1.

Figure 1: Distribution of Results Using Bootstrapping Technique



Source: WisdomTree, Bloomberg, S&P. Analysis covers three year simulated returns series bootstrapped from data from January 2014 to May 2025. Calculations are based on monthly returns in USD. **Historical performance is not an indication of future performance and any investments may go down in value.**

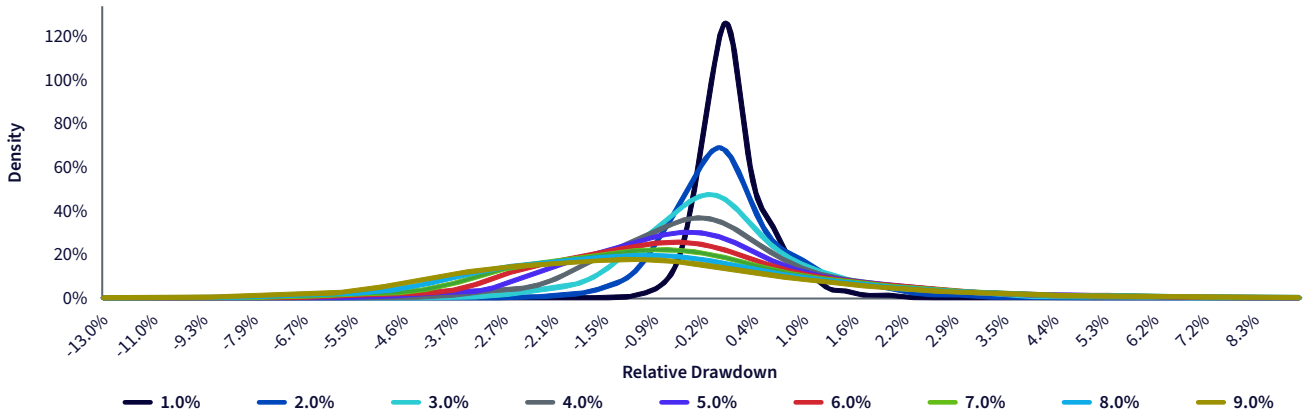
Determining a Potential Bitcoin Allocation Using a Relative Risk Framework

Let's now turn more attention to maximum drawdown—a critical metric for any risk-sensitive investor. Maximum drawdown represents the **largest peak-to-trough decline** an investment or portfolio experiences over a given time period. It captures the worst possible loss an investor would have faced if they bought at the highest point before a downturn and sold at the lowest point of that downturn. In essence, it shows the most severe loss of value before the portfolio began to recover. Moving beyond a fixed 1% allocation, we expand our analysis to assess a range of bitcoin allocations, from 1% to 9%, using quarterly rebalancing.

Continuing our analysis using the bootstrapping method, we once again generated thousands of portfolio paths by **bootstrapping monthly USD returns with replacement** into 36-month simulated periods. For every path, and for each bitcoin allocation (1%–9%), we computed the portfolio's **maximum drawdown** and then **subtracted** the max drawdown of an otherwise identical **0%-bitcoin 60/40 portfolio baseline on the same path;** this difference is the **relative drawdown** on the x-axis. We then plotted **smoothed density curves** (kernel density estimates) of those relative-drawdown values, so the **y-axis is probability density** and the **area under each colored line equals 1.** Each colored line therefore shows how frequently a given change in worst-case loss occurred for that specific bitcoin allocation.

Here's how to read the shapes. A tall, narrow peak centered near zero (typical of lower bitcoin weights) means most simulations clustered tightly around the baseline drawdown—low dispersion and short tails. As lines become lower and wider and shift left, outcomes spread out and the typical (median) relative drawdown becomes more negative, indicating deeper worst-case losses are more common at higher bitcoin weights. The left tail of a curve represents scenarios where peak-to-trough losses were much worse than baseline, while any right-of-zero mass reflects cases where adding bitcoin improved the worst drawdown via diversification. Collectively, figure 2 shows non-linear left-tail risk growth as bitcoin allocation rises—wider, curves with fatter negative tails indicate increased likelihood of worse max drawdowns—so the "right" allocation is the one whose additional downside severity you're prepared to tolerate.

Figure 2: Relative Drawdown Distribution of Multi-Asset Portfolios With Varying Levels of Investment In Bitcoin



Source: WisdomTree, Bloomberg, S&P. Analysis covers three year simulated returns series bootstrapped from data from January 2014 to May 2025. Calculations are based on monthly returns in USD. **Historical performance is not an indication of future performance and any investments may go down in value.**

This clear link between crypto allocation and downside risk offers a practical framework for determining an investor's portfolio exposure. Risk-aware allocators can use this relative risk lens as a part of calibrating their bitcoin allocation based on their drawdown tolerance.

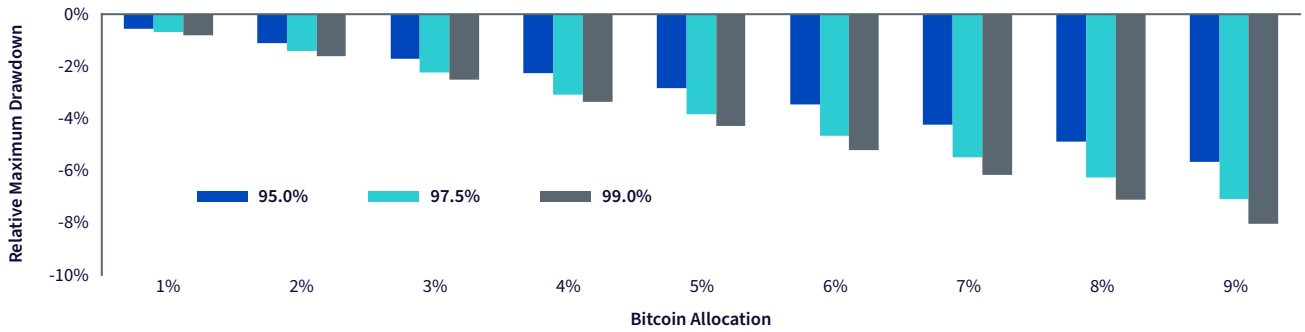
In figure 3, we plot the relative Value at Risk (VaR) for various allocation levels, providing a probabilistic view of downside outcomes. Value-at-Risk (VaR) estimates the worst expected loss of a portfolio over a given time horizon at a chosen confidence level, such as one day at 95%. A one-day 95% VaR of $10 million means there

is a 5% chance that losses could exceed $10 million in a single day. Or, more intuitively, for every 1 in 20 days we would expect a loss to exceed $10 million. Importantly, this number can be calculated either from **historical data** (using past return patterns) or from **statistical assumptions** (like assuming returns follow a normal or log-normal distribution), and the choice of method affects how realistic or stylized the risk estimate is.

Figure 3 was constructed by first generating thousands of bootstrapped portfolio paths across varying levels of bitcoin allocation and then calculating the relative maximum drawdown for each case. For every simulated path, we compared the worst peak-to-trough loss of the portfolio that included bitcoin to the worst loss of an otherwise identical portfolio without bitcoin. The difference is plotted on the y-axis as "Relative Maximum Drawdown," while the x-axis shows increasing bitcoin weights from 1% to 9%. The colored bars reflect the Value-at-Risk perspective, showing how the 95th, 97.5th, and 99th percentiles of relative drawdown outcomes distribute across allocations. In other words, each bar indicates the potential additional loss that could be expected at those confidence levels if bitcoin is included in the portfolio.

