BITCOIN IN MULTI-ASSET PORTFOLIOS

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Key highlights:

- Fifteen years after its launch, we believe Bitcoin is reaching "asset class adulthood," so to speak. The market value of bitcoin (number of coins * price per coin) has eclipsed $1 trillion in the past, and as we write this piece, it has appreciated back into this range of total market capitalization.
- Bitcoin has exhibited high growth potential. It is a network, and there are reasons why adoption could increase in the future. While the past cannot tell us with certainty what may happen in the future, we have seen a lower correlation between bitcoin's price movements and the returns of other, more longstanding asset classes.
- If we look at the 10-year period from 2013 to 2023, the price appreciation of bitcoin has exhibited something on the order of 50% per year, but with an annualized volatility well over 70%.[1] Such a strong period of appreciation has attracted attention, and we believe that studying asset class correlations and different portfolio allocations could be warranted. We note, however, that the next 10 years may not look anything like the past 10 years.
- People may focus on the "impact" of adding bitcoin to a multi-asset portfolio. They might consider different percentages, but we would remind investors that it is not solely about adding a percentage to bitcoin one time. With an asset that has exhibited greater than 70% annualized volatility over the past 10 years, it is also important to think about the rebalance frequency. How often you reset the target weights can have a significant impact on any observed results.

Satoshi Nakamoto's bitcoin whitepaper came out in October 2008,[2] and it is amazing to think that we are now more than 15 years forward from that point. Bitcoin's price behavior, while volatile, has certainly proven to have a certain degree of "staying power" over this period. The approval of 11 different spot bitcoin ETFs that began trading on January 11, 2024, we believe was a huge step in giving the asset class a certain new platform of credibility[3].

[1] Sources: Bloomberg, WisdomTree, 12/31/13–12/31/23. Calculated in USD on daily returns. Historical performance is not an indication of future performance, and any investment may go down in value. 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.
[2] Source: https://bitcoin.org/bitcoin.pdf
[3] Source: Jesse Pound, "Bitcoin ETFs begin trading on U.S. Exchanges," CNBC.com, 1/11/24.

WHAT IS THE MARKET PORTFOLIO?

One of the most longstanding and popular academic constructs is something often referenced as "the market portfolio." We advise any investor to beware of context when they see these words, in that "the market" can mean many different things. However, if properly defined, we believe there can be useful illustrations drawn from using the market portfolio as a baseline. Importantly, we do not believe that anyone would ever directly invest in our conception of the market portfolio, but it could show us important foundational characteristics of how different asset classes relate to each other.

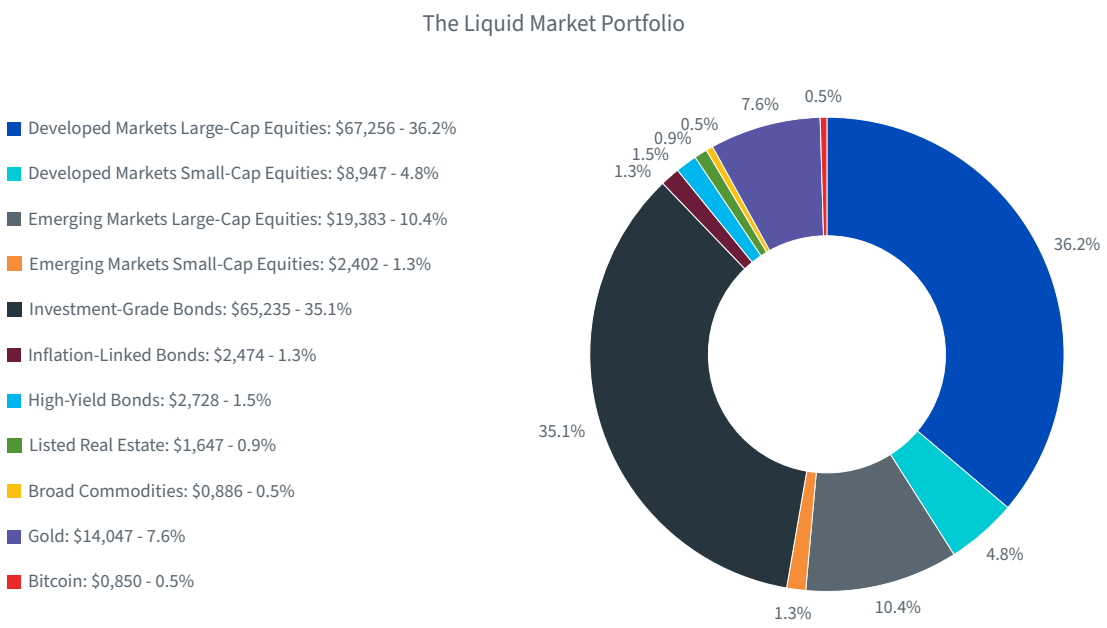
To set up our conception of the market portfolio, we have to first denote the list of available asset classes that could be represented. We recognize that no list like this could ever be viewed as 100% exhaustive, but it is still helpful in establishing a baseline from which to draw out certain characteristics and insights:

- Developed Markets Large-Cap Equities: MSCI World Index.
- Developed Markets Small-Cap Equities: MSCI World Small Cap Index.
- Emerging Markets Large-Cap Equities: MSCI Emerging Markets Index.
- Emerging Markets Small-Cap Equities: MSCI Emerging Markets Small Cap Index.
- Inflation-Linked Bonds: Bloomberg Global Inflation-Linked Total Return Index.
- Investment-Grade Bonds: Bloomberg Global Aggregate Index.
- High-Yield Bonds: Bloomberg Global High Yield Index.
- Listed Real Estate: FTSE EPRA NAREIT Developed Index.
- Broad Commodities: Calculated as the sum of the open interest across all futures contracts of all commodities within the Bloomberg Commodity Index.
- Gold: Gold is based on the above-ground quantity in tons adjusted for 2,500 tons per year of mining and then converted into dollars through the LBAM PM gold price.
- Bitcoin: Coinmarketcap.

