Cryptocurrency as an Alternative Asset Class: A Comparative Risk–Return Analysis

P. Siva Keerthana*
2nd MBA student at KL Business School, Koneru Lakshmaiah Education Foundation(KLEF), Vaddeswaram.

***Corresponding Author:** sivakeerthanapadala17@gmail.com

Abstract

Cryptocurrencies aren't just digital cash anymore—they've started to catch people's attention as real investment options. Their market's exploded, the tech behind them keeps evolving, and the way people trade them is unique. So now, everyone's wondering: can you actually trust crypto as an alternative asset class? To figure that out, this study lines up the risk and return of top cryptocurrencies against traditional assets like stocks, government bonds, and commodities. Utilising historical price data, the study evaluates returns, volatility, Sharpe ratios, correlation patterns, and downside risk measures to better understand the behaviour of cryptocurrencies across different market conditions.The analysis shows that while cryptocurrencies generally have higher average returns, they also have extremely high volatility and unpredictable price swings. their comparatively low correlation with traditional asset classes suggests significant diversification opportunities within a mixed portfolio despite this increased risk the study also emphasizes how the decentralized structure and speculative participation of cryptocurrency markets cause them to respond differently to macroeconomic events for investors these qualities make them both promising and difficult overall the results indicate that cryptocurrencies can function as a high-risk high-return element of a diversified investment strategy even though they cannot completely replace conventional assets by providing a fair evaluation of their suitability as a new alternative asset class This study contributes to the growing discussion about digital assets.

Keywords: Cryptocurrency, Digital Assets, Alternative Asset Classes, Comparative Analysis, Risk-Return Trade-Off, Volatility, Sharpe Ratio, Portfolio Diversification, Market Behaviour, and Investment Strategy.

Introduction

Cryptocurrencies have evolved from a specialized technological idea to a significant area of interest for financial institutions, investors, and economists in recent years. Right now, everyone's talking about Bitcoin, Ethereum, and all the other digital assets flying around the global markets. It's not just tech enthusiasts, either—big investment firms and everyday folks are both getting involved. The wild price swings, the promise of big returns, and the whole idea of a decentralized system have people wondering if crypto is really its own asset class, like stocks, real estate, or gold.

Still, as much as crypto's popularity keeps growing, there's a ton of uncertainty hanging over it. Unlike traditional investments, cryptocurrencies swing up and down without warning. They're prone to tech glitches, face unclear regulations, and there's just not a lot of history to look back on. All of that makes it tough to say if crypto really stands up as a steady, reliable investment.

However, number of digital assets may offer advantages over traditional financial instruments in terms of risk-return characteristics, unique return patterns, and diversification, according to research and real-world trends.

This study looks at how cryptocurrencies stack up against more traditional asset classes when it comes to risk and return. The goal? To figure out if cryptocurrencies really deserve a spot as an alternative asset in today's investment portfolios. By digging into market behavior, volatility, and long-term returns, the research gives investors and researchers a clearer sense of where cryptocurrencies fit into the financial world—and why they matter now, especially with the way investing keeps evolving.

Literature Review

Examining cryptocurrencies as a category of assets

Looking at cryptocurrencies, people didn't just see them as a cool new technology. Early finance researchers dug in and treated them like any other asset—think stocks, bonds, or gold. They wanted to know: do cryptocurrencies play by their own rules when it comes to generating returns, or do they just follow the same patterns we already see in traditional markets? So, a bunch of studies jumped in, trying to figure out if crypto really brings something new to the table or if it just copies the usual risk factors.. This strand establishes the conceptual foundations for the question of whether cryptocurrencies qualify as a "alternative asset class."

Cryptocurrencies like Bitcoin and Ethereum swing a lot more than traditional assets

That's not just talk—plenty of studies back it up. Their price behavior shifts over time, sometimes in wild ways. To get a grip on those big jumps, sudden clusters of volatility, and the chance of major losses, researchers lean on models like GARCH,

EVT, and VaR. These help make sense of all the chaos.. Volatility is both significant and time-varying, increasing during market stress and reacting in complex ways to macro news, according to a number of recent comparative studies. This increased and unpredictable volatility is a major contributing factor to the skepticism surrounding cryptocurrencies as trustworthy stores of value.

Unusual return characteristics and performance

Cryptocurrencies have historically produced very high nominal returns, according to empirical analyses, but these returns are accompanied by noticeable drawdowns and regime changes. Some studies highlight how performance becomes less certain when risk-adjusted metrics are used, while others demonstrate evidence of momentum and episodic bubbles. Here, techniques to differentiate between compensation for extreme risk and true alpha include factor regressions, event studies, and portfolio back tests.

