

Financial Performance Evaluation of Cryptocurrencies in the Digital Financial Market

A Study of Selected Digital Assets (2015–2025)

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ABSTRACT

This study evaluates the financial performance of ten selected cryptocurrencies—Bitcoin (BTC), Ethereum (ETH), Binance Coin (BNB), Cardano (ADA), Solana (SOL), Polkadot (DOT), Ripple (XRP), Tether (USDT), USD Coin (USDC), and Dogecoin (DOGE)—over the period 2015 to 2025, benchmarked against the NIFTY 50 index. Secondary data sourced from cryptocurrency exchanges and financial portals were analysed using Return & Risk Analysis, Mean, Standard Deviation (SD), Coefficient of Variation (CV), Compound Annual Growth Rate (CAGR), Sharpe Ratio, Paired Sample t-test, Bootstrap Paired t-test, Levene's Test for Homogeneity of Variance, and One-Way ANOVA. Results show that Solana achieved the highest risk-adjusted return (Sharpe Ratio: 1.90), while stablecoins (USDT, USDC) demonstrated near-zero volatility but negative risk-adjusted returns. All paired sample comparisons were statistically significant ($p < 0.05$). ANOVA results indicate no significant inter-group price differences ($p > 0.05$), suggesting homogeneity of group means within individual assets. The findings confirm a positive risk-return relationship in crypto markets and provide actionable insights for investors and policymakers.

Keywords: Cryptocurrency; Financial Performance; Risk-Return Analysis; Sharpe Ratio; ANOVA; Paired t-test; Bitcoin; Ethereum; Blockchain; Digital Financial Market

JEL Classification: G11, G14, G15, O31

1. INTRODUCTION

The global financial landscape has undergone a paradigm shift with the proliferation of blockchain-based digital currencies. Since the launch of Bitcoin in 2009 by the pseudonymous Satoshi Nakamoto, cryptocurrencies have evolved from niche technological curiosities to mainstream financial instruments attracting significant capital inflows from retail and institutional investors alike. The total cryptocurrency market capitalisation surpassed \$3 trillion at its 2021 peak, underscoring the asset class's systemic importance in the contemporary financial system.

Cryptocurrencies operate on decentralised blockchain networks, precluding the involvement of central banks or governmental monetary authorities. This structural feature introduces both distinctive advantages—such as borderless transactions, financial inclusion, and transparency—and significant risks, notably extreme price volatility, regulatory uncertainty, and cybersecurity vulnerabilities. The high return potential, epitomised by Bitcoin's ascent from below \$500 in 2015 to over \$93,000 in 2024, has attracted investors willing to tolerate elevated risk. Simultaneously, the emergence of stablecoins such as Tether (USDT) and USD Coin (USDC)—pegged to fiat currencies to minimise volatility—reflects a demand for price stability within the crypto ecosystem.

Against this backdrop, rigorous financial performance evaluation of cryptocurrencies is imperative. Investors, financial advisors, and policymakers require empirical evidence regarding return potential, risk metrics, and statistical behaviour of digital assets. This study addresses that need by systematically analysing ten prominent cryptocurrencies over a decade-long horizon (2015–2025) using a comprehensive battery of financial and inferential statistical tools. A comparison with the NIFTY 50 index anchors the analysis within the broader context of traditional equity markets, enabling an assessment of relative investment merit.

1.1 Research Problem

Despite the rapid expansion of cryptocurrency markets, there remains a significant gap in empirical literature that comprehensively examines multi-asset performance across extended time horizons using both classical financial metrics and robust inferential statistical tests. Many existing studies focus exclusively on Bitcoin or Ethereum, neglecting the comparative performance dynamics of the broader crypto market. This study seeks to bridge this gap.

2. REVIEW OF LITERATURE

The academic discourse on cryptocurrency financial performance has grown substantially over the past decade. Liu and Tsyvinski (2022) conducted a seminal comparative analysis demonstrating that cryptocurrencies exhibit distinct risk-return profiles vis-à-vis traditional asset classes such as equities and commodities, with investor sentiment and network factors serving as unique return predictors. Almeida and Gonçalves (2024) synthesised a decade of investment literature through systematic review and bibliometric analysis, identifying investor behaviour, market efficiency, and volatility as core research themes.

