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Aim and Scope:

The Journal of Emerging Technologies in Accounting (JETA) has started with the aim of expanding the concepts of accounting, auditing and finance in English in order to identify and eliminate gaps in these areas.

The Journal of Emerging Technologies in Accounting (JETA) accepts the articles in the form of Research Article, Review Article, Short Papers, Case-study, Methodologies including these items:

- Emerging technology in the field of Accounting and its future
- Using of new tools in accounting education
- Corporate Governance and the related subjects
- Internal and external auditing and there innovation
- Risk management and its new technologies
- Internal control and new technologies
- Integrated and modern accounting information systems in the organization
- Other research topics related to emerging technologies in accounting

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The Impact of Blockchain Technology on Enhancing Transparency and Security of Financial Reporting: Opportunities and Challenges

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Abstract

Objectives: This study aims to examine the impact of blockchain technology on transparency, security, fraud reduction, and stakeholder trust in financial reporting. It is grounded in the view that emerging technologies like blockchain can transform financial processes by enhancing accuracy, reliability, and efficiency.

Methodology/Design/Approach: A quantitative approach and Partial Least Squares Structural Equation Modeling (PLS-SEM) were employed to analyze data collected from 312 accounting and financial professionals working in companies listed on the Tehran Stock Exchange.

Findings: The results indicate that the adoption of blockchain technology significantly enhances financial reporting transparency, improves information security, reduces fraud and financial errors, and increases stakeholder trust and technology acceptance.

Innovation: This research contributes to the literature by empirically demonstrating the strategic importance of blockchain technology in transforming financial and auditing processes. It highlights its role as an effective tool for improving the accuracy, reliability, and efficiency of financial reporting in emerging markets.

Keywords: Blockchain, Financial Reporting, Transparency, Security, Trust..

1. Introduction

Blockchain technology has attracted substantial attention as a disruptive innovation with the potential to transform accounting and financial reporting processes (Yermack, 2017; Dai & Vasarhelyi, 2017). Characterized by a decentralized and immutable ledger architecture, blockchain enables secure, transparent, and real-time transaction recording, thereby addressing long-standing challenges related to data manipulation, fraud, and opacity inherent in traditional financial reporting systems (Kokina & Davenport, 2017; Chen et al., 2020). As financial markets become increasingly complex and stakeholders demand higher levels of accountability, blockchain presents promising opportunities to enhance the reliability and integrity of financial information.

Conventional accounting systems typically rely on centralized control mechanisms and periodic verification procedures, which may be vulnerable to errors, delays, and intentional misstatements. These weaknesses can undermine investor confidence and expose firms to regulatory sanctions (Goh et al., 2023). In contrast, blockchain's distributed ledger technology eliminates intermediaries and facilitates peer-to-peer transactions that are securely recorded in a tamper-resistant database (Tapscott & Tapscott, 2017; Kim & Laskowski, 2023). This fundamental shift has the potential to significantly reduce reconciliation errors, lower audit costs, and improve the timeliness and accuracy of financial disclosures.

Empirical evidence suggests that blockchain adoption supports continuous auditing and real-time assurance, both of which are critical in dynamic and rapidly evolving market environments (Sun et al., 2024; Park & Lee, 2023). Moreover, the cryptographic mechanisms underlying blockchain technology ensure the confidentiality, integrity, and availability of sensitive financial data, thereby protecting it against cyberattacks and unauthorized access (Casino et al., 2019; Zhang et al., 2025). Enhanced data security fosters greater stakeholder trust, which is essential for effective corporate governance and regulatory compliance (Fanning & Centers, 2016; Nguyen et al., 2024).

Despite its potential advantages, the implementation of blockchain in accounting is accompanied by several significant challenges. Technological barriers—including high infrastructure costs, scalability constraints, and shortages of skilled professionals—represent major obstacles to adoption (Glaser, 2017; Weber et al., 2019; Li & Xu, 2024). In addition, legal and regulatory uncertainties complicate blockchain integration, as many jurisdictions lack comprehensive frameworks capable of accommodating blockchain-based financial records and addressing issues such as data privacy and cross-border transactions (Johnson & Wang, 2023; Silva et al., 2025). Organizational resistance, stemming from cultural inertia and limited awareness, further constrains widespread blockchain adoption (Hossain & Kaur, 2023).

Overcoming these challenges requires organizations to enhance their technological readiness through targeted investments in infrastructure and human capital, as well as the strategic alignment of blockchain initiatives with broader business objectives (Rahman et al., 2024). Furthermore, strong leadership commitment and greater regulatory clarity are critical to creating an enabling environment for effective blockchain deployment (Park et al., 2025). Consequently, a comprehensive understanding of the interaction among technological, organizational, and regulatory factors is pivotal to the successful adoption of blockchain in accounting.

This study seeks to examine the impact of blockchain technology on improving transparency and security in financial reporting. Specifically, it investigates both the opportunities afforded by blockchain and the challenges encountered during its implementation. By analyzing how blockchain adoption influences key outcomes such as data accuracy, fraud detection, and stakeholder trust, the study contributes to the expanding body of knowledge on the role of blockchain in accounting and auditing. Additionally, it provides practical insights for

professionals and policymakers aiming to leverage blockchain to enhance the quality of financial reporting.

Accordingly, the study addresses the following research questions: (1) How does blockchain technology influence the transparency and security of financial reports? (2) What are the primary organizational and technological challenges associated with blockchain adoption in accounting? (3) How do these challenges affect the extent of blockchain integration? (4) To what extent does stakeholder trust mediate the relationship between blockchain utilization and financial reporting quality?

Addressing these questions advances theoretical understanding and informs managerial decision-making aimed at developing more robust, transparent, and secure financial reporting systems. Given the rapidly evolving technological landscape and increasing regulatory scrutiny, this research is both timely and relevant for organizations seeking to maintain competitive advantage and uphold financial integrity in the digital era.

Although blockchain research is expanding globally, its application within the Iranian context remains relatively underexplored. Iran's distinctive economic conditions, regulatory environment, and technological infrastructure present unique challenges and opportunities for blockchain adoption in accounting and financial reporting. Moreover, the Iranian financial sector faces growing pressure to enhance transparency and combat fraud, rendering blockchain's potential benefits particularly salient. As the regulatory framework governing blockchain in Iran is still evolving, its influence on adoption trajectories may differ from that observed in other countries. Consequently, empirical research focused on blockchain implementation in Iran addresses a critical gap in the literature and offers context-specific insights and recommendations that can inform policy and practice, ultimately supporting the modernization and integrity of financial reporting in the country.

2. Literature Review

2.1 Blockchain Technology and Accounting

Blockchain technology, first introduced by Satoshi Nakamoto (2008) as the underlying architecture of Bitcoin, has rapidly evolved beyond cryptocurrencies and is now recognized as a transformative innovation for accounting and auditing functions. At its core, blockchain is a distributed ledger technology (DLT) that enables data to be securely recorded, validated, and shared across a network without reliance on a central authority (Dai & Vasarhelyi, 2017; Kim & Laskowski, 2023). This architecture inherently promotes data immutability and transparency—two attributes that are fundamental to accounting systems seeking to enhance reliability and mitigate fraudulent activities (Kokina & Davenport, 2017).

The decentralized nature of blockchain reduces risks associated with centralized databases, such as single points of failure and susceptibility to unauthorized data manipulation (Yermack, 2017). In addition, blockchain supports automation through smart contracts—self-executing agreements in which contractual terms are embedded directly into code—thereby streamlining routine accounting processes and minimizing human error (Chen et al., 2020). More recent developments have examined the integration of blockchain with artificial intelligence and machine learning technologies to strengthen predictive analytics and improve anomaly detection in financial data (Sun et al., 2024; Nguyen et al., 2024).

Previous studies have provided important insights into the accounting implications of blockchain technology. Dai and Vasarhelyi (2017) were among the first to conceptualize blockchain's role in continuous auditing, emphasizing its capacity to enable real-time data verification and reduce audit costs. Chen et al. (2020) reviewed and synthesized the existing literature on blockchain in accounting, highlighting advantages such as improved traceability and reduced reconciliation efforts. More recently, Goh et al. (2023) empirically examined blockchain adoption patterns within accounting firms and found

that organizational size and technological readiness are key determinants of adoption. However, the majority of these studies focus primarily on developed economies, leaving the unique institutional, regulatory, and technological conditions of emerging markets relatively underexplored.

2.2 Transparency Enhancement through Blockchain

Transparency is a foundational element of effective financial reporting and plays a critical role in ensuring market efficiency while protecting investors from information asymmetry and opportunistic behavior (Bushman & Landsman, 2010; Dechow et al., 2011). Traditional accounting processes, which rely heavily on periodic reporting cycles and manual reconciliation procedures, are inherently vulnerable to reporting delays and potential data manipulation (Chen et al., 2020). Blockchain's distributed ledger technology fundamentally alters this paradigm by providing an immutable, time-stamped record of transactions that is accessible to all authorized participants, thereby substantially enhancing transactional transparency (Yermack, 2017; Kim & Laskowski, 2023).

Empirical evidence increasingly supports the role of blockchain in improving disclosure quality. Sun et al. (2024) report that firms adopting blockchain technologies produce more timely and accurate financial information, largely due to continuous monitoring capabilities and automated transaction recording. Similarly, Park and Lee (2023) demonstrate that blockchain reduces information asymmetry by granting auditors and regulators greater and more immediate visibility into financial events. In addition, Kim and Laskowski (2023) emphasize blockchain's ability to maintain comprehensive and verifiable audit trails, which facilitates more efficient fraud detection and strengthens compliance verification processes.

Nevertheless, the pursuit of transparency through blockchain is not without challenges. Johnson and Wang (2023) highlight the inherent tension between enhanced transparency and data privacy, emphasizing the importance of selective disclosure mechanisms that safeguard sensitive information while preserving openness. Furthermore, Silva et al. (2025) stress the need for well-defined regulatory frameworks to govern data sharing practices and ensure compliance with privacy regulations, such as the General Data Protection Regulation (GDPR), in order to build and sustain stakeholder confidence in blockchain-based reporting systems.

2.3 Security Improvements in Financial Reporting

Cybersecurity threats have intensified alongside the rapid digitization of business processes, posing substantial risks to the integrity and confidentiality of financial data (Kshetri, 2017). Blockchain leverages cryptographic hashing, decentralized consensus mechanisms, and permissioned access controls to deliver robust security features capable of mitigating such risks (Casino et al., 2019; Zhang et al., 2025). The distributed ledger's inherent resistance to tampering and unauthorized data alteration is particularly valuable for preserving the accuracy, reliability, and trustworthiness of financial records (Glaser, 2017).

A growing body of research has examined the effectiveness of blockchain in strengthening security within accounting systems. Casino et al. (2019) present a comprehensive review of blockchain's security architecture, highlighting its resilience against common cyberattacks and data breaches. Li and Xu (2024) investigate the trade-offs between scalability and security in blockchain-based financial applications and propose hybrid architectures that integrate on-chain and off-chain processing to enhance both performance and security. Furthermore, Nguyen et al. (2024) empirically demonstrate a positive association between blockchain adoption and improved corporate governance outcomes, attributing these effects to stronger data protection mechanisms and enhanced auditability.

Despite these advantages, blockchain systems are not entirely immune to vulnerabilities. Weber et al. (2019) and Zhang et al. (2025) identify several

technical risks, including 51% attack—where a malicious actor controlling a majority of network computing power may manipulate transaction records—as well as coding flaws in smart contracts that can be exploited by attackers. These challenges underscore the necessity for continuous technological innovation, rigorous security audits, and robust governance mechanisms to ensure the long-term integrity and resilience of blockchain-based accounting systems.

2.4 Challenges and Barriers to Blockchain Adoption in Accounting

The transformative potential of Blockchain is constrained by a range of practical challenges that impede its widespread adoption. Technological barriers include the substantial costs associated with deploying blockchain infrastructure, limitations related to network scalability, and the complexity of integrating blockchain solutions with existing legacy systems (Glaser, 2017; Li & Xu, 2024). In addition, the steep learning curve faced by accounting professionals who lack familiarity with blockchain technology further complicates the adoption process (Hossain & Kaur, 2023).

From a regulatory perspective, ambiguity and fragmentation in blockchain-related legal frameworks constitute significant obstacles (Johnson & Wang, 2023; Silva et al., 2025). Uncertainties concerning the legal admissibility of blockchain-based records in auditing processes, compliance with data privacy regulations, and the handling of cross-jurisdictional transactions reduce organizations' willingness to fully commit to blockchain solutions. Moreover, organizational resistance—often rooted in risk aversion and cultural inertia—continues to slow adoption, particularly within traditionally conservative industries (Rahman et al., 2024).

Previous studies have provided valuable insights into these adoption barriers. Hossain and Kaur (2023), through qualitative analysis, identify shortages in human capital and insufficient organizational readiness as major impediments to blockchain integration. Rahman et al. (2024) emphasize the pivotal role of leadership in advancing blockchain initiatives and cultivating an organizational culture that is receptive to technological innovation. Silva et al. (2025) conduct a comparative analysis of global regulatory frameworks, demonstrating that clear and supportive legislation is positively associated with higher rates of blockchain adoption. Similarly, Park et al. (2025) highlight the strategic alignment of blockchain projects with corporate objectives as a critical success factor in overcoming organizational resistance.

Addressing these barriers requires a multifaceted approach that includes sustained investments in technological infrastructure, comprehensive education and training programs, and the development of coherent and harmonized regulatory policies. Furthermore, increased industry collaboration and standardization initiatives are essential to enhance interoperability, reduce uncertainty, and build stakeholder trust in blockchain-based accounting and reporting systems (Rahman et al., 2024; Park et al., 2025).

3. Research Gap and Rationale

Despite the growing body of scholarly research, blockchain adoption in accounting remains an emerging area with several underexplored dimensions. The majority of empirical studies concentrate on developed economies, resulting in a limited understanding of how blockchain technologies are implemented, interpreted, and evaluated in emerging markets characterized by distinct technological capacities, regulatory frameworks, and economic conditions (Goh et al., 2023; Kim & Laskowski, 2023). In this regard, Iran—with its unique economic structure and evolving regulatory environment—constitutes a particularly relevant and underexamined context for investigating the practical implications of blockchain adoption in financial reporting.

Moreover, Iran continues to face notable challenges related to financial transparency and fraud prevention, domains in which the inherent features of blockchain—such as immutability, traceability, and

enhanced auditability—may offer considerable advantages. Nevertheless, empirical evidence addressing the specific barriers to and enablers of blockchain adoption within the Iranian accounting profession remains scarce. Bridging this gap not only enriches the global literature on blockchain in accounting by incorporating insights from a transitional economy but also generates context-specific implications for policymakers and practitioners seeking to modernize financial reporting systems in Iran and comparable emerging markets.

4. Theoretical Foundations and Hypotheses

4.1. Blockchain Technology and Transparency in Financial Reporting

Transparency in financial reporting is a fundamental principle that ensures all stakeholders—including investors, creditors, regulators, and the general public—have access to complete, accurate, and timely financial information (Bushman & Landsman, 2010). By reducing information asymmetry and mitigating agency problems, transparency enhances both market efficiency and the effectiveness of corporate governance mechanisms (Healy & Palepu, 2001). Nevertheless, traditional accounting systems frequently encounter limitations that undermine transparency. Reliance on manual record-keeping, periodic reporting cycles, and centralized databases creates vulnerabilities such as reporting delays, incomplete disclosure, and heightened exposure to manipulation or fraud (Chen et al., 2020).

Blockchain technology fundamentally alters this landscape by enabling a decentralized and immutable record of transactions (Satoshi Nakamoto, 2008; Yermack, 2017). Unlike conventional ledgers governed by a single authority, blockchain allows multiple participants to maintain synchronized copies of the ledger that are validated through consensus mechanisms (Kim & Laskowski, 2023). This structural feature ensures that once information is recorded on the blockchain, it cannot be retroactively modified without network-wide agreement, thereby substantially limiting opportunities for data tampering or selective omission (Dai & Vasarhelyi, 2017).

Within the context of financial reporting, blockchain enables transactions, adjustments, and other financial events to be recorded in near real time and verified by all authorized stakeholders, including auditors and regulators (Sun et al., 2024). Such enhanced visibility supports continuous auditing and ongoing monitoring, rather than exclusive reliance on periodic reviews, leading to improvements in the reliability and credibility of financial disclosures (Alles, 2015). Furthermore, the inherent traceability of blockchain records allows stakeholders to verify the origin and authenticity of financial data, reinforcing confidence in reported figures and disclosures (Park & Lee, 2023).

Empirical findings provide support for these theoretical arguments. Sun et al. (2024) document that firms adopting blockchain exhibit higher levels of disclosure quality and reduced information asymmetry. Similarly, Goh et al. (2023) report increased stakeholder satisfaction regarding the accessibility and accuracy of financial information following blockchain implementation. Nonetheless, the extent to which blockchain enhances transparency remains contingent upon factors such as system design choices, governance arrangements, and the strength of regulatory oversight (Johnson & Wang, 2023).

Hypothesis 1: *The use of blockchain technology in accounting and financial reporting significantly increases the transparency of financial reports.*

4.2. Blockchain Technology and Security of Financial Information

The security of financial information is a critical prerequisite for safeguarding the integrity of financial markets and maintaining stakeholder trust (Kshetri, 2017). The increasing digitization of accounting data has exposed organizations to a wide range of cybersecurity threats, including hacking, data breaches, unauthorized access, and insider fraud (Glaser, 2017). Traditional centralized databases

exacerbate these risks by creating single points of failure, rendering systems particularly vulnerable to cyberattacks and data manipulation (Casino et al., 2019).

Blockchain technology addresses many of these challenges through its reliance on cryptographic techniques and decentralized system architecture (Zheng et al., 2017). Each transaction recorded on a blockchain is cryptographically hashed and linked to preceding transactions, forming an immutable chain of data blocks (Yli-Huumo et al., 2016). As a result, altering any stored information becomes computationally infeasible without detection by the network's consensus mechanism, thereby substantially enhancing data integrity and system security (Li & Xu, 2024).

Moreover, blockchain networks frequently implement permissioned access controls that restrict participation to authorized entities, effectively reducing the system's attack surface (Johnson & Wang, 2023). Such selective access mechanisms also support compliance with data protection regulations, including the General Data Protection Regulation (GDPR), by enabling controlled data visibility and access rights (Silva et al., 2025). In addition, smart contracts automate transaction validation and enforce predefined operational rules, which reduces reliance on manual intervention and minimizes risks associated with human error and insider misconduct (Sun et al., 2024).

Empirical evidence further indicates that blockchain adoption enhances organizational cybersecurity resilience. Casino et al. (2019) emphasize blockchain's robustness against prevalent cyber threats, such as Distributed Denial-of-Service (DDoS) attacks and unauthorized data alteration. Li and Xu (2024) demonstrate that hybrid blockchain architectures—integrating on-chain and off-chain data storage—can achieve an effective balance between security and scalability. Nonetheless, certain vulnerabilities persist, including the risk of a 51% attack, in which majority control of the network could compromise data integrity, as well as exploitable flaws in smart contract code (Weber et al., 2019; Zhang et al., 2025). Consequently, continuous advancements in blockchain security protocols, combined with robust regulatory oversight, remain essential to ensuring the long-term security of blockchain-based accounting and financial reporting systems.

Hypothesis 2: *The use of blockchain technology in accounting and financial reporting significantly improves the security of financial information.*

4.3. Blockchain Technology and Reduction of Fraud and Errors

Fraud and errors in financial reporting undermine trust in financial markets and may result in substantial economic losses (Dechow et al., 2011). The limited transparency and centralized control inherent in traditional accounting systems create conditions that facilitate both fraudulent manipulation and unintentional errors (Kokina & Davenport, 2017). Blockchain addresses these concerns through its immutable ledger structure, which ensures that once a transaction is recorded, it cannot be altered or deleted without network consensus. This feature generates a secure, transparent, and verifiable audit trail that strengthens accountability and deters opportunistic behavior (Dai & Vasarhelyi, 2017).

In addition, blockchain's capacity to incorporate smart contracts enables automated transaction validation and compliance checks, thereby reducing reliance on manual processing and limiting opportunities for both human error and intentional misstatement (Chen et al., 2020). The continuous, real-time monitoring facilitated by blockchain allows auditors and internal control systems to identify anomalies and irregularities more promptly than is possible under traditional, periodic audit cycles (Sun et al., 2024). Such proactive detection mechanisms enhance the reliability of financial reporting and reduce the probability of material misstatements (Nguyen et al., 2024).

Empirical research provides further support for blockchain's role in fraud mitigation. Dai and Vasarhelyi (2017) argue that the enhanced auditability

afforded by blockchain significantly lowers audit risk by offering tamper-resistant and comprehensive transaction histories. Similarly, Sun et al. (2024) document instances in which blockchain implementation enabled the early identification of discrepancies that would likely have remained undetected within conventional accounting systems. Nevertheless, the extent to which blockchain effectively reduces fraud is contingent upon its integration with robust organizational control mechanisms and alignment with prevailing regulatory and compliance frameworks (Rahman et al., 2024).

Hypothesis 3: *The use of blockchain technology in accounting and financial reporting significantly reduces financial fraud and errors.*

4.4. Blockchain Technology and Stakeholder Trust and Technology Acceptance

The acceptance and successful implementation of Blockchain in accounting largely depend on stakeholder trust and perceived usefulness (Davis, 1989). Trust is particularly vital in financial reporting, where stakeholders—including auditors, regulators, investors, and other financial actors—rely heavily on the accuracy, reliability, and security of reported information (Johnson & Wang, 2023). Blockchain's inherent features of transparency, immutability, and data security foster stakeholder trust by addressing long-standing concerns related to data manipulation and cybersecurity breaches (Rahman et al., 2024).

According to the Technology Acceptance Model (TAM), stakeholders' perceptions of ease of use and usefulness are critical determinants of their willingness to adopt new technologies (Davis, 1989). Blockchain's automation capabilities and enhanced transparency increase perceived usefulness, while user-friendly interfaces and seamless integration with existing systems improve perceived ease of use (Park et al., 2025). As trust in the technology strengthens, resistance to adoption decreases, thereby facilitating broader organizational acceptance (Hossain & Kaur, 2023).

Empirical studies underscore the link between blockchain characteristics and stakeholder trust. Johnson and Wang (2023) report that confidence in blockchain's security and transparency positively influences auditors' willingness to rely on blockchain-based records. Rahman et al. (2024) further demonstrate that leadership endorsement and effective communication of blockchain benefits enhance technology acceptance within accounting firms. Nonetheless, skepticism stemming from perceived technical complexity and regulatory uncertainty can hinder trust and impede adoption (Silva et al., 2025).

Hypothesis 4: *The use of blockchain technology in accounting and financial reporting significantly increases trust and technology acceptance among financial stakeholders*

5. Methodology

This study employs a quantitative research design to examine the impact of Blockchain on transparency, security, fraud reduction, and stakeholder trust in financial reporting. Quantitative methods are appropriate for this investigation because they allow for objective measurement and statistical testing of hypotheses, providing empirical evidence regarding the effects of blockchain adoption in accounting practices (Creswell, 2014).

The target population comprises accounting and financial professionals employed by companies listed on the Tehran Stock Exchange (TSE). These individuals were selected due to their direct involvement in financial reporting processes and their growing exposure to emerging technologies, including blockchain (Rahman, Sultana, & Hasan, 2024). Based on Cochran's sample size formula and an estimated population of approximately 800 professionals, a minimum sample of 260 was determined to ensure adequate representation at a 95% confidence level and a 5% margin of error (Cochran, 1977). To enhance the robustness of the findings and account for potential non-responses, 350 questionnaires were distributed, resulting in 312 valid responses and an effective response rate of 89%, which is considered highly

satisfactory for survey research (Baruch & Holtom, 2008).

