



Digital Transformation and Audit Fees: Evidence from Innovation Investment and Risk Exposure

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Abstract. Against the backdrop of the rapid development of the digital economy, the impact of corporate digital transformation on audit pricing has attracted increasing academic attention. Using A-share listed firms in China, this paper examines the relationship between digital transformation and audit fees, along with its underlying mechanisms. The results show that a higher level of digital transformation is associated with significantly higher audit fees. Mechanism analyses indicate that digital transformation increases R&D investment and operational risk, thereby raising business complexity and audit uncertainty, which in turn leads auditors to charge higher fees. Further analyses reveal that this positive relationship is more pronounced among non-state-owned enterprises, firms audited by non-big4 accounting firms, and high-tech firms. Overall, this study provides empirical evidence on the audit-related economic consequences of corporate digital transformation and offers implications for audit pricing and risk management.

Keywords: Digital transformation; Audit fees; R&D investment; Operational risk.

1 Introduction

Amid the rapid expansion of the digital economy, corporate digital transformation has become a key driver of firm competitiveness, fundamentally reshaping information environments and operational processes. While existing studies primarily emphasize its efficiency-enhancing effects [1,2], its implications for auditing remain insufficiently explored, particularly in emerging markets such as China. Given that digital transformation simultaneously improves information availability and increases complexity and risk, its overall impact on audit pricing is theoretically ambiguous and warrants empirical investigation. Using Chinese A-share listed firms, this study examines how digital transformation affects audit fees and identifies two underlying mechanisms: increased R&D investment, which raises business complexity and information asymmetry, and heightened operational risk, which amplifies audit uncertainty. By integrating digital transformation into the audit fee framework, this study extends the literature from a focus on information quality to information structure, and provides new evidence on how technological change reshapes audit cost functions and governance mechanisms in developing economies.

2 Literature Review and Hypotheses Development

2.1 Literature Review

The literature on the economic consequences of digital transformation mainly focuses on information, efficiency, and governance mechanisms. Existing studies find that digital transformation improves information transparency [3], enhances resource allocation and innovation efficiency [4], and strengthens internal governance [5]. Meanwhile, the audit fee literature, based on firm size, complexity, and risk, has expanded to include broader informational and institutional factors [6-9]. However, empirical evidence on the relationship between digital transformation and audit fees remains mixed, with some studies suggesting a cost-reducing effect through improved information environments, while others highlight a cost-increasing effect driven by greater complexity and risk.

Despite these insights, limited attention has been paid to how changes in information structure and risks triggered by digital transformation affects auditing. This study addresses this gap by examining the impact of digital transformation on audit fees and exploring the internal mechanisms from the perspectives of business complexity and operational risk.

2.2 Hypotheses Development

Digital transformation reshapes the way information is generated, processed, and transmitted within firms [10], thereby altering the fundamental environment in which audit activities are conducted. Departing from the traditional emphasis on information transparency, this study focuses on firm behavior and risk characteristics, and argues that digital transformation mainly affects audit fees through two channels: increased R&D investment and elevated operational risk.

On the one hand, digital transformation is typically accompanied by sustained investment in new technologies and business models, leading to higher R&D intensity [11]. The inherent uncertainty and technical complexity of R&D activities significantly increase business complexity and information asymmetry, making it more difficult for auditors to identify and verify related transactions and accounting treatments. This, in turn, raises audit effort and costs. On the other hand, while fostering business innovation, digital transformation also introduces multiple sources of risk [12], including technological uncertainty, data security concerns, and operational volatility, thereby increasing overall operational risk. Under a risk-based auditing framework, auditors respond to heightened uncertainty by expanding testing scope, increasing audit procedures, or charging higher risk premiums, all of which contribute to higher audit fees.

In the Chinese context, digital transformation is still in rapid development [13], with substantial heterogeneity in firms' technological capabilities, internal control systems, and data governance practices. As a result, the complexity and risks induced by digital transformation are more likely to be reflected in audit pricing. Accordingly, this study proposes the following hypothesis:

H1: *Ceteris paribus*, a higher level of corporate digital transformation is associated with higher audit fees.

3 Research Design

3.1 Data

Our sample covers Chinese A-share listed firms over the period 2009–2024. The raw data are primarily obtained from the China Stock Market & Accounting Research Database. We first exclude financial firms due to their distinct financial structures and regulatory environments. We then remove firms with abnormal operating status and those that were delisted during the sample period, in order to ensure the stability and comparability of the sample. In terms of data treatment, to mitigate the influence of outliers on the empirical results, all continuous variables are winsorized at the 1st and 99th percentiles. After applying these procedures, the final sample consists of 4,389 listed firms, yielding a total of 35,648 firm-year observations in an unbalanced panel dataset.

