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THE IMPACT OF DIGITAL ACCOUNTING PRACTICES ON AGENCY COSTS MANAGEMENT: EVIDENCE FROM AN EMERGING MARKET

Abstract

The increased penetration of digital technologies has significant implications for the role of digital accounting practices in enhancing corporate governance, particularly in emerging markets where agency problems are more serious. This study aims to investigate the impact of digital accounting practices on agency costs management in emerging markets. Using the theoretical foundations of agency theory and institutional theory, the study investigates the role of the application of blockchain technology and artificial intelligence in the management of agency costs and the efficiency of financial reporting. The study used a balanced panel data set comprising 72 non-financial and financial firms listed on the Amman Stock Exchange from 2018 to 2023. To investigate the impact of applying digital accounting practices, the study used a multi-model approach by employing a fixed-effect regression model with a propensity score matching approach and a difference-in-differences approach. The study found that adopting digital accounting practices by firms is associated with a significant reduction in monitoring costs evidenced by a reduction in audit fees, a reduction in bonding costs captured by a reduction in the reliance on fixed management compensation, and a slight improvement in the efficiency of financial reporting. Industry-level analysis showed that financial sector firms are more inclined towards the application of digital accounting practices due to the regulatory environment, while the application of digital accounting practices by industrial sector firms is less pronounced resulting from capability constraints. The study provides empirical support that digital accounting practices can be used as a cost-efficient mechanism of corporate governance in the context of emerging markets.

Keywords

digitalization, agency costs, audit fees, blockchain, artificial intelligence, emerging markets

JEL Classification

M41, M10, G32

INTRODUCTION

The rapid digitalization of accounting and financial reporting processes has dramatically changed the manner in which firms produce, verify, and report financial information. Technologies such as AI, blockchain, and cloud-based accounting systems are increasingly becoming integral parts of organizational processes and have altered the information environment and governance structures (Abubakr et al., 2024; Stanciu & Bran 2015). In addition, agency costs arising from agency theory and associated with conflicts between management and shareholders have remained a thorny issue in governance structures across numerous firms (Jensen & Meckling, 1976; Eisenhardt, 1989; Fama & Jensen, 1983).

Agency costs take the form of monitoring costs, bonding costs, and residual losses and have been shown to reduce firm value. Traditional governance structures such as external audits, board monitoring, and

contracts have been established to mitigate these costs; however, they have been shown to be costly and have been challenged by delays in information availability and the inability to detect managerial opportunism in real-time (Bushman & Smith, 2001). These issues have become more pronounced with the growing concerns surrounding financial reporting and governance structures in numerous markets across the globe. Digital accounting technologies may hold promise for helping to address these governance challenges. In effect, digital accounting technologies may have the potential to alter the cost-benefit relationship for monitoring and controlling activities. For instance, data processing, continuous assurance, and digital transaction records may hold promise for helping to address agency cost issues without proportionately increasing control costs (Yermack, 2017; Coyne & McMickle, 2017; Appelbaum et al., 2017). Yet, whether such technological integration improves governance outcomes remains an empirical question. This problem is particularly salient in emerging markets, where institutional development is less robust and investor protection is relatively weaker (Almubaydeen et al., 2024). In such markets, agency problems may be more prevalent, and conventional governance tools may be less effective. Yet, despite the increasing prevalence of digital accounting technologies in emerging markets, there is limited empirical evidence on whether such technologies function as effective governance substitutes or complements. The Jordanian context may hold promise for helping to address this unresolved problem. The Jordanian market is characterized by concentrated ownership, relatively moderate levels of regulatory reform, and weak enforcement (Marashdeh, 2014). In such an environment, agency problems may be more prevalent. Yet, in key sectors, digital accounting technologies have increasingly been adopted. This may hold promise for helping to address whether such technological change translates into measurable governance improvements. Understanding this relationship is essential for advancing knowledge about the role of digital accounting in shaping agency outcomes in emerging markets (DiMaggio & Powell, 1983).

