Impact of Digital Transformation on Audit Fees

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Abstract: In the digital age, companies are either proactively or reactively adapting to digital transformation, which in turn will have far-reaching effects on the enterprises themselves and their information users. This study utilizes data from A-share listed companies in Shanghai and Shenzhen spanning the years 2011 to 2020, this paper empirically analyzes and examines the direction and mechanism of how corporate digital transformation affects audit fees, and concludes that digital trans-formation significantly increases audit fees, and that digital transformation has a notable and beneficial effect on audit fees when audited by "non-Big 4" account-ing firms compared to "Big 4" accounting firms. This study broadens the under-standing of how digital transformation affects audits and provide rich empirical evidence for CPAs to address misstatement risks in digital transformation.

Keywords: Digital Transformation; Audit Fees; Internal Controls; Information Systems Com-plexity

1. Introduction

Digital transformation is a high-level transformation that builds on digital conversion and digital upgrading and impacts the company's core business in order to develop a new business model. By 2021, China's digital economy will reach 45,5 trillion yuan, or 39.8 percent of GDP; the digital economy has become one of the primary economic growth drivers. China's digital economy will reach 50,2 trillion yuan in 2022, an increase of 10.32% annually, according to the "Electric Data" e-commerce database.

The digital transformation of organisations introduces new technology and generates vast quantities of data, which might have an effect on enterprise information users. The majority of research on audit pricing and fee affecting factors has focused on the level of the accounting firm, audit client characteristics, client size, audit market structure, audit risk, etc. And as an influencer, does the digital transformation of businesses minimise audit fees? Scholars have examined this topic in greater depth, and there are divergent research findings. (Yongshen Zhang et al., 2021)[1] propose that there is a negative correlation between the degree of enterprise digital transformation and audit fees. This relationship is attributed to a reduction in business risks, improvement in information disclosure quality, and a decrease in audit costs. (Dongxue Fu et al., 2014)[2] conducted an empirical analysis of the factors that impact audit fees for listed companies in China. They concluded that the ratio of information technology input-output is inversely proportional to audit fees.But, the digital transformation of corporations also increases the scale and complexity of businesses, which makes auditing more difficult. (Deng, Fang, 2017)[3] and other empirical studies found that due to changes in the

form of evidence collection and the development of audit methods, it is more difficult to obtain evidence for audits of digitally transformed enterprises, and audit risks will continue to rise. Consequently, the higher the level of information technology of enterprises, the higher the audit fees, i.e. there is a significant positive correlation between the two. Some academics also argue that with the digital transformation of organisations for the change of business model and the enhancement of the level of governance, the business risk of enterprises may be significantly decreased, and audit pricing is an external reflection of audit risk and audit costs (Du, Yong et al., 2019) [4] the rapid development of a new generation of information technology exemplified by big data and blockchain may also bring increased risk, which may have a stronger impact on audit work (Qin Rongsheng, 2014; Gao Tingfan and Chen Yongjun, 2019; Yang Deming et al., 2020)[5].

In general, the existing literature has explored the connotation path of enterprise digital transformation, the mechanism of the effect of digital transformation on audit fees, and the research on the variables affecting audit fees. However, scholars have primarily studied from accounting firms, clients, and the audit market, etc., and less frequently have taken enterprise digital transformation as a variable affecting audit fees, which has not been adequately studied. There are contradictions and ambiguities in the research findings about the relationship between corporate digital transformation and audit fees, with competing viewpoints of boosting and hindering. This article empirically explores the link between digital transformation and audit fees for listed firms in China from 2011 to 2020, and provides a theoretical foundation and decision support for digital transformation and audit fees decisions.

