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PAYMENT SYSTEMS: IMPACT ON AUDIT AND TAX
EXPENSES OF COMPANIES (ІНТЕГРАЦІЯ
КРИПТОВАЛЮТ В ПЛАТІЖНІ СИСТЕМИ: ВПЛИВ НА
АУДИТОРСЬКІ ТА ПОДАТКОВІ ВИТРАТИ КОМПАНІЙ)»**

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INTRODUCTION

The rise of cryptocurrencies has transformed the global financial ecosystem, with companies increasingly integrating digital assets into their payment systems. As businesses adopt cryptocurrencies, they face new challenges related to financial auditing and tax compliance. Consequently, traditional financial oversight mechanisms must adapt to decentralized, pseudonymous, and rapidly evolving crypto transactions. While existing research explores the economic and security implications of cryptocurrencies, limited studies focus on their direct impact on audit and tax expenses. Therefore, understanding these implications is crucial for companies, auditors, and regulatory bodies seeking to ensure compliance and financial transparency.

Moreover, the increasing adoption of cryptocurrencies in corporate payment systems presents a fundamental challenge for auditors and tax authorities. Due to the decentralized nature of blockchain transactions, companies must navigate a complex landscape of financial oversight, regulatory compliance, and risk assessment. Since traditional accounting frameworks are not fully equipped to address the complexities of cryptocurrency transactions, this often leads to potential inconsistencies in financial reporting and regulatory enforcement. Furthermore, tax authorities struggle to classify and regulate cryptocurrency-based transactions, creating uncertainty in compliance costs for businesses. In response to this gap, this study aims to bridge the existing knowledge void by providing empirical evidence on how cryptocurrency adoption affects audit and tax expenses, thereby addressing a pressing issue in modern financial management.

To achieve this, the **research sets out** to evaluate the impact of cryptocurrency integration on audit and tax expenses. Specifically, the study will analyze whether cryptocurrency adoption significantly affects audit expenses, investigate how cryptocurrency usage influences tax compliance costs, and assess the role of regulatory environments in moderating these effects.

More precisely, the **object** of this study is the process of integrating cryptocurrencies into corporate payment systems, whereas the **subject** of the study is the impact of cryptocurrency adoption on financial oversight, particularly in auditing and

taxation.

In terms of **methodology**, the study employs a quantitative research approach using panel data analysis. The primary methodology includes econometric modeling through regression analysis to measure the relationship between cryptocurrency adoption and audit/tax expenses, along with panel data analysis using fixed and random effects models to control for firm-specific characteristics over time. Additionally, statistical testing, including Hausman tests to determine the best econometric model and Durbin-Watson tests to check for autocorrelation, will be conducted to ensure robustness in the findings.

Furthermore, the research relies on multiple data sources, including financial statements of companies that have adopted cryptocurrencies, cryptocurrency market data from sources such as CoinMarketCap, regulatory documents from government agencies and financial authorities, as well as academic literature and empirical studies on cryptocurrency auditing and taxation.

Additionally, this study provides valuable insights for businesses, auditors, and policymakers on managing audit and tax expenses related to cryptocurrency transactions. More importantly, the findings will help companies navigate regulatory challenges, improve compliance strategies, and optimize financial management in the evolving digital economy.

Ultimately, this research expands existing knowledge by introducing empirical evidence on the financial costs associated with cryptocurrency adoption. Unlike prior studies that focus on macroeconomic impacts, this study quantifies direct effects on audit and tax expenses, incorporating regulatory factors as moderating variables. While existing literature has explored either audit or tax implications in isolation, few have adopted a unified econometric approach encompassing both dimensions simultaneously, especially across a broad international sample. As a result, the findings will contribute to the academic discourse on cryptocurrency regulation, auditing standards, and corporate financial transparency across different jurisdictions.

Keywords: cryptocurrency adoption, corporate payment systems, audit expenses, tax compliance, blockchain regulation, financial oversight, panel data analysis

THEORETICAL AND EMPIRICAL PERSPECTIVES ON CRYPTOCURRENCY INTEGRATION IN CORPORATE FINANCE

1.1 Theoretical Background of Cryptocurrencies and Payment Systems

Understanding the theoretical foundation of cryptocurrencies and corporate payment systems is essential for analyzing their integration and impact on companies' expenses. A strong comprehension of the fundamental principles, terminology, and technological foundations provides a basis for evaluating the implications of cryptocurrencies within corporate payment infrastructures. This section explores the evolution of cryptocurrencies, their market structure, and the mechanisms of corporate payment systems, laying the groundwork for further discussion on their integration and associated challenges.

1.1.1 Cryptocurrency origin and terminology

In the 2000s, e-commerce on the Internet was entirely dependent on financial institutions as trusted third parties for processing electronic payments. The classical online payment system had inherent trust and transaction transparency issues. For instance, users had no direct access to verify whether a transaction was completed or altered, relying solely on centralized payment services that could delay processing or reverse transactions without the consent of both parties. Additionally, third-party intermediation prevented users from bypassing additional costs, thereby obstructing the existence of a convenient payment processing method that could compete with traditional cash payment methods. There was a need to search for new forms of secure information processing and data distribution on the network [30].

To create a new practical method of online transactions based on cryptographic proof, an individual or group of individuals under the pseudonym Satoshi Nakamoto developed a technology for a distributed database in 2008 that stored an ordered chain of blocks, which constantly grew longer. This system allowed for payments to be made

between two parties without the intervention of a third party that would incur all additional costs and could handle funds at the time of the transaction [40].

This technology was named “blockchain” and served as the foundation for the creation of the cryptocurrency Bitcoin, the first widely adopted digital currency that did not rely on a centralized server. Instead, Bitcoin had an independent blockchain file. The accessibility of such a file allowed for the tracking of every transaction [9].

However, Satoshi Nakamoto was not the first person to implement the idea of payments without double spending. In 1982, American inventor and cryptographer David Chaum described every element of blockchain functionality in his work, except for cryptographic proof [6]. David Chaum is credited with inventing the blockchain and cryptocurrency in his 1982 dissertation. Later that year, he created eCash, a platform that allowed users to anonymously perform financial transactions. In 1995, his company DigiCash created the first digital currency based on the application, which adopted his name – eCash. For three years, this currency operated in one of the American banks, but in 1998, the company went bankrupt and sold all its assets [38].

Therefore, the first person to invent the principle of a cryptographic database was David Chaum, who published his work “Computer Systems Established, Maintained, and Trusted by Mutually Suspicious Groups” in 1982 [7]. Then, in 2008, Satoshi Nakamoto developed a flawless Proof of Work (PoW) system and named it blockchain, based on which the first flawless digital currency Bitcoin was created.

The term “cryptocurrency” gained widespread use after the emergence of the digital payment system named Bitcoin. However, there is no universally accepted definition of cryptocurrency. Instead, several fundamental characteristics distinguish cryptocurrencies traded on exchanges:

- Transactions are recorded on a blockchain or other distributed ledger technology.
- Absence of a central governing authority.
- Transactions are linked to cryptographic addresses rather than personal identities, ensuring partial privacy.

- Validation of transactions typically relies on cryptographic protocols, such as proof-of-work (PoW) or proof-of-stake (PoS) systems.

Regarding the etymology of the term itself, “cryptocurrency” is derived from the words “crypto” (short for cryptography, referring to secure communication techniques) and “currency” (a medium of exchange). Linguistically, it suggests “encrypted money” or “cryptographically secured currency”. Moreover, the core of cryptocurrency functionality lies in blockchain technology, which ensures decentralization, security, and transparency of transactions [33].

Due to its decentralized nature, Bitcoin lacks clear regulatory bodies, and it is not determined by market forces. The US dollar is commonly accepted as the exchange currency for cryptocurrencies. Furthermore, trading, or financial transactions with cryptocurrencies, are often executed on cryptocurrency exchange platforms, where the exchange rate dependency is unknown, although it is declared to be dependent on the volume of buying or selling. Thus, during a surge in demand, cryptocurrency prices rise, but afterward, they may fall, leading to a so-called “crypto winter”, a term describing a period of decline following earlier positive dynamics and significantly reduced demand [39].

The popularity of cryptocurrency is determined by its market capitalization. Beyond Bitcoin, the landscape features a range of high-capitalization protocol-level cryptocurrencies such as Ethereum, BNB, Solana, and Cardano. These assets are often referred to as platform or infrastructure coins, as they provide the foundational architecture for decentralized applications (dApps), smart contracts, and financial services. Their independent blockchains and extensive development communities distinguish them from simpler alternative tokens. In contrast, a second class of cryptocurrencies, commonly termed “true altcoins”, comprises digital assets that, while built on independent or forked blockchain infrastructures, typically serve more niche or speculative purposes. Examples include memecoins such as Dogecoin and Shiba Inu, or privacy-focused tokens like Monero, which prioritize anonymity and untraceability. A third major segment of the market is occupied by stablecoins, such as Tether (USDT) and USD Coin (USDC), which are typically centralized and backed by fiat reserves. These

instruments are designed to reduce price volatility and enhance liquidity, making them especially attractive for transactional use and as temporary stores of value. In terms of market capitalization, Bitcoin remains the absolute leader, valued at approximately 1.65 trillion US dollars, which can be observed on infographic 1.1.



Graph 1.1 – All-time Bitcoin Market Capitalization

(source: CoinMarketCap Website [2])

To conclude, cryptocurrency represents a decentralized digital medium of exchange defined by its blockchain-based transaction record, absence of central governing authority, pseudonymous transaction content, and cryptographic verification mechanisms – characteristics that distinguish it from traditional financial instruments while enabling peer-to-peer transactions without intermediary costs.

1.1.2 Corporate Payment Systems

Corporate payment systems refer to the financial infrastructures and mechanisms that facilitate internal and external financial transactions within businesses. These systems ensure the smooth processing of payments between companies, suppliers, customers, and financial institutions. They contain various technologies, regulations, and financial instruments designed to enhance efficiency, security, and compliance [27].

Payment processing networks enable the authorization, clearing, and settlement of transactions. These include credit card networks such as Visa and MasterCard, Automated

Clearing House (ACH) systems for electronic fund transfers, and Real-Time Gross Settlement (RTGS) systems for high-value transactions. Businesses rely on merchant accounts provided by acquiring banks to accept electronic payments, where the acquiring bank processes transactions and transfers funds accordingly. These networks have evolved significantly with the development of digital payment infrastructures, as outlined by Boel (2019), who examined the historical evolution of payment systems and their impact on economic transactions [4].

Payment gateways serve as intermediaries between businesses and financial institutions, securely transmitting payment information for authorization and processing. These gateways are especially crucial for e-commerce and digital transactions. Many corporations integrate payment systems within their Enterprise Resource Planning (ERP) platforms, such as SAP, Oracle Financials, and Microsoft Dynamics, to streamline financial operations, automate invoicing, and enhance cash flow management [13].

To mitigate risks, corporate payment systems adhere to regulatory standards such as the Payment Card Industry Data Security Standard (PCI DSS) and anti-money laundering (AML) regulations. Tokenization and encryption techniques help secure sensitive financial data, ensuring compliance with industry regulations and reducing fraud risks [4].