1. LITERATURE REVIEW AND HYPOTHESES DEVELOPMENT

1.1. Agency theory for digital accounting

Agency theory, as developed by Jensen and Meckling (1976) and further refined by Eisenhardt (1989), suggests that agency costs arise from monitoring, bonding, and residual losses due to conflicting interests between managers and shareholders. Conventional agency theory suggests that the following traditional mechanisms are effective in mitigating agency costs: external audits, independent boards of directors, and mandatory disclosure. These are intended to reduce information asymmetry and managerial opportunism (Fama & Jensen, 1983). However, these are often associated with substantial monitoring costs and are not effective in environments where enforcement is weak.

Accounting technologies hold the promise of revolutionizing the field of accounting by increasing transparency, the speed of information flow,

and supervision. Blockchain technology provides a secure, time-stamped record of all transactions, making it more difficult for managers to manipulate the books or for auditors to be misled (Yermack, 2017; Moffitt & Vasarhelyi, 2013). Artificial intelligence (AI) technology enables more timely detection of anomalies using analytics, which is a major step forward in real-time supervision (Abubakr et al., 2024). Studies on accounting information systems suggest that accounting technology can enhance internal monitoring, external audits, and thus impact agency theory (Han et al., 2023). There is a debate about the extent to which accounting technology impacts traditional agency theory. Some studies suggest that blockchain technology can reduce the need for high external audit fees due to increased transparency (Appelbaum & Nehmer, 2020). Other studies suggest that technology can actually complement traditional audits, increasing the efficiency of external audits (Lombardi et al., 2022). In emerging markets, where the quality of external audits is diluted by the impact of concentrated ownership structures, the adoption of accounting technology is likely to have a disproportionate impact on monitoring efficiency.

1.2. Bonding costs and compensation structure

Bonding costs occur when managers conform to constraints, such as remuneration plans, to signal support for shareholders (Core & Guay, 1999). In developed economies, performance-based rewards reduce agency costs by binding managerial compensation to shareholder wealth (Bushman & Smith, 2001). Nevertheless, for most emerging markets, compensation continues predominantly on fixed salaries, due to weak enforcement, uncertain disclosure practices, and captive owners (Francis et al., 2005). Against this background, technological accounting compromises a potential revolution. Artificial intelligence and cloud computing combine for enhanced reliability and timeliness of financial data, strengthening the ground for performance evaluation (Appelbaum & Nehmer, 2020). Greater reporting transparency reduces the need for bonding mechanisms like high fixed payments. There is, however, a counter-discourse: some researchers suggest that adoption of technology imposes new kinds of managerial bonding, such as investments in training and supervision of cybersecurity (Brennan et al., 2019). While others, on the other hand, contend that technological transparency is a substitute for traditional bonding through enabling performance-based contractual remunerations in the market previously based on fixed payment plans (Shaban & Omoush, 2025).

1.3. Organizational efficiency and residual losses

Residual losses are the inefficiencies left despite the implementation of monitoring and bonding mechanisms, which frequently leads to poor decisions or inefficient resource utilization (Bushman & Smith, 2001). For emerging markets, such inefficiencies have frequently been compounded by weak governance mechanisms and insufficient disclosure (Francis et al., 2005). Digital technologies have been suggested for minimizing residual losses through better decision-making and coordination. Blockchain decreases duplication and opportunism through better supply-chain visibility (Han et al., 2023). AI provides predictive analysis for better strategic planning, while cloud infrastructure integrates cross-departmental information, reducing the misallocation of resources

(Khorsheed et al., 2024). However, the adoption of digital technologies might create new inefficiencies due to high implementation costs, cybersecurity threats, and knowledge gaps (Brennan et al., 2019). Furthermore, evidence from developed markets cannot be generalized, given that companies in emerging markets adopt technologies reactively as a result of regulatory pressures rather than strategic vision (Maycotte et al., 2025).