Laksana and Fauziyah (2023) analysed 30 leading cryptocurrencies over 2020–2023, finding substantial cross-asset heterogeneity in returns and risk; Fantom yielded the highest returns while Thorchain demonstrated superior risk-adjusted performance. Saleem et al. (2024) documented the increasing integration of crypto assets with traditional financial systems, noting contagion risks and stability implications. Nagl (2024) employed machine learning models to predict cryptocurrency returns, highlighting the non-linear complexity of crypto price dynamics compared to equity markets.

More recently, Alsulami and Raza (2025) examined pre- and post-FTX collapse volatility dynamics for Bitcoin and Ethereum, confirming heightened volatility transmission from traditional equity indices following the collapse. Almadadha (2025) provided evidence from Australian banks showing that blockchain adoption positively affects return on assets (ROA) and return on equity (ROE). Wang and Bai (2025) established that investment experience and domain knowledge—rather than general financial literacy—are the primary determinants of cryptocurrency investment decisions. Ram and Arulmurugan (2026) corroborated the role of FOMO (Fear of Missing Out) and herding behaviour as psychological drivers of cryptocurrency adoption.

Collectively, the literature underscores the need for comprehensive longitudinal analyses that integrate multiple performance metrics and statistical tests, a gap that the present study addresses.

3. RESEARCH METHODOLOGY

3.1 Objectives of the Study

The following specific objectives guide this research:

- (1) To analyse the annual return and risk of ten selected cryptocurrencies during 2015–2025.
- (2) To compute and interpret key performance indicators: Mean, Standard Deviation (SD), Coefficient of Variation (CV), Compound Annual Growth Rate (CAGR), and Sharpe Ratio.
- (3) To examine price trends and assess the long-term growth trajectory of selected cryptocurrencies.
- (4) To assess the role of cryptocurrencies as an alternative investment avenue in the contemporary digital financial ecosystem.
- (5) To test statistical hypotheses—using Paired t-test, Bootstrap, Levene's Test, and ANOVA—regarding differences in cryptocurrency performance.

3.2 Research Design

The study adopts a descriptive and analytical research design. Secondary data on annual closing prices of ten selected cryptocurrencies were sourced from cryptocurrency exchanges, financial portals (Coin Market Cap, Coin Gecko), and published financial reports. NIFTY 50 annual return and risk data were obtained from NSE India archives.

3.3 Period of Study

The study covers the period from January 2015 to March 2025 (ten financial years), capturing multiple market cycles including the 2017 bull run, the 2018 bear market, the 2020–2021 pandemic-era surge, the 2022 crypto winter, and the 2023–2024 recovery.

3.4 Sample

Ten cryptocurrencies were selected based on market capitalisation, trading volume, and diversity of use-case: Bitcoin (BTC), Ethereum (ETH), Binance Coin (BNB), Cardano (ADA), Solana (SOL), Polkadot (DOT), Ripple (XRP), Tether (USDT), USD Coin (USDC), and Dogecoin (DOGE). Stablecoins (USDT, USDC) are included to provide a risk-stability benchmark.

3.5 Analytical Tools

The following quantitative techniques were employed:

1. Annual Return (%) = $[(P_t - P_{t-1}) / P_{t-1}] \times 100$
2. Risk (Standard Deviation, σ) of annual returns
3. Coefficient of Variation (CV) = $(SD / \text{Mean}) \times 100$
4. Compound Annual Growth Rate (CAGR) = $(\text{Ending Price} / \text{Beginning Price})^{(1/n)} - 1$
5. Sharpe Ratio = $(R_p - R_f) / \sigma_p$ [Risk-free rate proxied at 5%]
6. Paired Sample t-test with Bootstrap validation (1,000 replications)
7. One-Way ANOVA with Levene's Test for Homogeneity of Variance

3.6 Hypotheses

H₀₁: There is no significant difference in mean prices between paired cryptocurrencies (Paired t-test).

H₀₂: There is no significant difference in group mean prices of selected cryptocurrencies (ANOVA).

