ETC Group

MACROHIVE PROFESSIONAL

September 2023

Can Crypto Enhance Portfolio Returns?

An Independent Digital Asset Allocation Study

About the Authors

This asset allocation study has been produced in collaboration with Macro Hive

ETC Group

ETC Group is bridging the gap between crypto and traditional financial services. Founded in 2019, the company is a first mover in European investment products that provide institutional-grade access to cryptocurrencies.

Blockchain technology and its applications continue to gain acceptance and traction. The world's largest banks, asset managers and transaction service providers are increasingly adopting cryptocurrencies and investing in the sector. Cryptocurrencies are the fungible payment units of blockchain ecosystems and therefore indispensable for blockchain and co.

ETC Group launched the world's first centrally cleared bitcoin ETP on Deutsche Börse XETRA, Europe's largest ETF trading venue. Since the product listing in June 2020, the company has become a leading European provider of physically-backed Crypto ETPs. With customer centric innovation at core of its product development approach, ETC Group continues to pioneer the field, having launched the first crypto basket ETP on an MSCI digital asset index in April 2023.

The company consists of an experienced team of financial services professionals and entrepreneurs. Years of experience in both the crypto sector and conventional investment products enable ETC Group to guide traditional investors and their risk and investment committees through the intricacies and novelty of the digital asset ecosystem.

Macro Hive

Macro Hive provides global macroeconomic research and strategy. Its user base includes top banks (e.g., JP Morgan, Citi, and Bank of America) and the largest hedge funds, asset managers, family offices, private wealth, etc. Macro Hive combine best-in-class human and artificial intelligence, led by its Co-Founders Bilal Hafeez and Andrew Simon, former Head of Research and direct advisor to the CEO at Deutsche Bank, and former Head of Sales Europe JP Morgan, respectively.

The company's mission is to give institutional and retail investors a trusted platform to discover the best investment opportunities in an accessible and concise format. To do this, Macro Hive combine best-in-class human and artificial intelligence, and its team of seasoned experts features ex-heads from global organisations such as JP Morgan, Nomura, Deutsche Bank, the IMF, and the NY Fed. Macro Hive focuses on complete global coverage, and asset focus on FX, Rates, Emerging markets, commodities, sector equities, crypto and an underlying focus on volatility analysis and machine learning work.

Contributing authors to this report were Dalvir Mandara and Bilal Hafeez.

macrohive.com

All charts provided by MACRO HIVE

Summary

We investigate what impact minor allocations (1% to 5%) of crypto in a portfolio of well-diversified assets have on the overall portfolio performance.

Three versions of a model portfolio aimed at European investors are considered:

Eurozone portfolio (calculated in EUR, Table 1)

Swiss Portfolio (calculated in CHF, Table 2)

UK portfolio (calculated in GBP, Table 3)

The bond ETF used being the only difference between the three. The results of the analysis are calculated in each respective currency.

Some key considerations involved in the study include:

- All data is obtained from Bloomberg.
- Each portfolio starts on 2 August 2010 and ends on 11 July 2023.
- Each portfolio simulates the progression of a 100 EUR/CHF/GBP investment.
- The crypto component in each portfolio is the MSCI Global Digital Assets Select Top 20 Capped Index backdated to 2010 using bitcoin prices.
- Weights and returns are calculated in EUR. CHF, and GBP for each of the three portfolios, respectively.
- We use total returns for each asset.
- Monthly, quarterly, and yearly rebalancing (with fractions) are considered.
- We perform a bootstrapped analysis to arrive at distributional estimates for performance metrics to try and mitigate the path-dependency of portfolio returns.
- Trading costs are ignored.

Table 1: Eurozone Portfolio

Asset Class	ETF	BBG Code
Global Equity	iShares Core MSCI World UCITS ETF USD (Acc)	EUNL GY Equity
Global EM Equity	Lyxor MSCI Emerging Markets UCITS ETF	LYXLEM GY Equity
Fixed Income	Lyxor Euro Government Bond (DR) UCITS ETF	LYQ1 GY Equity
Gold	Gold Bullion Securities	GG9B GY Equity
Commodity	iShares Diversified Commodity Swap UCITS ETF	DJCOMEX GY Equity
Crypto	ETC Group MSCI Digital Assets Select 20 ETP	DA20 GY Equity

Table 2: Swiss Portfolio

Asset Class	ETF	BBG Code
Global Equity	iShares Core MSCI World UCITS ETF USD (Acc)	EUNL GY Equity
Global EM Equity	Lyxor MSCI Emerging Markets UCITS ETF	LYXLEM GY Equity
Fixed Income	iShares Swiss Domestic Government Bond 3-7 ETF	CSBGC7 SW Equity
Gold	Gold Bullion Securities	GG9B GY Equity
Commodity	iShares Diversified Commodity Swap UCITS ETF	DJCOMEX GY Equity
Crypto	ETC Group MSCI Digital Assets Select 20 ETP	DA20 GY Equity

Table 3: UK Portfolio

Asset Class	ETF	BBG Code
Global Equity	iShares Core MSCI World UCITS ETF USD (Acc)	EUNL GY Equity
Global EM Equity	Lyxor MSCI Emerging Markets UCITS ETF	LYXLEM GY Equity
Fixed Income	iShares Core UK Gilts UCITS ETF	IGLT LN Equity
Gold	Gold Bullion Securities	GG9B GY Equity
Commodity	iShares Diversified Commodity Swap UCITS ETF	DJCOMEX GY Equity
Crypto	ETC Group MSCI Digital Assets Select 20 ETP	DA20 GY Equity

Model Portfolio Weights with and Without Crypto

The model portfolios are split into a risk component (60%) and a risk averse component (40%). Their structure and asset allocation is not the result of our portfolio analysis – it rather represents a pattern that can be found very often in discretionary portfolios and DIY portfolios.

- The risk component (60%) contains all assets except the bond ETF.
- The risk averse component (40%) contains the respective bond ETF only.
- We introduce crypto weightings (1% to 5%) to each portfolio by reducing the 60% risk component proportionally across all the risk assets (the risk averse component remains 40%).

Examples of the weightings for the EUR portfolios with crypto allocations from 1% to 5% are shown in Charts 1 to 6. Notably, all risk components are reduced proportionally, and the bond ETF is left untouched. The same is true for the CHF and GBP portfolios.

