

The Impact of Digital Transformation on the Cost of Equity

Ruijie Yang^{1, *}

¹ Nanjing University of Science and Technology, Nanjing, China

* Corresponding Author Email: 15376122243@163.com

Abstract. In the context of the digital era, the rapid development of computers and information technology has brought profound changes to the operating environment of enterprises, creating broad opportunities while also presenting a series of challenges that require urgent responses. Against this backdrop, digital transformation has gradually become a strategic focus for enterprises seeking to capitalize on emerging opportunities and effectively address these challenges. This study empirically examines listed companies in the Shanghai and Shenzhen stock markets from 2014 to 2023. The results show that corporate digital transformation significantly reduces the cost of equity. Specifically, digital transformation can reduce the cost of equity by mitigating information asymmetry and improving the corporate governance environment. Further analysis reveals that the negative effect of digital transformation on the cost of equity is more pronounced among firms located in eastern China and those with overconfident executives. Based on these findings, this study proposes several recommendations to promote corporate digital transformation and help enterprises implement digital transformation more effectively, thereby enhancing their competitiveness in the market.

Keywords: Digital Transformation, Cost of Equity, Information Asymmetry, Internal Control.

1. Introduction

Since the implementation of the reform and opening-up policy, China's economy has experienced rapid growth, accompanied by substantial improvements in the level and scale of corporate development. Against the backdrop of the continuous advancement of computer and information technologies, China's economy has entered an era of digital transformation. In the digital era, digital technologies are driving the transformation and upgrading of traditional business models and reshaping the development trajectory of society and industries, thereby exerting a profound impact on the real economy. Moreover, pursuing digital transformation can help enterprises, as well as the broader market economy, move toward a more advanced, intelligent, and sustainable direction.

According to the Global Digital Economy White Paper (2023) released by the China Academy of Information and Communications Technology (CAICT), the total value of the digital economy across 51 major economies worldwide reached USD 41.4 trillion in 2022, reflecting the sustained growth of the digital economy on a global scale. The Report to the 20th National Congress of the Communist Party of China made important strategic arrangements for promoting the deeper integration of the digital economy with the real economy and explicitly proposed the goal of "building internationally competitive digital industry clusters." In addition, the 14th Five-Year Plan for National Economic and Social Development of the People's Republic of China emphasizes the need to cultivate new advantages in the digital economy and provide strong digital momentum for the transformation and upgrading of traditional industries.

However, considerable challenges and obstacles remain on the path toward digital transformation. According to the 2023 Report on the Development of the Digital Economy of Listed Companies released by the China Association for Public Companies, digital transformation faces several major challenges, including shortages of digital talent, long investment payback periods, and insufficient integration between business operations and technology. Against the backdrop of the rapid expansion of the digital economy and its ongoing efforts to achieve deeper integration with traditional business activities, whether digital transformation can effectively promote corporate development has become an important topic of academic concern. Although most researchers have found that digital transformation has a positive impact on corporate development, a small number of scholars argue that

its outcomes remain uncertain. Therefore, digital transformation remains a “mystery” involving numerous unresolved factors, and its effects on enterprises warrant further investigation. Exploring the mechanisms through which digital transformation affects the cost of equity can help unveil the underlying effects of digital transformation and contribute to a better understanding of its impact on corporate operating performance and market value. To some extent, such findings may also provide theoretical foundations and practical guidance for corporate managers and investors.

2. Literature Review

2.1. Economic Consequences of Digital Transformation

Current research on the economic consequences of digital transformation can be broadly divided into two levels: the macro level and the micro level. At the macro level, existing studies mainly examine the effects of corporate digital transformation on industrial structure, domestic economic development, and export trade. Zhang Chenxia and Yu Pingping^[1] argue that corporate digital transformation has a significant positive effect on China’s economic development. Wang Shuying and Zhang Yuanfang^[2] find that the deepening of corporate digital transformation can inhibit the convergence of industrial structures. Xu Huichao^[3], from the perspectives of digital factor allocation and innovation, finds that digital transformation significantly improves domestic economic performance. Chen Fenglan et al.^[4] demonstrate that the digital transformation of the manufacturing industry promotes the expansion of corporate export activities. Ren Baoping et al.^[5] argue that the digital economy provides impetus for high-quality economic development by improving resource allocation efficiency, promoting advances in social productivity, and enhancing production efficiency.

