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AUDIT ANALYTICS OF MULTI-ASSET INVESTMENTS IN BITCOIN, GOLD, AND STOCKS DURING 2022–2024: FINANCIAL REPORTING, RISK, AND GOVERNANCE PERSPECTIVES

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Abstract: Multi-asset allocations combining Bitcoin, gold, and stocks have become increasingly common, yet they raise heightened challenges for financial reporting reliability, downside-risk communication, and governance assurance because these assets differ in volatility, custody mechanisms, and valuation evidence chains. **Objective**: This study aims to develop and apply a multi-asset investment audit perspective for Bitcoin, gold, and stocks over 2022–2024 by integrating market-risk evidence with financial reporting and governance implications to support more risk-informed assurance and disclosure practices. **Methodology**: The research uses a quantitative design based on secondary daily closing price data for Bitcoin (BTCUSD), gold (XAUUSD), and stocks proxied by the S&P 500 index (^SPX) for 2022–2024. Data were collected from a public market database and analyzed using comparative return–risk measures, cross-asset correlation, drawdown analysis, and tail-risk indicators (VaR and CVaR/Expected Shortfall), complemented by a structured audit evidence-chain mapping to translate risk signatures into audit and control priorities. **Findings**: Bitcoin produced the highest annualized mean return (38.90%) but also the highest annualized volatility (55.47%), deepest maximum drawdown (-67.02%), and most severe tail risk (daily CVaR/ES 95% = -7.59%). Gold exhibited the most stable profile (14.51% volatility; -20.84% drawdown), while stocks were moderate (17.50% volatility; -25.38% drawdown). An equal-weight portfolio reduced overall volatility (22.89%) and tail risk (daily CVaR/ES 95% = -3.12%) relative to Bitcoin alone, yet still experienced a meaningful maximum drawdown (-35.65%). Bitcoin also showed stronger co-movement with stocks (0.441) than with gold (0.116), indicating equity-like risk sensitivity during this period. **Implications**: The results support a risk-weighted approach to auditing multi-asset investments, emphasizing valuation governance, disclosure specificity, and custody/existence assurance for digital assets, while aligning portfolio narratives with observed tail-risk concentration and dependence patterns. **Originality/value**: The study contributes an integrated framework that links downside-focused risk analytics (drawdowns and CVaR) with audit evidence-chain and governance mapping in a single multi-asset setting, extending prior work that typically separates portfolio performance analysis from assurance and reporting implications.

Keywords: multi-asset investment; audit analytics; tail risk; disclosure governance; Bitcoin; gold; stocks.

INTRODUCTION

Multi-asset investment strategies combining Bitcoin, gold, and stocks have increasingly been adopted as a diversification approach, particularly amid heightened macroeconomic uncertainty and shifting cross-asset

correlations. In practice, the integration of digital assets, commodities, and equity instruments creates a clear trade-off: while diversification opportunities and return potential may increase, the complexity of risk management, internal control, and reliable financial reporting also intensifies. Portfolio literature suggests that Bitcoin has attracted attention due to its relatively distinct correlation structure compared to traditional assets, thereby offering potential diversification benefits under certain market conditions (Guesmi et al., 2019). However, Bitcoin's extreme price volatility and its reliance on a technological transaction infrastructure that differs fundamentally from conventional markets introduce risk exposures that are not fully comparable to those of more established assets such as gold and stocks.

During the 2022–2024 period, the relevance of auditing multi-asset investments has become more pronounced as portfolios have been exposed simultaneously to two major challenges: (1) rapidly changing market risk driven by volatility clustering and evolving cross-asset correlations, and (2) governance-related risks stemming from differences in ownership structures, custody mechanisms, and price discovery processes across Bitcoin, gold, and stocks. Recent empirical evidence confirms the existence of dynamic linkages across these markets, indicating that cryptocurrency volatility can influence both stock and gold markets, although the magnitude and direction of these effects vary across time and methodological settings (Zhang et al., 2024). Other studies further demonstrate that during periods of crisis, gold and Bitcoin may play complementary rather than substitutive roles in portfolio diversification due to regime-dependent correlation behavior (Oosterlinck et al., 2023). Consequently, performance and risk evaluation of multi-asset portfolios in 2022–2024 cannot rely solely on return-based metrics, but must be translated into audit-relevant considerations concerning measurement reliability, risk disclosure, and governance adequacy.