2. Theoretical analysis and hypotheses of research

2.1. Enterprise internal control effectiveness improvement

Enterprise digital transformation is the process through which businesses combine their operations, procedures, and data onto a digital platform in order to increase efficiency, cut costs, and optimise decision-making, among other benefits. Digital transformation may give businesses with more extensive, accurate, and real-time data and information, making it easier for businesses to monitor and control internal processes and risks. Through the combination of digital technology, enterprises can build and improve digital financial platform systems such as financial sharing centre and financial middle desk, and "embed" relevant control measures into the platform to automate the control process, reduce human intervention, ensure the orderly operation of business processes in each functional department, and help enterprises detect internal control deficiencies in a timely manner (Wang, Hailin, 2018)[6]. And high-quality internal control can also increase auditors' confidence in the financial statements of audited entities and decrease superfluous substantive procedures, enabling auditors to offer more reasonable audit opinions on financial statements (Xiaohong Dong and Wenxiang Sun, 2021)[7]. Thus, digital transformation of enterprises may not only directly reduce audit risk by optimising internal control, but also indirectly reduce audit risk by optimising internal control and subsequently restraining management's rent-seeking behaviour or even influencing the auditor's level of trust in the audited entity.

2.2. Increased complexity of external information systems for enterprises

2.2.1. Digital transformation of businesses increases the possibility of misrepresentation.

The risk of material misstatement is the possibility of material misstatement in financial statements prior to audit, and is comprised of the risk of material misstatement at the financial statement level and the risk of material misstatement at the determination level, which is influenced by the audited entity. Considered at the negative level, the new generation of digital technology has triggered changes in multiple areas such as business models, competitive models, new human capital and systems of enterprises (Xiao, Jing-Hua, 2020)[8] , which may further increase the difficulty of auditing for auditors and make it possible to increase audit risk. The digital transformation of enterprises may lead to digital technology and institution building as constraints to each other. The digital transformation of enterprises will bring about a deep integration of digital technology and enterprise operations, resulting in systematic changes in the resources, business processes, products and services, and business ecology of enterprises (Hanelt et al., 2020)[9] , which will increase the complexity of transactions or even form new types of transactional operations, and traditional accounting recognition, measurement, recording and reporting may be difficult to adapt to the demand, bringing difficulties to accountants in business processing and also increase audit difficulty and audit costs, reducing the likelihood of auditors finding material misstatements and increasing the risk of audit failure. In addition, digital transformation activities are inherently risky and uncertain, and the degree of digital exploitation, integration of different resources, and cross-departmental coordination and cooperation are all challenges that companies need to overcome (Porter and Heppelmann, 2015)[10] . If not properly handled, it will increase the burden on the company in terms of technology, personnel, and organization. If not properly handled, it will increase the technical, personnel, and organizational burden on the enterprise, and the enterprise's own risk will increase significantly, which undoubtedly increases the difficulty and possibility of audit errors. In addition, existing financial digitization solutions are not mature and may not agree on recognition, measurement, recording and reporting (Appelbaum et al., 2017)[11] , which in turn induces audit risk.

2.2.2. Enterprise digital transformation reduces audit costs.

Digitization and related technologies will build a more efficient data-based analysis platform between enterprises and accounting firms, enabling auditors to obtain broader and deeper corporate financial information and reduce the risk of fraud and litigation (Yongshen Zhang, 2021). At the same time, it can liberate the auditor's simple labor and promote the audit work toward automation, which is conducive to improving the auditor's efficiency and reducing audit costs. Moreover, in the digital platform, the transaction information of the audited entity and the auditor will be strictly recorded, which reduces the possibility of tampering with the results and makes a big change in the traditional audit operations.

3. Study design

3.1. Selection of samples and data sources

This analysis examines data from 2011 to 2020 of A-share listed firms in Shanghai and Shenzhen, excluding banking industry companies, *ST, ST, delisted, and IPO listed companies, as well as those with aberrant financial data and missing information. After data exclusions, the

final sample size was 24775 after obtaining the financial and corporate governance data from Cathay United's (CSMAR) database. To limit the influence of outliers, continuous variables were tail-shrunk at the 1% and 99% quartiles. Explanatory and control variable data came from the Cathay Capital (CSMAR) database, while explanatory variable data came from the annual reports of SSE and SZSE-listed enterprises.

