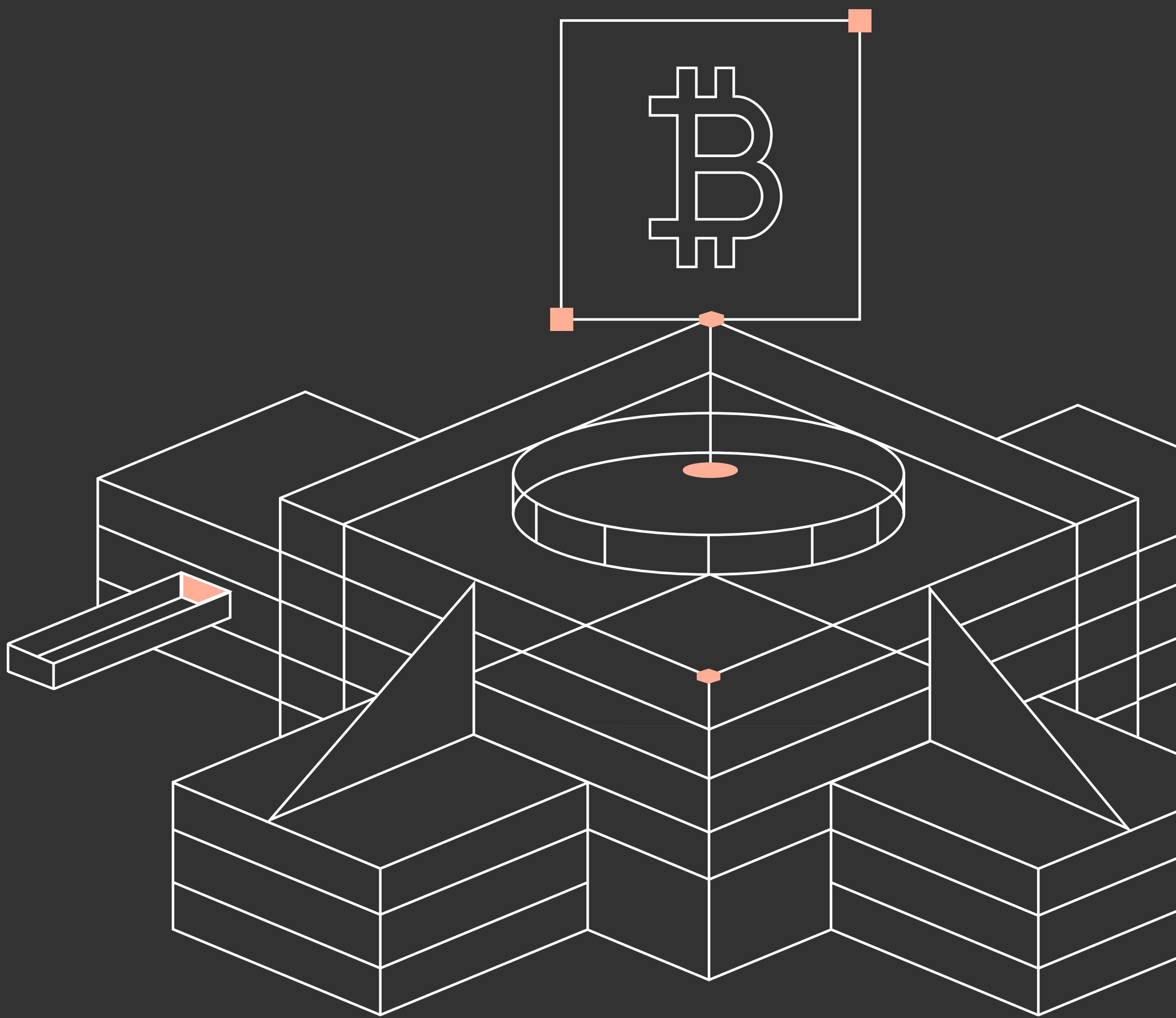
Galaxy Research

The Impact and Opportunity of Bitcoin in a Portfolio

OCTOBER 2, 2023



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This report is a product of Galaxy Research, a research organization within Galaxy, the leading provider of financial services in the digital assets, cryptocurrency, and blockchain technology sector. Galaxy Research provides top-tier market commentary, thematic views, tactical insights, and deep protocol research.

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What is bitcoin?

Born in the wake of the 2008 global financial crisis, bitcoin leverages innovative blockchain technology to function as a transparent and decentralized digital asset. Evolving from a concept of peer-to-peer electronic cash to a resilient store of value upheld by open-source code[1] and mathematical principles, it ensures highly secure, trust-minimized transactions without a centralized intermediary. Bitcoin is the first natively digital asset and its advent heralded the beginning of digital finance.

The Bitcoin blockchain is a distributed ledger that guarantees a transparent, predictable, and immutable monetary policy,[2] which has led many to refer to it as "digital gold." Bitcoin shares gold's traditional attributes of being a non-sovereign store of value with a scarce supply, but it also surpasses gold in many ways. While Bitcoin's gold-like properties have spurred its use as a hedge against central bank monetary policy or inflation, Bitcoin is also significantly more portable, verifiable, transferrable, divisible than gold.

1 Open-source code refers to software that is made available in source code form, under a license that allows users to use, modify, and distribute the code freely.

2 An immutable monetary policy refers to the ability to maintain the issuance and overall supply of a denomination so no one individual or centralized body can alter the policy in the future.

Exhibit 1: Gold vs. Fiat vs. Bitcoin

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Source: Galaxy Asset Management

Traits of Money	Gold	Fiat (USD)	Bitcoin
Scarce (predictable supply)	Moderate	Low	High
Durable	High	Moderate	High
Portable	Moderate	High	High
Divisible	Moderate	Moderate	High
Verifiable (cannot be counterfeited)	Moderate	Moderate	High
Fungible (interchangeable)	High	High	High
Scalable & Easily Transactable	Low	High	High
OTHER TRAITS TO CONSIDER			
Non-Sovereign (Not government issued)	High	Low	High
Longevity	High	Moderate	Low
Decentralized	Low	Low	High
Smart (programmable)	Low	Low	High

See Appendix (p. 12) for more explanation.

