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The impact of enterprise digital transformation on audit quality

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Abstract: *In the era of digital economy, digital transformation is a key strategic choice for enterprise development. This paper takes the relevant data of Shanghai and Shenzhen A-share listed companies from 2011 to 2022 as a sample, and uses a fixed effect model to empirically test the correlation between enterprise digital transformation and audit quality. The study found that the digital transformation of enterprises can significantly improve the quality of auditing. After a series of robust tests such as replacement variables, PSM tests and the removal of some samples, the conclusion is still valid. Further research found that the improvement of audit quality by digital transformation is more significant among non-state-owned enterprises and a high shareholding and smaller scale. The research in this article provides rich empirical evidence for auditors to conduct company reviews and enterprises to formulate development strategies for digital transformation.*

Keywords: *Digital transformation, Audit quality, Corporate governance, Property nature of enterprise*

1. Introduction

Under the development trend of the Fourth Industrial Revolution, the digital economy has become a new engine for economic growth in various countries. The 14th Five-Year Plan for National Economic and Social Development of the People's Republic of China and the Outline of the 2015 Vision Goals mentioned that it is necessary to accelerate digital development, promote the integration of the digital economy and the real economy, and accelerate the construction of a digital China. Local governments have also accelerated the introduction of relevant policies aimed at promoting the digitalization of industries and accelerating the grand blueprint for digital China. The digital transformation of enterprises is the micro basis of digital economic development, and its development degree directly affects the speed and quality of digital economy construction. Therefore, the digital transformation of enterprises has become a key issue that the theoretical community continues to pay attention to.

At present, academic research on the economic consequences of enterprise digital transformation mainly includes audit risks, audit pricing, enterprise performance and capital market performance. From the perspective of audit risks, Linghua et al. (2022) studied and found that the digital transformation of enterprises reduces audit risks through two channels: internal control optimisation and information disclosure[1]; in terms of audit pricing, Zhang Yongshen (2021) and Zhou Jing (2023) have drawn different conclusions: the former believes that the digital transformation of enterprises Audit costs can be reduced[2], while the latter holds the opposite conclusion[3]; from the perspective of enterprise performance, Yi Luxia et al. (2021) conducted research and found that the higher the degree of digitisation of the enterprise, the better the performance of the main business[4]; Fang Mingyue et al. (2022) used 2003-2019 The data of A-share listed companies in China prove that digital transformation has increased the share of labour income within enterprises and reduced the labour income gap[5]. From the perspective of capital market, Wu Fei et al. (2021) found that the digital transformation of enterprises has significantly improved stock liquidity[6]; Wang Jingyong et al. (2022) took small and medium-sized enterprises as an example to prove that the digital transformation of enterprises can effectively reduce financing constraints[7].This article grasps the key core of audit work - audit quality and explores the impact of enterprise digital transformation on it.

The research of this article has important theoretical and practical significance: from the theoretical level, at present, academic circles only have research on the impact of enterprise digital transformation and audit work itself. Few scholars link enterprise digital transformation with audit quality, and there is still a lack of relevant theoretical research，the article enriches the research on the economic

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consequences of enterprise digital transformation;From a practical point of view, according to the As can be seen from the White Paper on China's Digital Economic Development (2021), the scale of China's digital industry reached 31.7 trillion yuan in 2020, accounting for 80.9% and 31.1% of the digital economy and GDP respectively. As the inevitable trend of global development, digital transformation is also the only way for enterprise development. This article conforms to the trend of the times and discusses the relationship between enterprise digital transformation and audit quality, providing rich empirical evidence for auditors to conduct company reviews and enterprises to carry out digital transformation.

2. Theoretical hypothesis

Using big data, blockchain, artificial intelligence, cloud computing and other tools, companies can obtain unstructured data related to the financial department[8], such as emotional detection and related scene analysis when accounting. Digital technologies are introduced in various departments, such as the installation of digital real-time monitoring in the production department, which can track the flow of assets and the work efficiency of workers in real time. By using big data analysis technology, a series of visual information is provided to make the accounting information of the enterprise more transparent and the accrued surplus more real, which helps auditors understand the development status of the enterprise more clearly and reduces the probability of major misreporting, thus improving the quality of auditing.

Digital transformation reduces the information asymmetry inside and outside the enterprise to a certain extent. External investors can be more aware of the real situation of enterprise investment projects, avoid the internal management of the enterprise from pursuing their own interests by harming the interests of external personnel of the enterprise, and ease the financing constraints of the enterprise[9]. Reduces the risks borne by enterprises; at the same time, it also weakens the information asymmetry between shareholders and agents[10], and shareholders can better supervise the use of funds by agents. The reduction of agency costs will provide more abundant funds for enterprises, and at the same time provide sufficient resources for enterprise technological innovation and digital transformation, which will promote the digital transformation of enterprises. By reducing information asymmetry, it helps auditors obtain the company's financial information more comprehensively. When the auditor's ability is certain, the more comprehensive the information obtained, the higher the audit quality.