[4] Source: https://www.gold.org/goldhub/data/how-much-gold#:~:text=Above%2Dground%20stocks,-1%20February%2C%202024&text=The%20best%20estimates%20currently%20available,in%20one%20form%20or%20another

Once we have created this list, we can come up with a market capitalization for each of these segments. If we take the total market value of all of these segments together, we get a figure of around US$190 trillion, and then we can look at how each asset class contributes to this total. These percentages do not tell us that we must hold any certain percentage in one asset class or another, but they do tell us a bit about how the market has valued each segment. We'd also note that "liquid" in this context means there is a focus away from private market transactions and other investments with lockup periods and toward securities that trade in public markets with a clear avenue to buy or sell on shorter notice.

Figure 1: A Hypothetical 'Market' Multi-Asset Portfolio of Liquid Assets



Sources: Bloomberg, WisdomTree. Data is current as of 1/31/24. All figures are quoted in U.S. dollar terms and represent units of "billions." **You cannot invest directly in an index. Historical performance is not an indication of future performance, and any investment may go down in value.**

BITCOIN HAS EXHIBITED A NOTEWORTHY BALANCE OF HIGH RISK AND HIGH RETURN OVER THE PAST 10 YEARS

Before going further, we have to just recognize the obvious, which we can do with a rather "historic" transaction. On May 22, 2010, Laszlo Hanyecz paid Jeremy Sturdivant 10,000 bitcoins for two pizzas.[5] These pizzas did not cost millions of dollars—they were the price of a regular pizza in 2010, between US$10 and US$20 each. If we assume US$40, which would be each pizza at US$20, that would mean that each bitcoin would have been worth US$0.004, or four-tenths of one cent.

If we are honest with ourselves, when bitcoin's price was less than one cent per unit, this would have represented a time when the technology was a small novelty within a small community of tech-savvy individuals, likely focused more on computer science and cryptography than on investing and returns. It would not have been easy for a non-technical individual to establish an investment position, and there would have been a significant chance of that investment, if established, going to a value of zero. Today, knowing that the price per unit has achieved levels in the tens of thousands of dollars—incredible appreciation—it is psychologically impossible to fully eliminate that feeling of having "missed out."

Anytime we look at measures of bitcoin's price appreciation, it is important to have the recognition that going from less than one cent per unit to tens of thousands of dollars per unit represents a transition from a "novelty" to a technology that is more established with a much larger base of users. No one can know with certainty how high bitcoin's price may go, but we just recognize that it is one thing to go from one cent to US$10,000 (that is an increase in value of 1 million times), and it is something else to go from US$10,000 to US$100,000 or beyond.

This is part of the reason our market portfolio analysis is useful, in that we note any time you see a price forecast of the value of a single coin, it is important to think about what this would mean in terms of a "total value" of all bitcoin. If the total value of gold is roughly US$15 trillion, for example, and forecasts are representing that bitcoin's total value can get to or even exceed that value…it just helps to have a perspective that gold has been around for thousands of years, and while nothing is impossible, bitcoin matching or exceeding the value of gold should not be viewed as an "easy" milestone.

[5] Source: https://www.coindesk.com/consensus-magazine/2023/05/22/celebrating-bitcoin-pizza-day-the-time-a-bitcoin-user-bought-2-pizzas-for-10000-btc/

As we turn our focus to figure 2, we see 10 calendar years of returns with different asset classes noted. It's important to recognize that in figure 1, we were seeking to represent a global investable universe for illustrative purposes, meaning that the assets represented are domiciled in countries across the world. In figure 2, we recognize that a typical U.S.-based investor exhibits a bias toward assets domiciled in their own country. For example, even if there is an MSCI ACWI Index, which is global and places roughly 60% of its weight in U.S. equities, the typical U.S.-based investor will have more than this weight in U.S. equities in their portfolio. Additionally, over this specific 10-year period, we have the benefit of hindsight: we know that U.S. assets tended to outperform non-U.S. assets, so comparing the performance of U.S. assets to that of bitcoin's price appreciation is a tougher comparison, at least over much of this 10-year period. There is no "right" or "wrong" approach to take, but we wanted people to understand why we employed a U.S. focus.

+ In seven out of the ten years, bitcoin's price appreciation ranked ahead of the returns of all the other asset classes detailed in the figure. In each of these years, the margin between bitcoin's price appreciation and the asset class return in the second position was significant—bitcoin was not slightly beating the next option; it was significantly ahead.

+ In the three years when bitcoin was not in the number 1 position, it was in the tenth or LAST position. In our view, this is a classic "high risk, high reward" illustration. Similar to how bitcoin's appreciation was not slightly ahead of the number two position, it was not slightly behind the number nine position—it was significantly behind. 2018 was the worst year, and bitcoin's price dropped more than 74% in this period. The psychology of being able to hold a position after it drops this much—well, do not underestimate this difficulty.