Why bitcoin belongs in a portfolio?

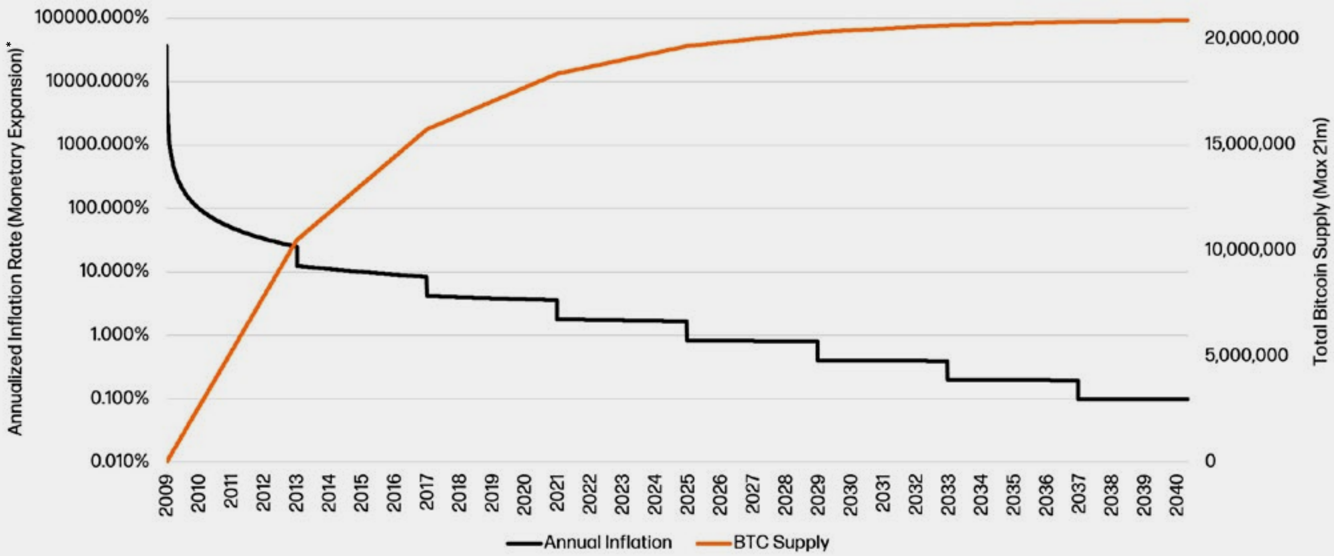
Bitcoin is the only verifiably scarce, fixed-supply asset in the world. It's underlying code controls how much new bitcoin is created and limits the maximum amount of bitcoin that will ever exist to 21 million. It's code is simultaneously enforced by a decentralized network of thousands of independent node[1] operators around the world. Bitcoin has a price-inelastic supply, meaning that a change in price does not change its supply issuance.

Said differently, bitcoin's supply is transparent and immutable; it is strictly bound, algorithmically coded, and governed by a community of global participants that believe in the long-term fundamental properties bitcoin offers to individuals.

3 A Bitcoin node is a computer that stores a copy of the entire Bitcoin blockchain and verifies transactions on the network.

Exhibit 2: Bitcoin Supply & Annualized Inflation Rate (Model)

Source: Galaxy Research

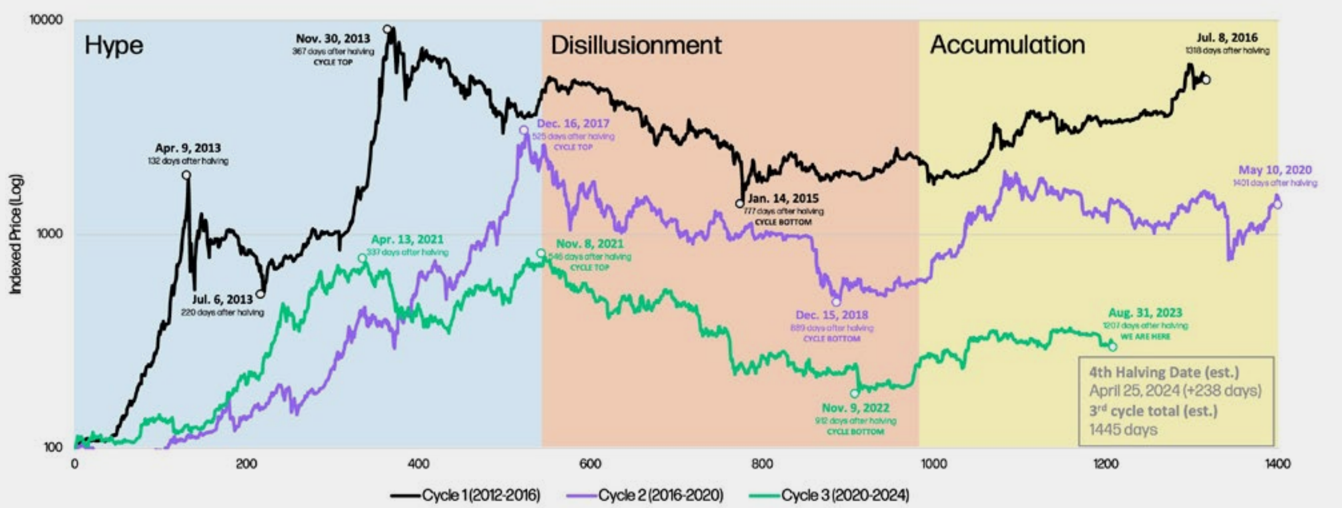


Past performance is no guarantee of future similar results.
* Annual Inflation is defined as the annual issuance of new bitcoin relative to the total bitcoin supply. The Bitcoin network is programmed to issue a fixed amount of bitcoin in four-year periods, whereby each new four-year period reduces the bitcoin issuance in half until all 21 million bitcoins are in circulation. | Data: Coin Metrics, Galaxy Research | As of Aug. 31, 2023

Bitcoin's Halving Cycles: Bitcoin's fixed terminal supply is enacted in code through quadrennial "halving" events. Approximately every four years, the rate of newly issued bitcoin reduces by half. These events will continue until roughly the year 2140 when the last piece of newly issued bitcoin is expected to be mined. A byproduct of these halving events has provided a seasonality effect in bitcoin's price, as evidenced in exhibit 3.

