

## Article

# The impact of enterprise digital transformation on management tone manipulation and its ‘double-edged sword’ effect

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**Abstract:** Does digital transformation, as an important means for firms to gain market competitiveness, reduce the incentives for management tone manipulation? This paper examines the effect of corporate digital transformation on management tone manipulation and its mechanism from the perspectives of psychology and behavioral finance. The results show that the relationship between digital transformation and tone of voice manipulation is inverted ‘U’ shape, with digital transformation increasing the degree of tone of voice manipulation in the early stage and decreasing it in the later stage. The mediation test concludes that digital transformation mainly affects management tone manipulation by influencing the level of information asymmetry and financing constraints. In addition, the effect of digital transformation on management tone manipulation is more pronounced in firms with more myopic management. This paper examines the internal logic of the impact of digital transformation on management tone manipulation from the perspective of management, reveals the ‘double-edged sword’ effect of digital transformation on management tone manipulation, and enriches the literature on digital transformation and management tone manipulation.

**Keywords:** management tone manipulation; information asymmetry; management short-sightedness

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## 1. Introduction

In recent years, enterprises have been navigating a landscape fraught with persistent uncertainties stemming from external factors such as pandemics, climate change, and geopolitical conflicts. Concurrently, competitive pressures like the US-China trade and technology wars have intensified, while customer demand continues to evolve unpredictably. Amidst this volatility, companies must ensure that their R&D, production, and supply chain systems maintain a degree of operational certainty. This coexistence of uncertainty and the necessity for stability presents enterprises with a survival paradox: How to thrive in an environment characterized by unpredictability while sustaining essential business functions.

The advent and maturation of digital transformation technologies—including cloud computing, the Internet of Things (IoT), machine learning, and industrial robotics—have emerged as pivotal tools for enterprises aiming to mitigate these challenges. Governments and society at large have increasingly recognized digital transformation as a critical strategy to address economic downturn risks and fierce industry competition. For instance, China’s 14th Five-Year Plan (2020) dedicated a chapter to “Accelerating Digital Development and Building a Digital China”, outlining strategic plans for the digital economy’s growth. The 20th Party Congress further emphasized the need to deepen the comprehensive empowerment of digital

technologies, expedite digital innovation applications, support the transformation of traditional industries, and foster the development of digital enterprises. As of June 2021, China's digital economy funds exceeded 400, with a total scale surpassing 360 billion yuan, demonstrating robust growth (Wind database).

Despite the widespread adoption of digital transformation, its implications for corporate management behavior, particularly regarding tone manipulation in communications, remain underexplored. The principal-agent problem, exacerbated by information asymmetry, often drives management to prioritize short-term investments to enhance reputation or meet performance targets. Concurrently, investors, analysts, and financial institutions, wary of information asymmetry, tend to favor enterprises engaging in short-term, low-risk investments due to limited risk tolerance. Reis et al. [1], Chen et al. [2] found that digital transformation, characterized by long lead times, high costs, and inherent uncertainties, is nonetheless widely supported by enterprises seeking to navigate these dual pressures.

While existing research has predominantly examined the relationship between digital transformation and firms' financial performance, the impact of digital transformation on management behavior, particularly tone manipulation, remains ambiguous. It is generally posited that digital transformation can alleviate financing constraints and enhance firms' capacity to manage uncertainty, thereby reducing incentives for management tone manipulation. However, according to principal-agent theory, digital transformation may also reduce information asymmetry within firms, potentially constraining management's ability to exploit information gaps for personal gain or to navigate firm challenges. This could paradoxically compel management to manipulate corporate tone to widen information gaps.

This study aims to address the following questions: What is the relationship between the degree of digital transformation and management tone manipulation? Does this relationship vary with the transparency of accounting information? What are the underlying mechanisms driving this influence? Clarifying these questions will enhance the understanding of how digital transformation impacts management practices, providing valuable insights for governments, the public, investors, and financial institutions, and fostering a more nuanced perspective on digital transformation among external stakeholders.

To investigate these issues, this paper employs textual analysis to explore the effects and mechanisms of corporate digital transformation on management tone manipulation, drawing on theories from psychology and behavioral finance. The findings indicate that corporate digital transformation influences management tone manipulation by affecting the degree of information asymmetry and the level of financing constraints. Additionally, firms with more myopic management exhibit a more pronounced effect of digital transformation on management tone manipulation.