The first stream of literature primarily examines the diversification role of Bitcoin within portfolios containing traditional assets, focusing on correlation structures and volatility transmission. A number of multivariate studies employing GARCH-type models provide evidence that Bitcoin can enhance portfolio diversification under specific market conditions, although these benefits are highly sensitive to market regimes and tend to diminish during periods of severe stress (Guesmi et al., 2019). More recent research highlights that volatility linkages among Bitcoin, gold, and stock markets are inherently time-varying, with empirical results depending on sample periods, volatility proxies, and modeling techniques (Terraza et al., 2024; Zhang et al., 2024). While this body of research contributes valuable insights into portfolio risk dynamics, it largely remains confined to asset allocation and optimization, without explicitly linking these findings to financial reporting implications or audit procedures necessary to ensure the reliability of reported investment information.

The second stream of research addresses financial reporting challenges associated with cryptocurrencies, particularly in relation to classification, measurement, and judgment-intensive areas affecting comparability and transparency. Within the IFRS context, prior studies emphasize ongoing debates over appropriate accounting models for cryptocurrencies, such as whether they should be treated as intangible assets or inventories depending on the underlying business model, each carrying distinct implications for measurement and impairment recognition (Procházka, 2018). More recent literature further argues for the need to establish clearer definitions and typologies of crypto-assets, as the heterogeneity of tokens directly affects their economic substance and, consequently, their accounting treatment (Parrondo et al., 2023). Despite these advances, existing reporting-focused studies rarely integrate accounting considerations with empirical risk profiles observed in specific periods such as 2022–2024, even though heightened volatility and correlation shifts may materially affect fair value estimates, disclosure judgments, and users' risk assessments.

The third stream of literature focuses on audit and governance issues related to cryptocurrency holdings and transactions, highlighting risks associated with custody arrangements, private key management, third-party platforms, and the availability of appropriate audit evidence. Prior audit research emphasizes that cryptocurrencies expand the traditional audit risk spectrum, particularly with respect to existence, rights and obligations, and the sufficiency and appropriateness of audit evidence when assets are held via external exchanges or custodians (Vincent & Wilkins, 2020). Other studies underline that the rapidly evolving crypto ecosystem presents both challenges and opportunities for assurance services, requiring auditors to reassess client acceptance, risk assessment, and procedure design in light of technology-driven controls and governance structures (Hsieh & Brennan, 2022). However, there remains limited integrative research that systematically combines audit and assurance insights with cross-asset comparisons specifically between

Bitcoin, gold, and stocks within a unified framework that connects market risk behavior, financial reporting implications, and investment governance practices.
Addressing this gap, the present study aims to develop and examine a comprehensive multi-asset investment audit framework for Bitcoin, gold, and stocks over the 2022–2024 period. Specifically, the study evaluates: (1) financial reporting implications arising from differences in asset characteristics and measurement bases, (2) comparative risk profiles based on volatility, correlation, and tail-risk metrics as a foundation for materiality and disclosure assessments, and (3) governance and control mechanisms including custody, valuation, authorization, reconciliation, and audit trails required to ensure the reliability and auditability of multi-asset investment information.

This study advances the argument that differences in economic substance and transactional infrastructure lead to asymmetric audit implications across asset classes. Empirical evidence suggests that volatility spillovers between cryptocurrencies, stock markets, and gold are neither uniform nor stable, implying that multi-asset portfolio risk during 2022–2024 is largely driven by evolving correlation structures and cross-market volatility transmission (Terraza et al., 2024; Zhang et al., 2024). At the same time, crisis-period evidence indicates that gold and Bitcoin may serve complementary diversification roles rather than acting as direct substitutes, reinforcing the need for auditors to assess whether risk disclosures and investment policies are consistent with observed portfolio behavior (Oosterlinck et al., 2023). From a reporting and assurance perspective, ongoing debates surrounding cryptocurrency accounting models and asset heterogeneity support the hypothesis that material misstatement risk associated with Bitcoin is more strongly linked to valuation judgment, classification ambiguity, and custody controls than is the case for gold and stocks (Parrondo et al., 2023; Procházka, 2018). Consequently, audit procedures for digital assets are expected to require more specialized controls testing and evidence-gathering approaches compared to traditional investment assets (Hsieh & Brennan, 2022; Vincent & Wilkins, 2020).

RESEARCH METHOD

This study examines a multi-asset investment portfolio comprising Bitcoin, gold, and stocks over the 2022–2024 period. The unit of analysis is twofold. First, it includes asset-level behavior (each asset's return and risk characteristics) and portfolio-level behavior (risk and diversification outcomes when the three assets are combined). Second, it includes an audit-oriented evaluative unit, namely the set of financial-reporting and governance assertions relevant to investment holdings such as measurement basis, valuation reliability, existence, and rights/obligations operationalized through an audit checklist informed by prior audit research on crypto assets and related assurance challenges (Hsieh & Brennan, 2022; Vincent & Wilkins, 2020).