Data were collected using a structured questionnaire developed based on a comprehensive literature review and previously validated instruments (Sun, Li, & Zhang, 2024; Johnson & Wang, 2023). The questionnaire measured five key constructs: blockchain usage, transparency of financial reporting, security of financial information, fraud reduction, and stakeholder trust and acceptance. Each construct was operationalized using multiple items measured on a five-point Likert scale ranging from "strongly disagree" to "strongly agree." Content validity was ensured through expert review by specialists in accounting and information technology, confirming the relevance and clarity of the questionnaire items (Hsu & Sandford, 2007).

Questionnaires were distributed both electronically and in printed form between March and April 2025. Follow-up reminders were sent two weeks after the initial distribution to maximize response rates (Dillman, Smyth, & Christian, 2014). This mixed-mode approach facilitated the inclusion of a broad range of professionals across diverse organizations.

For data analysis, Partial Least Squares Structural Equation Modeling (PLS-SEM) was employed using SmartPLS 4 software (Ringle, Wende, & Becker, 2020). PLS-SEM is particularly suitable for this study due to its ability to handle complex models, perform effectively with small to medium sample sizes, and remain robust under non-normal data distributions (Hair et al., 2019). The analytical procedure involved two main stages: first, assessing the measurement model to evaluate the reliability and validity of constructs using Cronbach's alpha, composite reliability, average variance extracted (AVE), and discriminant validity (Fornell & Larcker, 1981); second, testing the structural model by analyzing path coefficients and their significance through bootstrapping with 5,000 resamples, while evaluating the explanatory power of the model using R^2 values.

Ethical considerations were rigorously observed throughout the study. Participants were assured of confidentiality and anonymity, and informed consent was obtained prior to data collection. The study adhered to the ethical principles outlined in the Declaration of Helsinki and relevant institutional guidelines to protect participants' rights (Resnik, 2018).

In summary, the methodological framework employed in this research provides a systematic and rigorous approach to empirically investigating the role of blockchain technology in enhancing financial reporting processes within the Iranian context. The selected population, data collection methods, and analytical techniques are aligned to generate reliable and valid findings, contributing both to academic knowledge and practical applications in accounting.

Findings: Demographic Analysis of the Sample

Table 1 presents the demographic characteristics of the 312 respondents who participated in this study. The gender distribution shows a higher proportion of male participants (61.9%) compared to females (38.1%), reflecting the general trend within the accounting profession in Iran (Rahman et al., 2024).

Regarding age, the majority of respondents were between 31 and 40 years old (44.9%), followed by those aged 20–30 years (30.1%). This indicates that the sample predominantly comprises young to middle-aged professionals actively engaged in accounting and financial reporting.

In terms of educational attainment, half of the respondents hold a bachelor's degree (50%), a substantial portion possess a master's degree (40.1%), and nearly 10% have earned a doctorate or higher. This distribution highlights the relatively high academic qualifications of the sample.

Work experience among participants was diverse: 42% had between 5 and 10 years of professional experience, 30.1% had less than 5 years, and 27.9% had more than 10 years. This variation ensures that perspectives on blockchain adoption are captured across different career stages.

Table 1: Demographic Characteristics of the Respondents

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	193	61.9
	Female	119	38.1
Age	20–30 years	94	30.1
	31–40 years	140	44.9
	41–50 years	62	19.9
	Above 50 years	16	5.1
Education Level	Bachelor's degree	156	50.0
	Master's degree	125	40.1
	Doctorate or higher	31	9.9
Work Experience	Less than 5 years	94	30.1
	5–10 years	131	42.0
	More than 10 years	87	27.9
Professional Field	Accounting & Financial Reporting	172	55.1
	Internal/External Auditing	78	25.0
	Financial Management & Internal Control	62	19.9

Finally, the distribution of professional fields indicates that over half of the respondents (55.1%) are directly involved in accounting and financial reporting, while others work in auditing (25%) or financial management and internal control (19.9%). This diversity enhances the generalizability of the findings across various accounting-related roles.

6. Model Fit and Measurement Model Evaluation

In this study, the measurement model was assessed using Partial Least Squares Structural Equation Modeling (PLS-SEM), following the methodological guidelines outlined by Hair et al. (2017). The primary aim was to evaluate the validity and reliability of the constructs, as well as the overall fit of the conceptual model, which encompasses blockchain technology, financial reporting transparency, financial information security, and fraud and error reduction.

Internal consistency reliability was examined using Cronbach's alpha and composite reliability (CR) indices. Cronbach's alpha values ranged from 0.702 to 0.819, exceeding the recommended threshold of 0.70, indicating satisfactory internal consistency among the indicators (Nunnally & Bernstein, 1994). Composite reliability values ranged from 0.809 to 0.873, further confirming the high reliability of the constructs in capturing the underlying concepts (Henseler et al., 2016).

Convergent validity was evaluated through factor loadings and Average Variance Extracted (AVE). Initial factor loadings ranged between 0.521 and 0.579, with some indicators related to the interaction between blockchain technology and transparency removed due to insufficient loadings. In the final model, all factor loadings exceeded the critical threshold of 0.50, demonstrating adequate explanatory power for their respective constructs. AVE values for all constructs surpassed the recommended minimum of 0.50, confirming the model's convergent validity (Fornell & Larcker, 1981).

The results, presented in Table 2 and Figure 1, illustrate the measurement model's validity, internal consistency, and convergent validity. These assessments are particularly important in studies investigating the integration of blockchain technology, transparency, and security for detecting financial fraud. While a few indicators required minor conceptual adjustments, their impact on the overall model was negligible.

In summary, the findings confirm the precision, validity, and reliability of the measurement instruments, making them appropriate for conducting complex structural analyses and testing hypotheses related to the role of blockchain in enhancing transparency and security to reduce financial fraud. Furthermore, the established measurement properties support the generalizability of the results in the domains of financial technology, auditing, and corporate governance.

Table 2: Model Fit and Measurement Model Evaluation (Final Stage)

Construct	Items	Factor Loadings	Cronbach's Alpha	AVE	Composite Reliability
Financial Reporting Transparency	Q1–Q5	0.776 – 0.799	0.819	0.580	0.873
Blockchain Technology	Q1–Q5	0.740 – 0.872	0.878	0.651	0.903
Financial Information Security	Q1–Q4	0.528 – 0.924	0.838	0.665	0.884
Fraud and Error Reduction	Q1–Q10	0.505 – 0.679	0.826	0.508	0.854

7. Discriminant Validity: Assessing Conceptual Distinctiveness of Constructs in the Measurement Model

Discriminant validity is a critical criterion for assessing the validity of measurement models in structural equation modeling. Originally proposed by Fornell and Larcker (1981), discriminant validity requires that each construct shares more variance with its own indicators than with other constructs in the model. In other words, each construct must be conceptually and statistically distinct from all others.

According to the Fornell-Larcker criterion, discriminant validity is established when the Average Variance Extracted (AVE) for each construct exceeds the squared correlations between that construct and any other construct in the model. This ensures that each construct maintains conceptual independence and is accurately measured by its respective indicators.

As presented in Table 3, the AVE values for all constructs in this study—including blockchain technology, financial reporting transparency, financial information security, and the integrated construct of fraud reduction—exceed the squared inter-construct correlations. This indicates strong discriminant validity and confirms the conceptual distinctiveness of each construct.

These results suggest that the constructs in the measurement model do not exhibit unwanted conceptual overlap and effectively represent their theoretical constructs. This strengthens the structural validity of the measurement model and provides a robust foundation for causal analyses in the structural model, such as examining the moderating role of corporate governance on the relationship between blockchain technology and transparency in detecting financial fraud.

Therefore, it can be concluded that the hypotheses tested in this study are based on independent, valid, and generalizable constructs, supporting the reliability and rigor of the structural model analysis.

Stone-Geisser Q^2: Assessing Predictive Relevance of the Research Model

The Q^2 index, first introduced by Stone and Geisser (1975), is a crucial metric for evaluating the predictive quality of structural equation models, particularly concerning endogenous constructs. This index measures the model's ability to accurately predict the observed values of dependent variables. In other words, Q^2 reflects the effectiveness of the causal relationships defined in the conceptual model in explaining the variance of the dependent constructs.

According to guidelines by Henseler et al. (2009) and Hair et al. (2017), Q^2 values are interpreted at three levels:

- Values above 0.02 indicate weak predictive power,
- Values above 0.15 indicate moderate predictive power,
- Values above 0.35 indicate strong predictive power of the model.

As shown in Table 4, the Q^2 values for all endogenous variables in the current study, including blockchain technology, financial reporting transparency, financial information security, and the moderating role of corporate governance in fraud detection, are all above the threshold of 0.35. This finding highlights the strong predictive relevance of the structural model and validates the causal relationships established in the conceptual framework.

Therefore, it can be concluded that the research model not only fits the data well but also possesses high predictive capability. This feature enhances the theoretical and empirical robustness of the model and demonstrates that the proposed conceptual framework can accurately analyze and explain the detection of financial fraud networks through blockchain technology while accounting for the moderating effects of corporate governance mechanisms. Consequently, the research findings have high generalizability and practical applicability for future studies and operational implementations.

Analysis and Discussion of Hypotheses

After confirming the adequacy of the measurement and structural models, the research hypotheses were tested using Partial Least Squares Structural Equation Modeling (PLS-SEM). This method is selected due to its robustness in handling complex models and non-normal data distributions (Hair et al., 2019). The path coefficients, t-statistics, and p-values for each hypothesis are presented in Table 5.

Table 3. Fornell-Larcker Criterion Test

Constructs	Synergy of Blockchain & Transparency in Governance	Corporate Governance	Fraud Detection	Blockchain Technology	Synergy of Blockchain & Transparency	Transparency
Synergy of Blockchain & Transparency in Governance	1.000					
Corporate Governance	0.158	0.708				
Fraud Detection	0.124	0.837	0.762			
Blockchain Technology	0.071	0.181	0.227	0.807		
Synergy of Blockchain & Transparency	0.323	0.376	0.357	0.505	0.555	
Transparency	0.175	0.176	0.207	0.741	0.619	0.815

Table 4. Stone-Geisser Q^2 Values

Construct	Q^2 Value
Synergy of Blockchain Technology and Internal Controls in Governance	0.789
Corporate Governance	0.542
Fraud Detection	0.621
Blockchain Technology	0.535
Synergy of Blockchain and Internal Controls	0.529
Internal Controls	0.749

Table 5: Hypothesis Testing Results

Hypothesis	Path Coefficient (β)	t-Statistic	p-Value	Result
H1: Impact of Blockchain Technology on Financial Reporting Transparency	0.381	5.738	<0.001	Supported
H2: Impact of Blockchain Technology on Financial Information Security	0.422	6.214	<0.001	Supported
H3: Impact of Blockchain Technology on Reduction of Financial Fraud and Errors	0.359	4.891	<0.001	Supported
H4: Impact of Blockchain Technology on Stakeholders' Trust and Technology Acceptance	0.408	5.462	<0.001	Supported

Hypothesis 1: Impact of Blockchain Technology on Financial Reporting Transparency

The findings indicate that blockchain technology significantly enhances the transparency of financial reports ($\beta = 0.381$, $t = 5.738$, $p < 0.001$). This suggests that the decentralized and immutable ledger structure improves both the accessibility and accuracy of financial data. According to information asymmetry theory (Akerlof, 1970), greater transparency fosters increased stakeholder trust in financial disclosures (Tapscott & Tapscott, 2017). Additionally, blockchain ensures data integrity and timeliness, enabling more reliable and credible financial reporting.

Hypothesis 2: Impact of Blockchain Technology on Financial Information Security

A strong positive and significant relationship was found between blockchain adoption and the security of financial information ($\beta = 0.422$, $t = 6.214$, $p < 0.001$). Blockchain's core features, including cryptographic encryption and distributed consensus mechanisms, effectively prevent data tampering, unauthorized access, and cyber threats (Zheng et al., 2018). By enhancing information security, blockchain not only mitigates cyber risks but also strengthens user and organizational confidence, which is essential for the reliable exchange and management of financial data.

Hypothesis 3: Impact of Blockchain Technology on Reduction of Financial Fraud and Errors

The results indicate that blockchain usage significantly reduces financial fraud and errors ($\beta = 0.359$, $t = 4.891$, $p < 0.001$). By providing an auditable and immutable record of all transactions, blockchain limits the possibility of unauthorized data alterations. Prior research has emphasized that such transparency enhances auditing processes and facilitates fraud detection (Yermack, 2017). Consequently, the immutable transaction ledger not only serves as a strong deterrent to fraudulent behavior but also contributes to greater accuracy and reliability of financial data.

Hypothesis 4: Impact of Blockchain Technology on Stakeholders' Trust and Technology Acceptance

With a path coefficient of 0.408 and a t-value of 5.462, blockchain technology has a significant positive effect on stakeholder trust and acceptance ($p < 0.001$). This finding is consistent with the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT), which emphasize trust as a key determinant of new technology adoption (Venkatesh et al., 2003). Blockchain's inherent features—security, transparency, and reliability—strengthen stakeholder confidence, thereby facilitating broader acceptance and use of blockchain in accounting and financial reporting processes.

The results further confirm the significant positive impact of blockchain technology on enhancing transparency, information security, fraud reduction, and stakeholder trust within accounting and financial reporting contexts. These findings underscore blockchain's potential to transform financial and auditing systems by improving the efficiency, accuracy, and reliability of financial data. Overall, the evidence aligns with prior research and highlights that investment in blockchain represents a strategic priority for organizations and financial institutions aiming to enhance financial governance and reporting quality in the digital era.

8. Discussion and Conclusion

In the current digital era, emerging technologies, particularly Blockchain, have become pivotal in transforming accounting and financial reporting systems. With features such as transparency, immutability, and enhanced security, blockchain holds substantial potential to improve accounting processes and the quality of financial reporting. This study examined the impact of blockchain on multiple dimensions of financial reporting, providing important insights into its role in enhancing the reliability of financial information and fostering stakeholder trust.

The findings indicate that the adoption of blockchain in accounting and financial reporting significantly improves transparency and information

security, reduces financial fraud and errors, and strengthens stakeholder trust. These results are consistent with prior research highlighting blockchain's transformative potential in enhancing transparency and reliability within financial systems (Casino et al., 2019; Yermack, 2017).

The observed increase in transparency can be attributed to blockchain's decentralized and immutable structure, which minimizes information asymmetry and enhances data verification capabilities (Kokina & Davenport, 2017). These characteristics enable more accurate and timely reporting, thereby facilitating informed decision-making by stakeholders (Rejeb et al., 2021). From the perspective of structural trust theory, technologies that provide traceable and verifiable data substantially enhance user and investor trust (Beck et al., 2017).

Regarding information security, blockchain's cryptographic features and consensus algorithms provide robust protection against unauthorized modifications, fraud, and cyberattacks (Zheng et al., 2018). Compared to traditional centralized systems, which are more susceptible to security breaches, blockchain ensures data integrity and confidentiality, corroborating previous findings on its security benefits (Kshetri, 2018).

The results also demonstrate that blockchain significantly mitigates financial fraud and errors. Its immutability and full transaction traceability support auditing processes and accountability (Tapscott & Tapscott, 2017). These findings align with empirical evidence showing blockchain's effectiveness in reducing fraudulent activities and enhancing transparency (Miller, 2020). From an internal control perspective, blockchain strengthens monitoring and reporting mechanisms, thereby substantially lowering fraud risk (Kshetri, 2018).

In addition, the study highlights that increased stakeholder trust and technology acceptance are central to successful blockchain adoption (Venkatesh et al., 2003). Higher trust not only facilitates adoption but also accelerates blockchain diffusion within accounting systems, allowing organizations to fully harness its benefits (Beck et al., 2017). This observation is consistent with the Technology Acceptance Model (TAM), which emphasizes perceived ease of use and perceived usefulness as key determinants of technology adoption (Davis, 1989).

Despite these advantages, challenges such as scalability limitations, legal uncertainties, technical complexities, and organizational resistance remain significant barriers to widespread blockchain adoption in accounting systems (Christidis & Devetsikiotis, 2016). These limitations underscore the need for future research focused on developing technical and regulatory solutions, as well as investigating the long-term effects of blockchain integration on financial reporting quality.

In conclusion, this study underscores the critical role of blockchain technology in accounting and financial reporting. The findings demonstrate that blockchain can substantially enhance financial statement transparency, ensure data security, reduce fraud and errors, and strengthen stakeholder trust. These results suggest that blockchain represents a strategic innovation capable of improving the reliability, integrity, and efficiency of financial information systems in the digital age.

For managers, policymakers, and financial system practitioners, it is recommended to consider blockchain as a strategic tool for strengthening financial governance, improving the accuracy and reliability of financial reports, and addressing operational and legal challenges through technological advancement, clear regulatory frameworks, and enhanced professional expertise.

Overall, blockchain constitutes a paradigm shift in financial reporting, with the potential to fundamentally enhance data integrity and stakeholder trust. With continued research and practical implementation, significant improvements in the performance, transparency, and reliability of accounting and financial systems are expected in the near future.

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Investigating the Relationship between the Uncertainty of Economic Policies and the Fulfillment of Social Responsibilities, Considering the Role of Government Ownership

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Abstract

Objectives: This study aims to investigate the relationship between economic policy uncertainty and corporate social responsibility (CSR) practices, considering the moderating role of government ownership among firms listed on the Tehran Stock Exchange (TSE).

Methodology/Design/Approach: The research is applied in nature, covering the period 2017–2022. A sample of 100 firms was selected using the stratified random sampling method. The hypotheses were tested using multiple regression analysis to examine the impact of both direct and indirect indicators of economic uncertainty on CSR activities.

Findings: The results reveal that the inflation rate (a direct indicator of economic uncertainty) has a positive and significant relationship with CSR participation, while GDP (an indirect indicator) shows a negative and significant relationship. These findings suggest that as economic uncertainty increases, firms tend to engage more in CSR activities. However, in government-owned firms, greater economic uncertainty leads to reduced CSR participation.

Innovation: This study contributes to the literature by highlighting how economic uncertainty shapes CSR practices and demonstrating the contrasting effects in private versus government-owned firms. The findings offer practical implications for policymakers and corporate managers seeking to balance economic conditions with social responsibility commitments.

Keywords: Economic Policy Uncertainty, GDP, Inflation, CSR.

1. Introduction

Corporate social responsibility (CSR) has become a central component of contemporary business strategy, significantly influencing corporate decision-making and organizational outcomes (Li et al., 2024). As societal expectations evolve, stakeholders increasingly demand ethical and sustainable business practices, compelling firms to integrate CSR into their operations to ensure long-term sustainability and competitiveness (Zho et al., 2024). By actively engaging in CSR activities, firms not only fulfill their ethical obligations but also gain tangible benefits, such as enhanced brand trust, reputation, and customer loyalty. Additionally, CSR initiatives can function as strategic tools for risk management, helping firms navigate complex regulatory environments, mitigate reputational risks, and prevent potential crises (Wang et al., 2024).

Contemporary finance and economics literature also emphasizes the critical role of policy uncertainty in shaping firm performance and strategic decision-making. Variations in government regulations, fiscal policies, trade agreements, and geopolitical conditions introduce unpredictability and risk into business operations, affecting investment decisions, capital allocation, and market behavior (Joe & Lee, 2024). Empirical studies have highlighted correlations between policy uncertainty and firm policies, including innovation, capital expenditure, and risk management strategies. Consequently, understanding the impact of policy uncertainty on corporate and investment behavior has become a key research focus.

Environmental and economic instability, driven by macroeconomic trends, globalization, technological advances, and increased competition, further heightens uncertainty. Managers often exercise discretion and flexibility to adapt to such environmental changes, influencing investment policies and strategic decisions (Huang, Sun, & Zha, 2017; Drobetz et al., 2018; Bloom et al., 2012). Research indicates that high environmental economic uncertainty negatively affects capital market returns (Baker & Bloom, 2013), and investment decisions—being long-term and resource-intensive—are particularly sensitive to economic instability, potentially impacting the firm's capital stability (Jori, Khieu & Ngo, 2020).

In recent years, organizational objectives have shifted from solely maximizing shareholder wealth to protecting broader stakeholder interests, including societal welfare (Rezaee, Dou, & Zhang, 2017). CSR has thus become a key area of focus in financial and accounting research, examining its interplay with financial functions such as earnings quality (Hung, Wong & Zhang, 2015). CSR entails actions that extend beyond contractual and legal obligations to minimize negative social and environmental impacts while maximizing positive contributions. This can include activities aimed at serving communities, society, and the environment beyond what is legally required (Joe & Harjoto, 2012). Moreover, CSR can create competitive advantages by aligning financial and non-financial values, enhancing reputation, shareholder reciprocity, risk management, and innovation (Levno & Srivastava, 2019; Viswanathan et al., 2020).

Economic policy uncertainty may reduce the willingness of both individual and institutional investors to invest, including in CSR initiatives. Investments in social responsibility can positively affect firm performance by promoting ethical practices, increasing sales, enhancing customer loyalty, and supporting sustainable profits. At the societal level, CSR activities help address social needs and reinforce stakeholder awareness of a firm's ethical and societal obligations, thereby encouraging responsible investment decisions (Fazilat et al., 2021).

Despite widespread privatization, governments continue to hold stakes in strategic industries such as water, electricity, mining, and defense, making state-owned enterprises (SOEs) a significant part of the economy. Research suggests that SOEs may pursue more diverse social objectives compared to private firms. Therefore, examining the role of state ownership in moderating the relationship between economic policy uncertainty and CSR performance is critical for advancing the literature.

2. Theoretical Foundations and Research Background

The impact of economic uncertainty on corporate credit policies remains inconclusive, as empirical findings and theoretical perspectives have yet to reach a consensus. During periods of economic downturn or instability, demand for products may decline or fluctuate (Jury et al., 2020). According to Emery (1984), firms can respond to such demand fluctuations by adjusting prices, modifying production, or extending trade credit. In particular, increasing the provision of business credit is often employed as a strategy during recessions to sustain operations and support customers.

Economic uncertainty—defined as the risk arising from unpredictable changes in fiscal, regulatory, and monetary policies at the macroeconomic level—has more profound implications than a temporary recession. It can exacerbate financial constraints by reducing returns on assets and increasing the cost of debt (Pastor & Veronesi, 2013). Firms often respond to heightened uncertainty by increasing cash reserves (Phan, Sharma, & Tran, 2018). Baker, Bloom, and Davis (2016) note that economic uncertainty can amplify the adverse effects of a recession, hindering recovery. In such environments, both buyers and sellers face liquidity risks, and access to business credit may be restricted, with creditors shortening repayment periods and raising interest costs (Jury et al., 2020).

The real options theory provides a useful framework for understanding how economic uncertainty influences corporate investment decisions, including social responsibility. Real options theory emphasizes the importance of flexibility when investment decisions are partially irreversible and managerial discretion is exercised (Kogut & Kulati, 2001). Irreversible investments, such as long-term projects or social responsibility initiatives, cannot be fully recovered without significant cost. Uncertainty can lead to deviations between projected and actual future cash flows, skewing net present value calculations and leading firms to postpone or reduce investments (Yuan et al., 2022).

Empirical studies support the notion that firms adopt more cautious investment behavior under uncertainty. Rodrik (1991) and Jeong (2002) show that policy uncertainty leads firms to delay investments, while Julio and Yook (2012) demonstrate that political uncertainty, such as during presidential election years, can reduce corporate capital expenditures. Similarly, Gulen and Lon (2016) found that higher economic uncertainty correlates with lower levels of capital investment. Social responsibility initiatives, being long-term and often non-recoverable (e.g., charitable donations), fall into the category of high-risk investments (Cruz & Wakolbinger, 2008; McWilliams & Siegel, 2000).

