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How Much Bitcoin Should We Allocate to the Portfolio?

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Abstract

A comparative analysis between 2013-2017 and 2018-2023 reveals a significant transformation in Bitcoin and cryptocurrency investments. In the earlier phase, methods like the Markowitz Model suggested significant allocation to Bitcoin due to its high returns, diversification benefits, and low correlation with other assets. However, with the financialization of Bitcoin in December 2017, the cryptocurrency market underwent a fundamental shift, integrating into the mainstream financial system and increasing its correlation with traditional assets. In the subsequent period from 2018 to 2023, Bitcoin emerged as an average asset class with relatively high risk compared to others. Given these changes and increased institutional interest, our analysis suggests it's prudent to cap allocation to Bitcoin to maximally 2-3% of the portfolio. The analysis highlights the need for caution and realistic expectations when interpreting historical data and extrapolating long-term conclusions.

Keywords: Asset allocation, Cryptocurrencies, Diversification, Bitcoin

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1. Introduction

After years of waiting, the recent launch of spot Bitcoin ETFs marked a significant milestone in the cryptocurrency market, making Bitcoin even more accessible for investors. Spot ETFs provide a convenient and regulated way to gain exposure to Bitcoin without the need to hold the digital asset directly, potentially attracting a broader range of market participants. Many investors are waiting to see this change's long-term impact on the cryptocurrency's price while putting their faith in the potentially significant returns from Bitcoin within their investment portfolios. These events are taking place after two significant milestones in Bitcoin's history – the introduction of BTC futures in 2017 and the launch of the BTC futures ETF (BITO) in 2021. While examining the whole history of Bitcoin may give the impression of a new super asset, we need to set realistic expectations. What have all these historical changes brought, and what lessons can we learn from similar occurrences involving other assets throughout history?

Examining the whole graph, covering the period from 2013 to 2023, it's easy to get the impression that becoming a millionaire is within reach. The strategy to hold BTC between 2013 and 2023 exhibits a CAR

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(Compound Annual Return) of 103,77%. However, using the entire 11-year graph and extrapolating any long-term conclusions is misleading. From 2013 to 2017, cryptocurrencies were an obscure asset class known only to enthusiasts. This period represented a unique chapter in the evolution of digital currencies – when cryptocurrencies were still beginning, with limited mainstream recognition. It was a time of experimentation, with various cryptocurrencies emerging, often driven by passionate communities of supporters. Such a period is unlikely to happen again – it was a singular, once-in-a-lifetime occurrence. But what significant event reshaped the world of cryptocurrency in 2017?

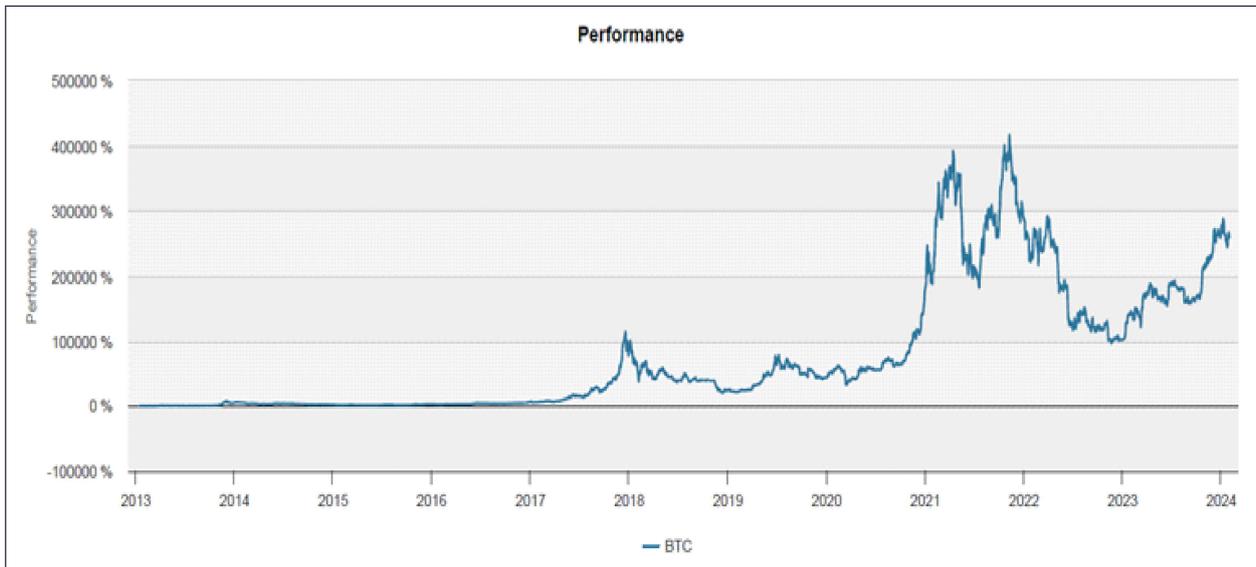


Figure 1: Bitcoin - Performance 2013-2023

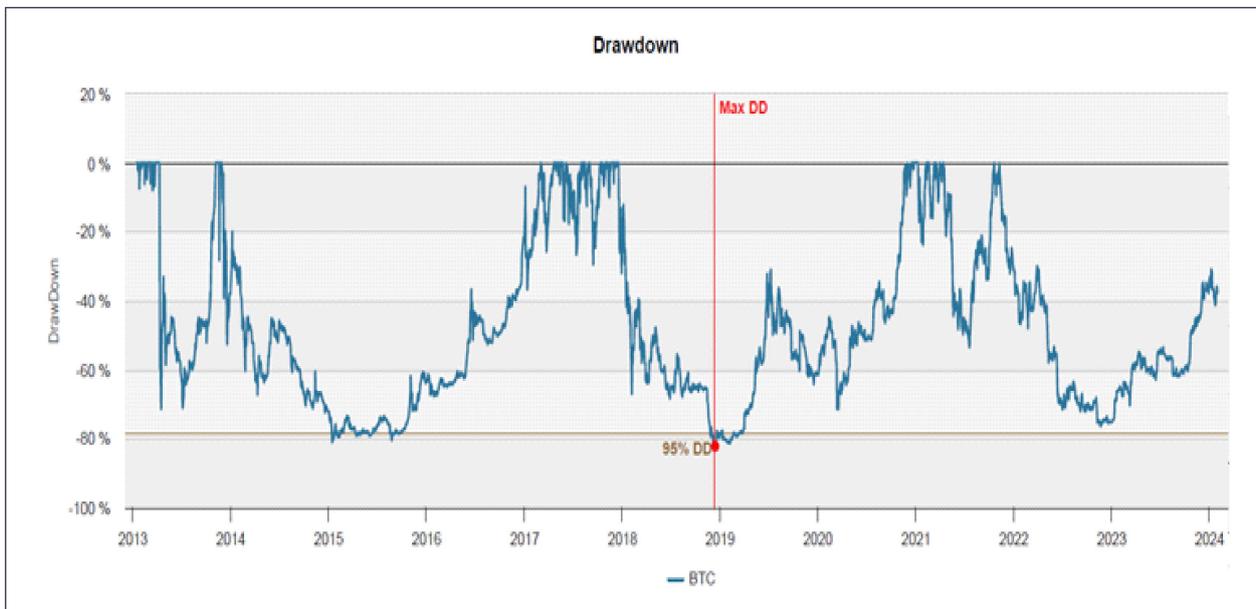


Figure 2: Bitcoin - Drawdown 2013-2023

Table 1: Bitcoin - Performance Statistics 2013-2023

2013-2023	CAR p.a.	Volatility p.a.	Sharpe Ratio	Max DD	95% DD	CAR/Max DD	CAR/95%DD
BTC	103.77%	83.03%	1.25	-82.18%	-78.24%	1.26	1.33

2. Financialization

The introduction of futures trading on Bitcoin by the Chicago Board of Options Exchange (CBOE) on December 10, 2017, Cboe Global Markets (2018, May 16) followed by the Chicago Mercantile Exchange (CME) on December 18, 2017, (Luft Carl et al., 2019) marked a milestone development in the cryptocurrency space. A liquid financial instrument became available legally for the first time in history, allowing funds and hedge funds to buy and sell Bitcoin in their portfolios without needing to open accounts in unregulated (and often very very shady) crypto exchanges. This event facilitated the financialization of cryptocurrency markets, a term describing how a market becomes integrated into the broader financial system and gains characteristics similar to traditional financial assets.