A quantitative design with audit-analytics framing is employed because the core research problem requires (1) measurable risk comparisons across heterogeneous assets and (2) translation of those risk characteristics into auditable implications for reporting and governance. Quantitative analysis is appropriate for capturing volatility, correlation dynamics, and tail risk using standardized risk metrics, enabling consistent comparisons across Bitcoin, gold, and stocks within a single observation window. The audit-analytics framing complements the quantitative design by mapping risk outputs (e.g., volatility clustering, drawdowns, tail risk) to audit concerns such as valuation uncertainty, materiality sensitivity, and control reliance. This approach aligns with assurance literature emphasizing that crypto-asset auditing requires explicit linkage between technology-driven risks and evidence design (Hsieh & Brennan, 2022; Vincent & Wilkins, 2020).

The study uses secondary data consisting of time-series price observations for Bitcoin, gold, and stocks over 2022–2024. Price data are collected at a consistent frequency (daily or monthly, depending on availability and robustness requirements), then transformed into continuously compounded or simple returns for comparability across assets. To represent "stocks," the study uses either a broad market index (e.g., a major equity index) or a well-defined stock proxy (e.g., large-cap representative), as long as the proxy is consistently observable and replicable. In addition to market data, the study uses documentary sources to construct the audit-oriented component, including academic audit literature on cryptocurrency assurance and governance risks to structure a control-and-disclosure checklist and to define audit-relevant assertions for digital and traditional assets (Hsieh & Brennan, 2022; Vincent & Wilkins, 2020).

Market price series are obtained from reputable public or institutional databases and exported into a structured dataset, then cleaned to ensure alignment of timestamps and handling of non-trading days

(especially for assets traded continuously such as Bitcoin). Data preprocessing includes standardizing date formats, removing duplicates, reconciling missing values using transparent rules (e.g., listwise deletion for non-overlapping periods or forward-fill only when methodologically justified), and ensuring that all series are synchronized before computing returns. For the audit-oriented dataset, the study performs a structured document-based extraction process: key audit issues and control domains for crypto assets (custody, valuation inputs, third-party reliance, audit trail sufficiency) are coded into a checklist instrument, with categories and indicators derived from peer-reviewed assurance research to avoid ad hoc governance claims (Hsieh & Brennan, 2022; Vincent & Wilkins, 2020).

Analysis proceeds in sequential stages. First, the study computes descriptive risk indicators at the asset and portfolio levels, including average return, volatility, correlation, and drawdown-based indicators to capture downside behavior. Second, to capture tail risk, the study estimates Value-at-Risk (VaR) and Conditional Value-at-Risk / Expected Shortfall (CVaR/ES), because CVaR provides coherent risk measurement for extreme losses and is widely used in portfolio risk optimization (Rockafellar & Uryasev, 2000). Third, the study evaluates time-varying dependence using dynamic correlation modeling when needed (e.g., a DCC-type framework) to reflect changing cross-asset relationships during 2022–2024, consistent with the econometric foundation of dynamic conditional correlation in financial markets (Engle, 2002). Finally, the quantitative outputs are translated into audit implications through a risk-to-audit mapping matrix: results indicating high valuation uncertainty, extreme tail risk, or unstable correlations are linked to more stringent audit responses (e.g., strengthened valuation procedures, enhanced third-party confirmations, and tighter governance expectations for custody and access controls), as recommended by the crypto-asset audit literature (Hsieh & Brennan, 2022; Vincent & Wilkins, 2020).

RESULT AND DISCUSSION

Dataset and construction.

This study uses daily closing prices for Bitcoin (BTCUSD), gold (XAUUSD), and stocks proxied by the S&P 500 index (^SPX) obtained from Stooq. To ensure comparability across assets with different trading calendars, the series were aligned on the intersection of common trading dates (i.e., business days available for all three series). The final sample covers January 4, 2022 to December 31, 2024 with 752 daily return observations. The portfolio is constructed as an equal-weight blend (1/3 Bitcoin, 1/3 gold, 1/3 stocks) at the daily return level.

Financial Reporting and Audit Evidence (Financial Reporting, Risk, and Governance Lens)

The first evidence set consists of audit-relevant reporting attributes of the three asset classes and the audit assertions most exposed to misstatement risk. The “data” in this subsection are not price movements; instead, they are documentable characteristics that affect how investment balances and disclosures can be supported with audit evidence: (i) the custody/holding mechanism, (ii) the valuation pathway and price sourcing, (iii) the nature of evidence supporting existence and rights/obligations, and (iv) the disclosure areas most sensitive to risk and measurement uncertainty. These attributes are organized into a comparative evidence map so the reporting implications are stated consistently across Bitcoin, gold, and stocks.

Table 1 operationalizes the reporting implications into a cross-asset audit evidence map. It is designed to show where the evidence chain is straightforward and where it becomes control-dependent (especially for custody and valuation).