Compared to existing studies, this paper contributes to the literature in several key ways. First, it broadens the research perspective by examining the consequences of digital transformation beyond financial and innovation dimensions, specifically focusing on management behavior. Second, it enriches the understanding of factors influencing management tone manipulation, addressing a gap in the literature regarding the impact of digital transformation on such practices. Third, by identifying a "double-edged sword" effect between digital transformation and management tone

manipulation, this study provides empirical evidence of the nuanced impacts of digital transformation on managerial behavior, highlighting both its benefits and potential drawbacks.

## **2. Literature review and hypothesis formulation**

### **2.1. Literature review**

Existing literature examining the impact of digital transformation in firms is mainly based on both the firm's own and stakeholder levels. At the level of the enterprise itself, Liu et al. [3], Chen et al. [4] found that digital transformation accelerates the formation of the 'cost reduction, efficiency enhancement and innovation' mechanism, and is reflected in the enterprise's innovation capability, by optimising the organisational structure, improving the efficiency of R&D organisations in communicating with the parent company [5], and facilitating the change of enterprise management and business model [6,7]. The formation of the 'cost reduction and innovation' mechanism[3], which is reflected in corporate innovation capacity [8], new product performance [9], service performance [10], and total factor productivity [11], and on the continuous optimization of the various economic consequences [12]; at the stakeholder level, Wu et al. [13] found that digital transformation enhances stock liquidity, fosters the development of a digital society [14], improves the satisfaction of the different participants [15], and so on. In summary, the existing literature is rich in studies on the impact of digital transformation on firms, but most of them are based on firms and external stakeholders, and do not take into account the impact on management's own behaviour. Although digital transformation presents a positive side for the firm itself and external stakeholders, it is not yet clear whether the impact on management's own behaviour is positive or negative, so research from management's perspective may become a new perspective.

Kile and Phillips [16] found that the Chinese language is profound and rich in emotional connotations, and people have a strong ability to interpret the emotional meanings contained in textual information. Therefore, Zhu and Xu [17], Zeng et al. [18] found that management tone is extremely valuable in the study of corporations, yet it is based on that value and the lack of relevant legal institutional constraints that management is more motivated to engage in tone manipulation for self-interested purposes [19]. Chen and Cao [20] found that textual tone is an important means for management to manipulate disclosure, and management is able to reap lucrative returns in the stock market through tone manipulation [21], and the specific paths of action may include inducing analysts to embody erroneous incremental information about tone in surplus forecasts [22] as well as using textual tone to distort the external interests' stakeholders' perceptions in tandem with surplus management [23], which in turn affects the accuracy of stock recommendation reports and improves the corresponding ratings. In summary, management tone manipulation is one of the important means for management to achieve its own ends. So, will the deepening digital transformation of firms, which is a more positive trend compared to firms, lead to an increase in the degree of management tone manipulation because it inhibits management's self-interested tactics?

## **2.2. Research hypotheses**

As the market enters the VUCA (Volatile, Uncertain, Complex and Ambiguous) era, countries have gradually begun to pay attention to the ability of enterprises to cope with the uncertainty of the external environment, the competitive situation, customer demand and other survivability. The State Council has issued policy documents such as the ‘Guiding Opinions of the State Council on Deepening the Integration and Development of Manufacturing and the Internet’ to support the transformation and upgrading of traditional industries empowered by digital technology, and investors, analysts, and financial institutions have taken the degree of digital transformation of enterprises as an important indicator for investment decisions [24]. However, in the initial stage of enterprise digital transformation, on the one hand, due to the challenges and uncertainties brought to enterprises by the introduction of new digital tools and strategies, the management may face such contradictions as high investment and the difficulty of guaranteeing short-term returns, and slow transformation and the market’s overly high expectations. Due to Chinese people’s strong ability to interpret the emotional connotations of textual information [25] and the lack of a legal system to regulate the manipulation of the tone of text in annual reports, management may manipulate the tone of the text based on asymmetric information to create an optimistic and positive image in order to gain the trust and support of external investors and to further promote the digital transformation of the enterprise. In addition, as the substantial investment required for digital transformation may not be adequately rewarded in the short term, the financial position of the enterprise may experience a certain downturn, leading to an increase in financing constraints. In this case, management may be more inclined to manipulate the tone to boost the confidence of external stakeholders, thereby easing the financing constraints. Therefore, we can expect that the degree of tone manipulation by firm management may increase in the early stages of digital transformation.