Interpreting the bars is straightforward once we connect them to VaR. A bar extending further down the axis signals that the tail of the distribution—the rare but severe loss scenarios—is getting worse as bitcoin's share grows. At 1% allocation, the relative drawdowns are close to zero, meaning the additional risk is minimal across even extreme scenarios. But by 7–9% allocations, the 99% tail outcomes show relative drawdowns reaching –8%, illustrating how downside risk accelerates as exposure increases. The figure therefore provides a calibration tool: investors can decide how much risk to take on by directly observing how far potential worst-case losses extend at different allocation levels and confidence thresholds.

Figure 3: Using Relative Drawdown to Calibrate the Allocation to Bitcoin



Source: WisdomTree, Bloomberg, S&P. Analysis covers three year simulated returns series bootstrapped from data from January 2014 to May 2025. Calculations are based on monthly returns in USD. **Historical performance is not an indication of future performance and any investments may go down in value.**

This framework can help illustrate how different levels of bitcoin exposure would have affected portfolio risk and return historically. For example, the chart illustrates the drawdown implications across a range of bitcoin exposures; individual investors may interpret these results differently depending on their own objectives. We'd note that none of these techniques forecast the future with accuracy, but they might help in giving investors a broader toolkit to try to consider bitcoin as an asset class within a portfolio context.

Part 2 - Using the Markowitz Mean-Variance Framework to Analyze a Potential Bitcoin Allocations

A Historical Perspective

The mean-variance optimization framework, introduced by Harry Markowitz, remains a cornerstone of modern portfolio construction[13]. Markowitz's portfolio theory provides a structured way to think about diversification and the trade-off between risk and return, but it is not a crystal ball. The strength of the model is that it encourages investors to look at portfolios holistically—returns, volatility, and correlations all matter in determining whether an allocation is balanced. In applying this to bitcoin, the framework lets us ask how introducing a **volatile, low-correlation asset changes the overall distribution of outcomes,** particularly in terms of drawdowns and risk-adjusted returns. We can use historical return series to build an evidence-based view of bitcoin's contribution to portfolios, rather than relying solely on anecdotes or intuition. This backward-looking exercise is valuable for illustrating diversification potential and helping to calibrate position size.

That said, the Markowitz model has well-known weaknesses that need to be acknowledged, especially when applied to assets like bitcoin. The framework assumes that past returns, volatilities, and correlations provide reliable guidance for the future—but in practice, these inputs are unstable and regime-dependent. Markets often exhibit "fat tails" and extreme events that mean-variance optimization understates, and transaction costs, liquidity, and behavioral responses are absent from the framework. Bitcoin, in particular, has a short and highly volatile history, which makes the backward-looking input data less reliable than for established asset classes. As such, the model is best understood not as a definitive answer for an "optimal" allocation, but as a tool for framing trade-offs and stress-testing how much additional risk investors may accept when adding bitcoin to a multi-asset portfolio.

We construct an efficient frontier[14] using the following asset set[15], all denominated in USD:

- Bloomberg Short Treasury Total Return Index
- Bloomberg US Aggregate Total Return Index
- MSCI ACWI Net Total Return Index
- CME CF Bitcoin Reference Rate

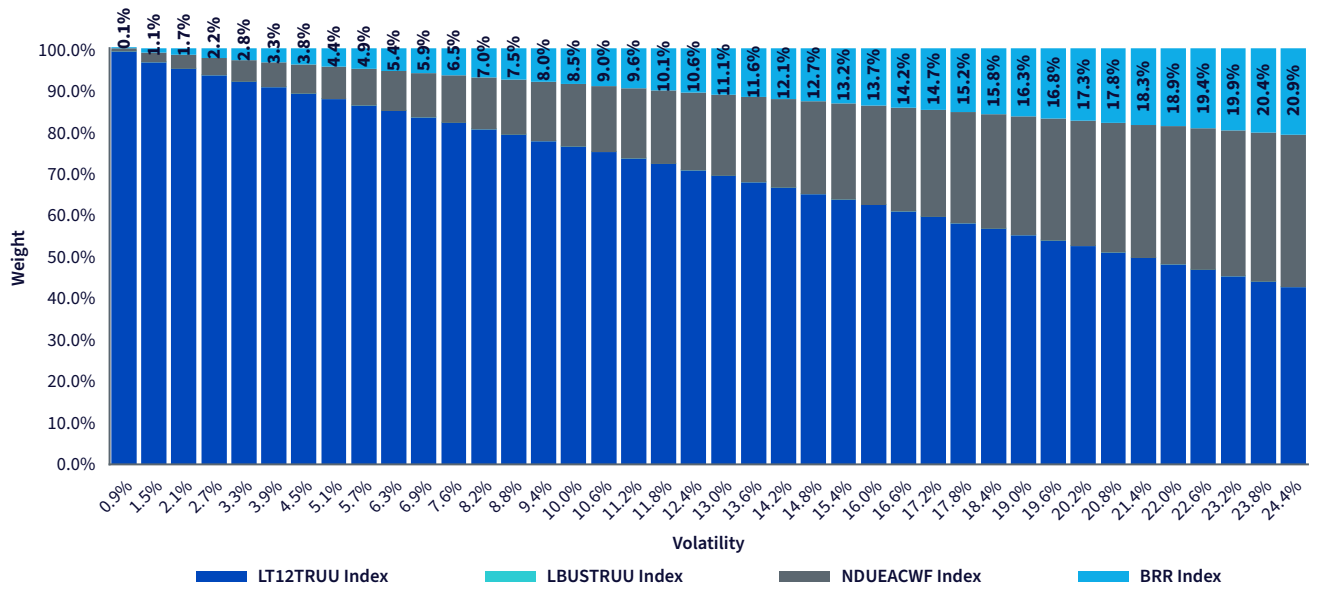
The dataset spans January 2014 to May 2025, and the optimisation includes standard constraints – no shorting, no leverage.

[13] Source: Markowitz, H. (1952). Portfolio selection. The Journal of Finance, 7(1), 77–91.
[14] The Efficient Frontier is the maximum return for a given level of risk of a portfolio, i.e. the portfolio constructed of asset weights that results in the highest reward to risk ratio, as defined by the Sharpe ratio
[15] Tickers: **LT12TRUU Index, LBUSTRUU Index, NDUEACWF Index and BRR Index.**

Figure 4 shows how the historical efficient frontier was constructed by calculating, for each level of portfolio volatility, the combination of assets that would have produced the maximum return from January 2014 to May 2025. The x-axis represents portfolio volatility (standard deviation of monthly returns annualized), while the y-axis shows the weight of each asset class in the portfolio at that volatility level. Each vertical bar is a snapshot of the maximum-return portfolio at a given volatility, with colors representing the asset weights: blue for long-term Treasuries (LT12TRUU Index), teal for U.S. aggregate bonds (LBUSTRUU Index), gray for global equities (NDUEACWF Index), and light blue for bitcoin (BRR Index). As volatility increases, the model progressively shifts allocations away from bonds toward equities and bitcoin, which historically offered higher returns but came with larger swings. The chart is essentially a decomposition of the efficient frontier, broken down by the asset composition needed to sit on it at various levels of volatility tolerance.