Table 1. Comparative Financial Reporting and Audit Evidence Map (Bitcoin vs Gold vs Stocks)

Dimension	Bitcoin	Gold	Stocks (S&P 500 proxy)
Holding/custody reality	Reliant on digital custody infrastructure (platform/wallet controls)	Reliant on physical safeguarding and storage documentation	Reliant on custodian/broker chain and market infrastructure
Valuation pathway	Market price from a defined price source; high sensitivity to source selection and timing	Market reference price tied to commodity benchmark; depends on documented quantity/unit	Quoted market index level; typically standardized market pricing
Existence evidence	Strongly dependent on custody evidence + access/control trail	Dependent on storage confirmation and physical/quantity	Dependent on custodian/broker statements and

Dimension	Bitcoin	Gold	Stocks (S&P 500 proxy)
		documentation	confirmations
Rights/obligations evidence	Depends on legal title + custody arrangements and access governance	Depends on ownership documentation and storage contract terms	Depends on brokerage/custody records and legal ownership documentation
Disclosure sensitivity	High: volatility/tail risk and custody reliance often require prominent risk disclosure	Moderate: commodity price risk and safeguarding disclosures	Moderate: market risk and concentration disclosures
Dominant audit risk area	Valuation governance and custody/existence evidence	Safeguarding and quantity/valuation reconciliation	Completeness and consistency of market valuation/disclosure

In practical terms, Table 1 shows that these three assets can be reported as "investments," but they do not behave the same from an audit evidence perspective. The main difference is not simply that prices move differently; the difference is that the evidence chain supporting the reported numbers differs in reliability drivers. For example, for stocks (using the market index as a proxy), valuation is typically the most standardized; for gold, valuation depends on linking market reference pricing to documented units; for Bitcoin, the audit burden often concentrates in custody and valuation governance, because reporting reliability can depend on how price sources are defined and how custody is evidenced.

Four consistent tendencies emerge from this evidence mapping: Valuation is also a governance question. Even with market prices, audit reliability depends on whether the entity has a consistent, defensible valuation policy (especially when prices can vary by venue or timing).

1. Existence and rights are not "one procedure fits all." Evidence types differ across digital custody, physical storage, and broker/custodian systems.
2. Disclosure needs are asymmetric. A portfolio narrative and risk disclosure that is adequate for stocks may not be adequate for Bitcoin if volatility and tail risk are materially higher (quantified in Section 4.2).
3. Control dependence increases with operational complexity. Where the evidence chain depends on third parties and system controls, audit planning must respond by emphasizing control testing and corroborative procedures.

This first result establishes the logic for linking market risk behavior to audit implications: the same portfolio can generate different reporting pressures across assets, and those pressures intensify when risk metrics indicate high volatility and deep drawdowns. Therefore, Section 4.1 provides the reporting "map," while Section 4.2 provides the quantified risk evidence that determines which parts of that map become most material during 2022–2024.

Cross-Asset Risk Profile and Portfolio Behavior (2022–2024)

The second evidence set is the daily return dataset derived from aligned daily closing prices for Bitcoin, gold, and the S&P 500 index (^SPX). The analysis computes (i) annualized mean return, (ii) annualized volatility, (iii) maximum drawdown, (iv) cross-asset correlations, and (v) tail risk metrics using historical VaR (95%) and CVaR/Expected Shortfall (95%) on daily returns. The equal-weight portfolio is evaluated alongside individual assets to show how diversification translates into measured risk reduction (or lack thereof).

Table 2 reports return–risk–drawdown metrics. Table 3 reports tail risk (VaR/CVaR). Figure 1 visualizes indexed performance paths; Figure 2 visualizes drawdowns to emphasize downside depth and recovery duration.

Table 2. Return and Risk Summary (Annualized), 2022–2024 (n = 752 daily returns)

Asset	Annualized mean return	Annualized volatility	Max drawdown
Bitcoin (BTCUSD)	38.90%	55.47%	-67.02%
Gold (XAUUSD)	13.67%	14.51%	-20.84%
Stocks (S&P 500, ^SPX)	8.37%	17.50%	-25.38%

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Portfolio (equal-weight)	20.31%	22.89%	-35.65%

Table 3. Tail Risk (Historical), 2022–2024 (Daily VaR/CVaR at 95%)

Asset	VaR 95% (daily)	CVaR/ES 95% (daily)
Bitcoin (BTCUSD)	-4.99%	-7.59%
Gold (XAUUSD)	-1.44%	-1.99%
Stocks (S&P 500, ^SPX)	-1.75%	-2.55%
Portfolio (equal-weight)	-2.11%	-3.12%

Correlation evidence (daily returns, 2022–2024).
Bitcoin–Stocks correlation is 0.441, Bitcoin–Gold 0.116, and Gold–Stocks 0.151 (pairwise, daily). This indicates Bitcoin co-moves with stocks more than with gold, while gold remains comparatively weakly correlated with both.