As a firm’s digital transformation progresses, especially in the mid-to-late stages, it may begin to receive the benefits of the transformation. Digital transformation can lead to stronger competitive advantage by optimising organisational structure [26], improving the efficiency of R&D organisations in communicating with the parent company [5], etc., which may help to improve the firm’s financial position [12] and alleviate financing constraints, and such a change decreases management’s incentives for tone manipulation. On the other hand, as the degree of digital transformation deepens, the degree of automation in each industry chain and the transparency of the financial and internal control processes of firms gradually increase [25], which leads to a rise in the ability of investors, analysts, and financial institutions to monitor management’s behavior, resulting in a decrease in management’s ability to achieve self-interested purposes by concealing relevant information [27,28]. Therefore, we can expect that the degree of tone manipulation by corporate management may decrease as the degree of digital transformation increases, especially into the middle and late stages of the transformation.

In summary, this paper proposes the following hypotheses:

H1: There is an inverted ‘U’ shaped relationship between digital transformation and management tone.

### 3. Research design

#### 3.1. Data sources

This paper takes the annual report data of A-share listed companies from 2010 to 2022 as the research samples, and further screens them by the following criteria: (1) Excluding financial and insurance companies such as banks, securities and investment; (2) excluding ST and \*ST listed companies; and (3) excluding listed companies with missing data. After screening, a total of 20,149 samples are obtained. In order to exclude the effect of extreme values, this paper Winsorize all continuous variables by 1% up and down. The annual report data required for this paper comes from Juchao Information Network, and the company's financial and governance data comes from CSMAR database.

#### 3.2. Model construction and variable definition

##### 3.2.1. Model construction

To examine the impact of corporate digital transformation on management tone manipulation, this paper employs a Double Fixed Effects Model. This model effectively controls for unobserved firm-specific heterogeneity and time fixed effects, thereby mitigating potential endogeneity issues and enhancing the reliability and robustness of the estimation results.

$$ABTONE_{i,t} = \alpha_0 + \alpha_1 DCG_{i,t} + \alpha_2 DCG^2_{i,t} + \alpha_3 Controls_{i,t} + Industry + Year + \xi_{i,t} \quad (1)$$

Among them, the explanatory variables ABTONE and ABTONE\_FE indicate the degree of management tone manipulation, the explanatory variable DCG indicates the degree of digital transformation of the firm, and Controls are the control variables, including firm size (Size), capital structure (Lev), net rate of return on total assets (ROA), growth of the firm (Growth), number of directors (Board), Proportion of Independent Directors (Indep), Proportion of Shares Held by the First Largest Shareholder (Top1), Equity Checks and Balances (Balance), and Ownership Structure (SOE). In addition, the paper controls for industry and year fixed effects.

##### 3.2.2. Definition of key variables

- 1) Enterprise digital transformation. In this paper, two currently commonly used quantitative measures of the degree of enterprise digital transformation are selected, namely, the Wu et al. [26] and Zhao Zhenyu et al. [12] versions. In the data analysis of this paper, the Wu Fei version is used to define the degree of digital transformation of enterprises (DIG), and the Zhao Zhenyu version is used as a proxy variable for the degree of digital transformation of enterprises (DIG2) in the robustness testing stage.
- 2) Management tone manipulation. First, based on Song et al. [29], the number of positive tone (Pos) and the number of negative tone (Neg) in the MD&A text are used to calculate the net tone of management (TONE), which is calculated as (number of positive tone - number of negative tone)/(number of positive tone + number of negative tone). Secondly, referring to the study by Yu et al. [30], the residual terms obtained from the regression of models Equations (2) and (3) were

used to measure management tone manipulation (ABTONE and ABTONE\_FE), respectively.