From a narrative perspective, figure 4 highlights the trade-offs inherent in mean-variance analysis. At the lowest end of the volatility spectrum, portfolios are dominated by bonds, since they historically offered the most stability. As investors accept more volatility, the model introduces equities and, eventually, bitcoin in growing proportions, because these assets lifted historical returns despite contributing more risk. The stepwise growth of the light blue bars (bitcoin allocation) is particularly notable, since it shows how a relatively small weight in bitcoin significantly increased portfolio returns in portfolios willing to accept higher volatility. At the same time, this backward-looking construction makes clear the model's limitation: it assumes that the relationships between asset classes observed over the sample period will persist. Figure 4 therefore provides a clear and structured view of history, but its forward-looking usefulness depends on whether those past returns, correlations and volatilities remain valid.

Figure 4: Historical Asset Allocation of Efficient Portfolios by Portfolio Volatility



Source: WisdomTree, Bloomberg, S&P. From January 2014 to May 2025. Calculations are based on monthly returns in USD. **Historical performance is not an indication of future performance and any investments may go down in value.**

The importance of recognizing this limitation lies in the fact that mean-variance optimization is only as reliable as the inputs fed into it. When an asset like bitcoin delivers extraordinary historical returns, the model interprets those numbers mechanically and recommends disproportionately large allocations—even if such allocations would be impractical or risky in a real-world portfolio. This sensitivity can produce what look like "optimal" solutions on paper but which are actually unstable: small changes in assumed returns or correlations can dramatically alter the recommended weights. In practice, that means portfolios built strictly from historical inputs risk being overfitted to the past, capturing unique circumstances that may not repeat. Without this awareness, investors could walk away with the false impression that aggressive exposures are justified simply because they back-tested well, overlooking the fact that future regimes may involve lower returns, higher correlations, or different risk dynamics altogether.

Understanding this limitation also helps frame why practitioners often adjust or constrain optimization outputs before using them in decision-making. Institutional investors rarely accept unconstrained allocations that exceed practical limits on liquidity, volatility, or regulatory considerations, so they impose caps, floors, or alternative risk measures to avoid extreme outcomes. Recognizing the fragility of mean-variance results encourages a more balanced approach: blending historical analysis with forward-looking judgment, scenario testing, and qualitative considerations about asset roles in the portfolio. In the context of bitcoin, this means appreciating that while history suggests powerful diversification and return potential, real-world allocations must temper that promise with an understanding of volatility, regulatory uncertainty, and shifting market structure. In short, the key lesson is not to discard the framework but to respect its weaknesses—using it as a tool for exploring trade-offs rather than a blueprint for blindly following numerical outputs.

A Forward-Looking View

To address this, we re-ran the optimisation using forward-looking assumptions, replacing historical inputs with more conservative, scenario-based projections. By re-running the optimization with forward-looking assumptions, we strengthen the usefulness of mean-variance analysis by addressing one of its biggest flaws: reliance on historical data. Historical returns and correlations can capture what did happen, but they may not represent what is likely to happen in the future, especially when structural changes, new regulations, or shifting macroeconomic regimes come into play. By replacing backward-looking inputs with more conservative, scenario-based projections, we can stress-test portfolios against conditions that are more realistic or prudent for the road ahead. This allows us to temper the influence of assets that benefited from exceptional past performance—such as bitcoin—so that the resulting allocations are less extreme and more stable. In short, forward-looking assumptions inject judgment and context into an otherwise mechanical optimization process.

That said, even with forward-looking inputs, the mean-variance framework retains some weaknesses. It still assumes that returns, volatilities, and correlations can be estimated with enough precision to guide decisions, when in reality these estimates are inherently uncertain and subject to change. Scenario-based projections are ultimately educated guesses, which means different teams of analysts could arrive at very

different expected returns for the same asset. Moreover, the model remains focused on averages and standard deviations, which do not fully capture risks like fat tails, liquidity shocks, or regime shifts. So, while forward-looking assumptions make the optimization outputs more realistic, the results should still be seen as one input among many—helpful for framing trade-offs, but not a standalone prescription for portfolio construction.

To make these capital market assumptions clear, it helps to break the discussion into three parts: what comes directly from **J.P. Morgan's Long-term Capital Market Assumptions (LTCMA),** what is drawn from **historical bitcoin data,** and what are the **forward-looking hypotheses** layered on top. The LTCMA provides expected returns, volatilities, and correlations for traditional asset classes such as U.S. equities and U.S. bonds. These values are widely used in institutional analysis because they represent carefully researched forward-looking assumptions. For bitcoin, however, there is no official entry in the LTCMA, so the framework here supplements the LTCMA with scenarios built from a mix of historical evidence and reasoned forecasts. That distinction is crucial: equities and bonds are grounded in the JPM report, while bitcoin rests on modeled assumptions designed to stress-test different possible future scenarios.

The "good, mid, and bad" scenarios for bitcoin are essentially structured hypotheses layered on top. The **good scenario** assumes bitcoin will return 20% per year more than U.S. large-cap equities, with volatility 20% lower than its history and unchanged correlations. This reflects an optimistic view where bitcoin matures, delivers excess returns, and stabilizes somewhat. The **mid scenario** assumes a smaller excess return (+12.5%) versus equities, a modest 10% volatility reduction, and correlations rising 10% above history—an acknowledgment that as bitcoin integrates more with financial markets, its volatility may decline and diversification benefits could erode. The **bad scenario** reduces the return premium to just +7.5%, holds volatility at historical levels, and raises correlations by 20%—a view where bitcoin loses some of its distinctiveness and becomes more tightly linked to equities. Each of these scenarios is not a prediction but a structured way to bracket possibilities around return, volatility, and correlation.

When applied to portfolio construction, these assumptions are translated into the specific indices shown in figures 5, 6 and 7. Equities are represented by the **NDUEACWF Index** (MSCI ACWI Index), bonds by the **LBUSTRUU Index** (Bloomberg U.S. Aggregate Bond Index), commodities by the **BCOM Index** (Bloomberg Commodity Index), and bitcoin by the **BRR Index** (CME Bitcoin Reference Rate). The JPM return assumptions feed into the equity and bond slots, while bitcoin's modeled scenarios supply inputs for the BRR component. By combining these inputs, the model can simulate the "maximum return portfolios by volatility," as in figures 5, 6 and 7 below, which shows how allocations would shift across indices under the various scenarios.

These figures highlight the mechanical implications of these assumptions. At very low volatility targets, bonds dominate because they provide the most stability. As volatility tolerance rises, equities increasingly fill the allocation, and bitcoin becomes a greater allocation only at higher levels of volatility, capped around 14% of the portfolio in the "bad scenario". At lower levels of volatility consistent with a traditional 60/40 portfolio (aggregate portfolio volatility levels of ~10%), bitcoin still enters into the portfolio at 2% in the "bad scenario". This reflects the fact that even under conservative assumptions, bitcoin's diversification benefits can counterbalance the high volatility that often keeps it from being adopted in portfolios.