Exhibit 3: Bitcoin's Prior Halving Cycles

Source: Galaxy Research



Past performance is no guarantee of future similar results.
Data: Coin Metrics, Galaxy Research | As of Aug. 31, 2023

In a world beset with stubborn inflation, monetary debasement, divergent and extreme fiscal policies, and other macroeconomic challenges, bitcoin's non-sovereign, transparent, and predictable supply dynamic stands out. Bitcoin's fundamental properties may help it serve as a hedge against global uncertainties for investment portfolios in the long run.

Historically, bitcoin's correlation relative to established macro assets, on average, hovers within a +/- 0.30 range around zero. Over its 14-year history, bitcoin has demonstrated very low or even slightly negative correlation to most major global asset classes, including the S&P 500, Russell 2000, MSCI ACWI Index, US Agg Bond Index, Bloomberg Commodities, Gold, and the US Dollar index (see Exhibit 5). It is these typically low correlations to major asset classes paired with bitcoin's asymmetric return profile that has enabled bitcoin to demonstrate return-enhancing outcomes when added to traditional portfolios. Although bitcoin is more volatile than traditional assets, its 30-day realized volatility continues to decline as adoption grows. While many view bitcoin as a risk asset and more closely correlated to equities, we anticipate bitcoin's price behavior to resemble other non-fiat stores of value, like gold, in the long-term.

Exhibit 4: Rolling 90-Day Correlations of Bitcoin to Traditional Assets

Source: Galaxy Asset Managemen

Data: Coin Metrics, Galaxy Research | As of Aug. 31, 2023

Bitcoin is still a novel asset, so there is no guarantee the current relationship between its returns and those of traditional asset classes will persist going forward, but our research suggests bitcoin may have an impactful role in a diversified portfolio. With its unique blend of scarcity, potential for significant returns, and role as a hedge against global macro uncertainties, bitcoin has carved a niche for itself as an indispensable asset in a diversified investment portfolio.

Exhibit 5: Expanded Correlation Matrix

Source: Galaxy Asset Management

	Bitcoin	S&P 500	NASDAQ 100	Russell 2000	MSCI ACWI	MSCI EAFE	MSCI EM	US Aggregate	Global Aggregate	US Corporate	Global Corporate	Global High Yield	1-3 Month T-Bills	US REITs	Commodities	Global REITs	Gold	US Dollar Index	Base Portfolio (55/35/10)
Bitcoin	1.00																		
S&P 500	0.27	1.00																	
NASDAQ 100	0.29	0.93	1.00																
Russell 2000	0.28	0.88	0.79	1.00															
MSCI ACWI	0.29	0.95	0.87	0.87	1.00														
MSCI EAFE	0.22	0.56	0.45	0.55	0.77	1.00													
MSCI EM	0.15	0.43	0.38	0.42	0.63	0.69	1.00												
US Aggregate	0.05	0.00	0.05	-0.01	0.03	0.08	-0.01	1.00											
Global Aggregate	0.11	0.07	0.09	0.07	0.17	0.35	0.17	0.81	1.00										
US Corporate	0.07	0.14	0.15	0.11	0.19	0.24	0.13	0.92	0.78	1.00									
Global Corporate	0.12	0.18	0.18	0.17	0.29	0.43	0.24	0.86	0.92	0.93	1.00								
Global High Yield	0.18	0.54	0.45	0.51	0.68	0.75	0.61	0.30	0.52	0.52	0.66	1.00							
1-3 Month T-Bills	0.02	-0.04	-0.02	-0.06	-0.05	-0.04	-0.06	0.04	0.06	0.01	0.04	-0.01	1.00						
US REITs	0.20	0.78	0.62	0.78	0.76	0.48	0.34	0.09	0.15	0.22	0.26	0.53	-0.04	1.00					
Commodities	0.17	0.31	0.24	0.33	0.37	0.35	0.32	-0.01	0.12	0.05	0.13	0.32	-0.08	0.25	1.00				
Global REITs	0.21	0.75	0.58	0.76	0.78	0.61	0.44	0.12	0.24	0.28	0.35	0.64	-0.04	0.97	0.29	1.00			
Gold	0.15	0.08	0.10	0.07	0.13	0.19	0.12	0.42	0.50	0.38	0.45	0.20	0.02	0.12	0.33	0.16	1.00		
US Dollar Index	-0.18	-0.18	-0.18	-0.19	-0.30	-0.46	-0.25	-0.35	-0.64	-0.36	-0.58	-0.47	-0.03	-0.17	-0.24	-0.27	-0.47	1.00	
Base Portfolio (55/35/10)	0.29	0.99	0.93	0.88	0.95	0.57	0.43	0.11	0.18	0.24	0.29	0.58	-0.04	0.77	0.40	0.75	0.16	-0.26	1.00

- 0.80 – 1.00
- 0.60 – 0.79
- 0.30 – 0.59
- 0.00 – 0.29
- -0.29 – -0.01
- -0.59 – -0.30
- -0.79 – -0.60

Data: Bloomberg, from August 31, 2018 to August 31, 2023

How to think about a bitcoin allocation?

