A Bit of Bitcoin
Considerations for an Allocation

"It's part of our job as stewards of capital to understand and evaluate these innovations"

Björn Jesch, Global Chief Investment Officer, DWS

DWS × galaxy

In A Nutshell

- According to financial site Trading View, cryptocurrencies now represent around 0.70% of the portfolio comprising all investable assets globally. Too big to ignore, they have earned their right to be considered by well-diversified investors.
- The debate around cryptocurrencies is real, until it comes time to think about allocation. Then, it's the data that matters. We use empirical data to formulate reasonable assumptions for return, risk, and correlation, and report the portfolio impacts that result.
- Bitcoin and Ethereum have a role to play in the asset allocation process for well-diversified investors – not for risk reduction, but potentially for changing the balance of portfolio risks, or as Sharpe ratio enhancers.

Authors

Robert Bush
DWS Research Institute
DWS | robert.bush@dws.com

Angelina Kostyrina
Portfolio Manager, Multi Asset & Solutions
DWS | angeline.kostyrina@dws.com

Steve Kurz
Global Head of Asset Management
Galaxy | steve.kurz@galaxy.com

David Knowlton, CFA
Head of Product, Asset Management
Galaxy | david.knowlton@galaxy.com

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Illuminating the Crypt

There's no doubt that cryptocurrencies are a divisive topic, with a litany of vocal supporters, and detractors, standing ready to make their case at the slightest provocation. At DWS, we recognize that tension. Indeed, profit-motivated disagreement over the merits of all financial assets goes to the very heart of price discovery, and market efficiency. And, of course, capital markets reflect those changing sentiments every second of the day.

However, although disagreement is extremely important in finance, in this paper we intend to sidestep the fundamental discussion about cryptocurrencies. We will focus instead on the cold, hard numbers, and examine the return, risk, and correlations of the two cryptocurrencies with the largest market shares – Bitcoin and Ethereum. We will then use those numbers to provide some insights into whether they justify an allocation, and to what extent. And we will examine that in the context of three industry standard approaches to portfolio construction – the Global Market Portfolio, Risk Parity, and Optimization. Each have their own merits and idiosyncrasies, and each will attack potential allocations to cryptocurrencies from a slightly different angle. Sure, it might not be as much fun as a full-blooded and torrid debate, but it will be based on facts and well-researched forecasts, and not opinions – surely not a bad thing for investors.

Figure One alludes to one of the many ways in which digital assets are disrupting traditional finance. It shows the indexed returns to several traditional assets (global stocks and bonds, denominated in US dollars), as well as the returns to Bitcoin and Ethereum, the two largest cryptocurrencies to date which together account for approximately 70% of the space. Note that we use post-2017 data to accommodate for data availability, mainstream media awareness for the asset class, and growing institutional interest (e.g., Bitcoin CME futures launching in 2017).

However, before you conclude that Bitcoin and Ethereum have generated returns broadly like traditional assets, but with a more volatile path, take another careful look at the chart. You will see that we have had to present the returns on a compressed scale on the left-hand side of the chart (technically known as a "semi-log scale"). And the reason is that because the cryptocurrency returns have been so extreme (effectively exponential) that showing everything on a more usual linear scale would reduce the bond and stock market returns to, effectively, a flat line.

Of course, no return story is complete without its risk counterpart, and here the numbers are quite sobering. Figures Two and Three show two of the most common ways of looking at financial risk, the "standard deviation" (commonly called the volatility of an asset), and its "maximum drawdown" (the biggest peak-to-trough decline over a given period).

Just as the return numbers for cryptocurrencies were markedly different from those of the traditional assets, so too are the risk numbers, with volatilities at levels that many investors may not have experienced in their careers.

We would draw your attention to three points from these risk charts. Firstly, in terms of methodology, there are many choices for how to compute the volatility, and we have chosen to use simple weighting for Figure Two, but later use exponentially decayed weighting. This latter method puts relatively more emphasis on recent price moves. Our rationale is simply that, with nascent, and rapidly evolving, asset classes like these, recent data is more relevant for actual portfolio construction.