Chart 1: EUR Portfolio; No Crypto

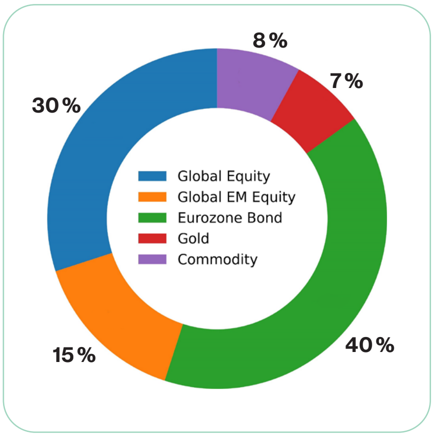


Chart 2: Portfolio; 1% Crypto

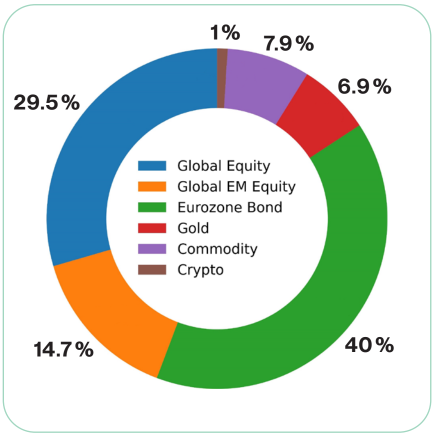


Chart 3: EUR Portfolio; 2% Crypto

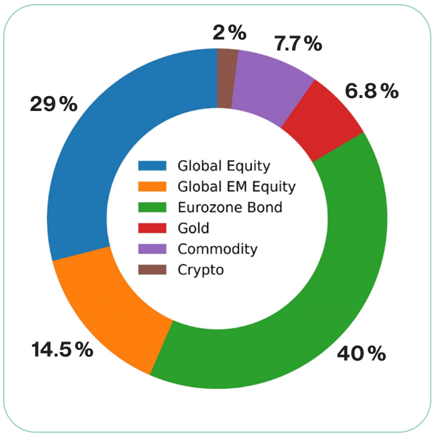


Chart 4: EUR Portfolio; 3% Crypto

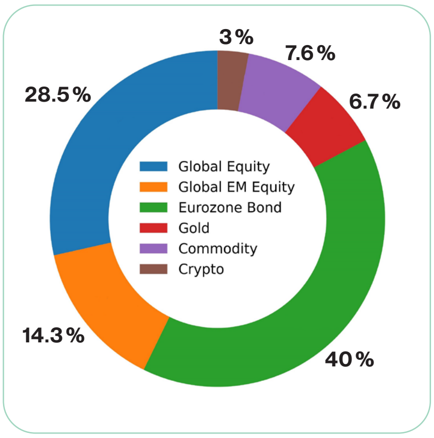


Chart 5: EUR Portfolio; 4% Crypto

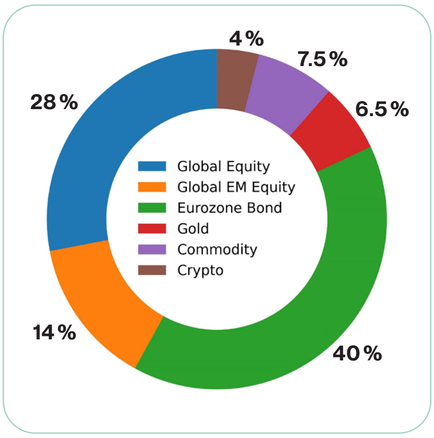
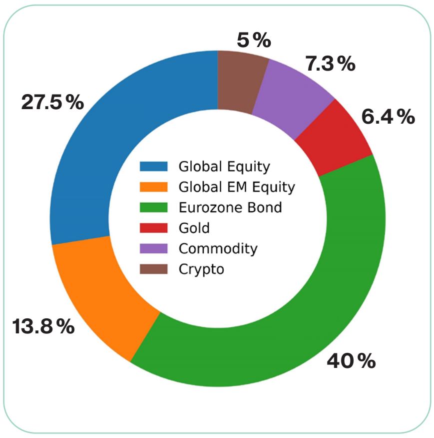


Chart 6: EUR Portfolio; 5% Crypto



Crypto Correlations

Cryptocurrencies can serve well as an extra source of diversification in a portfolio of well-diversified assets. Here are the details on crypto correlations through time:

- From the inception of crypto: The correlation between crypto (proxied by the MSCI Global Digital Assets Select Top 20 Capped Index which has been backdated using bitcoin prices obtained from Bloomberg) and other assets considered in the model portfolios is low. Since the inception of crypto (c. 2010), it has been most correlated to the Global Equity Index (+10%) and the Global EM Equity Index (+7%) while being uncorrelated to the rest (Chart 7).
- When crypto became mainstream: Crypto became more mainstream from 2017 onward and prices peaked (locally) in December 2017 with the launch of CME bitcoin futures. Looking at data from 2017 onward reveals the crypto components correlation to the Global Equity Index is +23%.
- Institutional flows: Another pivotal moment in the history of crypto as an asset class was when the first US Bitcoin ETF (based on CME Bitcoin futures) started trading on 19 October 2021 which made it easier for institutional investors to participate in the space. Looking at all data from this date onward reveals the crypto components correlation to the Global Equity Index is +46%.
- Where are we now? Year to date the correlation of the crypto component to the Global Equity Index (+16%) remains low (Chart 8). A correlation between crypto and equities exists, but the relationship is more nuanced and often more overstated than reality when looking at the big picture.

Chart 7: Correlation Using Data from 2010 Onward

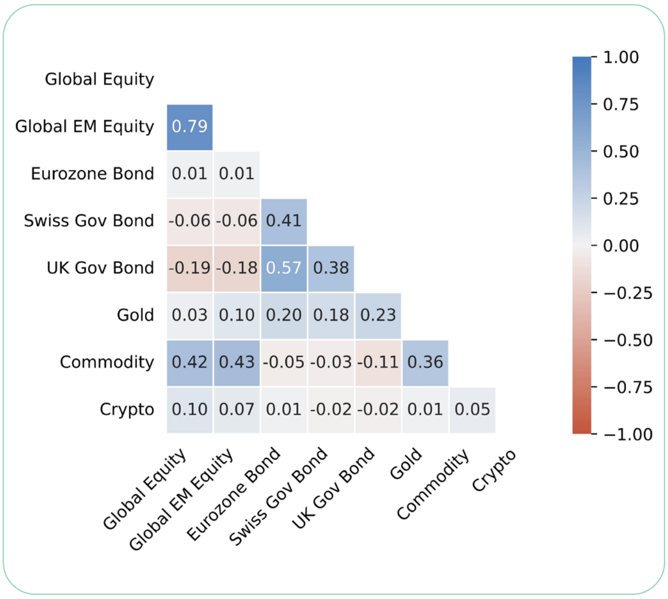
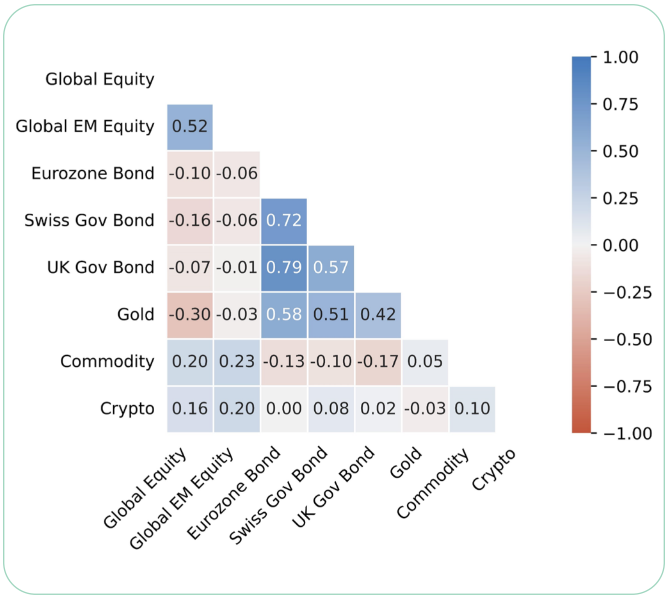


Chart 8: Correlation Using Data from 2023 Onward



In terms of any patterns we observe in the correlation structure between crypto and the other assets we find that:

- Crypto's correlation to developed market equities (Global Equity) and emerging market equities (Global EM Equity) generally moves in the same direction over time as shown by the rolling 3-month correlation (Chart 9). Indeed, we show the percentage of days per year the sign of the correlation to each of the equity ETFs differed (Chart 10). From 2017 onward, with the exception of the Covid pandemic that started in 2020, the percentage has been relatively low (sub 15%).
- The correlation between crypto and the Eurozone, Swiss, and UK bond ETFs has some bias for moving in the same direction, though there are more frequent instances where the sign of the correlations differs when compared to that of the equity ETFs (Charts 11 and 12). Standout years include 2017 where almost 70% of the year saw these correlations move in different directions.
- The relationship between crypto's correlation to gold and commodities is more intermittent, with instances recently where the correlations have diverged completely (Chart 13 and 14).