$$\text{TONE}_{i,t} = \alpha_0 + \alpha_1 \text{ROA}_{i,t} + \alpha_2 \text{RET}_{i,t} + \alpha_3 \text{Size}_{i,t} + \alpha_4 \text{BTM}_{i,t} + \alpha_5 \text{RET\_SD}_{i,t} + \alpha_6 \text{ROA\_SD}_{i,t} + \alpha_7 \text{AGE}_{i,t} + \alpha_8 \text{Loss}_{i,t} + \alpha_9 \text{D\_ROA}_{i,t} + \varepsilon_{i,t} \quad (2)$$

$$\text{TONE}_{i,t} = \alpha_0 + \alpha_1 \text{ROA}_{i,t} + \alpha_2 \text{RET}_{i,t} + \alpha_3 \text{Size}_{i,t} + \alpha_4 \text{BTM}_{i,t} + \alpha_5 \text{RET\_SD}_{i,t} + \alpha_6 \text{ROA\_SD}_{i,t} + \alpha_7 \text{AGE}_{i,t} + \alpha_8 \text{Loss}_{i,t} + \alpha_9 \text{D\_ROA}_{i,t} + \alpha_{10} \text{F\_ROA}_{i,t} + \varepsilon_{i,t} \quad (3)$$

where ROA denotes the net interest rate on total assets; RET denotes the annual yield to hold-to-maturity; Size denotes the size of the firm; BTM denotes the book-to-market ratio; RET\_SD denotes the standard deviation of the monthly stock return for the current year; ROA\_SD denotes the standard deviation of the operating performance for the past five years; AGE denotes the year of the firm's listing after logarithmisation; Loss is a dummy variable which is set to 1 if the firm's current year profits are negative, then 1, otherwise 0; D\_ROA denotes the difference between the net profit in period  $t$  and the net profit in period  $t-1$  divided by the total assets in period  $t-1$ ; F\_ROA denotes the net profit in period  $t+1$  divided by the total assets of the enterprise in period  $t$ .

Specific variables are defined as shown in **Table 1**.

**Table 1.** List of variable definitions.

Variable type	variable name	variable symbol	Variable Definition
implicit variable	Digital Transformation	DCG	Measured using Yuan et al. [27]
		Dig	Measured using Wu et al. [26]
independent variable	Management tone manipulation	ABTONE	Residual term of model Equation (2)
		ABTONE_FE	Residual term of model Equation (3)
control variable	Company size	Size	Natural logarithm of total assets
	capital structure	Lev	Total liabilities/total assets
	Net interest rate on total assets	ROA	Net profit/average balance of total assets
	Enterprise growth	Growth	(Current year-end operating income/previous year-end operating income)-1
	Number of directors	Board	The number of board members is taken as a natural logarithm
	Proportion of independent directors	Indep	Independent directors divided by number of directors
	Shareholding ratio of the largest shareholder	Top1	Number of shares held by the largest shareholder/total number of shares
	Shareholding checks and balances	Balance	Total shareholding of the second to fifth shareholders divided by the shareholding of the largest shareholder
	Property rights structure	SOE	Dummy variable, SOEs take value 1, others 0
	Industry	Industry	Industry dummy variable, by SEC 2012 industry classification standards
	Year	Year	Year dummy variable

### 3.3. Descriptive statistics

**Table 2** presents the descriptive statistics of the key variables. In particular, the standard deviation of the management tone manipulation (ABTONE, ABTONE\_FE) is 0.124, which is greater than 0.05, indicating a greater degree of dispersion in the values. The mean value of the firm's degree of digital transformation (DCG) is 1.239 with a standard deviation of 1.354, indicating a greater degree of digital transformation between firms and a greater variation in the sample.