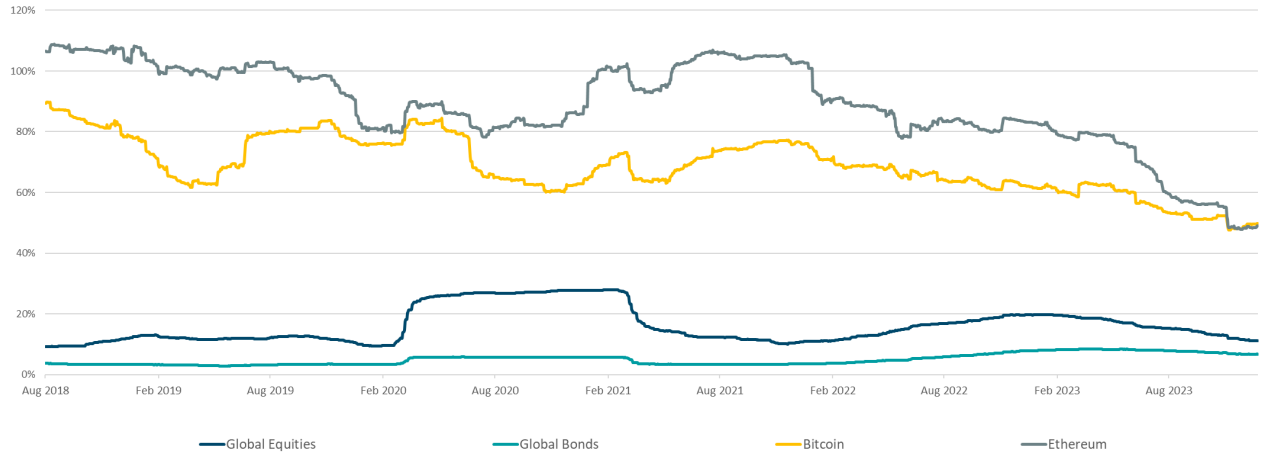
Secondly, we note that the volatility levels have, at times, not been too far from 100%. Though this is simply a result of the calculation, the intuition for a volatility above that level is not strong (because it implies an investor can lose more than their initial investment – which they can't). We suggest a more pragmatic interpretation, and one which the drawdown numbers confirm, which is simply that these have been very risky instruments indeed, and that there was a time, for example with Ethereum, when the maximum drawdown exceeded -90%.

Finally, we note that a reasonable view from Figure Two could be that the volatility of these two cryptocurrencies has been coming down over time. Certainly, recent data suggests that, while still very volatile, they are at the least risky point in the period we examined. We think the increase in institutional adoption and the growing ecosystem that we have witnessed in recent years provide an economic intuition for this development. Aspects such as the establishment of digital asset trading desks at major banks, the creation and trading of cryptocurrency futures and Exchange Traded Products (ETPs), and the interest and attention of major regulators and asset managers (ourselves included of course), all suggest a maturing process which might explain part of this de-risking.

Figure One: The daily returns to Bitcoin, Ethereum, Global Equities (MSCI All Country World Index), and Global Bonds (Bloomberg Global Aggregate) indexed to 100 (8/17-12/23, semi-logarithmic scale)

Source: DWS, Bloomberg, as of 12/23

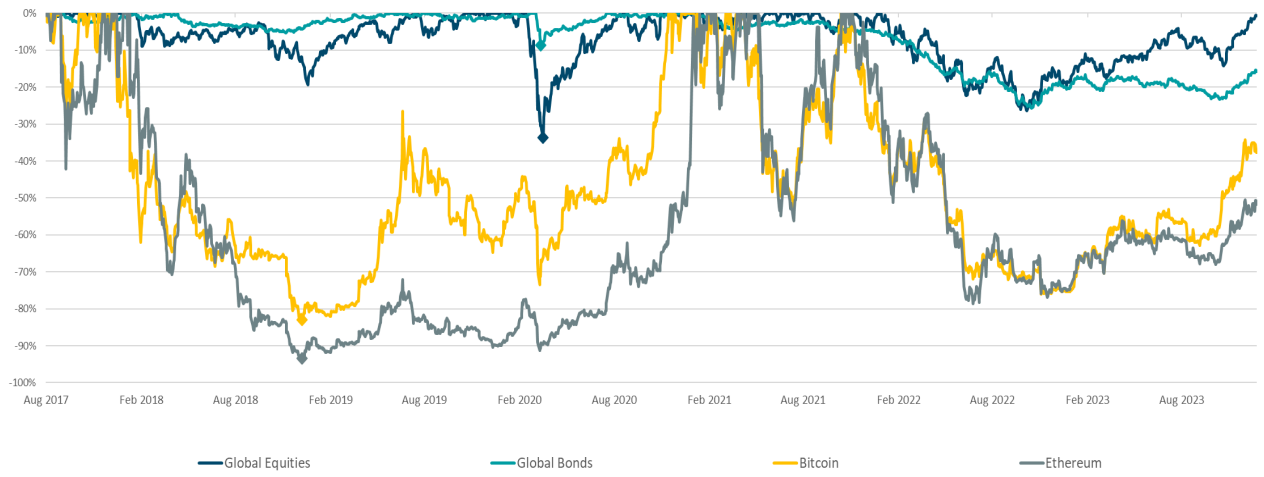
Figure Two: The volatilities of Bitcoin, Ethereum, and other major asset markets, rolling one year of daily returns (8/17-12/23)