The financialization of cryptocurrency markets mirrors similar developments in emerging markets and commodities. Once considered obscure asset classes, emerging markets and commodities underwent a similar transformation. Initially, only specialized funds traded in these markets, but introducing indexes and ETFs in the mid-2000s made commodities more accessible to mainstream investors.

According to Zeno Adams and Thorsten Glück (2015), a recent phenomenon known as financialization, has changed the behavior and dependence structure between commodities and the general stock market. A similar path can be expected for cryptocurrencies. As cryptocurrencies continue to become more increasingly integrated into the global financial system and attract demand from institutional investors, they will undergo a process of financialization. This evolution will likely involve introducing more financial instruments, such as active ETFs and broad indexes, making cryptocurrencies more accessible to a broader investor base. However, it's essential to approach this transformation with caution. Similar to commodities, past performance of cryptocurrencies may not accurately reflect future outcomes, especially as market dynamics shift with increased institutional involvement. Investors should be mindful of the changing landscape and adjust their strategies accordingly, looking at the history of Bitcoin in two different periods – pre-financialization and post-financialization.

First, let's look at the first period – until 2017. The cryptocurrency experienced extraordinary growth, with a remarkable compounded annual return of 283.33%. However, this period was also marked by significant volatility, with fluctuations in price reaching 95.83%. The maximum drawdown during this time was -81.15%.

Table 2: Bitcoin - Performance Statistics 2013-2017

2013-17	CAR p.a.	Volatility p.a.	Sharpe Ratio	Max DD	95% DD	CAR/Max DD	CAR/95% DD
BTC	283.33%	95.83%	2.96	-81.15%	-78.34%	3.49	3.62

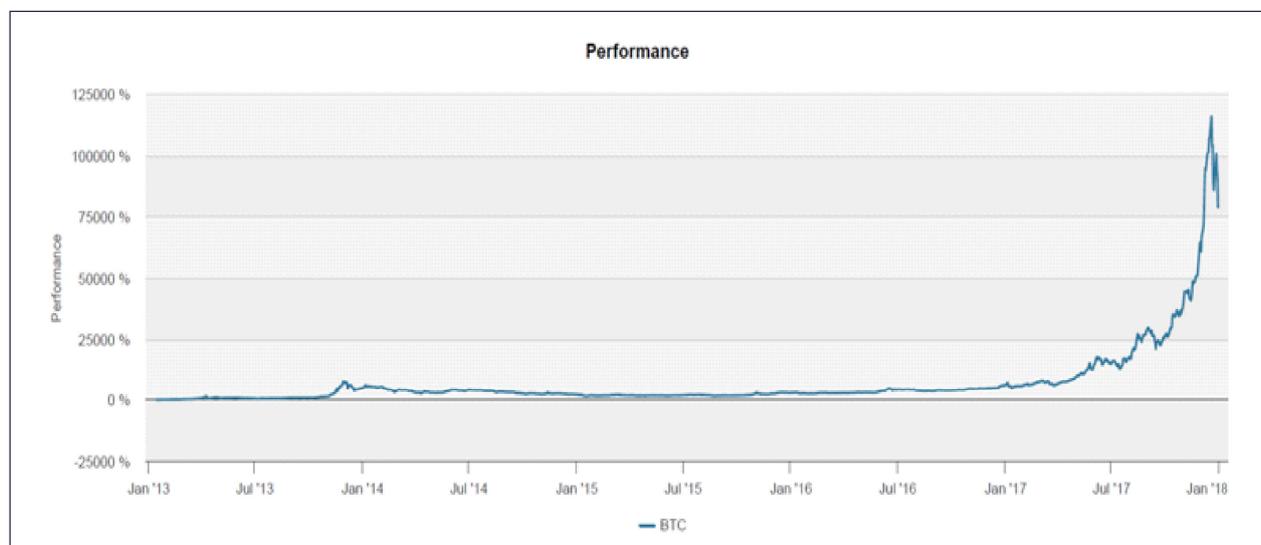


Figure 3: Bitcoin - Performance 2013-2017

This pre-financialization period offered exceptional Bitcoin’s risk-return characteristics with a Sharpe ratio of 2.96 and Calmar ratio (CAR/MaxDD) of 3.49.

Regulated futures trading on Bitcoin was launched by the Chicago Board Options Exchange (CBOE) on December 10, 2017, followed closely by the Chicago Mercantile Exchange (CME) on December 18, 2017. Secondly, on October 19, 2021, another milestone was reached with the launch of the first Bitcoin futures exchange-traded fund (BITO) (Xudong Wang and Xiaofeng Hiu, 2024). Introducing a Bitcoin futures ETF represented an important step towards mainstream acceptance of cryptocurrencies within traditional financial markets. Finally, on January 10, 2024, the launch of spot Bitcoin ETFs marked a significant milestone in the cryptocurrency market. Unlike futures-based ETFs like BITO, spot ETFs would directly hold Bitcoin, offering investors exposure to the actual cryptocurrency itself rather than futures contracts.

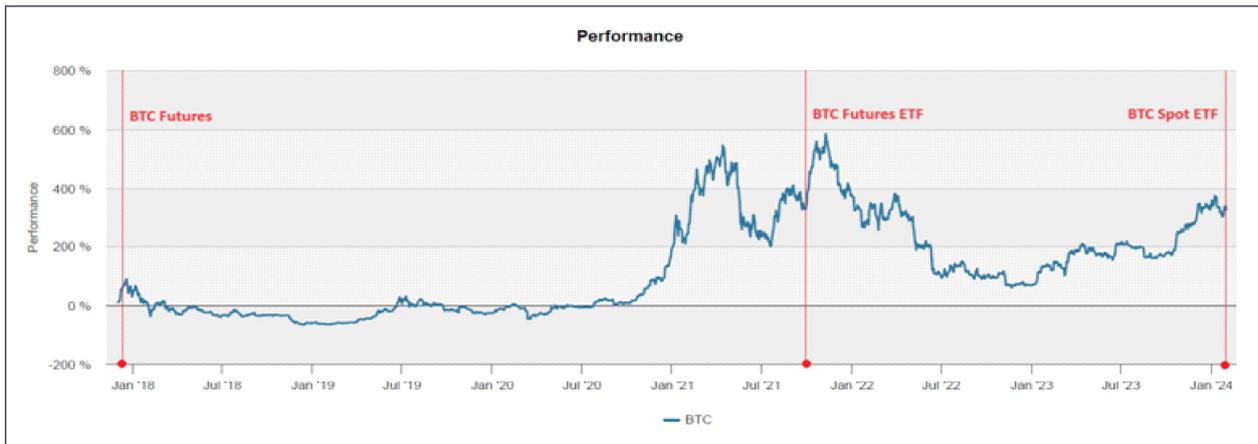


Figure 4: Bitcoin - Performance 2018-2023

Table 3: Bitcoin - Performance Statistics 2018-2023

2018-23	CAR p.a.	Volatility p.a.	Sharpe Ratio	Max DD	95% DD	CAR/Max DD	CAR/95% DD
BTC	21.95%	70.89%	0.31	-79.75%	-75.39%	0.28	0.29

In contrast to the enormous rise experienced in Bitcoin’s earlier years, 2018 to 2023 presented a compounded annual Return of 21.95%. Volatility stayed high, though less than before, at 70.89%, showing Bitcoin might be getting steadier, but still with a significantly high maximum drawdown of -79.75%. Bitcoin’s risk-return ratios in the post-financialization period are nothing spectacular, with a Sharpe ratio of just 0.31 and a Calmar ratio of 0.28.