At the micro level, existing research mainly focuses on the effects of digital transformation on corporate operating performance, firm value, corporate governance, corporate innovation, and information quality. Gupta and Bose^[6] find that firms that take the lead in digital transformation can increase their operating revenue by 34% by adopting a digital-first strategy. Li et al.^[7], based on empirical evidence, find that digital transformation contributes to corporate innovation and that the two are significantly positively correlated. Ionaşcu et al.^[8] point out that digital transformation enables firms to make more effective use of natural resources and reduce pollution, thereby facilitating the transformation of their business models toward more sustainable models in the circular and digital economy. Zhao Chenyu et al.^[9] argue that, during the transformation process, digital technologies can break down information silos, facilitate the flow of knowledge and information within firms, and improve the utilization efficiency of data as a new factor of production. Digital transformation can also optimize processes such as research and development and production, reduce production costs, and improve total factor productivity. Chen Jian et al.^[10] further find that digitalization improves the efficiency of corporate operations and management from four perspectives: demand forecasting, product design, pricing and inventory management, and supply chain management. Moreover, digitalization can promote innovation in corporate operations and management models.

However, some scholars argue that digital transformation may also have negative effects on corporate development. This phenomenon is referred to as the “digital transformation paradox,” the “Solow paradox,” or the “information technology (IT) productivity paradox”^[11]. Building on this perspective, some scholars argue that only a proportion of firms can achieve the expected benefits of digital transformation and derive value from it. Relatively few studies have examined the “digital transformation paradox.” Jago^[12] points out that digital management systems may lack flexibility, making information transmission and processing rigid and opaque, which may ultimately lead firms to make biased and inefficient production decisions. Xu Mengzhou and Lü Tie^[13] argue that digital transformation has a relatively long payback period and therefore entails substantial hidden costs, meaning that short-term returns may be insufficient to cover the costs of investment.

2.2. Factors Affecting the Cost of Equity

Current research on the determinants of the cost of equity mainly focuses on how it is affected by internal and external factors. Regarding external factors, Zheng et al.^[14] find that the degree of market competition affects corporate information disclosure, and that intense competition encourages firms to improve both the quantity and quality of information disclosure, thereby reducing the cost of equity. Kwabi^[15], through empirical analysis, finds that economic policy uncertainty significantly increases the cost of equity. Zhao Yuliang^[16] finds that in regions with a higher degree of marketization, resource allocation and corporate operations rely primarily on market mechanisms, with relatively limited government intervention and a more well-established legal system. Under such market conditions, information is disseminated more widely and rapidly, reducing information asymmetry and investors' perceptions of risk, which in turn lowers the cost of equity. Xiao Zuoping and Zhou Jingfei^[17] point out that media monitoring can effectively mitigate information asymmetry and consequently reduce the cost of equity. Xie Shanshan^[18] finds that geographical location affects the cost of equity through both "information effects" and "risk effects." The greater the geographical distance between a firm's location and a central city, the higher its cost of equity.

Regarding internal factors, Balakrishnan et al.^[19] find that a number of firm-specific characteristics, including leverage, firm size, book-to-market ratio, and idiosyncratic volatility, also affect the cost of equity. Bui et al.^[20] demonstrate that an increase in national carbon emissions leads to a higher cost of equity, while the disclosure of carbon emission information can help mitigate this negative effect. Similarly, Ding and Shahzad^[21] find that the disclosure of environmental penalties imposed on firms increases their cost of equity in the following year. In the context of China, Yu Ziqin et al.^[22] argue that internal control, ownership structure, and equity incentives affect the cost of equity. Wei Gang et al.^[23] find that a higher degree of ownership checks and balances helps reduce agency costs, thereby mitigating the positive effect of controlling shareholders' share pledges on firms' cost of capital. Hu Tao et al.^[24] argue that corporate financial information disclosure can satisfy investors' information needs, help reduce information asymmetry, and consequently lower the cost of equity.