H₀₃: The variances of cryptocurrency prices across groups are homogeneous (Levene's Test).

4. DATA ANALYSIS AND INTERPRETATION

4.1 Annual Return and Risk — Bitcoin (BTC)

Table 1 presents the year-wise return and risk metrics for Bitcoin, the world's oldest and most dominant cryptocurrency, over the study period.

Table 1: Annual Return and Risk — Bitcoin (BTC), 2015–2025

Year	Bitcoin Price (USD)	Annual Return (%)
2015	430	—
2016	965	35.11
2017	13,850	115.69
2018	3,742	−56.83
2019	7,193	28.38
2020	29,001	60.55
2021	46,306	20.32
2022	16,547	−44.69
2023	42,265	40.73
2024	93,429	34.45
Mean	—	23.09
SD	—	49.72

Source: CoinMarketCap; Author's Calculations

Bitcoin's price surged from \$430 in 2015 to \$93,429 in 2024, representing cumulative growth of over 21,700% over nine years. The highest annual return of 115.69% was recorded in 2017, coinciding with the initial coin offering (ICO) boom and retail investor frenzy. Significant corrections occurred in 2018 (−56.83%) and 2022 (−44.69%), reflecting the

cryptocurrency winter following monetary tightening and market deleveraging. The mean annual return of 23.09% is attractive relative to traditional equity benchmarks; however, the standard deviation of 49.72% signals extreme volatility. The CAGR of 0.8051 confirms exceptional long-term compounding potential. Bitcoin remains a high-risk, high-return asset, suitable primarily for investors with high risk tolerance and long investment horizons.

4.2 Comparative Annual Returns — All Cryptocurrencies

Table 2 presents the consolidated annual returns for all ten cryptocurrencies and the NIFTY 50 benchmark across the study period.

Table 2: Consolidated Annual Returns — All Cryptocurrencies (%), 2015–2025

Year	BTC	USDC	BNB	ADA	SOL	ETH	USDT	XRP	DOGE
2016	35.11	—	—	—	—	93.29	0	0.00	−50.84
2017	115.69	—	—	—	—	197.74	0	257.98	21.76
2018	−56.83	—	−15.04	−125.52	—	−75.38	−0.43	80.16	82.85
2019	28.38	0	37.32	−12.49	—	−1.04	0.43	27.75	43.81
2020	60.55	0	43.26	77.81	—	75.29	0	6.37	−23.29
2021	20.32	0	113.90	86.53	200	69.81	0	57.67	3.12
2022	−44.69	−0.43	−31.74	−72.26	−77.81	−48.79	−0.43	38.76	187.29
2023	40.73	0.43	10.32	38.02	60.20	28.03	0.43	26.09	−31.95
2024	34.45	0	28.54	0.71	25.52	16.56	0	0.00	−11.67
2025	—	—	−1.24	−4.49	−10.91	−5.08	0	5.20	33.74
Mean	23.09	0	23.16	−1.46	65.66	35.04	0	19.62	25.48
SD	49.72	0.25	44.88	71.84	103.30	78.33	0.29	91.58	69.34

Source: CoinMarketCap, CoinGecko; '—' = Not launched / Data not available

The consolidated return data reveals significant heterogeneity across cryptocurrencies and time periods. Year 2021 stands out as universally the strongest bull year across nearly all assets: Solana yielded 200%, Binance Coin 113.90%, Cardano 86.53%, Polkadot 89.08%, and Ethereum 69.81%. The 2022 bear market erased gains universally—Solana fell 77.81%, Cardano 72.26%, and Polkadot 58.98%. Stablecoins USDT and USDC demonstrated near-constant returns near zero across all years, confirming their role as liquidity anchors rather than return-generating instruments. Ripple (XRP) showed notable resilience, posting positive returns in eight of ten observable years, attributable to its institutional cross-border payment use case.

4.3 Risk-Adjusted Performance — Sharpe Ratio Rankings

Table 3 presents the comprehensive performance metrics for all assets, enabling cross-asset comparison.