3.2.   Variable definition

Interpreted variables: Auditfee, which is the natural logarithm of a listed company's yearly audit fee (Ke et al. 2015; Dou Chao et al. 2020; Jin Jie and Yu Bo 2020) [12,13]

Explanatory variables: Digital transformation of enterprises (DCG), This work uses the research findings of Wu Fei et al. (2021)[14] to thoroughly quantify the degree of digital transformation of organisations from two perspectives: the utilisation of underlying technologies and the deployment of technologies in practise. In addition, we employ Python crawler technology to count the frequency of digital transformation-related keywords in the annual reports of publicly traded corporations as a proxy for the degree of digital transformation among businesses. In practise, the proxy is processed logarithmically because the digital transformation of businesses is right-skewed in terms of time.

Control variables: Table 1 lists the control variables and their meanings.

Table 1 Variables and their definitions

Variable Type	Variable Name	Variable Symbol	Variable Description
Interpreted Variable	Audit Fees	Auditfee	Natural logarithm of the audit fees for the company's year-end financial report
Explanatory Variables	Digital Transformation	DCG	The natural logarithm of the frequency of digital transformation-related words in firm year-end financial reports.
Control Variables	Company Size	Size	The year-end natural logarithm of the company's total assets.
	Gearing ratio	Lev	End-of-year total liabilities / End-of-year total assets
	Accounting Firm Size	Big4	Dummy variable, if the firm auditing the company's annual report for the year is one of the "Big Four" worldwide accounting firms, then the value is 1, otherwise it is 0.
	Return on Assets	ROA	Net income / Total assets at year-end
	Board Size	BDS	Natural logarithm of the number of board directors
	Shareholding Concentration	S-D	Proportion of the company's shares held by its largest shareholder
	Percentage of independent directors	Ration	Number of independent directors / Total number of directors
	Whether loss	Loss	Dummy variable, takes the value of 1 if the company's net profit for the year is negative, otherwise it is 0
	Two jobs in one	Dual	Dummy variable, which takes the value of 1 if the chairman and general manager of the company are the same person in the year, and 0 otherwise
	Business Complexity	IR	(year-end inventory + year-end accounts receivable)/year-end total assets
	Number of years on the market	Age	The number of years the company has been listed multiplied by the natural logarithm of the number of years + 1

	Nature of ownership	SOE	Dummy variable, state-owned enterprises take 1, otherwise take 0
	Internal Control Deficiencies	Deficiency	Takes the value of 1 when the enterprise has internal control deficiencies, otherwise 0
	Audit Opinion	opinion	Audit opinion for the year is non-standard opinion = 1, standard opinion = 0

3.3. Model setting

This research develops model (1) to examine the relationship between the digital transformation of organisations and audit fees.

$$Auditfee = \beta + \beta_1 DCG + \sum Controls + \sum Industry + \sum Year + \varepsilon \qquad (1)$$

The explanatory variable is Auditfee, the core explanatory variable is Corporate Digital Transformation (DCG), Controls are the control variables described previously, Industry and Year are industry dummy variables and year dummy variables, respectively, and ε is a random disturbance term that clusters the standard errors at the individual firm level during regression.

4. Evidence-based findings and analyses

4.1. Statistics descriptive

Table 2 displays the descriptive statistics for the paper's primary variables. The minimum value of Auditfee is 12.61 and the maximum value is 16.25, indicating a large difference in audit fees among listed companies; the minimum value of Corporate Digital Transformation (DCG) is 3.1 and the maximum value is 4.18, indicating that the degree of digital transformation varies among listed companies; the mean value of Accounting Firm Size (BIG4) is 0.06, indicating that approximately 6% of listed companies have international accounting firms; and the minimum value of Corporate Digital Transformation (DCG) is 3.1 and The mean BIG4 value is 0.06, suggesting that approximately 6% of listed companies are audited by the worldwide "Big 4" firms during the sample period.