In summary, existing research has identified a wide range of factors affecting firms' cost of equity. However, with the accelerating trend of digital transformation, further research is needed to examine the impact of digital transformation on the cost of equity. In particular, information disclosure quality and internal control should be incorporated into the analysis of the underlying mechanisms to further investigate the relationship between corporate digital transformation and the cost of equity.

3. Theoretical Analysis and Hypothesis Development

Corporate digital transformation refers to the process through which firms utilize digital technologies to optimize their organizational structures, improve operational decision-making, and transform their business models. By leveraging data as a factor of production and applying digital technologies to enhance firm value, enterprises can ultimately achieve strategic transformation^[25]. Digital transformation also has a profound impact on firms' capital structures and costs of capital. The cost of equity refers to the cost incurred by a firm to attract and retain investors, and its direct determinants include investors' perceptions of firm risk and corporate dividend policies^[26]. Among these factors, investors' perceptions of firm risk are also influenced by information transparency, agency problems, corporate performance, operational risks, and financial risks.

From the perspective of information asymmetry, investors who are at an informational disadvantage may find it difficult to obtain sufficient and effective information to assess the true value of a firm. This increases investment uncertainty and the costs of obtaining information, thereby leading to the emergence of risk premiums and higher transaction costs, which ultimately increase the firm's cost of equity. Digital transformation, however, can generate an information transmission effect and improve the quality of corporate information disclosure in several respects, including information transmission efficiency, willingness to disclose information, and information disclosure channels, thereby reducing the cost of equity. On the one hand, the process of digital transformation

enables firms to establish transparent information disclosure platforms through digital technologies. The collection, analysis, and processing of internal information can be enhanced, allowing financial information within the firm to be utilized more effectively. As a result, firms can disclose financial and non-financial information more accurately and in a timelier manner, thereby improving information quality^[27,28]. On the other hand, digital transformation facilitates the transmission of effective information in the market, enabling investors to obtain more incremental information and gain a more comprehensive understanding of firms' operating conditions. This reduces investors' perceptions of firm risk and, consequently, lowers the cost of equity^[29].

From the perspective of corporate governance, digital transformation can generate a governance effect by optimizing internal organizational structures, strengthening the role of external monitoring, and constraining management's opportunistic behavior in selectively disclosing information for self-interested purposes, thereby reducing the cost of equity. Digital transformation shifts firms from traditional business models toward modern development models based on digital technologies. The application of digital technologies enables firms to implement data-driven decision-making and strengthen the monitoring of managerial decision-making, thereby reducing opportunities for managers to engage in self-interested behavior and alleviating agency problems to some extent^[30]. Furthermore, digital transformation can help firms improve internal risk control, break down information silos within organizations, optimize information transmission processes, and enhance corporate governance. These improvements can send positive signals to relevant stakeholders, strengthen market investors' confidence in firms' development prospects, and consequently reduce the cost of equity^[31].

Based on the above analysis, this study proposes the following hypothesis:

H1: Digital transformation can reduce firms' cost of equity.

4. Research Design

4.1. Sample Selection and Data Sources

To promote the development of the digital economy, the Chinese government promulgated a series of policy documents around 2013 to support the research, development, and application of digital technologies, such as the Medium- and Long-Term Plan for the Construction of National Major Scientific and Technological Infrastructure (2012–2030). This study selects data from A-share listed companies in the Shanghai and Shenzhen stock exchanges over the ten-year period from 2014 to 2023. The data are primarily obtained from the China Stock Market & Accounting Research Database (CSMAR) and the Chinese Research Data Services Platform (CNRDS), supplemented by information collected from the annual reports of sample firms. The data are processed and organized using Stata and Excel.