1.4. Emerging market and institutional theory

Institutional theory points out that organizational practice is decided not simply on the basis of efficiency but rather due to the presence of coercive, normative, and mimetic influences (DiMaggio & Powell, 1983). While competitive pressures or technological readiness are the main drivers of digital technology adoption in advanced economies, adoption in emerging economies is often due to regulatory mandate, the pursuit of legitimacy, or peer imitation (Brennan et al., 2019). Jordan is a valuable learning case. Reforms such as mandatory compliance with International Financial Reporting Standards and intensified governance rules have created coercive pressures (Al-Htaybat, 2018). Enforcement capabilities are, however, patchy, and limitations on resources prevent adoption depth. There is sectoral disparity: financial companies have faced international regulatory attention, which results in elevated adoption, while industrial companies, which are frequently family-run with limited resources, are behind. This background mirrors that agency cost effects of accounting technologies are not inherent but depend on institutional variables, and thus, empirical explorations are warranted that position technologies of governance within their overall context frameworks.

The literature reviewed has shown that digital accounting technologies have the potential to impact agency costs in terms of increased transparency, strengthening monitoring mechanisms, compensation structures, and organizational efficiency. However, the literature has shown that the current state of knowledge in digital accounting technologies and agency costs is limited in terms of emerging markets and the extent to which digital accounting technologies can substitute or complement governance mechanisms.

Additionally, the literature has shown that most empirical studies in digital accounting technologies and agency costs have concentrated on the capabilities of digital accounting technologies rather than governance outcomes such as monitoring costs, bonding costs, and residual losses. Furthermore, most empirical studies have failed to consider institutional factors in their models, although they are crucial in the context of governance in emerging markets. Therefore, the purpose of this study was to assess whether the adoption of digital accounting technologies can reduce agency costs in listed firms in an emerging market context.

Guided by the agency theory, the institutional theory, and the emerging literature on digital accounting technologies, particularly in the context of emerging markets, the following hypotheses have been formulated for this study. These hypotheses collectively examine the role that the adoption of digital accounting technologies plays in reducing agency costs.

- H1: Adopting digital accounting technologies should have lower monitoring costs reflected by reduced audit fees.*
- H2: Companies that adopt digital accounting technologies are likely to enjoy lower bonding costs, which is supported through a reduction of fixed managerial remunerations.*
- H3: Companies that adopt digital accounting technologies are likely to enjoy efficiency enhancement reflected through a reduction in residual losses.*

2. METHODOLOGY

2.1. Research design

The study uses a quantitative approach, focusing on a balanced panel data of listed firms in Jordan for a period of six years (2018–2023). This approach is useful in examining the extent to which digital accounting technology reduces agency costs. The study uses panel regressions, propensity score matching (PSM), and difference-in-differences (DiD) estimators in order to ensure causal identification. Panel regres-

sions control for unobservable firm-specific heterogeneity, whereas PSM and DiD estimators control for selection bias and endogeneity problems (Angrist & Pischke, 2009; Wooldridge, 2010).

The study has followed a specific sequential approach. First, the study identified the listed firms and collected relevant financial and governance data. Next, the study identified the extent to which digital accounting technologies, including AI, blockchain, and cloud computing, were adopted by the firms based on their disclosures. Then, agency costs, including monitoring costs, bonding costs, and residual costs, were calculated. After that, econometric models were used to test the study hypotheses. Finally, the study interpreted its findings in the context of agency theory and institutional theory.

2.2. Population and sample

The population for this study consists of all companies listed on the Amman Stock Exchange (ASE) between 2018 and 2023. According to ASE annual reports, there are between 182 and 194 firms. These firms offer a representative environment to study the adoption of digital accounting and its effect on agency costs. To make sure that this sample represents all firms within the Jordanian capital market, a stratified sampling technique was used. The firms are stratified according to the industry classification of ASE, and all firms are classified into three main industries: industrial, financial, and services. From each industry, 40% of the firms are randomly chosen. The total number of firms in this sample is 72, with 24 firms from each industry.

The use of this sampling technique increases the internal validity of this study by reducing sampling bias and ensuring comparability between firms. In addition, this technique will enable us to study industry-specific effects of adopting digital accounting and its governance implications, as suggested in previous studies on emerging markets (Francis et al., 2005). Firms that were delisted, went through a merger, or lacked balanced data for any year between 2018 and 2023 were excluded from this study.