Figure 2: A Multi-Asset Quilt of Calendar Year Returns

2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
REITS 15.9%	Bitcoin 36.2%	Bitcoin 120.3%	Bitcoin 1403.2%	US Treasuries 0.9%	Bitcoin 94.8%	Bitcoin 305.1%	Bitcoin 59.8%	Commodities 16.1%	Bitcoin 152.9%
US Equities 13.7%	US Equities 1.4%	US Small Caps 21.3%	US Equities 21.8%	US IG Bonds 0.0%	US Equities 31.5%	Gold 24.6%	US Equities 28.7%	Gold 0.4%	US Equities 26.3%
US Corporates 7.5%	US Treasuries 0.8%	US High Yield 17.1%	US Small Caps 14.6%	Gold -0.9%	US Small Caps 25.5%	US Small Caps 20.0%	REITS 27.2%	Infrastructure -4.7%	US Small Caps 16.9%
Infrastructure 7.4%	US IG Bonds 0.5%	US Equities 12.0%	Gold 12.7%	US High Yield -2.1%	REITS 23.1%	US Equities 18.4%	Commodities 27.1%	US High Yield -11.2%	Gold 14.6%
US IG Bonds 6.0%	REITS 0.1%	Commodities 11.8%	REITS 11.4%	US Corporates -2.5%	Infrastructure 21.6%	US Corporates 9.9%	US Small Caps 14.8%	US Treasuries -12.5%	US High Yield 13.4%
US Treasuries 5.1%	US Corporates -0.7%	Gold 8.1%	Infrastructure 9.8%	US Equities -4.4%	Gold 18.4%	US Treasuries 8.0%	Infrastructure 6.3%	US IG Bonds -13.0%	REITS 10.9%
US Small Caps 4.9%	US Small Caps -4.4%	Infrastructure 8.0%	US High Yield 7.5%	REITS -4.7%	US Corporates 14.5%	US IG Bonds 7.5%	US High Yield 5.3%	US Corporates -15.8%	US Corporates 8.5%
US High Yield 2.5%	US High Yield -4.5%	US Corporates 6.1%	US Corporates 6.4%	Infrastructure -5.3%	US High Yield 14.3%	US High Yield 7.1%	US Corporates -1.0%	US Equities -18.1%	US IG Bonds 5.5%
Gold 0.1%	Infrastructure -6.2%	REITS 5.0%	US IG Bonds 3.5%	US Small Caps -11.0%	US IG Bonds 8.7%	Infrastructure 0.1%	US IG Bonds -1.5%	US Small Caps -20.4%	US Treasuries 4.1%
Commodities -17.0%	Gold -12.1%	US IG Bonds 2.6%	US Treasuries 2.3%	Commodities -11.2%	Commodities 7.7%	Commodities -3.1%	US Treasuries -2.3%	REITS -24.4%	Infrastructure 3.4%
Bitcoin -57.5%	Commodities -24.7%	US Treasuries 1.0%	Commodities 1.7%	Bitcoin -74.3%	US Treasuries 6.9%	REITS -8.2%	Gold -4.3%	Bitcoin -64.2%	Commodities -7.9%

Sources: Bloomberg, WisdomTree, 12/31/13–12/31/23. Returns are calculated in U.S. dollar terms. Bitcoin is represented by "XBTUSD," as quoted in Bloomberg. Commodities is represented by the Bloomberg Commodity Total Return Index. Gold is represented by the LBMA Gold Price PM USD. US High Yield is represented by the Bloomberg U.S. High Yield Total Return Index. U.S. Small Caps is represented by the Russell 2000 Total Return Index. U.S. Treasuries is represented by the Bloomberg U.S. Aggregate Treasuries Total Return Index. U.S. IG Bonds is represented by the Bloomberg U.S. Aggregate Total Return Index. Infrastructure is represented by the MSCI World Infrastructure Net Total Return Index. U.S. Corporates is represented by the Bloomberg U.S. Aggregate Corporates Total Return Index. U.S. Equities is represented by the S&P 500 Total Return Index. REITS is represented by the FTSE EPRA NAREIT Developed Total Return Index. **You cannot invest directly in an index. Historical performance is not an indication of future performance, and any investment may go down in value.**

THE EVOLVING PICTURE OF CORRELATION BETWEEN BITCOIN AND OTHER ASSET CLASSES

We start any discussion of correlation with the recognition that it is not a constant. One must always know such details as the frequency of returns in the calculation (daily, weekly, monthly, etc.) and the specific period. A different period could yield a very different result.

In figure 3, we can see the correlation of bitcoin, based on weekly returns, against the array of other asset classes.

- A figure close to 1.0 or 100% would indicate that the two assets in the pair tend to move almost in lockstep with one another.
- A figure close to 0.0 or 0% would indicate that the two assets in the pair do not tend to exhibit much of a relationship between each other's returns.
- Negative values, should they occur, would indicate that the two assets in the pair tend to move in opposite directions.
- Lower correlations are shown in darker shades of green—when considering the potential complementary properties of returns across two asset classes, lower correlations could be more interesting than higher correlations. Higher, more positive correlations are shown in darker shades of red.

Figure 3: Cross Asset Correlations of Returns

	U.S. Equities	U.S. Small Caps	U.S. All Caps Equities	All Fixed Income	U.S. IG Bonds	U.S. Treasuries	U.S. Corporates	U.S. High Yield	Commodities	Gold	Infrastructure	Legend
Bitcoin	17%	20%	18%	12%	4%	0%	7%	14%	13%	7%	15%	1.0
U.S. Equities		88%	100%	27%	16%	-9%	37%	75%	37%	12%	77%	0.9
U.S. Small Caps			91%	25%	13%	-12%	33%	74%	39%	11%	70%	0.8
U.S. All Caps Equities				28%	16%	-9%	38%	77%	38%	13%	77%	0.7
All Fixed Income					84%	75%	80%	48%	18%	58%	45%	0.6
U.S. IG Bonds						94%	90%	40%	2%	41%	33%	0.5
U.S. Treasuries							73%	11%	-11%	38%	12%	0.4
U.S. Corporates								65%	13%	40%	50%	0.3
U.S. High Yield									41%	25%	72%	0.2
Commodities										32%	42%	0.1
Gold											29%	-