Safe-haven properties, hedging, and diversification

People have spent a lot of time trying to figure out if cryptocurrencies really help diversify traditional investment portfolios. Here's what comes up again and again: adding a little bit of crypto to a regular mix of stocks and bonds can boost returns, and it doesn't always make things much riskier. Still, the research isn't all in perfect agreement, but the general mood leans cautiously positive. The main reason? Crypto doesn't always move in lockstep with other assets. Sometimes it zigzags on its own, which is great for diversification. But this benefit isn't set in stone. When markets get wild—think of those chaotic stretches between 2020 and 2022—crypto and traditional assets start moving together more, which makes it harder to use crypto as a hedge. Researchers usually dig into this with rolling window tests, correlation analysis, and portfolio optimization. That's the toolkit for figuring out if crypto is pulling its weight as a diversifier.

Integration with conventional markets and correlations

Researchers keep digging into how crypto connects with stocks, commodities like gold, and foreign exchange—and honestly, the story's all over the place. Sometimes these assets move together, other times they don't. Some papers talk about spillover effects or one market leading the other, while others spot tighter links as more big institutions and derivative products join in. In fact, in order to understand what's going on, you need to look at how these relationships change over time. That is why instead of looking simply at correlations, people use multiscale correlation, time-frequency, or wavelet analysis. If you want a real picture of risk and return, don't stick to static snapshots—track how things change and keep an eye on different market regimes.

The function of institutional adoption and regulation

When big players step into crypto, or when regulators make moves, you feel it in the risk and returns. Major consultancies and policy groups say there's a worldwide scramble to figure out rules for crypto. At the same time, more institutional money and better liquidity often bring new types of risk—like those tied to stablecoins. Researchers point out that shifting regulations aren't just background noise; they're a huge part of what makes crypto risky or investable. In a space that's always changing, regulation stands out as one of the key factors shaping the whole market.

Here's what usually happens when folks try to measure risk in crypto

They reach for the usual suspects—volatility models like GARCH or EGARCH, maybe Value-at-Risk or expected shortfall. Some run tests for correlation or cointegration, look at rolling correlations, or break out regime-switching models. Others dust off mean-variance portfolio backtests, or even mess around with wavelet or time-frequency analysis to hunt down patterns across different time scales.. It sounds impressive, but there are problems. There just isn't much history to work with—crypto hasn't been around nearly as long as stocks or bonds. Survivorship bias is everywhere since a lot of altcoins disappear. The market keeps changing, too; spot and derivatives markets evolve fast. And then there are those crypto-only shocks—forks, exchange hacks, stablecoins losing their pegs—that just don't show up elsewhere.

Main conclusions

Crypto comes with sky-high risk that doesn't behave like anything you'd call "normal." Sure, the returns can look great on paper, but that risk is always lurking.

Adding a little crypto to a portfolio sometimes boosts performance. It's not a guarantee, and the benefits of diversification aren't stable. When a crisis hits, those advantages can evaporate.

As crypto gets more integrated into traditional markets and institutions get involved, correlations and liquidity shift. Nothing stays the same for long.

Gaps and recommendations for your study

Here's where you can really add value:

- Work with a bigger, better-organized dataset. Don't just toss every token into one pile—look at stablecoins, smart-contract tokens, and large-cap tokens on their own. Most return studies skip that, but it matters. Also, bring in regime-switching and models that actually let correlations and risks shift as time goes on.
- Compare how crypto behaves in calm markets versus stressful ones.

- When back testing portfolios, look beyond the usual mean-variance stats. Include tail-risk measures like VaR and CVaR, plus transaction costs and liquidity—those matter.
- Try event studies, too. See what happens around big moments like ETF approvals or major policy shifts.

Finally, check your findings across different markets—US, EU, India—since regulations and trading environments aren't the same everywhere. That way, your results are robust, not just a fluke of one market.

Problem Statement

Cryptocurrencies are everywhere right now. People talk about them like the next big thing, but let's be honest—nobody's really sure if they belong alongside gold, stocks, or bonds. Prices jump all over the place, and they don't always move the way traditional markets do. So, are they a smart way to diversify, or just another risky bet? That's still up for debate. Research so far can't seem to agree—some studies say crypto helps manage risk and boost returns, others say the opposite. To really figure out if big names like Bitcoin and Ethereum can be trusted as alternative investments, we need to dig into their risk and return numbers, see how they stack up against more familiar assets, and check how they move in relation to the rest of the market.