Fundamentally, we now understand the role bitcoin can play in an investor's portfolio – a hedge against global financial uncertainty; a scarce, secure, price-inelastic digital commodity, but which also possesses portability features that allow it to function as money. Quantitatively, we now also understand the role bitcoin can play as a diversifier in a portfolio. Next, we would like to further contextualize how bitcoin can enhance a portfolio and ways to think about an allocation.

To perform our test, we started with a base portfolio of 55% equities (S&P 500 index), 35% fixed income (Bloomberg US Aggregate Bond Index), and 10% commodities (Bloomberg Commodities Index) ("Base portfolio"), rebalanced quarterly to these target weights. In our view, a five-year sample lookback period provides a comprehensive, yet conservative, window to assess the impact bitcoin may have on a diversified portfolio. This sample period excludes the bull-run in 2017, but includes two "crypto winters" and the all-time-highs reached in 2021. It was important to capture, in our view, a representative sample of bitcoin's peaks, troughs, and volatility, while also excluding impacts of the base effect inherent with pre-2018 bitcoin price levels.

To conduct a thorough analysis, we created portfolios containing bitcoin allocations of 1% through 10%, reallocating entirely from the commodity sleeve, entirely from the equity sleeve, entirely from the fixed income sleeve, equally across all three sleeves, and pro rata from all three sleeves – creating fifty model portfolios in total.

In all scenarios, our analysis indicates the best approach to portfolio construction is to "get off zero" when it comes to a bitcoin allocation. Regardless of where the reallocation is sourced, all portfolios we analyzed benefitted from an allocation to bitcoin over the observation period. In fact, the strongest marginal improvement to a portfolio's risk-adjusted return, as measured by the Sharpe[1] and Sortino[2] ratios, occurred when moving from a 0% to a 1% allocation.

1 A Sharpe ratio is a measure of a portfolio's risk-adjusted performance. It compares the portfolio's return to its risk, as measured by standard deviation. A higher sharpe ratio indicates a better risk-adjusted performance. Sharpe ratio = (Annualized Portfolio Return – Risk-Free Rate) / Annualized Volatility

2 The Sortino ratio is a measure of a portfolio's risk-adjusted performance. It compares the portfolio's return to its downside volatility, rather than total volatility. Sortino ratio = (Annualized Portfolio Return – Risk-Free Rate) / Annualized Downside Volatility

Exhibit 6: The Risk-Adjusted Benefits of Bitcoin

Source: Galaxy Asset Management

	From Commodity Allocation				From Equity Allocation				From FI Allocation				Equal Allocation				Pro Rata Allocation			
	Sharpe	Δ	Sortino	Δ	Sharpe	Δ	Sortino	Δ	Sharpe	Δ	Sortino	Δ	Sharpe	Δ	Sortino	Δ	Sharpe	Δ	Sortino	Δ
Base Portfolio	0.17	–	0.26	–	0.17	–	0.26	–	0.17	–	0.26	–	0.17	–	0.26	–	0.17	–	0.26	–
1% BTC	**0.23**	**0.06**	**0.35**	**0.09**	**0.23**	**0.06**	**0.36**	**0.09**	**0.23**	**0.06**	**0.36**	**0.09**	**0.23**	**0.06**	**0.35**	**0.09**	**0.23**	**0.06**	**0.35**	**0.09**
2% BTC	0.28	0.05	0.43	0.08	0.29	0.06	0.44	0.09	0.29	0.06	0.44	0.09	0.29	0.05	0.44	0.08	0.29	0.06	0.44	0.08
3% BTC	0.44	0.05	0.51	0.08	0.34	0.05	0.52	0.08	0.34	0.05	0.52	0.08	0.34	0.05	0.52	0.08	0.34	0.05	0.52	0.08
4% BTC	0.38	0.04	0.58	0.07	0.39	0.05	0.60	0.08	0.39	0.05	0.60	0.07	0.38	0.05	0.59	0.07	0.39	0.05	0.59	0.07
5% BTC	0.42	0.04	0.64	0.07	0.44	0.05	0.68	0.07	0.44	0.04	0.67	0.07	0.43	0.04	0.66	0.07	0.43	0.05	0.66	0.07
6% BTC	0.45	0.04	0.70	0.06	0.48	0.04	0.74	0.07	0.47	0.04	0.73	0.06	0.47	0.04	0.72	0.06	0.47	0.04	0.72	0.06
7% BTC	0.49	0.03	0.76	0.05	0.52	0.04	0.81	0.06	0.51	0.03	0.78	0.06	0.50	0.03	0.77	0.06	0.50	0.04	0.78	0.06
8% BTC	0.52	0.03	0.80	0.05	0.55	0.03	0.86	0.06	0.54	0.03	0.83	0.05	0.53	0.03	0.83	0.05	0.54	0.03	0.83	0.05
9% BTC	0.54	0.03	0.85	0.04	0.58	0.03	0.91	0.05	0.57	0.03	0.88	0.05	0.56	0.03	0.87	0.05	0.56	0.03	0.88	0.05
10% BTC	0.56	0.02	0.89	0.04	0.61	0.03	0.96	0.05	0.59	0.02	0.92	0.04	0.58	0.02	0.91	0.04	0.59	0.03	0.92	0.04

Data: Bloomberg, from August 31, 2018 to August 31, 2023

But, while "getting off zero" is clear, determining "how to get off zero" is just as important. Once an investor decides to allocate to bitcoin, from where in the portfolio should they draw capital for the allocation? Based on our analysis of the Base portfolio, funding a bitcoin allocation from the equity sleeve provided the most significant portfolio enhancement as measured by lower annualized volatility, higher risk-adjusted returns (Sharpe ratio), and lower maximum drawdowns. Intuitively, this makes sense given bitcoin's elevated correlation with equities during the observed sample period relative to other asset classes.