Source: DWS, Bloomberg, as of 12/23

Past performance is not a reliable indicator of future returns.
Forecasts are based on assumptions, estimates, views and hypothetical models or analyses, which might prove inaccurate or incorrect.

Figure Three: The maximum drawdowns to Bitcoin, Ethereum, and other major asset markets, (8/17-12/23)

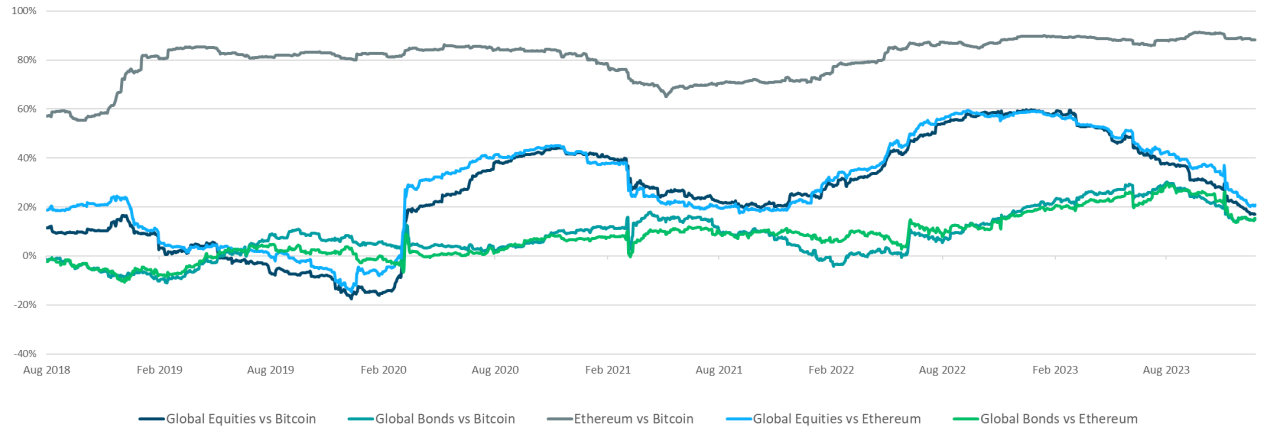


Source: DWS, Bloomberg, as of 12/23

The final relationship that we examine in this empirical section is the correlations between Bitcoin and Ethereum and traditional assets classes (see Figure Four). Several points stand out. Firstly, it's clear that we are facing the same problem with correlation that we always have – that it is often unstable and can range quite widely over time. For both crypto assets, it also had the well-documented tendency of many asset classes to spike higher at times of turmoil (see the onset of Covid in early 2020).

That said, one can make a case that the correlations are still sufficiently low to be of interest, although, as we will argue later, the portfolio impact of a new asset depends crucially not just on its correlation but also on its own standalone risk and thus the risk contribution. In the case of these two digital assets at least, that latter fact has been enough to more than outweigh the benefit from their relatively low correlations.

Figure Four: The correlation of Bitcoin/Ethereum with each other and other major asset markets, rolling one year of daily returns (8/17-12/23)



Source: DWS, Bloomberg, as of 12/23

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The Global Market Portfolio

For anyone familiar with the Capital Asset Pricing Model (CAPM), and its incredibly widespread and influential body of work, the concept of the "Market Portfolio" will not be new. Put simply, it is the global basket of all investable financial assets (and so the sum of all individual portfolios) which CAPM proponents argue represents the right benchmark against which to compare asset class returns.