Table 3: Performance Indicators — Mean, SD, CV, CAGR, Sharpe Ratio and Rank

Cryptocurrency	Mean Price (USD)	SD	CV (%)	CAGR	Sharpe Ratio	Rank
Bitcoin	31,021.45	31,773.50	102.42	0.8051	0.460	3
USD Coin	1.00	0.00	0.33	0	−0.120	9
Polkadot	11.92	10.48	87.96	0	0.120	7
Binance Coin	257.87	241.94	93.82	0	0.512	2
Cardano	0.48	0.39	80.71	0	0.020	8
Solana	99.42	65.61	65.99	0	1.900	1
Ethereum	1,384.85	1,355.32	97.87	1.4512	0.440	4
Tether	1.00	0.00	0.39	0	−0.200	10

Cryptocurrency	Mean Price (USD)	SD	CV (%)	CAGR	Sharpe Ratio	Rank
Ripple (XRP)	0.55	0.60	110.03	0.6521	0.210	6
Dogecoin	0.00	0.00	141.92	0.9193	0.360	5
Nifty 50	3,277.85	33,447.84	80.68	—	0.170	—

Source: Author's Calculations. SD = Standard Deviation; CV = Coefficient of Variation; CAGR = Compound Annual Growth Rate

Solana achieves the highest Sharpe Ratio of 1.90 and is ranked first, indicating the best risk-adjusted returns among all assets studied. Despite exhibiting substantial absolute volatility (SD: 65.61), its relatively lower CV (65.99%) versus Bitcoin (102.42%) suggests better return consistency per unit of risk. Binance Coin (Sharpe: 0.512, Rank 2) and Bitcoin (Sharpe: 0.460, Rank 3) follow, reflecting strong market adoption and network effects. Ethereum ranks fourth (Sharpe: 0.440), supported by its foundational role in DeFi and smart contracts. Dogecoin achieves a surprisingly respectable fifth rank (Sharpe: 0.360), driven by viral social media activity and speculative demand, although its mean price approaches zero, indicating negligible absolute value appreciation.

Stablecoins USDT and Tether record negative Sharpe Ratios (−0.200 and −0.120 respectively), confirming that after accounting for the risk-free rate, these assets do not generate investment returns. Cardano's Sharpe Ratio of 0.020 and negative mean return (−1.46%) place it eighth, reflecting that its dramatic losses in 2018 and 2022 outweighed the bull-market gains. The NIFTY 50 (Sharpe: 0.170) underperforms most volatile cryptocurrencies on a risk-adjusted basis but far outperforms stablecoins and Cardano, reinforcing the diversification potential of equities relative to the crypto market's extremes.

4.4 Trend Analysis

Trend analysis across the period 2015–2025 reveals a broadly upward long-term trajectory for major cryptocurrencies, punctuated by cyclical bull-bear patterns. Bitcoin's trend is the most pronounced, ascending from \$430 to a peak of \$93,429 in 2024 before a modest correction to \$87,508 in 2025—a CAGR of approximately 80.5%. Ethereum grew from \$0.93 in 2015 to \$3,679 in 2021 and maintained a value of \$2,971 in 2025 (CAGR: 145.1%), reflective of the dramatic but volatile value creation in smart contract ecosystems. Newer entrants such as Solana (\$1.50 in 2020 to \$180 in 2024) and Binance Coin (\$8.20 in 2017 to \$602 in 2024) also exhibit exponential trend growth. Polkadot and Cardano display more muted trends with higher correction depth. The stablecoins USDT and USDC remain flat by design, while Dogecoin and Ripple exhibit smaller absolute values but notable percentage volatility.

4.5 NIFTY 50 Comparative Analysis

The NIFTY 50 index returned an average annual return of 0.346 with standard deviation 0.2338 over 2015–2024. The best year was 2017 (return: 0.9116; risk: 1.180), coinciding with global economic optimism; the worst was 2015 (return: −0.150). The COVID-19 year 2020 was notable for the highest risk (4.583) yet strong positive return (0.503), reflecting pandemic-led volatility followed by extraordinary monetary stimulus. The NIFTY's Sharpe Ratio of 0.170 places it below most positive-return cryptocurrencies on risk-adjusted terms but significantly ahead of stablecoins, suggesting that traditional equity markets offer intermediate risk-adjusted performance relative to the crypto spectrum.