The sample is screened according to the following criteria: (1) firms in the financial industry are excluded; (2) firms classified as ST are excluded; and (3) firms with substantial missing data are excluded. In addition, all continuous variables are winsorized at the 1% and 99% levels. After applying these screening criteria, a final sample of 18,469 firm-year observations is obtained.

4.2. Variable Definitions

Existing studies primarily employ three approaches to measure corporate digital transformation. The first uses a dummy variable to indicate whether a firm has undertaken digital transformation^[32]. The second measures the degree of digital transformation using the ratio of digital technology-related intangible assets to total intangible assets^[33]. The third employs text analysis to extract the frequency of digital transformation-related keywords from firms' annual reports and uses the resulting word frequency to measure the degree of digital transformation^[34].

Following Wu et al.^[34], this study constructs a digital transformation keyword dictionary, as presented in Table 1. Based on text analysis of firms' annual reports, the characteristic keywords are searched, matched, and counted to obtain the aggregate frequency of digital transformation-related

words, thereby constructing an indicator of corporate digital transformation. Since firms tend to describe their digital transformation activities in ways that are favorable to themselves, the resulting data typically exhibit a pronounced right-skewed distribution. To mitigate the influence of zero values, this study adds one to the total word frequency and then takes its natural logarithm. The resulting measure is used as the overall indicator of corporate digital transformation and serves as the core explanatory variable in this study.

Table 1. Keyword Dictionary for Corporate Digital Transformation

Category	Keywords
Artificial Intelligence Technologies	Artificial intelligence, business intelligence, image recognition, investment decision support systems, intelligent data analysis, intelligent robots, machine learning, deep learning, semantic search, biometric recognition technology, facial recognition, speech recognition, identity verification, autonomous driving, natural language processing
Big Data Technologies	Big data, data mining, text mining, data visualization, heterogeneous data, credit reporting, augmented reality, mixed reality, virtual reality
Cloud Computing Technologies	Cloud computing, stream computing, graph computing, in-memory computing, multi-party secure computing, federated computing, green computing, cognitive computing, federated architecture, hyper-convergence, EB-level storage, Internet of Things, information physical systems
Blockchain Technologies	Blockchain, digital currency, distributed computing, differential privacy technology, smart financial contracts
Digital Technology Applications	Mobile Internet, Industrial Internet, mobile interconnection, Internet healthcare, e-commerce, mobile payment, third-party payment, NFC payment, smart energy, B2B, B2C, C2B, C2C, O2O, Internet of Vehicles, smart wearable devices, smart agriculture, smart transportation, smart healthcare, intelligent customer service, smart home, smart investment advisory, smart tourism, smart environmental protection, smart power grid, smart marketing, digital marketing, unmanned retail, Internet finance, digital finance, FinTech, financial technology, quantitative finance, open banking

Depending on the timing at which risk compensation is determined, the cost of equity capital can be classified into ex ante and ex post costs of equity capital. This study employs the ex ante cost of equity capital, which refers to the minimum required rate of return determined by investors prior to making an investment, based on their expectations of the firm's future risks. The ex ante cost of equity capital is primarily estimated using the PEG and OJ models. Specifically, the PEG model is employed in the baseline regression, while the MPEG and OJ models are adopted in the robustness tests. The calculation procedures for the three models are as follows:

$$R_{peg} = \sqrt{\frac{EPS_2 - EPS_1}{P_0}} \quad (1)$$

Where R_{peg} denotes the cost of equity capital estimated using the PEG model; EPS_2 denotes the forecasted earnings per share EPS two years ahead, based on the current period; EPS_1 denotes the forecasted EPS one year ahead, based on the current period; and P_0 denotes the current stock price.

$$R_{mpeg} = \sqrt{\left(\frac{dps_1}{P_0}\right)^2 + \frac{EPS_2 - EPS_1}{P_0}} + \frac{dps_1}{P_0} \quad (2)$$

Where R_{mpeg} denotes the cost of equity capital estimated using the MPEG model. EPS_1 , EPS_2 , and P_0 are defined consistently with those in the PEG model. In addition, $dps_1 = EPS_1 * \delta$, where δ represents the average dividend payout ratio over the preceding three years. When two real roots are obtained, the positive real root is selected.

$$P_0 = \frac{EPS_1}{r} + \frac{EPS_2 - EPS_1 - r * (EPS_1 - D_1)}{r * (r - g)} \quad (3)$$

Where EPS denotes earnings per share, g denotes the firm's long-term growth rate, r denotes the cost of equity capital, and D denotes dividends per share.