The assumptions, findings, and importance of the CAPM are vast, and well beyond the scope of this paper, but we invoke it for one important insight. If an investor is relatively open to the lessons of the CAPM mindset, then they would likely agree that a global market-cap weighted portfolio is a very important reference point. Indeed, under the many assumptions of the CAPM framework it is the absolute best an investor can do (it has the highest Sharpe ratio of all portfolios). And, while the "true" market portfolio may exist only in theory (partly because it includes assets that are hard to value, such as intellectual capital), we would argue that a well-constructed global multi-asset portfolio is a decent proxy.

Figure Five, represents just such a portfolio. It is the result of a separate piece of DWS research which tried to come up with reasonable market cap weightings for some of the largest and most commonly held asset classes available to investors today (see Appendix for the indexes used). We invoke it for one simple reason – to give readers a context for understanding the relative size of the cryptocurrency market.

As the table states, at that time Digital Assets had a weighting of 0.68% in the global market portfolio. The paper used the June 2023 cryptocurrency market capitalization of around $1.2 trillion to approximate the digital asset market. Since then, according to coinmarketcap.com, the cryptocurrency market has grown by around 40% to $1.7 trillion, which could indicate an even higher digital asset weight in the global market portfolio. Nonetheless, this is still very small compared to the equity and fixed income markets but in the nearly 20% of the portfolio allocated to Alternatives, it is enough to justify its own line item. Indeed, it is quite eye opening to consider that, as an asset class that has existed for a fraction of the time that Gold has, which is often drawn upon for comparison purposes, it is already nearly a quarter of the size of the market for the yellow metal.

Figure Five: A Hypothetical Global Market Cap Portfolio

Category	Asset Class	Weight
Equities	Large Cap	37.59%
Equities	Small Cap	4.71%
Fixed Income	Developed Sovereign	20.90%
Fixed Income	Developed Credit	8.01%
Fixed Income	Emerging Markets	5.87%
Fixed Income	Securitized	5.18%
Fixed Income	Convertibles	0.19%
Alternatives	Private Equity	3.78%
Alternatives	Private Debt	0.76%
Alternatives	Real Estate	6.64%
Alternatives	Infrastructure	0.39%
Alternatives	Hedge Funds & Liquid Alts	2.27%
Alternatives	Digital Assets	0.68%
Alternatives	Gold	3.03%

A Risk Parity Approach

Another popular portfolio construction technique in finance is known as "Risk Parity." Extensive details of how and why asset managers use this technique is also beyond the scope of this paper, but, put simply, the idea is that one's selected choice of assets should all be weighted, not by market cap, or some other scheme, but – as the name implies – so that they all contribute nearly equally to the overall risk of the portfolio. Figures Six and Seven will clarify (the former for Bitcoin, and the latter for Ethereum). In each case, the outer ring shows the intended outcome of the approach, that the risk from each asset contributes approximately evenly to the overall portfolio risk. With 12 assets now in the mix (so a different blend to the approach above, with greater emphasis on liquid asset classes[1]), it should come as no surprise that each asset is contributing around 8%-9% of the risk (the risks are not precisely equal due to the constraints and estimates of the optimization process).

[1] We narrow the investment universe to liquid assets only for the purpose of higher representativeness for a typical investment portfolio.
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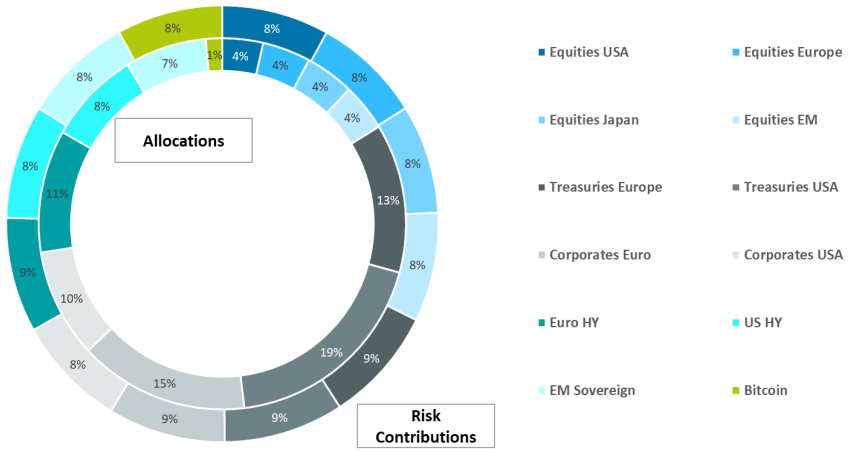
Of more interest than that is the information in the inner rings, which shows the sizes of the asset allocations needed to achieve that very balanced risk profile. Note two things. Firstly, balancing the risk of stocks and bonds will almost always result in much smaller equity and much larger fixed income weightings than typical strategic asset allocations (due, of course, to the typically much higher risk of equity compared to debt). Secondly, because of the very high standalone risks of cryptocurrencies, they need only relatively small allocations to contribute the same risk as stocks and bonds – at the time of writing, 1.4% in the case of Bitcoin, and 1.2% for Ethereum.