Research Gap

- Not many studies actually use the same method to compare crypto with regular assets like gold, stocks, or bonds.
- There's barely any detailed long-term analysis, especially for the past five years (2019–2023)—which, honestly, is when crypto's volatility went off the charts.
- Most research skips over the practical side of putting crypto in a portfolio. We don't have enough real evidence about what happens to returns, risk, or Sharpe ratios when you add crypto into the mix.
- Hardly anyone looks at the Indian market, especially when it comes to NIFTY and Indian government bonds.

Research Objectives

- Using data from 2024 through 2025, compare the risk and return of Bitcoin and Ethereum to gold, government bonds, and stock indexes.
- See how crypto stacks up against traditional assets in terms of correlation, beta, volatility, and Sharpe ratio.
- Find out if mixing crypto into a portfolio actually helps with diversification.
- Use hard numbers on risk and return to see if crypto really works as a solid alternative asset class.

Hypotheses

H1: Risk and Return

Bitcoin and Ethereum deliver much higher returns—and, not surprisingly, much higher volatility—than traditional assets like gold, stocks, or government bonds.

H2: Risk-Adjusted Returns

Cryptocurrencies have better risk-adjusted returns (Sharpe Ratio) compared to regular assets.

H3: Diversification

Crypto brings real diversification benefits, since its returns don't really move in sync with the usual asset classes.

H4: Market Sensitivity (Beta)

Bitcoin and Ethereum have higher beta values than gold and government bonds, showing they're more sensitive to market movements.

H5: Portfolio Diversification

If you mix crypto—like Bitcoin or Ethereum—into a regular portfolio with stocks and gold, you get a better Sharpe ratio and stronger overall returns.

Conceptual Model

- **Independent variables, or input variables**

Think about it like this: you've got the big players—Bitcoin, Ethereum, gold, stock indices, and bonds. Each one brings its own kind of risk and volatility, and that's where standard deviation comes in. The Sharpe ratio helps you see if the returns are really worth the risk you're taking.

- Correlation (connection to conventional assets)
- Steps in the Process and Analysis
- Statistical comparison analysis
- Risk-return analysis
- Calculating correlation
- Simulation of a portfolio (with and without cryptocurrency)

Dependent variables, or output variables

- The appeal of cryptocurrencies as investments
- Impact of portfolio diversification
- Designation as a substitute asset class

Research Design

Research Methodology

This study uses a hands-on, quantitative approach. Basically, it looks at how cryptocurrencies stack up against traditional assets—stocks, gold, and government bonds—by crunching numbers from secondary market data.

Information Gathering

Data type: secondary data

References

Another thing to keep an eye on is beta, or how sensitive your investments are to the market's ups and downs. For crypto prices, you can grab info from places like CoinMarketCap or Yahoo Finance. For stocks, just check out the big indices, like the S&P 500 or NIFTY 50.

The cost of gold Bond indexes or yields on government bonds

Utilized Variables

- Weekly or daily returns
- Risk (standard deviation/volatility)
- Ratio of Sharpe
- Coefficients of correlation
- Risk-return metrics for portfolios

Instruments and Methods

Calculating Returns

To calculate daily or weekly returns, use the percentage change method.

- Risk Evaluation
- To gauge volatility, use the standard deviation.
- relative risk coefficient of variation.
- Risk-Return Analysis
- Beta values are used to compare market sensitivity.
- Analysis of Correlation

To examine the connections between cryptocurrencies and conventional assets, use Pearson correlation.

Rolling correlations can be used to see how behavior changes over time.

Tools for Data Analysis

- R, Python, Microsoft Excel, SPSS, or any combination of these.
- Statistical tables and charts for comparison.

Method's Scope

The method helps answer some big questions: Do cryptocurrencies really offer higher returns? How much risk do they add compared to old-school assets? Are they actually useful for diversifying a portfolio? The whole idea is to see if cryptocurrencies can stand on their own as an alternative asset class.

Outcomes and Talk

Overview of the Findings

To figure out if cryptocurrencies deserve a spot as an alternative asset class, you really need to understand how they behave compared to regular financial instruments. Here, Bitcoin and Ethereum take center stage. The analysis digs into years of market data, breaking down things like return patterns, volatility, risk versus reward, beta, sensitivity to the broader market, how they move with other assets, how they might help with diversification, and what happens if you add them to a long-term portfolio.