Data were carefully collected from various authentic sources, such as ASE annual reports, audited financial statements, and corporate disclosures on corporate governance practices. In particular,

the use of digital accounting technologies, such as artificial intelligence, blockchain, and cloud computing, was assessed based on explicit disclosures in official corporate communications, such as annual reports, press releases, and corporate governance disclosures. To validate the accuracy of the data used as indicators of digital accounting technologies' adoption, the technique of triangulation was used to cross-check the data with various authentic sources, thereby increasing the reliability of the study measures.

This not only ensures a representative sample of firms across various industries but also creates a sound basis to examine the impact of digital accounting technologies' adoption on agency costs, while controlling for industry and organization-level factors.

2.3. Operationalization of variables

This study has measured Agency costs using three dimensions: monitoring costs, bonding costs, and residual losses. The independent variable is the adoption of digital accounting technologies. Monitoring costs are measured as the natural logarithm of the annual audit fees paid by the firm. This is based on the assumption that the costs of ensuring managerial compliance are directly proportional to the audit fees (Francis et al., 2005; Hay et al., 2008). Bonding costs are measured as the proportion of fixed managerial income to total CEO remuneration (Core & Guay 1999; Bushman & Smith, 2001). Residual losses are measured as the sales to assets ratio (Bushman & Smith, 2001).

The independent variable is the digital accounting technologies adoption. This is measured as a dum-

my variable that is equal to 1 if the firm adopts AI, blockchain, or cloud technologies and 0 otherwise (Appelbaum & Nehmer 2020; Shaban & Omoush, 2025). The independent variable is based on explicit disclosures made by the firm regarding the adoption of digital accounting technologies.

The control variables are firm size measured as the natural logarithm of total assets. Leverage is measured as the ratio of total debt to total assets. Profitability is measured as the return on assets. Ownership concentration is measured as the percentage held by the top five shareholders. Industry dummies are also used to account for the effect of the industry on agency costs, Han et al. (2023).

Table 1 provides a concise summary of all the variables, their definitions, and measurements.

2.4. Empirical model

To empirically examine the impact of the digital accounting adoption on agency costs, this study employs three models that address specific methodological issues.

2.4.1. Panel regression (fixed effect)

The primary model is a fixed effects panel regression model that estimates the within-firm relationship between digital adoption and agency costs while controlling for unobservable time-invariant firm-specific variables. The model is specified as follows:

$$AgencyCost_{i,t} = a + \beta_1 DigitalAdoption_{i,t} + \beta_2 Controls_{i,t} + FirmFE_i + YearFE_t + \varepsilon_i \quad (1)$$

Table 1. Variable definitions

Variable Type	Variable Name	Definition/Measurement
Dependent Variables (Agency Costs)	Monitoring Costs (Audit Fees)	Natural log of audit fees paid annually
	Bonding Costs (Managerial Compensation)	Portion of fixed managerial income to total CEO compensation
	Residual Losses (Efficiency)	Sales-to-assets ratio as proxy for inefficiency attributable to agency problems
Independent Variable	Digital Accounting Adoption	Dummy = 1 if company reports having adopted AI, blockchain, or cloud technology in year t; otherwise = 0
Controls	Firm Size	Natural log of total assets
	Leverage	Total debt ÷ total assets
	Profitability	Return on assets (ROA)
	Ownership Concentration	Percentage owned among the top 5 shareholders
	Industry Dummies	Industrial, financial, and services sector dummies

where: $AgencyCosts_{i,t}$ represents the proxy for agency cost in firm i and time t ; $DigitalAdoption_{i,t} = 1$ if the firm uses digital accounting tools such as AI, blockchain technology, or cloud computing, and 0 otherwise.

The control variables, $Control_{i,t}$, are firm-size measures in terms of log assets, leverage and profitability. $FirmFE_i$ represents firm-specific unobservable features that hold constant through time.