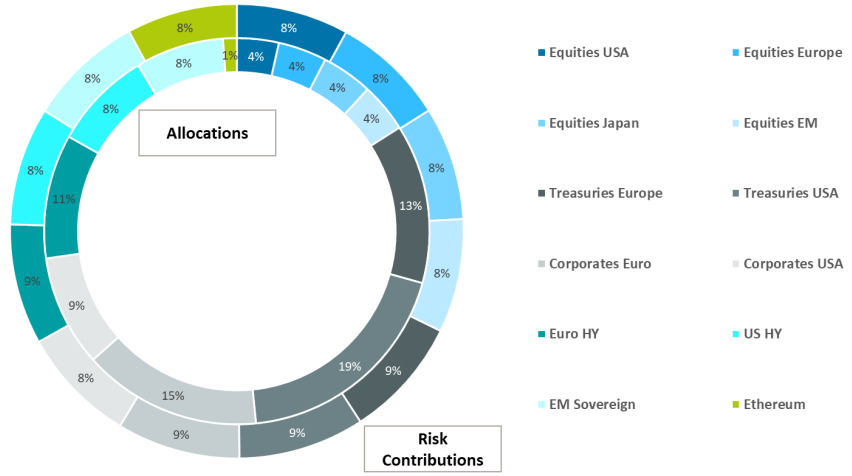
Of course, this approach is not for everyone, nor do we claim that even risk parity advocates must now allocate to cryptocurrencies. We share this merely to demonstrate the relative weightings that such an approach would require.

Figure Six: A Risk Parity allocation with Bitcoin included as a candidate asset class



No leverage allowed, long exposure only, no volatility target.
Source: DWS

Figure Seven: A Risk Parity allocation with Ethereum included as a candidate asset class



No leverage allowed, long exposure only, no volatility target.
Source: DWS

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Optimizing a Multi-Asset Portfolio

This section will look at a third, and final, method of portfolio construction – optimization. For those not familiar with this approach, we simply use a computational answer to what would otherwise be a complex problem:

- Create a list of candidate asset classes (see Figure Eight), we have kept them unchanged versus the Risk Parity section.

- Assign to each of those asset classes a preferred assumption for expected return, expected risk, and expected correlation. The first two of these numbers are also shown in Figure Eight and are taken from DWS' Long-Term Capital Markets Assumptions (LTCMAs, see Glossary) and calculations from our multi-asset team. Here we assume a Euro-denominated investor, who hedges out the US dollar exposure of their lower risk fixed income allocations (Treasuries, and Investment Grade Corporates). For Bitcoin we use variable return assumptions ranging between 0 and 35% per annum (note that this range does not represent DWS opinion about the future value of this asset, rather an estimate based on the above method of portfolio construction, which may prove inaccurate or incorrect).

- For risk we use weekly, exponentially weighted returns (with some statistical trimming of outliers), and our correlation matrix, though not shown, follows similar relatively commonplace estimation assumptions.

- Finally, we use the Mean Variance optimization approach, maximizing portfolio expected return for each volatility target.