Sources: Bloomberg, WisdomTree. Period is 12/31/13–12/31/23. Returns are in U.S. dollar terms, and the frequency of returns is weekly. Bitcoin is represented by "XBTUSD," as quoted in Bloomberg. Commodities is represented by the Bloomberg Commodity Total Return Index. Gold is represented by the LBMA Gold Price PM USD. U.S. High Yield is represented by the Bloomberg U.S. High Yield Total Return Index. U.S. Small Caps is represented by the Russell 2000 Total Return Index. U.S. Treasuries is represented by the Bloomberg U.S. Aggregate Treasuries Total Return Index. U.S. IG Bonds is represented by the Bloomberg U.S. Aggregate Total Return Index. Infrastructure is represented by the MSCI World Infrastructure Net Total Return Index. U.S. Corporates is represented by the Bloomberg U.S. Aggregate Corporates Total Return Index. U.S. Equities is represented by the S&P 500 Total Return Index. REITS is represented by the FTSE EPRA NAREIT Developed Total Return Index. **You cannot invest directly in an index. Historical performance is not an indication of future performance, and any investment may go down in value.**

RETURNS, CORRELATIONS—ASSET ALLOCATION

Where the rubber ultimately meets the road, in our opinion, is in taking a baseline portfolio exposure and adding bitcoin. Importantly:

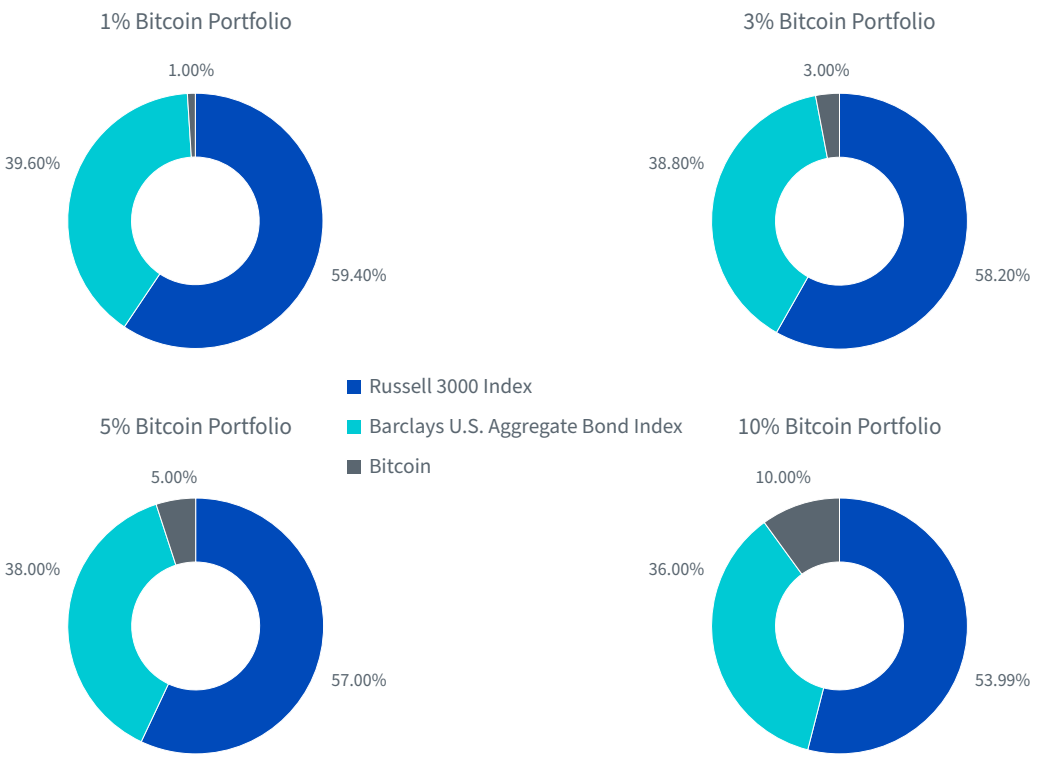
+ Allocations are meant as hypothetical illustrations only, and they are not directly investable.
+ Bitcoin has been a very volatile asset, judged by its price movements, since 2009. There have been wide swings in both the upward and downward directions.
+ We meant to show a range of impacts. One percent is meant to indicate a very small exposure and the impact of a small exposure. Three percent and 5% are meant to indicate more "middle-of-the-road" exposures. The 10% is meant to indicate a larger exposure.
+ Any investor needs to assess things based on their own suitability and situation, as well as their risk tolerance.
+ The primary benefits of showing allocations are 1) the returns of each underlying asset, 2) the volatility of each underlying asset and 3) the correlations of each underlying asset to each other underlying asset are all mixed together to show the "total impact." It is very difficult to intuitively picture the meaning of correlation across three assets.
+ It's important to keep the positive and negative angles in mind. As we have noted, bitcoin's price appreciation has been so extreme that looking at return impacts could be biased upward. To provide balance, one can also include a significant focus on drawdowns and volatility.

With all of that said, figure 4 indicates the different allocations, the period and the rebalancing frequency. The bitcoin allocation is sourced proportionately from the 60% equity/40% fixed income U.S. asset portfolio.

We note the following:

- Each allocation is calculated in the following way. There is a specified percentage allocation to bitcoin (1%, 3%, 5% and 10%). For the 10% allocation, we take 10% from the 60% equity allocation (6%) and 10% from the 40% fixed income allocation (4%). Proportionately, the equity and fixed income allocations are still 60/40 at the start, and now we also have 10% in bitcoin. One always takes the specified percentage from both equity and fixed income, and when added together, the two will lead to the appropriate amounts of bitcoin—1%, 3%, 5% and 10%.
- Rebalancing is the other critical detail. Our calculations reflect monthly rebalancing. Annual, semi-annual or quarterly rebalancing would yield different results but, of course, could be calculated in a further analysis.