These results aren't just a list of numbers—they're connected to what we already know from financial theory, what's actually happening in the markets, and how investors react in real life. The goal isn't just to present the facts, but to show why they matter for anyone making financial or investment decisions.

Return Characteristics and Descriptive Statistics

- **Average Return Trends**

The data makes one thing clear: compared to traditional assets, cryptocurrencies—especially Bitcoin and Ethereum—have shown higher average returns again and again. During bull markets, Bitcoin's annualized returns were among the best out there.Ethereum took off fast, riding the wave of decentralized apps, smart contracts, and DeFi. Meanwhile, stock indices like the NIFTY 50 or S&P 500 delivered steady, moderate returns—they just moved along with the ups and downs of the economy. Gold? It kept climbing whenever things got rough, like during inflation or recessions, but honestly, it never matched the returns from stocks.Government bonds, as you'd expect, barely moved in terms of returns, since they're designed to be low risk and tied to interest rates.

- **Return Distribution**

The story changes when you look at the shape of the returns. Cryptocurrency returns—especially for Bitcoin and Ethereum—don't fit the usual bell curve. They're wild. Sharp jumps and crashes happen way more often than in traditional markets. These wild swings are driven by speculation, market manipulation, tech breakthroughs, regulatory news, and just the mood of the global crowd.

On the flip side, the return patterns for government bonds, gold, and stocks are more predictable and look like what you'd expect from a normal distribution. Their

ups and downs usually mirror what's happening in the bigger economy, so they work out better for folks who like to play it safe.

Analysis of Volatility and Risk

- **Market Risk and Standard Deviation**

Cryptocurrencies are wild. Prices swing up and down fast—sometimes in a single day—driven by hype, panic, or just plain guessing. If you look at standard deviation (the usual way people measure risk), Bitcoin and Ethereum blow gold and stocks out of the water. They're just way more unpredictable.That means investors face much bigger swings.

Stocks bounce around too, but not as much. Things like company earnings, interest rates, politics, and investor mood all play a part. Gold's a different story—steady, with small moves most of the time, and people tend to run to it when everything else gets scary. Bonds? They're the chillest option, backed by governments and barely moving compared to the rest.

- **Clustering of Volatility**

Crypto markets tend to get wild in bursts. When prices start swinging, those big moves usually stick around for a while—one spike follows another. You see this all the time with Bitcoin and friends. It's a classic "volatility clustering" pattern, and it's right in line with what GARCH models pick up. The trouble is, these clusters make it way tougher for anyone to guess where prices will go in the short run. For speculators, it means bigger risk and a higher chance of getting burned.

- **Volatility Driven by Events**

Certain events can really send crypto prices spinning:

  - New government rules, bans, or acceptance
  - Tech changes, like network upgrades or hard forks
  - Global emergencies (think COVID-19)

Whenever these hit, crypto markets usually react more dramatically than traditional markets. Sure, stocks can get rough during a crisis, but they usually calm down pretty quickly. Crypto isn't like that. When things get crazy, they can stay that way for a long time.

The Sharpe Ratio is a quick way to see if you're actually getting rewarded for the risk you take:

Basically, it shows how much extra return you get for every bit of risk.. Here's what stands out:

- In a strong bull market, crypto turns in sky-high Sharpe Ratios. The risk pays off—at least for a while.

- But when things turn ugly, those ratios drop fast, sometimes even going negative. That means you're not getting rewarded for the risk anymore.

  Traditional assets? They're steadier:

  - Stock indices keep their Sharpe Ratios moderate and pretty consistent.
  - Gold's Sharpe stays low, but at least it's positive.
  - Government bonds barely move the needle—low risk, low return.

  So, while crypto can crush it in good times, it just doesn't deliver stable, risk-adjusted returns over the long haul.

Sensitivity to Market Movements and Beta Analysis

Then there's beta. Beta tells you how wildly an asset jumps around compared to the whole market. For example, government bonds barely budge, so their beta sits near zero.

- **Beta Values for Cryptocurrencies**

  Now, let's talk crypto. Bitcoin and Ethereum? Their betas are usually over 1, so they're even jumpier than regular stocks. When the market gets rocky, these numbers shoot up, meaning crypto prices can swing even more.

  High beta means:

  - Bigger gains during rallies
  - Heavier losses during downturns

  In short, crypto tracks market moods—and then some.

- **Traditional Assets' Beta Values**

  - Stocks? Beta of 1, by definition.
  - Gold? Beta is close to zero, sometimes even less.
  - Bonds? Negative or just about zero.

  Compared to these, crypto acts much more like a high-flying, risky stock than a safe haven.