For the control variables, based on the relevant literature and data availability, this study selects firm size (Size), leverage (Lev), return on assets (ROA), revenue growth rate (Growth), board size (Board), number of independent directors (Indep), shareholding ratio of the largest shareholder (Top1), listing age (ListAge), monthly excess turnover rate (Dturn), and controlling shareholder fund occupation (Occupy) as control variables.

4.3. Model Specification

To test the hypotheses proposed in this study, the following model is constructed. In the model, PEG represents the dependent variable, namely the cost of equity capital, while DT represents the explanatory variable, namely digital transformation. Controls denotes the set of all control variables. Year and Industry represent year and industry fixed effects, respectively. The subscripts i and t denote firm i and year t , respectively. α denotes the constant term, α_n denotes the coefficients to be estimated, and ε denotes the random error term.

$$PEG_{i,t} = \alpha_0 + \alpha_1 DT_{i,t} + \sum \alpha_j Controls_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (4)$$

5. Empirical Analysis

5.1. Descriptive Statistics

As shown in Table 2, the mean value of the digital transformation level (Dig) for the sample of selected listed firms during 2013–2022 is 1.792, with a standard deviation of 1.445 and a maximum value of 6.306. These results indicate substantial variation in the extent of digital transformation across firms in China. For the dependent variable, the cost of equity capital (PEG), the mean value is 0.109, with a minimum value of 0.026 and a maximum value of 0.245, indicating considerable differences in the cost of equity capital among listed firms in the Chinese market. Overall, the selected sample firms exhibit a certain degree of representativeness, providing a reasonable basis for the subsequent regression analysis.

Table 2. Descriptive Statistics

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
Dig	18,469	1.792	1.445	0	6.306
PEG	18,469	0.109	0.038	0.026	0.245
Size	18,469	22.640	1.299	19.680	26.090
Lev	18,469	0.414	0.191	0.0521	0.894
ROA	18,469	0.057	0.053	-0.221	0.216
Growth	18,469	0.195	0.367	-0.573	2.213
Board	18,469	2.117	0.198	1.609	2.708
Indep	18,469	0.378	0.055	0.143	0.571
Top1	18,469	0.340	0.148	0.086	0.743
ListAge	18,469	2.145	0.777	0.693	3.367
Dturn	18,469	-0.143	0.499	-2.138	1.034
Occupy	18,469	0.013	0.0222	0.001	0.218

5.2. Baseline Regression

This study conducts the regression analysis using Stata 17. Based on the results of the Hausman test, which yields a p-value of 0.000, a fixed-effects model is employed, with year and industry fixed effects included in the regression. As shown in Table 3, when only fixed effects are considered, the regression coefficient of digital transformation on the cost of equity capital is -0.001 , which is statistically significant at the 5% level. After incorporating the control variables and controlling for year and industry fixed effects, the statistical significance of the coefficient increases. These results

indicate that corporate digital transformation has a significant negative effect on the cost of equity capital, thereby supporting Hypothesis H1.

Table 3. Baseline Regression

	(1) PEG	(2) PEG
Dig	-0.001** (-2.3607)	-0.001*** (-4.6278)
Size		0.002*** (6.6023)
Lev		0.042*** (21.8694)
ROA		0.015** (2.5428)
Growth		0.002* (1.8501)
Board		-0.013*** (-7.6355)
Indep		-0.009* (-1.6589)
Top1		-0.023*** (-12.7844)
ListAge		-0.005*** (-10.4419)
Dturn		0.001* (1.7199)
Occupy		0.034** (2.4535)
_cons	0.097*** (28.6542)	0.083*** (10.8957)
Year	Yes	Yes
Industry	Yes	Yes
N	18469	18469
Adjust-R ²	0.157	0.206

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The values in parentheses are t-statistics.