Exhibit 7: Risk-Adjusted Returns

Source: Galaxy Research

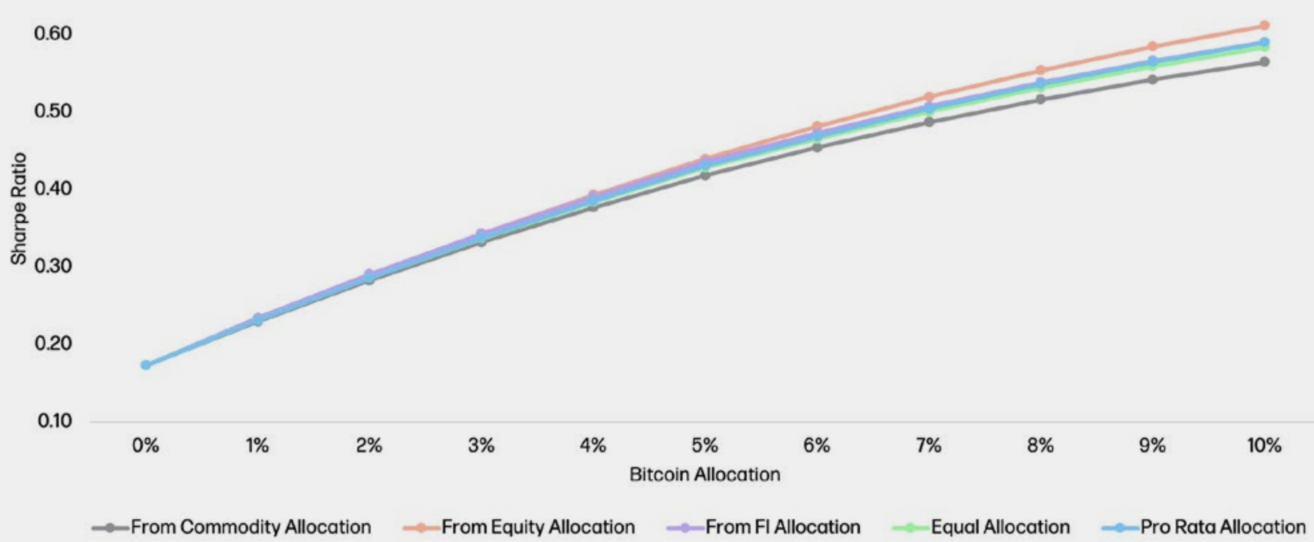


Exhibit 8: Average Annualized Volatility

Source: Galaxy Research

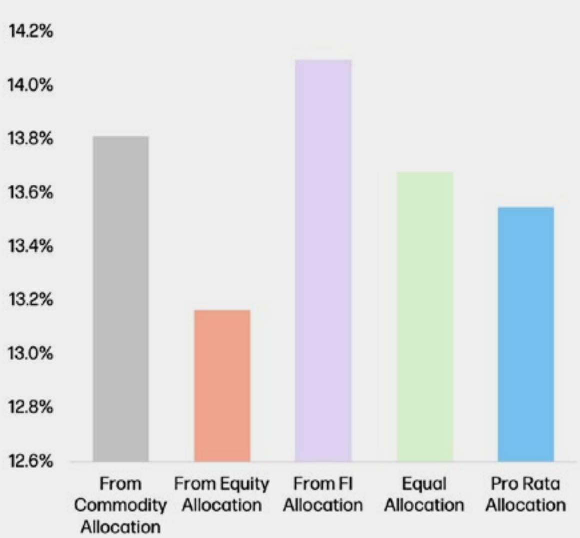
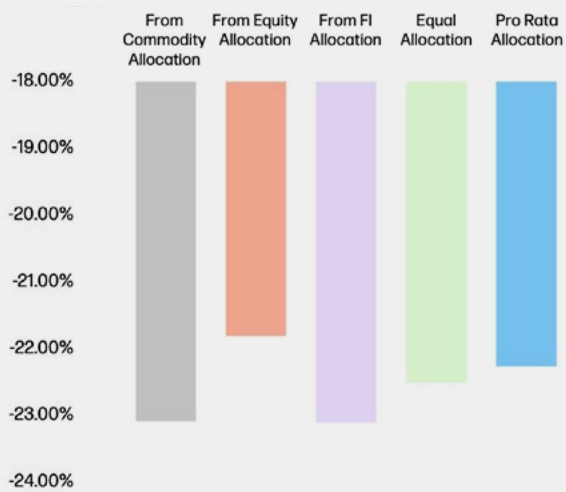


Exhibit 9: Average Maximum Drawdowns

Source: Galaxy Research



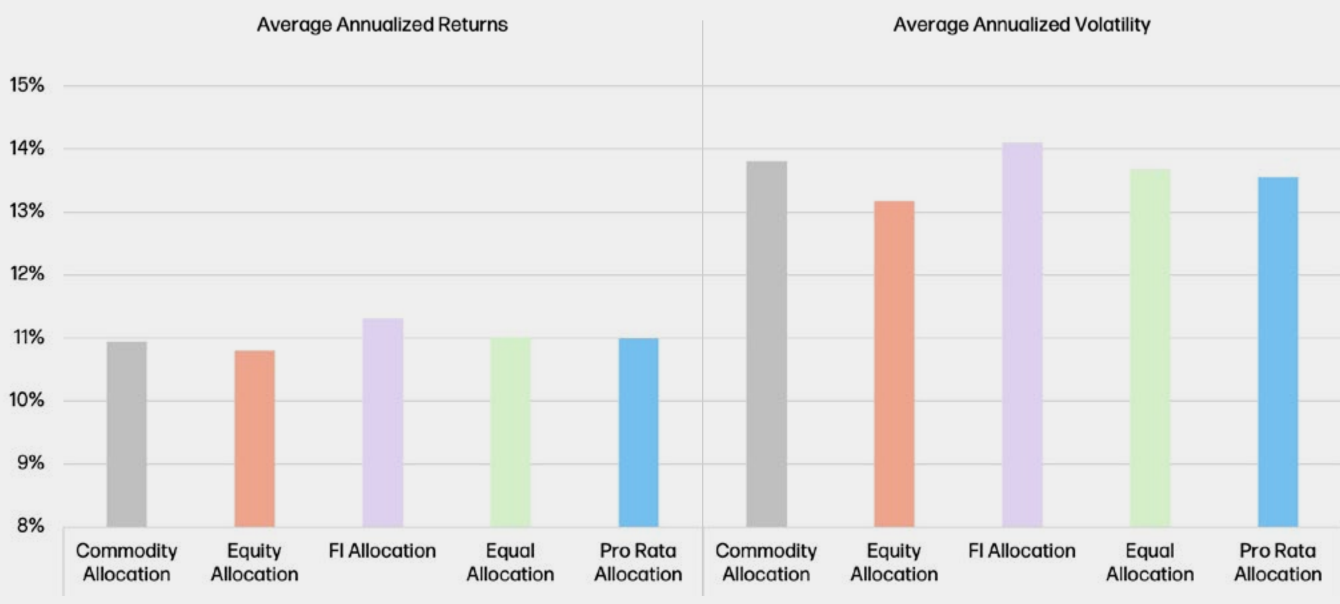
Now, not all investor preferences are the same. An investor's tolerance towards risk may dictate the size of a bitcoin allocation and where to reallocate from. Consequently, investors that tend to be more risk averse may also benefit by reallocating from their equity sleeve.