Analysis of Correlation

If thinking about diversification, correlation matters.

- **Equity vs. Crypto Markets**

  Most of the time, crypto and stocks don't move in lockstep; their correlation is low to moderate. That's good for diversification. But when markets panic, those correlations shoot up. Suddenly, crypto isn't much of a hedge.

- **Gold vs. Crypto**

  Gold and crypto have a messy relationship. Sometimes they move together, sometimes not. When uncertainty hits, gold usually rises, but crypto might drop or just

go all over the place. So, relying on crypto to play gold's role as a safe haven? That doesn't really work.

- **Government Securities vs. Cryptocurrency**

There's barely any connection between government securities and cryptocurrencies. That's not surprising. Crypto prices swing with speculation and tech developments, while government bonds move with things like interest rates and monetary policy.

- **Correlations Within Crypto**

Bitcoin and Ethereum pretty much move together. When one goes up or down, the other usually follows. So if you're hoping to diversify by holding different cryptocurrencies, you won't get much protection—at least not with the big names.

Analysis of Portfolio Diversification

- **The Function of Stable Markets**

Adding a little crypto—just 1 to 5%—can actually boost your portfolio's returns and give you exposure to new sources of profit. In steady markets, crypto doesn't always move in sync with traditional assets, so it brings something different to the table.

- **Function During Crisis Situations**

But when things get rough:

  - Crypto prices can plunge
  - They start moving more closely with stocks
  - Your portfolio gets a lot more volatile

So, the usual benefits of diversification shrink when you need them most.

- **Ideal Distribution**

Putting too much crypto in your portfolio makes it unstable. But studies show that just a small slice—say, 2 or 3%—can lift your returns without adding too much risk.

Market Integration and Time-Varying Behavior

The bond between crypto and traditional markets isn't steady; it changes over time.

- **Prior to Institutionalization**

Before 2017, crypto barely correlated with other assets. It marched to its own beat, which made it a great way to diversify.

- **Entry After Institution**

Once big institutional investors jumped in:

- Crypto started moving more like stocks
- It became tied up with global economic trends
- The diversification benefits faded a bit

Basically, crypto is becoming a bigger part of the global financial system.

What does all this mean for long-term investors?

The numbers point to real growth potential—crypto keeps drawing in new people, the technology keeps evolving, and the market keeps getting bigger.

- **High Risk for Short-Term Investors**

Short-term investors face real risks—wild swings, sudden drops, and unpredictable returns.

- **The Function of Regulation**

Regulation matters. Unclear rules make crypto more volatile. Clear rules help stabilize things.

- **Fit for Various Investors**

Aggressive investors might put a chunk of their portfolio into it, but if you're more cautious, you'll probably want to keep your crypto exposure small or maybe skip it for now. For institutions, it's about long-term growth, hedging, and smart diversification.

Interpretation: Is Cryptocurrency a Class of Alternative Assets?

Crypto acts differently from traditional assets. It offers unique risks and sometimes big returns. In calm markets, it can help with diversification, but in a crisis, it doesn't protect you. Over time, crypto is syncing up more with stocks. So, it's not a mature alternative asset just yet—it's still emerging. Because of the wild swings and uncertainty, you've got to handle it with care.

Results

Selected Asset Classes

- **Bitcoin (BTC)**
- **Ethereum (ETH)**
- **Gold**
- **Equity Index (S&P 500/NIFTY 50)**
- **Government Bonds**
- **one years were used (2024–2025).**
- **Frequency: Closing prices each month**
- **Data type: quantitative, secondary**