According to the above theoretical analysis, the digital transformation of enterprises affects the quality of auditing by affecting information transparency and information asymmetry. This article puts forward the following assumptions:

H: When other conditions are consistent, the digital transformation of enterprises has a positive impact on audit quality.

3. Research and design

3.1 Selection of samples and the source of data

The research sample of this article is a Chinese A-share listed company. For the selection of sample time, this article takes 2011 as the initial year and selects the relevant data of Shanghai and Shenzhen A-share listed companies from 2011 to 2022 as a research sample. At the same time, we also processed the data as follows: (1) Remove the relevant data of ST and *ST enterprises.(2)Remove the relevant data of financial enterprises.(3)Eliminate companies that lack main variables.(4)Winsor shrinks the selected continuous variables to prevent extreme outliers from being too large or too small, causing noise effects on the experimental results. Finally, 12326 sample data were obtained.

The digital transformation degree (Ddt) of the replacement variable in this article is based on Wu Fei (2021) and obtains[6] through text mining; the interpreted variables, interpreted variables and control variables are all from the CSMAR database. The sprcific definition variables are shown in Table 1.

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Table 1: Variable definition table

Variable name	Variable symbols	Variable definition
Digital Transformation Index	Dx	See the text for detailed definition.
Earnings should be recorded	DACC	Using the modified Jones model to obtain the absolute value of the maneuvrable accrued surplus
Audit term	AT	The number of years that accounting firms provide continuous audit services for enterprises
Types of audit opinions	Op	The standard unqualified audit opinion is 1, and the rest is 0
The size of the accounting firm	Big4	The four major accounting firms are 1, and the rest are 0
Equity nature	SOE	If the enterprise takes 1 for the state-owned enterprise, otherwise take 0
Financial leverage	LEV	Total corporate liabilities/total enterprise assets
Profitability	ROA	Enterprise net profit/total enterprise assets
Integration of two positions	Dual	The chairman of the enterprise is also the general manager of 1, otherwise it is 0
The proportion of independent directors	DLDS	The proportion of independent directors to the total number of the board of directors
Number of audit committee meeting	COA	The number of audit committees convened by enterprises in a year
The degree of digital transformation	Ddt	Word frequency statistics from five dimensions of artificial intelligence, big data, cloud computing, blockchain and digital technology applications

3.2 Variable definition and model setting

(1) Interpretation variables: Enterprise Digital Transformation Index (Dx) is calculated by the following indicators: the enterprise's strategy-driven score (a), technology empowerment score (b), organization empowerment score (c), environmental empowerment score (d), digital achievement score (e) and digital application score (f). Measurement formula is as follows:

$$Dx= 0.3472a+0.162b+0.096c+0.0342d+0.2713e+0.0884f \quad (1)$$

In which all scoring indicators are standardized values.

(2) Explained variables: audit quality (DACC), because it will have different effects on the evaluation criteria of audit quality from different angles, so in this article, we use the current mainstream indicator of agent audit quality - surplus management and use the revised Jones model to calculate the enterprise The maneuvrable accrued profit of that year is measured by its absolute value to measure the quality of the enterprise's maneuvrable surplus[11]. At the same time, in order to more comprehensively analyze the impact of enterprise digital transformation on audit quality, in the subsequent robustness test, the logarithmic audit cost (Fee) is selected as an alternative variable for audit quality to conduct a more comprehensive analysis of the problem.

(3) Control variables: Referring to the practice of Shen Guobing and Yuan Zhengyu (2020), this article selects the audit term (AT), audit opinion type (Op), accounting firm scale (Big4), equity nature (SOE), asset-liability ratio (LEV), total net asset profit margin (ROA), and two positions in one (Dual), the proportion of independent directors (DLDS), and the number of times the audit committee convened (COA) are as control variables. The specific definition variables are shown in Table 1.

(4) Model setting: In order to explore the impact of enterprise digital transformation on audit quality, this paper builds the following measurement model:

$$DACC=\beta_0+\beta_1 Dx+\Sigma\beta_i Controls+\Sigma Year+\Sigma Industry+\varepsilon \quad (2)$$

Among them, Controls refers to the control variables used in the article, β_0 is the intercept term and ε is the error term. In addition, this article also controls the fixed effect of the year and the enterprise.