Conversely, risk-seeking investors focusing on absolute returns may prefer allocating to bitcoin from their fixed income sleeve.

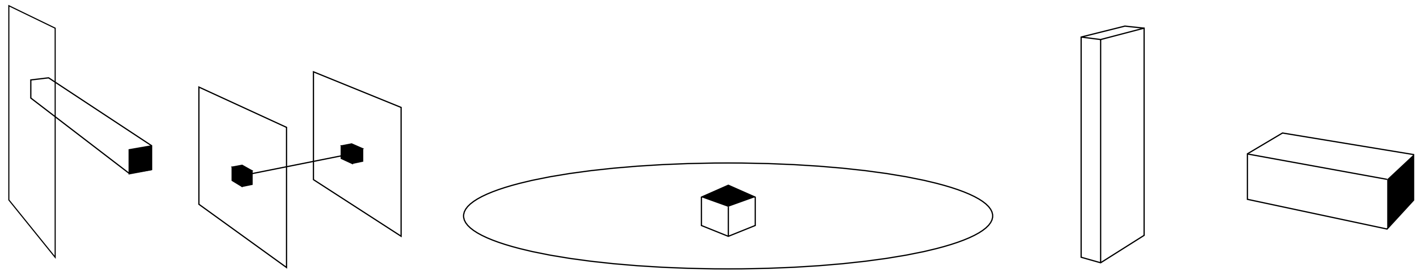
Our analysis suggests that funding a bitcoin allocation from fixed income may reward investors with higher annualized returns on average, but that comes at the expense of accepting the greatest risk, as measured by average annualized volatility.

Exhibit 10: Average Annualized Returns and Volatility

Source: Galaxy Asset Management



Data: Bloomberg, from August 31, 2018 to August 31, 2023



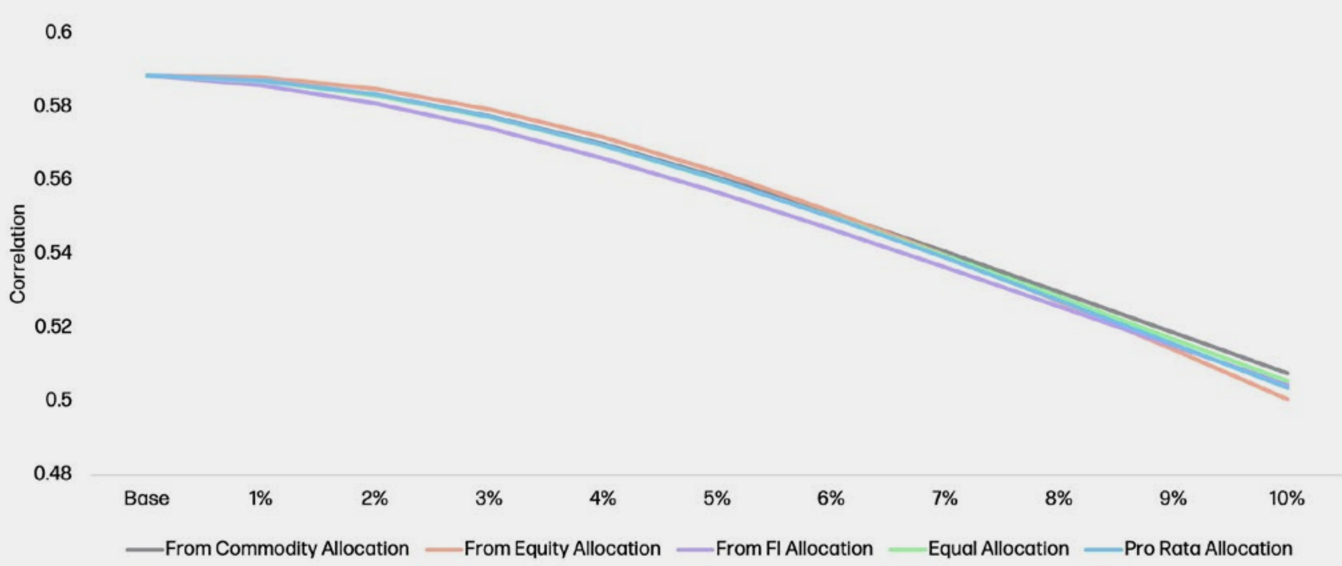
An alternative approach to the reallocation question is to look at dynamic rebalancing methods. Since the five-year sample period for our analysis is brief relative to a long-term investment horizon, it may be prudent to initiate a bitcoin allocation pro-rata across the portfolio. Based on our analysis, this allocation framework, on average, resulted in some of the strongest all-around portfolio statistics. The appendix of this paper contains additional details.