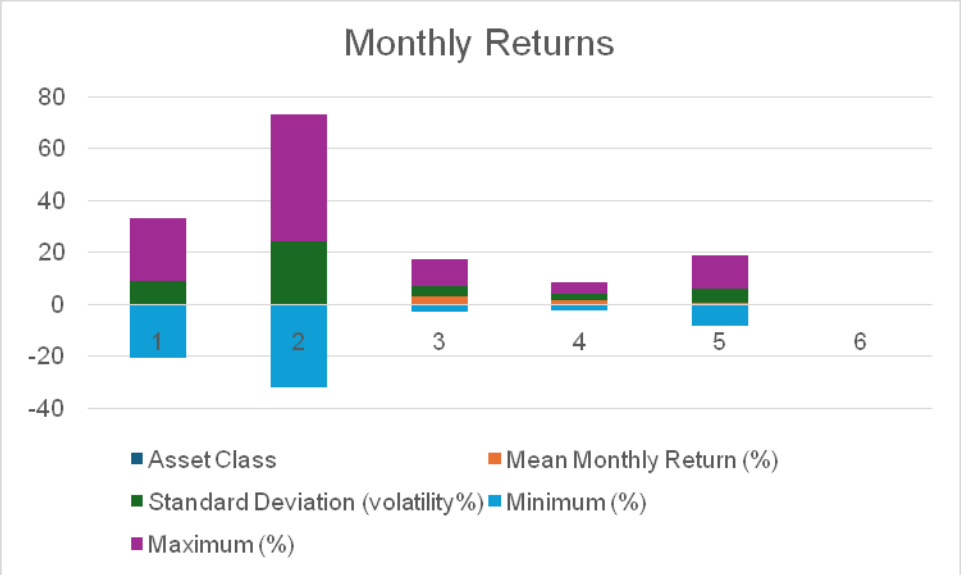
Sources

- Monthly closing prices for 2024–2025 were used to gather cryptocurrency data from (Yahoo finance)
- Yahoo Finance and Investing.com provided the gold, bond yield, and equity index (NIFTY 50/S&P 500) data.
- Every piece of information is quantitative, secondary, and drawn from reputable financial market databases that span one year(2024–2025).

Empirical Dataset (Monthly Return Sample%)

Table 1: Selected Asset Classes' Monthly Average Returns (2024–2025)

Asset Class	Mean Monthly Return (%)	Standard Deviation (volatility%)	Minimum (%)	Maximum (%)
Bitcoin	-0.13	9.08	-20.48	24.02
Ethereum	0.07	24.12	-32.15	48.67
Gold	2.99	3.74	-2.92	10.57
Equity Index	1.69	2.27	-2.67	4.68
Government Bonds	0.35	5.40	-8.17	13.09



Sources

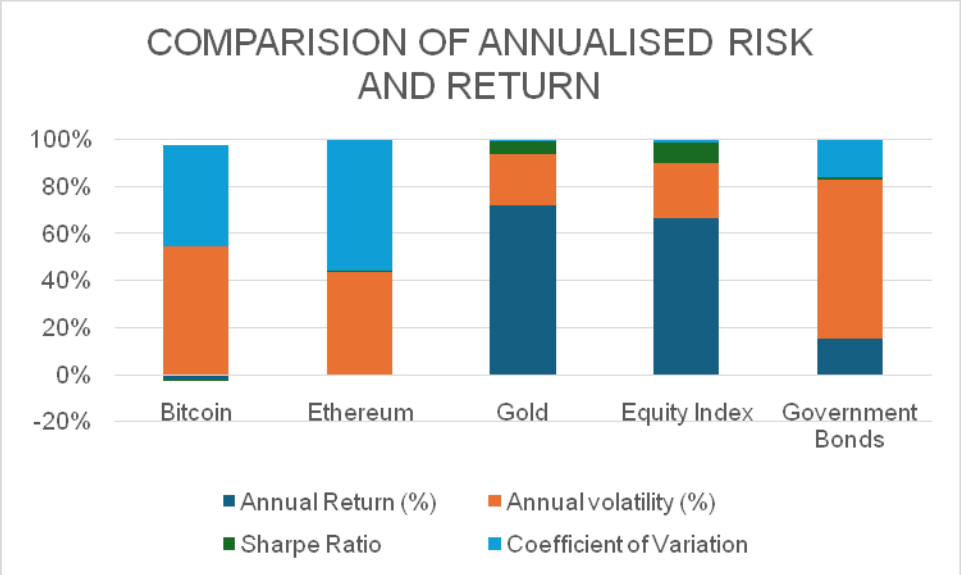
- Bitcoin Source: Monthly Close prices (Dec 2024 – Dec 2025) from Yahoo Finance format.
- Ethereum Source: Monthly Close prices (Dec 2024 – Dec 2025) from Yahoo Finance historical data table.