Figure 4: Baseline Allocation Details



IMPORTANT INFORMATION ABOUT HYPOTHETICALS PRESENTED

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. The hypothetical information that follows should only be used by financial advisors solely as an educational resource, along with other potential resources advisors may consider, in providing services to their end clients. The hypothetical information is not intended to provide, and

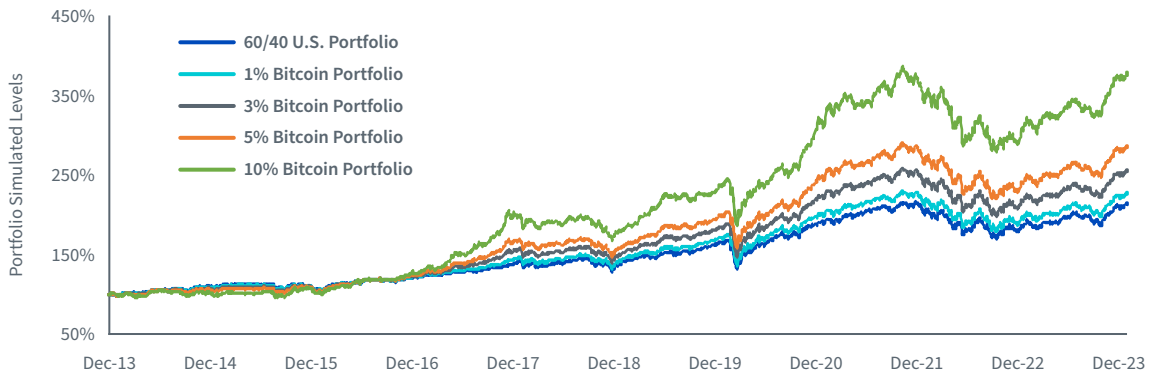
should not be relied on for, tax, legal, accounting, investment or financial planning advice by WisdomTree, nor should any hypothetical information be considered or relied upon as investment advice or as a recommendation from WisdomTree, including regarding the use or suitability of bitcoin in a portfolio. In providing hypothetical information, WisdomTree is not acting and has not agreed to act in an investment advisory, fiduciary or quasi-fiduciary capacity to any advisor or end client, and has no responsibility in connection therewith, and is not providing individualized investment advice to any advisor or end client, including based on or tailored to the circumstance of any advisor or end client. Hypothetical information is provided "as is," without warranty of any kind, express or implied. WisdomTree is not responsible for determining bitcoin to be purchased, held and/or sold for any advisor or end client accounts, nor is WisdomTree responsible for determining the suitability or appropriateness of bitcoin for any third party, including end clients. Advisors are solely responsible for making investment recommendations and/or decisions with respect to an end client and should consider the end client's individual financial circumstances, investment time frame, risk tolerance level and investment goals in determining the appropriateness of a particular investment or strategy, without input from WisdomTree. WisdomTree does not have investment discretion and does not place trade orders for any end client accounts. Information and other marketing materials provided to you by WisdomTree—including allocations, performance and other characteristics—may not be indicative of an end client's actual experience. Using an asset allocation strategy does not ensure a profit or protect against loss, and diversification does not eliminate the risk of experiencing investment losses. There is no assurance that investing in accordance with a hypothetical allocation will provide positive performance over any period.

Hypothetical portfolio allocation scenarios retroactively apply market data from periods when the allocation strategy was not actually used. It is important to understand that hypothetical performance is not a forward-looking application of stated investment methods or criteria and does not reflect investment decisions made in real time with actual financial risk. In other words, hypothetical performance shows how a portfolio may have performed during a period in the past with the benefit of hindsight. Due to retroactive application, no actual investor experienced the scenario above. Hypothetical returns are theoretical. The performance experienced by an actual investor may vary significantly from performance reports based on a hypothetical strategy. Performance results of a hypothetical investment strategy do not reflect the investment management skills or capabilities of a financial advisor.

Hypothetical performance results do not include the effects that actual trading, market or economic conditions would have on a financial advisor's decision-making. Since trades have not actually been placed, the investment results do not reflect how a financial advisor may have under- or overcompensated for the impact of economic or market events or other factors, such as a lack of liquidity. For example, had the financial advisor been managing actual client accounts during the period shown, they may have made different investment management decisions in response to economic or market events than what is shown in the hypothetical performance information.

In addition, the investment holdings underlying a hypothetical performance report may differ from those of an actual client due to the client's unique investment objectives, preferences and risk tolerance.

Figure 5: Summary of Risk/Return Characteristics For Different Asset Allocations



	60/40 US Portfolio	1% Bitcoin Portfolio	3% Bitcoin Portfolio	5% Bitcoin Portfolio	10% Bitcoin Portfolio	Russell 3000	U.S. Aggregate	Bitcoin
Annualised Return	7.78%	8.42%	9.69%	10.94%	14.03%	11.50%	1.77%	49.29%
Volatility	10.54%	10.58%	10.81%	11.21%	12.81%	17.68%	4.46%	69.30%
Sharpe Ratio	0.62	0.67	0.78	0.86	1.00	0.58	0.11	0.69
Beta	64%	65%	67%	69%	74%	100%	11%	160%
Max Drawdown	-22.3%	-22.4%	-23.1%	-24.3%	-27.5%	-35.0%	-18.4%	-83.1%