Chart 9: Equity Components Rolling 3-month Correlation to Crypto

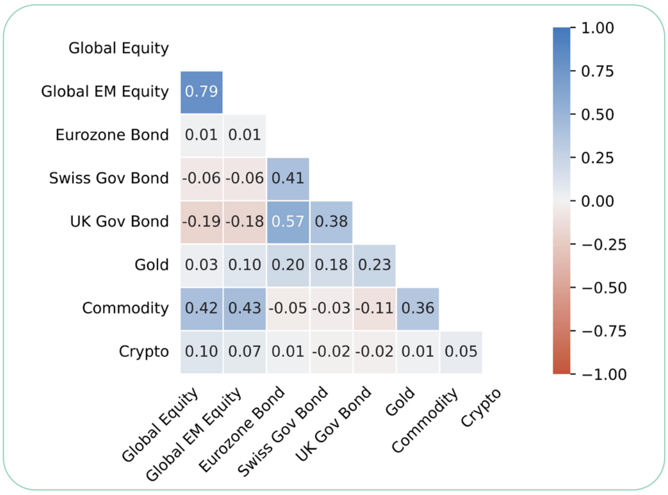


Chart 10: Percentage of Days the Correlation Between the Equity ETFs and Crypto Disagreed Per Year

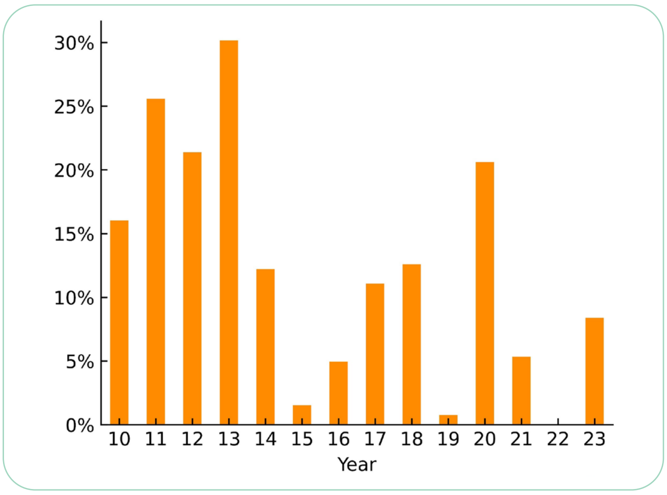


Chart 11: Fixed Income Components Rolling 3-month Correlation to Crypto

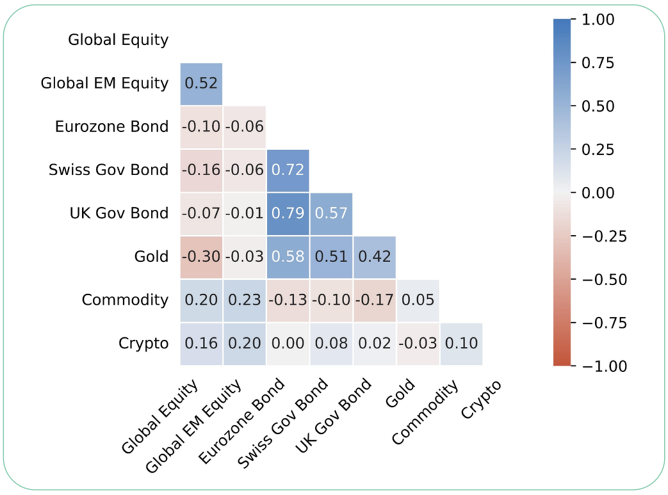


Chart 12: Percentage of Days the Correlation Between the Bond ETFs and Crypto Disagreed Per Year

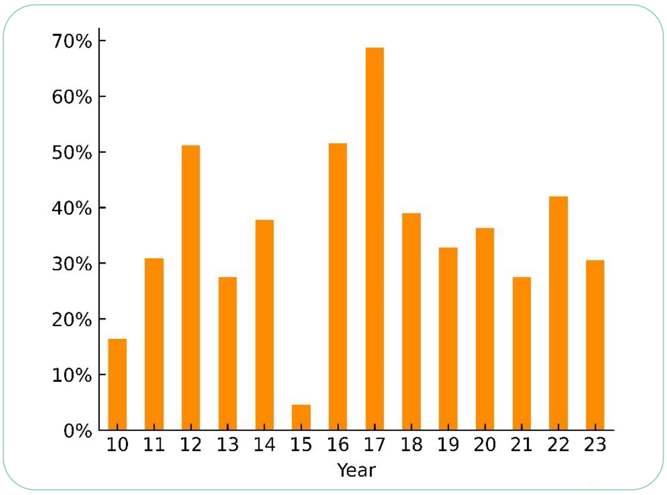


Chart 13: Gold and Commodity Components Rolling 3-month Correlation to Crypto

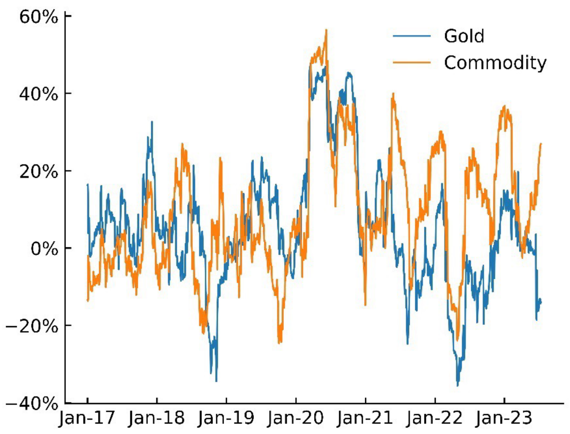
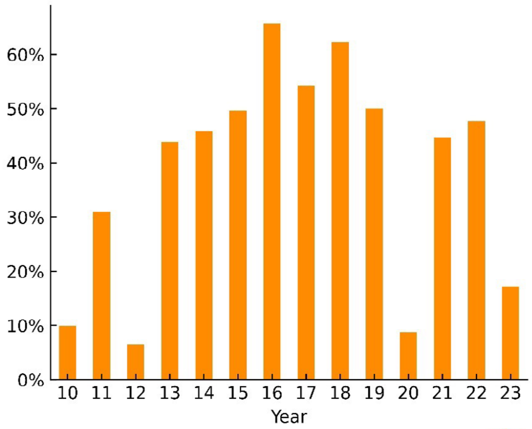


Chart 14: Percentage of Days the Correlation Between the Gold and Commodity ETFs and Crypto Disagreed Per Year



EUR Portfolio Performance

Tables 4 to 6 show the performance of the Eurozone model portfolios over the period (2 August 2010 – 11 July 2023) for all crypto weightings and rebalancing frequencies considered (we provide an in-depth analysis for the Eurozone portfolio, but the following analysis is similar for the CHF (Tables 9-11) and GBP (Tables 12-14) portfolios).

In terms of risk-return comparisons, we find that:

- **Returns**: As expected, including the crypto component increases the CAGR (Compound Annual Growth Rate) and percentage returns over the period for all crypto weightings and rebalancing frequencies considered.
- **Portfolio risk:** With a monthly rebalance frequency the portfolio volatility increases slightly when using 3%+ crypto weightings. Portfolio volatility increased significantly for all crypto weightings when using a quarterly or yearly rebalance, compared to monthly rebalancing.
- **Risk-adjusted returns:** All scenarios led to higher Sharpe ratios (and better Calmar and Sortino ratios). The largest increase is seen in the 5% weighting for a monthly rebalance – there is an over +142% uplift in the Sharpe Ratio (0.97) when compared to that of the no crypto portfolio (0.40).
- **Drawdowns:** For monthly rebalancing, the maximum drawdown over the period for the portfolios that include a crypto component are comparable to the no crypto portfolio. For quarterly and yearly rebalancing, the maximum drawdowns increase significantly as we increase the crypto weight.

Another observation alongside the uplift in risk adjusted returns is the increase in the skew (of the returns) as the crypto weight is increased. Skew refers to the distribution of returns, particularly the likelihood and magnitude of extreme gains or losses.