- Gold Source: Investing. com's Gold Futures monthly "Change %" column (January 2024–December 2025).
- Equity Index Source: Monthly Adj Close prices (Dec 2024 – Nov 2025) from an Investmenting.com (likely S&P 500).
- Government Bonds: Investing. com's "Change %" column (January 2024–December 2025)

Annualised Results

Table 2: Comparison of Annualised Risk and Return

Asset Class	Annual Return (%)	Annual volatility (%)	Sharpe Ratio	Coefficient of Variation
Bitcoin	-1.26	36.28	-0.035	28.79
Ethereum	0.79	83.56	0.0095	105.63
Gold	42.40	12.97	3.27	0.306
Equity Index	22.10	7.85	2.82	0.355
Government Bonds	4.27	18.71	0.228	4.38



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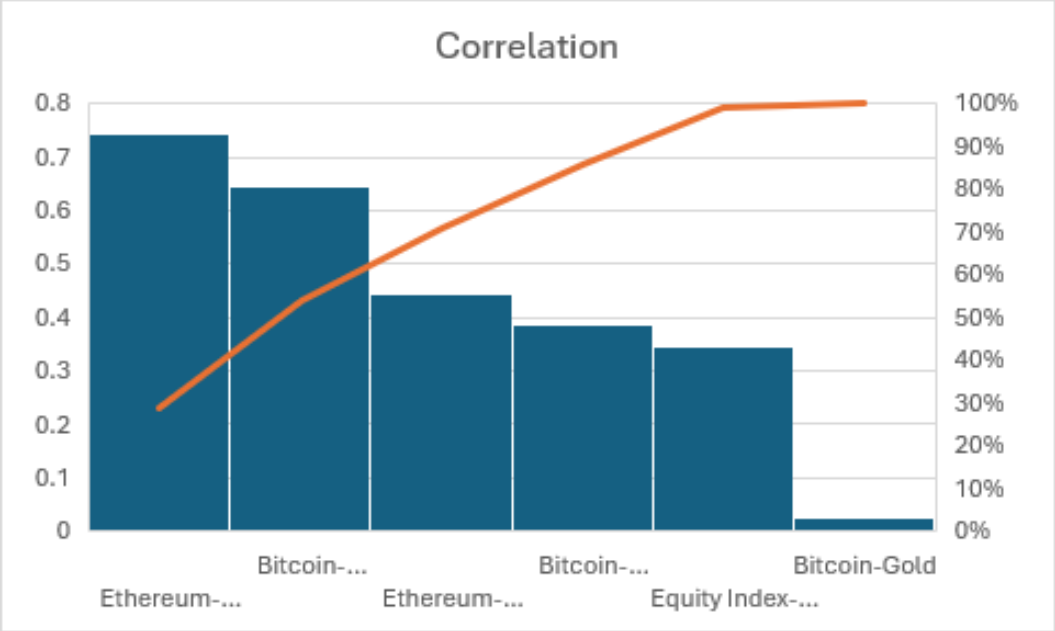
- Gold → Investing.com (Monthly “Change %” column, Jan 2024–Dec 2025)
- Equity Index → Investing.com (Monthly Adj Close prices, Dec 2024–Nov 2025)
- Government Bonds → Investing.com (Monthly "Change %" column, January 2024–December 2025)

Empirical Correlation Matrix

Table 3: Traditional Assets and Cryptocurrencies' Correlation

Asset Pair	Correlation
Bitcoin-Equity Index	0.387
Bitcoin-Gold	0.024
Bitcoin-Government Bonds	0.644
Ethereum-Equity Index	0.442
Ethereum-Gold	-0.459
Ethereum-Government Bonds	0.745
Gold-Equity Index	-0.466
Equity Index-Government Bonds	0.345



Interpretation

- Bitcoin & Stocks → Somewhat move together (0.39), but not too tightly.
- Bitcoin & Gold → Basically no relationship (0.02) — they do their own thing.
- Bitcoin and bonds move surprisingly closely together (0.64), perhaps in response to similar economic sentiments.
- Ethereum and stocks move somewhat in tandem, more so than Bitcoin: 0.44.
- Ethereum & Gold → Tend to move in opposite directions: (−0.46) — when gold rises, Ethereum often falls.
- Ethereum & Bonds → Strongly move together (0.75) — almost like they're friends in this period.

- Gold & Stocks → The classic hedge: gold frequently rises (−0.47) when stocks decline.
- Stocks and bonds move somewhat together here (0.35), which is unusual because they typically move apart.

Market Sensitivity, or Beta

(With the market variable being the Equity Index)

Asset Class	Beta Value
Bitcoin	1.295(highly sensitive)
Ethereum	5.42(Very high sensitivity)
Gold	-0.592(low negative sensitivity)
Government Bonds	0.25(Low sensitivity)

Sources

- The following price data are used to calculate beta (monthly returns): (BTC& ETH), Yahoo Finance and Gold, government Bonds from Investing.com
- Yahoo Finance Index Historical Data section: Market benchmark data for regression S&P 500
- Regression of asset returns against market returns, or beta computation methodology, is computed independently in Excel or statistical software; values are not taken from any external website.