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. The results shown are theoretical and do not reflect any investor's actual experience. Thus, the performance shown does not reflect the impact that economic and market factors had or might have had on decision-making if actual investor money had been managed and allocated as shown. The actual performance achieved in allocating a particular amount to bitcoin may differ from the theoretical performance shown for a number of reasons, including the timing of implementation of trades (including rebalancing trades to adjust to changes), market conditions, fees and expenses (e.g., brokerage or trading platform commissions, bid-ask spreads, deduction of advisory or other fees or expenses charged by advisors or other third parties to investors, strategist fees and/or platform fees), contributions, withdrawals, account restrictions, tax consequences and/or other factors, any or all of which may lower returns. Sources: Bloomberg, WisdomTree, 12/31/13–12/31/23. Calculated in USD on daily returns. Base 60/40 portfolio represents 60% Russell 3000/40% Bloomberg U.S. Aggregate. **You cannot invest directly in an index. Historical performance is not an indication of future performance, and any investment may go down in value. For illustrative purposes only.**

LIMITED DOWNSIDE DESPITE DEEP DRAWDOWNS FOR BITCOIN

Because the appreciation of bitcoin has been so extreme over this period of ten years, we find it important to force the focus back to the worst periods. While it is easy to see the 50% annualized price appreciation of bitcoin, it is less easy to see the three rather extreme drawdowns.

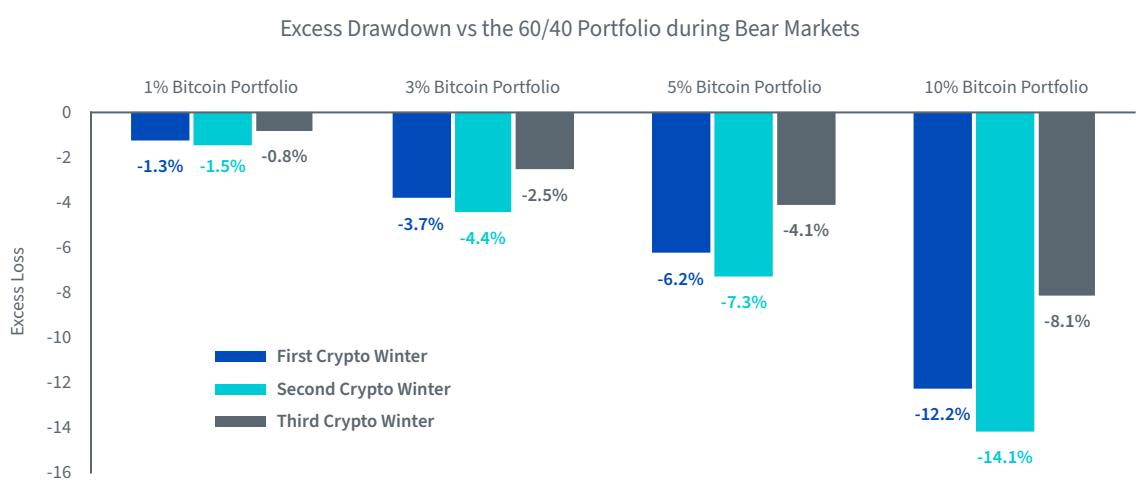
Focusing purely on the downside, figure 8 exhibits the impact of the Bitcoin allocation on the worst period for the asset:

- 2014 and up to January 14, 2015—Bitcoin lost 75.5%
- December 18, 2017, to December 14, 2018—Bitcoin lost 83.1%
- November 10, 2021, to November 21, 2022—Bitcoin lost 72.8%

However, the downside remain limited for small allocations:

- First Crypto Winter: December 31, 2013 to January 14, 2015
- Second Crypto Winter: December 18, 2017 to December 14, 2018
- Third Crypto Winter: November 10, 2021 to November 21, 2022

Figure 6: Relative Drawdown During Periods Of Intense Pressure On Bitcoin



	1% Bitcoin Portfolio	3% Bitcoin Portfolio	5% Bitcoin Portfolio	10% Bitcoin Portfolio	U.S. All Caps Equities	U.S. IG Bonds	Bitcoin
First Crypto Winter	-1.26%	-3.75%	-6.21%	-12.20%	10.11%	7.42%	-75.49%
Second Crypto Winter	-1.50%	-4.44%	-7.29%	-14.08%	-2.21%	-0.83%	-83.10%
Third Crypto Winter	-0.83%	-2.47%	-4.10%	-8.11%	-10.35%	-13.25%	-72.74%

Sources: Bloomberg, WisdomTree. Total period is 12/31/13–12/31/23, with specific crypto winter periods specified. **You cannot invest directly in an index. Historical performance is not an indication of future performance, and any investment may go down in value.**

VOLATILE ASSETS MAY REQUIRE CAREFUL CONSIDERATIONS ON REBALANCING FREQUENCY

Figure 4 detailed four baseline allocations, representing 1%, 3%, 5% and 10% additions of bitcoin to hypothetical 60/40 U.S. equity/U.S. fixed income portfolios. When we say "rebalancing" in this context, we are considering how often we are re-establishing the precise weights that are noted in figure 4.