One final consideration to the allocation framework brings us back to bitcoin's role as a diversifier. As a standalone asset, it's evident that bitcoin has low correlations to most major asset classes. However, it's important to demonstrate that bitcoin can maintain its ability to diversify in a portfolio context. To test this, we took our Base portfolio and calculated the correlation of its returns to that of a broad, global multi-asset benchmark – the Barclays Global Multi-Asset index. Next, we calculated the correlations of the returns of each of our model portfolios to the returns of this same benchmark to determine if the addition of bitcoin to our Base portfolio provided any portfolio diversification. The results suggest that bitcoin may not only help further diversify a portfolio, but as the bitcoin allocation increased, so did its ability to enhance portfolio diversification.

Regardless of an individual's fundamental views of bitcoin, our analysis shows clearly that bitcoin improved the risk-adjusted returns and portfolio diversification of our Base portfolio. Applying a strategic asset allocation framework to bitcoin can result in several approaches. However, during our five-year sample period, allocating to bitcoin from the Base portfolio's equity sleeve yielded the strongest risk-adjusted returns, lowest volatility, and lowest draw downs. More importantly, "getting off zero" is not just prudent, but imperative for investors seeking diversification and robust performance. In essence, integrating bitcoin into traditional investment portfolios is no longer a speculative bet, but a forward-looking approach to holistic financial planning and wealth preservation.

Exhibit 11: Portfolio Return Correlations with a Diversified Benchmark

Source: Galaxy Asset Management



Data: Bloomberg, from August 31, 2018 to August 31, 2023

Appendix: Portfolio Statistics for all Model Portfolios over the 5-year sample period

Source: Galaxy Asset Management

From Commodity Allocation

	Base	1% BTC	2% BTC	3% BTC	4% BTC	5% BTC	6% BTC	7% BTC	8% BTC	9% BTC	10% BTC	5-year Avg
aReturns	7.46%	8.20%	8.92%	9.63%	10.33%	11.02%	11.68%	12.34%	12.99%	13.62%	14.24%	10.95%
aVolatility	12.37%	12.52%	12.73%	12.99%	13.29%	13.63%	14.01%	14.42%	14.86%	15.32%	15.81%	13.81%
aDownVolatility	8.08%	8.18%	8.31%	8.47%	8.65%	8.84%	9.05%	9.29%	9.53%	9.79%	10.07%	8.93%
Sharpe	0.17	0.23	0.28	0.33	0.38	0.42	0.45	0.49	0.52	0.54	0.56	0.40
Sortino	0.26	0.35	0.43	0.51	0.58	0.64	0.70	0.76	0.80	0.85	0.89	0.62
MaxDrawDown	-21.04%	-21.28%	-21.52%	-21.76%	-22.00%	-22.23%	-22.90%	-23.87%	-24.84%	-25.80%	-26.74%	-23.09%
Global Index Corr	0.59	0.59	0.58	0.58	0.57	0.56	0.55	0.54	0.53	0.52	0.51	0.56

From Equity Allocation

	Base	1% BTC	2% BTC	3% BTC	4% BTC	5% BTC	6% BTC	7% BTC	8% BTC	9% BTC	10% BTC	5-year Avg
aReturns	7.46%	8.16%	8.85%	9.53%	10.20%	10.88%	11.50%	12.13%	12.75%	13.36%	13.96%	10.80%
aVolatility	12.37%	12.38%	12.45%	12.57%	12.74%	12.96%	13.22%	13.51%	13.84%	14.20%	14.59%	13.17%
aDownVolatility	8.08%	8.10%	8.14%	8.21%	8.31%	8.42%	8.56%	8.72%	8.90%	9.09%	9.30%	8.53%
Sharpe	0.17	0.23	0.29	0.34	0.39	0.44	0.48	0.52	0.55	0.58	0.61	0.42
Sortino	0.26	0.36	0.44	0.52	0.60	0.68	0.74	0.81	0.86	0.91	0.96	0.65
MaxDrawDown	-21.04%	-21.13%	-21.22%	-21.32%	-21.41%	-21.50%	-21.60%	-21.69%	-22.34%	-23.01%	-23.67%	-21.81%
Global Index Corr	0.59	0.59	0.58	0.58	0.57	0.56	0.55	0.54	0.53	0.51	0.50	0.56

From FI Allocation

	Base	1% BTC	2% BTC	3% BTC	4% BTC	5% BTC	6% BTC	7% BTC	8% BTC	9% BTC	10% BTC	5-year Avg
aReturns	7.46%	8.27%	9.06%	9.84%	10.61%	11.39%	12.11%	12.84%	13.56%	14.26%	14.96%	11.30%
aVolatility	12.37%	12.59%	12.86%	13.17%	13.53%	13.93%	14.36%	14.82%	15.30%	15.81%	16.33%	14.10%
aDownVolatility	8.08%	8.23%	8.41%	8.61%	8.83%	9.07%	9.32%	9.59%	9.88%	10.17%	10.48%	9.15%
Sharpe	0.17	0.23	0.29	0.34	0.39	0.44	0.47	0.51	0.54	0.57	0.59	0.41
Sortino	0.26	0.36	0.44	0.52	0.60	0.67	0.73	0.78	0.83	0.88	0.92	0.64
MaxDrawDown	-21.04%	-21.46%	-21.88%	-22.29%	-22.71%	-23.12%	-23.53%	-23.93%	-24.33%	-24.73%	-25.15%	-23.10%
Global Index Corr	0.59	0.59	0.58	0.57	0.57	0.56	0.55	0.54	0.53	0.52	0.50	0.55