Economic uncertainty increases the risk associated with CSR investments. According to real options theory, firms may delay CSR activities until uncertainty declines, treating the postponement as a valuable "option to wait" (Yuan et al., 2022). However, CSR can also serve as a strategic tool for achieving long-term competitive advantages, building stakeholder trust, and enhancing customer loyalty. In some cases, firms may increase CSR investment during periods of high uncertainty to signal resilience and commitment to stakeholders (Baker et al., 2016). Consequently, prior research has not reached definitive conclusions regarding the effect of economic uncertainty on CSR investment.

Ownership structure further moderates these dynamics. State-owned enterprises (SOEs) often exhibit less sensitivity to economic uncertainty due to government support, which stabilizes their investment policies (Li & Zhang, 2010). At the same time, partial state ownership may incentivize firms to engage more actively in CSR, aligning with government policies and societal expectations. Therefore, the impact of economic uncertainty on corporate investment decisions, including CSR, can vary depending on the level of state ownership (Yuan et al., 2022).

3. Empirical Background

Several recent studies have examined the relationship between economic policy uncertainty, corporate governance, ownership structure, and corporate social responsibility (CSR) in both emerging and developed markets.

Hong et al. (2024) investigated the effect of economic policy uncertainty on CSR performance in six emerging Southeast Asian countries using panel data from 2004 to 2021. Their findings indicate a negative relationship between national-level economic policy uncertainty and CSR performance, particularly concerning environmental and social dimensions.

Shahzad et al. (2024) explored the moderating role of CSR disclosure in the relationship between corporate governance and corporate risk behavior. Using panel data from 73 non-financial firms listed on the Pakistan Stock Exchange between 2014 and 2018, they found that stronger corporate governance measures, in contexts with weak regulations, can increase corporate risk. However, CSR disclosure enhances stakeholder information, reduces information asymmetry, and mitigates operational risk.

Yuan et al. (2022) examined the effect of economic uncertainty on firms' participation in social activities in China during 2008–2015, considering the role of state ownership. Their results demonstrate that economic uncertainty increases firms' CSR engagement, and this relationship is amplified for state-owned enterprises.

Mamori (2021) studied the link between CSR and firm performance across 23 developed countries from 2002 to 2013, considering exploration and growth strategies. The study revealed a positive and significant relationship between CSR participation and firm performance, with growth and exploration strategies strengthening this relationship.

Dalkhi (2021) investigated the effect of ownership structure on CSR in French firms listed on the Paris Stock Exchange between 2010 and 2018. The findings indicate that higher institutional ownership is positively associated with greater CSR engagement, highlighting the role of institutional shareholders in promoting social activities within firms.

Ebrahimi et al. (2023) analyzed ownership structure, political uncertainty, and asymmetric cost behavior using a sample of 325 firms listed on the Tehran Stock Exchange and Iran Fara Bourse. The study found that state-owned firms exhibit sticky cost behavior during election years, while private firms display more linear cost behavior. These results underline the moderating effect of ownership type on firm responses to political uncertainty.

Ghorbani et al. (2022) examined auditor conservatism, economic policy uncertainty, and earnings quality in 150 firms listed on the Tehran Stock Exchange during 2013–2019. Results show that auditor conservatism positively affects earnings quality, whereas economic policy uncertainty negatively impacts it.

Yazdi et al. (2022) investigated the moderating role of stakeholder influence on the relationship between CEO power and CSR for 172 Tehran Stock Exchange-listed firms during 2015–2019. They found a positive relationship between CEO power and CSR, which is further strengthened by stakeholder influence.

Fakhr Hosseini (2022) studied the impact of CSR, credibility, and competitive advantage on business performance across 109 firms from 19 industries between 2015 and 2020. The findings reveal that CSR negatively affects corporate credit, whereas competitive advantage positively influences return on equity and return on assets.

Finally, Dadashi et al. (2022) analyzed the effect of CSR and risk-taking on firm performance under the moderating influence of financial constraints, using data from 455 firm-years listed on the Tehran Stock Exchange during 2014–2018. Their results indicate that CSR and risk-taking negatively affect performance, while financial constraints positively moderate the relationship between CSR and firm performance, but not between risk-taking and performance.

Collectively, these studies highlight the complex interplay between economic policy uncertainty,

ownership structure, corporate governance, and CSR. While economic uncertainty generally poses challenges for CSR investment, factors such as state ownership, stakeholder influence, and strategic governance mechanisms can mitigate or even reverse its impact, promoting sustainable firm performance and social engagement.

4. Research Hypotheses

H1: Economic uncertainty has a significant relationship with participation in social activities.

H2: State ownership has a significant effect on the relationship between economic uncertainty and participation in social activities.

Research Methodology

The present study is descriptive and a type of correlational (post-event) research. Descriptive research is defined as a research method that describes the characteristics of the population or phenomenon under study. Post-event research intends to investigate the relationships between independent and dependent variables after the occurrence of an action or event. Come. Applied research is conducted to investigate the possibility of applying knowledge in a society or organization. The research period was between 2015 and 2021. The research hypotheses were tested using multiple regression methods.

Research hypothesis test models

To test the research hypotheses, following Yuan et al. (2020), models (1) and (2) are developed as follows:

$$CSR = \beta 0 + \beta 1\, EPU_{it} + \beta 2\, \gamma * Controls_{it} + \varepsilon \quad \text{Model (1)}$$

$$CSR = \beta 0 + \beta 1\, EPU_{it} + \beta 2\, SOE_{it} + \beta 3\, (SOE_{it} * EPU) + \beta 2\, \gamma * Controls_{it} + \varepsilon \quad \text{Model (2)}$$

In the above models

CSR: Participation in Social Activities

Following the action of et al. (2020), the following 19 indicators are used as a criterion for measuring participation in the firm's social responsibilities, so that if any of the following indicators are disclosed, the number 1, and otherwise the number zero, will be assigned to this variable. Finally, the sum of the scores shows the firm's social participation score.

Table (1) Indicators of Social Responsibility

Environment	Production	Social Participation	Employee Relations
• Air pollution control • Prevention and Compensation Program • Protection and use of products resulting from recycling • Environmentalism	• Product Safety • Product quality • Product Development • After-sales service	• Cash donation program • Khyariyeh Program • Yeli Scholarship Program • Sponsor or sponsor for sports activities • Public Projects	• Employee Environmental Health • Staff training • Employee Benefits • Staff Profile • Ownership of employee shares • Employee safety and health

EPU: Economic Uncertainty

Following Shokarkhah et al. (2016), two indices of inflation rate and GDP growth are used as indicators to measure economic uncertainty.

EPU1: This variable is equal to the inflation rate

EPU2: This variable is equal to the GDP growth rate announced by the Central Bank

Moderating Variable:

SOE: Following Yuan et al. (2020), if the ownership of the government and government entities in the

firm's shares exceeds 20% (significant influence), this variable is assigned a number, and otherwise the number is zero.

Control Variables

Following Yuan et al. (2020), the control variables are as follows:

Size: The size of the firm, which is equal to the natural logarithm of the total assets of the firm

Lev: Financial leverage is equal to the ratio of total debt to total assets of the firm

ROA: Return on assets, which is equal to the ratio of operating profit to total assets of the firm.

Capex: Capital expenditure that is equal to the ratio of the purchase of fixed assets to the total assets of the firm

5. Research Findings

Descriptive Research Statistics

The descriptive statistics of the research are presented in Table 2. Descriptive statistics include the mean, median, minimum, maximum, and standard deviation of each variable. The mean is the main central index that indicates the equilibrium point and center of gravity of the distribution, and it is a good indicator to show the centrality of the data. The median is the value that 50% of the sample data is below and 50% above. Those whose shape is asymmetrical are used. The standard deviation is the most important scattering parameter that is obtained from the root of variance, and this index indicates the average fluctuation of the observations from their mean.

Table 2 presents the descriptive statistics of the key research variables. The corporate governance index exhibits a mean value of 37%, indicating that, on average, the sample firms achieved 37% of the total possible score on the corporate governance scale. The level of participation in social activities varies substantially among the firms, with a maximum score of 63% and a minimum of 5%, reflecting considerable heterogeneity in CSR engagement.

Economic indicators reveal notable uncertainty within the operating environment of the firms. The inflation rate averages 48%, ranging from 8% to 48%, where higher inflation is indicative of increased economic uncertainty. Similarly, the average GDP growth rate across the sample period is approximately zero, with a maximum of 0.04 and a minimum of -0.065, suggesting periods of economic stagnation or contraction, which further amplify uncertainty.

Firm-specific characteristics indicate a diverse sample. The average firm size is 14.82 (units in logarithmic scale if applicable), suggesting a predominance of medium-to-large firms. Leverage is relatively high, with an average of 54%, implying that firms rely more heavily on debt financing relative to equity. Profitability, as measured by return on assets (ROA), averages 15%, indicating that, on average, managers can generate 15% profit for each unit of assets employed. Capital expenditure averages 4%, reflecting the proportion of asset investments allocated to the acquisition of fixed assets within the sample firms.

Table 2: Descriptive Statistics

Persian Name	Symbol	Average	Middle	Most	Lowest	Standard deviation
Participation in social activities	Csr	0.379	0.421	0.632	0.053	0.174
Economic Inflation Rate	EPU1	0.254	0.269	0.480	0.082	0.151
GDP growth rate	EPU2	0.006	0.033	0.046	-0.065	0.040
Firm Size	SIZE	14.823	14.624	18.105	12.640	1.390
Financial Leverage	LEV	0.549	0.549	0.869	0.210	0.184
Return on Assets	ROA	0.154	0.125	0.447	-0.030	0.130
Capital expenditures	CAPEX	0.042	0.024	0.183	0.001	0.049
Participation in social activities	Csr	0.379	0.421	0.632	0.053	0.174

These descriptive statistics provide an overview of both firm-level and macroeconomic characteristics, offering a foundational understanding of the conditions under which corporate governance, CSR, and economic policy uncertainty interact in the context of the Tehran Stock Exchange. Additional descriptive measures, including standard deviations, minimums, and maximums for all variables, are presented in Table 2.

In Table 3, the frequency of the two-sided variable is presented.

The frequency distribution table for virtual variables shows that in about 76% of the observations, government ownership in the sample firms was more than 20%.

Table 3: Frequency Distribution for Virtual Variables

Variable	Zero		A	
	Abundance	Frequency Percentage	Abundance	Frequency Percentage
State Ownership	176	0.24	559	0.76

Results of Testing Research Hypotheses

Before addressing the results of the research hypotheses, it is necessary to examine the classical assumptions of regression models. The results of these assumptions, including residual normality, variance heterogeneity, and serial autocorrelation, are presented in Tables 4 to 7. Based on these results, the residuals of models (1) and (2) are not normally distributed; however, this issue is not critical due to the sample size and the Central Limit Theorem. Additionally, these models exhibit variance heterogeneity, and therefore, they were tested using generalized least squares regression. According to the Durbin–Watson statistic, the research variables do not suffer from serial autocorrelation. The collinearity test also indicates that no multicollinearity exists among the research variables. Finally, based on the Chow and Hausman tests, these models were estimated using panel data with fixed effects for both economic uncertainty indices.

5.1. Results of the first hypothesis test

The results of testing the first hypothesis of the research with the inflation rate index are presented in Table 4.

Table 4: Results of the test of the first model of the research with the inflation rate index

Persian Name	Symbol	Coefficient	Standard Error	T statistic	Significance	Inflation Factor
Inflation Rate	EPU1	0.134	0.036	3.690	0.010	1.175
Firm Size	SIZE	-0.007	0.001	-5.728	0.001	1.146
Financial Leverage	LEV	-0.005	0.010	-0.459	0.662	1.479
Return on Assets	ROA	-0.034	0.035	-0.959	0.375	1.743
Capital expenditures	CAPEX	-0.060	0.048	-1.264	0.253	1.096
Width from Origin	C	0.460	0.019	24.344	0.000	-
Watson Camera		1.51	Adjusted coefficient of determination			0.60
Statistic F		68.82	Probability of F Statistic			0.00
Jarco-Berra Test Statistic - Normality of Model Residues		24.39	The probability of the Jarko-Berra statistic			0.00

Persian Name	Symbol	Coefficient	Standard Error	T statistic	Significance	Inflation Factor
Statistics of Pagan Godfrey's Method of Heterogeneity Test		3.27	Probability of Heterogeneity Test Probability			0.00
Chao Test Statistics		64.90	The probability of the statistics of the Chow test			0.00
Hausman Test Statistics		20.71	The probability of the Hausman test statistic			0.00

According to the results of Table 4, there is a positive and significant relationship between the inflation rate and participation in social activities. Therefore, it can be said that the first hypothesis of the research is not rejected at the 95% confidence level. These findings indicate that with the increase in economic uncertainty, participation in social activities also increases. Also, among the control variables, the size of the firm has a negative and significant relationship with the social responsibility index. The adjusted coefficient of determination also shows that the independent variables have been able to explain about 60% of the changes in the dependent variable.

5.2. Results of the first hypothesis test

The results of testing the first hypothesis of the research with the economic uncertainty index are presented in Table 5.

According to the results of Table 5, there is a negative and significant relationship between GDP growth rate and participation in social activities. Therefore, it can be said that the first hypothesis of the research is not rejected at the 95% confidence level. Considering that economic uncertainty is the inverse criterion for measuring economic uncertainty, it can be said that by decreasing GDP (increasing economic uncertainty), participation in social activities increases. Also, among the control variables, the size of the firm has a negative and significant relationship with the social responsibility index. The adjusted coefficient of determination also shows that the independent variables have been able to explain about 58% of the changes in the dependent variable.

Table 5: Results of the test of the first model of the research with the economic uncertainty index

Persian Name	Symbol	Coefficient	Standard Error	T statistic	Significance	Inflation Factor
Gdp	EPU2	-0.183	0.050	-3.687	0.000	1.014
Firm Size	SIZE	-0.035	0.009	-4.028	0.000	1.110
Financial Leverage	LEV	0.077	0.075	1.029	0.306	1.477
Return on Assets	ROA	0.098	0.095	1.038	0.302	1.632
Capital expenditures	CAPEX	-0.063	0.179	-0.349	0.728	1.098
Width from Origin	C	-0.202	0.149	-1.356	0.178	-
Watson Camera		1.53	Adjusted coefficient of determination			0.58
Statistic F		15.12	Probability of F Statistic			0.00
Jarco-Berra Test Statistic - Normality of Model Residues		24.12	The probability of the Jarko-Berra statistic			0.00
Statistics of Pagan Godfrey's Method of Heterogeneity Test		2.77	Probability of Heterogeneity Test Probability			0.00
Chao Test Statistics		57.87	The probability of the statistics of the Chow test			0.00
Hausman Test Statistics		22.72	The probability of the Hausman test statistic			0.00

5.3. Results of the second hypothesis test

The results of testing the second hypothesis of the research with the inflation rate index are presented in Table 6.

According to the results of Table 6, the simultaneous ratio of inflation rate and government ownership has a negative and significant relationship with the index of participation in social activities. Therefore, the second hypothesis of the research is not rejected using the inflation rate at the 95% confidence level. These findings indicate that in firms whose shares are partially owned by the government, an increase in the inflation rate leads to a decrease in participation in the activities of the firm. It is social. Also, firm size and financial leverage have a negative and significant relationship with the index of participation in social activities. The adjusted coefficient of determination also shows that the independent variables have been able to explain about 69% of the changes in the dependent variable.

Table 6: Results of Testing the Second Research Hypothesis with the Inflation Rate Index

Persian Name	Symbol	Coefficient	Standard Error	T statistic	Significance	Inflation Factor
Inflation Rate	EPU1	0.090	0.012	7.315	0.000	3.766
State Ownership	SOE	-0.006	0.001	-4.415	0.005	3.231
Simultaneous Ratio of Inflation Rate and State Ownership	SOE*EPU1	-0.033	0.007	-4.615	0.004	5.179
Firm Size	SIZE	-0.004	0.001	-4.418	0.005	1.221
Financial Leverage	LEV	-0.013	0.005	-2.678	0.037	1.490
Return on Assets	ROA	-0.011	0.006	-1.816	0.119	1.753
Capital expenditures	CAPEX	-0.004	0.005	-0.765	0.474	1.107
Width from Origin	C	0.442	0.016	27.138	0.000	-
Watson Camera		1.51	Adjusted coefficient of determination			0.69
Statistic F		658.08	Probability of F Statistic			0.00
Jarco-Berra Test Statistic - Normality of Model Residues		23.77	The probability of the Jarko-Berra statistic			0.00
Statistics of Pagan Godfrey's Method of Heterogeneity Test		3.78	Probability of Heterogeneity Test Probability			0.00
Chao Test Statistics		67.20	The probability of the statistics of the Chow test			0.00
Hausman Test Statistics		28.01	The probability of the Hausman test statistic			0.00

5.4. Results of the second hypothesis test

The results of testing the second hypothesis of the research with the economic uncertainty index are presented in Table 7.

According to the results presented in Table 7, the interaction between economic uncertainty and government ownership has a positive and significant relationship with the index of participation in social activities. Therefore, the second hypothesis of the research is not rejected at the 95% confidence level. Economic uncertainty leads to a decrease in participation in social activities. Additionally, return on assets shows a positive and significant relationship with the participation index. The adjusted coefficient of determination indicates that the independent variables explain approximately 68% of the variation in the dependent variable.

Table 7: Results of testing the second hypothesis of the research with the economic uncertainty index

Persian Name	Symbol	Coefficient	Standard Error	T statistic	Significance	Inflation Factor
Economic Uncertainty	EPU2	-0.277	0.078	-3.558	0.000	4.790
State Ownership	SOE	-0.010	0.005	-2.142	0.033	1.353
Simultaneous Relationship of Economic Uncertainty and State Ownership	SOE*EPU2	0.188	0.094	1.998	0.046	3.629
Firm Size	SIZE	0.002	0.003	0.747	0.455	1.201
Financial Leverage	LEV	0.004	0.018	0.197	0.844	1.494
Return on Assets	ROA	0.048	0.023	2.055	0.040	1.651
Capital expenditures	CAPEX	-0.012	0.067	-0.178	0.858	1.110
Width from Origin	C	0.343	0.048	7.072	0.000	-
Watson Camera		1.91	Adjusted coefficient of determination			0.68
Statistic F		60.93	Probability of F Statistic			0.00
Jarco-Berra Test Statistic - Normality of Model Residues		23.41	The probability of the Jarko-Berra statistic			0.00
Statistics of Pagan Godfrey's Method of Heterogeneity Test		3.06	Probability of Heterogeneity Test Probability			0.00
Chao Test Statistics		57.89	The probability of the statistics of the Chow test			0.00
Hausman Test Statistics		19.97	The probability of the Hausman test statistic			0.00

6. Conclusions and Suggestions

The effect of economic uncertainty on corporate credit policies has not been fully determined. In other words, empirical findings and theoretical literature have not reached a consensus on this issue. During periods of economic uncertainty, such as recessions, product demand tends to decrease or fluctuate. Economic uncertainty exacerbates financial constraints for firms by reducing returns on assets and increasing the cost of debt. Fan et al. (2018) note that firms tend to increase their cash reserves during periods of economic uncertainty. Similarly, Baker et al. (2016) emphasize that economic uncertainty intensifies the effects of economic recessions and can hinder recovery.

During such periods, both buyers and sellers face liquidity risks. Buyers who require business credit may fail to obtain it, as creditors are likely to shorten repayment periods and increase borrowing costs. One type of firm investment with a high potential return is participation in social activities. However, investing in social activities is generally considered risky and largely irreversible; under conditions of economic uncertainty, these risks are further magnified.

This study examines the relationship between economic policy uncertainty and corporate social responsibility (CSR) performance, considering the role of state ownership in firms listed on the Tehran Stock Exchange during 2017–2022, with a total of 600 firm-year observations.

The findings indicate a positive and significant relationship between inflation rates and participation in social activities, and a negative and significant relationship between GDP growth and social activity participation. Since GDP serves as an inverse indicator of economic uncertainty, these results suggest that, under conditions of increasing economic uncertainty, the studied firms tend to increase their engagement in social activities. Motivations for this behavior may include achieving competitive advantage, increasing market share and sales, enhancing sales sustainability through customer loyalty, and promoting ethics within the firm through effective CSR strategies. These findings are consistent with Yuan et al. (2020) and Baker et al. (2016).

Moreover, the study finds that for firms partially owned by the government, rising economic uncertainty leads to a decrease in participation in social activities.

This suggests that state-owned enterprises are less affected by economic uncertainty, likely due to their more secure future outlook stemming from their relationship with the government. These findings align with the results of Yuan et al. (2020).

Based on these findings, it is recommended that the government and state-owned enterprises increase investment in social activities to fulfill their social responsibilities during periods of economic uncertainty. Additionally, to further expand the theoretical literature, researchers are encouraged to investigate the role of corporate governance indicators in moderating the relationship between economic uncertainty and participation in social activities.

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The Impact of the COVID-19 Crisis on the Speed of Adjusting the Commercial Credit of Companies, Considering the Ability of Managers

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Abstract

Objectives: This study aims to investigate the impact of the COVID-19 crisis on the speed of adjustment of trade credit among companies listed on the Tehran Stock Exchange (TSE), with particular attention to the moderating role of managerial ability.

Methodology/Design/Approach: The research sample includes 131 listed firms observed over ten years (2013–2022), selected using the systematic exclusion method. A multivariable linear regression model was employed to test the research hypotheses. The model developed by Luo (2022) was used to measure the speed of adjustment of trade credit before and after the COVID-19 outbreak, while the model of Demerjian et al. (2012) was applied to evaluate managerial ability.

Findings: The results indicate that, on the demand side of trade credit, the speed of adjustment of accounts payable increased by approximately 17% after the COVID-19 outbreak, with capable managers further accelerating this trend. Conversely, on the supply side, the speed of adjustment of accounts receivable declined by nearly 50%. This decline is attributed to rising inflation and economic instability during the post-crisis period, which led managers—including highly capable ones—to deliberately slow the adjustment of credit sales to benefit from inventory retention and mitigate risks in inflationary conditions.

Innovation: This study extends the literature by demonstrating how crises such as COVID-19 reshape trade credit dynamics in emerging markets. It highlights the asymmetric effects on the supply and demand sides of trade credit and underscores the role of managerial ability in adapting financial policies under conditions of uncertainty and economic instability.

Keywords: Commercial Credit, COVID-19, Ability of Managers, Speed of Adjustment of Commercial Credit.

1. Introduction

Trade credit is an important source of financing for companies (Luo, 2022). Financial managers are responsible for deciding the extent to which trade credit should be used under different economic conditions. As a financing source—compared to bank financing or equity issuance—trade credit, although widely used in the market, has largely been neglected in research. It is particularly important for small and medium-sized enterprises as well as large commercial firms (Asif & Nisar, 2023). Previous studies indicate that trade credit accounts for approximately a quarter of a firm's total assets and about half of its short-term liabilities in samples of medium-sized British firms and small American firms. This information can be used to reduce information asymmetry when dealing with banks and creditors (Silaghi & Moraux, 2022).

While trade credit is a crucial source of short-term financing and plays a key role in business operations, it also reflects the level of trust suppliers and creditors place in a company. Firms with high trade credit receive goods and services from suppliers without immediate cash payments, and banks and other lenders are more likely to extend facilities based on the firm's trade credit. Prior research, such as Petersen and Rajan (1997), documented that managers decide on trade credit usage based on firm characteristics and capabilities. However, due to internal and external risks and macroeconomic shocks, a firm's observed trade credit often deviates from its target or optimal level (Kardan et al., 2016). Under these conditions, firms may not fully utilize their capabilities and must attempt to reach their target trade credit more quickly (Luo, 2022).

The unprecedented spread of COVID-19 caused significant macroeconomic shocks to labor supply, production inputs, and ultimately company operations worldwide (Shafeeq Nimr Al-Maliki et al., 2023). Luo (2022) noted that the United States was among the most affected countries, experiencing a 3.5% decrease in economic size in 2020. With no clear end to the pandemic and ongoing uncertainties in the global economy, companies have been forced to adjust their financial and operational policies. Among these, trade credit policy has likely been the most affected, as the pandemic directly impacted cash flows and business activities for both buyers and sellers along the supply chain.