3.2 Empirical Model

To test Hypothesis H1, this study specifies the following baseline regression model:

$$\begin{aligned} AuditFee_{i,t} = & \alpha + \beta_1 Digital_{i,t} + \beta_2 Size_{i,t} + \beta_3 Lev_{i,t} + \beta_4 ROA_{i,t} + \beta_5 Growth_{i,t} + \\ & \beta_6 GrossProfit_{i,t} + \beta_7 TobinQ_{i,t} + \beta_8 Dual_{i,t} + \beta_9 Board_{i,t} + Firm_i + Year_t + \varepsilon_{i,t} \end{aligned} \quad (1)$$

where the dependent variable $AuditFee_{i,t}$ denotes audit fees, measured as the natural logarithm of a firm's annual audit fees [14]. The key independent variable $Digital_{i,t}$ captures the degree of corporate digital transformation. Referring to prior literature [15], this study constructs a digital transformation keyword dictionary encompassing multiple dimensions, including artificial intelligence, big data, cloud computing, and blockchain technologies. Using a textual analysis approach, we collect and process the full sample of annual reports of A-share listed firms on the Shanghai and Shenzhen Stock Exchanges from 2009 to 2024. By performing keyword matching and word frequency counts, we obtain the total frequency of digital-related terms, and take its natural logarithm to proxy for the level of corporate digital transformation.

Regarding control variables, we include a set of firm-level characteristics that may affect audit fees to mitigate potential omitted variable bias. Specifically, these include firm size ($Size$, measured as the natural logarithm of total assets), financial leverage (Lev , measured by the asset–liability ratio), profitability (ROA , measured as return on assets), growth opportunities ($Growth$, measured by the revenue growth rate), profitability structure ($GrossProfit$, measured by the gross profit margin), market valuation ($TobinQ$), CEO duality ($Dual$, a dummy variable equal to one if the chairman also serves as CEO), and board size ($Board$, measured by the number of directors). In addition, year and firm fixed effects are included in the model.

4 Empirical results

4.1 Descriptive Statistics

Table 1 reports the descriptive statistics of the main variables, including firm characteristics and the key independent variable—digital transformation (*Digital*). The results show that the mean value of *Digital* is 1.5, with a minimum of 0 and a maximum of 5.2, indicating substantial variation in the digital transformation degree across firms, and suggesting that some firms have not yet substantively engaged in digital transformation. Regarding the dependent variable, the natural logarithm of audit fees (*Audit-Fee*) ranges from 12.6 to 15.6, reflecting a certain degree of dispersion in firms' audit expenditures. Furthermore, the distributions of the control variables generally fall within reasonable ranges. Their means and standard deviations are broadly consistent with prior studies, with no evidence of significant outliers. This suggests that the sample used in this study is reasonably representative and provides a reliable basis for subsequent regression analyses.

4.2 Baseline Analysis

Table 2 reports the baseline regression results. It sequentially presents three specifications: a model including only the key independent variable, a model incorporating all control variables, and a model additionally controlling for firm and year fixed effects. The coefficient on digital transformation (*Digital*), is consistently positive and significant at the 1% level across all specifications. In the full model (Column 3) which includes both firm and year fixed effects, the coefficient on *Digital* is 0.014 with a robust t-statistic of 4.24. This indicates that, after controlling for observable firm characteristics as well as unobservable firm-specific and time-specific factors, digital transformation still significantly increase audit fees, providing strong support for H1.

Table 1. Descriptive Statistics

Variables	Obs	Mean	SD	Min	Median	Max
<i>AuditFee</i>	35684	13.8040	0.6046	12.6115	13.7515	15.5987
<i>Digital</i>	35684	1.5153	1.4382	0.0000	1.3863	5.2095
<i>Size</i>	35684	22.1549	1.1905	19.8893	22.0027	25.7368
<i>Lev</i>	35684	0.4197	0.2032	0.0553	0.4112	0.8949
<i>ROA</i>	35684	0.0340	0.0636	-0.2513	0.0352	0.1955
<i>Growth</i>	35684	0.1530	0.3769	-0.5615	0.0981	2.2133
<i>Gross-Profit</i>	35684	0.2902	0.1775	-0.0050	0.2567	0.8430
<i>TobinQ</i>	35684	2.0660	1.2886	0.8442	1.6512	8.2514
<i>Dual</i>	35684	0.2958	0.4564	0.0000	0.0000	1.0000
<i>Board</i>	35684	2.1136	0.1949	1.6094	2.1972	2.6391

Table 2. Baseline Analysis

Variables	(1)	(2)	(3)
	<i>AuditFee</i>	<i>AuditFee</i>	<i>AuditFee</i>
<i>Digital</i>	0.083*** (15.26)	0.060*** (15.41)	0.014*** (4.24)
Controls	NO	YES	YES
Year FE	NO	NO	YES
Company FE	NO	NO	YES
Observations	35,684	35,684	35,520
Adjusted R ²	0.039	0.540	0.877

Note: Robust t-statistics in parentheses, and *** p<0.01, ** p<0.05, * p<0.1.