Bitcoin "Bad" Scenario

In the bad scenario, bitcoin is assumed to deliver only a modest return premium (+7.5% over U.S. large-cap equities), with volatility unchanged from history and correlations rising by 20%. In the chart, this leads to bitcoin (light blue) appearing in large allocations only at the far right of the volatility spectrum—portfolios with higher risk tolerance. For low- to mid-volatility portfolios, bonds (teal, LBUSTRUU Index) and equities (gray, NDUEACWF Index) dominate, while bitcoin appears nearly absent, yet remains a nonzero allocation.

Bitcoin "Mid" Scenario

The mid scenario assumes a healthier return profile (+12.5% relative to equities), slightly reduced volatility (–10%), and correlations rising by only 10%. Compared to the bad case, bitcoin appears more meaningfully earlier along the volatility spectrum and rises to higher allocations. In the chart, light blue segments show bitcoin contributing between 10–16% of the portfolio at the higher end of risk levels, while bonds and equities adjust downward accordingly. Under moderately favorable conditions, bitcoin is no longer a niche component but instead earns a consistent slice of the allocation across a wide range of portfolio volatilities. At moderate volatility levels consistent with the traditional 60/40 portfolio (e.g. ~10%), the model might be indicative of allocations of up to 5% under these assumptions.

Bitcoin "Good" Scenario

In the good scenario, bitcoin is modeled as having the strongest profile: a return premium of +20%, volatility 20% lower than history, and correlations unchanged. This results in bitcoin being introduced much earlier in the volatility spectrum and taking on significantly larger weights, with allocations climbing above 20% at the upper end of portfolio risk. In the chart, the light blue bars expand significantly, displacing both equities and bonds as bitcoin becomes a core contributor to return generation. For investors, the lesson is **not** that bitcoin *will* reach these levels, but that if it continues to grow while maintaining low correlations, it has the potential to become a major part of the efficient frontier. The scenario also underscores how sensitive portfolio outcomes are to the assumptions fed into the model, and why structured scenario testing is a critical tool for forward-looking allocation decisions.

Figures 5, 6 and 7: Asset Allocation of Efficient Portfolios by Portfolio Volatility in Three Forward-Looking Scenarios

Figure 5: Maximum Return Portfolio By Volatility – Bitcoin Bad Scenario

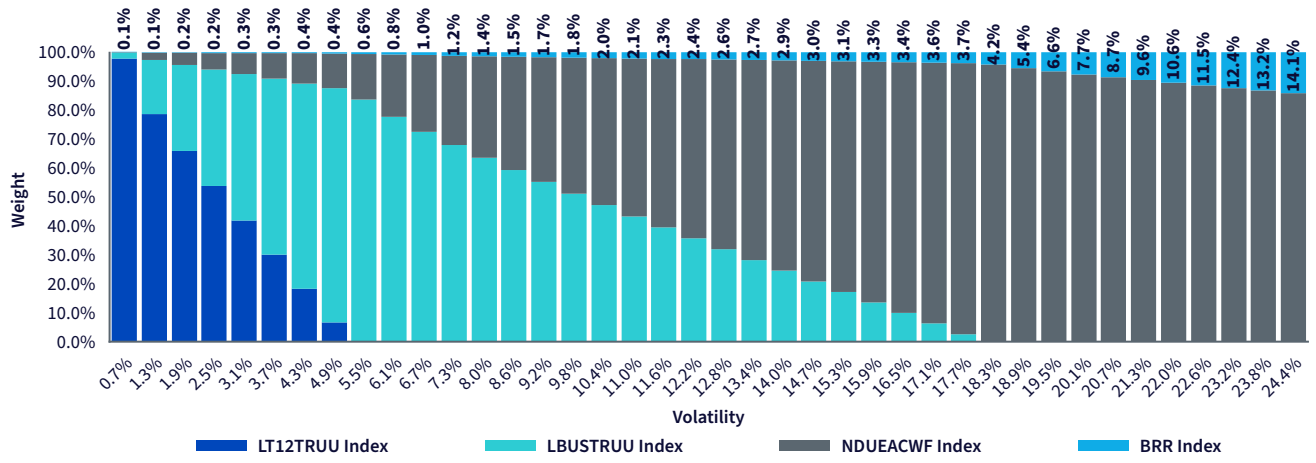


Figure 6: Maximum Return Portfolio By Volatility – Bitcoin Mid Scenario

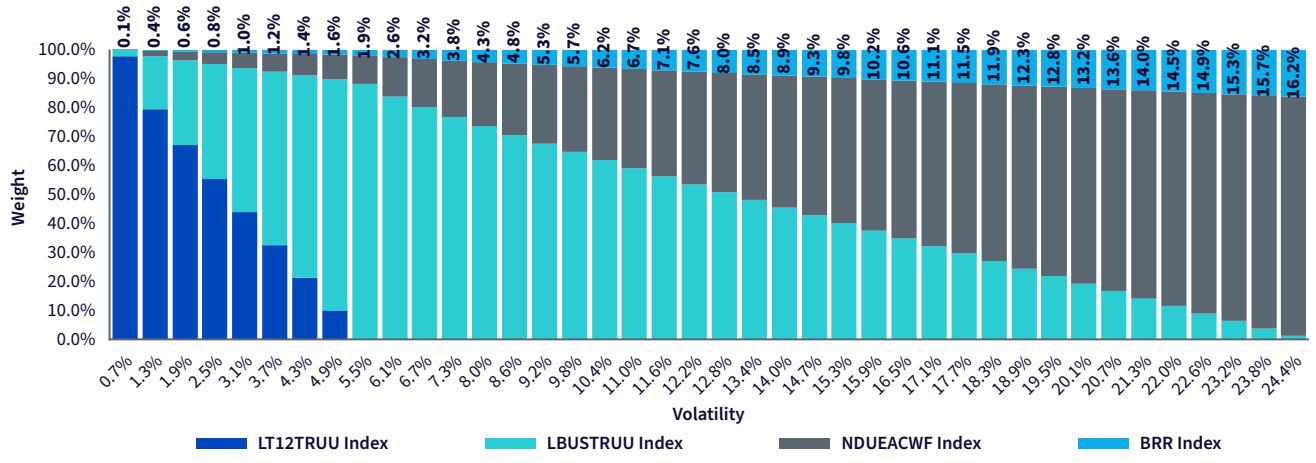
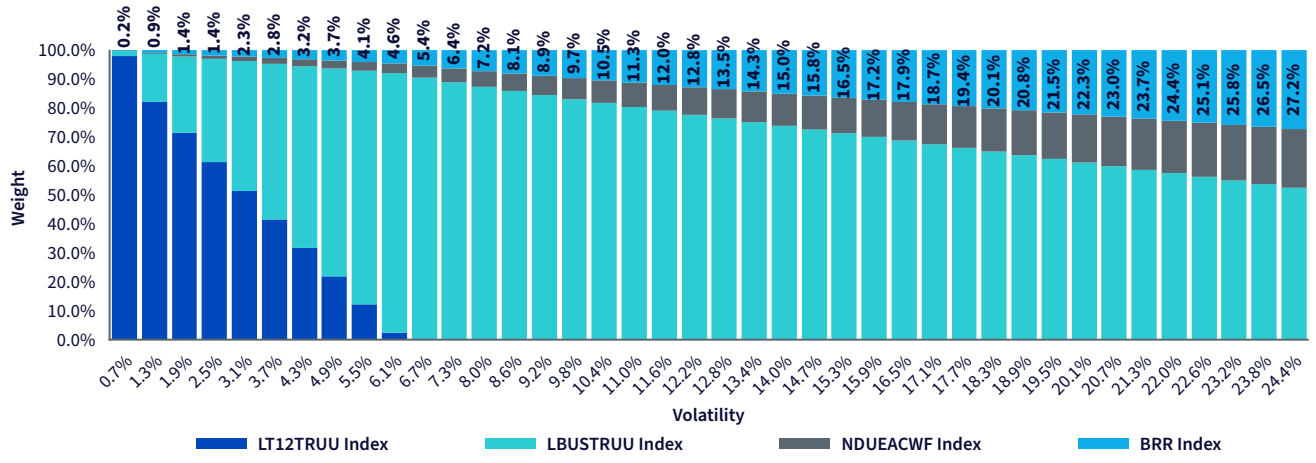