Table 2 Results of Statistics descriptive of variables

VarName	Obs	Mean	SD	Min	Median	Max
Auditfee	24775	13.80	0.687	12.61154	13.71015	16.25
DCG	24775	3.57	0.263	3.197027	3.523031	4.185207
Deficiency	24775	0.31	0.461	0	0	1
Lev	24775	0.42	0.208	.0509	.4079	.8918
Roa	24775	0.06	0.138	-.8203	.0689	.3147
Big4	24775	0.06	0.231	0	0	1
Dual	24775	0.28	0.451	0	0	1
Age	24775	2.06	0.895	0	2.197225	3.295837
Ration	24775	37.54	5.304	33.33	35.71	57.14
S D	24775	34.82	14.630	9.63	32.76	74.3
BDS	24775	2.13	0.195	1.609438	2.197225	2.639057
Loss	24775	0.10	0.295	0	0	1
IR	24775	0.27	0.162	.0078738	.2482303	.7322152
SOE	24775	0.36	0.479	0	0	1
Size	24775	22.01	1.327	19.47588	21.84761	26.0264
opinion	24775	0.03	0.170	0	0	1

4.2. Correlation analysis

The two-by-two correlations between some of the variables in this work are presented in Table 3. From Table 3, it can be seen that the positive correlation between digital transformation of enterprises and audit fees is statistically significant at the 1% level, which tentatively verifies the hypothesis that the greater the degree of digital transformation of enterprises, the greater their audit fees, i.e., Hypothesis 2 is tentatively valid. Due to the fact that the correlation study merely examined the correlation between the two variables, a multiple regression analysis is required to provide more precise evidence. By testing the variance inflation factor of the model, test table 4 determined that the VIF value of each variable is less than 10, the largest VIF value is 2.06, and the mean value is 1.34, indicating that there is no significant multicollinearity between the variables, and the next step of multiple regression analysis can be performed.

Table 3 Correlation analysis

	Auditfee	DCG	Deficiency	Lev	Roa	Big4	Dual	Age	Ration	S_D	BDS	Loss	IR	SOE	Size	opinion
Auditfee	1															
DCG	0.077***	1														
Deficiency	0.221***	-0.044***	1													
Lev	0.401***	-0.062***	0.174***	1												
Roa	0.004	-0.020***	-0.071***	-0.189***	1											
Big4	0.439***	-0.014**	0.085***	0.114***	0.059***	1										
Dual	-0.126***	0.081***	-0.114***	-0.146***	0.013**	-0.069***	1									
Age	0.324***	0.000	0.227***	0.398***	-0.127***	0.070***	-0.259***	1								
Ration	0.022***	0.070***	0.002	-0.007	0.018***	0.032***	-0.113***	-0.033***	1							
S_D	0.126***	-0.115***	0.059***	0.052***	0.126***	0.145***	-0.044***	-0.070***	0.042***	1						
BDS	0.170***	-0.085***	0.078***	0.148***	0.036***	0.083***	-0.184***	0.154***	-0.549***	0.022***	1					
Loss	0.022***	-0.003	0.066***	0.175***	-0.697***	-0.029***	-0.012*	0.128***	0.017***	-0.087***	-0.024***	1				
IR	-0.039***	0.116***	-0.057***	0.259***	0.004	-0.058***	-0.029***	-0.037***	0.014*	-0.031***	-0.068***	-0.019***	1			
SOE	0.239***	-0.123***	0.223***	0.308***	-0.028***	0.139***	-0.306***	0.455***	-0.066***	0.202***	0.278***	0.027***	-0.076***	1		

| Size | 0.765*** | 0.035*** | 0.226*** | 0.527*** | 0.026*** | 0.336*** | -0.211*** | 0.478*** | -0.007 | 0.201*** | 0.264*** | -0.002 | 0.018*** | 0.396*** | 1 | |
| opinion | 0.019*** | -0.027*** | 0.095*** | 0.127*** | -0.291*** | 0.019*** | -0.004 | 0.089*** | 0.007 | 0.073*** | -0.011* | 0.233*** | -0.026*** | -0.028*** | -0.028*** | 1 |

t statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 4 VIF test

Variable Symbol	VIF	1/VIF	Variable Symbol	VIF	1/VIF
Size	2.062	.485	Big4	1.164	.859
Lev	1.746	.573	Dual	1.147	.872
Age	1.66	.603	Loss	1.116	.896
BDS	1.648	.607	Deficiency	1.105	.905
SOE	1.561	.64	opinion	1.101	.908
Ration	1.473	.679	DCG	1.076	.929
IR	1.173	.852	Roa	1.005	.996
S D	1.166	.858	Mean VIF	1.347	.