- Positively skewed returns will generally have more losing days than those of negatively skewed returns but the losing days will be relatively small in magnitude.
- Negatively skewed returns will have fewer down days, but the losses on those days will be larger. Positive skew is attractive as it focuses on generating a higher frequency of smaller gains while minimising the likelihood of large losses.
- The model portfolio without crypto has a negative skew (unfavourable), but when incorporating crypto the skew increases (favourable) which helps the portfolio enhance the potential for outsized profits while managing the risk of significant losses.

Table 4: Eurozone Portfolios with Monthly Rebalance (2 August 2010 – 11 July 2023)

	0% Crypto	1% Crypto	2% Crypto	3% Crypto	4% Crypto	5% Crypto
CAGR	3%	5%	6%	7%	8%	10%
% Return	83%	133%	193%	268%	360%	473%
Volatility	8%	8%	8%	9%	9%	10%
Sharpe Ratio	0.40	0.56	0.70	0.81	0.90	0.97
Calmar Ratio	0.17	0.24	0.30	0.36	0.42	0.47
Sortino Ratio	0.51	0.71	0.90	1.06	1.20	1.30
Skew	-0.80	-0.84	-0.80	-0.65	-0.44	-0.20
Max Drawdown	-19%	-19%	-20%	-20%	-20%	-21%

Table 5: Eurozone Portfolios with Quarterly Rebalance (2 August 2010 – 11 July 2023)

	0% Crypto	1% Crypto	2% Crypto	3% Crypto	4% Crypto	5% Crypto
CAGR	3%	6%	8%	10%	12%	14%
% Return	86%	184%	320%	503%	746%	1066%
Volatility	8%	9%	11%	13%	15%	17%
Sharpe Ratio	0.41	0.63	0.73	0.78	0.82	0.85
Calmar Ratio	0.18	0.30	0.31	0.33	0.35	0.37
Sortino Ratio	0.53	0.81	0.94	1.02	1.07	1.11
Skew	-0.75	-0.19	1.19	2.20	2.79	3.12
Max Drawdown	-18%	-19%	-26%	-31%	-35%	-38%

Table 6: Eurozone Portfolios with Yearly Rebalance (2 August 2010 – 11 July 2023)

	0% Crypto	1% Crypto	2% Crypto	3% Crypto	4% Crypto	5% Crypto
CAGR	3%	8%	11%	14%	17%	20%
% Return	85%	302%	645%	1158%	1894%	2914%
Volatility	8%	16%	24%	29%	32%	35%
Sharpe Ratio	0.41	0.47	0.48	0.51	0.53	0.56
Calmar Ratio	0.18	0.16	0.18	0.20	0.23	0.25
Sortino Ratio	0.52	0.54	0.56	0.59	0.63	0.67
Skew	-0.77	1.43	2.72	3.29	3.55	3.66
Max Drawdown	-18%	-49%	-64%	-71%	-76%	-79%

Observations on Rebalancing

More often rebalancing allows for more control of portfolio risk but also increases trading costs (which we do not consider in this study). A trade-off between the two must be made. To show how much extra risk is being born by adopting lower frequency rebalancing, we show the evolution of the asset weights for the 3% crypto component portfolio for the three rebalancing frequencies (Charts 15 to 17).

The average weight of the crypto component for the monthly rebalance is 3.2%, compared to 4.1% for the quarterly and 8% for the yearly (Table 7). Furthermore, at times the crypto weight becomes unacceptably large for the quarterly and yearly rebalance frequency with the maximum weight of the crypto component being 54% and 76%, respectively.

If we look at all instances where the weight of crypto exceeds 10% (which is over 3 times its intended weight of 3%) we can get a better understanding of how long the extreme allocations have lasted historically. Table 8 shows the number of days per year this occurred for the 3% crypto Eurozone portfolio – 2013 stands out with 206 days for the yearly rebalance, 40 for the quarterly, and 5 for the monthly. Moreover, in 2013 the allocation for crypto exceeded 50% on 31 occasions for the yearly rebalance.

Chart 15: Weights for the 3% Crypto Eurozone Portfolio with Monthly Rebalancing

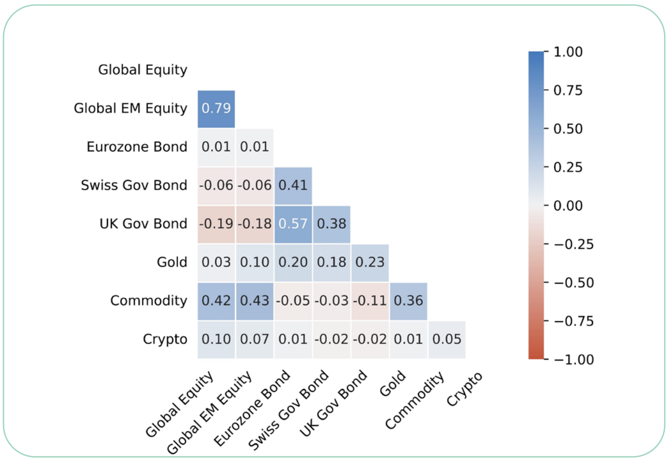


Chart 16: Weights for the 3% Crypto Eurozone Portfolio with Quarterly Rebalancing

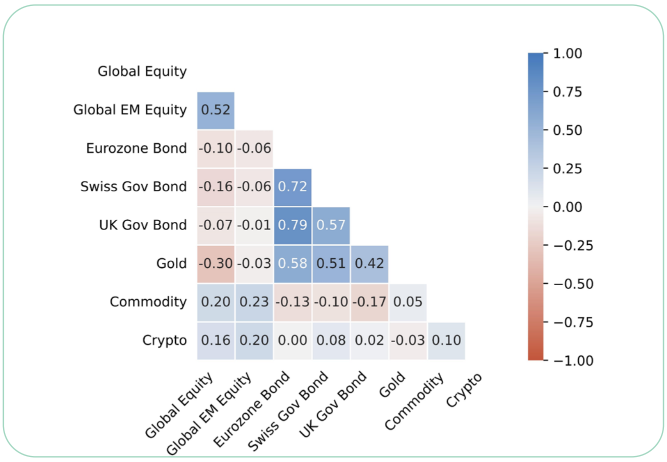


Chart 17: Weights for the 3% Crypto Eurozone Portfolio with Yearly Rebalancing

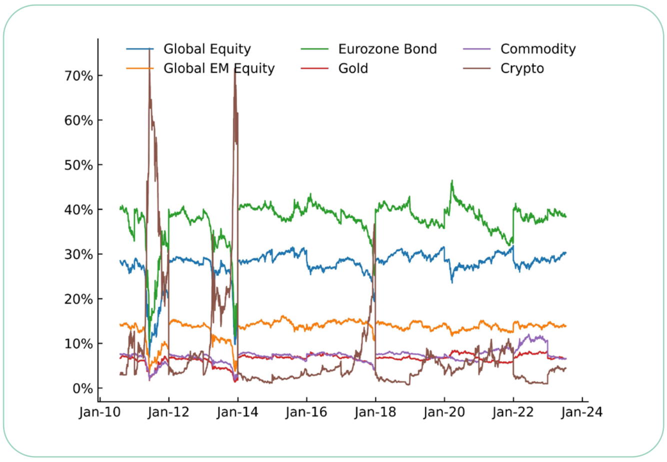


Table 7: Weight Statistics for the 3% Crypto Eurozone Portfolios with Monthly, Quarterly and Yearly Rebalancing (2 August 2010 – 11 July 2023)