5.3. Robustness Tests

5.3.1. Alternative Measures of the Explanatory Variable

This study replaces the original measure of digital transformation with two alternative measures: the ratio of intangible assets related to digital technologies to total intangible assets (dig) [33] and the one-period lagged value of digital transformation based on the original measurement approach (LDig). The results are reported in Table 4. The regression coefficients remain significantly negative at the 1% level, indicating that the results are robust and that Hypothesis H1 continues to be supported.

5.3.2. Alternative Measure of the Dependent Variable

This study re-estimates the above model by replacing the original measure of the cost of equity capital with alternative measures based on the MPEG and OJ models. The results are reported in Table 4. After replacing the dependent variable, the regression coefficients of digital transformation on the cost of equity capital remain significantly negative at the 1% level. These results further indicate that digital transformation can effectively reduce firms' cost of equity capital.

Table 4. Alternative Measures of the Core Explanatory Variable

	(1) PEG	(2) PEG	(3) MPEG	(4) OJ
dig	-0.015*** (-5.7824)			
LDig		-0.001*** (-4.0137)		
Dig			-0.001*** (-4.9073)	-0.001*** (-3.9354)
Size	0.002*** (5.8231)	0.002*** (5.5684)	0.005*** (11.9632)	0.001*** (3.7291)
Lev	0.043*** (22.0936)	0.046*** (20.3345)	0.034*** (13.0764)	0.036*** (16.9956)
ROA	0.015** (2.4933)	0.009 (1.2748)	0.036*** (4.4226)	0.001 (0.1541)
Growth	0.002* (1.8042)	0.000 (0.3021)	-0.004*** (-3.8726)	0.001 (1.1578)
Board	-0.012*** (-7.5177)	-0.013*** (-6.6519)	-0.011*** (-4.6718)	-0.011*** (-5.8132)
Indep	-0.009* (-1.6935)	-0.011* (-1.7767)	-0.011 (-1.3777)	-0.006 (-0.9005)
Top1	-0.023*** (-12.5847)	-0.026*** (-11.7287)	-0.011*** (-4.5362)	-0.018*** (-8.7404)
ListAge	-0.005*** (-10.4859)	-0.005*** (-9.8369)	-0.004*** (-7.6422)	-0.005*** (-9.7709)
Dturn	0.001 (1.5845)	-0.002** (-1.9904)	0.004*** (4.6943)	0.003*** (4.0202)
Occupy	0.032** (2.2916)	0.058*** (3.4014)	0.020 (1.1218)	0.022 (1.3961)
_cons	0.087*** (11.4051)	0.074*** (8.3024)	0.030*** (2.8193)	0.123*** (14.2736)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
N	18469	12867	18469	18469
Adjust-R ²	0.207	0.225	0.194	0.167

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The values in parentheses are t-statistics.

5.3.3. Instrumental Variable Approach

To address potential endogeneity concerns, in addition to controlling for year and industry fixed effects, this study employs an instrumental variable approach to conduct an endogeneity test. Following Li et al.^[35], the lagged average level of digital transformation among firms in the same region and industry is selected as the instrumental variable (IV). The rationale for using this instrumental variable is twofold. First, the level of digital transformation among firms in the same region and industry in the previous period is expected to affect the current level of digital transformation of a given firm, thereby satisfying the relevance requirement of the instrumental variable. Second, the lagged average level of industry-level digital transformation in the same region is unlikely to directly affect the firm's current cost of equity capital, thereby satisfying the exogeneity requirement.

As shown in Table 5, the first-stage results of the two-stage least squares (2SLS) estimation show that the coefficient of IV is significantly positive at the 1% level, indicating that the instrumental variable is significantly correlated with the core explanatory variable. Specifically, a higher average level of digital transformation among firms in the same region and industry in the previous period is associated with a higher level of digital transformation for the firm in the current period. The second-stage regression results show that the coefficient of Dig remains significantly negative, indicating that the conclusions obtained above remain unchanged after addressing potential endogeneity concerns.