Corporate payment transactions are categorized into internal and external payments. Internal payments include payroll disbursements, inter-company fund transfers, and employee reimbursements, while external payments cover supplier and vendor payments, customer refunds, and cross-border transactions via international payment networks. The role of payment systems in global economic transactions has been analyzed by Klein (2024), who examined how payment infrastructures have transformed from economic facilitators into geopolitical tools [29].

Emerging trends in corporate payment systems are reshaping financial operations. The integration of blockchain technology and cryptocurrencies offers decentralized, secure, and cost-effective alternatives to traditional transactions. Real-time payment (RTP) systems enhance liquidity management and transaction speed, reducing reliance on traditional banking hours. Additionally, artificial intelligence and automation improve

transaction monitoring, fraud detection, and reconciliation processes, boosting overall operational efficiency [13].

In summary, corporate payment systems are integral to the financial health and operational efficiency of businesses. The continuous integration of advanced technologies has led to the adoption of solutions capable of processing cryptocurrency transactions. Companies have incorporated cryptocurrency-compatible payment systems, enabling faster transactions, reduced costs, and enhanced financial transparency. This integration has improved the efficiency of corporate financial management, allowing businesses to operate more seamlessly in an increasingly digital economy.

1.2 Integration of Cryptocurrencies in Corporate Payment Systems

Corporate payment systems are essential for businesses to conduct financial transactions efficiently. These systems traditionally rely on centralized financial institutions, credit card networks, and electronic fund transfers to conduct business payments. However, with the emergence of cryptocurrencies, companies are increasingly exploring their integration into corporate payment infrastructures.

Several studies have examined the implications of integrating cryptocurrencies into corporate payment systems. Research suggests that businesses adopting cryptocurrencies can benefit from reduced transaction fees, faster cross-border transactions, and increased financial transparency. For instance, Chen (2025) discusses how digital currencies like Bitcoin and Ethereum can streamline cross-border payments, making transactions faster and more cost-effective [8]. Additionally, the decentralized nature of cryptocurrencies mitigates the risks associated with chargebacks and fraud, as transactions are irreversible once confirmed on the blockchain, reducing the burden of payment disputes for businesses. Some studies have also highlighted the potential for smart contract self-executing agreements on the blockchain to further automate and streamline corporate payment processes, minimizing human intervention and administrative overhead [28].

Despite these advantages, integrating cryptocurrencies into corporate payment systems presents challenges, including price volatility, regulatory uncertainty, and tax

implications. Many companies remain hesitant due to the fluctuating value of cryptocurrencies, which can impact financial planning and audit processes. The volatility of assets like Bitcoin and Ethereum introduces risks in maintaining stable financial records and can necessitate frequent adjustments in accounting practices. To address this, some firms have turned to stablecoins – cryptocurrencies connected to fiat currencies to minimize valuation risks while benefiting from blockchain technology. Furthermore, regulatory compliance is a significant consideration, as governments impose various tax and reporting requirements on cryptocurrency transactions. In Ukraine, for example, the legal regulation of cryptocurrency taxation remains a complex issue, with ongoing debates about how to classify and tax digital assets [34].

Large corporations such as Tesla, Microsoft, and PayPal have already experimented with cryptocurrency payments, demonstrating a growing trend toward digital asset integration. Studies have examined the motivations behind such adoption, citing factors such as consumer demand, innovation positioning, and the potential for cryptocurrencies to serve as an inflation hedge in volatile economic conditions [47]. Moreover, businesses leveraging blockchain-based payment solutions, such as stablecoins and central bank digital currencies (CBDCs), are exploring ways to mitigate volatility while maintaining the benefits of cryptocurrency payments. CBDCs have gained attention as government-backed digital assets that could integrate seamlessly with corporate payment infrastructures while addressing regulatory concerns [1].

As the landscape evolves, ongoing research focuses on improving regulatory frameworks, enhancing security measures, and addressing the audit and tax implications of cryptocurrency transactions within corporate payment systems. This area remains a key topic for businesses seeking to optimize payment efficiency while ensuring compliance with financial regulations.

1.3 Implications for Auditing

The integration of cryptocurrencies into corporate payment systems presents significant implications for auditing, fundamentally altering financial processes. Auditors

face new challenges in verifying cryptocurrency transactions, assessing valuation methodologies, and addressing risks related to fraud and financial misstatements. As businesses increasingly adopt digital assets, auditors must adapt their methodologies to accommodate the complexities of decentralized and pseudonymous transactions recorded on blockchain networks.

One of the main auditing challenges is transaction verification. Unlike traditional payment systems that rely on centralized financial institutions, cryptocurrency transactions are recorded on distributed ledgers, requiring auditors to use blockchain explorers or specialized tools to track and validate transactions. While blockchain's transparency allows for real-time access to transaction history, the pseudonymous nature of digital wallets complicates the identification of transaction counterparties, increasing the risk of money laundering and fraudulent activities. Companies using cryptocurrencies must implement stringent internal controls to maintain transaction integrity and ensure compliance with anti-money laundering (AML) regulations [20].

However, verifying these transactions effectively requires a deep understanding of blockchain technology, which many traditional audit teams may lack. The variety of digital assets, and the rapid evolution of the crypto market necessitate auditors to have a deep understanding of these areas. Without this expertise, auditors may struggle to accurately assess the existence, valuation, and ownership of digital assets, increasing the risk of undetected misstatements or fraud. The U.S. Securities and Exchange Commission (SEC) highlighted this issue in its action against the auditor of the failed cryptocurrency exchange, noting that the audit firm lacked the necessary understanding of the crypto market and assembled an audit team without adequate competence and knowledge. To address this challenge, audit firms must invest in training and developing their personnel's competencies related to digital assets [17].

Another critical issue in auditing cryptocurrency transactions is valuation. The application of accounting standards, particularly the International Financial Reporting Standards (IFRS) and International Accounting Standards (IAS), is essential in ensuring consistency and accuracy in financial reporting for cryptocurrency transactions. IFRS, developed by the International Accounting Standards Board (IASB), is a globally

recognized framework that ensures transparency, comparability, and efficiency in financial reporting across different jurisdictions [25]. IAS, which predates IFRS, consists of a set of accounting principles that provide specific guidance on various financial transactions, including intangible assets and inventory valuation [24].

Since cryptocurrencies are highly volatile, determining their fair value at any given time can be complex. IFRS 13 requires companies to report assets at their market value on the balance sheet date, but frequent price fluctuations challenge auditors in verifying consistency and reliability in valuations [23]. Businesses mitigate volatility risks by using stablecoins or immediately converting cryptocurrencies into fiat currencies, but those that hold digital assets must adopt appropriate accounting policies to ensure accurate financial reporting. Auditors must evaluate whether companies apply the correct valuation techniques, whether they use cost-based, fair-value, or revaluation models, and ensure compliance with accounting standards such as IAS 38 (Intangible Assets) or IAS 2 (Inventories), depending on the company's business model [22], [21].

The decentralized nature of cryptocurrencies also raises concerns regarding security and fraud prevention in audit engagements. Unlike traditional bank accounts, which benefit from regulatory protections, cryptocurrency holdings are stored in digital wallets that may be vulnerable to cyberattacks, private key theft, and unauthorized access. Auditors must assess a company's internal controls over wallet security, including multi-signature authentication, cold storage solutions, and incident response protocols. Furthermore, given that cryptocurrency transactions are irreversible, auditors must evaluate how businesses mitigate risks related to transaction errors, fraud, or potential misappropriation of assets.

In response to these challenges, audit firms are increasingly adopting blockchain analytics tools and accounting techniques to enhance their auditing capabilities for cryptocurrency transactions. Advanced data analytics enable auditors to track fund movements across blockchain networks, detect suspicious activities, and assess compliance with financial regulations. Additionally, the rise of regulatory technology (RegTech) solutions is helping businesses automate compliance monitoring and reporting, reducing the risk of audit discrepancies [46].

As the adoption of cryptocurrencies in corporate payment systems grows, auditing standards and best practices will need to evolve accordingly. One of the most pressing areas of concern is tax compliance. Since tax laws are intertwined with financial reporting requirements, auditors play a crucial role in ensuring that businesses not only report cryptocurrency transactions accurately but also comply with jurisdiction-specific tax regulations.

1.4 Taxation Challenges and Compliance Issues

As cryptocurrencies become increasingly integrated into corporate payment systems, they introduce a range of taxation challenges and compliance issues. The decentralized and pseudonymous nature of digital assets complicates tax classification, leading to significant regulatory gaps. Businesses must navigate evolving legal frameworks that vary across jurisdictions, making compliance a complex and costly endeavor.

1.4.1 Legal Frameworks for Cryptocurrency Taxation

The taxation of cryptocurrencies remains a contentious issue due to their unique characteristics and the absence of a universally accepted regulatory approach. While some jurisdictions classify cryptocurrencies as property, others treat them as financial assets or even as a form of legal tender. The differences in classification affect how businesses account for cryptocurrency transactions, determine taxable events, and report earnings to tax authorities.

In the United States, the Internal Revenue Service (IRS) classifies cryptocurrencies as property for tax purposes. This means that every transaction involving a digital asset may trigger capital gains tax obligations, requiring companies to track the acquisition cost and sale price of each transaction [26]. Similarly, the United Kingdom's HM Revenue & Customs (HMRC) treats cryptocurrencies as assets subject to capital gains tax but also applies different tax treatments based on whether they are held for investment or business

purposes [19]. The European Union lacks a unified regulatory framework, leaving taxation policies to individual member states, further complicating compliance for multinational corporations [15].

In Ukraine, cryptocurrency regulation has undergone significant development in recent years. The country took a major step forward with the enactment of the “Law on Virtual Assets” in 2022, which legally recognized cryptocurrencies and established a regulatory framework under the supervision of the National Securities and Stock Market Commission. While this law laid the foundation for integrating digital assets into the economy, taxation remains an evolving challenge. Currently, cryptocurrency transactions in Ukraine are subject to a 5% tax on personal income derived from digital assets, with businesses facing corporate income tax rules similar to those for traditional financial assets. The government is also working on additional regulatory measures to align with European Union standards, aiming to provide greater legal clarity for businesses operating in the crypto space [32].

Beyond classification, a major challenge in cryptocurrency taxation lies in transaction traceability and valuation. Given the volatility of cryptocurrencies, determining fair market value at the time of a transaction is complex. Companies must adopt robust accounting practices to ensure accurate reporting, but inconsistencies in regulatory guidelines often lead to discrepancies in financial statements. The application of anti-money laundering (AML) and know-your-customer (KYC) laws also adds to compliance burdens, requiring businesses to maintain detailed transaction records to satisfy tax authorities [5].

Moreover, certain jurisdictions impose indirect taxes, such as value-added tax (VAT) or goods and services tax (GST), on transactions involving digital assets. This taxation is particularly complex due to the heterogeneous classification of cryptocurrencies across legal systems. For instance, in its 2015 landmark decision in Case C-264/14, the European Court of Justice ruled that transactions involving the exchange of Bitcoin for fiat currencies are exempt from VAT, recognizing Bitcoin as a means of payment similar to traditional currency. However, this ruling applies specifically to Bitcoin, and not necessarily to other crypto-assets, whose classification may differ

depending on their economic function or design. Consequently, some digital assets, particularly utility tokens or non-fungible tokens (NFTs), may still fall under VAT obligations when used in exchange for goods or services [16].