Figure 7: Maximum Return Portfolio By Volatility – Bitcoin Good Scenario



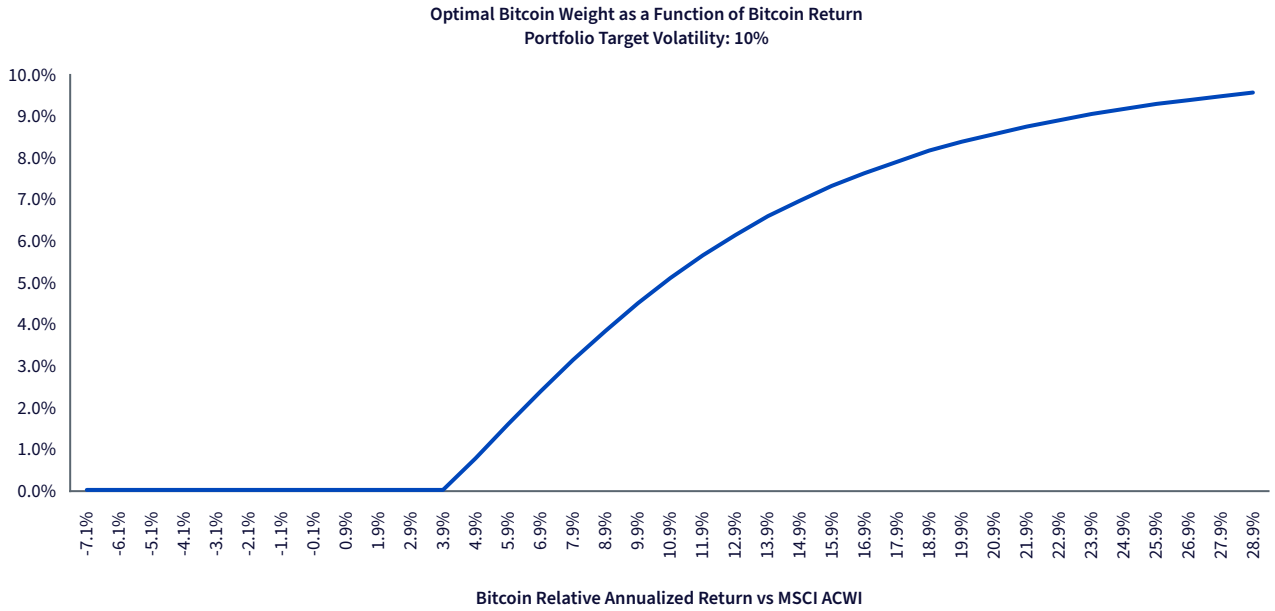
Source: WisdomTree, JP Morgan. Calculations are based on monthly returns in USD. **Historical performance is not an indication of future performance and any investments may go down in value.**

Sensitivity to Expected Returns

Figure 8 below is designed to show how the share of bitcoin in a portfolio could change depending on the expected return assumptions investors hold, while keeping volatility and correlation inputs fixed at the "mid" scenario. The x-axis represents the assumed annualized return of bitcoin relative to global equities (MSCI ACWI), while the y-axis shows the corresponding portfolio weight assigned to bitcoin under a target portfolio volatility of 10%. At very low or negative return assumptions (to the left of the chart), bitcoin is not held—because its risk is not compensated by sufficient expected reward. As expected return assumptions rise, the curve slopes upward, showing that bitcoin's allocation grows steadily, though at a diminishing rate, as returns become more attractive relative to risk added to the portfolio.

The key message is not that there is a single "optimal" weight, but that the allocation is highly sensitive to investor beliefs about future returns. This figure provides a framework for translating those beliefs into a tangible portfolio expression. If you think bitcoin will earn only modest returns, its contribution may remain small or zero, even if volatility moderates. If you believe higher returns are plausible, then bitcoin might earn a meaningful role in the portfolio. The curve is a simple but powerful visualization of how return expectations directly shape potential allocations: the stronger the anticipated reward per unit of added risk relative to other assets, the greater the role bitcoin can play in a multi-asset portfolio.

Figure 8: Weight as a Function of Bitcoin Expected Annualised Relative Returns Over the Next 10 Years



Source: WisdomTree, JP Morgan. Calculations are based on monthly returns in USD. **Historical performance is not an indication of future performance, and any investments may go down in value.**

Part 3 - Bitcoin Allocations: Building a Risk Contribution Approach

Target Risk Allocation Without Relying on Return Forecasts

Unlike return-dependent models, a risk-based allocation approach starts from a different foundation: it does not ask "which asset will earn the most," but rather "how can risk be shared more evenly across the portfolio?" Traditional mean-variance analysis often ends up with equity-heavy allocations, because equities tend to dominate long-term returns. A risk-based framework corrects this imbalance by looking at how much each asset contributes to the overall volatility of the portfolio. This is done by combining the asset's own volatility with its covariance (or co-movement) with the other holdings. In practical terms, an asset that is highly volatile but moves independently of the rest of the portfolio may actually contribute less total risk than one with moderate volatility that is tightly correlated with everything else.

This lens is especially important when considering an asset like bitcoin, whose headline volatility can easily make it look unsuitable under traditional models. By focusing on risk contribution rather than expected return, we can evaluate whether a small allocation to bitcoin provides diversification benefits that reduce reliance on equities as the primary driver of risk. The framework highlights how portfolio construction is not just about chasing returns but about creating a balanced distribution of risk across asset classes. However, it is not without limitations: risk parity approaches assume that volatility and correlations remain reasonably stable over time, which may not hold in periods of market stress. Still, this shift in perspective is valuable because it forces us to reconsider the role of assets like bitcoin—not as return engines to be maximized, but as tools for redistributing and potentially stabilizing portfolio risk.

In a two-asset portfolio, the risk contribution of Asset 1 is:

$$\textbf{Asset 1 Risk Contribution} = (w_1^2\sigma_1^2 + w_1w_2Cov_{12}) / \sigma^2(p)$$

Where:

- w_1 = weight of the asset
- σ_1 = volatility
- Cov_{12} = covariance with Asset 2
- $\sigma(p)$ = total portfolio volatility

The Starting Point: Traditional Risk Budgeting

A typical 60/40 equity-bond portfolio allocates 60% of capital to equities, but due to the higher volatility of equities, they often contribute over 90% of total portfolio risk[16]. Diversifying away from such concentration is a common objective for multi-asset managers. Commodities are often considered in this framework as a potential first line of diversification.