Therefore, the first objective of the present research is to answer the question: Does the spread of COVID-19 affect the speed at which companies adjust their trade credit? Policies and decisions in this area are critical for aligning trade credit with its optimal level. The role of capable and expert managers is also crucial: firms with skilled managers tend to experience an increase in received trade credit, and managerial ability has a stronger effect on accounts payable in firms with weaker credit quality or greater financial constraints. By making strategic decisions, managers can maintain trade credit policies even under critical conditions, thereby narrowing the gap between actual and optimal trade credit more quickly (Khoo & Cheung, 2022).

Consequently, the second objective of this research is to answer the question: Does managerial ability affect the speed of trade credit adjustment during the COVID-19 crisis? Considering economic challenges, internal and external risks, the impact of COVID-19, and the cost of external financing, understanding how companies can restore trade credit to its optimal level under macroeconomic shocks is essential. Furthermore, given the research gap—namely, the lack of definitive studies on the effect of COVID-19 on trade credit adjustment speed, especially in the national context—the necessity of this study is evident. The results will advance the field and clarify whether managerial ability influences trade credit adjustment speed during the pandemic.

The structure of the study proceeds as follows: first, the theoretical foundations, hypotheses, and empirical bases are presented; next, the research methodology and operational definitions of the variables are outlined; finally, the research findings and conclusions are presented.

2. Theoretical principles and hypothesis development

As stated, trade credit is an essential source of financing for both small and large companies worldwide. Companies urgently require financial resources to take

full advantage of investment opportunities, and the allocation and use of these resources must be properly determined to support growth and profitability (Zou et al., 2023). Hasan et al. (2021) showed that companies in the introduction, growth, and decline stages use significantly more trade credit, while firms in the maturity stage rely more on internal or other credit sources.

Trade credit is an agreement between buyers and sellers, under which sellers allow buyers to pay for goods and services after a specified period (Routledge, 2023). The key advantage of trade credit is that customers do not need to pay cash at the time of purchase; instead, a receivable or payable account is recorded on the customer's balance sheet, allowing payment at a later date. In this sense, accounts receivable can be viewed as a substitute for cash, making trade credit one of the short-term investment tools (Silaghi & Moraux, 2019). Wang et al. (2023) noted that companies with high trade credit can receive necessary goods and services without immediate cash payment, and lenders can also provide financing based on the company's trade credit status. If a company's debt repayment ability is deemed low, creditors will require greater assurance and may charge higher interest rates. As a result, companies continuously strive to improve their trade credit ratings (Ma et al., 2022).

Lenders, however, remain concerned that borrowers may experience financial difficulties and fail to meet obligations, as credit decisions influence future financial flexibility and can expose companies to risk (Wu et al., 2023). Asif and Nisar (2023) investigated the impact of trade credit on corporate financial performance and found that trade credit strongly stimulates financial performance. Profitable firms with high participation in trade credit can further improve performance by optimally utilizing available credit sources.

Discussion of corporate credit status is crucial not only for firms themselves but also for stakeholders, including creditors and investors. The long-term financial health of customers is especially important when suppliers aim to maintain long-term business relationships. Many companies use trade credit both to finance purchases and inputs (accounts payable) and to provide financing to their customers (accounts receivable) (Luo et al., 2023; Abuhommous, 2021). Suppliers must consider not only customers' ability to meet short-term obligations but also their long-term financial stability, as investments in equipment or contractual commitments depend on customers' financial reliability. In practice, late payments often increase supplier concerns (Ma et al., 2022).

Luo (2022) demonstrated that companies actively adjust toward their target trade credit, covering the gap between actual and optimal trade credit at an annual adjustment rate of approximately 70% in the United States. The global spread of COVID-19 disrupted business operations, employment, and income for many firms, sometimes forcing significant workforce adjustments or reporting negative income (Salehi et al., 2020). High debt levels, risk of default, and disrupted financing further complicated operations during this period (Devi et al., 2020). Measures such as border closures, quarantines, and reduced human interaction introduced unprecedented challenges, decreasing liquidity and forcing companies to rely more heavily on short-term financial obligations. Consequently, the role of trade credit from suppliers and distributors became more critical than ever (Amnim et al., 2021).

Hasan and Alam (2022) examined the relationship between asset redeployment ability and the use of trade credit, finding that asset redeployment ability significantly impacts short-term financing decisions. Gonçalves et al. (2018) highlighted that changes in product market power affect trade credit decisions, with reduced trade credit observed during financial crises due to competitive pressures. While some businesses earned more during this period, companies facing risk relied on trade credit to manage operations. The results show that during the COVID-19 crisis, the estimated adjustment speed of trade credit significantly increased compared to pre-pandemic levels. In the United States, the adjustment speed for accounts receivable rose from 54% pre-COVID to 64% during the pandemic, while accounts payable adjustment speed increased from 61% to 78% (Luo, 2022). Based on the above, the first hypothesis of this research is formulated as follows:

H1: The average speed of commercial credit adjustment has increased in the period after the spread of COVID-19 compared to before.

One of the possible channels through which uncertainty caused by COVID-19 has affected companies' trade credit is an increase in risk. This phenomenon can be examined at both micro and macro levels, considering social, medical, and economic perspectives. The risks involved are primarily a combination of general economic conditions and firm-specific characteristics. As systematic uncertainty rises during the pandemic, liquidity risk and default risk increase significantly, which, according to research, affects the speed of trade credit adjustment (Luo, 2021).

Dao et al. (2022) provided evidence that companies with more effective internal controls settle their trade credit contracts faster than those with weaker controls. They also noted that firms with ineffective internal controls tend to demand more trade credit. Consequently, significant deviations from optimal trade credit levels expose firms to greater risk. Given the higher operational risk and reduced credit availability during disease outbreaks, the greater the deviation from the optimal level, the higher the adjustment costs for the firm. Therefore, companies are motivated to achieve their target trade credit faster to take full advantage of its benefits (Luo, 2022). Based on the above, the second and third hypotheses of the current research are formulated as follows:

H2: The COVID-19 crisis has a significant positive effect on the speed of adjusting the demand for commercial credit in the form of payable credit.

H3: The COVID-19 crisis has significantly affected the speed of adjusting the supply of commercial credit in the form of receivables.

If the increase in convergence speed during the COVID-19 period is driven by the motivation to avoid risk, risk-taking companies adjust their trade credit more quickly. However, the speed of adjustment depends not only on motivation but also on the firm's ability to execute it. Managers' negotiation and bargaining power significantly impact the speed of trade credit adjustment, as larger companies can leverage their negotiation power to secure more favorable credit terms with business partners and reach their optimal trade credit faster (Choi & Kim, 2005).

As highlighted in previous literature, management involves the effective and efficient use of material and human resources in planning, organizing, mobilizing resources and facilities, guiding, and controlling activities to achieve organizational goals based on accepted values. Managers play a critical role in organizations and, as the main decision-makers, substantially influence strategic choices. Khoo and Cheung (2022) provided evidence that companies with higher managerial ability tend to receive more trade credit. Moreover, the effect of managerial ability on accounts payable is stronger in companies with weaker credit quality or more binding financial constraints.

The impact of competent managers on earnings, income, profit, and organizational success is evident in many successful firms today. The ability to respond quickly to contemporary threats and opportunities positions managers as vital resources in organizational problem-solving, underscoring the growing need for skilled managers (Salehi et al., 2021). Demerjian et al. (2012) define managerial ability as the efficiency of managers relative to competitors in converting company resources into income. These resources include inventory costs, sales, administrative and general expenses, tangible fixed assets, operating rents, research and development costs, and intangible assets. Competent managers are expected to generate higher profits after controlling for internal effects.

Therefore, companies with higher managerial ability are associated with increased trade credit. Additionally, the influence of managerial ability on accounts payable is more pronounced in firms with lower credit quality or tighter financial constraints (Khoo & Cheung, 2022). Skilled managers can navigate critical situations and maintain the company's trade credit by effectively managing risks and crises.

H4: Managers' ability has a significant positive effect on the relationship between the COVID-19 crisis and the speed of adjustment of commercial credit payables.

H5: Managers' ability has a significant and positive effect on the relationship between the COVID-19 crisis and the speed of adjustment of commercial credit receivable.

3. Research methodology

3.1. Research Population

Due to the presence of established theoretical foundations related to the investigated variables, the current research is classified as applied research in terms of its purpose. In terms of the research method, since the study does not manipulate an independent variable to measure its effect on a dependent variable, but rather examines the variables as they naturally occur, it is categorized as descriptive-causal research.

Given the historical and post-event nature of the required data, library and archival methods were used to collect the information necessary to test the research hypotheses. The statistical population of this study includes all companies listed on the Tehran Stock Exchange, excluding those whose fiscal year ends at dates other than the end of March. To ensure data comparability and homogeneity, investment companies, banks, and insurance firms were also excluded due to the distinct nature of their operations and reporting.

Finally, information from 131 companies was selected using a systematic screening approach. Data were collected over ten years, from 2013 to 2022, to obtain a sufficiently large sample consistent with similar studies. Given the mixed nature of the research data, a multivariate linear regression model was employed. After verifying data homogeneity and satisfying other preconditions for regression analysis, the hypotheses were tested using EViews 12 software, applying robust standard error techniques and appropriate statistical methods for final hypothesis testing.

Table 1. The selection of the statistical sample

The statistical population in 2020		**546**
Inactive companies	-189	
Companies with trading suspension	-36	
Companies that have changed the financial period	-57	
Companies that entered the stock market during the research period	-81	
Investment companies, banks, and holdings	-52	
Final sample		131

3.2. Regression model

The research model for payable and receivable trade credit has been tested separately.

$$SubscriptSTR_{it} = \beta_0 + \beta_1 COVID-19_{it} + \beta_2 MA_{it} + \beta_3(COVID-19_{it} \times MA_{it}) + \beta_4 ROA_{it} + \beta_5 growth_{it} + \beta_6 LEV_{it} + \beta_7 Inst_{it} + \beta_8 IND_{it} + \beta_9 Age_{it} + \varepsilon_{it}$$

3.3. How to measure research variables

3.3.1. The dependent variable of the research: Trade credit adjustment speed (S-TR)

According to Luo (2022), the partial adjustment model is widely used in studies measuring the speed of adjustment. In this model, both actual and optimal trade credit levels should be measured in the first stage. However, since optimal trade credit cannot be directly observed, its value must be inferred using other observable variables. In this research, the observable characteristics of the firm that influence financing decisions are considered, while other factors—such as the broader economic environment and unobservable (uncontrollable) effects that also affect financing decisions but are difficult to measure—are treated as error terms in the estimator. Optimal trade credit is estimated using the following model.

$$TR_{i,t} - TR_{i,t-1} = \lambda(TR^*_{i,t} - TR_{i,t-1}) + u_{it}$$

Where:

TR∗ i,t+1 is the firm's target trade credit in year t. (λ) The unobservable adjustment speed towards the target is the gap between the target and the current trade credit. The target trade credit (TR∗ i,t) is unobservable but can be estimated with the following model:

$$TR^*_{i,t} = \beta' x_{it-1} + u_{it}$$

Where:

Xi,t-1 is the vector of explanatory variables determining the target's business credibility. According to previous studies (Petersen and Rajan 1997; Choi and Kim 2005; Luo 2021; 2022), according to the suggestions of these researchers, different variables (accounts receivable, AR, and accounts payable, AP) are determined respectively.

Xi,t - 1 For AR, the determinants include sales, sales growth, firm size, inventory, retained earnings, firm age, and short-term debt.

Xi,t - 1 for AP, includes costs, cost changes, company size, inventory, accumulated profit, company age, and short-term debt, also used in the current research to estimate the target's business credit.

Table 2. Functional variables of company characteristics in the research model

Variables	Sign	How to operate
Sales	Sale	Total sales are divided by total assets (Luo 2022; Salehi and Moghadam 2019).
Positive sales changes	Sale + Δ	If sales changes are positive, the number is one; otherwise, it is zero (Luo 2022).
Negative sales changes	Sale – Δ	If sales changes are negative, the number is one; otherwise, it is zero (Luo 2022).
Costs	Cost	The cost of goods sold is divided by total assets (Luo 2022).
Positive cost changes	Δ Cost +	If the cost changes are positive, the number is one; otherwise, it is zero (Luo 2022).
Negative cost changes	Δ Cost -	If the cost changes are negative, the number is one; otherwise, it is zero (Luo 2022).
size of the company	SIZE	The natural logarithm of total assets (Luo 2022; Salehi et al. 2018).
warehouse stock	Inventory	The ratio of total inventory to assets (Luo 2022).
accumulated earnings	RE	The ratio of retained earnings divided by total assets (Luo 2022).
Company age	AGE	The natural logarithm of the difference between the date of establishment and the desired date of the company (Salehi et al. 2017).
Short-term debt	Short debt	The ratio of short-term debt to total assets (Luo 2022).
Trade credit payable	AP	Accounts payable divided by total assets (Luo 2022).
Trade credit receivable	AR	Accounts receivable divided by total assets (Luo 2022).

By replacing the company's characteristics in Model 1, the following model will obtain the optimal trade credit received and paid.

3.3.1.1. How to calculate AR (trade credit receivable) (supply)

$$TR^*_{i,t} = \beta_1 SALE_{it} + \beta_2 \Delta SALE_{it} + \beta_3 size_{it} + \beta_4 Inventory_{it} + \beta_5 RE_{it} + \beta_6 AGE_{it} + \beta_7 Short\ debt_{it} + u_{it}$$

3.3.1.2. How to calculate AP (trade credit payable) (demand)

$$TR^*_{i,t} = \beta_1 COST_{it} + \beta_2 \Delta COST_{it} + \beta_3 size_{it} + \beta_4 Inventory_{it} + \beta_5 RE_{it} + \beta_6 AGE_{it} + \beta_7 Short\ debt_{it} + u_{it}$$

As mentioned, the partial adjustment model obtains the optimal trade credit adjustment speed. In this research, the partial adjustment model of Fama and French (2002) is used as follows:

$$\Delta TR_{it} = \lambda\left(TR^*_{i,t} - TR_{it-1}\right) + v_{it}$$

Where in ΔTRit, the difference between the real commercial credit of the current year and the real commercial credit of the previous year; TRit, target trade credit; TR_(it-1), real trade credit of the previous year; λ is the speed of adjustment, and v_it is the one-way error component that includes firm-unique fixed effects (u_it Model 2) and the error component (e_it).

This model allows the named company to reduce the gap between its actual and target trade credit by one each year. The range of coefficient 1 is between zero and one, and a value close to one indicates a higher adjustment speed and vice versa. For the final calculation of the adjustment speed of the above two patterns, the following pattern is obtained by merging.

$$TR_{it} = \emptyset_1 SALEE_{it} + \emptyset_2 \Delta SALE_{\ it} + \emptyset_3 size_{it} + \emptyset_4 Inventory_{it} + \emptyset_5 RE_{it} + \beta\emptyset_6 AGE_{it} + \emptyset_7 Short\ debt_{it} + (1-\lambda)TR_{it-1} + v_{it}$$

$$TR_{it} = \emptyset_1 COST_{it} + \emptyset_2 \Delta COST_{\ it} + \emptyset_3 size_{it} + \emptyset_4 Inventory_{it} + \emptyset_5 RE_{it} + \beta\emptyset_6 AGE_{it} + \emptyset_7 Short\ debt_{it} + (1-\lambda)TR_{it-1} + v_{it}$$

The above model states that managers usually adopt strategies that reduce the gap between their current received and paid business credit position and their desired position. In addition, this relationship assumes that all companies adjust their trade credits at the same rate (Fama and French 2002). Therefore, subtracting the estimated coefficient for 〖TR〗_(it-1) from the number one will determine the speed of trade credit adjustment.
Commercial credit adjustment speed = 1-(1-λ)

3.3.2. Independent variable: COVID-19

COVID-19 started at the beginning of December 2019 in Wuhan, China, and this disease was officially announced in Iran at the end of 2018. This disease spread worldwide several months ago, and its consequences will affect the country. It was not until the official announcement of the government that this variable was dummy (0 and 1), which was assigned code (1) in the years 2019, 2018, and 2019, and code (0) in the previous years.

3.3.3. Moderator variable: managers' ability (MA)

The model by Demerjian et al. (2012) will be used to measure managers' abilities. After performing the regression test, the management efficiency is determined through the residual value (ε_t) in each year-company as follows: calculated through the residual of the regression model, a positive residual value means high efficiency, and a negative residual value means less efficient management.

3.2.3.1. Coverage analysis to measure management efficiency

Demerjian et al. (2012) calculated the results of managers' ability using a series of data envelopment analyses, and this data analysis is based on a series of optimizations using linear programming, also referred to as a non-parametric method. Demerjian et al.'s 2012 model will be used in this research to measure management ability. Coverage analysis is used through equation 1 to measure the company's efficiency.

$$\max_v \theta = \frac{\text{Sales}}{v_1\text{CoGS} + v_2\text{SG\&A} + v_3\text{NetPPE} + v_4\text{OpsLease} + v_5\text{R\&D} + v_6\text{Intan}}$$

Table 3. Definition of the variables used in the above equation

Model input	Variable	Sign	Operational definition
Output variable	Sales	Sales	The amount of company sales
Input variables	Cost	CoGS	The total cost of goods sold
	Net fixed assets	NetPPE	Net property, machinery, and equipment
	Operating lease cost	OpsLease	The financial statements do not identify research and development costs and information related to rents, so the effects of these two variables are removed from the models.
	Research and development costs	R & D	
	Intangible assets	Intan	Net intangible assets

The calculated efficiency score of a company ranges from zero to one. Companies with an efficiency score below one are considered to be below the efficiency frontier and must move toward the frontier by either reducing costs or increasing revenues. The purpose of calculating a company's efficiency is to measure managerial ability.

However, since the inherent characteristics of a company also influence efficiency calculations, managerial ability cannot be measured accurately; the score may be higher or lower than its true value due to these characteristics.

To control for the effect of a company's inherent characteristics, Demerjian et al. (2012) divided the company's efficiency into two distinct components: efficiency attributable to inherent company characteristics and managerial efficiency. They controlled for five firm-specific characteristics—firm size, market share, cash flow, stock exchange listing age, and foreign sales (exports). These intrinsic characteristics can influence management decisions, assist managers in making better choices, or, conversely, constrain managerial ability.

The five firm-specific characteristics controlled in the model presented by Demerjian et al. (2012) are as follows:

$$Firm\ Efficiency_{j,t} = \alpha_0 + \alpha_1 Size_{j,t} + \alpha_2 Marketshare_{j,t} + \alpha_3 FreeCashFlowIndicator_{j,t} + \alpha_4 Age_{j,t} + \alpha_5 ForeignCurrencyIndicator_{j,t} + \varepsilon_{j,t}$$

Where:

Sizej,t is the size of company j in year t and is equal to the natural logarithm of the company's total assets.

MSHj,t = the market share of company j in year t, and is equal to the ratio of the company's sales to the total industry sales.

FCFIj,t = shows the increase (decrease) in the operating cash flow of company j in year t, which is equal to one if the operating cash flow is positive and zero if it is negative.

Agej,t is company j's life in year t and is equal to the natural logarithm of the number of these years.

FCIj,t = The export of company j in year t; for companies that have exported, it is considered equal to 1 and, otherwise, zero.

εj,t = the remainder of this pattern indicates the level of management ability.

3.3.4. Research control variables

Following previous studies such as Luo (2022), to control possible unwanted effects affecting the speed of adjustment of companies' leverage, the following options have been used as control factors:

Return on assets (ROA): Net profit divided by total assets

Growth: Sales revenue minus the sales of the previous period divided by the sales of the previous period

Financial Leverage (LEV): The ratio of the total liabilities of the company to the total assets of the company at the end of each financial period

Institutional shareholders (Inst): The percentage of shares owned by institutional investors, including institutional investors such as banks and insurance companies, and individuals who own more than 5% of the company's shares.

Board independence (IND): The ratio of non-executive board members to total board members.

Firm Age: the natural logarithm of the difference between the company's founding year and the target year.

4. Research findings

4.1. Descriptive statistics of research variables

The research findings include descriptive and inferential statistics, which are first presented in the table below descriptive statistics.

Table 4 presents the descriptive statistics of the research variables. Descriptive statistics illustrate the dispersion of data, mean, and standard deviation, which are two key indicators in this context. According to the table, the average speed of adjustment of trade receivables is 0.27, while the average speed of adjustment of trade payables is 0.48, indicating a notable difference between these two components of trade credit.

The highest standard deviation is observed for institutional shareholders (31.2), while the lowest is for managers' ability, at 0.12. The maximum company size is 19.61, and the minimum is 11.03. Skewness and kurtosis, which reflect the dispersion of data frequency, indicate that the variables do not follow a normal distribution, based on the positive and negative values obtained.

Table 4. Descriptive statistics of quantitative research variables

Variable	Sign	Mean	Median	Max.	Min.	Standard deviation	Skewness	Kurtosis
Payment adjustment speed	STR(AP)	0.480	0.480	0.980	0.053	0.190	0.190	3.710
Received adjustment speed	STR(AR)	0.270	0.170	0.980	0.011	0.250	1.840	5.030
Return on assets	ROA	0.140	0.120	0.650	-0.240	0.150	0.610	3.520
The ability of managers	MA	0.005	0.009	0.420	-0.400	0.120	-0.030	3.650
financial leverage	LEV	0.540	0.540	0.990	0.096	0.200	-0.053	2.420
Institutional shareholders	INST	57.160	67.490	99.900	0.000	31.280	-0.720	2.150
Independence of the board of directors	IND	0.660	0.600	1.000	0.000	0.180	-0.270	3.190
Sales growth	growth	0.360	0.280	2.870	-0.380	0.500	1.870	9.110
Firm age	Age	3.600	3.660	4.240	2.300	0.370	-0.620	2.690

4.2. Descriptive statistics of the speed of adjustment of commercial credit before and after the outbreak of COVID-19)

The results show that the speed of adjustment of payable trade credit after the COVID-19 period is being adjusted faster. Using the standard deviation of the table, after the spread of COVID-19, there is less dispersion between the speed of adjustment of commercial credit received and paid by companies in the market.

Table 5. The descriptive statistics of the speed of adjustment of commercial credit before and after the outbreak of COVID-19)

Variable	Sign	Mean	median	Max.	Min.	Standard deviation
Payment adjustment speed before COVID-19	STR(AP)	0.460	0.470	0.980	0.053	0.200
Payment adjustment speed after COVID-19	STR(AP)	0.540	0.510	0.980	0.140	0.140
The speed of adjustment received before COVID-19	STR(AR)	0.300	0.160	0.980	0.011	0.290
The speed of adjustment received after COVID-19	STR(AR)	0.200	0.170	0.950	0.011	0.120

4.3. Frequency distribution of years for COVID-19

The disease of COVID-19 is a two-value qualitative variable (0 and 1) whose frequency distribution is presented in the table below.

As shown in Table 6, the number of 393 cases, equivalent to 0.30% of the years during the outbreak of COVID-19, and 917 cases, equivalent to 0.70% of the years, are in the period before the outbreak of COVID-19.

Table 6. Distribution of the frequency of COVID-19

Description	Sign	Value	Frequency	Frequency percentage
Spread of COVID-19)	COVID-19	1.000	393	0.30
No spread of COVID-19	COVID-19	0.000	917	0.70
Total	-	-	1310	100

4.4. Stationary test of variables

According to the results obtained in Table 7, the significance level of the variables in the significance test is less than 5%, indicating the variables' significance.