This lack of harmonization across tax regimes creates substantial compliance risks for multinational companies operating in diverse regulatory environments. Businesses may be required to simultaneously navigate conflicting obligations, being VAT-exempt in one jurisdiction while incurring VAT liabilities in another. The situation is further complicated in countries that apply differing rules for token issuance, exchange, and consumption.

Recent advancements in regulatory technology (RegTech) aim to assist businesses in managing cryptocurrency taxation. Blockchain analytics tools enable companies to track transactions, calculate tax liabilities, and generate reports for compliance purposes. However, the high costs associated with implementing such solutions pose additional financial burdens on businesses adopting digital assets [46].

Overall, the legal frameworks for cryptocurrency taxation remain fragmented, requiring companies to stay informed of jurisdiction-specific regulations. As regulatory bodies refine their approaches, businesses must adopt proactive tax strategies to mitigate compliance risks and optimize tax efficiency in the evolving digital economy.

1.4.2 Complexities in Tax Reporting and Compliance

Although cryptocurrencies offer innovative financial solutions, businesses operating in multiple jurisdictions face major obstacles in tax reporting and compliance. Each country applies different tax rules to digital assets, ranging from capital gains taxes to transaction levies and VAT, creating significant disparities in how companies handle tax obligations. Large multinational corporations such as Tesla and Microsoft must account for cryptocurrency transactions under different national tax codes, leading to increased administrative burdens and potential compliance risks.

One of the primary challenges in tax reporting is the shadow economy facilitated by cryptocurrencies. Due to their pseudonymous nature, digital assets are frequently used

in unregulated markets, enabling tax evasion and money laundering. Governments worldwide are strengthening enforcement mechanisms, requiring exchanges and financial institutions to implement robust tracking measures. However, businesses accepting cryptocurrency payments must still ensure compliance with tax laws, even when dealing with decentralized finance (DeFi) platforms that lack centralized oversight [36].

Additionally, determining the cost basis of cryptocurrencies is particularly complex for companies engaged in high-frequency trading, cross-border transactions, or decentralized finance activities. Unlike traditional assets, digital currencies can be acquired at different prices across multiple exchanges, making accurate tax calculations more difficult. Companies must use sophisticated blockchain analytics tools to reconcile transaction records, ensuring that capital gains and losses are reported correctly.

The volatility of cryptocurrency prices further complicates tax reporting. For example, if a company receives Bitcoin as payment for services rendered, the value of that Bitcoin may change drastically before the tax reporting period ends. This fluctuation can lead to discrepancies between recorded revenue and taxable income, requiring businesses to implement dynamic accounting strategies to remain compliant.

To address these challenges, regulators in countries such as the United States and Germany have introduced stringent reporting requirements for cryptocurrency transactions. Businesses must disclose digital asset holdings, report gains and losses, and in some cases, comply with anti-money laundering measures. The introduction of automated tax reporting solutions, such as those provided by blockchain compliance firms, is helping companies streamline their tax obligations, but these solutions often come at a high cost, particularly for smaller enterprises [10], [31].

As governments refine their approaches to cryptocurrency taxation, businesses must adopt proactive strategies to mitigate risks. This includes maintaining transparent financial records, implementing automated compliance tools, and staying informed about regulatory changes in the jurisdictions where they operate. By adopting a structured approach to tax reporting, companies can navigate the complexities of cryptocurrency taxation while ensuring compliance with evolving global standards.

1.5 Empirical Studies on the Impact of Cryptocurrency Adoption on Audit and Tax Expenses

The integration of cryptocurrencies into corporate payment systems significantly affects financial oversight mechanisms, particularly audit and tax expenses. This subsection systematically reviews empirical studies related to cryptocurrency payment adoption and its implications for corporate auditing and taxation. The reviewed literature is structured based on three key dimensions: methodological complexity (basic descriptive studies versus advanced econometric approaches), geographical context (developed versus developing countries), and the nature of payment innovation studied (cryptocurrency versus other innovative payment systems).

Several researchers have analyzed how cryptocurrencies influence audit practices and associated costs. Huang et al. (2024) conducted an advanced econometric analysis based on disclosures in 10-K filings of U.S. companies. They found that blockchain disclosures significantly correlate with increased perceived audit risk, which consequently raises audit fees. This comprehensive econometric approach is robust, employing multiple regression models and sensitivity analyses. However, its limitation lies in the exclusive focus on the U.S., a developed regulatory environment, and its exclusion of tax expense implications, thus limiting comprehensive insights into the broader financial impact on companies [20].

Similarly, Chen (2025) employed regression models to analyze financial systems integrating cryptocurrencies, indicating higher auditing complexities due to the valuation volatility of digital currencies. The research effectively highlighted the challenges but lacked a deeper exploration of specific accounting standards such as IFRS 13, which directly impacts fair-value measurement practices [8].

From a taxation perspective, Meling et al. (2024) presented empirical evidence on crypto-related tax evasion, using a dynamic stochastic general equilibrium (DSGE) model. Their analysis incorporates heterogeneous agents and simulates behavioral responses to taxation and enforcement policies, allowing them to quantify the potential compliance costs and welfare implications associated with cryptocurrency adoption, but

authors predominantly utilized data from developed European countries, limiting insights into developing nations with potentially weaker regulatory frameworks [36].

The literature addressing payment innovations outside cryptocurrencies also provides relevant insights. Klein (2024) explored traditional payment systems and new foreign policy influences, applying a descriptive analysis rather than econometric methods. While informative, Klein's study could benefit from empirical econometric validation to substantiate its theoretical claims about audit implications [12].

A study by Dubey (2022) conducted network analysis and bibliometric reviews of blockchain-based payment systems, providing comprehensive descriptive insights. Although the study offers a strong theoretical foundation, its lack of quantitative analysis weakens its applicability to specific audit and tax cost analyses [13].

Cui et al. (2024) conducted an empirical panel study analyzing the relationship between cryptocurrency exposure and corporate tax avoidance among U.S. publicly traded firms. The study spanned from 2015 to 2023 and included companies directly involved in cryptocurrency transactions. Utilizing fixed effects regression models and robust standard errors, the authors assessed effective tax rates (ETR) as a proxy for tax avoidance behavior. The authors report that cryptocurrency-involved firms had an average ETR (Effective Tax Rate) of 14.2%, compared to 19.6% for non-involved firms, suggesting a reduction of over 5 percentage points in tax burden due to crypto exposure. The study's methodological rigor is a notable strength, as it includes several control variables for firm size, leverage, and profitability, and conducts robustness checks using alternative ETR measures. However, the focus of the study is restricted to the U.S. market, which benefits from comparatively high regulatory transparency and enforcement capabilities. As such, the implications may not fully translate to firms in developing or transitioning economies with weaker tax infrastructures. Moreover, the paper does not extend its analysis to audit cost implications, which could provide a more holistic understanding of financial oversight dynamics in crypto-integrated companies [12].

Marah et al. (2024) offered another empirical contribution by exploring the impact of cryptocurrency use on audit report lag in European public companies. Drawing on firm-level data from 15 EU member states between 2017 and 2022, the authors applied

both OLS regression and fixed effects panel modeling to examine whether Bitcoin adoption correlates with delays in the issuance of audit opinions. Their findings confirmed that firms utilizing cryptocurrencies had an average audit report lag of 72.87 days, compared to 65.14 days for non-adopting firms - an increase of 7.73 days that was statistically significant at the 5% level. The regression coefficient for the cryptocurrency dummy variable was 7.728, confirming a strong positive relationship between crypto adoption and delayed audit reporting. While the study presents meaningful evidence that cryptocurrency usage contributes to audit delays, it also has limitations. Most notably, the audit report lag is a proxy measure and does not directly quantify audit costs. The analysis also omits interaction terms for regulatory environments, which could provide further insights into how legal complexity moderates audit challenges. Nonetheless, Marah et al. (2024) offer one of the few cross-country empirical investigations into the operational audit implications of blockchain-based payment integration.

Existing literature frequently overlooks the context of developing countries, where regulatory frameworks and technological infrastructure differ from developed regions. For instance, Makurin (2021) conducted descriptive research on Ukraine's cryptocurrency accounting practices. While insightful, the study lacked econometric analysis and did not extensively address auditing costs or taxation challenges explicitly [34].

Table 1.1 Comparative Analysis of Empirical Studies on Cryptocurrency Adoption and Its Impact on Audit and Tax Expenses

Study	Methodological Approach	Strengths	Limitations
Huang et al. (2024)	Multivariate regression analysis	Comprehensive regression analysis, robust findings	Limited to audit expenses, no tax analysis

Continuation of **Table 1.1**

Study	Methodological Approach	Strengths	Limitations
Chen (2025)	Regression Analysis	Highlights volatility impact on audits	Insufficient exploration of IFRS 13 standards
Meling et al. (2024)	DSGE Model	Robust identification of tax evasion costs	Limited developing country insights
Klein (2024)	Descriptive	Strong theoretical insights on audit implications	Lacks empirical econometric analysis
Dubey (2022)	Descriptive	Broad theoretical overview	Lacks specific quantitative analysis
Makurin (2021)	Descriptive	Practical insights on accounting practices	No quantitative assessment of audit/tax expenses
Cui et al. (2024)	Panel Regression (FE)	Statistically robust, long series and multiple control variables	U.S.-only sample; does not examine audit expenses
Marah et al. (2024)	OLS & Fixed Effects	Cross-country perspective, strong control structure	Lacks audit/tax cost data and regulatory interaction analysis

(Source: made by the author)

Despite valuable contributions, the reviewed literature consistently highlights critical gaps. Specifically, Huang et al.'s study (2024), while methodologically robust, does not incorporate tax expenses – an essential component of overall financial compliance costs. Moreover, none of the existing studies combine a comprehensive econometric approach explicitly targeting both audit and tax expenses within a broader range of countries, particularly those experiencing increasing geopolitical tensions.

This study seeks to fill this gap by adopting a comprehensive econometric model,

employing panel data analysis with fixed and random effects models to evaluate both audit and tax expenses simultaneously. Additionally, interaction terms reflecting regulatory environments will further enhance the model's robustness and depth, distinguishing this research from existing studies.

The scientific novelty of this research lies in its combined econometric evaluation of audit and tax expenses, specifically considering regulatory interaction effects. Unlike previous studies such as Huang et al. (2024), which omit taxation impacts, this work will comprehensively analyze both expenses together, bridging an identified critical research gap.

RESEARCH METHODOLOGY

2.1 Research Design

This study employs an explanatory correlational research design to examine how cryptocurrency integration into corporate payment systems influences audit and tax expenses. By analyzing the relationships between cryptocurrency adoption, audit complexity, and tax reporting obligations, this approach enables a structured assessment of financial oversight challenges faced by companies.

The correlational approach is chosen to quantify the relationships among key variables, specifically how cryptocurrency adoption affects audit expenses, tax compliance costs, and whether regulatory environments moderate these relationships. This study will utilize econometric modeling and statistical tests to analyze company financial data, cryptocurrency market trends, and relevant regulatory frameworks.