Naturally, questions arise: How much Bitcoin should we allocate to the portfolio?

3. Main Analysis

The main analysis examines a globally diversified portfolio across various asset classes, offering exposure to various geographic regions and investment instruments. The equally weighted portfolio consists of

1. SPY (SPDR S&P 500 ETF)
2. EEM (iShares MSCI Emerging Markets ETF)
3. EFA (iShares MSCI EAFE ETF)
4. IYR (iShares U.S. Real Estate ETF)
5. IEF (iShares 7-10 Year Treasury Bond ETF)
6. LQD (iShares iBoxx \$ Investment Grade Corporate Bond ETF)
7. HYG (iShares iBoxx \$ High Yield Corporate Bond ETF)

8. DBC (Invesco DB Commodity Index Tracking Fund)
9. GLD (SPDR Gold Trust)
10. and finally BTC (Bitcoin)

4. 2013-2017

In our initial analysis, we examined an equally weighted portfolio over the period from 2013 to 2017. This allocation yielded a notable return of 22.86% alongside volatility of 11.76% and a maximum drawdown of -18.02%. Subsequently, we used the Portfolio Analysis to analyze correlations between different assets and Bitcoin, the Markowitz model to find the optimal portfolio that realizes the highest possible Sharpe ratio, and the Risk Parity for an alternative way to build a portfolio with a reduced concentration of the risk.

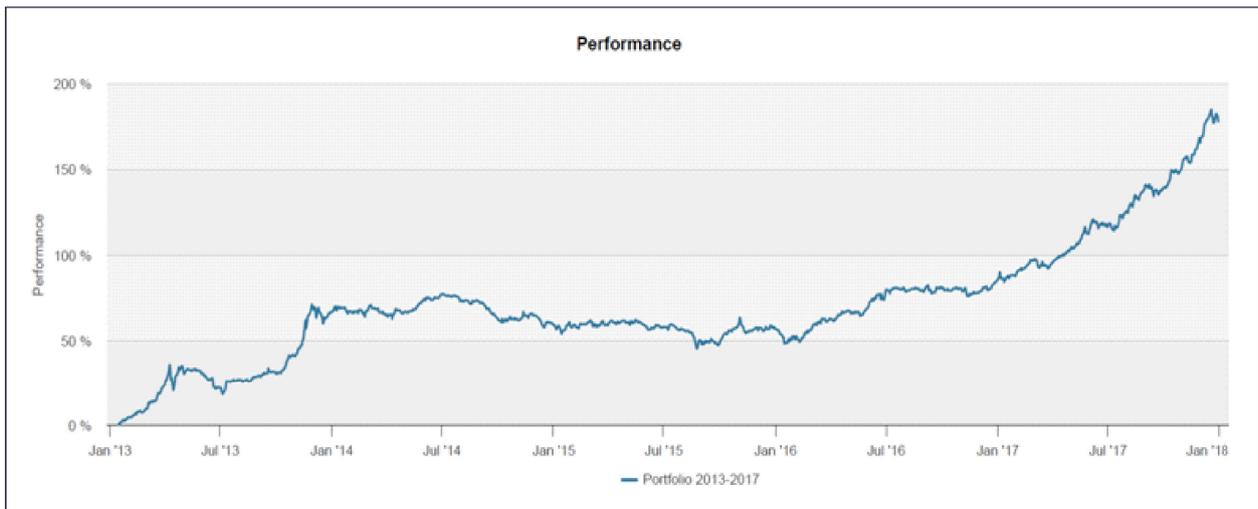


Figure 5: Equally Weighted Portfolio - Performance 2013-2017

Table 4: Equally Weighted Portfolio - Performance Statistics 2013-2017

2013-17	CAR p.a.	Volatility p.a.	Sharpe Ratio	Max DD	95% DD	CAR/Max DD	CAR/95% DD
Portfolio	22.86%	11.76%	1.94	-18.02%	-13.19%	1.27	1.73

5. Correlation Table

Firstly, we looked into the Correlation Table to understand the relationship between Bitcoin and other assets. We found that the correlation of Bitcoin with other assets in the period of 2013-2017 was nearly negligible,

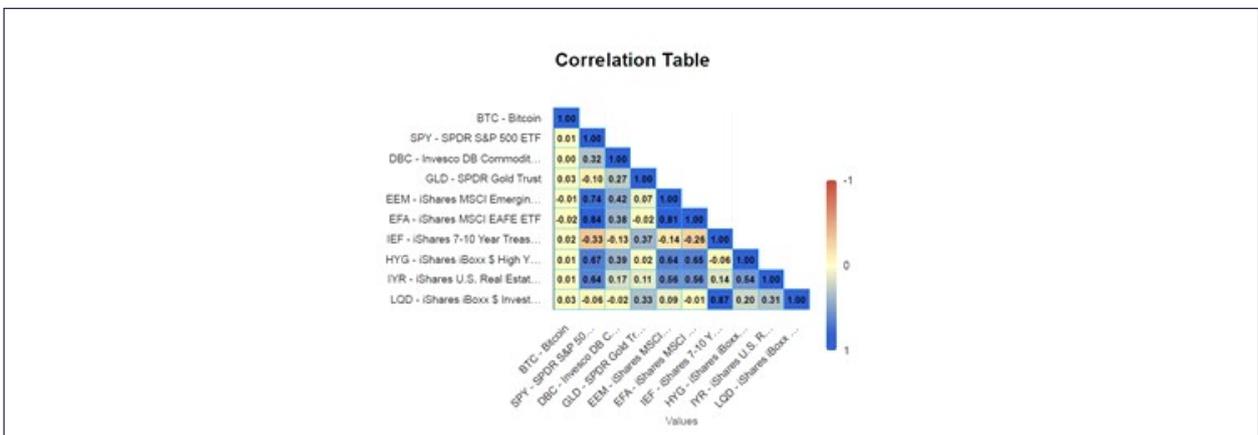


Figure 6: Correlation Table - Main Asset Classes - 2013-2017

with values ranging between -0.02 to 0.03. This near absence of correlation underscores the diversification benefits Bitcoin offered in this period.

6. Markowitz Model

Next, we used the Markowitz Model to analyze portfolio combinations based on expected returns and standard deviations (variance). The Longest Period Efficient Frontier chart displays portfolios with all the different combinations of assets that result in efficient portfolios (i.e., with the lowest risk, given the same return, and portfolios with the highest return, given the same risk). Risk is depicted on the X-axis, and return on the Y-axis.

The Efficient Frontier chart also displays the Tangency portfolio – the optimal portfolio that realizes the highest possible Sharpe ratio, Minimum Variance portfolio – the portfolio with the lowest risk and Equal Risk Portfolio (ERP) shows how your portfolio (in this case, our equally weighted portfolio) can be improved in return with the same amount of risk.