[16] Source: DB Research. (2023). *The new 60-40: risk exposure trumps correlations.* Deutsche Bank

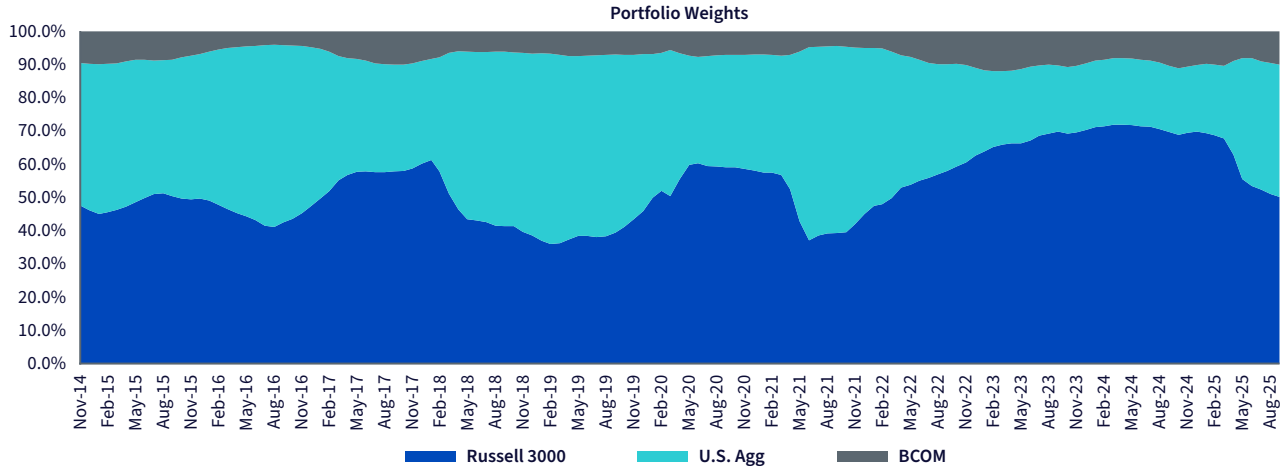
As a starting benchmark, we use a Target Risk Contribution (TRC) portfolio structured with:

- 90% risk from equities, using the S&P 500 Index.
- 5% from bonds, using the Bloomberg U.S. Aggregate Index.
- 5% from commodities, using the Bloomberg Commodity Index.

Figure 9 shows how the **portfolio weights evolved over time** in a benchmark "Target Risk Contribution" strategy labeled TRC 90/5/5/0, spanning from December 2014 through September 2025. The **x-axis** tracks time, with labels by year, while the **y-axis** measures portfolio weights as percentages, adding up to 100% at every point in time. Each color corresponds to a specific asset class: blue represents the **S&P 500 Index** (U.S. equities), teal represents the **Bloomberg U.S. Aggregate Bond Index** (U.S. investment-grade bonds), and gray represents the **Bloomberg Broad Commodities Index** (commodities). The stacked format shows how the weights of these three asset classes changed dynamically while maintaining the overall TRC structure. In this framework, the target allocation by risk contribution is 90% equities, 5% bonds, and 5% commodities, with bitcoin set to 0%.

What figure 9 represents is the **translation of risk contributions into changing capital weights over time.** Because equities are far more volatile than bonds, a portfolio targeting 90% risk contribution from equities does not mean a static 60% capital weight in equities; instead, the equity slice fluctuates depending on how volatile stocks are relative to bonds and commodities at any given point. When equity volatility spikes, the model reduces the capital allocation to equities to keep risk exposure in line, and conversely, when equity volatility subsides, the allocation to equities increases. The turquoise and gray slices behave in the same way, reflecting how bonds and commodities contribute to the overall risk budget. Interpreted correctly, this figure demonstrates how a risk-targeted portfolio dynamically reallocates capital in response to changing market conditions, ensuring that risk contributions remain anchored to the TRC 90/5/5/0 design rather than drifting with market volatility.

Figure 9: Portfolio Construction Via Risk Budgeting - 90% Equities, 5% Fixed Income, 5% Commodities



Source: WisdomTree, Bloomberg. From December 2014 through September 2025. The portfolio represents the benchmark 'TRC 90/5/5/0' portfolio where 'TRC' denotes 'Target Risk Contribution', and the portfolio consists of 90% risk allocated to equities, 5% to bonds, 5% to commodities, and 0% to bitcoin. US Equities represents the S&P 500 Index, the US Agg represents Bloomberg US Aggregate Bond Index and BCOM represents Bloomberg Broad Commodities Index. **Historical performance is not an indication of future performance and any investments may go down in value.**

Figure 10 reports the performance characteristics of the starting benchmark portfolio under the Target Risk Contribution (TRC) framework, evaluated over different horizons. The top rows show the annualized return, volatility, and Sharpe ratio over 1-year, 3-year, 5-year, and since-inception periods, illustrating how both return and risk evolve depending on the length of measurement. For example, the portfolio produced an 18.5% return with 8.7% volatility in the past year, but its long-run average return since December 2014 is 7.9% with 9.3% volatility, translating to a Sharpe ratio of 0.66. The lower section provides complementary downside measures: maximum drawdowns ranged from –6.1% over the last year to nearly –19% over the longer periods, highlighting the severity of losses that investors would have faced in adverse conditions. The table also notes the assumed risk-free rates used in Sharpe ratio calculations, making clear that while the TRC framework balances risk across asset classes, the realized results still fluctuate significantly depending on the market environment.

Figure 10: Key Performance Metrics of Starting Benchmark

	1-Year	3-Year	5-Year	Since Inception
Annualised return	18.5%	5.9%	9.6%	7.9%
Volatility	8.7%	12.7%	12.1%	9.3%
Sharpe ratio	1.52	0.16	0.59	0.66
Max drawdown	-6.1%	-18.5%	-18.9%	-18.9%
Risk free	5.3%	3.9%	2.5%	1.7%

Source: WisdomTree, Bloomberg. From December 2014 through September 2025. **Historical performance is not an indication of future performance and any investments may go down in value.**

Introducing Bitcoin into the Risk Budget

While we cannot claim precise knowledge about how bitcoin will behave in the future, we do know that its historical record has been marked by unusually high volatility alongside episodes of very strong returns. This combination makes it difficult to assume that past dynamics will repeat unchanged, but it does provide enough evidence to explore what role bitcoin could play in a diversified portfolio. Importantly, the analysis is not about predicting exact returns, but about learning how an asset with bitcoin's characteristics—low correlation to traditional markets and powerful diversification potential, even more so than commodities[17]—might affect risk allocation when introduced thoughtfully. To test this, we progressively reassign the 5% commodity risk budget to bitcoin within the Target Risk Contribution (TRC) framework. By constructing four TRC portfolios spanning equities, bonds, commodities, and bitcoin, we can begin to understand the potential pathways for incorporating bitcoin, balancing caution about its uncertain future with the value of grounding our decisions in what history can already tell us..