4.3. Univariate test

Prior to the multiple regression analysis, a univariate t-test was utilised to analyse the link between enterprise digital transformation and audit fees. The results of tests comparing the means and medians of audit fees (Auditfee) in the two groups based on whether digital transformation (DCG)indicators in the sample were greater than their medians are presented in Table 5. The premise that audit expenses are proportional to the enterprise's degree of digital transformation.

Table 5 Univariate tests

Variable Symbol	Digital Transformation Low Group		Digital Transformation High Group		Median Difference	Difference in Means
	Median	Average value	Median	Average value		
Auditfee	13.592	13.724	13.771	13.867	278.092***	-0.143***

4.4. Regression analysis

To examine the impact of corporate digital transformation on audit fees, this paper conducted a multiple regression test using model (1). To make the regression results more robust, this paper drew on the studies of He Fan (2019)[15] and Tang S. Yuan et al. (2019)[16], controlling for firm-level fixed effects before conducting the regression. The results of the regression are reported in Table 6. Column (1) displays the impact of corporate digital transformation on financial reporting audit fees based on OLS regressions, whereas Column (2) displays the influence of corporate digital transformation on financial reporting audit fees after controlling for firm fixed effects. The regression results indicate that the coefficient of digital transformation DCG is 0.131, which is significantly positive at the 1% level, and the coefficient of digital transformation DCG after controlling for firm fixed effects is 0.0587, which is significantly positive at the 1% level. These results indicate that firm digital transformation significantly increases financial reporting audit fees, and the empirical results support the null hypothesis.

Table 6 Regression consequences of enterprise digital transformation and audit fees

Variable Symbol	(1)	(2)	Variable Symbol	(1)	(2)
DCG	0.131***	0.0587***	Loss	0.0458***	0.0396***
	(12.57)	(4.24)		(3.67)	(3.30)
Deficiency	0.0873***	0.0565***	IR	-0.137***	-0.0603**
	(14.55)	(9.67)		(-7.77)	(-3.02)
Lev	0.110***	0.213***	SOE	-0.0878***	-0.0590***
	(6.53)	(12.58)		(-12.79)	(-8.56)
Roa	0.0308	0.0609*	Size	0.371***	0.359***
	(1.13)	(2.32)		(129.19)	(121.94)
Big4	0.616***	0.621***	opinion	0.120***	0.102***
	(50.21)	(52.28)		(7.32)	(6.51)
Dual	0.0240***	0.0133*	constant	5.312***	5.637***
	(3.85)	(2.21)		(69.53)	(71.76)
Age	-0.0255***	-0.0327***	Industry	Yes	Yes
	(-6.71)	(-8.54)			
Ration	0.000390	0.000647	Year	Yes	Yes
	(0.64)	(1.11)			
S_D	-0.00160***	-0.00126***	N	24775	24773
	(-8.23)	(-6.59)			
BDS	-0.0553**	0.00545	adj. R2	0.637	0.671
	(-3.17)	(0.32)			
t statistics in parentheses, * p < 0.05, ** p < 0.01, *** p < 0.001					

4.5. Robustness test

4.5.1. The explanatory variable is lagged by one period.

Considering that in practise it may take some time for corporate digital transformation to influence the auditor's decision on audit fees, this paper treats the core explanatory variable corporate digital transformation (DCG) with a one-period lag, generates the lagged variable L_DCG, and adds it to the regression model. This treatment also mitigates the endogeneity interference problem caused by the reverse causality in time to some extent. As demonstrated in column (1) of Table 7, the correlation between the lagging term of corporate digital transformation (L_DCG) and audit fees (Auditfee) is statistically significant at the 5% level .