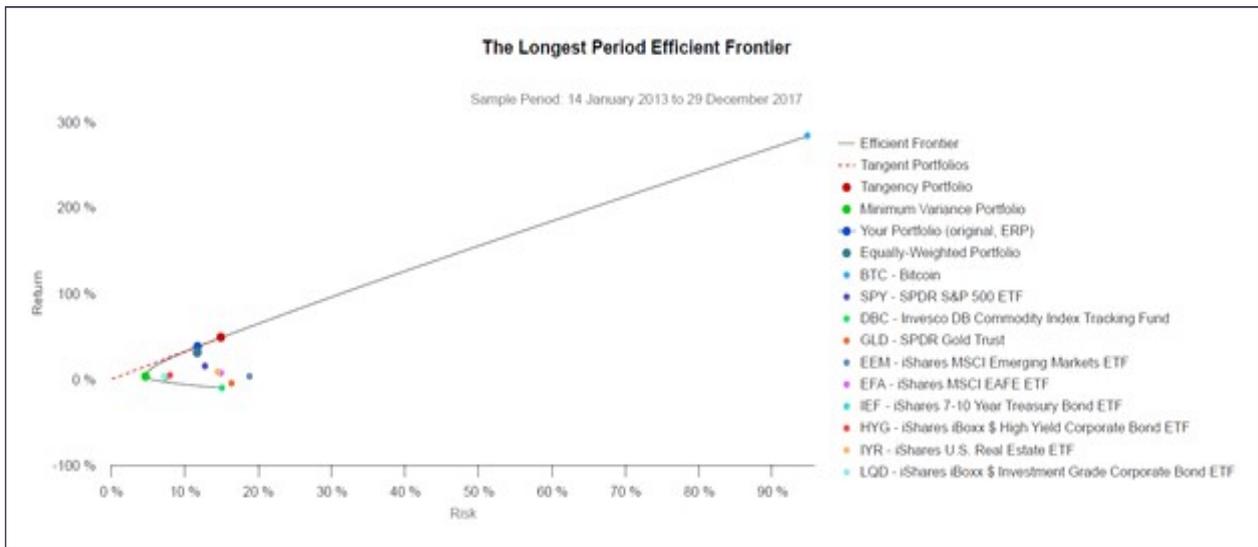


Figure 7: Efficient Frontier – 2013 – 2017

The Tangency portfolio (TP) – the optimal portfolio realizing the highest possible Sharpe ratio representing the portfolio with the highest risk adjusted return tells us to allocate 14,42% to Bitcoin.

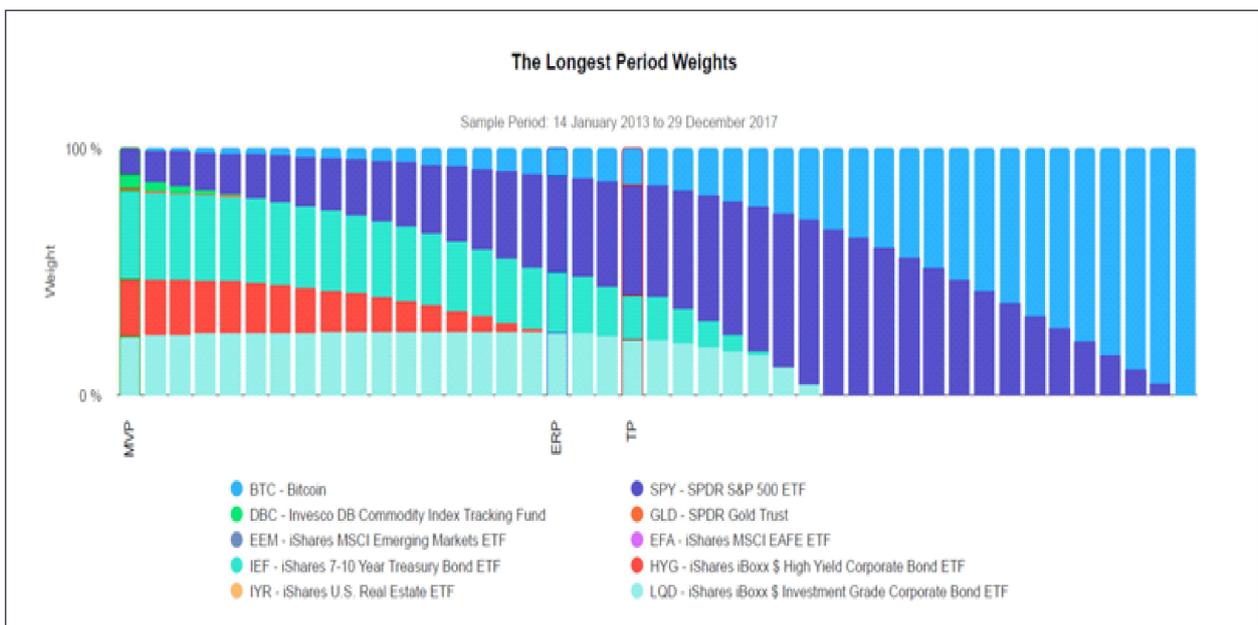


Figure 8: Weights Along the Efficient Frontier – 2013 – 2017

This tangency portfolio would give us approximately 48.7% return with a 14.97% volatility and respectable Sharpe ratio of 3.25. The portfolio’s extraordinary results are driven mainly by its allocation to Bitcoin. But of course, a minimal number of people had any allocation to Bitcoin at that time, and **those times will never return!**

7. Risk Parity

In the next step, we looked into Risk Parity, an investment management strategy focusing on risk allocation. The main aim is to find weights of assets selected in the Portfolio Manager that ensure an equal level of risk for all assets. To allocate the correct risk parity weight to an asset, we must measure its risk (e.g. historical 126-day volatility). This approach helps to reduce the concentration of risk in a few assets and enhances diversification. The initial graph (Equally-Weighted Benchmark Volatility Contribution) shows how much BTC contributed to risk over the years. Over time, BTC remained the main contributor to risk in our equally weighted portfolio.