Table 5. Instrumental Variable Approach

	(1) Dig	(2) PEG	(3) MPEG	(4) OJ
LIV	0.268*** (12.6816)			
Dig		-0.004* (-1.9546)	-0.013*** (-4.0582)	-0.007*** (-2.6270)
Size	0.120*** (9.6472)	0.002*** (5.3515)	0.006*** (9.0182)	0.002*** (3.4032)
Lev	-0.295*** (-3.6173)	0.045*** (19.1485)	0.037*** (10.8287)	0.040*** (14.5822)
ROA	-0.902*** (-3.8523)	0.006 (0.8069)	0.017* (1.6842)	-0.008 (-0.9876)
Growth	0.039 (1.1244)	0.001 (0.4697)	-0.006*** (-4.0747)	0.000 (0.1151)
Board	-0.233*** (-3.4609)	-0.014*** (-6.8275)	-0.014*** (-4.6569)	-0.013*** (-5.5053)
Indep	0.352 (1.5571)	-0.010 (-1.5952)	-0.008 (-0.8449)	-0.006 (-0.8327)
Top1	-0.318*** (-4.3159)	-0.027*** (-11.4689)	-0.017*** (-5.0052)	-0.022*** (-8.2091)
ListAge	-0.059*** (-3.1736)	-0.006*** (-9.8076)	-0.006*** (-7.6314)	-0.006*** (-9.2868)
Dturn	0.062* (1.7251)	-0.002* (-1.7962)	-0.001 (-0.4694)	-0.001 (-0.4853)
Occupy	3.108*** (5.6834)	0.068*** (3.6768)	0.079*** (3.1354)	0.055*** (2.5960)
_cons	-1.135*** (-3.8890)	0.102*** (11.0496)	0.057*** (4.3493)	0.146*** (13.8819)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
N	12867	12867	12867	12867
Adjust-R ²	0.340	0.215	0.138	0.151

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The values in parentheses are t-statistics.

5.4. Mechanism Analysis

To examine the underlying mechanisms through which digital transformation affects the cost of equity capital, this study constructs the following models to test the mediation effect.

$$Mediator_{i,t} = \alpha_0 + \alpha_1 DT_{i,t} + \sum \alpha_j Controls_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (5)$$

$$PEG_{i,t} = \alpha_0 + \alpha_1 DT_{i,t} + \alpha_2 Mediator_{i,t} + \sum \alpha_j Controls_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (6)$$

5.4.1. Degree of Information Asymmetry

Digital transformation promotes the widespread application of digital technologies within firms, thereby broadening channels for information collection, enhancing firms' ability to process non-standardized and unstructured information, and encouraging firms to disclose more information to external markets. Moreover, digital technologies improve the standardization of information formats, the uniformity of information presentation, and the efficiency of information utilization. These improvements expand the scope of digital information utilization and enhance the flow and transmission efficiency of information both within and outside the firm, thereby reducing information asymmetry. A lower degree of information asymmetry enables market participants to more accurately assess a firm's risk and investment value, reduces investors' uncertainty regarding the firm's future profitability, and lowers the rate of return required by investors to compensate for investment risk. Consequently, the cost of equity capital is reduced.

This study employs the information asymmetry index developed by Song et al.^[36] using principal component analysis. A higher value of the index indicates a higher degree of information asymmetry. As shown in Table 6, the regression coefficient of digital transformation on information asymmetry is significantly negative at the 1% level, indicating that firms' digital transformation can effectively reduce information asymmetry. After incorporating both digital transformation and information asymmetry into the regression model, the coefficient of digital transformation on the cost of equity capital remains significantly negative, while the coefficient of information asymmetry on the cost of equity capital is significantly positive. These results indicate that information asymmetry plays a mediating role in the relationship between digital transformation and the cost of equity capital, supporting the existence of the mediation effect.