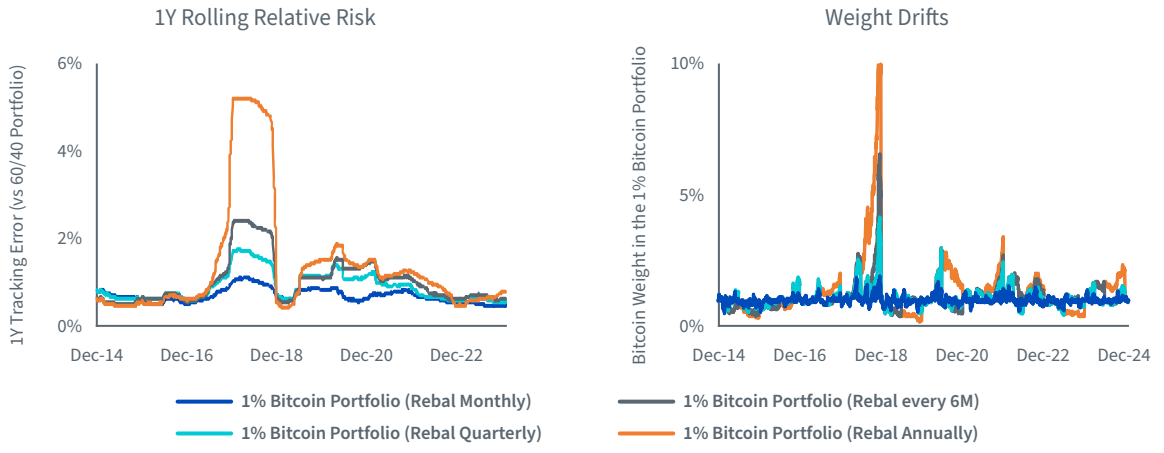
Typically:

- Less frequent rebalancing tends to let things ride for more extended periods, which might lead to stronger run-ups or stronger drawdowns.
- More frequent rebalancing can mute extended runs of returns in either direction, but constantly trimming positions in an upward-trending market could mute some of the possible upside.

In figure 7, we look at the 1% bitcoin allocation and note four different rebalancing frequencies: monthly, quarterly, semi-annually and annually.

It is clear that things looked very similar across these four options, with one exception brought on by the fact that the price appreciation of bitcoin in 2017 was more than 1,400%. The annual rebalancing frequency would have allowed for the capture of the greatest proportion of this, but we see that the weight of bitcoin also appreciated from the 1% starting point to a total allocation of greater than 10%. We also see substantial incremental volatility. We believe this illustration helps people visualize that if they sign up for a 1% approach, it is important to monitor the situation and recognize that the 1% starting point can drift significantly without adjustment.

Figure 7: Summary of Risk/Return Characteristics For Different Asset Allocations



	1% Bitcoin Portfolio (Rebal Monthly)	1% Bitcoin Portfolio (Rebal Quarterly)	1% Bitcoin Portfolio (Rebal every 6M)	1% Bitcoin Portfolio (Rebal Annually)
Annualised Return	8.42%	8.74%	8.75%	9.41%
Volatility	10.58%	10.53%	10.48%	10.58%
Sharpe Ratio	0.67	0.71	0.71	0.77
Max Drawdown	-22.40%	-21.84%	-21.96%	-22.06%

Sources: Bloomberg, WisdomTree, 12/31/13–12/31/23. Returns are calculated in U.S. dollars. **You cannot invest directly in an index. Historical performance is not an indication of future performance, and any investment may go down in value.**

CONCLUSION: A NEW TOOL IN THE ASSET ALLOCATION TOOLKIT?

It is fascinating to watch the ongoing evolution of bitcoin, as it is not often that the world sees the creation of, well, anything that attains an overall market value (price per unit x number of units) of more than $1 trillion. We believe that this piece represents an initial foray into some of the types of details that might be interesting for those embarking on the study as to whether this asset makes sense within a broader portfolio context. Continuing to study the relationship between bitcoin's price movements and the returns of other assets will be essential since we believe that most investors will continue to focus on diversified portfolios of many assets.

Glossary

60/40 portfolio: A portfolio of 60% equities and 40% fixed income. Asset allocation: An investment strategy that helps investors diversify their portfolios. Beta: A measure of the volatility of a security or a portfolio in comparison to a benchmark. In general, a beta less than 1 indicates that the investment is less volatile than the benchmark, while a beta more than 1 indicates that the investment is more volatile than the benchmark. Bitcoin: A digital currency (also called a cryptocurrency) created in 2009, which is operated by a decentralized authority as opposed to a traditional central bank or monetary authority. Coinmarketcap: A website that provides information and data such as prices, trade volumes, market capitalization on cryptocurrencies. Commodity: A raw material or primary agricultural product that can be bought and sold. Corporate bond: Debt issued by a company in order for it to raise capital. Correlation: Statistical measure of how two sets of returns move in relation to each other. Correlation coefficients range from -1.0 to 1.0. A correlation of 1.0 means the two subjects of analysis move in lockstep with each other. A correlation of -1.0 means the two subjects of analysis have moved in exactly the opposite direction. Crypto winter: A prolonged period of decline in the cryptocurrency market. High yield: Sometimes referred to as "junk bonds," these securities have a higher risk of default than investment-grade securities. Investment grade: A rating that signifies a municipal or corporate bond presents a relatively low risk of default. Liquid assets: Assets that can be easily bought or sold. Market Capitalization: Market cap = share prices x number of shares outstanding. Firms with the highest values receive the highest weights in approaches designed to weight firms by market cap. Max drawdown: A measure of an asset's largest price drop from a peak to a trough. Multi-asset portfolio: A combination of different types of asset classes. These asset classes can include equities, bonds, cash, alternatives, and property. Relative risk: A ratio of the probability of an event occurring in the exposed group versus the probability of the event occurring in the non-exposed group. Sharpe ratio: A measure of risk-adjusted return. Higher values indicate greater return per unit of risk, specifically standard deviation, which is viewed as being desirable. U.S. Treasury: A debt obligation issued by the U.S. government with payments of principal and interest backed by the full faith and credit of the U.S. government. Volatility: A measure of the dispersion of actual returns around a particular average level. Weight drift: A veer off of the original allocation over time.