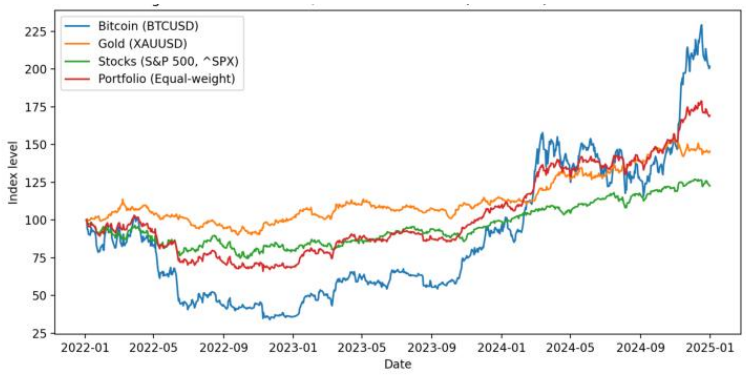

Figure 1. Indexed Prices / Cumulative Returns (Base = 100), 2022–2024

This figure overlays the indexed trajectories of Bitcoin, gold, stocks, and the equal-weight portfolio, illustrating differences in volatility clustering and cumulative performance paths.

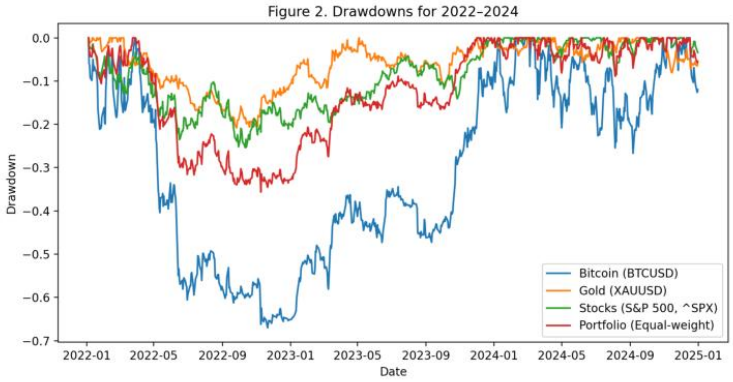

Figure 2. Drawdowns, 2022–2024

This figure plots drawdown series to display downside depth and recovery duration across assets and the portfolio. Put plainly, the data show that Bitcoin delivers the highest annualized mean return in this window, but also carries by far the highest volatility and the deepest drawdown. Gold is the most stable among the three (lower volatility and shallower drawdowns), and stocks sit between gold and Bitcoin. When combined equally, the portfolio reduces volatility and tail risk compared with Bitcoin alone, but it does not eliminate large downside exposure because Bitcoin's downside episodes remain influential.

1. Risk concentration is evident in Bitcoin's downside behavior. Bitcoin exhibits a -67.02% maximum drawdown, far deeper than gold (-20.84%) and stocks (-25.38%). This implies that downside risk and recovery dynamics are heavily influenced by Bitcoin during adverse regimes.
2. Diversification reduces volatility but not proportionally to Bitcoin's risk. The equal-weight portfolio volatility is 22.89%, substantially lower than Bitcoin's 55.47%, indicating diversification

benefits; however, portfolio max drawdown remains sizable (-35.65%), showing that diversification does not fully neutralize severe downside episodes.

3. Tail risk differs materially across assets. Bitcoin's daily CVaR/ES at 95% is -7.59%, versus -1.99% for gold and -2.55% for stocks. Portfolio CVaR/ES is -3.12%, demonstrating risk reduction but also confirming that extreme-loss exposure remains meaningful in a blended portfolio.
4. Co-movement is stronger between Bitcoin and stocks than between Bitcoin and gold. The Bitcoin–Stocks correlation of 0.441 is notably higher than Bitcoin–Gold (0.116), implying that in this period Bitcoin behaves more like a risk-sensitive asset than a gold-like hedge.

These results directly support audit relevance: (i) where volatility and tail risk are higher (notably Bitcoin), valuation sensitivity and disclosure materiality increase; (ii) where drawdowns are deep and recovery is prolonged, investors' and regulators' focus on risk reporting typically intensifies; and (iii) where correlations indicate that a "diversifier" co-moves with equities, portfolio narratives must be consistent with evidence. In audit terms, the risk metrics suggest that the highest incremental audit attention should be allocated to valuation governance, disclosure specificity, and risk concentration associated with the most downside-sensitive component.