The core analytical framework of this study is built upon the assumption that the adoption of cryptocurrencies in corporate payment systems introduces additional complexities in financial oversight, thereby influencing audit and tax expenses. Companies incorporating cryptocurrencies into their payment infrastructure must ensure compliance with evolving regulatory standards, leading to variations in audit and tax burdens. The correlation analysis aims to measure the strength and direction of these relationships.

The study hypothesizes that:

- H1: The integration of cryptocurrencies into payment systems has a statistically significant impact on audit expenses.

Cryptocurrencies introduce challenges such as transaction traceability, valuation, and security risks, which may necessitate more extensive audit procedures. Companies dealing with digital assets might require increased audit scrutiny, leading to higher audit costs. This hypothesis will be tested through regression models evaluating the correlation between cryptocurrency transactions and reported audit expenses.

- H2: Cryptocurrency adoption leads to an increase in tax reporting complexity and expenses.

Tax authorities across different jurisdictions have yet to establish uniform regulatory frameworks for cryptocurrency transactions. This results in inconsistent tax treatments, creating additional administrative burdens for companies. Increased tax reporting requirements and potential legal uncertainties may contribute to higher tax compliance costs. The hypothesis will be tested by examining the relationship between cryptocurrency transaction volumes and tax-related expenditures.

- H3: Regulatory environments moderate the relationship between cryptocurrency usage and compliance costs.

The regulatory stance of a jurisdiction is expected to shape the extent to which cryptocurrency adoption translates into corporate compliance costs. In countries with stringent digital-asset rules, firms must satisfy more detailed disclosures, undergo deeper audit procedures, and comply with closer tax scrutiny, driving up both external audit fees and tax-related expenses. Where regulatory frameworks are more permissive, the additional burden is lighter, so the cost premium tied to crypto transactions should be smaller. To test this hypothesis, interaction terms between regulatory environment indicators and cryptocurrency adoption indexes will be included in the regression models.

To empirically test these hypotheses, econometric modeling techniques will be employed, incorporating fixed and random effects models to control for firm-specific factors. A Hausman test will be conducted to determine whether a fixed or random effects model is the most appropriate choice based on data diagnostics. Interaction terms will be introduced to evaluate the moderating influence of regulatory environments on tax and audit expenses. The methodological framework will be further detailed in subsequent sections, outlining the variables, data sources, and statistical techniques that will ensure the robustness of the analysis.

By adopting this research design, the study contributes to the understanding of how cryptocurrency transactions interact with audit and tax compliance costs. The findings will offer insights into whether firms adopting cryptocurrencies face increased financial

burdens and how regulatory environments influence these outcomes. This approach ensures an attentive examination of the financial implications associated with cryptocurrency adoption while maintaining methodological robustness.

2.2 Data Collection Methods

To conduct a comprehensive analysis of the impact of cryptocurrency adoption on audit and tax expenses, this study relies on multiple sources of data. The selection of data collection methods is guided by the need to capture firm-level financial characteristics, cryptocurrency market trends, and regulatory conditions. By integrating financial statements, market data, and legal documentation, the study ensures a robust foundation for empirical analysis. The following subsections will detail the sources and types of data used, including company financial records, cryptocurrency transaction volumes, and relevant regulatory policies.

2.2.1 Company Financial Data

The collection of company financial data for this study was conducted through a systematic approach, ensuring reliability and accuracy in capturing audit and tax-related expenses. The primary sources of data were publicly available financial statements, including DEF-14A proxy statements and 10-K filings from the U.S. Securities and Exchange Commission (SEC) for U.S.-based companies, as well as mandatory public disclosures from corporate websites and regulatory agencies in Japan and Canada.

To provide a comprehensive analysis of the impact of cryptocurrency adoption on audit and tax expenses, a diverse selection of companies was made. Overstock.com was included as it was one of the first major retailers to accept Bitcoin as a payment method. The financial data for Overstock was obtained from its DEF-14A and 10-K filings, ensuring consistency across the years analyzed [41]. Similarly, Microsoft, another early adopter of cryptocurrencies, provided relevant financial disclosures on its official website and through its SEC filings [37]. These companies represent the group that has actively

engaged in cryptocurrency transactions.

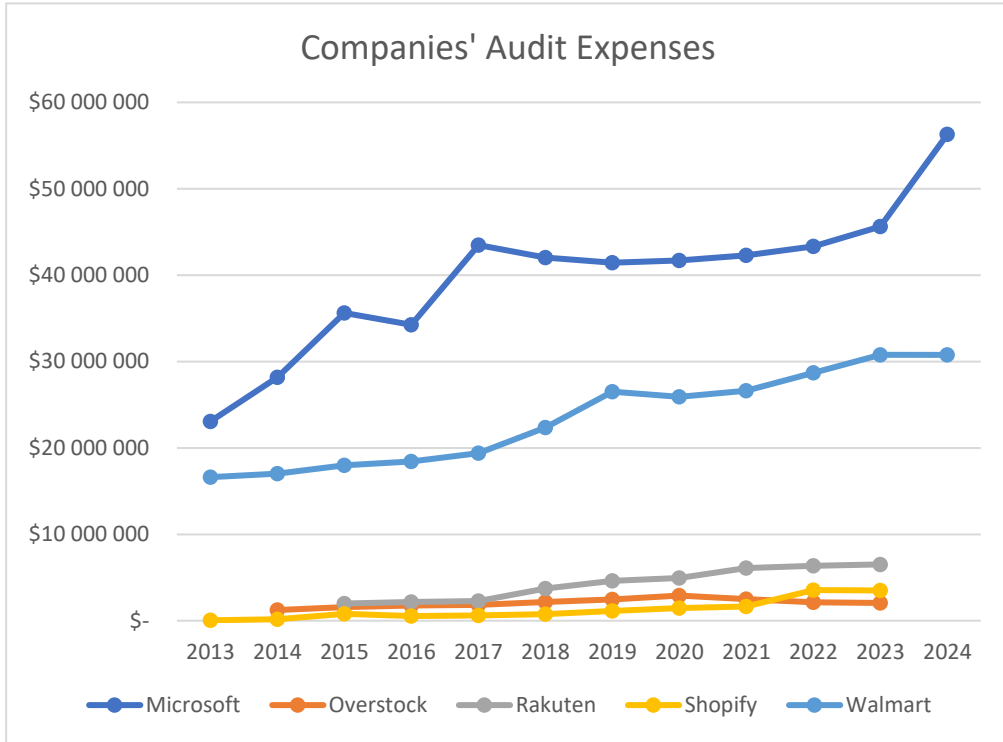
Walmart was selected as a contrast case, as it has never accepted cryptocurrency as a payment method. The inclusion of Walmart allows for a comparative analysis within the econometric model, ensuring that the impact on audit and tax expenses can be observed against a non-crypto-accepting company. Data for Walmart was retrieved from its DEF-14A statements and 10-K reports published annually [44].

To incorporate an international perspective, Rakuten, a Japanese-based company, was added to the dataset. Rakuten began accepting cryptocurrency in 2015, and financial data was sourced from its public disclosures, specifically the Yukashoken-Hokokusho reports available on its Japanese website. To maintain uniformity, all financial data recorded in yen were converted into U.S. dollars based on the annual exchange rate for each corresponding year [42].

Shopify, a Canadian company, was also included due to its integration of cryptocurrency payments in 2019. The financial statements required for this study were extracted from its annual reports available on its website. The presence of Shopify provides an additional international dimension to the study, considering variations in tax treatment and regulatory frameworks in Canada [43].

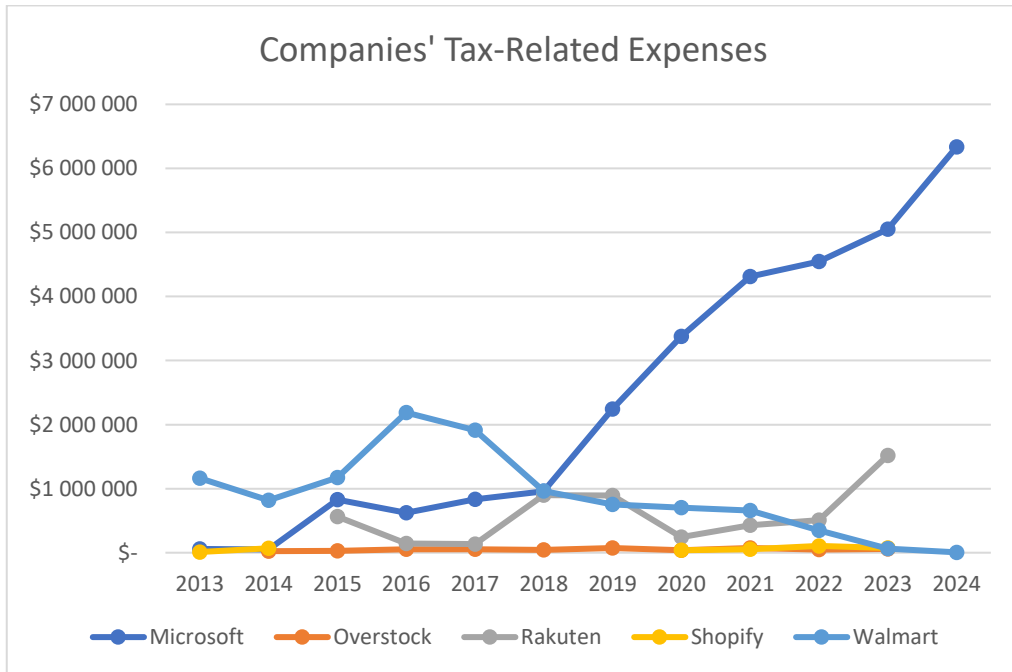
Yearly financial data was chosen over quarterly reports as the latter did not consistently feature detailed breakdowns of audit and tax fee expenses. Annual filings ensured that all necessary financial elements, including audit fees, tax expenses, and compliance costs, were captured comprehensively. The collected data was structured in a panel format, allowing for cross-sectional and time-series analysis, which is essential for econometric modeling and hypothesis testing.

The graphs presented in this subsection illustrate the audit and tax expenses of the selected companies over time. Each company's financial trajectory is represented with distinct lines, allowing for an easy comparison of cost variations across years. Overall, larger companies such as Microsoft and Walmart typically pay higher audit and tax-related fees, while corporations like Shopify spend less on audit services. It was also observed that while Rakuten experienced a surge in tax-related expenses in recent years, Walmart saw a significant decrease in tax fees.



Graph 2.1 – Companies' Audit Expenses

(Source: made by the author based on the sources [37, 41, 42, 43, 44])



Graph 2.2 – Companies' Tax Related Expenses

(Source: made by the author based on the sources [37, 41, 42, 43, 44])

By integrating data from companies with varying levels of cryptocurrency adoption and ensuring standardization in currency conversion and reporting structures, this study aims to provide a robust empirical analysis of the relationship between cryptocurrency adoption and corporate financial oversight costs.