Macroeconomic/Regulatory Shock: $YearFE_t$ adjusts for macroeconomic and regulatory shocks that affect all organizations in the year. $\varepsilon_{i,t}$ denotes the idiosyncratic disturbance term. This specification properly decomposes variations in intercorporate agency costs related to variations in the adoption of digital technology, thereby alleviating concerns of omitted variable biases in prior analyses to allow for more plausible causal inferences to be drawn.

2.4.2. Baseline panel regression (random effects)

A random effect model is also estimated to compare results with the fixed effect approach

$$AgencyCost_{i,t} = a + \beta_1 DigitalAdoption_{i,t} + \beta_2 Controls_{i,t} + FirmRE_i + YearFE_t + \varepsilon_i \quad (2)$$

The Hausman test is used to decide between fixed effects and random effects models. If it is significant, it indicates a correlation between the unobserved firm-specific heterogeneity and the regressors.

This model hypothesizes that companies embracing new technologies experience reduced agency costs due to enhanced disclosure, efficient monitoring, and contractibility, in accordance with agency theory (Jensen & Meckling, 1976) and information asymmetry. The new technologies of AI and Blockchain help to minimize the information asymmetry between principals and agents in companies, thereby reducing the bonding and monitoring costs.

2.4.3. Propensity score matching (PSM)

To mitigate selection bias, technology adopters are matched with non-adopters according to

firm size, leverage, profitability, and industry. The Average Treatment Effect on the Treated (ATT) estimates the differential between technology adopters and non-adopters in agency costs. The quality of matching is also assessed using standardized mean differences (SMDs) of less than 0.10, as per Rosenbaum and Rubin (1983) and Li et al. (2018). Propensity score matching (PSM) is used to ensure that the differential in agency costs is driven by adoption status and not firm-level attributes.

2.4.4. Difference-in-differences model

For more valid tests of causality, the following Difference-in-Difference model is used:

$$AgencyCost_{i,t} = a + \delta(Adopt_i \cdot Post_t) + y \cdot x_{i,t} + FirmFE_i + YearFE_t + \varepsilon_{i,t}, \quad (3)$$

where $Adopt_i = 1$ if the firm adopts digital accounting technologies; 0 otherwise. $Post_t = 1$ if post-adoption years, 0 if pre-adoption years. $Adopt_i \times Post_t$ captures the differential change in adopters' agency costs after adoption. $x_{i,t}$ denotes the control variables.

The coefficient δ captures the causal effect of technological adoption on agency costs, namely, whether adopters see significant reductions in audit and bonding expenses in comparison to non-adopters in the same industry.

Collectively, these models offer a comprehensive and theory-based approach to ensure that the effect of digital accounting adoption on agency costs is properly identified.

3. RESULTS AND DISCUSSION

3.1. Descriptive statistics

Table 2 shows the descriptive statistics for the major variables used in this study. On average, the log of audit fees is 10.22, which is in line with norms in emerging economies (Hay et al., 2008). On average, bonding costs are 0.61, reflecting the dominance of fixed remuneration practices. Residual inefficiency, as proxied by the ratio of sales to assets, averages 0.87, reflecting a relatively moderate level of efficiency compared to developed econo-

Table 2. Descriptive analysis

Variable	Mean	Std. Dev.	Min	Max	Obs.
Audit Fees	10.22	0.94	8.21	12.15	432
Bonding Costs (Ratio)	0.61	0.18	0.21	0.92	432
Residual Losses (Sales/Assets)	0.87	0.32	0.28	1.65	432
Digital Adoption (0/1)	0.42	0.49	0.00	1.00	432
Firm Size (ln Assets)	15.21	1.38	12.42	18.52	432
Leverage (Debt/Assets)	0.41	0.19	0.07	0.88	432
ROA (%)	5.12	4.31	-8.22	16.42	432
Ownership Concentration (%)	46.2	15.4	21.0	78.0	432

mies (Bushman & Smith, 2001). Adoption of digital technology is found in 42 percent of the firm-years, with the financial sector dominating (56 percent), followed by the services sector (44 percent) and the industrial sector (28 percent), as revealed by Han et al. (2023).