Governance and Audit-Control Implications Derived from Risk and Reporting Evidence

The third evidence set is the risk-to-audit mapping output, constructed by combining: (a) the reporting evidence map (Section 4.1) and (b) quantified risk behavior (Section 4.2). The "data" here are not interview quotes; instead, they are structured control priorities derived from measurable risk signatures (high volatility, deep drawdowns, and elevated tail risk) and from the asset-specific evidence chains that support existence, rights, and valuation. This produces a governance-and-audit matrix that identifies where stronger controls and audit responses are required in a multi-asset portfolio context.

Table 4 translates the combined evidence into an actionable governance and audit-response matrix. The intention is to show what control areas become critical when the portfolio includes an asset with substantially higher tail risk and drawdown severity.

Table 4. Governance and Audit-Control Matrix Informed by Results (2022–2024 Evidence)

Risk domain (evidence-driven)	Bitcoin: control priority	Gold: control priority	Stocks: control priority	Audit response emphasis
Custody / safeguarding	Highest priority (custody governance is a key evidence link)	Moderate priority (storage documentation integrity)	Moderate priority (custodian/broker confirmations)	Increase evidence reliability where custody chain is control-dependent
Valuation / price verification	Highest priority (tail risk + volatility amplify valuation sensitivity)	Moderate (benchmark linkage + quantity documentation)	Moderate (standard market observability)	Stronger valuation procedures and consistency checks for the most volatile component
Authorization & limits	High (to prevent risk concentration beyond stated policy)	Moderate	Moderate	Substantive testing rises if limit governance is unclear
Reconciliation & completeness	High (frequency and control discipline matter more under high volatility)	Moderate	Moderate	Expand reconciliation testing where misstatement risk is amplified
Third-party reliance	High (platform/custodian dependency increases evidence risk)	Moderate	Moderate	Greater use of corroborative evidence where reliance is higher
Disclosure governance	High (CVaR/drawdown evidence implies	Moderate	Moderate	Ensure disclosures reflect measured tail risk and

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	disclosure materiality)			concentration, not generic narratives

In straightforward terms, the governance result says: because Bitcoin exhibits materially higher volatility, drawdowns, and tail risk in 2022–2024, governance and audit focus must become more intensive around the custody and valuation evidence chain for that component. Gold and stocks still require proper controls, but the quantitative evidence indicates that the portfolio's downside profile is most sensitive to the asset with the largest tail risk and drawdown severity.

1. Where tail risk is highest, disclosure governance becomes more material. Bitcoin's CVaR/ES (-7.59% daily) indicates that extreme downside events are more severe; this elevates the importance of disclosures that clearly describe risk exposure, measurement basis, and risk management approach.
2. Deep drawdowns shift audit attention to impairment/valuation sensitivity and evidence robustness. A -67.02% drawdown signals that measurement sensitivity and stakeholder scrutiny can rise; governance must ensure the valuation process is disciplined and consistently applied.
3. Diversification does not eliminate the need for asset-specific controls. Even though portfolio volatility and tail risk drop relative to Bitcoin, the portfolio drawdown (-35.65%) remains large enough that governance cannot treat the portfolio as "low risk" without qualification.
4. Correlation structure challenges simplistic hedging narratives. With Bitcoin more correlated to stocks than to gold in this sample, governance over investment policy statements and disclosures should ensure that diversification claims match observed co-movement.

Section 4.3 converts empirical risk evidence into audit and governance implications: the results support a multi-asset audit approach that is risk-weighted (allocating more audit attention where volatility, drawdown, and tail risk are materially higher) and evidence-chain sensitive (allocating more control evaluation where custody and valuation depend on governance). This strengthens the practical contribution of the study: a multi-asset portfolio is not only diversified in return space, but also diversified in audit risk drivers, requiring differentiated audit responses for Bitcoin, gold, and stocks.

DISCUSSION

This study investigates a multi-asset investment portfolio consisting of Bitcoin, gold, and stocks during the 2022–2024 period and examines its implications from the perspectives of financial reporting, risk, and governance. The results demonstrate a clear differentiation in risk characteristics across asset classes. Bitcoin exhibits the highest annualized return, but this return is accompanied by substantially higher volatility, deeper maximum drawdowns, and more severe tail risk compared to gold and stocks. Gold shows the most stable risk profile with relatively low volatility and shallower drawdowns, while stocks occupy an intermediate position. When the three assets are combined in an equal-weight portfolio, overall volatility and tail risk decline relative to Bitcoin alone, indicating diversification benefits; however, the portfolio still experiences a sizeable maximum drawdown, suggesting that diversification does not fully eliminate downside exposure when one asset dominates tail-risk behavior. Correlation analysis further shows that Bitcoin is more closely associated with stock market movements than with gold, indicating that during this period Bitcoin behaves more like a risk-sensitive asset rather than a defensive hedge.