- TRC 90/5/4/1: 90% risk to equities, 5% to bonds, 4% to commodities, and 1% risk to bitcoin
- TRC 90/5/3/2: 90% risk to equities, 5% to bonds, 3% to commodities, and 2% risk to bitcoin
- TRC 90/5/2/3: 90% risk to equities, 5% to bonds, 2% to commodities, and 3% risk to bitcoin
- TRC 90/5/1/4: 90% risk to equities, 5% to bonds, 1% to commodities, and 4% risk to bitcoin
- TRC 90/5/0/5: 90% risk to equities, 5% to bonds, 0% to commodities, and 5% risk to bitcoin

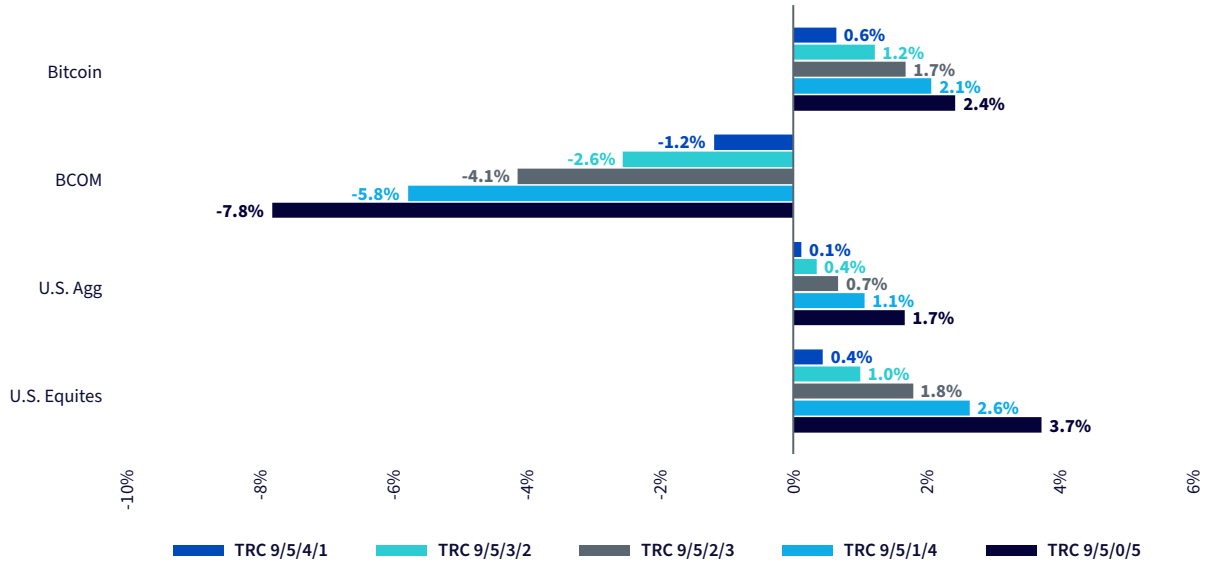
[17] Source: WisdomTree, Bitcoin in Multi-Asset Portfolios.

Each 1% of bitcoin risk replaces 1% of the commodity risk sleeve in the following analysis.

Figure 11 shows how different Target Risk Contribution (TRC) portfolios deviate from the baseline TRC 90/5/5/0 portfolio. The x-axis represents the resulting (capital allocation) percentage overweight or underweight relative to that baseline, while the bars show the average differences in weights for each asset class across the period December 2014 to September 2025. Each color corresponds to a different portfolio configuration, where the commodity risk allocation is progressively shifted toward bitcoin. This structure allows us to see how reallocating the commodity risk budget impacts the average exposures of equities, bonds, commodities, and bitcoin relative to the starting benchmark.

The interpretation of the figure is straightforward once the axes and colors are clear. Bars to the right of zero represent an **overweight** relative to the baseline, while bars to the left of zero represent an **underweight.** It highlights how introducing bitcoin alters the portfolio's capital allocations under a constant risk-budgeting framework. Because bitcoin has significantly higher volatility than traditional assets, a small *risk contribution* translates into a relatively small(er) *capital weight.* For instance, allocating 1% of total portfolio risk to bitcoin might only require about 0.6% of capital. This disproportionate relationship arises because bitcoin "consumes" more of the overall risk budget per unit of capital invested due to its risky nature. As a result, to maintain target risk contributions, more capital is allocated toward lower-volatility assets (relative to bitcoin) such as equities and bonds. Even though their risk contributions remain fixed (e.g., 90% equities, 5% bonds), their capital allocations rise modestly to absorb the unused capital left by bitcoin's higher risk intensity. The chart therefore illustrates how adding a high-volatility asset like bitcoin systematically increases the capital share of lower-volatility assets, even when their relative risk shares are unchanged.

Figure 11: Average Overweight/Underweight vs. Benchmark Portfolio



Source: WisdomTree, Bloomberg. From December 2014 through September 2025. 'TRC' denotes 'Target Risk Contribution', and '90/5/5/0' representing the benchmark portfolio of 90% risk allocated to equities, 5% to bonds, 5% to commodities, and 0% to bitcoin. **Historical performance is not an indication of future performance, and any investments may go down in value.**

Performance and Volatility Outcomes

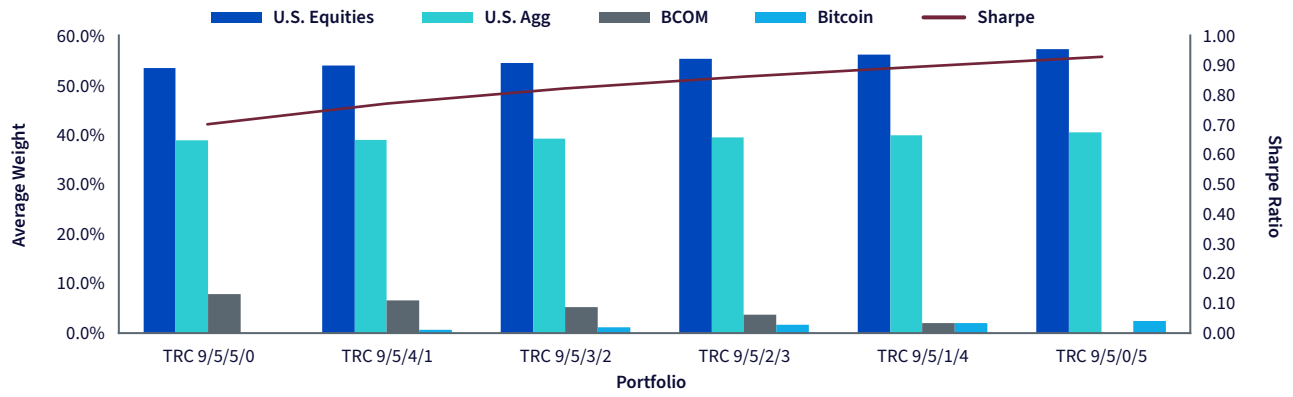
Figure 12 illustrates how the inclusion of bitcoin affects the **Sharpe ratios** of Target Risk Contribution (TRC) portfolios, alongside the average asset weights that result from those allocations. On the **x-axis,** we see a series of TRC portfolios, beginning with the baseline 9/5/5/0 (90% equity, 5% bonds, 5% commodities, 0% bitcoin) and progressively shifting the 5% commodity risk budget into bitcoin, ending with 9/5/0/5. The **bars** represent the **average capital weights** of each asset class within these portfolios: blue for equities (S&P 500), teal for bonds (US Agg), gray for commodities (BCOM), and yellow for bitcoin. These bars show how portfolio composition evolves as bitcoin enters the mix, while the **line plotted against the right-hand y-axis** traces the Sharpe ratio, capturing the change in risk-adjusted performance across these variations. The left-hand **y-axis** measures the percentage of average weight, while the right-hand **y-axis** measures the Sharpe ratio itself.