Table 7. Stationary test (Levin, Lin, and Chu) research variables

Variable	Sign	Test statistic	Significance level	Result
The adjustment speed of commercial credit payable	STR(AP)	-14.935	0.000	Stationary
The adjustment speed of commercial credit receivable	STR(AR)	-13.398	0.000	Stationary
Return on assets	ROA	-8.741	0.000	Stationary
The ability of managers	MA	-10.174	0.000	Stationary
financial leverage	LEV	-13.858	0.000	Stationary
Institutional shareholders	INST	-4.504	0.006	Stationary
Independence of the board of directors	IND	-3.580	0.000	Stationary
Sales growth	growth	-3.402	0.000	Stationary
Firm age	Age	-83.700	0.000	Stationary

4.5. The result of testing the second to fifth research hypotheses

The results presented in Table 8 indicate that COVID-19 has a positive and significant effect on the speed of adjustment of trade payables, with a coefficient of 0.15 and a significance level below 5% (0.0000). Therefore, the second hypothesis of the research is accepted at the 5% error level. Among the control variables, return on assets, institutional investors, and company age show a significant relationship with the dependent variable, with significance levels below 5%.

Furthermore, the interaction of managers' ability with COVID-19 has a positive coefficient (0.41) and a significance level below 5% (0.0002), affecting the speed of adjustment of trade payables. Hence, the third hypothesis of the research is also accepted at the 5% error level. The coefficient of determination (R^2) is 39%, indicating that the independent and control variables in the model explain 39% of the variation in the dependent variable. The Durbin-Watson statistic is 1.65, which lies between 1.50 and 2.50, showing no strong autocorrelation in the residuals. The collinearity statistics are below 5, indicating no severe multicollinearity between the research variables. Additionally, the F-test with a significance level below 5% confirms that the research model fits the data well.

Regarding the adjustment speed of trade receivables (left side of Table 8), COVID-19 has a negative and significant effect on this variable, with a significance level below 5% (0.000). Therefore, the second hypothesis is also accepted at the 5% error level. Moreover, the interaction between managers' ability and COVID-19 significantly affects the speed of adjustment of trade receivables, with a significance level below 5% (0.0046), confirming the fifth hypothesis at the 5% error level.

Among the control variables, company sales growth, company age, and return on assets show a significant relationship with the dependent variable, all with significance levels below 5%. The coefficient of determination (R^2) is 75%, indicating that the independent and control variables explain 75% of the variation in the dependent variable. The Durbin-Watson statistic is 2.10, again showing no significant autocorrelation in the residuals, and the collinearity statistics are below 5, confirming no strong multicollinearity. The F-test, with a significance level below 5%, further confirms that the model fits the data well.

Table 8. The test results of the first and second hypotheses

Variable	The adjustment speed of commercial credit receivable			The adjustment speed of commercial credit payable		
	Coefficients	Significance	VIF	Coefficients	Significance	VIF
COVID-19	0.150	0.000	1.430	-0.027	0.000	1.430
The ability of managers	-0.260	0.000	1.950	-0.012	0.570	1.950
The interaction of managers' ability and COVID-19	0.410	0.000	1.800	-0.085	0.004	1.800
Return on assets	0.140	0.050	2.060	0.100	0.000	2.060
Financial Leverage	0.082	0.110	1.130	0.026	0.130	1.130
Institutional investors	0.002	0.000	1.850	-0.0002	0.470	1.850
Independence of the board of directors	-0.018	0.720	1.070	-0.0005	0.970	1.070
Sales growth	0.014	0.084	1.080	0.008	0.004	1.080
Firm age	-1.820	0.000	1.021	-0.240	0.000	1.021
Intercept	6.600	0.000	-	1.430	0.000	-
AR(1)	-	-	-	0.420	0.000	-
Coefficients of determination		0.390			0.750	
Durbin-Watson		1.650			1.590	
F statistic		5.423			22.551	
Significance level		0.000			0.000	
F-Limmer test	4.300	0.000		9.526	0.000	
Hausman test	9.910	0.000		386.500	0.000	
Serial autocorrelation	43.722	0.000		0.000	544.900	
Variance heterogeneity	201.940	0.000		0.000	136.740	

5. Discussion and conclusion

Deciding on trade credit is one of the most important responsibilities of managers in organizations and companies. Trade credit is a mutual agreement between suppliers and buyers: when a purchase or sale occurs, and payment or receipt is delayed, trade credit is utilized. Considering companies' high cost of capital and the potential risk of being unable to fulfill obligations, trade credit is often a more reasonable method of financing production inputs compared to debt financing. Trade credit is reflected in accounts receivable and accounts payable, representing the supply and demand sides of credit.

Using trade credit is not only a method of financing but also a strategic tool for companies to retain customers and compete in the market. Companies often design marketing strategies to promote the use of trade credit and offer attractive terms to customers to enhance their competitive advantage. However, this strategy entails risks, including potential bad faith from the other party.

In recent years, an additional challenge has emerged with the outbreak of COVID-19. The pandemic has had destructive effects on the global economy: while a few businesses have profited from unique opportunities, many others have suffered recessions due to repeated closures and reduced demand, leading to business shutdowns and job losses. These effects are particularly pronounced in emerging and underdeveloped markets.

In such circumstances, securing external financing has become even more difficult, and companies must rely on alternative financial policies, especially in the short term. Trade credit has emerged as a critical financing mechanism worldwide. As observed in the hypothesis testing, both types of trade credit—payable

and receivable, representing the supply and demand of credit, have been utilized by companies to maximize their short-term financing capacity. To achieve this, companies aim to reach the optimal level of trade credit, and the process of closing the gap between actual and target trade credit is referred to in the literature as the adjustment speed. This adjustment speed indicates how quickly and efficiently a company can optimize its use of trade credit.

During the COVID-19 pandemic, companies increased their demand for trade credit and tried to accelerate the adjustment of commercial credit toward its optimal level to make maximum use of this financing method in a chaotic market. Capable managers played a key role in this process by identifying effective ways to manage trade credit and negotiating contracts with suppliers, acting as problem-solvers during the uncertainty caused by the pandemic.

However, as the hypothesis test results also indicate, credit suppliers were less willing to maximize trade credit provision during this period. They sought to reduce the supply of target trade credit due to market chaos and concerns about companies' ability to meet obligations on time. Furthermore, the rapidly increasing inflation and periodic price fluctuations during the pandemic reduced the affordability and real value of future payments, leading to a decrease in the supply of receivable trade credit. In response, operational policies implemented by competent managers became more influential than financial policies in managing trade credit.

The results regarding the adjustment speed of payable trade credit and its increase during the COVID-19 outbreak are consistent with the findings of Luo (2022), Asif and Nisar (2023), and Abuhommous (2021). However, the observed decrease in the adjustment speed of receivable trade credit contrasts with Luo's (2022) results. To provide a more comprehensive understanding, future research should further investigate this issue, considering different industries and comparing the results with those of the current study.

6. Practical implications

Since there is still no clear outlook for the end of the COVID-19 pandemic and considering the damage it has caused to the global economy, companies can reduce their financial risks by planning their contract policies. By achieving the optimal level of trade credit, creditors can secure their claims, which in turn contributes to commercial stability and prosperity in the capital market.

Owners and major shareholders have sought to employ managers with higher ability and experience in company operations, enabling them to maximize the company's credit capacity and achieve the target trade credit at a faster pace.

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The Effect of Tax Incentives and Tax Services on Taxpayer Compliance and the Moderating Role of Tax Socialization

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Abstract

Objectives: This study examines the impact of tax incentives and tax services on taxpayer compliance, with a focus on the moderating role of tax socialization. The research aims to clarify whether tax socialization can enhance the effects of incentives and service quality on tax compliance behavior.

Methodology/Design/Approach: The study adopts a causal-correlational research design. The statistical population includes tax auditors and taxpayers in Shiraz County. Data were collected through a structured questionnaire and analyzed using partial least squares structural equation modeling (PLS-SEM).

Findings: The results show that both tax incentives and improved tax services have a significant positive effect on taxpayer compliance. Tax socialization also directly and positively influences compliance behavior. However, the moderating role of tax socialization is not supported, indicating that it does not significantly alter the relationship between tax incentives or tax services and taxpayer compliance.

Innovation: This study contributes to the existing literature by empirically examining the interconnected effects of tax policy tools and social factors on taxpayer behavior. It provides practical insights for policymakers aiming to promote tax compliance through enhanced services and targeted socialization strategies.

Keywords: Tax Incentives, Tax Services, Taxpayer Compliance, Tax Socialization.

1. Introduction

The taxation sector accounts for the largest share of government revenue. The Tax Affairs Organization, as a governmental institution under the Ministry of Finance, aims to increase tax revenues by raising taxpayer awareness. Engaging new taxpayers is one strategy to broaden the tax base. To maximize tax revenue, taxpayers' knowledge must be enhanced to ensure compliance with their tax obligations. The introduction of a self-assessment system, replacing formal evaluation methods, has provided taxpayers with full confidence to exercise their tax rights and fulfill obligations. However, the self-assessment system relies heavily on taxpayers' honesty and compliance, which can lead to frustration or even intentional misuse. Many taxpayers still do not know how to calculate their tax liabilities, while some deliberately violate tax laws (Kusumawati, 2006).

Taxpayer compliance has always been a critical issue, as non-compliance often leads to tax evasion. Taxpayers attempt to minimize their tax responsibilities through both legal and illegal means. Meanwhile, tax authorities aim to enhance compliance, detect tax evasion, enforce tax laws, and close unintended loopholes that facilitate legal tax avoidance (Alm, 2024). The growing literature emphasizes tax awareness as a key factor explaining why some taxpayers engage in legal tax avoidance. Taxpayer awareness of tax regulations depends on the prominence of taxation in their environment (Bolnick, 2024).

Nogroho (2012) argues that when taxpayers understand how to calculate, pay, and report taxes according to regulations, their awareness naturally increases. Taxpayer awareness and compliance are influenced by multiple factors, including tax socialization, tax incentives, and the quality of tax officers' services. Compliance and willingness to settle tax obligations are essential for increasing tax revenues. Tax socialization enhances taxpayers' knowledge, while tax incentives encourage voluntary compliance. Taxpayers who understand tax regulations support the effective implementation of the self-assessment system (Rahmawati et al., 2013).

By adhering to tax regulations, taxpayers are expected to fulfill their obligations. Benefits of tax compliance include proper registration, timely filing of returns, accurate calculation and payment of taxes, and settlement of overdue liabilities (Winerungan, 2013). Tax compliance can be voluntary or compulsory. Voluntary compliance occurs when taxpayers report and pay taxes honestly without intending to commit fraud. Compulsory compliance, on the other hand, arises when taxpayers fulfill obligations due to fear of penalties, audits, or fines (Muttaqin, 2022).

Taxpayer non-compliance is influenced by internal and external factors. Internal factors originate from the taxpayer and relate to individual characteristics driving compliance. External factors arise from the environment and circumstances surrounding the taxpayer. The General Tax Office has introduced numerous innovations to facilitate taxpayer participation and improve compliance. Increased compliance not only raises tax revenue but also strengthens the government's treasury (Nurkhain et al., 2018).

According to Andrew and Sari (2021), tax incentives are government policies designed to encourage and facilitate taxpayers' compliance with current and future obligations. Alfiana and Diana (2021) found that tax incentives—either alone or combined with taxpayer awareness—significantly affect compliance in filing annual returns. Rahmawati and Ramayanti (2016) emphasized that incentives simplifying the calculation, payment, and reporting of taxable income positively and significantly influence taxpayer compliance.

Efforts to increase tax revenue can also be achieved by improving the quality of services provided to taxpayers. Enhancing service quality involves upgrading the skills and technical capabilities of tax personnel, improving infrastructure such as integrated service centers, and using information and technology systems to facilitate compliance. The better taxpayers perceive service quality, the higher their compliance

levels. Service quality reflects excellence in meeting taxpayers' expectations, which can be assessed by comparing expectations with actual service experience (Kayuno, 2017).

Tax socialization refers to efforts to disseminate information about taxation. Providing tax-related information increases public awareness and ensures compliance, leading to more effective tax collection and revenue growth. Through socialization, the public gains a deeper understanding of tax regulations and procedures, enhancing knowledge and awareness (Herawati et al., 2017). Consequently, tax socialization helps people recognize the benefits of paying taxes, and active participation in tax payments supports national financial development (Winerungan, 2013).

Given the significance of taxation in any country, including Iran, the main research question of this study is whether tax incentives and tax services influence taxpayer compliance, and whether tax socialization acts as a moderating factor in this relationship.

2. Theoretical Foundations and Research Background

Tax compliance can be either voluntary or compulsory. Voluntary compliance occurs when a taxpayer is motivated to report and pay taxes honestly without any intention of fraud. In contrast, compulsory compliance arises when taxpayers fulfill their tax obligations out of fear of penalties, audits, or fines in case of detected fraud (Muttaqin, 2022).

Kersch et al. (2023) explain that in both developed and developing countries, legislators focus on strategies to achieve and maintain a high level of tax compliance. Tax compliance refers to taxpayers' willingness to fulfill their obligations according to applicable tax laws without requiring strict examinations, investigations, threats, warnings, or sanctions such as legal or administrative penalties (Okafor, 2023). It reflects taxpayers' commitment to their duties while earning the rights and responsibilities assigned to them, without external enforcement (Putry, 2022).

Murphy (2008) identifies two main approaches to compliance strategies: deterrence and adaptation. The deterrence approach, based on the tax evasion model, posits that higher penalties and a greater likelihood of detection reduce tax evasion. In contrast, the adaptive approach represents a "softer" strategy that has gained attention among researchers and policymakers, as it can sustainably enhance tax compliance (Rillstone, 2015). The most effective strategy often integrates both approaches while considering taxpayer characteristics and the operational needs of tax authorities (Okafor & Farrar, 2021).

Tax compliance decisions are influenced by a variety of factors, including personal and social norms, tax knowledge, perceptions of fairness, demographic characteristics, attitudes, and taxpayer motivations (Hoffman et al., 2017; Kirchler, 2007). Studies indicate that lack of knowledge and insufficient understanding of tax laws contribute significantly to non-compliance (Fjeldstad & Heggstad, 2012).

2.1. Tax Incentives

Tax incentives are benefits provided by the government for specific activities within society. Their primary goal is to reduce the tax burden on taxpayers while motivating them to comply with their tax obligations and encouraging engagement in certain economic or social activities. In many cases, tax incentives are not only aimed at increasing government revenue but also at supporting economic development and stimulating growth (Bin-Nashwan & Muneeza, 2023).

Tax incentives remain a widely used policy tool for attracting foreign direct investment in developed, transitional, and developing countries. According to the United Nations (2018), tax incentives are special provisions that grant exemptions, credits, preferential tax rates, or deferrals on tax liabilities. Differentiating between regulations that are part of the general tax system and those that provide targeted benefits can be challenging, particularly in countries with limited capacity to implement focused tax incentives.

For instance, a country may set a corporate tax rate of 10% for income derived from manufacturing. This low rate can be interpreted either as a general feature of the overall tax system, applying to all taxpayers, or as a specific tax incentive limited to the manufacturing sector. Tax incentives can also be defined based on their effect in reducing the effective tax burden for particular projects or activities (Magaji et al., 2022).

2.2. Tax Services

High-quality tax services are an effective means of enhancing taxpayer satisfaction within the tax administration. Voluntary tax compliance is largely built on trust and the overall tax service environment; therefore, strengthening tax services and improving the organizational structure to support businesses can enhance taxpayer compliance. Numerous studies have confirmed that the quality of tax services influences taxpayer compliance, with service quality typically assessed through factors such as responsiveness, reliability, empathy, and the facilities provided by tax authorities (Hidayat et al., 2014). By establishing trust and satisfaction through a supportive tax service environment, taxpayers are more willing and prepared to follow the recommendations of tax authorities and adhere to national tax regulations, encouraging voluntary compliance without the need for enforcement actions (Nguyen, 2022).

Tax services encompass the facilities provided by the General Tax Office to the public in accordance with applicable tax regulations. The convenience of services, particularly online offerings by tax authorities, is expected to increase taxpayers' satisfaction, making them more inclined to meet their tax obligations. Simplified facilities, such as online tax payment and reporting systems, help taxpayers fulfill their obligations more comfortably and efficiently (Pebrina & Hidayatulloh, 2020).

2.3. Tax Socialization

Tax socialization is an effort by the General Tax Office to inform, guide, and create understanding among all taxpayers. To achieve its objectives, tax socialization activities are typically categorized into three types: (a) socialization for potential taxpayers, (b) socialization for new taxpayers, and (c) socialization for registered taxpayers (Hariyanto & Tuli, 2013). Broadly, socialization is understood as a learning process that occurs through interaction with others, enabling individuals to understand how to think, feel, and act—an essential process for effective social participation (Purba, 2021).

In the context of taxation, tax socialization refers to government initiatives that provide information on specific tax regulations to help taxpayers gain an appropriate understanding. Through these efforts, tax authorities aim to increase taxpayer awareness and compliance. Taxpayers can fulfill their tax obligations only if they possess sufficient knowledge and awareness of taxation (Limantoro et al., 2022).

According to Susanto and Visiana (2023), tax authorities must establish strong communication with the public and provide clear, transparent information as part of tax socialization. Effective socialization ensures that taxpayers acquire adequate knowledge, enabling them to comply with tax regulations. Consequently, tax socialization not only enhances taxpayers' understanding but also strengthens their overall tax awareness, which is expected to improve compliance and align tax revenues with targeted growth (Ardiani et al., 2022).

One of the key roles of tax socialization is to provide taxpayers with detailed information regarding their tax obligations. This includes educational efforts by tax officials and auditors, who help shape taxpayers' attitudes toward compliance. As representatives of the government, tax officials convey the quality of public services; their approach during socialization can significantly influence public perception. Tax auditors are considered competent when they provide accurate information on tax calculation, reporting procedures, and legal compliance (Safitri & Silalahi, 2020).

Hosseini Nourian et al. (2023) examined the effects of social trust on tax culture among taxpayers in Nowshahr and Chalous. Their findings indicate a

significant positive correlation: higher levels of social trust strengthen tax culture, explaining approximately 34% of the variance. This suggests that enhancing trust—both social and institutional—can improve tax-related behaviors and reduce tax evasion.

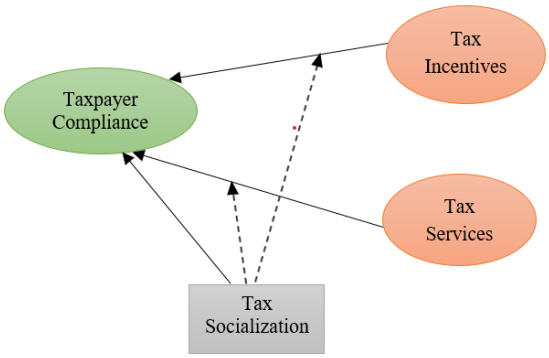
Rahmani et al. (2023) explored the impact of ethical behavior theory and Machiavellianism on tax compliance to support sustainability reporting. Ethical components included ethical skills, behavior, foundations, and commitment, while Machiavellian traits included dominance, confidence, honesty, and support for sustainability reporting. The study found that adherence to ethical objectives and avoidance of Machiavellian tendencies promoted tax compliance and participation in sustainability reporting.

Moazzi et al. (2023) examined how tax incentives affect taxpayers' compliance and business outcomes using agent-based modeling. Their results suggest that tax incentives can alter taxpayers' perception of their tax burdens, thereby influencing both compliance and financial performance.

Riska and Haryani (2024) investigated factors affecting taxpayer compliance, with information technology knowledge as a moderating variable. They found that accounting procedures and tax incentives positively influence compliance, while understanding of tax laws alone does not. Moreover, IT knowledge can moderate the relationship between accounting procedures or tax incentives and compliance, but not the link between tax law comprehension and compliance.

Ebele et al. (2025) studied the effect of financial incentives on corporate tax compliance in Nigeria's industrial clusters. Their findings indicate that factors such as regular audits, firm size, effective communication, deterrent messaging, business owners' education, political legitimacy, and financial incentives (including tax credits, reductions, capital allowances, and investment incentives) significantly influence corporate compliance and enhance firm performance.

Based on this review of theoretical foundations and empirical studies, the conceptual framework of the present study is developed as follows:



Research Conceptual Model

In pursuit of the research objectives and based on the theoretical foundations and research background, the following hypotheses have been formulated:

Hypothesis 1: Tax incentives have a significant impact on taxpayer compliance.

Hypothesis 2: Tax services have a significant impact on taxpayer compliance.

Hypothesis 3: Tax socialization has a significant impact on taxpayer compliance.

Hypothesis 4: Tax socialization moderates the effect of tax incentives on taxpayer compliance.

Hypothesis 5: Tax socialization moderates the effect of tax services on taxpayer compliance.

3. Research Methodology

Given that the results of this study are intended to inform decision-making by managers, tax authorities, and other stakeholders, the research is classified as applied. Furthermore, since it examines the relationships among multiple variables, it employs a descriptive-correlational approach in terms of both nature and methodology.

The statistical population of this study comprises all taxpayers, both individuals and legal entities, in

Shiraz. Due to the unknown population size and the lack of available variance data, the sample size is determined using Cochran's formula. Moreover, since the questionnaire employs a five-point Likert scale, with values ranging from 1 to 5, the standard deviation is 0.66 (Momani, 2008). Given a 95% confidence level and a margin of error of 0.01, the required sample size is calculated to be 170 respondents.

3.1. Validity and Reliability

To assess convergent validity, the Average Variance Extracted (AVE) index will be used. The AVE value should be 0.50 or higher (Chen, 1998), indicating that the construct explains at least 50% of the variance of its indicators. In this study, Cronbach's alpha will be utilized to measure questionnaire reliability, employing SPSS 25 software. Additionally, the research examines composite reliability of constructs, with an acceptable threshold set at 0.70 or higher.

3.2. Operational Definition of Research Variables

3.2.1. Dependent Variable: Taxpayer Compliance

This variable is measured using a questionnaire designed by Purba (2021), consisting of five items on a five-point Likert scale (ranging from 1: strongly disagree to 5: strongly agree).

3.2.2. Independent Variables:

Tax Incentives

This variable is measured using a questionnaire designed by Permata and Mortanto (2022), consisting of three items on a five-point Likert scale (ranging from 1: strongly disagree to 5: strongly agree).

Tax Services

This variable is measured using a questionnaire designed by Permata and Mortanto (2022), consisting of five items on a five-point Likert scale (ranging from 1: strongly disagree to 5: strongly agree).

3.2.3. Moderating Variable: Tax Socialization

This variable is measured using a questionnaire designed by Karnawati and Handayani (2021), consisting of three items on a five-point Likert scale (ranging from 1: strongly disagree to 5: strongly agree).

4. Research Findings

4.1. Descriptive Statistics of Research Variables

The descriptive statistics of the main research variables are presented in Table 1. The results indicate that tax incentives, tax socialization, and taxpayer compliance have averages higher than their expected range mean (i.e., 3). However, tax services have a lower average compared to their expected range mean. The highest average belongs to taxpayer compliance (3.525), while the lowest average is related to tax services (2.609).

Table 1: Descriptive Statistics of Main Research Variables

Variables	Mean	Standard Deviation	Minimum	Maximum	Range
Tax Incentives	133.3	905.3	1	5	1 to 5
Tax Services	609.2	828	1	5	1 to 5
Tax Socialization	3.700	*14.1*	1	5	1 to 5
Taxpayer Compliance	525.3	806	1	60.4	1 to 5

4.2. Reliability and Validity Testing

Cronbach's alpha method is used to calculate the internal reliability of measurement instruments. Cronbach's alpha assigns equal weights to all items, assuming their relative importance to be the same. To address this limitation, composite reliability is used instead. Since composite reliability calculations incorporate the factor loadings of items, they provide a

more accurate and enhanced measure of reliability compared to Cronbach's alpha.

An acceptable threshold for Cronbach's alpha and composite reliability is 0.70 or higher. The obtained values for these two indices in Table 2 exceed 0.70. Therefore, based on these indices, the measurement instruments demonstrate acceptable reliability.