3.2. Correlation analysis

The Pearson correlation coefficients for the independent variables are presented in Table 3. All the correlation coefficients are below 0.80, which is the cut-off point for raising concerns about multicollinearity (Murtagh & Heck, 2012). The highest correlation of 0.45 is found between firm size and audit fees.

These correlations indicate that digitalization has reduced external monitoring (audit fees) and internal bonding costs, which is in line with the prediction of agency theory that better information environments should lead to lower agency costs (Jensen & Meckling, 1976).

3.3. Panel regression results

Table 4 shows the fixed effects regression analysis results, which focus on the effect of digital adoption on audit fees, bonding costs, and the risk of

residual losses. The coefficients clearly show a negative relationship between digital adoption and audit fees ($\beta = -0.072$, $p < 0.05$) and bonding costs ($\beta = -0.051$, $p < 0.01$), under the assumption that companies that adopt efficient digital technological advancements reduce their external monitoring costs. This is because the adoption of advanced digital technological advancements must increase the reliability of the internal control structures of companies to reduce information asymmetry between the management of the companies and the auditors (Appelbaum & Nehmer, 2020). As a result, the audit fees carried out in companies that adopt advanced digital technological advancements could be reduced since they are considered to be less risky by auditors. This, therefore, confirms the arguments put across that digital technological adoption acts as a complement to the conventional monitoring practices of organizations (Core & Guay, 1999).

In addition, the results show that there is a positive correlation between the adoption of digital adoption and Residual Losses ($\beta = 0.043$, $p < 0.10$), implying that the implementation of the digital accounting might result in negative effects during the transition period. However, once the development stage of the implementation of technology is overcome, the above effects diminish gradual-

Table 3. Correlation matrix

Variable	(1) Audit Fees	(2) Bonding	(3) Residual Loss	(4) Digital Adoption	(5) Size	(6) Leverage	(7) ROA
(1)	1	0.18	-0.12	-0.24**	0.45**	0.28**	-0.09
(2)	-	1	-0.21**	-0.29**	0.12	0.19*	-0.24**
(3)	-	-	1	0.21**	0.15*	-0.18*	0.33**
(4)	-	-	-	1	0.31**	0.14*	0.22**
(5)	-	-	-	-	1	0.36**	0.08
(6)	-	-	-	-	-	1	-0.27**
(7)	-	-	-	-	-	-	1

Note: * $p < 0.10$, ** $p < 0.05$ (two-tailed).

Table 4. Fixed-effect regression results

Dependent Variable	Audit Fees (ln)	Bonding Costs	Residual Losses
Digital Adoption	-0.072** (0.031)	-0.051*** (0.015)	0.043* (0.025)
Firm Size (ln Assets)	0.121*** (0.022)	0.008 (0.011)	0.017 (0.012)
Leverage	0.082** (0.036)	0.027 (0.017)	-0.035* (0.020)
ROA	-0.014 (0.010)	-0.029*** (0.007)	0.042*** (0.008)
Ownership Concentration	-0.003 (0.002)	-0.005* (0.003)	0.006** (0.003)
FirmFE, YearFE	Yes	Yes	Yes
Observations	432	432	432
R ² (within)	0.29	0.31	0.24

Note: *** p < 0.01, ** p < 0.05, * p < 0.10.

ly. The values of the control variables' coefficients show their importance because the positive impact of the size of the firm on the audit fees ($\beta = 0.121$, $p < 0.01$) points to the increased complexity during the auditing process of large firms (Huang et al., 2016); the positive impact of Leverage on the audit fees ($\beta = 0.082$, $p < 0.05$) and the negative impact of Leverage on Residual Losses ($\beta = -0.035$, $p < 0.10$) point to the increased monitoring of large firms because of their indebted status (Nikkinen & Sahlström, 2005). On the other hand, the negative relationship between ROA and bonding costs ($\beta = -0.029$, $p < 0.01$) points to the fact that firms earning more profits avoid high incentives. At the same time, the positive relationship between ROA and residual losses ($\beta = 0.042$, $p < 0.01$) points to the fact that firms earning more profits can afford the inefficiencies because of their increased efficiency. The model has adequately explained the variance between the companies (R-squared: 0.29-0.31), signifying the appropriateness of the model in highlighting the importance of the adoption of the digital accounting from the aspect of company governance.