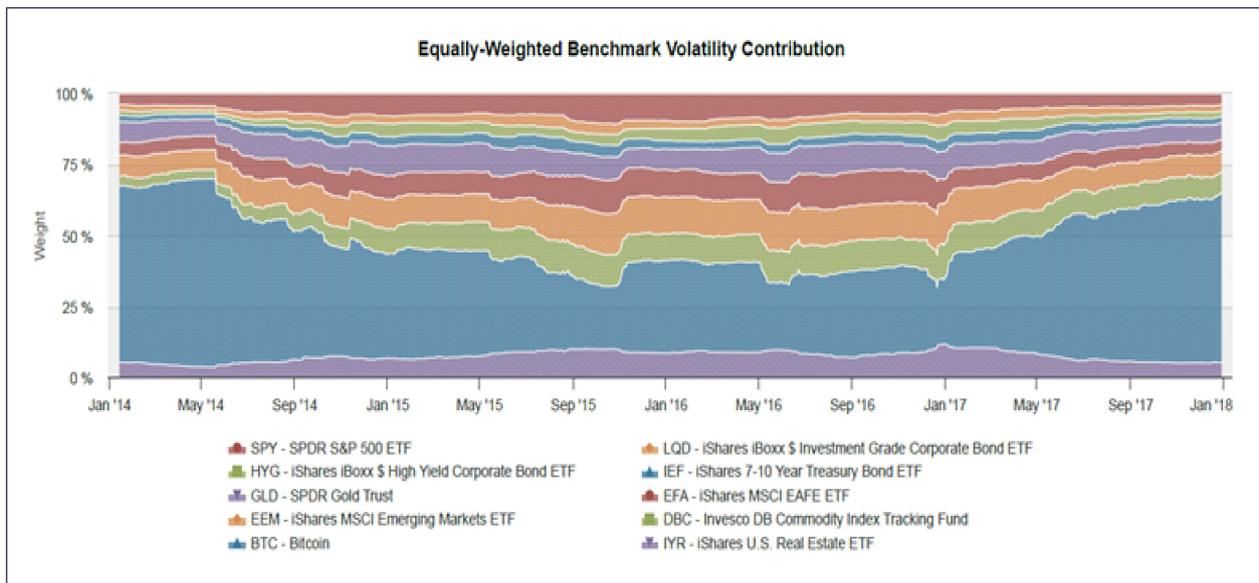


Figure 9: Volatility Contribution - Equally-Weighted Portfolio – 2013-2017

Next, let’s look at the equity curve of the Naive Risk Parity strategy in contrast to our equally weighted portfolio. Naive risk parity or naive risk weighting uses the inverse risk approach instead of equal weights. This approach gives lower weight to riskier assets and greater weight to less risky assets, ensuring that the risk contribution of each asset is the same. As we can see in the Naive Risk Parity Performance Table, this method

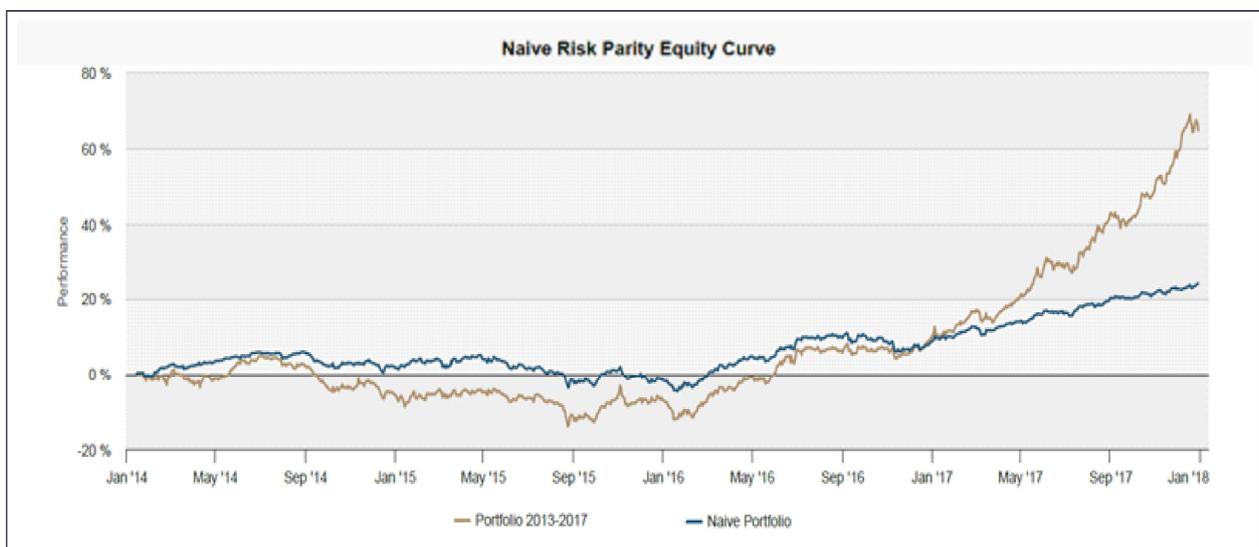


Figure 10: Naive Risk Parity vs. Equally Weighted Portfolio - 2013-2017

Table 5: Naive Risk Parity vs. Equally Weighted Portfolio - 2013-2017

2013-17	CAR p.a.	Volatility p.a.	Sharpe Ratio	Max DD	95% DD	CAR/Max DD	CAR/95% DD
EW	13.43%	9.38%	1.43	-18.02%	-14.33%	0.75	0.94
Risk Parity	5.61%	5.26%	1.06	-10.03%	-7.49%	0.56	0.75

significantly lowered the strategy’s volatility (from 9.38% to 5.26%). However, this risk reduction came at the expense of lower returns (from 13.43% to 5.61%).

This approach ensures that no single asset, including Bitcoin, dominates the portfolio’s risk exposure. As a result, Bitcoin’s high volatility led to a smaller allocation within the risk parity portfolio to maintain a balanced risk profile across all assets. What’s the Risk Parity’s average allocation to Bitcoin? It’s only approximately 2% due to Bitcoin’s excessively high risk.

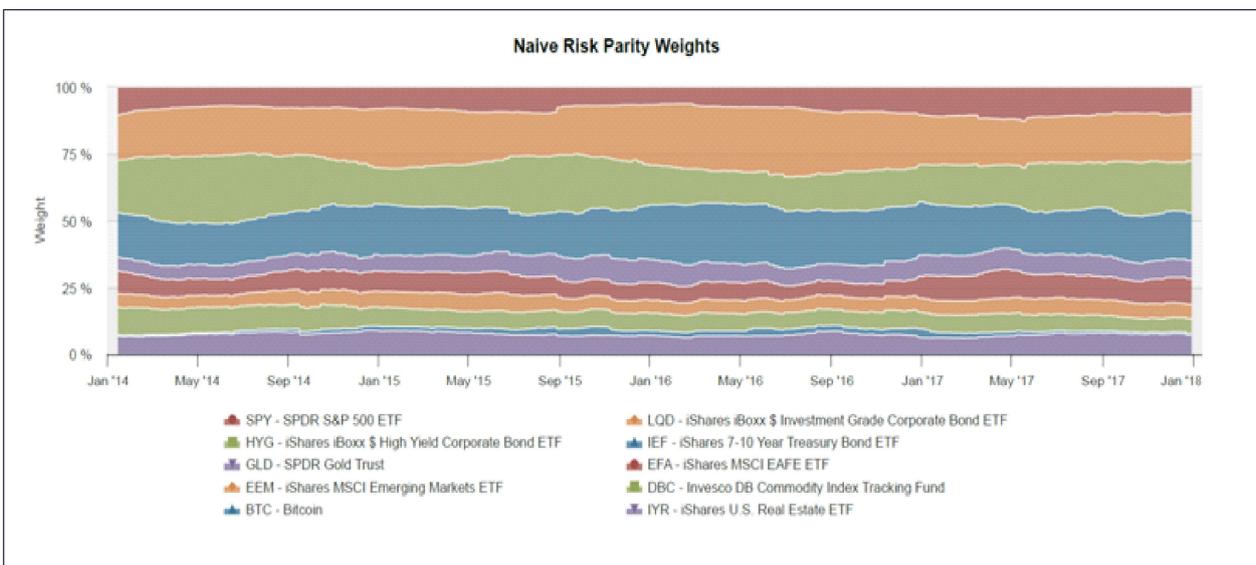


Figure 11: Naïve Risk Parity Weights – 2013-2017

8. 2018-2023

In the second part of our analysis, we examined an equally weighted portfolio of the ten assets including Bitcoin from 2018 to 2023. This allocation resulted in an annual return of only 9.05% (compared to 22.86%