Table 2: Cronbach's Alpha and Composite Reliability Coefficients of Measurement Instruments

Statistics / Variables	Cronbach's Alpha	Composite Reliability
Tax Socialization	792.0	865.0
Taxpayer Compliance	809.0	867.0
Tax Services	811.0	866.0
Tax Incentives	759.0	856.0

Factor loadings equal to or greater than 0.40 for each item indicate a well-structured construct. Additionally, the factor loadings must be statistically significant, meaning their t-values should fall outside the range of ±1.96 ($p < 0.05$).

As shown in Table 3, all item factor loadings exceed 0.40 and are statistically significant. This confirms that the items are appropriate. Consequently, based on this criterion, the reliability of the measurement instruments is validated.

Table 3: Factor Loadings of Measurement Instruments' Items

Variables	indicators	factor load	t-value	P-value
Taxpayer Compliance (TC)	TC1	728.0	73.16	000.0
	TC2	662.0	467.6	000.0
	TC3	714.0	096.13	000.0
	TC4	867.0	261.31	000.0
	TC5	783.0	213.26	000.0
Tax Incentives (TI)	TI1	892.0	587.39	000.0
	TI2	64.0	122.7	000.0
	TI3	895.0	145.50	000.0
Tax Services (TSE)	TSe1	798.0	286.19	000.0
	TSe2	75.0	265.12	000.0
	TSe3	69.0	772.11	000.0
	TSe4	769.0	489.20	000.0
	TSe5	747.0	965.17	000.0
Tax Socialization (TSo)	TSo1	672.0	039.6	000.0
	TSo2	885.0	395.22	000.0
	TSo3	906.0	088.36	000.0

To assess validity, the Average Variance Extracted (AVE) index is used. The AVE value should be 0.5 or higher, meaning the construct explains 50% or more of the variance of its indicators.

Table 4: Average Variance Extracted (AVE)

Statistics / Variables	AVE
Tax Socialization	685.0
Taxpayer Compliance	568.0
Tax Services	565.0
Tax Incentives	669.0

As observed in Table 4, the extracted variance values of the latent variables in the study exceed 0.5. Accordingly, the convergent validity of the measurement instruments is confirmed using the Average Variance Extracted (AVE) index.

4.3. Hypothesis Testing:

First Hypothesis: Tax incentives affect taxpayer compliance.

The path coefficient and t-value for this hypothesis are presented in Table 5.

Table 5: Testing the Effect of Tax Incentives on Taxpayer Compliance

Variables	Path Coefficient (β)	t-value	p-value	Result
Tax Incentives and Taxpayer Compliance	32.0	10.5	000.0	Confirmation

Tax incentives have a direct positive effect of 0.32 on taxpayer compliance. Given that the t-value ($t = 5.10$) falls outside the ±2.58 range, the path coefficient is statistically significant at the 0.01 level. Therefore, this hypothesis is confirmed with 99% confidence.

This result indicates that higher tax incentives lead to greater taxpayer compliance.

Second Hypothesis: Tax services affect taxpayer compliance.
The path coefficient and t-value for this hypothesis are presented in Table 6.

Table 6: Testing the Effect of Tax Services on Taxpayer Compliance

Variables	Path Coefficient (β)	t-value	p-value	Result
Tax Services and Taxpayer Compliance	31.0	19.4	000.0	Confirmation

Tax services have a direct positive effect of 0.31 on taxpayer compliance. Given that the t-value (t = 4.19) falls outside the ±2.58 range, the path coefficient is statistically significant at the 0.01 level. Therefore, this hypothesis is confirmed with 99% confidence.
This result indicates that higher tax services lead to greater taxpayer compliance.

Third Hypothesis: Tax socialization affects taxpayer compliance.
The path coefficient and t-value for this hypothesis are presented in Table 7.

Table 7: Testing the Effect of Tax Socialization on Taxpayer Compliance

Variables	Path Coefficient (β)	t-value	p-value	Result
Tax Socialization and Taxpayer Compliance	23	10.3	002.0	Confirmation

Tax socialization has a direct positive effect of 0.23 on taxpayer compliance. Given that the t-value (t = 3.10) falls outside the ±2.58 range, the path coefficient is statistically significant at the 0.01 level. Therefore, this hypothesis is confirmed with 99% confidence.
This result indicates that higher tax socialization leads to greater taxpayer compliance.

Fourth Hypothesis: Tax socialization moderates the effect of tax incentives on taxpayer compliance. The path coefficient and t-value for this hypothesis are presented in Table 8.

Table 8: Testing the Moderating Role of Tax Socialization in the Effect of Tax Incentives on Taxpayer Compliance

Variables	Path Coefficient (β)	t-value	p-value	Result
Tax Incentives × Tax Socialization and Taxpayer Compliance	09.0-	31.1	189.0	Rejection

Tax socialization moderates the effect of tax incentives on taxpayer compliance by -0.09. However, given that the t-value (t = 1.31) does not fall outside the ±1.96 range, the path coefficient is not statistically significant, and therefore, this hypothesis is rejected.
This relationship indicates that the interaction between tax incentives and tax socialization does not significantly affect taxpayer compliance.

Fifth Hypothesis: Tax socialization moderates the effect of tax services on taxpayer compliance. The path coefficient and t-value for this hypothesis are presented in Table 9.

Table 9: Testing the Moderating Role of Tax Socialization in the Effect of Tax Services on Taxpayer Compliance

Variables	Path Coefficient (β)	t-value	p-value	Result
Tax Services × Tax Socialization and Taxpayer Compliance	06.0-	969.0	333.0	Rejection

Tax socialization moderates the effect of tax services on taxpayer compliance by -0.06. However, given that the t-value (t = 0.333) does not fall outside the ±1.96 range, the path coefficient is not statistically significant, and therefore, this hypothesis is rejected.
This relationship indicates that the interaction between tax services and tax socialization does not significantly affect taxpayer compliance.

4.4. Final Research Model (Section 4-5):

Figures 1 and 2 illustrate the path coefficients and t-values of the tested model, while Table 10 provides a summary of hypothesis testing results.

As previously mentioned, the t-statistic is used to assess the significance of path coefficients in the model.

- If t falls outside the ±1.96 range, the path coefficient is significant at the 0.05 level.
- If t falls outside the ±2.58 range, the path coefficient is significant at the 0.01 level.

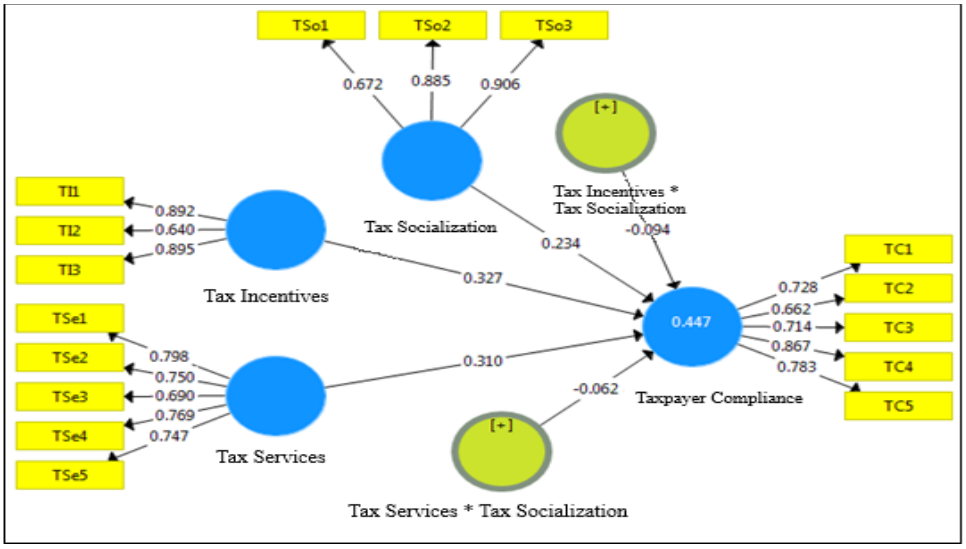


Figure 1: Path Coefficients (β)

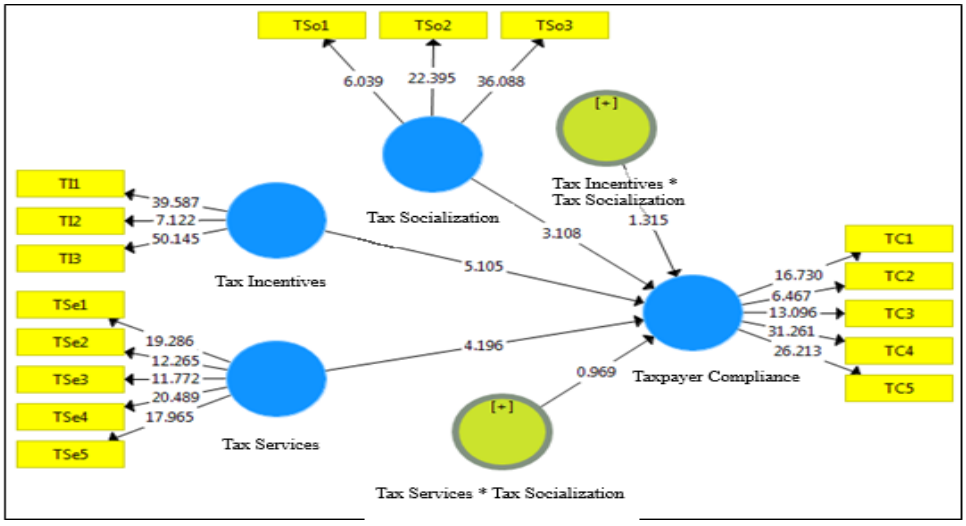


Figure 2: t-Values

Table 10: Summary of Research Hypothesis Results

	Variables	Path Coefficient	t-value	p-value	Result
1	Tax Incentives -> Taxpayer Compliance	32.0	10.5	000.0	Confirmation
2	Tax Services -> Taxpayer Compliance	31.0	19.4	000.0	Confirmation
3	Tax Socialization -> Taxpayer Compliance	23.0	10.3	002.0	Confirmation
4	Tax Incentives × Tax Socialization -> Taxpayer Compliance	09.0-	31.1	189.0	Rejection
5	Tax Services × Tax Socialization -> Taxpayer Compliance	06.0-	969.0	333.0	Rejection

To evaluate the structural model, the indices of the coefficient of determination (R^2), effect size (f^2), model predictive power or redundancy (Q^2), and standardized root mean square residual (SRMR) have been used.

The coefficient of determination (R^2) indicates what percentage of the variance in the dependent variable is explained and covered by the independent variable, or in other words, what percentage of the changes in the dependent variable is due to the independent variable(s). The coefficient of determination considers fewer independent variables and smaller sample sizes; therefore, some researchers prefer to use another index called the adjusted coefficient of determination. The R^2 value is reported in Table 11.

Table 11: R^2 Value

Statistics / Variables	Coefficient of Determination	Adjusted Coefficient of Determination
Taxpayer Compliance	447.0	0.43

The value of the coefficient of determination (R^2) indicates that 44% of the changes in taxpayer compliance are explained by the research model.

5. Discussion and Conclusion

The first research hypothesis examines the impact of tax incentives on taxpayer compliance. The results indicate that tax incentives have a positive and significant effect on taxpayer compliance; thus, this hypothesis is confirmed. The findings suggest that the greater the tax incentives, the higher the taxpayer compliance. Tax incentives are discounts or reliefs offered by the government to taxpayers, particularly in unfavorable economic conditions. The relationship between tax incentives and taxpayer compliance can be explained using Attribution Theory, which states that internal and external factors influence behavior. Tax incentives represent an external factor that facilitates tax payments by reducing the tax burden or shifting it partially to the government.

Based on the results, the first hypothesis confirms that tax incentives significantly and positively affect taxpayer compliance. These findings align with research by Sari et al. (2022) and Andrew & Sari (2021), supporting the government's objective of providing relief while improving compliance. It confirms that tax incentives can enhance taxpayer compliance by encouraging timely fulfillment of obligations.

The second hypothesis examines the impact of tax services on taxpayer compliance. The results show that tax services have a positive and significant effect on taxpayer compliance, confirming this hypothesis. These findings indicate that higher-quality tax services lead to greater taxpayer compliance. The Theory of Planned Behavior explains that internal perceptions of taxpayers and their evaluation of the environment (tax administration) influence their motivation to comply with tax obligations. Empirical studies have also shown that effective services by tax officers can improve taxpayer compliance.

Hypothesis 2 states that tax services significantly and positively affect taxpayer compliance. While this result differs from Listiyowati et al. (2021), which found no impact of tax services on compliance, it is consistent with the findings of Pravasanti & Prativi

(2021), Tan et al. (2021), Andrew & Sari (2021), and Pebriana & Hidayatullah (2020), which support the positive effect of tax services. Variations in results may be due to differences in study locations and respondent characteristics.

Hypothesis 3 examines the impact of tax socialization on taxpayer compliance. The results indicate that tax socialization has a direct, positive, and significant effect on compliance. This suggests that higher levels of tax socialization lead to greater taxpayer compliance. The effect of tax socialization can be explained using the Perceived Behavioral Control Theory, which highlights how external factors, such as the self-assessment process, influence individual beliefs and perceptions.

Hypothesis 4 investigates the moderating role of tax socialization in the relationship between tax incentives and taxpayer compliance. The results indicate that, although tax socialization moderates this relationship, the t-value falls outside the ±1.96 range, making the path coefficient insignificant. Therefore, this hypothesis is rejected.

Hypothesis 5 examines the moderating role of tax socialization in the relationship between tax services and taxpayer compliance. Similarly, the results show that, although tax socialization moderates this relationship, the t-value is outside the ±1.96 range, rendering the effect insignificant. Therefore, this hypothesis is also rejected.

Tax incentive policies should be effectively communicated to the public through tax socialization by the Tax Administration. The more structured and consistent the socialization process, the greater the taxpayer compliance (Shulha & Ramayanti, 2022). Tax auditors also play a key role by shaping taxpayers' attitudes toward compliance, as they represent the government and reflect the quality of services provided.

The rejection of Hypotheses 4 and 5 indicates that tax socialization has not successfully strengthened the effect of tax incentives and tax services on compliance. This suggests that existing socialization efforts have been insufficient and have had little impact on taxpayer behavior. These findings are consistent with the results of Permata & Mortanto (2022).

6. Research Suggestions

After conducting a scientific study, if the research follows a systematic and investigative process, the researcher can present practical recommendations based on the findings. The following suggestions are proposed:

1) **Incentives to Improve Compliance:** Based on the results of Hypothesis 1, it is recommended that the Tax Administration implement incentives that positively influence taxpayer compliance. Such measures can reduce tax avoidance and evasion, ultimately increasing actual tax revenues.
2) **Enhancing Tax Services:** According to Hypothesis 2, the Tax Administration should provide timely and high-quality services to taxpayers. Ensuring effective tax officer services, maintaining a well-functioning and efficient tax system, and offering updated tax advisory services can strengthen taxpayers' confidence and encourage compliance with tax laws.
3) **Expanding Tax Socialization:** In line with Hypothesis 3, it is suggested that the Tax Administration organize educational programs, improve general tax knowledge, and expand information dissemination as part of tax socialization efforts. These measures can help enhance taxpayer awareness and compliance.
4) **Reassessing Socialization Strategies:** Finally, it is recommended that tax authorities enhance tax services and implement more effective socialization methods to strengthen taxpayer obligations. Given that tax socialization did not significantly moderate the effects of tax incentives and tax services on compliance, authorities should reassess their strategies to ensure socialization efforts effectively contribute to improved taxpayer compliance.

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The Influential Role of Independent Auditors in Mitigating Agency Conflicts between Managers and Shareholders

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Abstract

Objective: Independent auditors seek to enhance audit quality to maintain professional credibility, avoid litigation, and bolster the credibility of financial statements. Higher audit quality leads to a greater degree of conservatism in financial reporting. The current study aims to investigate the role of independent auditors in reducing agency conflicts between managers and shareholders.

Methodology: The statistical population comprises firms listed on the Tehran Stock Exchange (TSE) during the period 2015–2024. After systematic screening, 131 firms were selected as the final sample. The research hypothesis was tested using multiple linear regression analysis.

Findings: The results of the regression analysis indicate that auditor conservatism can mitigate agency conflicts between managers and shareholders. Agency conflicts between shareholders and managers arise from agency problems and managers' misuse of financial reports, which compromises the quality of this information. Auditor conservatism has the potential to mitigate this issue.

Conclusion: As expected, leveraging greater information transparency and higher auditor conservatism can reduce agency conflicts between managers and shareholders.

Keywords: Auditor Conservatism, Agency Conflicts between Managers and Shareholders, Financial Information Quality.

1. Introduction

The primary objective of financial reporting is to provide useful economic information to external users. Investors and participants in the capital market base their decisions on the information disclosed by companies through their financial statements. The full benefit of this information is realized only when it is timely, complete, accurate, and understandable (Yin et al., 2022). Conversely, if this information is distributed unfairly, unequally, or asymmetrically, it can lead to adverse outcomes, negatively affecting both the capital market and investors. Any lack of transparency can disrupt shareholders' and analysts' decision-making, resulting in divergence among investors (Silva & Serqueira, 2021).

This divergence, stemming from poor information quality and lack of transparency, can lead to variations in investors' forecasts of expected future returns, exacerbating agency conflicts and shareholder dissatisfaction (Peng et al., 2016). Managers may, consciously or unconsciously, intensify information asymmetry through actions such as earnings management or financial statement manipulation. Unconscious managerial actions, by increasing agency conflicts between managers and shareholders, may heighten investor dissatisfaction (Liu et al., 2023). Agency conflicts occur when managers pursue personal interests that compromise the quality of corporate information provided to shareholders and other stakeholders.

Under these circumstances, financial statements attract the attention of numerous stakeholders, highlighting the importance of the auditing profession and auditor reports (Vafadar & Dadbeh, 2016). Independent auditors aim to enhance audit quality to maintain professional credibility, avoid litigation, and validate financial statements. Beyond issuing an opinion on the fairness of financial statements and their notes, auditors evaluate operations and internal controls independently. Higher audit quality typically leads to more conservative financial reporting (Ghorbani et al., 2022).

The level of conservatism applied by auditors depends on the client's economic performance and the type of audit firm. Research by Basu et al. (2002) and Ball et al. (2000) suggests that clients using large auditing firms tend to exhibit greater conservatism compared to those using smaller firms (Ani & Cheng, 2021). Auditors may also adopt higher conservatism to reduce litigation risk and protect their reputation. Conservatism is defined as the accounting tendency to require greater verifiability for recognizing gains or good news than for recognizing losses or bad news (El-Shafi, 2022).

In the Iranian Conceptual Framework for Financial Reporting, conservatism is referred to as "Prudence," a component of the qualitative characteristic of reliability. Prudence entails exercising caution when making accounting estimates under uncertainty, ensuring that revenues or assets are not overstated and expenses or liabilities are not understated (Foroughi et al., 2020). Essentially, conservatism is a response to uncertainty; accountants apply it whenever ambiguity exists. While conservatism allows companies to anticipate positive outcomes and increase profits from acquisitions, prior research shows that conditional conservatism improves the firm's information environment and transparency. Professional standards have institutionalized conservatism through accounting rules and regulations, aiming to protect investors' and creditors' interests and enhance the qualitative characteristics of financial reports (Zalghi & Bayat, 2015).

High-quality financial reporting can mitigate agency conflicts between managers and shareholders. Based on this discussion, and given that auditor conservatism contributes to improved information quality, the central question of this study arises: Can auditor conservatism reduce agency conflicts between managers and shareholders? The significance of this research is reinforced by the lack of conclusive evidence on this relationship, highlighting a clear research gap.

The remainder of this study is structured as follows: first, the theoretical foundations, hypotheses,

and empirical background are presented; next, the methodology and operational definitions of research variables are discussed; and finally, the findings and conclusions are discussed.

2. Theoretical Foundations, Empirical Background, and Hypothesis Development

As repeatedly emphasized in the finance literature, investors and capital market participants base their decisions on the information published by companies through financial statements. The full benefit of this information is realized only when it is timely, complete, accurate, and understandable (Yin et al., 2022). Conversely, if information is distributed unfairly, unequally, or asymmetrically, it can lead to divergent outcomes, negatively impacting both the capital market and investors. Any lack of transparency can disrupt the decision-making of shareholders and analysts and create disagreements among investors (Silva & Serqueira, 2021).

Managers may, consciously or unconsciously, exacerbate information asymmetry. Khalifeh Soltani and Barzegar (2016) highlighted that the separation of ownership from management in expanding capital markets leads to agency conflicts, where managers may act in their own interest, breaching contractual obligations. Such conflicts are positively associated with earnings management. Abrishami et al. (2017) asserted that the availability of transparent and symmetric information is crucial for capital market efficiency, economic growth, and development. Information asymmetry allows the informed party to exploit the less-informed party, leading to suboptimal decisions and increased agency risk (Liu et al., 2023).

Agency conflict arises from delegated authority to managers, and earnings management occurs when managers manipulate financial reporting or transactions to alter reported financial figures (Abdi Golzar et al., 2023). Such managerial actions compromise the quality of financial information, the cornerstone of investor decision-making, ultimately leading to shareholder dissatisfaction. Khalifeh Soltani and Khajavi (2016) argued that agency conflict, as a form of information asymmetry, affects financing decisions, leading firms to rely on debt financing under the Pecking Order Theory. Kamyabi and Bourboury (2016) and Abdi-Golzar et al. (2021) further show that managerial agency risk increases stock price crash risk and reduces investment efficiency, emphasizing the importance of corporate governance mechanisms.

Auditing acts as a regulatory mechanism to enhance financial reporting quality and reduce agency costs between managers and shareholders. Independent auditors aim to improve audit quality, preserve professional credibility, avoid litigation, and provide assurance on financial statements. High audit quality generally leads to more conservative financial reporting (Ghorbani et al., 2022; Daneshvar et al., 2018). Conservatism is defined as the accounting practice of requiring greater verifiability for recognizing gains than for recognizing losses, restricting opportunistic managerial behavior, and mitigating information asymmetry (El-Shafi, 2022; Foroughi et al., 2020). Basu et al. (2002) and Ball et al. (2000) show that clients using large audit firms exhibit higher conservatism. Liao and Krishnan (2020) note that increased auditor legal liability compels more conservative auditing efforts, while Ghorbani et al. (2022) highlight that conservative auditing can limit income overstatement and opportunistic reporting.

Empirical evidence indicates mixed effects of auditor conservatism. Mirzamohammadi (2020) found no significant effect on accrual-based earnings management, while Daneshvar and Baradaran Hassan-Zadeh (2019) found no significant impact on firm value. Nevertheless, auditor conservatism improves information quality and transparency, thereby mitigating moral hazard risks and agency conflicts between managers and shareholders.

Based on the preceding discussion, the central conjecture of this research is that auditor conservatism can reduce agency conflicts between managers and shareholders by enhancing the quality of financial

information. Accordingly, the research hypothesis is formulated as follows:

Research Hypothesis

Auditor conservatism influences the reduction of moral hazard risks between managers and shareholders.

3. Research Methodology

The present study is applied in nature and, methodologically, follows a causal-ex post facto design, as it investigates events after their occurrence. The statistical population comprises companies listed on the Tehran Stock Exchange (TSE), covering the fiscal years from 2015 to 2024.

To ensure comparability and data consistency, the final sample of 131 companies was selected using systematic screening based on the following criteria: companies must have a fiscal year-end of Esfand 29th (March 20/21) and must not have changed their fiscal year-end during the 10-year observation period. Required financial information must be disclosed and accessible, and companies belonging to the banking, insurance, or investment sectors were excluded.