Figure Eight: DWS Long-Term Return and Risk Forecasts

Asset Class	Return Assumptions	Risk Estimates
Equities USA	5.9%	15.5%
Equities Europe	6.8%	14.0%
Equities Japan	5.1%	14.1%
Equities EM	7.3%	15.0%
Treasuries Europe	3.1%	5.0%
Treasuries USA (hedged)	3.0%	4.6%
Corporates Euro	4.2%	3.4%
Corporates USA (hedged)	4.1%	5.7%
Euro HY	6.5%	5.0%
US HY	6.0%	7.4%
EM Sovereign	7.4%	7.4%
Bitcoin	(variable)	70.6%

Source: DWS, as of 09/23

We fully recognize that optimization approaches are both theoretically very simple and appealing, but practically very challenging. As one can see from the above there are many moving parts and assumptions embedded into the process. For this reason, we don't want to claim that any of our assumptions are the only ones that can be used - far from it. But we also argue that we do need a starting point, and while investors should feel free to challenge, or change, any of these initial assumptions, it's the end of the journey we are focusing on, and less the path taken. For example, we use certain constraints, such as neither allowing shorting nor leverage, that others might permit. We also put our own sensible restraints on the allocations to some asset classes and regions. This is to counter a well-known deficiency of optimization processes, that they will tend to allocate very heavily (or wholly) to the asset classes with the best numbers, not always recognizing the practical limits of return and risk forecasts that would call for more balanced solutions. But, again, we recognize that others may have different views, and want to change, or remove, some of these assumptions and constraints according to taste.

All those provisos stated, the key outcome of the optimization is shown in Figure Nine. This is how the table should be read: Across the top we show a range of portfolio volatilities targeted with every optimization iteration. On the left, going down the rows, we show a range of possible expected returns that an investor might have for Bitcoin (unhedged). Note that we have one instance of a significantly higher expected return in the table, when we jump to 35%. We base this on the approximate long-run relationship between risk and return for the best-known risky asset class – equities. According to "Triumph of the Optimists" by Dimson, Marsh, and Staunton (2002), stocks have returned roughly half of their volatility during the 20th century, and we use the same measure here. For every Bitcoin return assumption in the first column we conduct a separate range optimization. Finally, the resulting allocations to Bitcoin are presented in the table.

The body of the table shows the allocations to Bitcoin that those risk and return suggestions would call for if the investor wanted to maximize expected return of their portfolio given the specific risk targets. So, for example, an investor who wants to target an overall portfolio volatility of 8-9% and believes that Bitcoin may generate an annual return around 14-16%, might consider an allocation of around 3-5% of Bitcoin in their portfolio (again, subject to all the assumptions, and constraints in the approach. Also, note that neither this

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range, nor any example taken from Figure Nine, represent DWS' opinion about the present/future value of this asset, rather they are an estimate based on the above method of portfolio construction, which may prove inaccurate or incorrect). Note that in this case the risk contribution of Bitcoin would be around 13-20%. We find this table to be extremely useful in contextualizing potential Bitcoin allocations. It's clear that for risk averse, Bitcoin-skeptical investors who relish a good night's sleep not holding any digital coins may be preferred. Conversely, for investors who can stomach more risk, and who believe that Bitcoin's higher risk should earn higher returns, larger allocations may not disturb their nightly rest. But note that within the ranges we used, even the most bullish, risk-seeking investor would not go above a 14% allocation. Let's remind ourselves – when it comes to assets that are on the riskier side of the spectrum, correct position sizing is the investor's best friend.

We don't show the results for Ethereum separately because they are quite similar, although they do differ in one important respect: because Ethereum has been more volatile than Bitcoin, the hurdle of including it in the portfolio is higher than for Bitcoin. In other words, for a more risk averse investor, the minimum required return for Ethereum would tend to be higher than for Bitcoin.

Figure Nine: Mean Variance Optimization allocations to Bitcoin with various expected returns and risk targets

Expected Return for Bitcoin	Targeted Portfolio Volatility								
	4% vol	5% vol	6% vol	7% vol	8% vol	9% vol	10% vol	11% vol	12% vol
0% return	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
2% return	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
4% return	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
6% return	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.98%	6.67%	9.19%
8% return	0.00%	0.00%	0.12%	0.23%	0.33%	0.43%	3.98%	6.67%	9.19%
10% return	0.18%	0.54%	0.85%	1.13%	1.39%	1.65%	3.98%	6.67%	9.19%
12% return	0.47%	1.05%	1.53%	1.96%	2.38%	2.79%	4.53%	6.68%	9.19%
14% return	0.74%	1.51%	2.14%	2.73%	3.29%	3.83%	4.53%	7.04%	9.31%
16% return	0.98%	1.92%	2.70%	3.41%	4.09%	4.76%	5.41%	7.04%	9.48%
18% return	1.19%	2.28%	3.18%	4.01%	4.80%	5.57%	6.32%	7.06%	9.48%
20% return	1.38%	2.59%	3.60%	4.53%	5.42%	6.28%	7.12%	7.95%	9.48%
...					...				
ca.35% return	2.24%	4.07%	5.58%	6.97%	8.30%	9.60%	10.87%	12.12%	13.36%