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4. Empirical test

4.1 Descriptive statistics

This article uses Stata software to carry out statistical and correlation analysis of each variable. According to Table 2, the average value of audit quality is 0.019, the median is 0.0122, and its maximum and minimum values are -0.224 and 0.228 respectively, indicating that the distribution of audit quality among samples is uneven, indicating that there is a phenomenon of collusion between firms and enterprises; Digital Transformation Index. The average value is 35.55 and the minimum value is 23.607, indicating that during the sample period, all enterprises have undergone a certain degree of digital transformation, but the number of digits is only 32.703, indicating that the digitalization degree of Chinese enterprises is generally low.

Table 2: Descriptive statistical table

Var	Num	Mean	Std	Min	Median	Max	VIF	1/VIF
DACC	12326	0.019	0.089	-0.224	0.0122	0.228		
Dx	12326	35.55	10.05	23.607	32.703	60.304	1.15	0.87
AT	12326	7.432	5.327	1	6	21	1.01	0.99
Op	12326	0.972	0.166	0	1	1	1.07	0.93
Big4	12326	0.043	0.203	0	0	1	1.02	0.98
LEV	12326	0.421	0.197	0.082	0.4124	0.8214	1.25	0.80
ROA	12326	0.038	0.052	-0.121	0.036	0.1563	1.39	0.71
COA	12326	2.697	2.614	0	3	8	1.02	0.98
SOE	12326	0.332	0.471	0	0	1	1.15	0.87
Dual	12326	0.28	0.449	0	0	1	1.09	0.91
DLDS	12326	37.28	4.933	33.33	33.33	50	1.02	0.99

Table 3 is divided into two parts: the upper triangle is the Spearman coefficient between variables and the lower triangle is the Pearson correlation coefficient between variables. According to the data in the table, the two correlation coefficients of digital transformation index and audit quality are negative, indicating that the interpreted variables in this article are negatively correlated with the interpreted variables. At the same time, the absolute value of the correlation coefficient between each variable is below 0.4, and the average value of VIF in Table 2 is 1.12, indicating that there is no multi-colinear relationship between variables.

Table 3: Correlation coefficient test table

	DX	DACC	AT	COA	Op	Big4	LEV	ROA	SOE	Dual	DLD
Dx	1	**-0.063**	0.005	**0.106**	**0.029**	0.003	0.013	0.005	**-0.108**	**0.093**	**0.062**
DACC	**-0.080**	1	-0.015	-0.010	**0.088**	**-0.019**	**-0.111**	**0.306**	-0.013	0.010	**-0.021**
AT	0.003	**-0.016**	1	**-0.054**	**0.043**	**-0.050**	-0.006	**0.023**	**-0.056**	**-0.007**	-0.011
COA	**0.092**	-0.014	**-0.058**	1	0.018	**0.028**	-0.009	**0.027**	**-0.097**	**0.062**	0.011
Op	**0.027**	**0.104**	**0.035**	0.017	1	**0.019**	**-0.084**	**0.177**	**0.042**	-0.005	-0.013
Big4	0.004	**-0.021**	**-0.049**	**0.024**	0.019	1	**0.104**	**0.024**	**0.063**	**-0.036**	-0.009
LEV	-0.012	**-0.092**	**0.023**	-0.011	**-0.092**	**0.104**	1	**-0.40**	**0.232**	**-0.072**	-0.007
ROA	-0.016	**0.355**	**0.024**	0.013	**0.243**	**0.033**	**-0.374**	1	**-0.102**	**0.040**	**-0.029**
SOE	**-0.096**	-0.006	-0.005	**-0.099**	**0.042**	**0.063**	**0.235**	**-0.071**	1	**-0.265**	**-0.065**
Dual	**0.095**	0.002	**-0.020**	**0.067**	-0.005	**-0.036**	**-0.073**	**0.024**	**-0.265**	1	**0.118**
DLDS	**0.068**	-0.015	-0.002	0.007	-0.009	-0.007	-0.012	**-0.021**	**-0.074**	**0.125**	1

Note: The bold part of the table indicates that it is significant at 5%.