5. STATISTICAL ANALYSIS

5.1 Paired Sample t-test

The Paired Samples t-test was employed to determine whether statistically significant differences exist between the mean prices of paired cryptocurrency assets during the overlapping observation period (2020–2025, N = 6 years). The null hypothesis (H_{01}) states that no significant difference exists between paired means.

Table 4: Paired Samples t-test Results

Pair	Mean Diff.	Std. Error	95% CI Lower	95% CI Upper	t-value	df	Sig. (p)
Bitcoin vs USD Coin	52,508.34	12,765.43	19,693.76	85,322.91	4.113	5	0.009*
Polkadot vs Binance Coin	-370.27	89.35	-599.95	-140.58	-4.144	5	0.009*
Cardano vs Solana	-98.83	29.22	-173.95	-23.71	-3.382	5	0.020*
Ethereum vs Tether	2,366.35	485.39	1,118.62	3,614.08	4.875	5	0.005*
XRP vs Dogecoin	0.530	0.089	0.301	0.759	5.940	5	0.002*
NIFTY vs Year	-2,022.04	0.804	-2,024.11	-2,019.97	-2514.41	5	0.000*

* Significant at $p < 0.05$. CI = Confidence Interval. df = Degrees of Freedom.

All six paired comparisons are statistically significant ($p < 0.05$), leading to the rejection of H_{01} for all pairs. The Bitcoin–USD Coin pair exhibits the largest mean difference (52,508.34) with $t = 4.113$ ($p = 0.009$), confirming Bitcoin's vastly superior market valuation compared to the stable \$1.00 value of USD Coin. The Ethereum–Tether comparison (mean diff: 2,366.35; $t = 4.875$; $p = 0.005$) similarly reflects Ethereum's commanding price premium. The Polkadot–Binance Coin comparison (mean diff: -370.27; $t = -4.144$; $p = 0.009$) indicates Binance Coin's significantly higher price. The XRP–Dogecoin pair ($t = 5.940$; $p = 0.002$) is the most statistically robust result, reflecting XRP's consistent price superiority over the near-zero Dogecoin values. The Nifty–Year pair ($t = -2514.41$; $p = 0.000$) is mechanistically significant, confirming the temporal structure of the dataset. These results validate that the selected cryptocurrency pairs exhibit meaningfully distinct pricing levels during the study period.

5.2 Bootstrap for Paired Samples t-test

Bootstrap resampling with 1,000 replications was performed to validate paired t-test results and provide more robust confidence intervals, particularly given the small sample size ($N = 6$). The bootstrap analysis confirmed statistical significance for five of six pairs ($p < 0.05$). The Bitcoin–USDC pair (bootstrap $p = 0.044$; 95% CI: 30,767.09 to 76,716.39) and the XRP–DOGE pair (bootstrap $p = 0.014$) remained significant. The Cardano–Solana pair (bootstrap $p = 0.054$) marginally failed significance under bootstrap estimation, suggesting caution in interpreting this pairing—though the 95% CI (-149.15 to -44.59) still indicates Solana's price superiority. Overall, bootstrap results corroborate the parametric t-test findings, enhancing confidence in the conclusions despite the small sample limitation.

5.3 Pearson Correlation — Paired Assets

Table 5: Paired Sample Correlations

Pair	N	Correlation (r)	Sig. (p)	95% CI Lower	95% CI Upper
Bitcoin & USD Coin	6	0.563	0.244	-0.456	0.994
Polkadot & Binance Coin	6	0.381	0.456	-0.357	0.987
Cardano & Solana	6	0.704	0.118	0.038	1.000
Ethereum & Tether	6	0.483	0.332	0.126	0.991
Nifty & Year	6	-0.372	0.468	-0.961	0.539

Bootstrap confidence intervals based on 1,000 samples.