2.2.2 Cryptocurrency Market Data

Due to limited disclosure from companies regarding specific cryptocurrency transactions, an alternative proxy was needed to quantify and analyze the level of cryptocurrency adoption and activity. The number of Bitcoin transactions per year was selected as a suitable proxy for general cryptocurrency market activity, considering Bitcoin's position as the most prominent and widely adopted cryptocurrency. The rationale behind this selection lies in Bitcoin's market dominance, liquidity, and role as a barometer for overall cryptocurrency market trends. Additionally, the publicly available data on Bitcoin transactions provides a reliable, consistent, and comprehensive source, enabling systematic and replicable analysis.

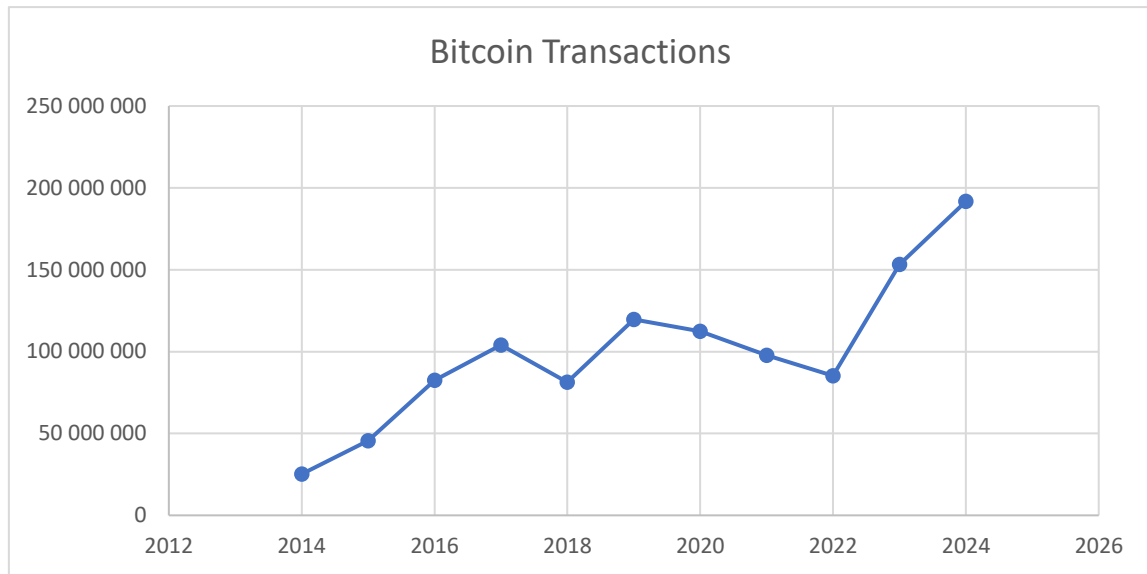
The Bitcoin transaction data was extracted by running a full Bitcoin node, a method involving operating software that fully validates transactions and blocks on the Bitcoin blockchain. A full node maintains an updated copy of the entire blockchain, ensuring complete autonomy in verifying data without relying on third-party services, thereby offering enhanced accuracy and security [3].

Moreover, Bitcoin transaction volume accurately represents cryptocurrency market activity due to its extensive adoption across various sectors, including retail, technology, and finance. Even companies accepting different cryptocurrencies often include Bitcoin among their accepted currencies, thereby reinforcing Bitcoin's utility as a proxy. Furthermore, changes in Bitcoin transaction volume can indirectly reflect broader shifts in market sentiment, regulatory environment, technological advancements, and consumer and corporate behavior regarding digital assets.

Analyzing trends in Bitcoin transaction data reveals significant growth and fluctuations corresponding to periods of increased mainstream adoption, regulatory developments, and market volatility. Over recent years, Bitcoin transactions peaked notably during periods of heightened public interest and institutional investment, such as during the bull markets of 2017 and 2021. Conversely, periods of declining transaction volumes often correlated with market downturns, regulatory uncertainty, or technological challenges within the cryptocurrency space. These observable patterns and shifts validate

the use of Bitcoin transaction data as a meaningful indicator for assessing the implications of cryptocurrency market dynamics on corporate financial oversight, specifically audit and tax expenses.

The graph illustrating Bitcoin transaction trends over the analyzed period provides a clear visual representation of cryptocurrency market dynamics



Graph 2.3 – Bitcoin Transactions

(Source: made by the author based on the sources [3])

In conclusion, Bitcoin transaction volumes provide a robust and reliable indicator of cryptocurrency market dynamics, serving effectively as a proxy variable for analyzing corporate interactions with digital assets. Despite the lack of detailed company-specific disclosures, this approach offers meaningful insights into how overall market trends may influence audit and tax expenses, reinforcing the relevance of Bitcoin transactions as an analytical tool for economic modeling in cryptocurrency-related research.

2.3 Data Analysis Techniques

This subsection outlines the data analysis techniques employed to examine the impact of cryptocurrency adoption on corporate audit and tax expenses. Considering the panel structure of the dataset, appropriate econometric models, hypothesis validation tests, and panel data methodologies are applied to ensure strong estimation.

2.3.1 Econometric modeling and regression specification

Econometric modeling serves as the core methodological approach to evaluate how cryptocurrency integration affects firms' financial oversight costs. Since the dataset combines cross-sectional and time-series information, panel data econometrics provides the ability to capture both firm-specific and temporal variations, while controlling for unobserved heterogeneity. Several econometric models are used:

- Fixed Effects (FE) Model: Controls for time-invariant, firm-specific characteristics that could influence audit and tax expenses.
- Random Effects (RE) Model: Assumes that firm-level variation is random and uncorrelated with the independent variables, facilitating broader generalization beyond the sample.
- Hausman Test: Determines whether the FE or RE model is preferable based on statistical testing [18].
- Diagnostic Tests: Include the Durbin-Watson test for autocorrelation, the White test for heteroskedasticity, and variance inflation factors (VIF) for multicollinearity to verify model robustness [14].

To empirically test how cryptocurrency adoption, overall crypto-market activity, and regulatory stance influence corporate oversight costs, this study specifies two panel-data regression equations. Each equation addresses a distinct, previously described, hypothesis while incorporating both firm-level and market-level drivers of financial oversight complexity. All equations index observations by firm i and time t , reflecting the panel data structure.

To quantify varying degrees of regulatory frameworks, the study employs a composite measure that assesses cryptocurrency-related regulations in each country's jurisdiction. Ranging from 1 to 5, the index highlights the following:

- 1 = Highly Unregulated (no rules or official frameworks)
- 2 = Lightly Regulated (minimal legal recognition; limited enforcement)

- 3 = Moderately Regulated (defined tax obligations and reporting requirements)
- 4 = Well-Regulated (comprehensive legal frameworks and clear standards)
- 5 = Highly Regulated (extensive oversight with detailed reporting and auditing frameworks)

Equation (2.1) corresponds to Hypothesis 1 (H1), which proposes that cryptocurrency integration into corporate payment systems significantly affects audit expenses. It also incorporates an interaction between cryptocurrency adoption and regulatory stringency, allowing the moderating effect posited in Hypothesis 3 (H3) to be evaluated within the audit-cost context.

$$\begin{aligned} AuditExp_{it} = & \beta_0 + \beta_1 BitcoinTransactions_t + \beta_2 CryptoAdopt_{it} + \\ & \beta_3 RegulatoryIndex_{it} + \beta_4 (CryptoAdopt_{it} \times RegulatoryIndex_{it}) + \\ & \beta_5 AssetTurnover_{it} + \beta_6 ProfitMargin_{it} + \beta_7 TaxAuditBurden_{it} + \varepsilon_{it}, \end{aligned} \quad (2.1)$$

where:

$AuditExp_{it}$ – total audit expenses for firm i in year t ;

$BitcoinTransactions_t$ – a proxy variable for a company's involvement in cryptocurrency-based transactions during period t ;

$CryptoAdopt_{it}$ – an indicator variable for cryptocurrency adoption (1 if the firm accepts cryptocurrency; 0 otherwise);

$RegulatoryIndex_{it}$ – captures differences in crypto audit oversight across jurisdictions as a standard control variable;

$CryptoAdopt_{it} \times RegulatoryIndex_{it}$ – an interaction term, that captures whether stricter regulation intensifies or mitigates the effect of adoption on audit expenses;

$AssetTurnover_{it}$ – a financial ratio measuring operational efficiency, calculated as total revenue divided by total assets;

$ProfitMargin_{it}$ – a financial ratio indicating profitability, calculated as net

income divided by total revenue;

$TaxAuditBurden_{it}$ – a financial ratio representing the firm’s compliance burden, calculated as tax audit expenses divided by total revenue;

ε_{it} – error term capturing unobserved factors.

Equation (2.2) addresses Hypothesis 2 (H2), positing that cryptocurrency adoption increases tax reporting complexity and, consequently, tax-related costs. Like the previous model, it embeds an interaction between cryptocurrency use and regulatory stringency, so the specification also yields a tax-cost-focused test of the moderating effect set out in Hypothesis 3 (H3):

$$TaxExp_{it} = \gamma_0 + \gamma_1 BitcoinTransactions_t + \gamma_2 CryptoAdopt_{it} + \gamma_3 RegulatoryIndex_{it} + \gamma_4 (CryptoAdopt_{it} \times RegulatoryIndex_{it}) + \gamma_5 AssetTurnover_{it} + \gamma_6 ProfitMargin_{it} + v_{it}, (2.2)$$

where:

$TaxExp_{it}$ – total tax-related expenses for firm i in year t ;

$BitcoinTransactions_t$ – a proxy variable for a company’s involvement in cryptocurrency-based transactions during period t ;

$CryptoAdopt_{it}$ – an indicator variable for cryptocurrency adoption (1 if the firm accepts cryptocurrency; 0 otherwise);

$RegulatoryIndex_{it}$ – captures differences in crypto taxation oversight across jurisdictions as a standard control variable;

$CryptoAdopt_{it} \times RegulatoryIndex_{it}$ – an interaction term, that captures whether stricter regulation intensifies or mitigates the effect of adoption on tax expenses;

$AssetTurnover_{it}$ – a financial ratio measuring operational efficiency, calculated as total revenue divided by total assets;

$ProfitMargin_{it}$ – a financial ratio indicating profitability, calculated as net income divided by total revenue;

v_{it} – error term capturing unobserved factors.

To conclude, equation (2.1) examines the impact of cryptocurrency adoption on audit expenses, addressing H1. It also includes an interaction term between adoption and regulatory stringency, allowing for a test of the moderating effect outlined in H3 within the audit context. Equation (2.2) mirrors this structure but focuses on tax-related expenses, thereby testing H2 while also providing a second test of H3 in relation to tax compliance. Together, these models offer a detailed view of how cryptocurrency usage affects different components of compliance costs and how this effect varies across regulatory environments.

2.3.2 Statistical Tests for Hypothesis Validation

The two panel-data models outlined in subsection 2.3.1 estimate the relationships among cryptocurrency adoption, Bitcoin transaction volume, regulatory environments, and corporate financial oversight costs. To ensure the reliability and validity of these estimates, several statistical tests and robustness checks are applied.

A basic step in hypothesis validation involves checking the significance of individual coefficients (via t-tests) and overall model fit (via the F-test). The t-tests assess whether each variable, such as *BitcoinTransactions*, *CryptoAdopt*, or *RegulatoryIndex* - exerts a statistically significant impact on the dependent variable. The F-test indicates whether the full set of explanatory variables jointly explains a significant portion of the variation in audit or tax expenses.