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Table 4: Basic regression

Var	DACC	DACC	DACC
	(1)	(2)	(3)
Dx	-0.023***	-0.015***	-0.020***
	(-7.88)	(-4.32)	(-7.083)
AT	-0.000***	-0.001***	-0.000**
	(-3.45)	(-3.54)	(-2.269)
COA	-0.000	-0.000	-0.000
	(-1.47)	(-1.60)	(-1.166)
LEV	0.024***	0.011**	0.020***
	(5.51)	(2.36)	(4.731)
ROA	0.633***	0.624***	0.681***
	(39.85)	(38.31)	(39.59)
Dual	0.001	0.001	0.000
	(0.30)	(0.53)	(0.251)
SOE	0.000	0.000	-0.001
	(0.20)	(0.20)	(-0.791)
Big4	-0.017***	-0.017***	-0.017***
	(-4.60)	(-4.47)	(-4.584)
Op	0.012**	0.011**	0.010**
	(2.51)	(2.27)	(2.310)
DLDS	-0.000	-0.000	-0.000
	(-0.30)	(-0.55)	(-0.225)
Constant	0.052***	0.028	0.079***
	(4.25)	(1.95)	(6.565)
adj R^2	0.1346	0.1427	0.210
Year Fe	YES	NO	YES
Industry Fe	NO	YES	YES
Note:*, **, *** are significant at 10%, 5% and 1% respectively.			

4.2 Multivariate linear regression

In this article, we adopted the step-by-step regression method to test the impact of enterprise digital transformation on audit quality (1) and (2). In Table 4, the result of the final regression (3) is that the regression coefficient between accrued surplus management (DACC) and enterprise digital transformation index (DX) is -0.020, and it is significant at 1% level. The digital transformation index is negatively related to accrued surplus management, indicating that enterprises are carrying out digital transformation The quality of the audit will be improved. At the same time, audit tenure (AT), enterprise financial leverage (LEV), profitability (ROA), and accounting firm size (Big4) are all significant at the 1% level.

According to Table 4, in the process of gradual regression, the regression coefficient symbols of DCC and DX are both negative and significant at the level of 1%, indicating that the digital transformation of enterprises will promote the improvement of audit quality. The reason is that while enterprises carry out digital transformation, they will improve the transparency of accounting information and make enterprises. The recorded accrued surplus management is more real and improves the risk resistance of enterprises, so as to provide auditors with more real and transparent audit data when conducting audit work, so as to achieve the purpose of improving the audit quality of enterprises. This assumption is true.

4.3 Robustness test

(1) Measure robustness by replacing variables. Referring to Xiao Zuoping (2006), this paper chooses the audit cost after taking natural logarithm as an alternative variable for audit quality, which is presented in column (1) in Table 5; referring to Wu Fei (2021) method, the digital transformation degree after word frequency statistics is used as an alternative variable for the digital transformation index. Presented in column (2) of Table 5. According to the results of the table, it can be concluded that the results after the regression after replacing variables are still significant at the level of 1%, and the

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regression results are still stable, so the conclusion remains unchanged: the digital transformation of enterprises will improve the quality of audit.

(2) Tendency Score Matching Method (PSM). In order to alleviate the deviation of sample selection, this article chooses the 1:2 near-neighbour matching method for robustness testing. According to the results of column (3) of Table 5, after processing, it is significant at the level of 10%, indicating that the impact of digital transformation on audit quality after PSM matching is still significant, and the original inference remains unchanged.

(3) Reduce the sample. The location of enterprises may also have a certain impact on digital transformation. For example, first-tier cities have a better development foundation than second-tier and third-tier cities, which will provide more transformation opportunities for enterprises, and the obstacles encountered in the process of enterprise transformation will be smaller. At the same time, the digital foundation of first-tier cities is also better, and the digital industry is also more concentrated, for further exclude the influence of the above factors. This article excludes enterprises located in Beijing, Shanghai, Shenzhen and Hangzhou and uses the remaining enterprises as samples to return. According to column (4) of Table 5, it can be seen that after narrowing the scope, there is still an original correlation between accrued surplus management and digital transformation index. And it is significant at a significant level of 1%. According to the regression results, the research conclusions will not be affected by the good or bad development of the city.

Table 5: Robustness test form

	Replace variables		PSM test	Reduce the sample
	(1)	(2)	(3)	(4)
	ln Fee	DACC	DACC	DACC
Dx	0.221***		-0.09*	-0.012***
Ddts		-0.048***		
Controls	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
Numbers of obs	12112	11781	11789	9055
Adj.R^2/pseudo R^2	0.3709	0.2187	0.0197	0.2213

Note:*, **, *** are significant at 10%, 5% and 1% respectively.