	Monthly Rebalance			Quarterly Rebalance			Yearly Rebalance		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Global Equity	25.3%	28.5%	30.1%	13.0%	28.4%	30.9%	6.9%	27.6%	31.9%
Global EM Equity	12.5%	14.2%	15.6%	6.5%	14.1%	15.6%	3.3%	13.4%	16.2%
Eurozone Bond	35.8%	39.8%	44.5%	19.3%	39.3%	46.5%	10.2%	37.3%	46.5%
Gold	5.6%	6.7%	8.1%	3.3%	6.6%	8.9%	1.4%	6.5%	8.4%
Commodity	6.7%	7.6%	9.3%	3.5%	7.5%	11.0%	1.8%	7.2%	12.0%
Crypto	1.3%	3.2%	13.7%	0.9%	4.1%	54.4%	0.7%	8.0%	76.0%

Table 8: Number of Days the Crypto Allocation Exceeded 10% in the 3% Crypto Eurozone Portfolio (2 August 2010 – 11 July 2023)

	Monthly Rebalance	Quarterly Rebalance	Yearly Rebalance
2010	0	35	34
2011	0	46	186
2013	5	40	206
2017	0	12	100
2021	0	0	18

Bootstrapped Performance Metrics

The performance metrics displayed so far relate to a single sample path – we are considering only one thread of history. While this is useful to understand at a high level what crypto can do for a portfolio, it introduces a path dependency which makes the metrics sensitive to the start date of the sample. Put another way, had we chosen a different start date, we would see different metrics (though we would expect the conclusions to be the same in this study).

To reduce the sensitivity of the metrics to the starting date, we run the following procedure to bootstrap performance metrics and obtain distributional estimates (monthly rebalancing is considered in this analysis):

1. Choose a random starting date such that there is at least three years of data available after this date.
2. Evaluate the no crypto portfolio and 3% crypto portfolio metrics over the following three years.
3. Repeat the process 1,000 times.

We focus on the following three metrics:

- **Sharpe ratio:** The Sharpe ratio evaluates the risk-adjusted return of an investment or portfolio, indicating the (excess) return earned per unit of risk taken. A higher Sharpe ratio signifies better risk-adjusted performance.
- **Calmar ratio:** The Calmar ratio assesses the risk-adjusted return in relation to maximum draw-down, representing the downside risk. A higher Calmar ratio implies better risk management, as it demonstrates the ability to recover from losses more efficiently.
- **Sortino ratio:** The Sortino ratio, similar to the Sharpe ratio, measures risk-adjusted returns but focuses solely on downside risk, particularly the volatility of returns below a target level (we use the volatility of negative returns i.e., a target level of 0). A higher Sortino ratio indicates better risk-adjusted

returns, emphasizing a portfolio's ability to protect against adverse market movements.

Across all 1,000 trials we find that the distribution of the Sharpe, Calmar, and Sortino ratios favour the 3% crypto component portfolio over the no crypto portfolio (Charts 18 and 19). In particular, we find that:

- The average Sharpe ratio for the 3% crypto component portfolio (0.84) is 75% higher than that of the no crypto portfolio (0.48).
- The average Calmar ratio for the 3% crypto component portfolio (0.59) is 79% higher than that of the no crypto portfolio (0.33).
- The average Sortino ratio of the 3% crypto portfolio (1.14) is 81% higher than that of the no crypto portfolio (0.63).
- The above conclusions are also generally true across the portfolios with the other crypto weightings. Moreover, the difference between the mean ratios for the crypto and no crypto portfolios is statistically significant under a T-test.
- A scatter plot of CAGR versus volatility for all 1,000 samples for the no crypto and 3% crypto portfolios reveals that adding crypto leads to higher CAGR values for a comparatively small increase in the portfolio volatility (Charts 20 and 21). This is consistent with higher risk adjusted returns.
- The skew of portfolio returns in the samples is also higher for the crypto portfolios with 208 samples out of 1,000 (20.8% of the total samples) having skew greater than 0 for the 3% crypto portfolios compared to just 8 (0.8% of the total samples) for the no crypto portfolios (Charts 20 and 21).

Chart 18: Bootstrapped Metrics for the No Crypto Eurozone Portfolio

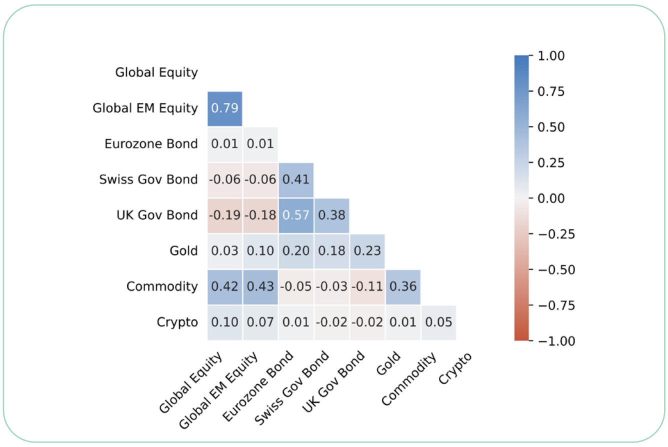


Chart 19: Bootstrapped Metrics for the 3% Crypto Component Eurozone Portfolio

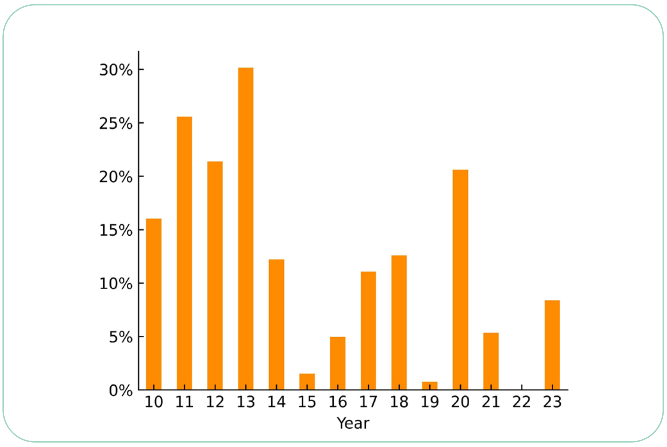


Chart 20: CAGR versus Volatility for the 1,000 Bootstrapped No Crypto Eurozone Portfolio Samples

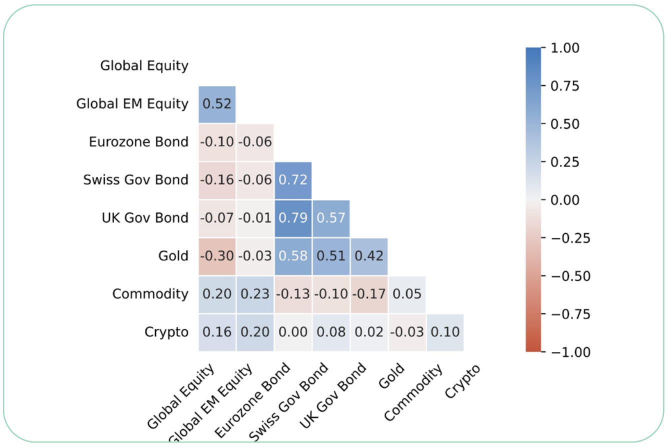
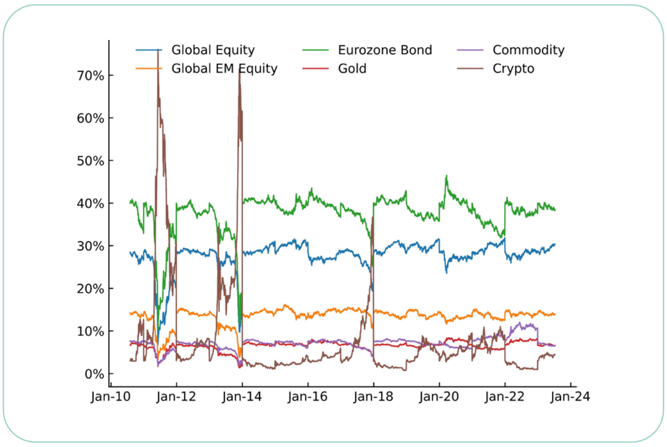