Source: DWS

Conclusions

In this paper we have shown empirical data for the return, risk, and correlation of Bitcoin and Ethereum, and then used those findings to inform three different approaches to portfolio construction – Global Market, Risk Parity, and Optimization. Our conclusions are as follows:

Empirical Evidence

- The returns, and risks, of both Bitcoin and Ethereum in their relatively short lives have been extreme. Indeed, to show the returns on the same chart as traditional assets we had to compress the scale to make the comparison meaningful.

- We don't think that their historical return and risk profiles are useful gauges for how these cryptocurrencies are likely to behave in the future because increased institutional adoption and a burgeoning ecosystem should bring more liquidity, and, in our view, more stability to these assets.
- Their correlation to traditional asset classes has ranged quite widely over time but has generally been sufficiently low to be of interest in a portfolio context. That said, the risk impact of an incremental holding depends on two metrics – its correlation, and its standalone volatility. In the case of cryptocurrencies this latter feature is still too high for risk reduction purposes.

- However, although they may not currently *reduce* the overall risk of a portfolio, they can *change the composition* of the risk which could be appealing to some investors.

Global Market Portfolio

- For adherents of the Capital Asset Pricing Model, the Global Market Portfolio is a fundamentally useful starting point for portfolio construction. Easier in theory than in practice, it effectively represents all investable assets at their market weights.

- Cryptocurrencies (predominantly Bitcoin and Ethereum) would represent around 0.70% in a working version of the Global Market Portfolio according to previous DWS research. That is around a quarter the size of the gold market, and, in our view, means that trying to achieve a broad, relatively passive, global exposure without holding any cryptocurrencies at all is inconsistent - the simple truth is that cryptocurrencies are now too big to brush them aside without consideration.

Risk Parity

- The risk parity approach to portfolio construction tries to roughly equate the contribution to risk from each of its component asset classes. It's a well-known strategy that is popular in practice.
- We invoke it as another lens through which to consider the impact of Bitcoin and Ethereum. In the risk parity portfolios that we constructed, starting with 11 commonly held asset classes, and adding either cryptocurrency as a 12th, allocations as small as 1.4% for Bitcoin, and 1.2% for Ethereum would contribute as much risk (approximately 8-9%) as each of the other asset classes.

Optimization

- Using DWS' Long Term Capital Market Assumptions, along with several industry standard constraints, we created a table of allocations to Bitcoin that would maximize portfolio return for a range of volatility targets given user determined expected return numbers for the cryptocurrency.

- For example, an investor who wants an overall portfolio volatility of around 8-9% and believes that Bitcoin could reasonably return between 14-16% annually might consider allocating around 3-5% of their portfolio to Bitcoin, using our forecasts and assumptions.

- We do not claim that these are the only ones to use, nor that our constraints and assumptions are the sole valid ones. Instead, we conduct this analysis in the spirit of a robust, practitioner attempt to gauge some reasonable position sizing for cryptocurrencies.

- We found similar results for Ethereum, though do not report all the details separately. Finally, we note that although the statistics of both cryptocurrencies lead to similar conclusions, that is not true of their economic use cases. Investors should think about the qualitative arguments at least as strongly as the quantitative ones. Further DWS and Galaxy research will shortly be available on this topic.

DWS and Galaxy Digital Holdings Ltd. (TSX: GLXY) ("Galaxy"), a financial services and investment management innovator in the digital asset and blockchain technology sector, have entered into a strategic alliance with the aim of initially developing a comprehensive suite of exchange-traded products (ETPs) on certain cryptocurrencies in Europe. The strategic allies plan to also subsequently explore other digital asset solutions.

As the digital asset market continues to mature, DWS and Galaxy's asset management unit will work together to provide European investors access to the USD ~1.4 trillion digital assets market (as of 15 Nov 2023) through cost effective investment solutions that are easy to access via traditional brokerage accounts. For DWS, this alliance fulfils a key priority to develop comprehensive digital solutions, unlocking investor access to the growing blockchain and digital assets universe. DWS will be Galaxy's exclusive ally for cryptocurrency ETPs in the European market. This alliance is expected to significantly enhance Galaxy's international distribution capabilities by deepening access to European investors who are keen to participate in the cryptocurrency market.