4.3 Robustness Tests

Alternative Independent Variable. This study replaces the measurement of the key independent variable. Following prior literature on alternative constructions of corporate digital transformation indicators, we construct a new proxy, *Digital2*, defined as the natural logarithm of one plus the total investment in digital tangible assets, to replace the original variable *Digital*. The regression results in column (1), (2) and (3) of Table 3 Panel A show that the coefficient on *Digital2* remains significantly positive across all model specifications, confirming the robustness of the baseline regression results.

Alternative Dependent Variable. To further validate the robustness of the baseline results, this study constructs a relative audit fee indicator (*AuditFee2*) defined as audit fees divided by total assets and multiplied by 10,000, replacing the original absolute audit fee measure (*AuditFee*). As reported in Columns (4), (5) and (6) of Panel A in Table 3, the regression results show that the coefficient on *Digital* remains significantly positive across all specifications and is significant at the 1% level, with the direction consistent with the baseline findings, confirming the robustness of the results. However, the coefficient in Column (6) becomes statistically insignificant. One plausible explanation is that Column (6) includes a more stringent set of fixed effects and controls, which absorb a substantial portion of cross-sectional and temporal variation in the relative audit fee measure, thereby weakening the estimated effect. Moreover, scaling audit fees by total assets may introduce additional noise or attenuate variation, particularly when firm size effects are already well controlled, leading to reduced statistical significance in the fully specified model.

Alternative Fixed Effect. To further mitigate potential bias from multidimensional omitted variables, this study conducts a robustness test by incorporating higher-order

interaction fixed effects. Building on the baseline specification with firm and year fixed effects, we additionally include industry-by-year (Industry $\times$ Year FE) and city-by-year (City $\times$ Year FE) fixed effects to control for industry-level cyclical shocks and region-specific policy variations. As reported in Columns (1) and (2) of Panel B in Table 3, the coefficient on Digital remains positive and statistically significant at the 1% level, with an estimated coefficient of 0.010. These results further confirm the robustness of the main findings.

Alternative Clustered Level. To further rule out the potential influence of clustering choices on the regression results, this study varies the clustering level of standard errors. Building on the baseline specification with firm-level clustering, we alternatively cluster standard errors at the industry and city levels to mitigate the impact of potential heteroskedasticity on statistical inference. As shown in Columns (3) and (4) of Panel B in Table 3, the coefficient on Digital remains significantly positive at the 1% level. This indicates that the baseline results are robust to different clustering specifications.

Lagged Independent Variable. To mitigate potential reverse causality and endogeneity concerns in the baseline regression, this study follows common approaches in the literature by lagging the key independent variable. Specifically, we use the one-period lag of corporate digital transformation (LDigital) to explain current audit fees. As reported in Columns (5) and (6) of Panel B in Table 3, the coefficient on LDigital remains significantly positive at the 1% level, and its magnitude is consistent with the baseline results. This finding suggests that, after addressing reverse causality concerns, the positive effect of digital transformation on audit fees remains robust and exhibits a sustained effect over time. It also supports the causal direction of the relationship.

Table 3. Robustness tests

Panel A						
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	<i>AuditFee</i>	<i>AuditFee</i>	<i>AuditFee</i>	<i>AuditFee2</i>	<i>AuditFee2</i>	<i>AuditFee2</i>
<i>Digital2</i>	0.099*** (29.30)	0.033*** (15.16)	0.003** (2.00)			
<i>Digital</i>				0.095*** (4.11)	0.116*** (7.54)	0.016 (1.02)
Controls	NO	YES	YES	NO	YES	YES
Year FE	NO	NO	YES	NO	NO	YES
Company FE	NO	NO	YES	NO	NO	YES
Observations	29,349	29,349	29,113	35,423	35,423	35,342
Adjusted R ²	0.176	0.532	0.882	0.003	0.578	0.864

Panel B						
	(1)	(2)	(3)	(4)	(5)	(6)
Variables	<i>AuditFee</i>	<i>AuditFee</i>	<i>AuditFee</i>	<i>AuditFee</i>	<i>AuditFee</i>	<i>AuditFee</i>
<i>Digital</i>	0.011*** (3.72)	0.010*** (3.08)	0.014*** (5.35)	0.014*** (4.28)		
<i>LDigital</i>					0.039*** (9.07)	0.013*** (4.02)
Controls	YES	YES	YES	YES	NO	YES
Year FE	YES	YES	YES	YES	YES	YES
Company FE	YES	YES	YES	YES	YES	YES
Industry×Year FE	YES	YES	NO	NO	NO	NO
City×Year FE	NO	YES	NO	NO	NO	NO
Observations	35,451	33,609	35,520	35,520	29,795	29,795
Adjusted R ²	0.882	0.886	0.877	0.877	0.841	0.882

Note: The same as above.