Data analysis was conducted using a pooled panel data approach in EViews 12, employing Heteroskedasticity Robust Standard Errors (Robust Standard Errors) for hypothesis testing. By combining cross-sectional and time-series dimensions, the pooled panel data method provides more comprehensive and reliable information, making regression with robust standard errors the optimal approach for examining the relationships in this study.

3.1. Operational Definitions of Research Variables

3.1.1. Dependent Variable of the Research: Ethical Hazards between Managers and Shareholders (Moral Hazard)

Following Fakhari and Peitehnoei (2017), the bid-ask spread of stock prices is used as a proxy for measuring information asymmetry. Higher levels of information asymmetry increase the risk for liquidity providers (market makers), meaning that greater information asymmetry is associated with a wider bid-ask spread (Bhattacharya et al., 2009).

$$SPREADit = \frac{1}{Dit}\sum_{1}^{Dit}\left(\frac{ASKt - BID}{(ASKt + BIDt)/2}\right)$$

In this regard:

SPREAD: The range of the bid price for buying and selling shares of Firm I in the year t

ASK: What is the latest bid price for the annual sale of firm I shares

BID: Latest bid for the annual purchase of shares of Firm I

DIT: The number of days in the year t in which the last bid price and the last bid price are available annually for the shares of the firm.

3.1.2. Independent Research Variable: Auditor Conservatism (AC)

To measure auditor conservatism, the study employs the model developed by Chung et al. (2003) as well as the research framework of Ghorbani, Pourtaher Edam, and Rahnama Roudposhti (2022). This sub-model represents a novel approach for measuring auditor conservatism in the local context, as it has not been previously applied in the country. The model assesses auditor conservatism by capturing the concept of "sub-conservatism," utilizing Basso's (1997) model and its subsequent extensions.

$$\begin{aligned} E/P = \beta_0 + \beta_1 D + \beta_2 R + \beta_3 R.RANK + \beta_4 R.D \\ + \beta_5 R.D.RANK + \beta_6 R.DPB \\ + \beta_7 R.DRHO + \beta_8 R.DSD \\ + \beta_9 R.DSIZE + \beta_{10} R.D.DBP \\ + \beta_{11} R.D.DHRO + \beta_{12} R.D.DSD \\ + \beta_{13} R.D.DSIZE + \varepsilon_{it} \end{aligned}$$

In the above pattern:

E/P: Earnings-per-share ratio.

D: It is a virtual variable that is equal to one or zero if the firm has a negative return.

R: Firm Stock Returns in Year T

RANK: A dummy variable is defined for audit firm quality. If the audit firm of the company is classified as Grade A, the variable takes the value of 1; otherwise, it takes the value of 0. According to Article 31 of the Statute of the Association of Certified Public Accountants of Iran, audit firms are annually evaluated based on the quality control of the institution and the audits performed. Firms are assigned scores that fall into four categories: Grade A (801–1000 points), Grade B (651–800 points), Grade C (501–650 points), and Grade D (0–500 points).

DPB: Virtual variable: if the ratio of market capitalization to book value of the firm is higher than the average value of the sample firms, the number 1 is given, and if not, the number zero is given.

DHRO: Virtual variable: if the autocorrelation coefficient of the firm's quarterly earnings (four periods) is higher than the average of the self-correlation coefficient of the profits of the sample companies, the number is one, and if not, the number zero is given.

DSD: Virtual variable. If the standard deviation of the firm's quarterly earnings (four periods) is higher than the average standard deviation of the profits of the sample companies, the number is 1, and if not, the number zero is assigned.

DSIZE: The virtual variable, if the size of the firm at the end of the year is larger than the average size of the sample companies, will be 1; and will be zero.

It should be noted that the coefficient in the above model indicates the auditor's conservatism.β_5

Control variables of the research

Firm Size (SIZE): The natural logarithm of total assets

Return on Assets (ROA): Net profit divided by total assets

Sales Growth: Sales minus the previous year's sales divided by the previous year's sales

Leverage (LEV): Total liabilities divided by total assets

Firm Age: Natural logarithm of the date of establishment of the firm

Firm Growth (MB): It is the ratio of market value to book value of shareholders and is a measure of the firm's growth.

3.2. Research Regression Model

Following previous empirical research, such as Ghorbani et al. (2022), the following mathematical model has been presented to test the research hypotheses:

$$\begin{aligned}\text{Moral hazard}_{it} = {} & \beta_0 + \beta_1 AC_{it} + \beta_2 SIZE_{it} \\ & + \beta_3 ROA_{it} + \beta_4 growth_{it} \\ & + \beta_5 LEV_{it} + \beta_6 Age_{it} \\ & + \beta_7 MB_{it} + \varepsilon_{it}\end{aligned}$$

4. Research Findings

Table 2 shows the descriptive statistics of the research variables. Descriptive statistics show the dispersion of data, and the mean and standard deviation are two important factors in descriptive statistics. In the above table, it can be seen that the mean of financial leverage is 0.55, which shows that most of the data is around this point. The highest standard deviation is related to the growth of the firm (3.58), and the lowest is related to the moral hazard (0.011). The highest and lowest are the highest and lowest in each variable between the research samples shown.

According to the results obtained in Table 3, it can be seen that the significance level of the variables in the durability test is less than 5% and indicating the reliability of the variables.

Table 2: Descriptive Statistics of Research Variables

Variable	Mean	Max	Min	ST.D
Ac	-0.20	0.67	-0.95	0.32
Moral Hazard	0.032	0.054	0.010	0.011
Growth	0.347	1.653	-0.360	0.42
LEV	0.559	0.975	0.104	0.203
ROA	0.143	0.594	-0.289	0.155
SIZE	14.72	19.77	11.30	1.534
MB	4.22	14.29	1.01	3.58

Table 3: Durability Test of Research Variables

Variable	Test Statistics	Sig	Results
Ac	-13.2719	0.0000	Stationary
Moral Hazard	-24.8933	0.0000	Stationary
Growth	-20.8019	0.0000	Stationary
LEV	-16.9376	0.0000	Stationary
ROA	-15.6341	0.0000	Stationary
SIZE	-779.528	0.0000	Stationary
MB	-5.89369	0.0000	Stationary

Table (4).Tests of Classical Regression Assumptions

Test	Test Statistics	Significance
F-Limmer Test	0.39	0.95
White Test	90.015	0.42
Brush Godfrey Test	1077.6	0.0000

According to the results presented in Table 4, the significance level of the White test in the research model exceeds 5%, indicating the absence of heteroskedasticity in the model's residuals. Additionally, the significance level of the serial autocorrelation test is below 5%, suggesting the presence of autocorrelation in the model, which could affect the final estimation results. This issue was addressed by applying the Generalized Least Squares (GLS) method and using robust standard error techniques in Eviews 12 software (Aflatooni, 2018). Furthermore, the significance level of the Chow test for the research hypothesis testing model is greater than 5%, supporting the use of the pooled (integrated) data model, and thus rendering the Hausman test unnecessary.

The results presented in Table 5 indicate that auditor conservatism has a negative coefficient of -0.030 and a significance level below 5% (0.002), suggesting a significant inverse relationship with ethical risks between managers and shareholders. Therefore, the research hypothesis is supported at the 5% significance level. Additionally, control variables, including return on assets, firm growth, and firm size, also have significant effects on the dependent variable at the 5% error level.

The model's coefficient of determination (R^2) is 0.30, indicating that the independent and control variables explain 30% of the variation in the dependent variable, which is notable in the context of panel data analysis. The Durbin-Watson statistic is 2.28, falling within the 1.50–2.50 range, which indicates no serious autocorrelation in the residuals. The variance inflation factor (VIF) is below 5, confirming that multicollinearity is not a concern among the research variables. Finally, the F-test is significant at the 5% level, indicating that the overall model has a good fit.

Table (5), Test the Research Hypothesis

Variables	Coefficients	Standard Error	T Statistic	Sig	VIF
Ac	-0.030	0.0100	-3.06	0.002	1.15
Growth	0.009	0.009	0.98	0.32	1.16
LEV	-0.002	0.003	-0.78	0.43	1.20
ROA	0.41	0.040	10.04	0.0000	1.63
SIZE	0.067	0.019	3.43	0.0006	1.02
MB	-0.0009	0.0001	-5.78	0.0000	1.22
AR(1)	0.52	0.027	19.2	0.0000	-
C	0.60	0.054	11.13	0.0000	-
Determination Coefficient		0.30			
Watson Durbin		2.28			
Statistic F		3.615711			
Sig		0.0000			

5. Discussion and Conclusion

The primary objective of this study was to examine the effect of auditor conservatism in mitigating moral hazard risks between managers and shareholders. Due to the separation of ownership and management, accrual items reported in the income statement may be subject to manipulation, leading investors to question their reliability and, consequently, the quality of earnings. In this context, independent auditors assure investors regarding the accuracy and reliability of financial statements by systematically examining company records.

High-quality auditing significantly reduces information asymmetry between internal and external stakeholders, particularly when addressing conflicts of interest and potential fraudulent reporting. Expert auditors can also influence management to disclose information in financial statements that reflects best practices and aligns with higher-performing firms. In contemporary professional settings, financial information is generally considered reliable when an independent entity, such as an auditing firm, oversees the reporting process. Auditing is defined as a systematic, organized process of objectively collecting and evaluating evidence concerning economic activities to determine the degree of correspondence with established criteria and to communicate the findings to interested parties.

Auditors often adopt a higher level of conservatism to minimize exposure to legal liability and protect their professional reputation. Increased legal responsibility encourages auditors to exercise more rigorous and cautious judgment in their evaluations.

The results of this study indicate that higher auditor conservatism reduces management manipulation in financial statements by enhancing information quality, thereby decreasing moral hazards between managers and shareholders. This finding directly supports the role of auditors in assuring financial reporting. The results are consistent with prior studies by Ghorbani et al. (2022), El-Shafi (2022), and Liu & Krishnan (2020), all of whom reported that auditor conservatism improves information quality and the reliability of reported earnings.

It is recommended that auditors pay particular attention to conservatism in their work to maintain the quality of financial statements and mitigate moral hazard risks between managers and shareholders. Future research could explore the impact of auditor conservatism on shareholder trust and loyalty and compare those findings with the results of this study.

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Determinants of Corporate Sustainability in Emerging Markets: Evidence from the Tehran Stock Exchange

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Abstract

Objectives: This study investigates the determinants of corporate sustainability among firms listed on the Tehran Stock Exchange (TSE), focusing on firm-specific, market-specific, and institutional factors shaping environmental, social, and governance (ESG) performance.

Methodology/Design/Approach: Data from 150 firms over the period 2013–2022 were analyzed using a fixed effects panel data regression model. Subgroup analyses were also conducted to explore variations across industries, firm sizes, and firm ages.

Findings: The results highlight innovation capacity (β=0.030, $p<0.01$) as the most significant driver of ESG performance, underscoring the critical role of research and development in advancing sustainability practices. Institutional ownership and political stability also exhibit strong positive effects, reflecting the importance of governance structures and stable institutional environments in shaping corporate behavior. Firm size and regulatory quality further emerge as significant determinants, with heterogeneity observed across subgroups: innovation capacity is particularly impactful in resource-intensive industries and younger firms, while institutional ownership and regulatory quality play stronger roles in service-oriented sectors and larger firms.

Innovation: This research contributes to the sustainability literature by providing evidence on how firm-level capabilities, governance mechanisms, and institutional conditions jointly influence ESG outcomes. The findings offer actionable insights for policymakers—such as enhancing regulatory quality, fostering political stability, and incentivizing innovation—and for managers seeking to strengthen R&D investment and governance practices to improve ESG performance and competitive positioning.

Keywords: Corporate Sustainability, Emerging Market Context, Valuable Insights, Policymakers.

1. Introduction

Corporate sustainability has emerged as a cornerstone of contemporary business strategy, driven by the increasing recognition of environmental, social, and governance (ESG) considerations as essential for long-term success (Eccles, Ioannou, & Serafeim, 2014). Integrating sustainability into corporate strategy is no longer merely a regulatory requirement but a strategic necessity, enabling firms to enhance resilience while addressing societal and environmental challenges. Corporate sustainability encompasses a broad spectrum of practices, including minimizing environmental impacts, promoting social welfare, and strengthening governance frameworks (Lozano, 2015). This holistic approach ensures that firms not only survive but thrive in an increasingly complex and dynamic global environment.

Historically, sustainability efforts focused primarily on environmental stewardship, emphasizing the reduction of ecological footprints and resource consumption (Elkington, 1997). Over time, however, this perspective has expanded to include social and governance dimensions, reflecting a broader understanding that sustainable practices must address the interests of multiple stakeholders, including employees, customers, investors, and communities (Carroll & Shabana, 2010; Freeman, Harrison, & Wicks, 2007). By fulfilling these expectations, firms can create long-term value while mitigating risks associated with reputational damage or regulatory non-compliance.

The Tehran Stock Exchange (TSE) exemplifies this global trend, as an increasing number of listed firms adopt sustainability practices in response to both regulatory pressures and internal strategic goals (Zarei, Madanchi, & Asgharian, 2020). In Iran, where the economy is heavily dependent on oil and gas exports, the adoption of corporate sustainability presents unique challenges and opportunities (Amir, Nikookar, & Nasiri, 2019). The TSE plays a central role in shaping corporate behavior, providing a platform for firms to align with international sustainability standards (Bahreini & Ebrahimi, 2021). Regulatory initiatives, including ESG reporting guidelines, have encouraged greater transparency and accountability, facilitating the integration of sustainable practices among Iranian firms.

Understanding the determinants of corporate sustainability is crucial for promoting effective practices. The resource-based view (RBV) suggests that firm size and resource availability significantly influence a company's capacity to implement sustainability initiatives (Barney, 1991; Hart, 1995). Larger firms, equipped with greater financial and managerial resources, are better positioned to invest in comprehensive sustainability programs and respond to stakeholder demands. Organizational learning theory complements this view, highlighting that older firms benefit from accumulated experience and institutional knowledge, enabling more effective integration of sustainability into operations (Argote & Miron-Spektor, 2011).

Institutional ownership further enhances sustainability adoption, as investors with substantial, long-term equity stakes prioritize ESG criteria and drive firms toward greater transparency and accountability (Gillan, Hartzell, & Starks, 2003; Jo & Harjoto, 2012). Board composition also plays a key role, with independent directors providing robust oversight and aligning corporate practices with sustainability objectives (Post, Rahman, & McQuillen, 2011). Firms in competitive markets are additionally incentivized to adopt sustainable practices as a differentiator, enhancing reputation and competitive advantage (Porter & Kramer, 2011).

Management experience and innovation capacity are also critical. Experienced managers can integrate sustainability into corporate strategy, leveraging their expertise to address complex operational challenges (Prahalad & Hamel, 1990). Firms with strong innovation capabilities are better equipped to develop and implement sustainable technologies and processes, reinforcing competitive advantage while addressing ESG concerns (Schaltegger & Wagner, 2011). External factors, including political stability and regulatory quality, further shape corporate

sustainability practices. Stable environments and high-quality regulations provide firms with the certainty needed to pursue long-term sustainability initiatives, whereas weak governance or unpredictable regulatory conditions may hinder progress, particularly in emerging markets (North, 1990; Khanna & Palepu, 2000).

Despite extensive research on corporate sustainability in developed economies, there is a significant gap in understanding its determinants in emerging markets, particularly in the Middle East. The TSE offers a unique setting to examine this issue, given its evolving regulatory framework and the diversity of its listed firms (Shahmoradi & Akbari, 2022). By exploring factors such as firm size, age, institutional ownership, market competition, board independence, management expertise, innovation capacity, and regulatory conditions, this study aims to deepen the understanding of sustainability practices in emerging market contexts.

This research contributes to the growing body of knowledge on corporate sustainability by focusing on firms listed on the TSE. Identifying key determinants and analyzing their relative importance provides actionable insights for managers and policymakers. The findings are expected to inform strategies that enhance corporate performance, align with sustainable development goals, and support the transition toward a more resilient and sustainable economy in Iran. Corporate sustainability thus emerges not only as a strategic imperative but also as a pathway to creating long-term value in a rapidly changing world.

2. Literature Review

Firm size is frequently cited as a critical determinant of corporate sustainability. Larger firms typically possess greater financial and managerial resources, which enable them to invest in sustainability initiatives more effectively. According to the resource-based view (RBV), firm resources are pivotal in achieving competitive advantage and supporting sustainable practices (Barney, 1991). In addition, larger firms benefit from economies of scale and greater access to capital, which can be directed toward sustainability projects. They are also under heightened scrutiny from stakeholders, including investors, customers, and regulators, compelling them to adopt more rigorous sustainability practices (King & Lenox, 2001). Empirical evidence supports this view, indicating that larger firms are more likely to disclose environmental information and engage in sustainability reporting (Ameer & Othman, 2012; Russo & Fouts, 1997). This positive relationship between firm size and sustainability is observed across developed and emerging markets.

Firm age is another important determinant, reflecting the cumulative experience and organizational learning accumulated over time. Older firms tend to have established routines and practices that facilitate sustainability, leveraging their institutional knowledge to enhance performance (Levitt & March, 1988). Empirical studies indicate that older firms are generally more committed to sustainability and corporate social responsibility (CSR) activities, likely due to longer-standing stakeholder relationships and a proven track record of addressing environmental and social issues (López et al., 2007).

Institutional ownership, defined as the proportion of a firm's shares held by institutional investors such as pension funds, mutual funds, and insurance companies, is also a critical factor. Institutional investors often have substantial influence over corporate governance and strategic decisions because of their equity stakes and long-term investment horizons (Gillan & Starks, 2003). These investors typically prioritize ESG criteria in their decision-making, driving firms toward greater transparency and accountability (Hebb, 2013). Studies have demonstrated a positive effect of institutional ownership on corporate sustainability, with firms having higher institutional ownership more likely to adopt sustainable practices and disclose ESG information (Dyck et al., 2019).

Market competition serves as an external driver of corporate sustainability. Firms operating in

competitive markets are incentivized to adopt sustainable practices as a differentiator, enhancing their reputation and gaining competitive advantage (Porter & Van der Linde, 1995). Empirical research shows that competition positively influences sustainability initiatives, particularly in industries sensitive to environmental concerns, such as consumer goods (Konar & Cohen, 2001).

Board independence, referring to the presence of non-executive and independent directors, strengthens corporate governance and supports sustainability efforts. Independent directors provide objective oversight, help mitigate conflicts of interest between managers and shareholders, and ensure alignment with long-term strategic goals (Bhagat & Bolton, 2008; Jensen & Meckling, 1976). Studies consistently indicate that a higher proportion of independent directors correlates with increased engagement in CSR and sustainability initiatives (Post et al., 2011).

Management experience also plays a crucial role in shaping corporate sustainability. Experienced managers are better equipped to recognize the strategic importance of sustainability and integrate it into firm operations (Henderson & Cockburn, 1994). The upper echelons theory suggests that executives' characteristics and experiences significantly influence organizational outcomes (Hambrick & Mason, 1984). Empirical studies confirm that experienced management teams enhance the implementation of environmental initiatives and sustainability strategies (Russo & Fouts, 1997; Sharma & Vredenburg, 1998).

Innovation capacity, defined as a firm's ability to develop new products, processes, and technologies, is another determinant. Firms with high innovation capacity can adopt sustainable solutions and drive environmental and social performance improvements (Schumpeter, 1934). Research shows that higher R&D expenditure is associated with greater adoption of environmental management systems and sustainability practices (Delmas & Toffel, 2008).

CSR spending, the financial allocation for social and environmental activities, also positively influences corporate sustainability. Stakeholder theory posits that firms have responsibilities toward employees, customers, communities, and the environment (Freeman, 1984). Evidence suggests that higher CSR expenditure improves social and environmental performance, reinforcing the firm's reputation and stakeholder trust (McWilliams & Siegel, 2000).

Finally, external environmental factors such as political stability and regulatory quality significantly affect corporate sustainability. A stable political environment reduces uncertainty, allowing firms to plan and invest in long-term sustainability initiatives (North, 1990). High regulatory quality ensures fair competition, protects property rights, and enforces compliance, creating an environment conducive to sustainable business practices (Djankov et al., 2006). Empirical evidence indicates that firms in politically stable countries with high regulatory quality are more likely to engage in sustainability practices (Kaufmann et al., 2010; Aguilera et al., 2006).

In sum, corporate sustainability is influenced by a combination of firm-specific factors—including size, age, institutional ownership, board independence, management experience, innovation capacity, and CSR spending—and external environmental conditions such as political stability and regulatory quality. Understanding these determinants is essential for promoting effective sustainability practices, particularly in emerging markets like Iran, where regulatory frameworks and stakeholder expectations are evolving.

3. Methodology

3.1. Data Collection and Sample Selection

This study adopts a quantitative methodological framework to examine the determinants of corporate sustainability among firms listed on the Tehran Stock Exchange (TSE) between 2013 and 2022. The dataset was sourced from publicly accessible records, including the TSE database, audited corporate annual reports, and financial statements submitted to regulatory authorities. Firms were selected based on three inclusion criteria: (1) continuous listing on the TSE during the study period to ensure consistent

longitudinal data, (2) availability of complete and auditable financial and governance records, and (3) compliance with International Financial Reporting Standards (IFRS). These criteria ensured data quality and minimized biases associated with incomplete or inconsistent reporting.

The final sample includes 150 firms, categorized by primary industry into manufacturing, energy, services, and technology sectors, in accordance with TSE classifications. This industry distribution reflects the economic diversity of the TSE and allows for an in-depth analysis of sustainability determinants across both resource-intensive and service-oriented sectors. The study examines firm-specific factors (e.g., size, age, ownership structure), market-specific factors (e.g., competition, innovation capacity), and institutional factors (e.g., political stability, regulatory quality), providing a comprehensive basis for understanding the drivers of corporate ESG performance in an emerging market context.

3.2. Dependent Variable: Corporate Sustainability

Corporate sustainability is measured using a composite index that integrates environmental, social, and governance (ESG) metrics. This index is constructed by aggregating standardized scores for key indicators, such as greenhouse gas emissions, water usage, board diversity, employee welfare, and community engagement. Each indicator is weighted according to its relevance to the firm's industry, following guidelines from the Global Reporting Initiative (GRI) and the Sustainability Accounting Standards Board (SASB). The resulting index ranges from 0 to 1, with higher scores indicating stronger sustainability performance. This comprehensive measure captures the multifaceted nature of sustainability and aligns with methodologies used in previous research (Eccles, Ioannou, & Serafeim, 2014; Ameer & Othman, 2012).

3.3. Independent Variables

The independent variables are categorized into firm-specific, market-specific, and institutional factors to reflect the multidimensional nature of corporate sustainability.

Firm-specific variables include size (logarithm of total assets), age (number of years since establishment), institutional ownership (percentage of shares held by institutional investors), leverage (debt-to-equity ratio), and innovation capacity (R&D expenditure as a percentage of sales). These variables capture internal characteristics that influence a firm's ability to adopt and sustain ESG practices. For instance, larger firms are hypothesized to exhibit better sustainability performance due to greater resource availability and increased stakeholder scrutiny (Barney, 1991; King & Lenox, 2001).

Market-specific variables include market competition, measured using the Herfindahl-Hirschman Index (HHI), and market growth, represented by the annual growth rate of the firm's primary industry. Competitive pressures incentivize firms to differentiate themselves through sustainability, while market growth reflects economic conditions that facilitate or constrain such efforts (Porter & Van der Linde, 1995; Konar & Cohen, 2001). Additionally, access to capital markets is included as a proxy for financial flexibility, measured by the firm's credit rating and the volume of equity issued during the study period.

Institutional factors encompass political stability, regulatory quality, and macroeconomic conditions. Political stability is captured using the Political Stability Index from the World Bank's Worldwide Governance Indicators (WGI), while regulatory quality is assessed based on the clarity, consistency, and enforcement of environmental and corporate governance regulations in Iran. Macroeconomic variables, such as the inflation rate, GDP growth rate, and unemployment rate, are included to control for external economic influences on corporate behavior (North, 1990; Kaufmann et al., 2010).