Chart 21: CAGR versus Volatility for the 1,000 Bootstrapped 3% Crypto Eurozone Portfolio Samples



CHF Portfolio Performance

Table 9: Swiss Portfolios with Monthly Rebalance (2 August 2010 – 11 July 2023)

	0% Crypto	1% Crypto	2% Crypto	3% Crypto	4% Crypto	5% Crypto
CAGR	2%	3%	4%	6%	7%	8%
% Return	40%	78%	126%	184%	257%	346%
Volatility	9%	9%	9%	10%	10%	11%
Sharpe Ratio	0.20	0.35	0.48	0.60	0.70	0.78
Calmar Ratio	0.10	0.17	0.24	0.30	0.36	0.42
Sortino Ratio	0.26	0.44	0.62	0.78	0.92	1.04
Skew	-0.76	-0.78	-0.74	-0.61	-0.43	-0.22
Max Drawdown	-18%	-18%	-19%	-19%	-19%	-20%

Table 10: Swiss Portfolios with Quarterly Rebalance (2 August 2010 – 11 July 2023)

	0% Crypto	1% Crypto	2% Crypto	3% Crypto	4% Crypto	5% Crypto
CAGR	2%	4%	6%	9%	11%	13%
% Return	41%	117%	224%	368%	560%	814%
Volatility	9%	10%	12%	13%	15%	17%
Sharpe Ratio	0.21	0.43	0.56	0.64	0.69	0.73
Calmar Ratio	0.10	0.18	0.22	0.25	0.29	0.32
Sortino Ratio	0.26	0.55	0.72	0.83	0.91	0.97
Skew	-0.76	-0.26	1.05	2.06	2.68	3.04
Max Drawdown	-18%	-23%	-30%	-34%	-37%	-39%

Table 11: Swiss Portfolios with Yearly Rebalance (2 August 2010 – 11 July 2023)

	0% Crypto	1% Crypto	2% Crypto	3% Crypto	4% Crypto	5% Crypto
CAGR	2%	6%	10%	13%	16%	18%
% Return	41%	207%	470%	865%	1435%	2231%
Volatility	9%	17%	24%	29%	33%	36%
Sharpe Ratio	0.21	0.37	0.41	0.45	0.48	0.51
Calmar Ratio	0.11	0.13	0.15	0.18	0.21	0.23
Sortino Ratio	0.27	0.43	0.48	0.53	0.58	0.62
Skew	-0.82	1.24	2.62	3.22	3.51	3.63
Max Drawdown	-17%	-48%	-63%	-71%	-75%	-78%

Chart 22: Bootstrapped Metrics for the No Crypto Swiss Portfolio

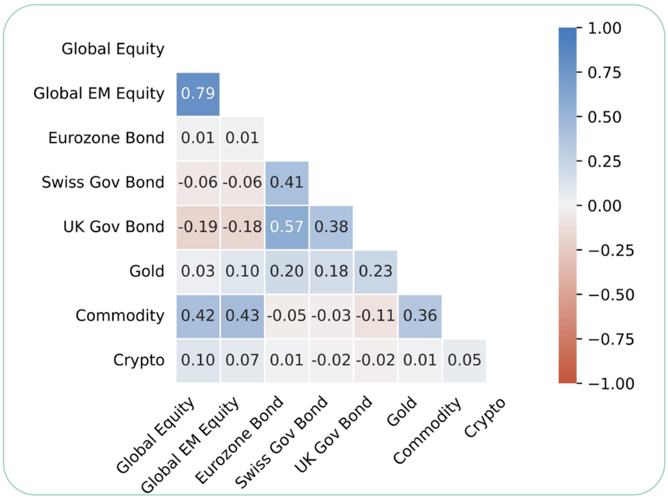


Chart 23: Bootstrapped Metrics for the 3% Crypto Component Swiss Portfolio

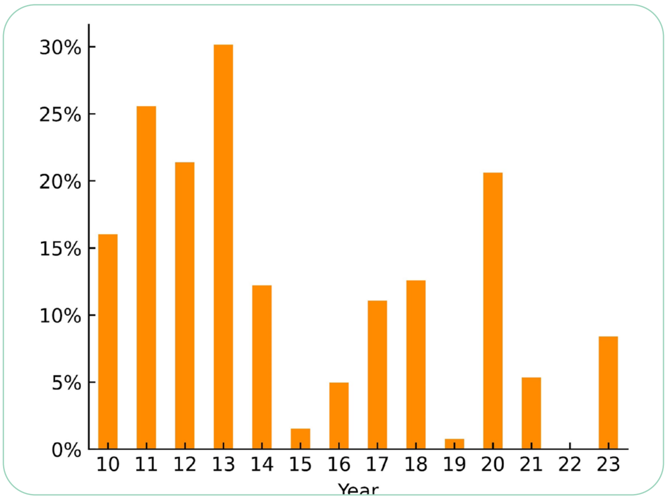


Chart 24: CAGR versus Volatility for the 1,000 Bootstrapped No Crypto Swiss Portfolio Samples

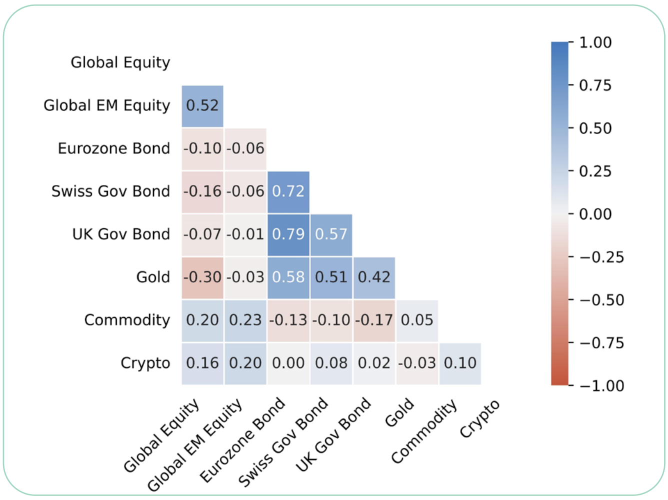
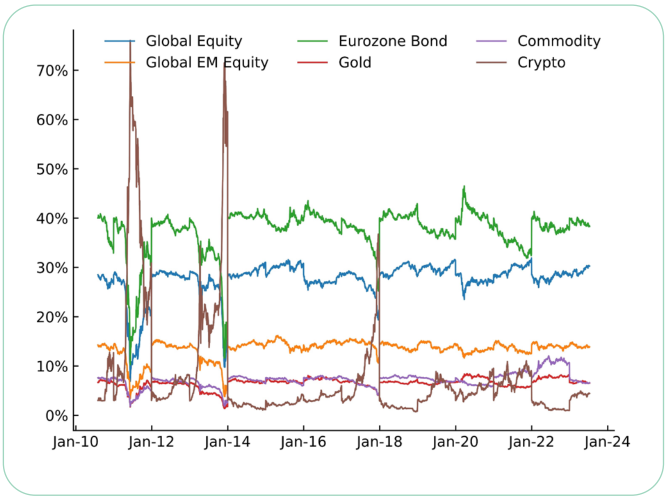


Chart 25: CAGR versus Volatility for the 1,000 Bootstrapped 3% Crypto Swiss Portfolio Samples



GBP Portfolio Performance

Table 12: UK Portfolios with Monthly Rebalance (2 August 2010 – 11 July 2023)