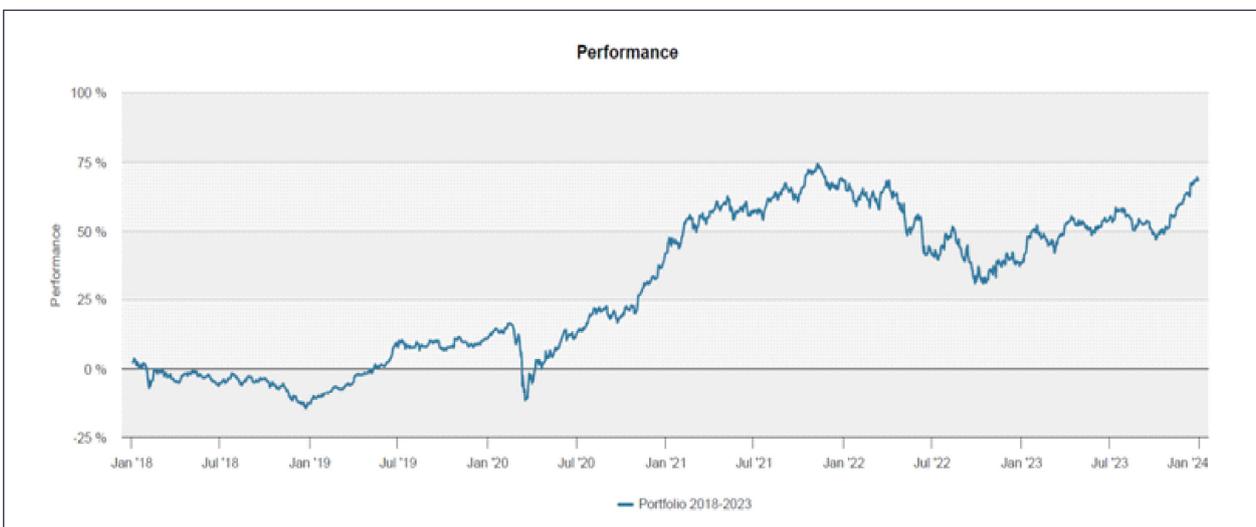


Figure 12: Equally Weighted Portfolio – 2018-2023

from the previous period), with a higher volatility of 13.93% (compared to 11.76% of the prior period) and a maximum drawdown of -24.92% (compared to -18.02% from the previous period). Similar to the previous part of our analysis, during the time interval from 2018 to 2023, we conducted a study that examined the Correlation Table 6, applied the Markowitz Model, and implemented the Naive Risk Parity strategy. So, how much Bitcoin should we allocate to the portfolio based on post-financialization period data?

2018-23	CAR p.a.	Volatility p.a.	Sharpe Ratio	Max DD	95% DD	CAR/Max DD	CAR/95% DD
Portfolio	9.05%	13.93%	0.65	-24.92%	-19.84%	0.36	0.46

9. Underlying Component Analysis

Additionally, in this phase of our analysis, we performed an Underlying Component Analysis to examine the individual performances of various assets within our equally weighted portfolio. This allows us to understand how each asset contributes to portfolio performance throughout the years.

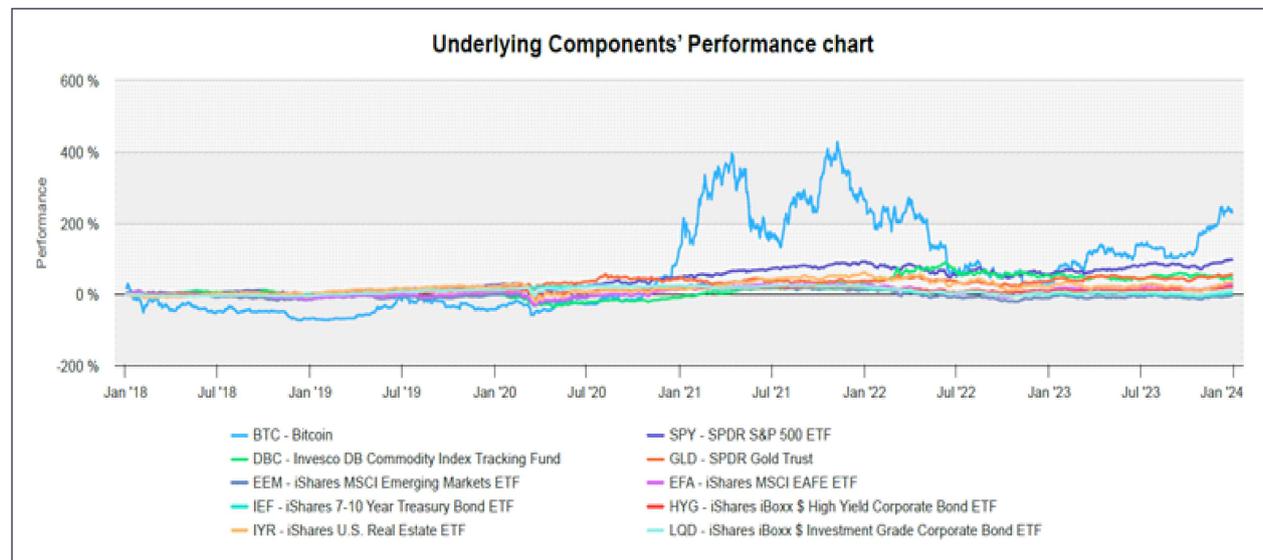


Figure 13: Underlying Components - Performance 2018-2023

2013-18	2023	1Y	3Y (p.a.)	5Y (p.a.)	From 2018	Sharpe	DD
Bitcoin	153.4%	153.2%	16.6%	59.4%	21.9%	0.31	-79.7%
S&P500	26.2%	28.1%	10.1%	15.8%	12.0%	0.59	-33.7%
Commodities	-6.2%	-5.5%	16.9%	10.3%	6.3%	0.33	-41.6%
Gold	12.7%	13.8%	2.8%	9.5%	7.5%	0.53	-22.0%
EM Equities	8.9%	9.2%	-5.0%	2.5%	-0.6%	-0.03	-39.8%
EAFE Equities	18.3%	19.0%	4.1%	8.2%	4.2%	0.22	-34.2%
7-10Y US Tr.	3.8%	3.9%	-5.1%	0.3%	0.3%	0.05	-23.7%
High Yield	11.5%	13.1%	1.0%	4.2%	4.0%	0.31	-22.0%
US REITS	11.9%	13.4%	5.2%	7.1%	5.1%	0.22	-42.3%
Inv. Grade	9.4%	9.5%	-4.0%	2.8%	1.6%	0.16	-24.9%

Bitcoin’s post-financialization Sharpe ratio of 0.31 makes it an average asset. It’s outmatched by S&P 500, commodities, and gold and is approximately in the same category as high-yield bonds, MSCI EAFE, or US REITs. Bitcoin had a higher performance but was the most risky asset in the whole portfolio (by a high margin).

10. Correlation Table

In the previous part (years 2013-2017), we found that the correlation of Bitcoin with other assets in the Correlation Table ranged from -0.02 to 0.03. As we can see, looking at the different periods, they changed a lot. Bitcoin maintained a consistently low correlation solely with IEF (iShares 7-10 Year Treasury Bond ETF). The highest correlation with SPY (SPDR S&P 500 ETF) and EFA (iShares MSCI EAFE ETF) equals 0.25.

This higher correlation suggests a stronger simultaneous movement or dependency between Bitcoin and these traditional market assets. Such findings are not surprising and underscore the evolving dynamics of Bitcoin’s relationship with mainstream financial instruments. Commodities and emerging markets also had low correlations in the pre-financialization period, and those correlations significantly increased in the post-financialization period (Wenjin Kang et al., 2023). We can expect that the correlation of Bitcoin to the main asset classes will increase even more in the future, and if you intend to allocate to cryptocurrencies, you should include this expectation in your decision process.