Furthermore, in panel-data regressions, residuals may exhibit autocorrelation over time if certain events or firm-specific traits persist. The Durbin-Watson statistic helps detect any first-order serial correlation in the errors. If autocorrelation is present, Newey-West standard errors or other correction methods are considered to preserve valid inference.

Firms in different jurisdictions, industries, or size classes may exhibit differing variances in their residuals. Heteroskedasticity can lead to biased standard errors if

uncorrected. White's test identifies whether the variance of errors is constant. When heteroskedasticity is detected, robust standard errors (e.g., White or cluster-robust) are applied to produce more reliable t-statistics and p-values [45].

Moreover, explanatory variables in the model – especially those that might be correlated (such as *AssetTurnover* and *ProfitMargin*) – can inflate the variance of coefficient estimates if they are overly collinear. The variance inflation factor (VIF) test quantifies the severity of multicollinearity. If any variable's VIF exceeds a common threshold (often 10), it may necessitate re-specifying the model, for example by excluding or transforming one of the correlated variables.

Besides these core tests, if necessary, outlier and leverage diagnostics (e.g., Cook's Distance) will be conducted to identify whether a small number of observations heavily influences the results. Outliers with extremely large or unusual values can mask true relationships or artificially inflate coefficients. If such observations are detected, the model is re-estimated excluding them to determine whether the results remain stable [11].

Collectively, these statistical tests verify the robustness of the panel-data regressions in Equations (2.1), and (2.2). By ensuring that autocorrelation, heteroskedasticity, or multicollinearity do not severely bias the results, the analysis can more convincingly evaluate whether each hypothesis – ranging from the effect of crypto adoption on auditing costs (H1) to the moderating role of regulation on tax expenses (H3) – holds under various model assumptions.

2.3.3 Panel Data Diagnostics

Each of the two panel-data models undergoes procedures specific to panel estimation in order to determine whether fixed effects, or random effects provides the most reliable specification. The Hausman test primarily guides this choice by comparing fixed and random effects estimations and examining whether unobserved heterogeneity across firms correlates with the regressors. A significant test result favors fixed effects, suggesting that firm-specific traits should be captured by individual intercepts; an insignificant result indicates that random effects may be adequate, assuming cross-

sectional variations are random and uncorrelated with the explanatory variables. Once the Hausman outcome clarifies whether fixed or random effects is preferable, the selected model is re-estimated with any required corrections for autocorrelation or heteroskedasticity.

By presenting final estimates of Equations (2.1), and (2.2) under the specification identified as most appropriate, the analysis considers firm-level and temporal effects influencing audit and tax expenses without introducing distortions in how cryptocurrency adoption, transaction volume, and regulatory environments shape financial oversight costs. In conclusion, this model selection process ensures that the subsequent empirical findings rest on solid econometric grounds, free from misspecification concerns related to unobserved heterogeneity.

DATA ANALYSIS AND RESULTS

3.1 Empirical Implementation of Data into EViews

EViews was employed as the primary statistical software for model estimation and diagnostics. The constructed panel dataset consists of annual observations for five publicly traded companies over the period 2013–2023, yielding a total of 55 firm-year observations. Details on the construction of interaction variables and EViews commands are provided in Appendix A. This setup allowed for a more flexible interpretation of this interaction term, which is central to the formulation of Hypothesis 3 (H3).

Following data setup, model estimation was conducted using panel least squares under both Fixed Effects (FE) and Random Effects (RE) specifications, according to the econometric strategy outlined in Section 2.3.2. Each equation was estimated in multiple forms, and results were saved for further diagnostics. Due to limitations in EViews' handling of small-N panels, the Random Effects model could not be estimated for Equation 2.1 because the number of cross-sectional units (five firms) was insufficient relative to the number of explanatory variables. Consequently, the Fixed Effects model was adopted as the primary specification for hypothesis testing.

The following equations represent the Fixed Effects versions of the audit and tax expense models, corresponding to Equations (2.1) and (2.2), respectively:

$$\begin{aligned}
 (AuditExp_{it} - \overline{AuditExp}_{it}) = & \beta_1 (BitcoinTransactions_t - \overline{BitcoinTransactions}_t) + \beta_2 (CryptoAdopt_{it} - \overline{CryptoAdopt}_{it}) + \\
 & \beta_3 (RegulatoryIndex_{it} - \overline{RegulatoryIndex}_{it}) + \beta_4 (CryptoAdopt_{it} \times \\
 & RegulatoryIndex_{it} - \overline{CryptoAdopt}_{it} \times \overline{RegulatoryIndex}_{it}) + \\
 & \beta_5 (AssetTurnover_{it} - \overline{AssetTurnover}_{it}) + \beta_6 (ProfitMargin_{it} - \\
 & \overline{ProfitMargin}_{it}) + \beta_7 (TaxAuditBurden_{it} - \overline{TaxAuditBurden}_{it}) + (\varepsilon_{it} - \\
 & \bar{\varepsilon}_{it}), (3.1)
 \end{aligned}$$

$$\begin{aligned}
(TaxExp_{it} - \overline{TaxExp}_{it}) = & \beta_1 (BitcoinTransactions_t - \overline{BitcoinTransactions}_t) + \beta_2 (CryptoAdopt_{it} - \overline{CryptoAdopt}_{it}) + \\
& \beta_3 (RegulatoryIndex_{it} - \overline{RegulatoryIndex}_{it}) + \beta_4 (CryptoAdopt_{it} \times \\
& RegulatoryIndex_{it} - \overline{CryptoAdopt}_{it} \times \overline{RegulatoryIndex}_{it}) + \\
& \beta_5 (AssetTurnover_{it} - \overline{AssetTurnover}_{it}) + \beta_6 (ProfitMargin_{it} - \overline{ProfitMargin}_{it}) + (v_{it} - \bar{v}_{it}), (3.2)
\end{aligned}$$

where:

$AuditExp_{it}$ – total audit expenses for firm i in year t ;

$TaxExp_{it}$ – total tax-related expenses for firm i in year t ;

$BitcoinTransactions_t$ – a proxy variable for a company's involvement in cryptocurrency-based transactions during period t ;

$CryptoAdopt_{it}$ – an indicator variable for cryptocurrency adoption (1 if the firm accepts cryptocurrency; 0 otherwise);

$RegulatoryIndex_{it}$ – captures differences in crypto taxation oversight across jurisdictions as a standard control variable;

$CryptoAdopt_{it} \times RegulatoryIndex_{it}$ – an interaction term, that captures whether stricter regulation intensifies or mitigates the effect of adoption on tax expenses;

$AssetTurnover_{it}$ – a financial ratio measuring operational efficiency;

$ProfitMargin_{it}$ – a financial ratio indicating profitability;

$TaxAuditBurden_{it}$ – a financial ratio representing the firm's compliance burden;

\bar{X}_i – firm-specific mean of variable X across the panel period;

ε_{it}, v_{it} – error terms capturing unobserved factors.

Furthermore, diagnostic tests such as the White test for heteroskedasticity were conducted using a pooled OLS version of the model, given the unavailability of residual-based diagnostics in the fixed effects context within EViews. Variance inflation factors (VIFs) and correlation matrices were also computed to assess multicollinearity. All

procedures were implemented directly within EViews through a combination of graphical menus and command-line input, ensuring full transparency and reproducibility of results.

Given the small sample of firms, the low dimensionality of the panel, and the use of robust standard errors to correct for heteroskedasticity, the risk of individual observations unduly influencing the results is considered minimal. Therefore, Cook's Distance was not computed.

With the empirical framework firmly established and all necessary diagnostic checks completed, the following subsections present and interpret the results of the estimated models.

3.2 Audit Expenses: Effects of Cryptocurrency Adoption and Regulatory Environment (H1, H3)

This subsection presents the empirical findings for Equation 2.1, which examines whether corporate cryptocurrency adoption and regulatory environments influence audit-related expenses. The model is estimated using a Fixed Effects (FE) panel specification to account for unobserved, time-invariant firm characteristics. All standard errors are corrected using White cross-section robust estimates, following confirmation of heteroskedasticity.

3.2.1 Core Model Estimates and Interpretation

The specification is designed to test two interrelated hypotheses: H1, which posits that corporate adoption of cryptocurrency increases audit expenses, and H3, which proposes that this relationship is moderated by the regulatory environment. The dependent variable is *AuditExp*, expressed in absolute dollar terms. The table below reports the coefficient estimates, robust t-statistics, and associated p-values.

Table 3.1 Robust Fixed Effects Results for Equation 2.1

Variable	Coefficient	t-Stat	p-Value
<i>CryptoAdopt</i>	5480470	1.398862	0.1692
<i>BitcoinTransactions</i>	0.072620	1.932225	0.0601
<i>RegulatoryIndex</i>	3051810	7.107615	0.0000
<i>AdoptionRegint</i>	-2840345	-3.192171	0.0027
<i>AssetTurnover</i>	-427361	-0.185369	0.8538
<i>ProfitMargin</i>	-1433304	-0.818176	0.4179
<i>TaxAuditBurden</i>	4.82E+09	1.156361	0.2541

(Source: EViews)

The key variable for H1 is *CryptoAdopt*, a firm-level dummy indicating whether a company integrates cryptocurrency into its operations. Although the estimated coefficient is large and positive, suggesting a tendency for crypto-adopting firms to incur higher audit expenses, the result is not statistically significant at the 10% level ($p = 0.1692$). This indicates that crypto adoption in isolation does not provide robust evidence of increased audit complexity or costs.

However, an important nuance emerges from the role of *BitcoinTransactions*. This variable serves as a market-level proxy for overall cryptocurrency activity, reflecting systemic exposure to crypto-based financial flows. The estimated coefficient on this variable is positive and statistically significant at the 10% level ($p = 0.0601$), suggesting that as the volume of Bitcoin transactions increases globally, firms tend to incur higher audit expenses, irrespective of their individual adoption status. This reinforces the spirit of H1 – that crypto-related financial complexity leads to increased audit burdens, even if not directly caused by firm-specific usage.

Turning to H3, which posits that regulatory strictness moderates the relationship between crypto adoption and audit expenses, the results provide strong support. The *RegulatoryIndex* itself is highly significant ($p < 0.001$), indicating that firms in jurisdictions with stricter cryptocurrency compliance frameworks tend to face higher audit costs in general.

However, the interaction term *AdoptionRegint* – which captures the moderated effect of adoption under different regulatory conditions – is both statistically significant ($p = 0.0027$) and negative in sign. This result implies that for crypto-adopting firms, higher regulatory stringency is associated with lower audit expenses. One plausible explanation is that well-defined regulatory expectations reduce ambiguity and risk, simplifying the auditing process despite the firm’s engagement with cryptocurrency. In contrast, in less-regulated environments, auditors may need to devote more effort and resources to evaluate compliance, thereby increasing fees.

Furthermore, the model exhibits strong explanatory power:

Table 3.2 Model Fit and Statistical Strength for Equation 2.1

Coefficient	Result
R-squared	0.949723
Adjusted R-squared	0.936555
F-statistic	72.12436

(Source: EViews)

This indicates that approximately 95% of the total variance and 93.7% of the within-firm variance in audit expenses are explained by the included regressors. The result reflects a well-specified model with minimal omitted-variable bias.