**Table 2.** Descriptive statistical analysis of key variables.

Variables	Sample Size	Mean	Standard Deviation	Minimum	Median	Maximum
ABTONE	20,149	−0.000543	0.124	−0.310	0.0015	0.303
ABTONE_FE	20,149	−0.0135	0.124	−0.322	−0.0114	0.288
DCG	20,149	1.239	1.354	0	0.693	5.004
Size	20,149	22.38	1.306	19.48	22.24	26.19
Lev	20,149	0.466	0.209	0.0656	0.462	0.959
ROA	20,149	0.0325	0.0680	−0.285	0.032	0.216
Growth	20,149	0.179	0.559	−0.625	0.884	4.087
Board	20,149	2.147	0.200	1.609	2.147	2.708
Indep	20,149	37.49	5.383	33.33	35.71	57.14
Top1	20,149	0.336	0.148	0.085	0.313	0.736
Balance	20,149	0.677	0.586	0.0249	0.504	2.615
SOE	20,149	0.458	0.498	0	0	1

## 4. Empirical results and analyses

### 4.1. Enterprise digital transformation and management tone manipulation: A test of overall benefits

**Table 3** presents the regression results of digital transformation and management tone manipulation of firms. The results show that the coefficients of digital transformation (DCG) and management tone manipulation (ABTONE, ABTONE\_FE) are 0.0226 and 0.0218, respectively, and both are significantly positive at the 1% level, and the coefficients of the quadratic term of digital transformation (DCG2) and management tone manipulation (ABTONE, ABTONE\_FE) are significantly negative at the 1% level, indicating an inverted 'U' shape relationship between digital transformation and management tone manipulation. The coefficients of the quadratic term of digital transformation (DCG2) and management tone manipulation (ABTONE, ABTONE\_FE) are all significantly negative at the 1% level, indicating that there is an inverted 'U' relationship between digital transformation and management tone manipulation. Further calculations show that the inflection points of the curves in columns (1) and (2) are at 17.17% and 15.96%, respectively, and the arithmetic mean is 16.6%, which indicates that when the degree of digital transformation of the enterprise is lower than 16.6%, digital transformation leads to further tone manipulation of the management, and when the degree of digital transformation of the enterprise is higher than 16.6%, digital transformation leads to a

decrease in the degree of tone manipulation of the management, i.e., helps to inhibit the tone manipulation of the management. decreases, i.e., it helps to curb management's myopic behavior.

**Table 3.** Enterprise digital transformation and management tone manipulation.

variable	(1)	(2)
	ABTONE	ABTONE_FE
DCG	0.023*** (0.00182)	0.022*** (0.00182)
DCG <sup>2</sup>	−0.002*** (0.001)	−0.002*** (0.001)
Size	0.011*** (0.001)	0.009*** (0.001)
Lev	0.002 (0.005)	0.005 (0.005)
ROA	−0.131*** (0.013)	−0.179*** (0.013)
Growth	0.016*** (0.001)	0.015*** (0.001)
Board	0.001 (0.001)	0.001 (0.001)
Indep	0.001 (0.001)	0.001 (0.001)
Top1	−0.000 ( $7.87 \times 10^{-5}$ )	−0.001** ( $7.84 \times 10^{-5}$ )
Balance	−0.005** (0.002)	−0.005*** (0.002)
SOE	0.022*** (0.002)	0.023*** (0.002)
Constant	−0.156*** (0.019)	−0.121*** (0.019)
Year	Y	Y
Industry	Y	Y
N	20,149	20,149
Adj.R <sup>2</sup>	0.228	0.227

Note: \*, \*\* and \*\*\* indicate significance at the 10%, 5% and 1% levels, respectively, with robust standard errors in parentheses. Same below.

#### 4.2. Path analysis of the impact of information asymmetry

According to the theoretical derivation of Hypothesis H1, the initial stage of firms' digital transformation may affect the management tone manipulation by reducing the degree of information asymmetry, which further enhances the degree of information asymmetry; and after the digital transformation has deepened to a certain extent, the decline in financing constraints caused by the reduction of information



asymmetry through the digital transformation can lead to the decline in the degree of management tone manipulation. Therefore, this paper draws on Song et al. [29] and Yu et al. [30] to characterise market liquidity by calculating the liquidity ratio LR, the illiquidity ratio indicator ILL, and the yield inversion indicator GAM, and then conducts a principal component analysis based on these three indicators to capture the common variance information of the three, i.e., the components associated with asymmetric information, which is denoted as asymmetric information (ASY). According to column (1) of **Table 4**, DCG and ASY are significantly positive at the 10% level, and DCG2 and ASY are significantly negative at the 1% level, which indicates that the relationship between enterprise digital transformation and information asymmetry is inverted ‘U’ shape. The above findings validate the path of ‘enterprise digital transformation (early stage) (increase) information asymmetry’ and ‘enterprise digital transformation (late stage) (decrease) information asymmetry’, i.e., the decrease of information asymmetry in the early stage of enterprise digital transformation will prompt management to manipulate information asymmetry through tone of voice. The decrease in the degree of information asymmetry in the early stage of enterprise digital transformation will prompt management to increase the degree of information asymmetry through tone manipulation, while when enterprise digital transformation enters the late stage, it will alleviate management’s tone manipulation behavior by decreasing the information asymmetry and thus the financing constraints.