The purpose of designing figure 12 this way is to let a potential investor see both the mechanics of capital allocation and the performance consequences as a result of increasing risk allocations to bitcoin in one view. The stacked bars show the trade-offs explicitly: each increment of bitcoin predominately reduces capital to commodities (while slightly increasing equity and bond capital allocations, refer to Figure 11)—even though risk allocations for bonds and equities remain stable.

The upward-sloping line indicates that, historically, these adjustments raised the Sharpe ratio, suggesting that adding bitcoin improved the risk-return efficiency of the portfolio. Notice how the slope of the rising Sharpe ratio flattens as allocations to bitcoin increased, indicating there are diminishing incremental benefits of adding increasingly more allocation to bitcoin.

Importantly, figure 12 is not a prediction that these benefits will persist, but rather an illustration of what has happened under the historical data sample. For an investor, the figure highlights the potential diversification value of bitcoin: small allocations can shift risk-adjusted returns upward, with the greatest incremental benefit at the low end, and weakening benefits as more is added. Ultimately, it is for the investor to determine whether these historical relationships merit confidence going forward.

Figure 12: The Sharpe Ratios of the Target Risk Contribution Portfolios



Source: WisdomTree, Bloomberg. From December 2014 through September 2025. 'TRC' denotes 'Target Risk Contribution', and '90/5/5/0' representing the benchmark portfolio of 90% risk allocated to equities, 5% to bonds, 5% to commodities, and 0% to bitcoin. **Historical performance is not an indication of future performance and any investments may go down in value.**

While the earlier section focused on how adding a risk allocation to bitcoin reshapes portfolio capital allocation and has historically improved risk-adjusted efficiency, it's equally important to examine the trade-off purely through the lens of volatility. Figure 13 below presents the annualized volatility of the different Target Risk Contribution (TRC) portfolios.

The first set of columns shows annualized volatility over rolling periods of 1, 3, 5, and 10 years, as well as since inception (SI) from December 2014 through September 2025. The right-hand section provides annual snapshots of realised volatility for each calendar year, highlighting how risk fluctuated in different market environments such as 2020 (pandemic volatility spike) or 2022 (inflation shock).

For an investor, the key insight is that as bitcoin enters into the portfolio even at small risk allocations (e.g. 1% of risk for 0.6% of capital allocation on average), volatility increases. For example, in the 1% risk allocation (TRC 9/5/4/1), since-inception volatility rises from 9.3% to 9.5%, and in the most extreme case with a 5% risk allocation (TRC 9/5/0/5), since-inception volatility rises to 10.4%. This is consistent with bitcoin's much higher standalone volatility compared to the other assets in the portfolio, even though its lower correlations[18] can provide some diversification.

Figure 13 also underscores that volatility is highly regime-dependent, swinging from as low as ~2% in calmer years like 2017 to above 17% in more turbulent years like 2020. The takeaway is that incorporating bitcoin does raise the overall risk profile, but the degree of increase is moderate when allocations are capped at a few percentage points, and the pattern of volatility remains shaped largely by the broader market environment. This helps frame bitcoin not as a dominant driver of portfolio risk, but as a marginal adjustment that can tilt outcomes depending on an investor's tolerance for higher volatility.

Figure 13: The Annualised Volatility for the Target Risk Contribution Portfolios

Portfolio Volatility	1Y	3Y	5Y	10Y	SI	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
TRC 9/5/5/0	8.7%	12.7%	12.1%	9.4%	9.3%	7.0%	4.4%	2.4%	6.6%	4.3%	15.8%	5.5%	16.4%	11.9%	8.7%
TRC 9/5/4/1	9.0%	12.9%	12.3%	9.6%	9.5%	7.4%	4.4%	2.8%	6.7%	4.2%	16.2%	5.6%	16.5%	12.0%	9.0%
TRC 9/5/3/2	9.7%	13.3%	12.6%	9.9%	9.7%	7.6%	4.3%	3.0%	6.7%	4.3%	16.5%	5.8%	16.7%	12.2%	9.7%
TRC 9/5/2/3	10.2%	13.6%	12.9%	10.1%	10.0%	7.8%	4.3%	3.3%	6.8%	4.3%	16.9%	6.0%	16.8%	12.4%	10.2%
TRC 9/5/1/4	10.8%	13.9%	13.2%	10.3%	10.2%	8.1%	4.3%	3.6%	6.8%	4.4%	17.2%	6.3%	16.9%	12.6%	10.8%
TRC 9/5/0/5	11.1%	14.3%	13.5%	10.5%	10.4%	8.4%	4.4%	3.8%	6.9%	4.5%	17.4%	6.5%	17.1%	12.9%	11.1%

Source: WisdomTree, Bloomberg. From December 2014 through September 2025. 'TRC' denotes 'Target Risk Contribution', and '90/5/5/0' representing the benchmark portfolio of 90% risk allocated to equities, 5% to bonds, 5% to commodities, and 0% to bitcoin. **Historical performance is not an indication of future performance, and any investments may go down in value.**

[18] Source: WisdomTree, Bitcoin in Multi-Asset Portfolios.

Conclusion

When thinking about bitcoin in the context of portfolio construction, it helps to step away from the temptation of labeling it as "good" or "bad" and instead embrace mental models that allow for structured learning. One useful lens is to treat history as a guide but not a prophecy. We can observe volatility, correlations, and diversification effects over the past decade, but we must always remind ourselves that these patterns may change dramatically in the future. The exercise of plugging bitcoin into frameworks like mean-variance optimization is not about dictating exact allocations, but about training our intuition for how an asset with such properties might reshape the balance of risk and reward.

A second framework is to focus on risk allocations rather than capital allocations. Investors often assume that a 60/40 split between equities and bonds implies balance, when in fact equities dominate the risk profile. Bitcoin, with its high volatility and unique behavior, forces us to confront this distinction directly. By reallocating risk to bitcoin, we can see how small shifts in risk budgeting might magnify or reduce portfolio sensitivity to shocks. This kind of exercise makes clear that the question is not "should bitcoin be in the portfolio?" but "what does my portfolio look like if it is included, and how comfortable am I with those trade-offs?"

Finally, a balanced way to learn from history is to treat it as a sandbox for experimentation rather than a strict rulebook. By examining simulated paths, stress tests, and alternative allocation schemes, investors can sharpen their understanding of potential outcomes without assuming the past will repeat. Bitcoin's short, volatile history makes it an imperfect dataset, but even imperfect history is valuable if used with humility—highlighting possibilities, tail risks, and diversification dynamics. In this sense, the real benefit of these exercises is not to prescribe a single "right" answer, but to empower investors with frameworks for their own analysis, so that individual risk and return preferences can be expressed with greater clarity and confidence.

IMPORTANT INFORMATION

There are risks associated with investing, including the possible loss of principal. Past performance is not indicative of future results.

Bitcoin is highly speculative and involves a high degree of risk, including the potential for loss of the entire investment. An investment in bitcoin involves significant risks (including the potential for quick, large losses) and may not be suitable for all investors.

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