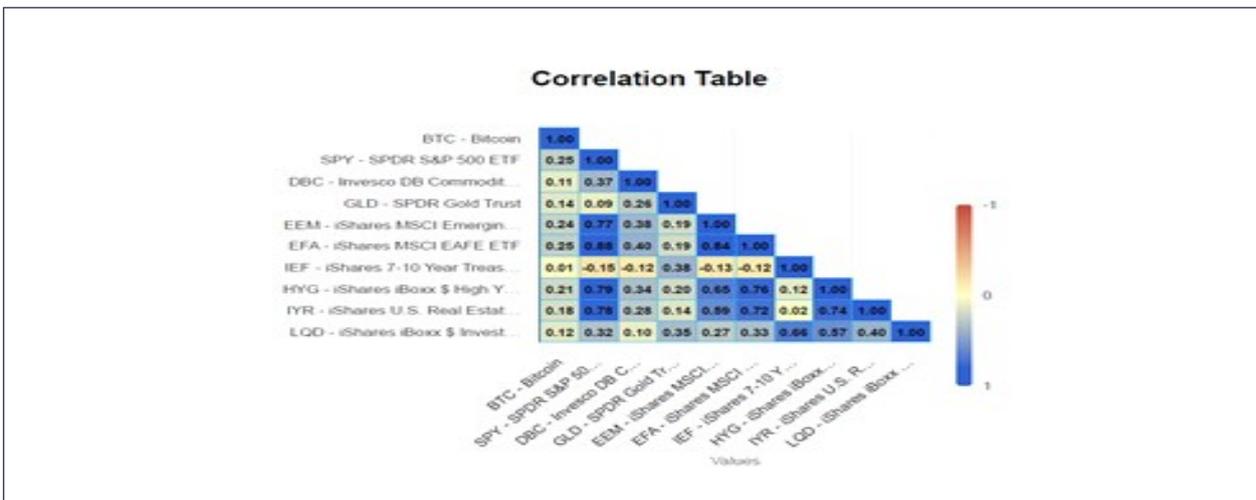


Figure 14: Correlation - 2018-2023

11. Markowitz Model

In applying the Markowitz Model to analyze the portfolio from 2013 to 2017, the Tangency portfolio (TP), representing the optimal portfolio with the highest risk-adjusted return, advised allocating approximately

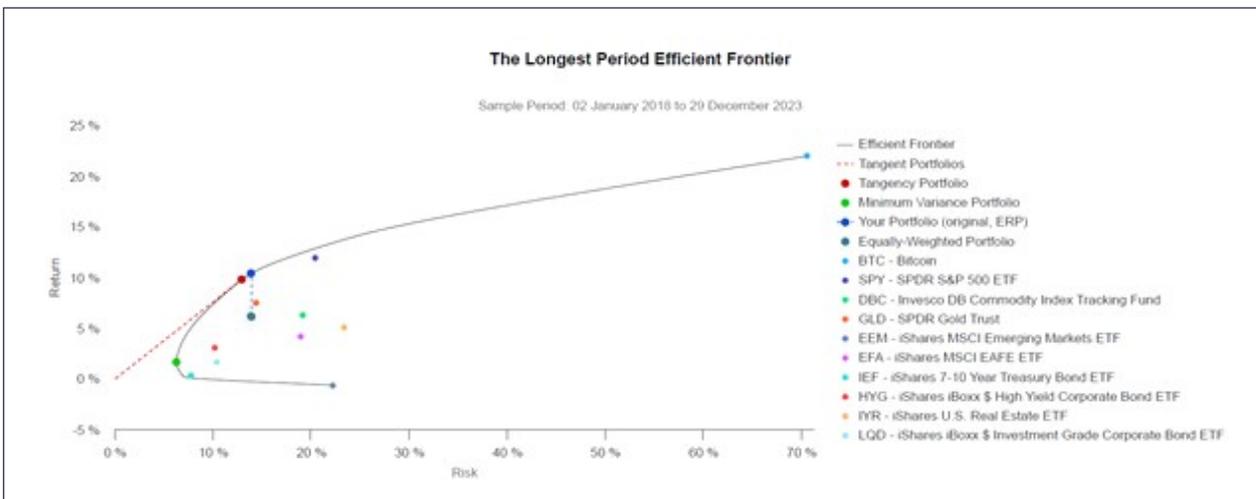


Figure 15: Efficient Frontier - 2018-2023

14.42% to Bitcoin, maximizing the Sharpe ratio. However, the analysis shifted from 2018 to 2023, and the Tangency portfolio suggested allocating only 2.94% to Bitcoin. This adjustment reflects changes in market conditions, risk profiles, and expected returns over the specified period. The Markowitz Model's analysis acknowledged the decrease in Bitcoin's performance and simultaneously considered its elevated risk relative to other asset classes. The resultant Tangency portfolio has a 9.82% return and 12.93% volatility, and Bitcoin's contribution to the performance is minimal (just 0.6%).

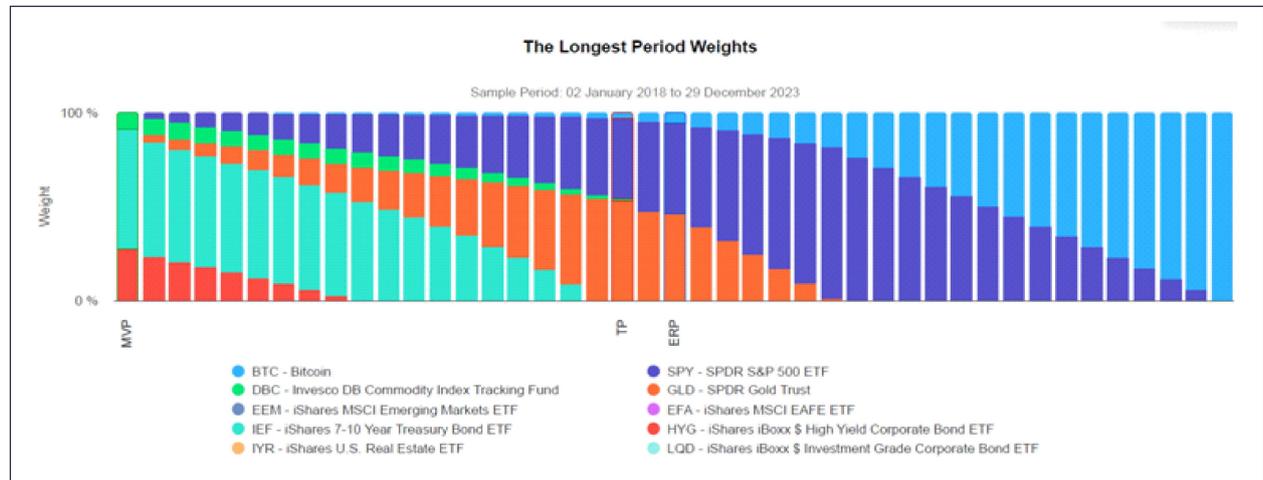


Figure 16: Weights Along the Efficient Frontier – 2018 – 2023

12. Risk Parity

As we can see on the Equally-Weighted Benchmark Volatility Contribution graph for 2018-2023, Bitcoin remained a significant contributor to overall portfolio volatility in equally weighed portfolio. What happens when we run a Naive Risk Parity in this period?