4.5.2. Substitution of explanatory variables.

Since audit fees are influenced by the size of the firm's assets, in order to minimise the bias of the research results caused by this influence, this paper refers to the practise of Liang, Yixin, and Li, Ying (2021)[17] and replaces audit fees with standardised asset size, i.e., audit fees are divided by the firm's asset size and then logarithmically transformed; the regression results are shown in column (2) of Table 7. Evidently, the association between enterprise digital transformation and audit fees passes the 1% statistical significance test.

4.5.3. Propensity score matching (PSM).

The above baseline regression results indicate that the greater a company's degree of digital transformation, the greater its audit costs; however, this result is likely influenced by the self-

selection of the sample, i.e., by the individuals observed in the research sample of this paper, rather than by the digital transformation of the firm. Based on the study by Baixing Li et al. (2019)[18], this paper employs PSM pairing followed by regression. In this study, the median of the degree of digital transformation is used as the median, with a value of 1 if the sample is greater than the median and 0 otherwise. As covariates, the variables firm size (Size), gearing (Lev), current year accounting performance (ROE), "Big 4" firms (Big4), and non-standard audit opinion (Opinions) are then utilised to generate the propensity score. The association between digital transformation and audit fees is statistically significant at the 1% level, as seen in column 3 of Table 7, and the matching results are consistent with the "equilibrium hypothesis" of propensity score matching. Thus, the findings of this paper are reliable.

Table 7 Robustness test results

	(1)	(2)	(3)		(1)	(2)	(3)
	Auditfee	Auditfee	Auditfee (PSM)		Auditfee	Auditfee	Auditfee (PSM)
L.DCG	0.0380*			S_D	-0.00119***	-0.0000546***	-0.00103***
	(2.49)				(-5.60)	(-6.27)	(-5.33)
DCG		0.00236***	0.0627***	BDS	0.000380	0.000447	-0.00437
		(3.73)	(4.47)		(0.02)	(0.58)	(-0.26)
Deficiency	0.0521***	0.00265***	0.0612***	Loss	0.0313*	0.00190***	0.0436***
	(8.19)	(9.96)	(10.39)		(2.45)	(3.48)	(3.56)
Lev	0.203***	0.0107***	0.250***	IR	-0.0359	-0.00360***	-0.0777***
	(10.78)	(13.79)	(14.33)		(-1.62)	(-3.95)	(-3.79)
Roa	0.0224	0.00336**	0.0759**	SOE	-0.0741***	-0.00254***	-0.0704***
	(0.79)	(2.81)	(2.84)		(-9.77)	(-8.09)	(-10.14)
Big4	0.606***	0.0275***	0.608***	Size	0.367***	-0.0122***	0.366***
	(46.62)	(50.84)	(50.68)		(112.69)	(-90.88)	(122.82)
Dual	0.0143*	0.000672*	-0.000951	opinion	0.0885***	0.00510***	0.108***
	(2.15)	(2.46)	(-0.16)		(5.15)	(7.12)	(6.27)
Age	-0.00244	-0.00172***	-0.0415***	_cons	5.500***	0.885***	5.520***
	(-0.49)	(-9.88)	(-10.67)		(63.17)	(247.21)	(68.37)
Ration	0.000279	0.0000485	0.0000899	N	20374	24773	24772
	(0.43)	(1.82)	(0.15)	adj. R2	0.666	0.459	0.678
t statistics in parentheses, * p < 0.05, ** p < 0.01, *** p < 0.001							

5. Conclusion

This study explores how digital transformation impacts audit fees for firms operating in the digital economy, while also investigating the influence of auditor expertise and property rights on this relationship. Results show that digital transformation can significantly raise financial reporting audit fees, particularly for non-Big 4 auditors and state-owned enterprises. These findings offer insights for government policymakers in guiding corporate digital transformation and informing accounting firms' fee decisions.

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