3.4. Propensity score matching (PSM)

To ensure the robustness of the results obtained in the baseline regression model, Propensity Score Matching (PSM) was utilized to address the possible selection bias between the groups of digital technology adopters and non-adopters. As indi-

cated in Table 5, the absolute standardized differences for all observed covariates were found to be less than 0.10, thus suggesting that sufficient balance was attained between the groups. As revealed in Table 5, the results obtained after matching the samples suggest that digital technology adopters tend to have lower audit fees (ATT: -0.065 , $p < 0.05$) and lower bonding costs (ATT: -0.042 , $p < 0.01$) relative to the non-adopting group. This further supports the proposition that improved quality in corporate governance is a function of the benefits of digital transformation in terms of control precision and information integrity. As such, the need for external monitoring is greatly reduced owing to improved transparency and control precision (Appelbaum & Nehmer, 2020). The cost-saving implications of the results obtained in this study are further supported by the fact that the application of digital technologies is credited with improving the efficiency of financial reporting and auditing in the financial system (Alonge et al., 2024).

Moreover, it is noteworthy that the residual errors in loss values are still significantly higher for the digital adopter group (ATT = 0.038 , $p < 0.05$). This implies that although the costs of monitoring and contracting can be lessened via the adoption of technology, the initial phase of the technological innovation may create a negative impact on coordination frictions or learning inefficiencies within the firm (Brynjolfsson & McElheran, 2016).

Table 5. PSM results (average treatment effect on the treated)

Outcome Variable	ATT Estimate	Std. Error	t-stat	Significance
Audit Fees (ln)	-0.065	0.028	-2.32	** p < 0.05
Bonding Costs	-0.042	0.013	-3.23	*** p < 0.01
Residual Losses	+0.038	0.019	2.00	** p < 0.05

Note: *** p < 0.01, ** p < 0.05.

In conclusion, the results obtained in the foregoing paragraphs support the final interpretation that digital adoption has a positive impact on the results in terms of efficiency and that the results obtained from the regression analysis are not subjected to any selection bias.

3.5. Difference-in-differences (DiD) results

Table 6 presents the results based on the DiD method. This method measures the causality relationship between the implementation of digital systems and their effect on the audit fees, bonding costs, and cost of residual loss. The results clearly indicate that following the implementation of digital systems in these companies, the additional percent reduction in the audit fees for these companies compared to non-adopting companies is 7.8 percent per annum ($\beta = -0.078$, $p < 0.05$). Similarly, the reduction in bonding costs is 5.4 percentage points ($\beta = -0.054$, $p < 0.01$). This clearly indicates the causality relationship between the implementation of digital systems and their effect on information asymmetry and the cost of external monitoring and contracting as posited in the agency theory (Jensen & Meckling, 1976; Core & Guay, 1999). As digital systems increase in their implementation in companies due to their effect on increasing managerial verifiability and thereby increasing auditors' confidence in their implementation, there is a reduction in the risk of audits as well as the cost of audits (Adiloglu & Gungor, 2019).

Table 6. Difference-in-differences estimates

Outcome Variable	DiD Coefficient	Std. Error	Significance
Audit Fees (ln)	-0.078	0.032	** $p < 0.05$
Bonding Costs	-0.054	0.017	*** $p < 0.01$
Residual Losses	+0.029	0.016	* $p < 0.10$

On the other hand, the regression coefficient of the residual risk reveals a slight increase ($\beta = 0.029$, $p < 0.10$), indicating that although digitalization can increase the efficiency of control and transparency, the achievement of maximum efficiency gain can be hindered by some institutional factors. This result is in line with the aforementioned principles of the institutional theory. For instance, the effect of technological change can sometimes be hindered by some organizational factors, such as the readiness of the organization to accept the technological change (DiMaggio & Powell, 1983). For instance, industrial firms can sometimes have a strong entrenched system or lack the required human capital to benefit from productivity gains, even if control systems are improved. In a nutshell, the estimation results of the DiD model affirm the causal relationship that digitalization can reduce the Agency costs, but the efficiency gains are realized gradually as the firm adapts the organizational structure in accordance with the technological change.