	0% Crypto	1% Crypto	2% Crypto	3% Crypto	4% Crypto	5% Crypto
CAGR	3%	5%	6%	7%	9%	10%
% Return	87%	137%	200%	276%	370%	486%
Volatility	8%	8%	8%	9%	9%	10%
Sharpe Ratio	0.43	0.59	0.73	0.84	0.93	0.99
Calmar Ratio	0.21	0.28	0.35	0.40	0.45	0.50
Sortino Ratio	0.59	0.81	1.01	1.18	1.31	1.41
Skew	-0.26	-0.30	-0.28	-0.18	-0.03	0.16
Max Drawdown	-16%	-17%	-17%	-18%	-19%	-20%

Table 13: UK Portfolios with Quarterly Rebalance (2 August 2010 – 11 July 2023)

	0% Crypto	1% Crypto	2% Crypto	3% Crypto	4% Crypto	5% Crypto
CAGR	3%	6%	8%	10%	12%	14%
% Return	89%	189%	325%	509%	754%	1075%
Volatility	8%	9%	11%	13%	15%	16%
Sharpe Ratio	0.44	0.65	0.74	0.79	0.83	0.85
Calmar Ratio	0.22	0.35	0.33	0.35	0.37	0.40
Sortino Ratio	0.61	0.90	1.01	1.07	1.11	1.14
Skew	-0.23	0.23	1.50	2.43	2.97	3.25
Max Drawdown	-16%	-17%	-24%	-29%	-33%	-36%

Table 14: UK Portfolios with Yearly Rebalance (2 August 2010 – 11 July 2023)

	0% Crypto	1% Crypto	2% Crypto	3% Crypto	4% Crypto	5% Crypto
CAGR	3%	8%	11%	15%	17%	20%
% Return	90%	310%	656%	1171%	1904%	2918%
Volatility	8%	16%	23%	28%	32%	35%
Sharpe Ratio	0.44	0.48	0.49	0.51	0.54	0.56
Calmar Ratio	0.24	0.17	0.18	0.21	0.23	0.26
Sortino Ratio	0.61	0.57	0.57	0.60	0.64	0.68
Skew	-0.25	1.53	2.81	3.38	3.63	3.74
Max Drawdown	-15%	-47%	-62%	-70%	-75%	-78%

Chart 26: Bootstrapped Metrics for the No Crypto UK Portfolio

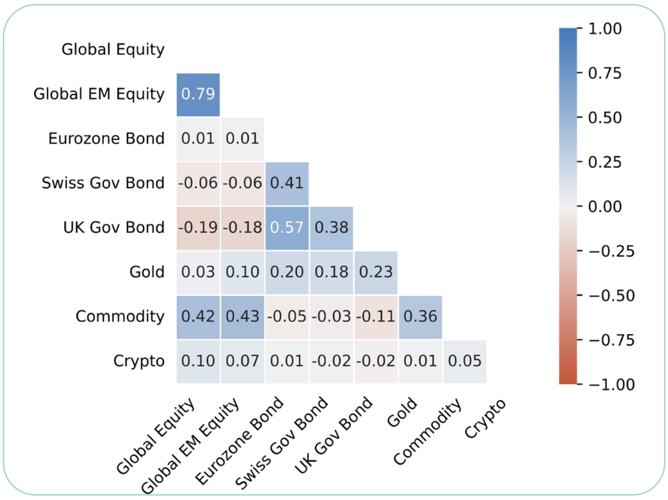


Chart 27: Bootstrapped Metrics for the 3% Crypto Component UK Portfolio

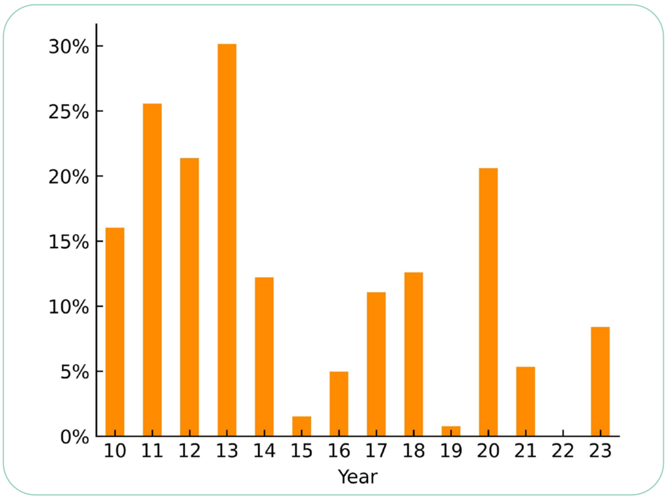


Chart 28: CAGR versus Volatility for the 1,000 Bootstrapped No Crypto UK Portfolio Samples

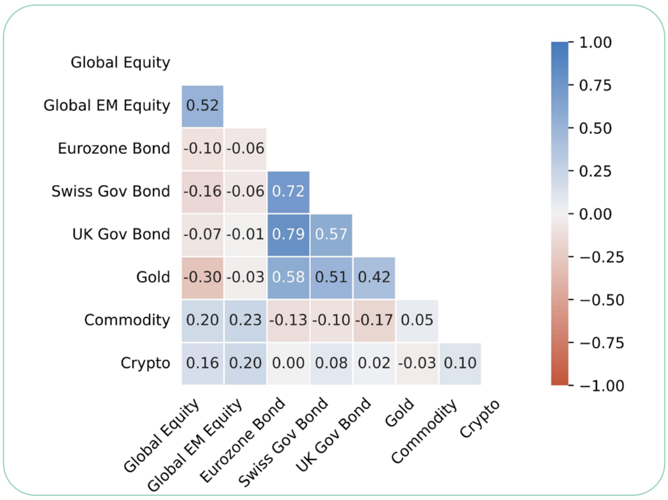
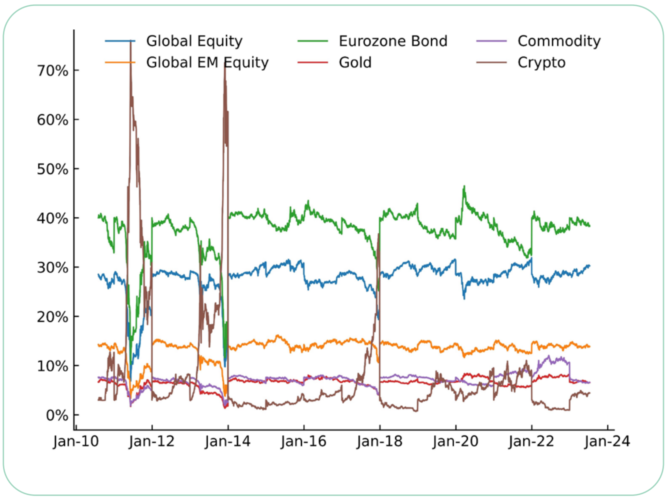


Chart 29: CAGR versus Volatility for the 1,000 Bootstrapped 3% Crypto UK Portfolio Samples



Conclusion

Should You Allocate Cryptocurrencies to Your Portfolio?

1

An allocation to crypto boosts (risk adjusted) returns

The analysis has shown that a minor allocation to crypto in a well-diversified portfolio enhances risk-adjusted returns. Indeed, in most cases a crypto allocation of around 3% with monthly rebalance frequency has led to a doubling of the Sharpe ratio with a very small increase in the total portfolio volatility (usually around 1 percentage point). Moreover, the bootstrapped analysis confirms the uplift in risk adjusted returns is statistically significant. This gives a good idea for the future use of crypto in the portfolio.

2

Crypto allocations can help increase skew

Aside from increasing the risk-adjusted returns, an allocation to crypto has been shown to increase the skew of portfolio returns. Therefore, a minor allocation to crypto should help well diversified portfolios enhance the potential for outsized profits while managing the risk of significant losses.

3

Crypto appears to be a good candidate for portfolio diversification

The growing number of cryptocurrency sectors (smart contract platforms, privacy coins, metaverse etc.) adds to the diversification effect. However, crypto's correlation to macro markets is not zero which does present some risks. Moreover, the correlation structure between crypto and macro is not always stable which adds to those risks.