#### 4.3. Path analysis of the impact of financing constraints

**Table 4.** Regression results of mechanistic analyses.

variable	(1)	(2)	(3)
	ASY1	SA	FC
DCG	0.006* (0.003)	0.006* (0.004)	0.004* (0.002)
DCG <sup>2</sup>	−0.006*** (0.001)	−0.003*** (0.001)	−0.002*** (0.001)
Controls	YES	YES	YES
Year	YES	YES	YES
Industry	YES	YES	YES
N	20,149	20,149	20,149
Adj.R <sup>2</sup>	0.590	0.229	0.732

Note: \*, \*\* and \*\*\* indicate significance at the 10%, 5% and 1% levels, respectively, with robust standard errors in parentheses.

As firms’ digital transformation will invest a large amount of human and material resources in the early stage, resulting in a temporary decline in operating conditions, this time will bring about a rise in financing constraints, while when firms enter the later stage of digital transformation, due to the overall improvement in performance of new products, service performance [10], and total factor productivity [12] performance across the board, financing constraints will show a decline, thus removing management’s incentives to engage in tone manipulation based on the firm’s

operational level considerations. Therefore, digital transformation and financing constraints should show an inverted ‘U’ shape, which in turn affects management tone manipulation behaviour. As shown in columns (2) and (3) of **Table 4**, the quadratic form of digital transformation (DCG2) and financing constraints SA and FC are both significantly negative at the 1% level, indicating that there is indeed an inverted ‘U’-shaped relationship between digital transformation and financing constraints.

#### 4.4. Further analysis: The moderating role of managerial myopia

**Table 5.** Moderating effect test for managerial short-termism.

variable	(1)	(2)
	ABTONE	ABTONE_FE
DCG	0.017*** (0.003)	0.016*** (0.003)
myopia	−0.102*** (0.013)	−0.099*** (0.013)
DCG_myopia	0.060*** (0.023)	0.060*** (0.023)
DCG <sup>2</sup>	−0.001 (0.001)	−0.001 (0.001)
DCG <sup>2</sup> _myopia	−0.015** (0.007)	−0.014** (0.007)
Controls	YES	YES
Year	YES	YES
Industry	YES	YES
N	20,149	20,149
Adj.R <sup>2</sup>	0.231	0.230

Note: \*, \*\* and \*\*\* indicate significance at the 10%, 5% and 1% levels, respectively, with robust standard errors in parentheses.

When management is characterized by short-termism, this usually means that they place too much emphasis on immediate performance and results at the expense of long-term development and strategy. Such short-sighted managers are more inclined to take decisions with immediate visible results and ignore the possible impact on the long-term health of the organization. Digital transformation is a long-term process that requires a huge investment with long term benefits. Therefore, when management is characterized by short-termism, they may misunderstand or misinterpret the value and importance of digital transformation, thus exacerbating the resilience of its impact on tone manipulation. Therefore, this paper draws on Hu et al.’s [31] approach of using Word2Vec machine learning technology to obtain the “short-term perspective” word set, and then further filtering to determine the final short-sightedness word set, and then using text analysis technology to calculate the proportion of the word frequency of the word set in the total word frequency of MD&A text, as a way to measure the management’s short-sightedness. short-sightedness. As shown in **Table 5**, the interaction terms of digital transformation and managerial

myopia (DCG\_myopia) are both significantly negative at the 5% level, indicating that the inverted ‘U’-shaped relationship between digital transformation and managerial tone of voice manipulation is more pronounced in short-sighted managers than in long-sighted managers.