These findings can be explained by fundamental differences in economic substance and market microstructure across the three asset classes. Bitcoin's high volatility and extreme drawdowns reflect its sensitivity to shifts in global liquidity, speculative trading behavior, and rapid repricing mechanisms within digital asset markets. Gold, in contrast, benefits from long-established commodity market structures and is often treated as a store of value during periods of uncertainty, which tends to dampen volatility. Stocks, represented by a broad market index, incorporate macroeconomic expectations and corporate earnings risk, resulting in moderate volatility relative to Bitcoin. The reduction in portfolio risk arises from imperfect correlations among assets; however, because Bitcoin contributes disproportionately large negative returns during stress periods, portfolio-level downside risk remains significant. This explains why tail-risk measures such as CVaR/Expected Shortfall remain elevated even after diversification, reinforcing the importance of downside-focused risk metrics beyond traditional volatility measures.

When compared with prior studies, the empirical patterns observed in this research are broadly consistent with the literature showing that Bitcoin may provide diversification benefits under certain conditions but

that these benefits are unstable and regime-dependent (Guesmi et al., 2019). The finding that Bitcoin exhibits stronger co-movement with stocks than with gold aligns with more recent evidence on volatility spillovers and cross-market linkages between cryptocurrencies and traditional financial markets (Terraza et al., 2024; Zhang et al., 2024). At the same time, earlier crisis-based research suggests that gold and Bitcoin can play complementary roles depending on the nature of the shock (Oosterlinck et al., 2023). The contribution of this study lies not in redefining Bitcoin as a universal hedge, but in demonstrating through drawdown and CVaR/Expected Shortfall analysis that downside risk is heavily concentrated in the digital asset component and that this concentration has direct consequences for audit, reporting, and governance. Unlike portfolio studies that focus solely on asset allocation, and audit studies that discuss crypto assurance challenges in isolation, this research integrates quantitative risk evidence with a structured audit and governance lens for a clearly defined multi-asset setting.

From a financial reporting and audit perspective, the results imply that materiality and disclosure judgments should be informed by empirically observed risk behavior rather than by asset labels alone. Where one asset exhibits extreme volatility and tail risk, reporting credibility depends not only on the numerical measurement outcome but also on the governance of valuation inputs and the transparency of risk disclosures. In this context, Bitcoin requires heightened attention to valuation governance, consistency of price sourcing, and disclosure of downside and concentration risk. Audit implications follow directly from this evidence. Severe drawdowns and high CVaR values increase sensitivity to valuation and disclosure misstatements, while the reliance on digital custody and third-party platforms amplifies risks related to existence and rights and obligations. These findings reinforce prior audit literature emphasizing that crypto assets extend the traditional audit risk space and require more control-dependent evidence than conventional investments (Vincent & Wilkins, 2020; Hsieh & Brennan, 2022).

A broader reflection on the results highlights both the functional and dysfunctional aspects of multi-asset investment strategies. On the functional side, diversification across Bitcoin, gold, and stocks reduces overall portfolio volatility and tail risk compared with holding Bitcoin alone, supporting the rationale for multi-asset allocation as a risk-mitigation strategy. On the dysfunctional side, diversification may create a false sense of security if decision-makers focus only on average returns or volatility while underestimating tail risk and drawdown persistence. The results also show that governance and assurance complexity increases as portfolios incorporate assets with heterogeneous evidence chains and operational dependencies. Without strong governance, the potential benefits of diversification may be offset by increased reporting and assurance risk. Moreover, the observed correlation structure challenges simplistic narratives that treat Bitcoin as analogous to gold; if disclosures and investment policies do not reflect actual co-movement with equity markets, informational risk for users of financial statements may increase.

Based on these findings, several practical actions are recommended. Entities holding multi-asset portfolios should adopt risk-informed reporting and disclosure practices that explicitly reflect tail risk and drawdown evidence rather than generic descriptions of diversification. Valuation governance policies should be formalized, particularly for assets with high volatility, to ensure consistent price sourcing, measurement timing, and verification procedures. Governance frameworks should prioritize custody and safeguarding controls for digital assets, including authorization limits, segregation of duties, reconciliation routines, and oversight of third-party service providers. From an assurance standpoint, auditors should implement a risk-weighted audit strategy that allocates audit effort in proportion to tail-risk contribution, valuation uncertainty, and evidence-chain fragility. Such an approach aligns audit procedures with where misstatement risk is most likely to be material and enhances the relevance of assurance in increasingly complex multi-asset investment environments.