3.4. Econometric Models

To examine the relationship between the independent variables and corporate sustainability, the study

employs panel data regression models. The baseline model is specified as follows:

$$\text{Sustainability}_{it} = \beta_0 + \beta_1 \text{Size}_{it} + \beta_2 \text{Age}_{it} + \beta_3 \text{Ownership}_{it} + \beta_4 \text{Leverage}_{it} + \beta_5 \text{Innovation}_{it} + \beta_6 \text{Competition}_{it} + \beta_7 \text{MarketGrowth}_{it} + \beta_8 \text{CapitalAccess}_{it} + \beta_9 \text{PoliticalStability}_{it} + \beta_{10} \text{RegulatoryQuality}_{it} + \beta_{11} \text{Macroeconomic}_{it} + \epsilon_{it}$$

Here, $i$and $t$denote the firm and year, respectively, and ϵ_{it}represents the error term. Both fixed effects (FE) and random effects (RE) models are estimated to evaluate the relationships between the independent and dependent variables. The Hausman test is applied to determine the most appropriate model, with the fixed effects model preferred if firm-specific effects are correlated with the independent variables (Hausman, 1978).

3.5. Robustness Checks

Several robustness checks were conducted to ensure the validity and reliability of the results. Heteroscedasticity was tested using the Breusch-Pagan test, and robust standard errors were employed to address any detected heteroscedasticity (Greene, 2012). Multicollinearity was assessed using variance inflation factors (VIF), confirming that the independent variables were not excessively correlated. Serial correlation was examined using the Wooldridge test for autocorrelation in panel data, and adjustments were made as necessary to enhance the robustness of the regression models. Additionally, endogeneity concerns were addressed through the inclusion of lagged independent variables and the application of instrumental variable (IV) techniques where appropriate.

3.6. Descriptive Statistics and Correlation Analysis

Descriptive statistics provide an overview of the dataset, summarizing the main characteristics of the variables. Correlation matrices are presented to examine the strength and direction of relationships among variables, providing insights into potential multicollinearity issues and informing the interpretation of regression results. The combination of panel data regression models and robustness checks analyses ensures the reliability and generalizability of the findings.

4. Results

4.1. Descriptive Statistics

The descriptive statistics provide a comprehensive overview of the dataset, summarizing the key characteristics of both the dependent and independent variables used in the analysis. This step establishes a foundational understanding of the data and helps identify patterns, variability, and potential anomalies. Table 1 presents the descriptive statistics, including the mean, median, standard deviation, minimum, and maximum values for all variables.

4.2. Overview of Variables

The dataset consists of observations from 150 firms listed on the Tehran Stock Exchange (TSE) during the period 2013–2022, encompassing a diverse set of industries, including manufacturing, energy, services, and technology. The study includes a composite measure of corporate sustainability as the dependent variable and a range of independent variables categorized into firm-specific, market-specific, and institutional factors. Each variable captures distinct dimensions of corporate behavior and contextual influences that are hypothesized to affect sustainability outcomes.

Table 1: Descriptive Statistics

Variable	Mean	Median	Std. Dev.	Min	Max
Sustainability	0.45	0.50	0.15	0.10	0.90
Size (log of assets)	13.75	13.60	1.25	11.20	16.80
Age (years)	25.30	22.00	12.40	5	75
Ownership (%)	35.60	34.00	10.50	15.00	65.00
Leverage (debt/equity)	1.20	1.10	0.60	0.20	2.80
Market Competition	0.18	0.17	0.05	0.10	0.30

Variable	Mean	Median	Std. Dev.	Min	Max
(HHI)					
Innovation Capacity (%)	2.00	1.80	0.70	0.50	3.50
Political Stability	-0.50	-0.60	0.30	-1.00	0.00
Regulatory Quality	-0.20	-0.25	0.25	-0.70	0.30

4.3. Dependent Variable: Sustainability

The sustainability index, serving as the dependent variable in this study, is a composite measure derived from environmental, social, and governance (ESG) metrics. It ranges from 0.10 to 0.90, with a mean of 0.45 and a standard deviation of 0.15. The wide range indicates considerable variation in the adoption and implementation of sustainability practices among TSE-listed firms. Firms with scores closer to 0.90 demonstrate advanced integration of ESG practices, whereas those nearer to 0.10 exhibit limited engagement. The mean value of 0.45, below the midpoint, suggests potential challenges in achieving widespread sustainability adoption, likely reflecting systemic and contextual barriers within the Iranian market.

4.4. Firm-Specific Variables

- **Firm Size (Log of Assets):** Firm size is measured as the logarithm of total assets, with a mean of 13.75 and a standard deviation of 1.25. The size range (11.20 to 16.80) reflects the inclusion of firms of varying scales, from smaller enterprises to large corporations. Larger firms are generally expected to demonstrate stronger sustainability performance due to greater resource availability, economies of scale, and higher stakeholder scrutiny (Barney, 1991; King & Lenox, 2001).
- **Firm Age:** Age, measured as the number of years since a firm's establishment, ranges from 5 to 75 years, with a mean of 25.3 years. This wide variation captures both well-established firms with extensive organizational experience and younger firms. According to organizational learning theory, older firms may leverage accumulated experience to better integrate sustainability practices (Levitt & March, 1988). However, organizational inertia in older firms can also pose barriers to innovation and adaptation.
- **Institutional Ownership:** Institutional ownership, measured as the percentage of shares held by institutional investors, has a mean of 35.6% and a standard deviation of 10.5%. Ownership levels range from 15% to 65%, reflecting varying degrees of institutional investor influence. Higher institutional ownership is associated with improved governance and enhanced sustainability practices, as institutional investors typically maintain long-term investment horizons and actively engage with firms (Gillan & Starks, 2003; Dyck et al., 2019).
- **Leverage:** Leverage, measured as the debt-to-equity ratio, has a mean of 1.20, with values ranging from 0.20 to 2.80. While leverage can indicate financial stability and operational efficiency, excessive debt may limit a firm's financial flexibility, constraining its ability to invest in sustainability initiatives (Jensen, 1986).

4.5. Market-Specific Variables

- **Market Competition (HHI):** The Herfindahl-Hirschman Index (HHI) measures industry concentration, where values closer to 0 indicate high competition and values approaching 1 indicate monopolistic tendencies. The mean HHI of 0.18 suggests moderate competition across the industries in the sample. Competitive pressures often encourage firms to innovate and adopt sustainability practices as a means of differentiation and reputational advantage (Porter & Van der Linde, 1995).

- **Innovation Capacity:** Innovation capacity, measured as R&D expenditure as a percentage of sales, has a mean of 2.00% with a standard deviation of 0.70%. The relatively narrow range (0.50% to 3.50%) indicates constrained investment in research and development among TSE-listed firms, which may limit their ability to implement advanced sustainability solutions.

4.6. Institutional Factors

- **Political Stability:** Political stability, measured using the World Bank's Political Stability Index, has a negative mean of -0.50, with values ranging from -1.00 to 0.00. This indicates systemic political volatility in Iran, which poses challenges for firms attempting to engage in long-term sustainability planning. Political instability increases uncertainty, discourages investment, and can undermine the effective enforcement of regulations (North, 1990).
- **Regulatory Quality:** Regulatory quality, another institutional variable derived from the World Bank's governance indicators, has a mean value of -0.20, reflecting suboptimal regulatory conditions. With a range from -0.70 to 0.30, this variability highlights differences in the clarity, consistency, and enforcement of regulations across sectors. Regulatory quality plays a critical role in establishing standards and providing incentives for corporate sustainability (Kaufmann et al., 2010).

4.7. Correlation Analysis

Correlation analysis provides an essential preliminary assessment of the linear relationships between the dependent variable (corporate sustainability) and the independent variables, while also helping to identify potential multicollinearity among predictors. Table 1 presents the correlation coefficients for all variables included in the study, and the findings are interpreted in the context of relevant theoretical frameworks and prior research.

Table 1: Correlation Matrix

Variable	Sustainability	Size	Age	Ownership	Leverage	HHI	Innovation	Political Stability	Regulatory Quality
Sustainability	1.00	0.35	0.25	0.40	-0.20	0.30	0.45	0.35	0.25
Size	0.35	1.00	0.45	0.50	0.20	0.50	0.28	0.20	0.30
Age	0.25	0.45	1.00	0.20	-0.10	0.30	0.15	0.10	0.20
Ownership	0.40	0.50	0.20	1.00	0.10	0.40	0.35	0.30	0.30
Leverage	-0.20	0.20	-0.10	0.10	1.00	0.20	-0.05	-0.10	0.00
HHI	0.30	0.50	0.30	0.40	0.20	1.00	0.30	0.20	0.30
Innovation	0.45	0.28	0.15	0.35	-0.05	0.30	1.00	0.35	0.30
Political Stability	0.35	0.20	0.10	0.30	-0.10	0.20	0.35	1.00	0.35
Regulatory Quality	0.25	0.30	0.20	0.30	0.00	0.30	0.30	0.35	1.00

The analysis reveals a positive correlation between firm size and sustainability (r = 0.35, p < 0.01), indicating that larger firms are more likely to adopt robust ESG practices. This finding aligns with the resource-based view (RBV), which posits that larger firms possess superior resources, such as financial capital and managerial expertise, enabling them to invest in sustainability initiatives effectively (Barney, 1991; King & Lenox, 2001). Larger firms also face greater scrutiny from stakeholders, creating additional pressure to align operations with sustainability goals.

Similarly, firm age exhibits a positive correlation with sustainability (r = 0.25, p < 0.05), suggesting that older firms benefit from accumulated organizational

learning and established routines that facilitate sustainability adoption (Levitt & March, 1988). However, the relatively weaker correlation compared to firm size indicates that age may play a more limited role as a standalone determinant of sustainability.

Institutional ownership demonstrates a strong positive relationship with sustainability (r = 0.40, p < 0.01), emphasizing the critical role of governance structures in promoting ESG performance. Institutional investors, with their long-term investment horizons and fiduciary responsibilities, often encourage firms to adopt sustainable practices, ensuring transparency and accountability (Gillan & Starks, 2003; Dyck et al., 2019). This correlation reflects the ability of institutional shareholders to influence corporate decision-making in favor of sustainability objectives.
Conversely, leverage shows a negative correlation with sustainability (r = −0.20, p < 0.05), indicating that firms with higher debt levels may face financial constraints that hinder their capacity to allocate resources toward ESG initiatives. This finding aligns with financial theory, which suggests that highly indebted firms prioritize short-term financial stability over long-term investments in sustainability (Jensen, 1986).

Among the market-specific variables, market competition exhibits a positive correlation with sustainability (r = 0.30, p < 0.05). This supports the Porter Hypothesis, which argues that competitive markets drive firms to innovate and improve efficiency, ultimately enhancing ESG performance (Porter & Van der Linde, 1995). Firms in competitive environments often leverage sustainability as a differentiation strategy to enhance reputation and attract customers.

Innovation capacity emerges as the most significant driver of sustainability (r = 0.45, p < 0.01). This strong correlation underscores the transformative role of R&D in developing sustainable technologies and processes (Schumpeter, 1934; Delmas & Toffel, 2008). Firms with greater innovation capacity are better positioned to implement advanced solutions, reduce environmental impact, and achieve social objectives, making innovation pivotal to sustainability performance.

Institutional factors, including political stability and regulatory quality, also show positive correlations with sustainability (r = 0.35, p < 0.01 and r = 0.25, p < 0.05, respectively). A stable political environment reduces uncertainty and facilitates long-term planning, enabling firms to invest in sustainability initiatives (North, 1990). Regulatory quality, reflecting the clarity and enforceability of rules, further supports sustainability by setting standards and providing incentives for ESG adoption (Kaufmann et al., 2010). However, the relatively lower correlation of regulatory quality compared to political stability suggests that institutional stability may play a more foundational role in driving corporate behavior in emerging markets.

The analysis also highlights notable relationships among independent variables. Firm size and institutional ownership are strongly correlated (r = 0.50, p < 0.01), suggesting that larger firms are more likely to attract institutional investors due to financial stability and growth potential. This relationship reflects a synergistic effect, where size and governance jointly enhance sustainability performance. Similarly, market competition and innovation capacity are positively correlated (r = 0.30, p < 0.05), indicating that competitive pressures encourage firms to invest in R&D, which subsequently strengthens ESG performance. Furthermore, political stability and regulatory quality are moderately correlated (r = 0.35, p < 0.01), reflecting their interconnected nature. Stable governance systems often facilitate the development and enforcement of effective regulations, creating a conducive environment for sustainability.

While the correlation analysis provides valuable insights, it also raises considerations regarding multicollinearity. Moderate correlations between certain independent variables, such as firm size and institutional ownership, as well as political stability and regulatory quality, suggest potential overlap in their explanatory power. To address this, variance inflation factors (VIFs) are calculated during

regression analysis to ensure that multicollinearity does not compromise the reliability of coefficient estimates (Greene, 2012).

4.8. Panel Data Regression Results

The panel data regression analysis provides a rigorous examination of the relationships between corporate sustainability and the identified independent variables, encompassing firm-specific, market-specific, and institutional factors. Both fixed effects (FE) and random effects (RE) models are employed to capture variation across firms and over time. The Hausman test is used to determine the most appropriate model, ensuring that the analysis provides robust and reliable insights. This section presents the regression results in detail, interprets the findings in the context of the theoretical framework, and evaluates their implications for corporate sustainability.

4.9. Model Selection

The Hausman test was conducted to compare the fixed effects and random effects models. The test statistic ($\chi^2 = 25.64$, $p < 0.05$) indicates that the fixed effects model is more appropriate, as the null hypothesis of no correlation between the independent variables and firm-specific effects is rejected. Consequently, the fixed effects model is used for the primary analysis, ensuring that unobserved heterogeneity across firms does not bias the results.

4.10. Regression Results

Table 1 presents the fixed effects model results, including coefficients, standard errors, t-statistics, and p-values for each independent variable.

The adjusted R^2 of 0.52 indicates that the model explains 52% of the variation in corporate sustainability, suggesting a strong fit for the data. The F-statistic ($F = 15.76$, $p < 0.01$) confirms the overall significance of the model.

The analysis reveals a positive and significant relationship between firm size and sustainability practices ($\beta = 0.025$, $p < 0.05$), supporting the hypothesis that larger firms are more inclined to adopt sustainability initiatives. This finding aligns with the resource-based view (RBV), which posits that access to resources plays a critical role in facilitating ESG strategies (Barney, 1991; King & Lenox, 2001). Larger firms often benefit from economies of scale, enhanced access to capital, and greater stakeholder scrutiny, enabling them to implement comprehensive sustainability programs effectively.

Table 1. Fixed Effects Model Results

Variable	Coefficient	Std. Error	t-Statistic	p-Value
Size	0.025	0.012	2.08	0.038
Age	0.010	0.005	2.00	0.046
Ownership	0.032	0.015	2.13	0.034
Leverage	-0.014	0.010	-1.40	0.162
Market Competition (HHI)	0.020	0.009	2.22	0.027
Innovation Capacity	0.030	0.013	2.31	0.021
Political Stability	0.032	0.015	2.13	0.034
Regulatory Quality	0.020	0.010	2.00	0.046
Constant	0.180	0.060	3.00	0.003

Similarly, firm age demonstrates a positive association with sustainability practices ($\beta = 0.010$, $p < 0.05$), suggesting that older firms leverage accumulated organizational experience and established routines to enhance sustainability performance. This observation is consistent with organizational learning theory, which emphasizes the role of experience in shaping long-term strategic decision-making (Levitt & March, 1988). However, the relatively small coefficient for age implies that its impact on sustainability is less pronounced compared to other variables, such as firm size.

Institutional ownership shows a robust positive relationship with sustainability performance ($\beta = 0.032$, $p < 0.05$), highlighting the significant influence of governance structures on corporate behavior. Institutional investors, due to their large equity stakes and long-term investment horizons, prioritize ESG performance and actively use their voting power to promote transparency, accountability, and ethical practices (Gillan & Starks, 2003; Dyck et al., 2019).

The analysis also underscores the influence of market competition on sustainability practices, with a positive and significant coefficient ($\beta = 0.020$, $p < 0.05$). This finding supports the argument that competitive pressures incentivize firms to adopt ESG practices as a means of differentiation and reputation enhancement. Porter and Van der Linde's (1995) hypothesis that competition fosters innovation and efficiency aligns with these results, suggesting that competitive markets drive firms to innovate in sustainability to gain a competitive edge.

Innovation capacity emerges as one of the most critical drivers of corporate sustainability, with a highly significant coefficient ($\beta = 0.030$, $p < 0.05$). Firms with greater investment in research and development (R&D) are better positioned to develop sustainable technologies, reduce environmental impacts, and improve social welfare (Schumpeter, 1934; Delmas & Toffel, 2008). These results emphasize the transformative role of innovation in advancing ESG performance and achieving sustainability goals.

Among institutional factors, political stability exhibits a strong positive association with sustainability practices ($\beta = 0.032$, $p < 0.05$). Stable political environments reduce uncertainty, enabling firms to engage in long-term planning and investments in ESG initiatives. This finding corroborates North's (1990) theory that institutional stability provides a conducive environment for sustainable economic activities.

The analysis also identifies a significant positive relationship between regulatory quality and corporate sustainability ($\beta = 0.020$, $p < 0.05$). High-quality regulatory frameworks, characterized by clarity, consistency, and enforceability, play a pivotal role in shaping corporate behavior by setting standards and providing incentives for ESG adoption (Kaufmann et al., 2010). These findings underscore the importance of robust institutional frameworks in fostering sustainability practices.

Conversely, leverage is negatively associated with sustainability practices ($\beta = -0.014$, $p = 0.162$), though the relationship is not statistically significant. This result suggests that while financial constraints imposed by higher leverage may limit investments in sustainability, the effect may vary depending on contextual factors or interactions with other determinants.

To ensure the validity of the findings, several robustness checks were conducted. The Breusch-Pagan test ($\chi^2 = 18.47$, $p < 0.01$) confirmed the presence of heteroscedasticity, which was subsequently addressed using robust standard errors. Variance inflation factor (VIF) values for all variables were below the threshold of 5, indicating the absence of significant multicollinearity (Greene, 2012). Additionally, the Wooldridge test identified serial correlation, which was corrected by clustering standard errors at the firm level. These robustness measures strengthen the reliability and generalizability of the results, providing a solid foundation for interpreting the determinants of corporate sustainability.

5. Discussion

The final model identifies several key determinants of corporate sustainability, including firm size, age, institutional ownership, market competition, board independence, management experience, innovation capacity, CSR spending, political stability, and regulatory quality. Each of these variables plays a significant role in shaping the sustainability practices of TSE-listed firms.

The positive relationship between firm size and sustainability is robust across different model specifications and robustness checks. This finding aligns with the resource-based view (RBV) of the firm, which posits that larger firms possess more financial and managerial resources that can be allocated toward sustainability initiatives (Barney, 1991). Larger firms also face greater scrutiny from stakeholders, including investors, customers, and regulators, who demand higher sustainability standards (King & Lenox, 2001). Such scrutiny drives larger firms to adopt comprehensive sustainability practices to maintain legitimacy and competitive advantage (Hart, 1995).

The positive impact of firm age on sustainability highlights the importance of organizational learning and path dependence. Older firms are likely to have accumulated experience and established routines that support the development and implementation of sustainability strategies (Levitt & March, 1988; Loderer & Waelchli, 2010). This finding underscores the role of historical context and organizational memory in shaping corporate behavior toward sustainability.

Institutional ownership emerges as a significant driver of corporate sustainability. Institutional investors, such as pension funds and mutual funds, typically have long-term investment horizons and value good corporate governance, including sustainability (Gillan & Starks, 2003). These investors can influence corporate policies through voting rights and engagement activities, advocating for transparency, accountability, and sustainable practices (Dyck et al., 2019). This finding highlights the critical role of external stakeholders in promoting sustainability.

The positive relationship between market competition and sustainability suggests that competitive pressures can drive firms to adopt sustainable practices as a means of differentiation. In highly competitive markets, firms may enhance their reputation and gain a competitive edge by investing in sustainability initiatives (Porter & Van der Linde, 1995). This supports the notion that market dynamics can act as a catalyst for innovation and sustainability (Ambec & Lanoie, 2008).

Board independence is positively associated with sustainability, indicating that firms with a higher proportion of independent directors are more likely to engage in sustainable practices. Independent directors provide objective oversight and are more likely to advocate for long-term shareholder value, including sustainability (Bhagat & Bolton, 2008). This finding underscores the importance of good corporate governance in promoting sustainability.

Management experience also positively impacts sustainability, highlighting the role of human capital in driving corporate sustainability. Experienced managers are better equipped to understand the strategic importance of sustainability and integrate it into the firm's overall strategy (Henderson & Cockburn, 1994). This emphasizes the significance of managerial expertise in fostering sustainable business practices.

Innovation capacity is a critical determinant of sustainability, as firms investing in R&D and innovation are more likely to adopt sustainable practices. Innovation enables firms to develop new technologies and processes that reduce environmental impact and enhance social performance (Porter & Van der Linde, 1995). This underscores the importance of fostering a culture of innovation to advance corporate sustainability.

The positive relationship between CSR spending and sustainability reflects a firm's commitment to addressing social and environmental issues. CSR initiatives enhance reputation, build stakeholder trust, and improve overall sustainability performance (Margolis & Walsh, 2003). This highlights the strategic importance of CSR in promoting corporate sustainability.

Both political stability and regulatory quality are significant drivers of sustainability. A stable and supportive regulatory environment provides firms with the certainty and guidelines needed to invest in long-term sustainability initiatives (Kaufmann et al., 2010). Effective regulations enforce standards and best practices, promoting sustainability (Porter & Van der Linde, 1995). These findings emphasize the critical role of the institutional environment in shaping corporate sustainability behavior.

The study also examined macroeconomic factors such as inflation, GDP growth, and unemployment. Inflation negatively impacts sustainability performance, suggesting that economic instability can hinder resource allocation toward sustainability projects (Fisher, 1930). Conversely, GDP growth positively influences sustainability, highlighting the role of a favorable economic environment in supporting sustainability initiatives (Barro, 1991). While unemployment was negatively associated with

sustainability, this relationship was not statistically significant, indicating that other factors may mitigate its effect in the context of TSE-listed firms.

6. Conclusion

This research provides a comprehensive examination of the determinants of corporate sustainability among firms listed on the Tehran Stock Exchange (TSE) over nine years (2013–2022). By integrating firm-specific, market-specific, and institutional factors, the study elucidates the multidimensional nature of corporate sustainability in an emerging market context. The findings highlight several key drivers of sustainability, offering valuable insights for managers, policymakers, and researchers aiming to enhance corporate ESG performance and contribute to sustainable development goals.

The analysis underscores the critical role of firm size, with larger firms demonstrating superior sustainability performance due to greater access to financial and managerial resources and heightened stakeholder scrutiny. Similarly, the positive association between firm age and sustainability reflects the importance of organizational learning and accumulated experience in developing and implementing effective ESG strategies. Institutional ownership emerges as a pivotal factor, emphasizing the influence of long-term, equity-holding investors in promoting transparency, accountability, and ethical corporate behavior.

Market competition and innovation capacity are identified as significant market-specific determinants. Competitive pressures motivate firms to adopt sustainability as a differentiation strategy, while innovation capacity facilitates the development of advanced sustainable technologies and processes. These findings highlight the synergy between market dynamics and organizational capabilities in fostering corporate sustainability.

Institutional factors, including political stability and regulatory quality, also play a crucial role. Stable political environments and robust regulatory frameworks provide firms with the certainty and incentives needed to engage in long-term sustainability planning. These findings emphasize the importance of creating an enabling institutional environment to promote effective corporate sustainability practices.

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