## 4.5. Robustness tests

### 4.5.1. Replacing firms’ digital transformation variables

Using Wu Fei’s version of the constructed degree of digital transformation (Dig) and management tone manipulation (ABTONE, ABTONE\_FE) for regression, as shown in columns (1) and (2) of **Table 6**, Dig is significantly positive for both ABTONE and ABTONE\_FE at the 1% level, and Dig<sup>2</sup> is significantly negative for both ABTONE and ABTONE\_FE at the 1% level. This suggests that the relationship between corporate digital transformation and the degree of management tone manipulation is inverted ‘U’ shape. Therefore, the conclusions of this paper are robust.

**Table 6.** Robustness test regression results.

variable	(1)	(2)
	ABTONE	ABTONE_FE
Dig	0.069*** (0.003)	0.068*** (0.003)
Dig <sup>2</sup>	−0.011*** (0.001)	−0.011*** (0.001)
Controls	YES	YES
Year	YES	YES
Industry	YES	YES
N	20,149	20,149
Adj.R <sup>2</sup>	0.239	0.238

Note: \*, \*\* and \*\*\* indicate significance at the 10%, 5% and 1% levels, respectively, with robust standard errors in parentheses.

### 4.5.2. Instrumental variables testing

Referring to Xiao et al. [32], the postal and telecommunication data of the prefecture-level city where the enterprise is located in 1984 is selected as an instrumental variable. The relevance to digital transformation is satisfied because the postal and telecommunication communications used by the location of the enterprise in its developmental history will affect the enterprise’s acceptance and application level of digital technology in terms of market preference and technological development; at the same time, postal and telecommunication, as a social infrastructure, is not directly linked to the developmental changes of the enterprise, and thus satisfies the requirement of exogeneity. In addition, considering the 1984 post and telecommunications data as cross-sectional data, the panel data is constructed by introducing the national information technology service revenue with time-varying characteristics with reference to previous studies [11]. The specific construction is to use the interaction term between annual national IT revenues and the number of landline telephones per million people in the prefecture where the firm is registered in

1984 (IV\_Tel) as an instrumental variable for the annual digitisation level of the firm. **Table 7** presents the results of the IV-2SLS method. IV\_Tel is significantly positive at the 1% level in the first stage regression, indicating that the instrumental variable IV\_Tel satisfies the correlation requirement. In the second stage regression, DCG is significantly positive with both ABTONE and ABTONE\_FE at and 1% level, and DCG2 is significantly negative with ABTONE and ABTONE\_FE at the 5% and 10% levels, respectively, indicating that the conclusions of this paper remain valid.

**Table 7.** Instrumental variable method test results.

variable	(1)	(2)	(3)
	DCG	ABTONE	ABTONE_FE
IV_Tel	0.014*** (0.002)		
DCG		0.176*** (0.058)	0.163*** (0.057)
DCG <sup>2</sup>		−0.026** (0.013)	−0.022* (0.013)
Controls	YES	YES	YES
Year	YES	YES	YES
Industry	YES	YES	YES
N	20,149	20,149	20,149
Adj.R <sup>2</sup>	0.496		

Note: \*, \*\* and \*\*\* indicate significance at the 10%, 5% and 1% levels, respectively, with robust standard errors in parentheses.

## 5. Conclusions and implications of the study

In recent years, with increasing internal and external uncertainties, corporate digital transformation has attracted widespread attention from a wide range of stakeholders, including governments, investors and other stakeholders, and has had a significant impact on business operations. Does corporate digital transformation affect the extent of management tone manipulation? Does this impact reflect heterogeneity as the transparency of accounting information varies? Based on the data of A-share listed companies in Shanghai and Shenzhen from 2010 to 2022, this paper explores the impact effect and mechanism of corporate digital transformation and management tone manipulation. The empirical study shows that the effect of corporate digital transformation on management tone manipulation shows an inverted ‘U’ shape, i.e., in the early stage of digital transformation, as the degree of digital transformation deepens, management will engage in tone manipulation; in the late stage of digital transformation, management will reduce tone manipulation behavior. The mediation effect test shows that digital transformation affects management tone manipulation by influencing the degree of information asymmetry and the level of financing constraints. In addition, the effect of firms’ digital transformation on management tone manipulation is more pronounced in firms with more myopic management. In the robustness test section, this paper replaces the measurement variable of the degree of digital transformation, as well as adding the instrumental variable postal data, and the

regression shows that the conclusions of this paper are still robust. Based on these findings, the following recommendations are made:

First, the government, the public and other external stakeholders should maintain reasonable expectations for the digital transformation of enterprises, and should not blindly pursue an increase in the degree of digital transformation of enterprises without taking into account the actual situation of enterprises. In recent years, with the intensification of internal and external uncertainties and the deepening of the concept of sustainable development, the degree of enterprise digital transformation has become a focus of attention for governments, investors and others. Research shows that digital transformation can promote the high-quality development of enterprises and enhance their innovation ability, but due to the difficulty of starting digital transformation, slow results and other characteristics of the digital transformation of enterprises will make the path of digital transformation is not smooth sailing, the government, the public and relevant investors should maintain reasonable expectations, should not blindly pursue the rapid combination of digital technology, but should be based on the actual start of the enterprise, to give the enterprise sufficient time for transformation. Instead, companies should be given sufficient time to transform from a practical point of view, as well as appropriate external pressure to mitigate the occurrence of undesirable behaviors, such as tone of voice manipulation, as a result of the decline in information asymmetry that drives management.

Second, investors, analysts and financial institutions should take a more dialectical view of the extent of digital transformation, and carefully consider the weight of the extent of a company's digital transformation in their investment decisions. With the growing popularity of digital transformation in the investment field, investors are faced with the problem of blindly pursuing digital transformation concept stocks, analysts' stock recommendation ratings for digitally transformed enterprises are generally high, and financial institutions are more inclined to borrow and invest in digitally transformed enterprises. However, while the development of digital transformation in enterprises is important for the above decisions, the impact of digital transformation on other indicators also needs to be considered, such as the unusually positive tone of the text of the annual report, which should be treated with greater sensitivity and caution.

Thirdly, we should accelerate the construction of a standardization and audit system for non-financial information in listed companies' annual reports, strengthen the supervision of relevant departments, and improve the non-abnormal tone of the text. At present, the non-financial information of listed companies, especially the tone of the text, cannot be standardized due to insufficient attention from the society, technical difficulties in supervision and auditing, etc. There is a lack of uniform standards, and its authenticity and timeliness are difficult to be guaranteed. Listed companies have the incentive to use text tone to mislead investors, analysts and financial institutions to make decisions, which is manifested in the manipulation of the tone of listed companies over the years. On the one hand, accelerate the construction of norms for non-financial information in annual reports, strengthen market regulation, and introduce impartial rating agencies when necessary. On the other hand, accelerating the research and development of text analysis technology and regulating the reasonableness of text tone to further release the dividends of digital

transformation are important means to reduce the degree of information asymmetry and guide the high-quality development of listed companies.

The theoretical implications are as follows: This study advances the theoretical understanding of the relationship between digital transformation and managerial behavior by leveraging principal-agent theory and information asymmetry theory. It elucidates how digital transformation influences management tone manipulation through the reduction of information asymmetry and the alleviation of financing constraints. Furthermore, the identification of an inverted U-shaped relationship offers a novel perspective on the dynamic evolution of managerial behavior throughout the digital transformation process, thereby broadening the applicability of existing theoretical frameworks.

The management/policy implications are as follows: The findings of this research hold important implications for corporate managers and policymakers. Corporate managers are encouraged to prioritize enhancing information transparency during digital transformation initiatives to mitigate unnecessary managerial tone manipulation and bolster the long-term sustainability of their enterprises. For policymakers, the study suggests the need to foster the healthy progression of corporate digital transformation by strengthening information disclosure systems, ensuring market transparency and fairness, and thereby enhancing investor confidence.

Limitations and recommendations for future research are listed below: Although this study validates its conclusions through various robustness tests, there are certain limitations. For instance, the sample is limited to Chinese A-share listed companies; future research could extend to other markets and countries to verify the generalizability of the conclusions. Additionally, future studies could explore other potential mediating and moderating variables, such as corporate culture and industry characteristics, as well as the impact of digital transformation on different types of managerial behaviors, to provide a more comprehensive understanding.

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