The Cardano–Solana pair shows the strongest positive correlation ($r = 0.704$), reflecting that both assets are influenced by the broader DeFi and smart-contract ecosystem trends, causing their prices to move in synchrony. Bitcoin–USDC ($r = 0.563$) and Ethereum–Tether ($r = 0.483$) also show moderate positive correlations, possibly reflecting the general crypto market cycle. Polkadot–Binance Coin ($r = 0.381$) shows a weaker positive relationship. The Nifty–Year negative

correlation ($r = -0.372$) reflects the expected non-linear relationship between the index value and the sequential year variable. None of the correlations achieve statistical significance at the 5% level (all $p > 0.05$), attributable to the small sample size ($N = 6$). The bootstrap 95% confidence intervals are wide, confirming this imprecision.

5.4 Test of Homogeneity of Variances (Levene's Test)

Table 6: Levene's Test for Homogeneity of Variances

Cryptocurrency	Levene Statistic	df1	df2	Sig. (p)	Variance Decision
Bitcoin	16.655	1	6	0.006	Heterogeneous*
USD Coin	3.999	1	6	0.092	Homogeneous
Polkadot	22.341	1	6	0.003	Heterogeneous*
Binance Coin	0.000	1	6	0.989	Homogeneous
Cardano	6.013	1	6	0.050	Borderline
Solana	0.127	1	6	0.734	Homogeneous
Ethereum	0.088	1	6	0.777	Homogeneous
Tether	3.999	1	6	0.092	Homogeneous
Ripple (XRP)	3.983	1	6	0.093	Homogeneous

* $p < 0.05$ indicates rejection of H_{03} (heterogeneous variances). NS = Non-significant.

H_{03} (equal variances) is rejected for Bitcoin (Levene = 16.655; $p = 0.006$) and Polkadot (Levene = 22.341; $p = 0.003$), indicating heterogeneous variance—consistent with these assets' reputation for extreme price swings. Cardano is borderline ($p = 0.050$), warranting cautious interpretation. For the remaining seven assets (USDC, BNB, ADA, SOL, ETH, USDT, XRP), homogeneity of variance is confirmed ($p > 0.05$). This distinction is analytically important: Bitcoin and Polkadot price data violate the equal-variance assumption, necessitating non-parametric or heteroscedasticity-corrected statistical tests for rigorous group comparison. Stablecoins unsurprisingly show homogeneous variance given their design-constrained price stability.

5.5 One-Way ANOVA

Table 7: One-Way ANOVA Results

Cryptocurrency	SS Between Groups	SS Within Groups	F-value	Sig. (p)	Decision
Bitcoin	310,333,918.94	5,247,199,210.06	0.355	0.573	NS
USD Coin	0.076	0.790	0.578	0.476	NS
Polkadot	56.45	604.56	0.560	0.482	NS
Binance Coin	18,698.09	256,277.38	0.438	0.533	NS
Cardano	0.113	0.745	0.909	0.377	NS
Solana	619.12	26,206.33	0.142	0.720	NS
Ethereum	62,748.35	8,497,569.59	0.044	0.840	NS
Tether	0.076	0.789	0.579	0.475	NS
Ripple (XRP)	0.001	0.242	0.028	0.872	NS

SS = Sum of Squares; NS = Not Significant ($p > 0.05$). Dogecoin omitted (zero variance).

One-Way ANOVA results indicate that H_{02} (no significant inter-group differences in mean prices) is accepted for all cryptocurrencies, as all F-statistics yield p-values well above 0.05. Bitcoin's low F-value (0.355; $p = 0.573$) despite its enormous Between-Groups Sum of Squares (310,333,918.94) reflects that the even larger Within-Groups variance dominates, confirming that price variation within years exceeds variation between compared groups. Ethereum ($F = 0.044$; $p = 0.840$) and XRP ($F = 0.028$; $p = 0.872$) record the lowest F-values, indicating exceptional consistency in

group mean differences. Cardano records the highest F-value (0.909) among cryptocurrencies, though still non-significant, consistent with its moderate volatility level. The ANOVA results collectively confirm that the selected cryptocurrency price datasets, when grouped for comparative purposes, do not exhibit statistically distinguishable between-group mean differences, implying market co-movement driven by macro-level crypto market sentiment.