Equal Allocation

	Base	1% BTC	2% BTC	3% BTC	4% BTC	5% BTC	6% BTC	7% BTC	8% BTC	9% BTC	10% BTC	5-year Avg
aReturns	7.46%	8.21%	8.94%	9.67%	10.38%	11.10%	11.77%	12.44%	13.10%	13.75%	14.39%	11.02%
aVolatility	12.37%	12.49%	12.68%	12.91%	13.18%	13.50%	13.85%	14.23%	14.65%	15.08%	15.54%	13.68%
aDownVolatility	8.08%	8.17%	8.29%	8.43%	8.59%	8.77%	8.97%	9.19%	9.42%	9.67%	9.93%	8.87%
Sharpe	0.17	0.23	0.29	0.34	0.38	0.43	0.47	0.50	0.53	0.56	0.58	0.41
Sortino	0.26	0.35	0.44	0.52	0.59	0.66	0.72	0.77	0.83	0.87	0.91	0.63
MaxDrawDown	-21.04%	-21.29%	-21.54%	-21.79%	-22.04%	-22.28%	-22.53%	-22.77%	-23.33%	-24.12%	-24.89%	-22.51%
Global Index Corr	0.59	0.59	0.58	0.58	0.57	0.56	0.55	0.54	0.53	0.52	0.51	0.56

Pro Rata Allocation

	Base	1% BTC	2% BTC	3% BTC	4% BTC	5% BTC	6% BTC	7% BTC	8% BTC	9% BTC	10% BTC	5-year Avg
aReturns	7.46%	8.20%	8.93%	9.65%	10.36%	11.07%	11.73%	12.40%	13.06%	13.71%	14.34%	10.99%
aVolatility	12.37%	12.47%	12.63%	12.82%	13.07%	13.36%	13.69%	14.05%	14.44%	14.86%	15.30%	13.55%
aDownVolatility	8.08%	8.15%	8.25%	8.38%	8.52%	8.69%	8.87%	9.08%	9.29%	9.53%	9.77%	8.78%
Sharpe	0.17	0.23	0.29	0.34	0.39	0.43	0.47	0.50	0.54	0.56	0.59	0.41
Sortino	0.26	0.35	0.44	0.52	0.59	0.66	0.72	0.78	0.83	0.88	0.92	0.63
MaxDrawDown	-21.04%	-21.26%	-21.48%	-21.70%	-21.92%	-22.14%	-22.36%	-22.57%	-22.79%	-23.47%	-24.19%	-22.27%
Global Index Corr	0.59	0.59	0.58	0.58	0.57	0.56	0.55	0.54	0.53	0.52	0.50	0.55

3 month t-bill as of August 31, 2023 used as risk-free rate for sharpe and sortino calculations
Data: Bloomberg, from August 31, 2018 to August 31, 2023

Index Definitions

Name	Index
Bitcoin	BBG Galaxy Bitcoin Index
S&P 500	S&P 500 Total Return
NASDAQ 100	NASDAQ 100 Total Return
Russell 2000	Russell 2000 TR Idx
MSCI ACWI	MSCI AC World Daily TR N
MSCI EAFE	MSCI EAFE NR
MSCI EM	MSCI EM
US Aggregate	Bloomberg US Agg Total Return Value Unhedged USD Index
Global Aggregate	Bloomberg Global-Aggregate Total Return Index Value Unhedged USD Index
US Corporate	Bloomberg US Corporate Total Return Value Unhedged USD Index
Global Corporate	Bloomberg Global Agg Corporate Total Return Index Value Unhedged USD Index
Global High Yield	Bloomberg Global High Yield Total Return Index Value Unhedged USD Index
1-3 Month T-Bills	US Treasury Bills 1-3 Month Index
US REITs	FTSE NAREIT EQTY REIT TR
Commodities	BBG Commodity TR
Global REITs	FTSE ENXG INDEX
Gold	XAUUSD
US Dollar Index	DXY Index
Base Portfolio (55/35/10)	55% S&P 500 Total Return, 35% Bloomberg US Aggregate Bond Index, and 10% Bloomberg Commodities Index

Definitions and Explanations

Exhibit 1: Gold vs. Fiat vs. Bitcoin

Scarce:	Refers to the supply being limited in number. Gold is scarce. Fiat is subject to a government or central bank. Bitcoin is scarce and finite.
Durable:	Refers to the ability to maintain its purchasing power over time.
Portable:	Refers to how easily transferable it is from one party to another. For instance, gold is very heavy and cumbersome to transport.
Divisible:	Refers to the size of the smallest denomination in native units. Physical gold is only divisible to small pieces. Fiat is divisible to two decimals (1 cent). Bitcoin is divisible to eight decimals (1 satoshi or sat).
Verifiable:	Refers to its resistance to being counterfeit or duplicated. Both gold and fiat have been counterfeited and verification can be cumbersome.
Fungible:	Refers to its ability to be interchangeable with other units of its denomination.
Scalable:	Refers to the speed, volume, and low-cost in which a denomination can be transferred or transacted with.
Non-Soveirgn:	Refers to the lack of centralized or single-state oversight.
Longeity:	Refers to the length of time it has been in circulation. Gold has the longest track record as money and maintaining purchasing power.
Decentralized:	Refers to the level of control governing the denomination’s supply and economic properties. Bitcoin operates entirely on a decentralized peer-to-peer network without the need for intermediaries. Transactions are recorded on a public ledge through the blockchain.
Smart:	Refers to the transparency and ability of the denomination’s supply to be programmed or systematically managed.

Appendix: Portfolio Metrics

aReturns:	Annualized Return
aVolatility:	Annualized Volatility as measured by the standard deviation of daily returns
aDownVolatility:	Annualized Downside Volatility as measured by the standard deviation of daily negative returns
Sharpe Ratio:	Annualized return (in excess of the risk-free rate) divided by annualized volatility
Sortino Ratio:	Annualized return (in excess of the risk-free rate) divided by annualized downside volatility
MaxDrawDown:	Maximum Drawdown of daily returns from peak-to-trough
Global Index Corr.:	Correlation of the specific portfolio relative to the Barclays Global Multi-Asset Index

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