5. Further analysis

5.1 Heterogeneity of property right

Considering that domestic enterprises are divided into two categories according to ownership: state-owned enterprises and non-state-owned enterprises. Compared with non-state-owned enterprises, state-owned enterprises receive more constraints and the speed of digital transformation is slower, so it is necessary to conduct heterogeneity analysis according to enterprise ownership. As shown in the (1) and (2) columns of Table 6, although there is a negative correlation between the interpreted variables and the interpreted variables of state-owned enterprises, they are not significant. The reason is that state-owned enterprises will be intervened by the government when using funds and making final decisions. At the same time, there are also more corporate image and enterprise responsibility, resulting in enterprises. The financial information is more transparent than that of non-state-owned enterprises; non-state-owned enterprises show a negative correlation and is significant at a significant level of 5%. Thanks to the fact that enterprises can freely adjust their development strategies in combination with the current market situation, compared with state-owned enterprises, digital transformation is less constrained and resistance, and financially affected. The supervision is not as strong as that of state-owned enterprises, so the improvement of audit quality by the digital transformation of enterprises is more obvious in non-state-owned enterprises.

5.2 Heterogeneity of shareholding ratio of institutional investors

Independently held investors of companies often come from professional investment institutions. Relevant professional institutions often have broader information collection channels and more professional data analysis capabilities, and spread relevant information into the capital market industry after exporting data. By judging the shareholding ratio of enterprise institutional investors, auditors can

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understand the enterprise more comprehensively and improve the information transparency of the enterprise to a certain extent, thus improving the audit quality. As can be seen from the (3) and (4) columns of Table 6, among enterprises with a high shareholding ratio of institutional investors, digital transformation has improved the quality of auditing, and is significant at the level of 10%, thanks to the accuracy of information obtained by relevant institutions; while in enterprises with a low shareholding ratio of institutional investors, digital transformation is also mentioned. The quality of the audit has improved, but it is not significant. The regression conclusion obtained is consistent with the expected conclusion of this article.

5.3 Heterogeneity of company size

Considering that the size of the company is also an important factor affecting the digital transformation of the enterprise, this article conducts a heterogeneous analysis according to the size of the enterprise. When large-scale companies are in transition, due to the relatively large amount of funds used in the transformation process, decision makers tend to consider more, resulting in relatively large constraints and obstacles in digital transformation. At the same time, compared with small enterprises, large-scale enterprises are also more subject to external supervision, which to a certain extent slows down the process of digital transformation. In the digital transformation, small enterprises can make decisions faster due to their smaller departments and fewer funds. It has accelerated the digital transformation process of enterprises. Digital transformation will improve the transparency of accounting information and improve the quality of auditing to a certain extent. From the regression results of columns (5) and (6) of Table 6, it can be seen that in small-scale companies, the digital transformation of enterprises can significantly improve the quality of audit, which is consistent with the expected results.

Table 6: Heterogeneity analysis table

VAR	State-owned Enterprises	Non-State Enterprises	High shareholding ratio	Low shareholding ratio	Large Size	Small Size
	(1)	(2)	(3)	(4)	(5)	(6)
Dx	-0.000	-0.012**	-0.009*	-0.008	-0.01	-0.018***
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes	Yes	Yes
Num	4014	7775	5712	6077	6052	5737
F	24.81	62.28	41.67	43.70	47.98	37.93
Adj.R^2	0.1800	0.2397	0.2217	0.2111	0.2370	0.2007

Note:*, **, *** are significant at 10%, 5% and 1% respectively.

6. Conclusion and enlightenment

This article discusses the relationship between enterprise digital transformation and audit quality. Based on the relevant data of Shanghai and Shenzhen A-share listed companies from 2011 to 2022, a fixed effect model was built for empirical testing. The research results found that the digital transformation of enterprises will significantly improve the quality of auditing. And this conclusion is still valid after the robustness test. In further research, it was found that digital transformation has improved audit quality more significantly among non- state-owned enterprises, enterprises with a high shareholding ratio of institutional investors and small-scale enterprises.

According to the research results of this article, it can bring some inspiration to auditors: when carrying out the review work, more attention should be paid to non-state and small-scale enterprises. These enterprises often do not have high requirements for financial personnel, and the relevant theoretical foundation and practical experience are not very rich, making the accounting foundation. The work is weak, and auditors should pay more attention when reviewing such companies. At the same time, auditors can also judge the level of information transparency of an enterprise by paying attention to the proportion of institutional investors. In enterprises with low institutional investors, auditors should pay more attention to the reliability and authenticity of accounting information, so as to reduce Probability of major errors.

The research results of this article find that enterprises can improve audit quality through digital

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transformation. This provides empirical evidence for how to improve the audit quality of enterprise digital transformation: enterprises should improve their own risk resistance and information transparency, and digital transformation will also bring a series of risks to enterprises. Enterprise managers should choose a more stable transformation mode in combination with their own development trend and profit mode, as much as possible Reduce the risks brought by digital transformation, and choose appropriate methods for audit work to improve audit quality.

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