Index Definitions

Bloomberg Commodity Total Return Index: A broadly diversified commodity price index distributed by Bloomberg Indexes that tracks prices of futures contracts on physical commodities on the commodity markets. Bloomberg Global Aggregate Index: A flagship measure of global investment grade debt from a multitude local currency markets. Bloomberg Global High Yield Index: A multi-currency flagship measure of the global high yield debt market. Bloomberg U.S. Treasury Total Return Index: The index represents the performance of the U.S. Treasury component of the Barclays U.S. Aggregate Index. Bloomberg U.S. Aggregate Corporates Total Return Index: A broad-based measure of the global investment-grade, fixed-rate, fixed income corporate markets outside the United States. Bloomberg U.S. Aggregate Total Return Index: The "Agg" is a broad-based fixed-income index used by bond traders and the managers of mutual funds and exchange-traded funds (ETFs) as a benchmark to measure their relative performance. Bloomberg U.S. High Yield Total Return Index: Measures the USD-denominated, high yield, fixed-rate corporate bond market. FTSE EPRA NAREIT Developed Total Return Index: Designed to track the performance of listed real estate companies and REITS worldwide. LBMA Gold Price PM USD: A term that refers to the price of a troy ounce of gold per London time, as stated in US dollars. MSCI EAFE Index: A market capitalization-weighted index composed of companies representative of the developed market structure of developed countries in Europe, Australasia and Japan. MSCI Emerging Markets Index: A free-float weighted equity index that captures large and mid-cap representation across emerging markets (EM) countries. MSCI Emerging Markets Small Cap Index: Includes small cap representation across 21 Emerging Markets countries. The small cap segment tends to capture more local economic and sector characteristics relative to larger Emerging Markets capitalization segments. MSCI World Index: Captures large and mid-cap representation across 23 Developed Markets (DM) countries. MSCI World Infrastructure Net Total Return Index: A market capitalization weighted index that measures performance of global infrastructure companies by capturing broad and diversified opportunities across telecommunication, utilities, energy, transportation, and social infrastructure sectors. MSCI World Small Cap Index: Captures small cap representation across 23 Developed Markets (DM) countries. Russell 2000 Index: Measures the performance of the small-cap segment of the U.S. equity universe. The Russell 2000 is a subset of the Russell 3000 Index representing approximately 10% of the total market cap of that index. It includes approximately 2000 of the smallest securities based on a combination of their market cap and current index membership. Russell 3000 Index: Measures the performance of the 3,000 largest U.S. companies based on total market capitalization. S&P 500 Index: A market cap-weighted benchmark of 500 stocks selected by the Standard and Poor's Index Committee designed to represent the performance of the leading industries in the U.S. economy. S&P GSCI Index: A composite index that measures the performance of the commodities market.

IMPORTANT INFORMATION

This material contains the opinions of the authors, which are subject to change, and should not be considered or interpreted as a recommendation to participate in any particular trading strategy or deemed to be an offer or sale of any investment product, and it should not be relied on as such. There is no guarantee that any strategies discussed will work under all market conditions. This material represents an assessment of the market environment at a specific time and is not intended to be a forecast of future events or a guarantee of future results. This material should not be relied upon as research or investment advice regarding any security in particular. The user of this information assumes the entire risk of any use made of the information provided herein. Unless expressly stated otherwise, the opinions, interpretations or findings expressed herein do not necessarily represent the views of WisdomTree or any of its affiliates.

Crypto assets, such as bitcoin and ether, are complex, generally exhibit extreme price volatility and unpredictability, and should be viewed as highly speculative assets. Crypto assets are frequently referred to as crypto "currencies," but they typically operate without central authority or banks, are not backed by any government or issuing entity (i.e., no right of recourse), have no government or insurance protections, are not legal tender and have limited or no usability as compared to fiat currencies. Federal, state or foreign governments may restrict the use, transfer, exchange and value of crypto assets, and regulation in the U.S. and worldwide is still developing.

Crypto asset exchanges and/or settlement facilities may stop operating, permanently shut down or experience issues due to security breaches, fraud, insolvency, market manipulation, market surveillance, KYC/AML (know your customer/anti-money laundering) procedures, noncompliance with applicable rules and regulations, technical glitches, hackers, malware or other reasons, which could negatively impact the price of any cryptocurrency traded on such exchanges or reliant on a settlement facility or otherwise may prevent access or use of the crypto asset. Crypto assets can experience unique events, such as forks or airdrops, which can impact the value and functionality of the crypto asset. Crypto asset transactions are generally irreversible, which means that a crypto asset may be unrecoverable in instances where: (i) it is sent to an incorrect address, (ii) the incorrect amount is sent or (iii) transactions are made fraudulently from an account. A crypto asset may decline in popularity, acceptance or use, thereby impairing its price, and the price of a crypto asset may also be impacted by the transactions of a small number of holders of such crypto asset. Crypto assets may be difficult to value, and valuations, even for the same crypto asset, may differ significantly by pricing source or otherwise be suspect due to market fragmentation, illiquidity, volatility and the potential for manipulation. Crypto assets generally rely on blockchain technology, and blockchain technology is a relatively new and untested technology that operates as a distributed ledger. Blockchain systems could be subject to internet connectivity disruptions, consensus failures or cybersecurity attacks, and the date or time that you initiate a transaction may be different than when it is recorded on the blockchain. Access to a given blockchain requires an individualized key, which, if compromised, could result in loss due to theft, destruction or inaccessibility. In addition, different crypto assets exhibit different characteristics, use cases and risk profiles. Information provided by WisdomTree regarding digital assets, crypto assets or blockchain networks should not be considered or relied upon as investment or other advice, as a recommendation from WisdomTree, including regarding the use or suitability of any particular digital asset, crypto asset, blockchain network or any particular strategy.

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