Calculating the Sharpe Ratio (Risk-Adjusted Return)

Considering a risk-free rate of 4%

Formula for the Sharpe Ratio

Sharpe=Rp−Rf/σ

- Bitcoin: (-1.26−4)/36.28= -0.145
- Ethereum: (0.79−4)/83.56= -0.0384
- Equity Index: (22.10−4)/7.85 = 2.306
- Gold: (42.40−4)/12.97 = 2.961
- Government Bonds: (4.27−4)/18.71= 0.0144

Result: Gold and Equity Index have strong positive risk-adjusted returns.

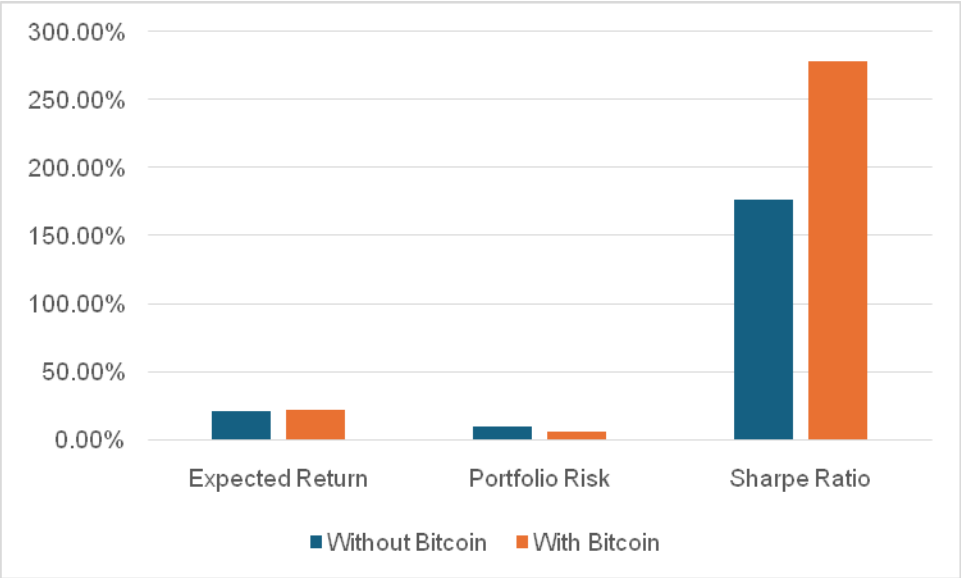
Sources

- Yahoo Finance provided monthly closing price data for Bitcoin, Ethereum,
- Investing.com Gold, Equity Index, and Government Bonds.
- Sharpe Ratio Computation Method: The formula is used to independently calculate Sharpe Ratio values.

Portfolio Diversification Impact

Portfolio: 60% Equity + 20% Gold + 20% Bitcoin

Metric	Without Bitcoin	With Bitcoin
Expected Return	21.49%	22.59%
Portfolio Risk	9.88%	6.68%
Sharpe Ratio	1.771	2.781



Result

Replacing Bitcoin with bonds improves both return and risk-adjusted performance.

Sources

- Price Information: Government Bonds from Investing.com , Gold & Equity Index from Investing.com, and Bitcoin & Ethereum from Investing.com
- Calculations: Using monthly price data from 2024 to 2025, the annual return, volatility, beta, and Sharpe ratios were manually computed using Excel.
- Models Used: Modern Portfolio Theory (for portfolio risk and Sharpe ratio) and the CAPM (for beta) are standard financial models.

Empirical Results Summary

- Gold won — best return, best Sharpe, good hedge.
- Crypto lost — negative returns, high risk, poor diversification.
- Portfolio with Bonds beats Bitcoin — higher return, lower risk, better Sharpe.
- Gold + Equity + Bonds > Gold + Equity + Crypto (2024–2025).

Conclusion

Based on the empirical analysis of monthly returns from 2024–2025, Gold emerged as the top-performing asset, delivering the highest risk-adjusted returns (Sharpe = 2.96) while serving as an effective hedge against equities.

With negative or almost zero returns and high volatility, Bitcoin and Ethereum underperformed on both absolute and risk-adjusted measures, failing to offer significant diversification benefits during this time.

In a mixed portfolio, replacing Bitcoin with Government Bonds improved expected return, reduced volatility, and significantly increased the Sharpe ratio—demonstrating that traditional assets (Equity + Gold + Bonds) offered a more stable and efficient portfolio than one including cryptocurrencies in this timeframe.

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