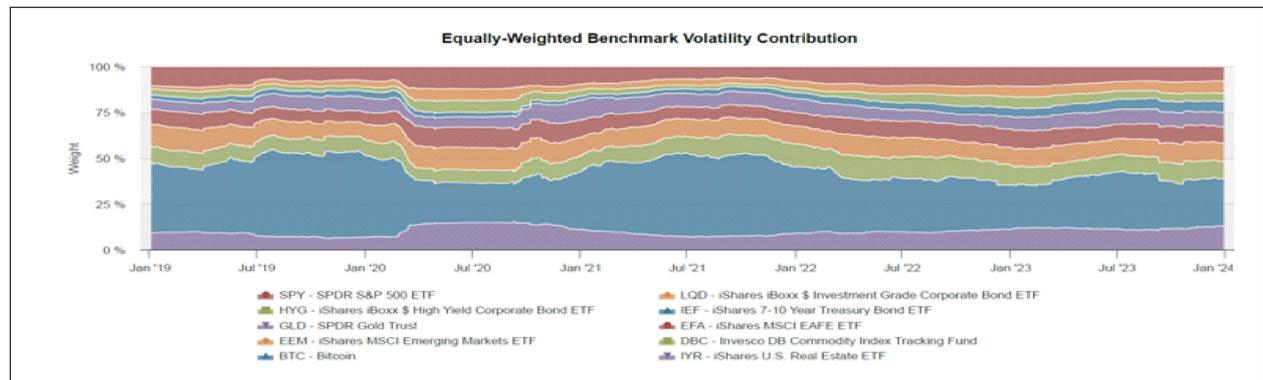


Figure 17: Equally-Weighted Portfolio - Volatility Contributions – 2018-2023

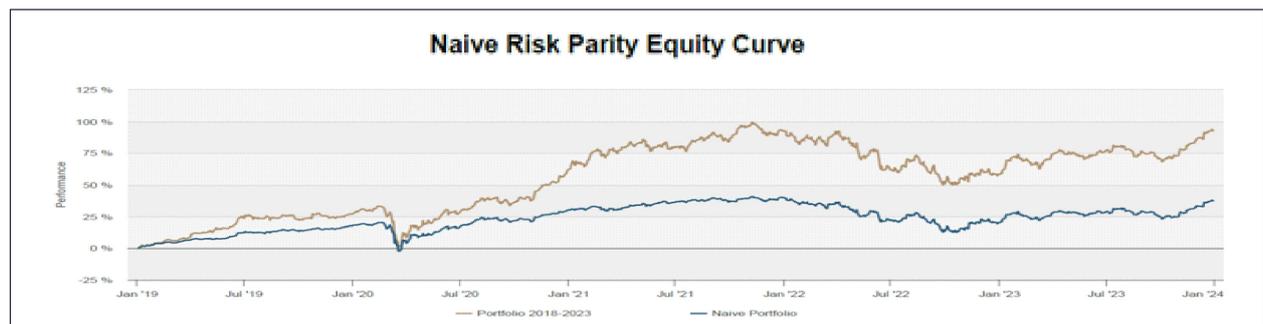


Figure 18: Naive Risk Parity vs. Equally Weighted Portfolio – 2018-2023

The Naive Risk Parity strategy mitigated some risk, decreasing portfolio volatility from 14.27% to 9.84% compared to the equally weighted portfolio. Once again, this risk reduction was accompanied by a decrease in returns, declining from 14.00% to 6.54%.

2018-23	CAR p.a.	Volatility p.a.	Sharpe Ratio	Max DD	95% DD	CAR/Max DD	CAR/95% DD
EW	14.00%	14.27%	0.98	-24.92%	-20.38%	0.56	0.69
Risk Parity	6.54%	9.84%	0.66	-20.10%	-14.59%	0.33	0.45

The outcome of the Naive Risk Parity strategy was again a significant decrease in allocation to Bitcoin (once again, to approximately 2%). This adjustment reflects the strategy’s focus on allocating more weight to less risky assets and reducing exposure to riskier ones. By decreasing Bitcoin’s allocation, the strategy aimed to mitigate the impact of Bitcoin’s volatility on the overall portfolio risk.

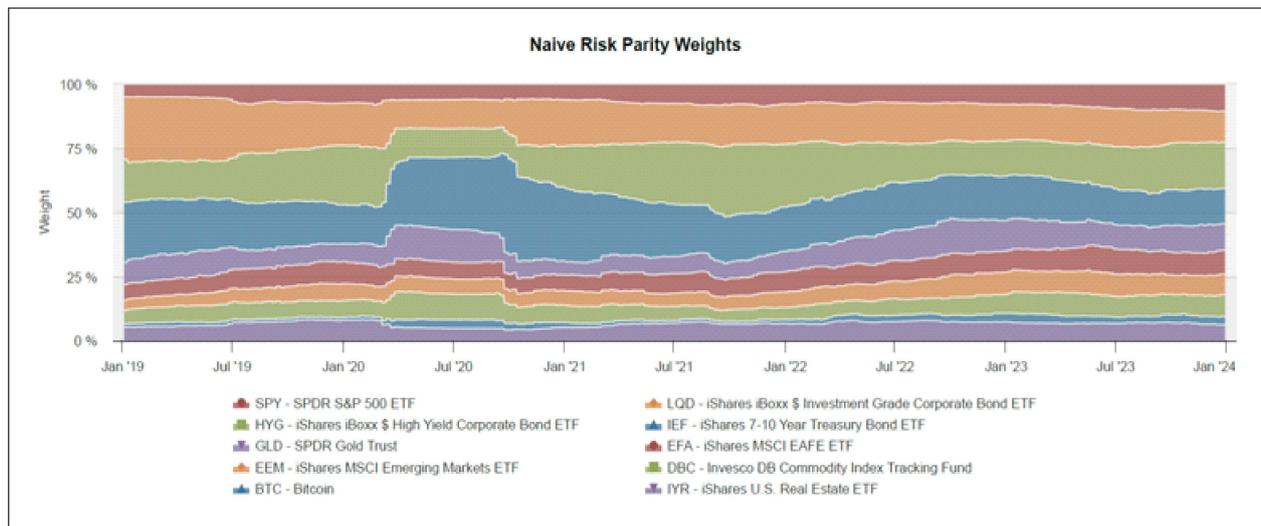


Figure 19: Naive Risk Parity Weights – 2018-2023

13. Conclusion

The comparison between the two periods, 2013-2017 and 2018-2023, reveals a significant shift in the Bitcoin and cryptocurrency investments landscape. During the earlier period, the methods employed, such as the Markowitz Model, may suggest allocating a considerable portion of the portfolio to Bitcoin due to its high return despite its inherent volatility and risk. At the same time, the absence of correlation with other assets underscores the diversification benefits Bitcoin offered in this period. However, as time progressed and the financialization of Bitcoin occurred in December 2017, the dynamics of the cryptocurrency market underwent a fundamental change. Bitcoin and cryptocurrencies became part of the mainstream financial ecosystem, increasing their adoption and recognition as a legitimate asset class while increasing the correlation with mainstream financial instruments.

When optimizing portfolios from 2018 to 2023, Bitcoin is now viewed as average compared to other asset classes and has a relatively high risk. Therefore, while Bitcoin may have shown exceptional growth and returns in its early years, the changing market dynamics and increased institutional involvement have altered its risk-return profile, and our analysis suggests that it’s prudent to cap allocation to Bitcoin (or the whole pool of cryptocurrencies as an asset class) to maximally 2-3% of the portfolio. The higher allocation to this new asset class is probably not justified and bears an unnecessary risk.

The analysis underscores the need for caution and realistic expectations when interpreting historical data and extrapolating long-term conclusions. While past performance may offer valuable insights, it does not guarantee future outcomes, especially in a rapidly evolving and volatile cryptocurrency market.

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