The F-statistic = 72.12 with a p-value of 0 confirms that the set of independent variables is jointly significant at any conventional level. In other words, the model, as a whole, predicts changes in audit costs, and the regressors are not jointly irrelevant.

3.2.2 Additional Diagnostic Checks

To ensure strong model robustness, several additional econometric diagnostics were performed. The following table summarizes the results of conducted tests and their interpretations:

Table 3.3 Diagnostic testing and interpretation for Equation 2.1

Test	Result
Durbin-Watson	1.124603
Correlation matrix	High correlations: <i>AdoptionRegint</i> with its components ($\rho \approx 0.86-0.92$); all other correlations < 0.45
Variance Inflation Factors (VIF)	All VIFs < 8 , except <i>AdoptionRegint</i> = 14.76

(Source: EViews)

The Durbin-Watson statistic for the fixed effects regression was 1.12, suggesting some positive first-order autocorrelation in the residuals. Given the small number of time periods and use of robust standard errors, this does not pose a major threat to inference, but may warrant further investigation in future research with longer panels.

The correlation matrix confirms expected structural correlation between the interaction term and its inputs. No signs of problematic multicollinearity among control variables were spotted.

Moreover, multicollinearity is not a concern except for the interaction term, which is expected to be collinear by construction, more detailed values are presented in the table below:

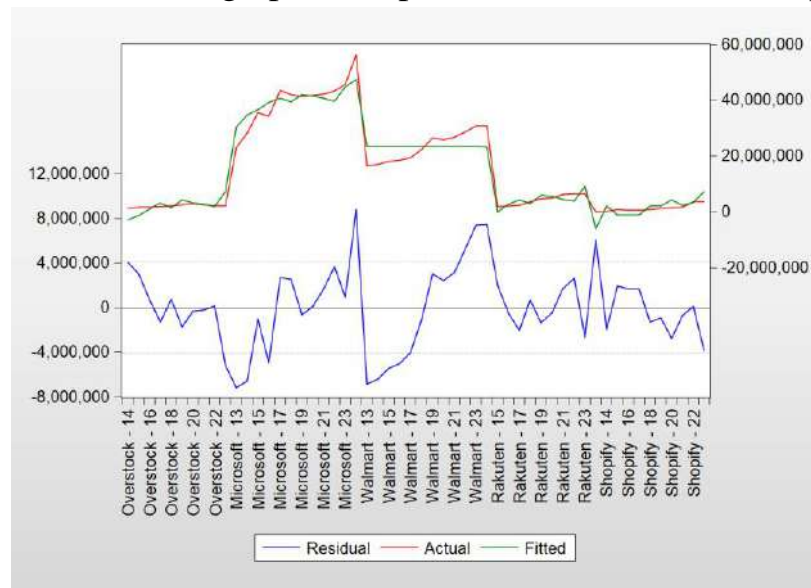
Table 3.4 Variance Inflation Factors across variables

Variable	R-squared	VIF
<i>CryptoAdopt</i>	0.8330	5.99
<i>BitcoinTransactions</i>	0.8670	7.52
<i>RegulatoryIndex</i>	0.7855	4.66
<i>AdoptionRegint</i>	0.9323	14.76
<i>AssetTurnover</i>	0.2251	1.29
<i>ProfitMargin</i>	0.3020	1.43
<i>TaxAuditBurden</i>	0.0991	1.11

(Source: EViews)

A more detail review indicates that most variables exhibit acceptable VIF values below the commonly used threshold of 10, suggesting no serious multicollinearity issues.

The figure below offers a graphical representation of the model's performance:



Graph 3.1 – Model Performance Graph for Equation 2.1

(Source: EViews)

The graph displays the observed (Actual) and model-predicted (Fitted) values of audit expenses for each firm-year observation, along with the corresponding residuals. The fitted line tracks the actual values closely across most firm-year combinations, particularly for Overstock, Shopify, and Rakuten, indicating a high level of predictive accuracy. Deviations between actual and predicted values appear in select years for Microsoft and Walmart, but these residuals are symmetrically distributed around zero, with no systematic bias or trend. The magnitude of residuals also appears proportionate to the level of audit expenses, supporting the validity of the model's error structure. Comprehensively, visual output corroborates the high R-squared value (≈ 0.95) reported in the regression and suggests that the model is well-specified for explaining intra-firm variation in audit costs over time.

These results form a strong empirical foundation for assessing how digital finance integration affects audit procedures and costs. The subsequent subsection will apply a similar methodology to test effects on tax-related expenses.

3.3 Tax Compliance Costs: Effects of Cryptocurrency Adoption and Regulatory Environment (H2, H3)

This subsection presents the empirical findings for Equation 2.2, which investigates whether the adoption of cryptocurrency by firms leads to increased tax-related expenses and whether this relationship is moderated by the regulatory environment. Estimation is conducted using a Fixed Effects (FE) panel regression to control for unobserved, firm-specific characteristics that do not vary over time. Heteroskedasticity detected through a pooled White test is addressed by applying White cross-section robust standard errors to ensure the reliability of inference.

3.3.1 Core Model Estimates and Interpretation

The equation tests two interrelated hypotheses: H2, which posits that companies adopting cryptocurrency increase tax audit fees, and H3, which proposes that this relationship is moderated by the regulatory environment. The dependent variable is *TaxExp*, expressed in absolute dollar terms. The table below reports the coefficient estimates, robust t-statistics, and associated p-values.

Table 3.5 Robust Fixed Effects Results for Equation 2.2

Variable	Coefficient	t-Stat	p-Value
<i>CryptoAdopt</i>	-851582.7	-1.106243	0.2748
<i>BitcoinTransactions</i>	0.012886	1.395942	0.1699
<i>RegulatoryIndex</i>	510803.8	3.534472	0.0010
<i>AdoptionRegint</i>	-190619.6	-0.730580	0.4690
<i>AssetTurnover</i>	-97179.09	-0.212603	0.8326
<i>ProfitMargin</i>	1146170	1.768988	0.0840

(Source: EViews)

Similarly to H1, the key variable for H2 is *CryptoAdopt*, a firm-level dummy indicating whether a company integrates cryptocurrency into its financial operations. In this specification, the estimated coefficient is negative and statistically insignificant ($p = 0.2748$), suggesting that, contrary to expectations, crypto-adopting firms do not experience systematically higher tax-related costs. The negative direction of the coefficient may also point to an efficiency or familiarity effect, however, given the lack of statistical significance, no definitive conclusion can be drawn.

In parallel to the audit fees model, the *BitcoinTransactions* variable serves as a market-level proxy for overall cryptocurrency activity. The coefficient is positive (0.0129), but the effect is not statistically significant ($p = 0.1699$). This implies that increases in global crypto transaction volume do not appear to exert meaningful upward pressure on corporate tax expenses, weakening support for H2 from both firm-level and environmental perspectives.

Turning to H3, which dictates that the effect of cryptocurrency adoption on tax expenses is moderated by the regulatory environment – the results are mixed. The main effect of *RegulatoryIndex* is positive and highly significant ($p = 0.001$), indicating that tax compliance costs are generally higher in jurisdictions with stricter cryptocurrency regulations. This confirms that regulation itself imposes a direct compliance burden on firms.

However, the interaction term *AdoptionRegint*, which captures how the effect of crypto adoption changes in response to regulatory intensity, is negative but statistically insignificant ($p = 0.469$). This suggests that, unlike in the audit model, regulatory environments do not significantly condition the tax cost impact of crypto adoption. One possible explanation is that tax compliance frameworks are often structured around formal reporting requirements that apply uniformly to all firms, regardless of whether they adopt cryptocurrency. In such environments, stricter regulations may elevate baseline tax compliance costs across the board, but not necessarily in a way that disproportionately affects crypto-adopting firms. As a result, the moderating effect of regulation, significant in the audit model, becomes statistically indistinct in the tax context, where fixed procedural burdens dominate over case-specific adoption strategies.

Regarding the explanatory capacity, the results are presented in the table:

Table 3.6 Model Fit and Statistical Strength for Equation 2.2

Coefficient	Result
R-squared	0.636928
Adjusted R-squared	0.552492
F-statistic	7.543366

(Source: EViews)

The model explains approximately 63.7% of the variation in tax-related expenses, which is a reasonably strong level of explanatory power. The adjusted R-squared of 0.55 also confirms that the explanatory capacity of the model remains substantial after accounting for the number of included regressors.

The F-statistic = 7.54, with a p-value of 0.000001, indicates that the regressors are jointly significant, meaning the overall model provides a meaningful explanation of variation in tax expenses across firms and years.

3.3.2 Additional Diagnostic Checks

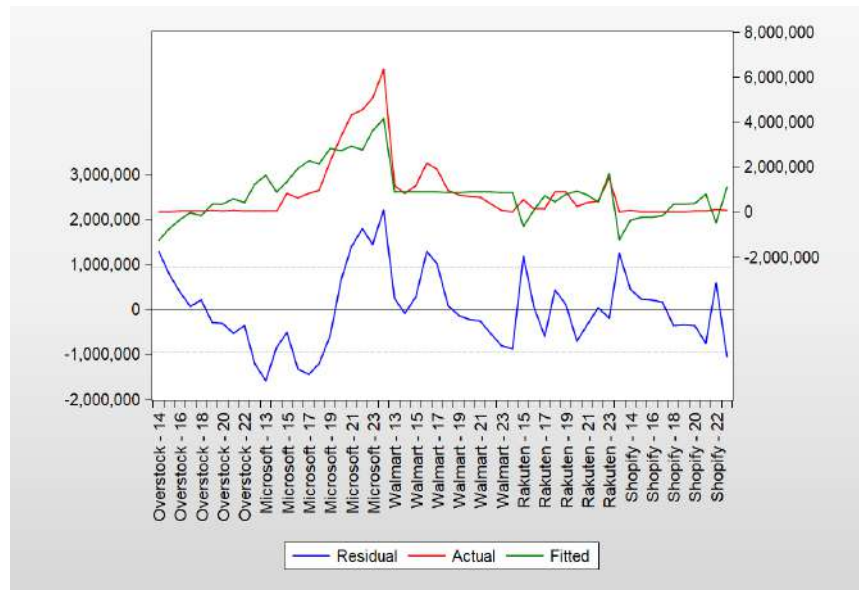
The Durbin-Watson statistic for Equation 2.2 is 0.755021, which is notably lower than the benchmark value of 2 and suggests the presence of positive first-order autocorrelation in the residuals. While such autocorrelation may reduce the efficiency of coefficient estimates, it does not bias them in the presence of fixed effects. Moreover, this concern is partially mitigated by the application of White cross-section robust standard errors, which adjust for both heteroskedasticity and serial correlation in panels with a small-time dimension.

Other diagnostic outcomes in Equation 2.2 were consistent with those observed in the audit-expense model (Equation 2.1). As independent variables and sample remain unchanged, the correlation matrix revealed identical patterns of association.

Likewise, the VIFs for Equation 2.2 remained stable, reaffirming that no problematic multicollinearity is present, apart from the structurally expected inflation in the interaction term (*AdoptionRegint*, VIF \approx 14.76).