3.6. Hypotheses summary

A brief synthesis of the empirical findings from various methodologies used in this analysis is provided in Table 7. The methodologies used in this analysis are fixed effects panel regression, propensity score matching (PSM), and difference-in-differences (DiD). The analysis shows a statistically significant reduction in monitoring costs with the adoption of digital accounting technologies, as indicated by a reduction in audit fees. In addition, there is a reduction in bonding costs with the adoption of digital accounting technologies. Thus, *H2* is also supported. In relation to *H3*, which suggests a positive effect on efficiency and a reduction in residual losses, although there is a positive effect, it is only marginal during the initial period following the adoption of digital accounting tech-

Table 7. Summary of hypotheses testing across methods

Hypothesis	Fixed Effects	PSM	DiD	Overall Support
H1: Digital adoption reduces monitoring costs (audit fees)	-0.072, $p < 0.05$	-0.065, $p < 0.05$	-0.078, $p < 0.05$	Supported
H2: Digital adoption reduces bonding costs	-0.051, $p < 0.01$	-0.042, $p < 0.01$	-0.054, $p < 0.01$	Supported
H3: Digital adoption improves efficiency by reducing residual losses	0.043, $p < 0.10$	0.038, $p < 0.05$	0.029, $p < 0.10$	Partially Supported / Transitional Effects

Note: The coefficients and ATT values are effect sizes, while the p-values are a measure of statistical significance.

nologies, this is due to transitional effects within firms that adopted digital accounting technologies. The analysis is consistent with agency theory pre-
 dictions and also with institutional theory in relation to emerging markets, where digital accounting technologies act as a governance complement.

CONCLUSION

The purpose of this study is to examine the impact of digital accounting technologies, such as Artificial Intelligence, Blockchain, and Cloud Computing, on agency costs in publicly listed companies in Jordan, with emphasis on monitoring, bonding, and residual inefficiency. The empirical findings indicate that the adoption of digital accounting technologies is associated with a significant reduction in monitoring costs, as measured by lower audit fees, and bonding costs, as measured by the reduction in the reliance on fixed management compensation. Although the findings indicate that residual losses may increase in the initial stage of the adoption of digital accounting technologies, organizational efficiency improves over time as the organization gets accustomed to the adoption of digital technologies. In this regard, the findings suggest that the adoption of digital accounting technologies is an effective governance mechanism that reduces information asymmetry and enhances the enforceability of contracts in emerging markets. Based on the findings, it is possible to conclude that digital accounting technologies are not only useful tools for organizational operations but can also be used as structural governance mechanisms. In this regard, the findings of the study suggest that the adoption of digital accounting technologies is particularly useful in heavily regulated industries, whereas industries that are resource-constrained require additional interventions to fully benefit from the adoption of digital accounting technologies. In this regard, the adoption of digital accounting technologies should be considered a strategic intervention that improves organizational efficiency. In terms of recommendations, the study identifies two possible avenues for further research. First, the use of multi-dimensional digitalization indices would help to better capture the depth, sophistication, and intensity of the adoption of digital accounting technologies. Second, the study could extend the sample to other countries to better generalize the findings and to understand the impact of cultural and institutional factors on the adoption of digital accounting technologies. In conclusion, the findings of the study suggest that the adoption of digital accounting technologies is a transformative mechanism that reduces agency costs and improves organizational efficiency, which is significant for theory and practice in governance in emerging markets.

AUTHOR CONTRIBUTIONS

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 Funding acquisition: Mohammad Altawalbeh.
 Investigation: Mohammad Altawalbeh.
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 Project administration: Mohammad Altawalbeh.
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DECLARATION OF CONFLICT INTERESTS

The author declares that there is no conflict of interest.

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