The alliance is expected to combine DWS's strong portfolio management, product structuring, and distribution expertise across liquid and illiquid asset classes with Galaxy's technical infrastructure and its asset management and research capabilities for digital assets. The alliance aims to be a catalyst for both firms to jointly profit from emerging digital asset opportunities.

Appendix

The following indexes were used to proxy the asset classes mentioned in the paper:

Asset Class	Index
US Equities	MSCI USA Net Total Return EUR Index
European Equities	MSCI Europe Net Total Return EUR Index
Japanese Equities	MSCI Japan Net Total Return EUR Index
EM Equities	MSCI Emerging Markets Daily Net Total Return EUR Index
Developed Sovereign Fixed Income	DWS calculations based on various index providers
Developed Credit Fixed Income	DWS calculations based on various index providers
Emerging Market Fixed Income	Bloomberg Emerging Markets Sovereign Total Return Index Unhedged EUR
Securitized Fixed Income	DWS calculations based on various index providers
Convertible Fixed Income	DWS calculations based on various index providers
US Treasuries	Bloomberg US Aggregate Total Treasury Value Hedged EUR
European Treasuries	Bloomberg Euro Aggregate Treasury Total Return Index Value Unhedged EUR
US Corporates	Bloomberg US Corporate Total Return Index Value Unhedged EUR
European Corporates	Bloomberg Euro Aggregate Corporate Total Return Index Value Unhedged EUR
US High Yield	Bloomberg US Corporate High Yield Total Return Index Unhedged EUR
European High Yield	Bloomberg Pan-European High Yield (Euro) TR Index Value Unhedged EUR
Private Equity	DWS calculations based on various index providers
Private Debt	DWS calculations based on various index providers
Real Estate	DWS calculations based on various index providers
Infrastructure	DWS calculations based on various index providers
Hedge Funds & Liquid Alts	DWS calculations based on various index providers
Bitcoin	Bitcoin Liquid Index
Ether	Bloomberg Galaxy Ethereum Index

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Glossary

Bitcoin: The first and largest crypto asset, enabling decentralized peer-to-peer transactions.

BBG Global Agg: The Bloomberg Global Aggregate Total Return Index, a value weighted unhedged USD index of bonds.

Capital Asset Pricing Model (CAPM): A hugely influential financial framework that quantifies the relationship between rewarded, and unrewarded, risks and returns.

Cryptocurrency: A crypto asset recorded on a Blockchain that is often neither issued nor controlled by any centralized authority.

Digital asset/crypto asset: Crypto assets digitally represent value, rights and obligations on a blockchain.

Exchange-traded fund (ETF): A security that tracks an index or asset like an index fund, but trades like a stock on an exchange.

Ether: The native cryptocurrency of the Ethereum network.

Ethereum: A decentralized, public blockchain network that supports composable smart contracts which can be used to create decentralized applications and tokens and facilitate peer-to-peer transfers.

Global Market Portfolio: A hypothetical portfolio that consists of all investable financial assets, held in proportion to their respective market capitalizations.

Hedge fund: An investment vehicle less regulated than a mutual fund that pools capital from different investors and uses different investment strategies.

Investment Grade Corporates: refers to a credit rating from a rating agency that indicates that a bond has a relatively low risk of default.

Leverage: attempts to boost gains when investing by borrowing to purchase assets

Mean Variance optimization: A computational technique that maximizes expected return by simultaneously changing several other variables given a pre-defined set of constraints.

MSCI ACWI: The MSCI All Country World Index Net Total Return USD, an index of market cap weighted global stock markets.

Multi-asset: Determines investing in more than one asset class, thus creating a group or portfolio of assets with varying weights and types of classes. The diversification of an overall portfolio is thus increased, and risk (volatility) reduced.

Risk Parity: An investing style that weights assets according to their contribution to a portfolio's overall risk.

Sharpe ratio: Puts an asset's excess return (the return above the risk-free rate) in relation to the asset's risk as measured by its standard deviation.

Shorting: selling (stocks or other securities or commodities) in advance of acquiring them, with the aim of making a profit if the price falls.

Volatility: The degree of variation of a trading-price series over time. It can be used as a measure of an asset's risk.

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DWS International GmbH I Mainzer Landstrasse 11-17 I 60329 Frankfurt am Main, Germany