4

The rebalancing frequency plays a critical role

Rebalancing gives ensuring that the weight of crypto component does not become unacceptable large, which we find occurs at times for quarterly and yearly rebalancing. A trade-off between transaction costs and how much risk an investor is willing to bare is needed.

Contacts

etc-group.com

investors@etc-group.com

linkedin.com/company/
etcgroup-crypto

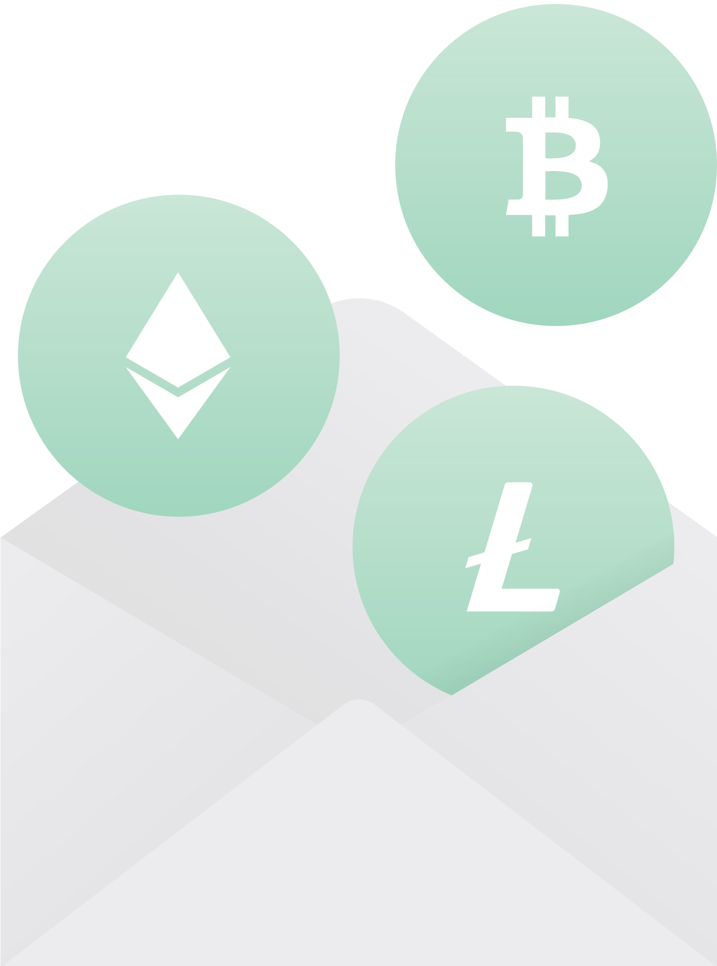
Product materials, analysis as well as due diligence collateral including SFDR information are available upon request.

Head office
ETC Management Ltd
3rd Floor Quality House,
5-9 Quality Court Chancery Lane,
WC2A 1HP, London, United Kingdom

Issuer
ETC Issuance GmbH
Thurn- und Taxis Platz 6,
60313 Frankfurt am Main
Deutschland

Be the first to get expert insights on the latest in crypto

Subscribe to our industry-leading newsletter and research content



Important Information

The information provided in this advertising material is for informative purposes only and does not constitute investment advice, a recommendation or solicitation to conclude a transaction. This document (which may be in the form of a marketing brochure, press release, social media post, blog post, broadcast communication or similar instrument – we refer to this category of communications generally as a "document" for purposes of this disclaimer) is issued by ETC Issuance GmbH (the "issuer"), a limited company incorporated under the laws of Germany, having its corporate domicile in Frankfurt, Germany. This document has been prepared in accordance with applicable laws and regulations (including those relating to financial promotions). If you are considering investing in any securities issued by ETC Group, including any securities described in this document, you should check with your broker or bank that securities issued by ETC Group are available in your jurisdiction and suitable for your investment profile.

Exchange-traded commodities/cryptocurrencies, or ETPs, are a highly volatile asset and performance is unpredictable. Past performance is not a reliable indicator of future performance. The market price of ETPs will vary and they do not offer a fixed income. The value of any investment in ETPs may be affected by exchange rate and underlying price movements. This document may contain forward looking statements including statements regarding ETC Group's belief or current expectations with regards to the performance of certain asset classes. Forward looking statements are subject to certain risks, uncertainties and assumptions, and there can be no assurance that such statements will be accurate and actual results could differ materially. Therefore, you must not place undue reliance on forward-looking statements. This document does not constitute investment advice nor an offer for sale nor a solicitation of an offer to buy any product or make any investment. An investment in an ETC that is linked to cryptocurrency, such as those offered by ETC Group, is dependent on the performance of the underlying cryptocurrency, less costs, but it is not expected to match that performance precisely. ETPs involve numerous risks including among others, general market risks relating to underlying adverse price movements and currency, liquidity, operational, legal and regulatory risks.

ETC Issuance GmbH, incorporated under the laws of Germany, is the issuer of any securities described in this document, under the base prospectus dated 21 November 2022, supplemented from time to time, and approved by BaFin.

Any decision to invest in securities offered by ETC Group (including products and amounts) should take into consideration your specific circumstances after seeking independent investment, tax and legal advice. You should also read the latest version of the prospectus and/or base prospectus before investing and in particular, refer to the section entitled 'Risk Factors' for further details of risks associated with an investment. These prospectuses and other documents are available under the "Resources" section at etcgroup.com. When visiting this website, you will need to self-certify as to your jurisdiction and investor type in order to access these documents, and in so doing you may be subject to other disclaimers and important information.

IF YOU ARE IN THE UK, US, OR CANADA

Information contained in this document is not, and under no circumstances is to be construed as, an advertisement or any other step in furtherance of a public offering in the United States or Canada, or www.etc-group.com any state, province or territory thereof, where neither the issuer nor its products are authorised or registered for distribution or sale and where no prospectus of the issuer has been filed with any securities regulator. Neither this document nor information in it should be taken, transmitted or distributed (directly or indirectly) into the United States.

PUBLICATIONS & SOCIAL MEDIA DISCLOSURE

Social media posts (including, but not limited to, LinkedIn and Twitter) of ETC Group and its subsidiaries ("Social Media") are not, and should not be considered to be recommendations, solicitations or offers by ETC Group or its affiliates to buy or sell any securities, futures, options or other financial instruments or other assets or provide any investment advice or service. ETC Group makes all reasonable efforts to ensure that the information contained on Social Media is accurate and reliable; however, errors sometimes occur. You should note that the materials on Social Media are provided "as is" without any express or implied warranties. ETC Group does not warrant or represent that the materials on Social Media are accurate, valid, timely or complete.

RISKS OF CRYPTOCURRENCIES

Cryptocurrencies are highly volatile assets and are known for their extreme fluctuations in prices. While there is potential for significant gains, you are at risk of losing parts or your entire capital invested. The value of the ETCs is affected by the price of its underlying cryptocurrency. The price of cryptocurrencies can fluctuate widely and, for example, may be impacted by global and regional political, economic or financial events, regulatory events or statements by regulators, investment trading, hedging or other activities by a wide range of market participants, forks in underlying protocols, disruptions to the infrastructure or means by which crypto assets are produced, distributed, stored and traded. The price of cryptocurrencies may also change due to shifting investor confidence in future outlook of the asset class. Characteristics of cryptocurrencies and divergence of applicable regulatory standards create the potential for market abuse and could lead to high price volatility. Amounts received by Bondholders (i) upon redemption of the Bonds in USD, in cases where Bondholders are prevented from receiving cryptocurrency for legal or regulatory reasons; or (ii) upon sale on the stock exchange depend on the price performance of the relevant cryptocurrency and available liquidity.

For a detailed overview of risks associated with cryptocurrencies and specifically associated with the ETCs, please refer to the prospectus and base prospectus available at the issuer's website at www.etc-group.com.