6. SUMMARY OF FINDINGS

1. Solana ranked first on risk-adjusted performance (Sharpe Ratio: 1.90), outperforming all other assets in the study, including traditional equity (NIFTY 50, Sharpe: 0.170).
2. Bitcoin delivered the highest mean price (\$31,021) and second-highest CAGR (0.8051), confirming its long-term dominance as the benchmark cryptocurrency despite a standard deviation of \$31,773.
3. Ethereum achieved the highest CAGR (1.4512) among the studied assets, reflecting exceptional long-term compounding driven by smart contract and DeFi adoption.
4. Stablecoins (USDT, USDC) recorded mean returns of approximately 0%, Sharpe Ratios below 0, and near-zero standard deviations—confirming their utility as liquidity instruments rather than return-generating investments.
5. Cardano (ADA) reported the only negative mean annual return (−1.46%) among the non-stablecoin cryptocurrencies, attributable to the severe 2018 drawdown (−125.52%).
6. The 2021 bull cycle was the most universally profitable year: all active non-stablecoin cryptocurrencies registered positive returns ranging from 3.12% (DOGE) to 200% (SOL).
7. All six Paired Sample t-tests rejected H_{01} ($p < 0.05$), confirming statistically significant price differences between paired cryptocurrency assets.
8. ANOVA accepted H_{02} for all assets ($p > 0.05$), indicating no significant inter-group mean price differences—consistent with macro-level market co-movement.
9. Levene's Test rejected H_{03} for Bitcoin and Polkadot ($p < 0.05$), signalling variance heterogeneity for these assets and the need for robust statistical methods in future research.

7. CONCLUSION

This study provides a comprehensive empirical assessment of the financial performance of ten major cryptocurrencies over the period 2015–2025. The findings reveal that the cryptocurrency market is characterised by a pronounced risk-return trade-off: assets generating superior average returns (Solana, Ethereum, Bitcoin) simultaneously exhibit the highest volatility. The Sharpe Ratio ranking—with Solana (1.90) and Binance Coin (0.512) leading—provides investors with a scientifically grounded framework for evaluating return per unit of risk.

The statistical analysis confirms that while individual cryptocurrencies differ significantly in mean price levels (Paired t-test), group mean price variations across observation sub-periods are not statistically significant (ANOVA). This finding is consistent with the hypothesis that cryptocurrency markets are driven by common sentiment and macroeconomic cycles rather than idiosyncratic asset-specific factors within annual sub-periods. Bitcoin and Polkadot's rejection of homogeneity of variance, however, underscores the unique instability of these assets, requiring investors and analysts to employ robust inferential methods.

Stablecoins emerge as distinct instruments serving liquidity and risk-management functions within crypto portfolios but offer no meaningful investment return above the risk-free rate. Their inclusion in a portfolio, however, can significantly reduce overall portfolio volatility during market corrections. The NIFTY 50's moderate Sharpe Ratio (0.170) positions traditional equity as a viable risk-adjusted alternative for conservative investors, while more aggressive investors may benefit from selective cryptocurrency exposure—particularly in Solana, Binance Coin, and Ethereum—calibrated to their risk tolerance.

Future research should investigate intraday and monthly return dynamics, multi-factor predictive models, regulatory impact analysis, and portfolio optimisation strategies integrating both traditional and digital assets. A longitudinal extension of this study to post-2025 data will be particularly instructive as the cryptocurrency market matures and regulatory frameworks consolidate globally.

8. SUGGESTIONS FOR INVESTORS AND POLICYMAKERS

1. Investors should adopt risk-calibrated portfolio strategies, weighting high-Sharpe assets (Solana, Binance Coin, Bitcoin) proportionate to their individual risk tolerance rather than chasing recent returns.
2. Stablecoins should be utilised as liquidity buffers during bear markets rather than as long-term investment holdings, given their negative risk-adjusted returns.
3. Long-term investment horizons (minimum five years) are recommended for crypto positions, as short-term trading during high-volatility periods amplifies downside risk.
4. Policymakers should establish transparent, unified regulatory frameworks that protect retail investors without stifling blockchain innovation, particularly in DeFi and cross-border payment sectors.
5. Cryptocurrency exchanges should enhance cybersecurity infrastructure and implement robust KYC/AML protocols to reduce fraud risk and build institutional confidence.

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