5 Further Analysis

5.1 Mechanism Analysis

To clarify the underlying impact mechanisms of digital transformation on audit fees, this study examines two transmission channels: R&D investment intensity and operational risk. First, for the R&D channel, *RDSpend* is defined as R&D expenditure divided by operating revenue. The Table 4 show that the coefficient on *Digital* is significantly positive, indicating that digital transformation effectively promotes firms' R&D investment. This suggests that digitalization enhances information processing efficiency and technological integration, thereby driving firms to increase innovation input, which raises business complexity, providing an important basis for higher audit fees.

Second, for the operational risk channel, this study constructs two alternative measures: *Risk1*, defined as the standard deviation of firm performance over a three-year observation window, and *Risk2*, defined as the range of firm performance over the same three-year period. The results indicate that the coefficients on *Digital* are all significantly positive at the 1% level, showing that digital transformation remarkably increases firms' operational risk. This implies that, during digital transformation, firms face greater uncertainty from business model innovation and technological upgrading, which elevates audit risk and induces auditors to increase audit effort and risk premiums.

Table 4. Mechanism Test

	(1)	(2)	(3)	(4)
Variables	<i>RDSpend</i>	<i>RDSpend</i>	<i>Risk1</i>	<i>Risk2</i>
<i>Digital</i>	0.075*	0.082**	0.147***	0.271***
	(1.90)	(2.25)	(3.94)	(3.89)
Controls	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Company FE	YES	YES	YES	YES
Observations	29,256	29,256	25,385	25,385
Adjusted R ²	0.821	0.843	0.471	0.472

Note: The same as above.

5.2 Heterogeneity Analysis

From the ownership structure dimension, the sample is divided into state-owned enterprises (SOEs) and non-state-owned enterprises. The results show that the coefficient of *Digital* is significantly positive and more pronounced in non-SOEs while only marginally significant in SOEs. The Chow test confirms that the difference between the two groups is statistically significant, indicating clear heterogeneity. This suggests that non-SOEs, facing stronger market discipline and lacking implicit government guarantees, are more sensitive to the increased complexity and risk brought by digital transformation, leading to a stronger audit fee response.

Considering auditor characteristics, firms are grouped based on whether they are audited by big4 accounting firms. The Table 5 indicate that the positive effect of *Digital* on audit fees is significant only in the not big4 subsample but not statistically significant among Big4 clients. This implies that non-big4 auditors, with more flexible pricing mechanisms, are better able to incorporate specific changes in complexity and risk induced by digital transformation into audit fees.

In terms of industry attributes, firms are classified into high-tech and not high-tech groups. The results show that *Digital* has a significantly positive effect on audit fees in both groups, but the effect is stronger for high-tech firms, with the between-group difference being statistically significant. This suggests that, in high-tech industries, digital transformation amplifies operational complexity and audit risk, resulting in a more pronounced increase in audit fees.

Table 5. Heterogeneity Test

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	<i>SOE</i>	<i>non-SOE</i>	<i>Big4</i>	<i>non-Big4</i>	<i>HighTech</i>	<i>non-HighTech</i>
	<i>AuditFee</i>	<i>AuditFee</i>	<i>AuditFee</i>	<i>AuditFee</i>	<i>AuditFee</i>	<i>AuditFee</i>
<i>Digital</i>	0.009*	0.012***	0.006	0.014***	0.012***	0.011**
	(1.72)	(3.15)	(0.43)	(4.45)	(2.96)	(2.18)

Chowtest P-value	0.0000		0.0000		0.0000	
Controls	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Company FE	YES	YES	YES	YES	YES	YES
Observations	11,570	23,889	1,363	34,119	21,487	13,914
Adjusted R ²	0.903	0.873	0.920	0.871	0.876	0.889

Note: The same as above.

6 Conclusion

This study examines the impact of corporate digital transformation on audit fees using Chinese A-share listed firms and finds a robust positive relationship. The evidence suggests that, although digital transformation may improve information availability, it simultaneously increases the company’s business complexity and operational risk, thereby raising audit input. Mechanism analyses confirm that both increased R&D investment and heightened operational risk serve as key channels driving this effect. Moreover, the impact is more pronounced in non-state-owned enterprises, firms audited by not big4 auditors, and high-tech firms, indicating that institutional environment and firm characteristics shape the extent to which digital transformation is priced by auditors. Overall, this study highlights that digital transformation reshapes the information and risk environment of firms, with important implications for audit pricing and external governance.

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