CONCLUSION

This study provides a multi-asset audit perspective on Bitcoin, gold, and stocks over the 2022–2024 period by integrating market risk evidence with financial reporting and governance implications. The main lesson from the findings is that return potential and auditability are not symmetric across assets: Bitcoin produced the highest annualized mean return in the sample, but it also carried materially higher volatility, deeper drawdowns, and more severe tail risk than gold and stocks. Gold exhibited the most stable risk profile, while stocks showed an intermediate risk pattern. Although an equal-weight portfolio reduced volatility and tail risk relative to Bitcoin alone, the portfolio still experienced a meaningful maximum drawdown, indicating that diversification mitigates but does not eliminate downside exposure when a high-tail-risk

component remains present. In practical terms, these results imply that portfolio-level diversification should not lead to uniform reporting or assurance treatment; instead, risk concentration and evidence-chain differences require differentiated audit attention, particularly toward valuation governance, disclosure specificity, and custody/existence assurance for the digital asset component.

The scientific contribution of this research lies in its integrated framework that connects cross-asset risk measurement to audit and governance requirements within a clearly defined observation window (2022–2024). Unlike studies that focus primarily on portfolio allocation outcomes or those that discuss crypto assurance issues in isolation, this study combines (i) downside-focused risk metrics (including drawdowns and CVaR/Expected Shortfall), (ii) dependence evidence across asset classes, and (iii) an audit-oriented reporting and control mapping to propose a risk-weighted auditing logic for multi-asset investments. This approach contributes a structured way to translate empirical risk signatures into audit planning priorities and governance control emphasis, strengthening the linkage between investment analytics and the reliability of financial reporting for heterogeneous asset portfolios.

Several limitations should be acknowledged. First, the analysis uses a single equity proxy (the S&P 500) and an equal-weight portfolio rule; alternative proxies, regional equity markets, or dynamic rebalancing strategies could yield different dependence structures and risk concentrations. Second, the study relies on historical (non-parametric) VaR and CVaR estimates; future research could incorporate parametric or simulation-based approaches, stress testing under defined scenarios, and regime-switching dependence models to better capture structural breaks. Third, the governance and audit implications are derived from an evidence-chain mapping rather than tested using firm-level internal control data or audited financial statements; subsequent studies could validate the framework through case studies, archival disclosure analysis, or field evidence from audit engagements involving multi-asset holdings. Expanding the scope in these directions would improve generalizability and provide deeper insight into how multi-asset investment auditing practices evolve as digital assets become more embedded in financial reporting environments.

REFERENCES

Parrondo, L. (2023). Cryptoassets: Definitions and accounting treatment under the current International Financial Reporting Standards framework. Intelligent Systems in Accounting, Finance and Management, 30(4), 208–227. https://doi.org/10.1002/isaf.1543

Engle, R. (2002). Dynamic conditional correlation: A simple class of multivariate generalized autoregressive conditional heteroskedasticity models. Journal of Business & Economic Statistics, 20(3), 339–350. https://doi.org/10.1198/073500102288618487

Guesmi, K., Saadi, S., Abid, I., & Ftiti, Z. (2019). Portfolio diversification with virtual currency: Evidence from bitcoin. International Review of Financial Analysis, 63, 431–437. https://doi.org/10.1016/j.irfa.2018.03.004

Hsieh, S. F., & Brennan, G. (2022). Issues, risks, and challenges for auditing crypto asset transactions. International Journal of Accounting Information Systems, 46, 100569. https://doi.org/10.1016/j.accinf.2022.100569

Oosterlinck, K., Reyns, A., & Szafarz, A. (2023). Gold, bitcoin, and portfolio diversification: Lessons from the Ukrainian war. Resources Policy, 83, 103710. https://doi.org/10.1016/j.resourpol.2023.103710

Procházka, D. (2018). Accounting for Bitcoin and other cryptocurrencies under IFRS: A comparison and assessment of competing models. The International Journal of Digital Accounting Research, 18, 161–188. https://doi.org/10.4192/1577-8517-v18_7

Rockafellar, R. T., & Uryasev, S. (2000). Optimization of conditional value-at-risk. Journal of Risk, 2(3), 21–41. https://doi.org/10.21314/JOR.2000.038

Stooq. (n.d.). Historical price data (BTCUSD, XAUUSD, ^SPX) [Data set]. Stooq.com. https://stooq.com/

Terraza, V., Boru İpek, A., & Rounaghi, M. M. (2024). The nexus between the volatility of Bitcoin, gold, and American stock markets during the COVID-19 pandemic: Evidence from VAR-DCC-EGARCH and ANN models. Financial Innovation, 10(1), Article 1. https://doi.org/10.1186/s40854-023-00520-3

Vincent, N. E., & Wilkins, A. M. (2020). Challenges when auditing cryptocurrencies. Current Issues in Auditing, 14(1), A46–A58. https://doi.org/10.2308/ciia-52675

Zhang, X., Chen, Z., & Wang, S. (2024). A study of the impact of cryptocurrency price volatility on the stock and gold markets. Finance Research Letters, 69(Part A), 106114. https://doi.org/10.1016/j.frl.2024.106114