The figure below shows a graphical representation of the model's performance:

Graph 3.2 – Model Performance Graph for Equation 2.2



(Source: EViews)

The fitted line closely follows the actual tax expenses for a majority of observations, particularly in the mid-range expense levels observed for Rakuten and Shopify. This alignment supports the moderately strong R-squared value (0.637) obtained in the regression. However, for firms like Microsoft and Walmart, deviations between actual and predicted values are more pronounced, especially in later years. The residuals reflect this, exhibiting positive autocorrelation and noticeable upward spikes in periods with high actual tax costs. These discrepancies are consistent with the Durbin-Watson statistic of 0.75, which suggests mild positive serial correlation in the residuals. While this could affect the efficiency of the estimates, the application of robust standard errors mitigates its influence.

The overall consistency of diagnostic results, aside from the slightly stronger autocorrelation observed in Equation 2.2, supports the internal validity of the estimation framework. Since multicollinearity and heteroskedasticity have been addressed, and the explanatory variables remain well-behaved across specifications, the lack of statistically significant results for Hypothesis 2 (the effect of crypto adoption on tax expenses) cannot be attributed to model misspecification. Instead, it reflects a genuine empirical finding that, unlike audit costs, tax-related fees are not systematically affected by cryptocurrency adoption, even under varying regulatory conditions. This divergence strengthens the

comparative insights between audit and tax compliance costs in crypto-integrated firms.

3.4 Practical and Theoretical Implications of the results

The empirical patterns uncovered in Subsections 3.2 and 3.3 shed light on how cryptocurrency affects the cost structure of corporate oversight while simultaneously refining existing academic debate. A first practical message emerges for senior finance staff and risk managers: when a firm decides whether to accept digital assets, attention should not focus solely on the firm's own internal systems. The results show that audit fees rise in years when global Bitcoin activity is intense, even for companies that do not settle transactions on-chain. Specifically, the coefficient on *BitcoinTransactions* (0.0726, $p \approx 0.06$) implies that, at the 2023 sample mean of roughly 500,000 on-chain transactions per day, a 10% rise in global Bitcoin activity adds about \$1.3 million to the annual audit bill of a representative firm in the panel, an amount equivalent to approximately 65% of average baseline audit costs. In other words, the audit profession includes systemic complexity into its fee schedules, so managers need to monitor market-wide crypto volumes and plan audit budgets accordingly. At the same time, the negative sign of the interaction between firm-level adoption and regulatory stringency indicates that operating in a jurisdiction with well-defined rules can offset a large share of that cost pressure. The data indicates that a move from the lowest to the highest observed value of the *RegulatoryIndex* increases audit fees by roughly \$3.05 million. Yet for adopters this premium almost disappears because the interaction term ($CryptoAdopt \times RegulatoryIndex = -2.84$ million, $p < 0.01$) offsets 92% of the stand-alone regulatory surcharge. Thus, clear rules appear to pay for themselves once a firm is actively using crypto. This suggests a practical cost-saving strategy: where possible, locate crypto-related activities in countries that already provide clear audit guidance and enforce it consistently.

From the auditor's perspective, the same evidence implies that engagement risk assessments need to combine two dimensions: client adoption status and macro-level crypto activity, rather than treating adoption as a binary switch. Investing in audit

software modules that automate wallet tracing and valuation in line with local regulations appears worthwhile, because stricter rulebooks reduced, fee premiums for adopters in the sample.

Tax departments face a subtly different picture. While audit expenses shifted with market dynamics, tax-related costs were driven almost exclusively by the density of local regulation and were essentially insensitive to whether the firm adopted crypto. The one-point rise in the *RegulatoryIndex* is associated with an additional \approx \$0.59 million in tax-related compliance costs ($p < 0.001$), and this figure is insensitive to adoption status. Neither the *CryptoAdopt* dummy (-0.85 million; $p \approx 0.27$) nor *BitcoinTransactions* (0.0129 ; $p \approx 0.17$) produces a statistically reliable shift in tax expenses. This implies that tax compliance budgets should be forecast with a stronger focus on legislative pipelines than on technological exposure. For regulators, the combined evidence suggests that writing precise, unambiguous rules can lower the friction of auditing without undermining the tax base: stricter regimes were associated with lower audit-fee premiums but still produced higher tax compliance costs across the board, indicating that standardized regulations streamline audit processes while maintaining tax revenue goals.

Software designers working on accounting information system modules can translate these findings into two design priorities. First, because auditors react to market-wide crypto complexity, it is useful to build node-agnostic data pipelines capable of collecting and normalizing on-chain data regardless of token type. Second, given the primary role of rule density in shaping both audit and tax outcomes, systems should include configurable rule libraries so that valuation routines, recognition thresholds and taxable-event triggers can be switched automatically when a firm operates in several jurisdictions.

Beyond immediate application, the study contributes to theory in several ways. By showing that clear regulation reverses the sign of the adoption and audit-cost relationship, the results extend contingency theory in auditing: environmental fit, here expressed as rule clarity, moderates the resource impact of a new technology. The divergence between audit and tax cost drivers also calls for a more granular view in compliance-cost theory,

separating transaction-level complexity from framework-level complexity (dominant in taxation). Furthermore, the significance of the Bitcoin-transactions variable, which operates at the macro level, supports a multi-level perspective in technology adoption research: even non-adopters bear external costs when a technology becomes systemically important.

Linking these empirical results back to Subsection 2.3, the thesis originally expected, based on contingency theory, that stricter regulation would amplify any cost premium associated with crypto adoption, because auditors and tax staff would need to check extra compliance steps. The result tells a more nuanced story. For tax fees, the expectation holds in spirit: rule density is indeed the main driver, even if its interaction with adoption is statistically muted. For audit fees, however, the negative interaction indicates that precise rules can temper rather than magnify the incremental cost of adoption once guidance removes uncertainty. This refinement suggests that the direction of the moderation effect depends on how far regulation substitutes for auditor judgement.

These findings offer a new perspective on earlier studies. For instance, Marah et al. (2024) found that cryptocurrency adoption increases audit report lag by 7.73 days across EU firms, yet did not estimate audit expenses or regulatory interactions [35]. On the taxation side, the lack of significant results for adoption echoes Cui et al. (2024), who reported that U.S. crypto-active firms reduce effective tax rates by about five percentage points but did not report absolute tax compliance costs [12]. Hence, the present results not only align with but also extend prior evidence.

Taken together, the analysis clarifies that cryptocurrency integration imposes costs that are context-specific rather than universally burdensome. Managers, auditors, regulators and system designers each have levers, ranging from jurisdictional choices to software architecture, to manage those costs. Moreover, it must be emphasized that the econometric specification, while appropriate for the five-firm panel available, cannot overcome all limitations of such a narrow cross-section. Consequently, the results are most applicable to early-adopting, large-capitalization companies operating in the 2013–2024 window, and they should be generalized with caution until broader samples become available.

CONCLUSIONS

The integration of cryptocurrencies into corporate payment systems presents profound implications for financial monitoring, particularly in auditing and taxation. This research set out to examine how cryptocurrency adoption, specifically Bitcoin, affects audit and tax expenses, and how regulatory environments moderate these effects. The study combined theoretical analysis, real-world case studies, and econometric modeling using panel data to produce both conceptual insights and empirical evidence.

The theoretical part outlined the origins and core characteristics of cryptocurrencies, the structure of corporate payment systems, and the challenges posed by decentralized and pseudonymous financial instruments. Existing standards such as IFRS and IAS were analyzed, highlighting their limitations in accommodating cryptocurrency transactions, especially regarding valuation and classification.

The empirical analysis utilized firm-level financial data and global Bitcoin transaction volumes as a proxy variable. Regression models were estimated using a fixed-effects panel, additional diagnostic tests ensured model robustness, with multicollinearity, heteroskedasticity, and autocorrelation addressed via standard corrections.

The results supported the first hypothesis (H1) partially. While the direct effect of company-level cryptocurrency adoption on audit expenses was not statistically significant, global Bitcoin transaction volume exhibited a strong positive association with audit costs, implying systemic exposure. Notably, regulatory environments played a moderating role: firms operating in stricter regulatory jurisdictions generated lower audit fees when they adopted crypto, suggesting that transparent regulations reduce risk-related audit costs.

The second hypothesis (H2), proposing that crypto adoption increases tax compliance costs, was not empirically supported. Neither firm-level adoption nor market-wide crypto activity significantly affected tax-related expenses. However, the level of regulatory stringency (regulation index) was a key determinant of tax costs, regardless of whether the firm adopted cryptocurrencies, confirming that taxation is shaped more by general legal frameworks than by actual cryptocurrency utilization of individual

companies.

The third hypothesis (H3) was confirmed only in the context of audit expenses. The interaction between adoption and regulation index significantly affected audit costs but not tax expenses. This highlights a crucial distinction: audit costs are responsive to both firm behavior and environmental complexity, while tax costs remain driven primarily by jurisdictional rules.

The findings carry several practical implications. Audit-related expenses respond not only to firm decisions but also to macro-level cryptocurrency activity. Hence, even non-adopters face cost pressures in crypto-dominant environments. However, firms can strategically mitigate these costs by operating in jurisdictions with clear and enforced crypto regulations. In contrast, tax departments must prioritize compliance with local rule density, as regulatory environments dictate costs more than technology use.

The study also makes theoretical contributions. It refines contingency theory in auditing by showing that environmental clarity can offset the resource burden of disruptive technologies. It further distinguishes between transaction-level and framework-level complexities in compliance cost theory, offering a nuanced lens for future research on digital finance.

It is important, however, to recognize the limits of the research, specifically, the econometric framework. The fixed-effects specification is appropriate for isolating unobserved, time-invariant firm characteristics, especially when random-effects assumptions fail in small-N settings. Yet the panel comprises only five early-adopting, mostly large-cap firms. While this reflects the reality that few public companies embraced cryptocurrency in the study window, the narrow cross-section reduces statistical power and may omit smaller adopters whose cost structures differ. Moreover, the inability to estimate random effects prevents a formal Hausman test, so it cannot entirely rule out alternative variance structures that a larger, more heterogeneous sample might reveal. These constraints do not invalidate the findings but do mean they should be viewed as descriptive of early adoption rather than definitive for the entire corporate landscape.

In conclusion, this research demonstrates that the integration of cryptocurrencies into corporate payment systems introduces asymmetrical challenges for audit and tax

compliance. While audit costs are sensitive to both adoption and systemic activity, modulated by regulation, tax fees are shaped primarily by the structure of the legal environment. This difference underscores the need for differentiated strategies by companies, auditors, and policymakers in managing cryptocurrency integration. Future research should continue refining these insights by expanding datasets, incorporating jurisdictional nuances, and exploring emerging technologies such as central bank digital currencies.

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APPENDIX A

The dataset was imported into EViews as a structured panel workfile with the cross-sectional dimension defined by firm identifiers and the time dimension represented by calendar years.

All key variables were either directly calculated in Excel prior to import or generated within EViews using transformation commands. In particular, the interaction term *AdoptionRegint* designed to test for moderation effects was constructed using the command:

```
genr      adoption_regint      =      crypto_adoption      *  
regulation_index
```