Table 6. Mediating Effect of Information Asymmetry

	(1) PEG	(2) ASY	(3) PEG
Dig	-0.001*** (-4.6278)	-0.023*** (-9.3541)	-0.001*** (-3.2116)
ASY			0.013*** (20.3824)
Size	0.002*** (6.6023)	-0.308*** (-57.8061)	0.006*** (16.0589)
Lev	0.042*** (21.8694)	0.434*** (20.4035)	0.036*** (18.8656)
ROA	0.015** (2.5428)	-2.085*** (-26.5278)	0.042*** (6.8452)
Growth	0.002* (1.8501)	-0.035*** (-3.6160)	0.002** (2.3555)
Board	-0.013*** (-7.6355)	-0.033 (-1.5395)	-0.012*** (-7.4116)
Indep	-0.009* (-1.6589)	-0.520*** (-7.1991)	-0.002 (-0.4440)
Top1	-0.023*** (-12.7844)	0.588*** (27.6080)	-0.031*** (-16.8035)
ListAge	-0.005*** (-10.4419)	-0.020*** (-3.8371)	-0.004*** (-9.9609)
Dturn	0.001* (1.7199)	-0.062*** (-10.1785)	0.002*** (3.0801)
Occupy	0.034** (2.4535)	-0.422*** (-2.6973)	0.040*** (2.8299)
_cons	0.083*** (10.8957)	6.505*** (55.3218)	-0.002 (-0.2321)
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
N	18469	18469	18469
Adjust-R ²	0.206	0.506	0.223

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The values in parentheses are t-statistics.

5.4.2. Corporate Governance

Digital transformation enables firms to employ digital tools and technologies, such as big data analytics and artificial intelligence, to monitor and provide early warnings of operational risks in real time, thereby improving firms' responsiveness to and ability to manage risks. Meanwhile, digital transformation breaks down departmental barriers by facilitating the integration of resources and decision-making and enabling data connectivity, thereby fostering a new organizational structure centered on smart contracts and reshaping the internal governance environment. According to information transmission theory and risk compensation theory, firms with effective governance can convey information about sound business operations to investors, thereby alleviating investors' and creditors' concerns about operational and financial risks. To avoid investment risks, rational investors

tend to invest in firms with sound governance structures, which can reduce firms' financing costs in the capital market and, consequently, lower their cost of equity capital.

This study uses the DIB Internal Control Index to measure the quality of corporate governance. Given the relatively large magnitude of the index, following Lu et al.^[37], this study divides the DIB Internal Control Index by 100 for standardization and uses the resulting value as a measure of internal control quality, denoted as IC. As shown in Table 7, digital transformation first has a significant positive effect on firms' internal control index. After incorporating both digital transformation and internal control quality into the regression analysis, the coefficients of digital transformation and the internal control index on the cost of equity capital remain significantly negative. These results indicate that internal control quality plays a mediating role in the relationship between digital transformation and the cost of equity capital, supporting the existence of the mediation effect.

Table 7. Mediating Effect of Corporate Governance

	(1) PEG	(2) IC	(3) PEG
Dig	-0.001*** (-4.6278)	0.041*** (6.7981)	-0.001*** (-4.4612)
IC			-0.001*** (-2.8826)
Size	0.002*** (6.6023)	0.177*** (19.7527)	0.002*** (7.0181)
Lev	0.042*** (21.8694)	-0.005 (-0.0859)	0.042*** (21.8683)
ROA	0.015** (2.5428)	4.432*** (21.6905)	0.019*** (3.0976)
Growth	0.002* (1.8501)	0.167*** (5.7742)	0.002** (2.0059)
Board	-0.013*** (-7.6355)	0.037 (0.7413)	-0.013*** (-7.6194)
Indep	-0.009* (-1.6589)	0.474*** (2.6717)	-0.009 (-1.5902)
Top1	-0.023*** (-12.7844)	0.127** (2.3469)	-0.023*** (-12.7233)
ListAge	-0.005*** (-10.4419)	-0.093*** (-6.8776)	-0.005*** (-10.6175)
Dturn	0.001* (1.7199)	-0.011 (-0.6965)	0.001* (1.7062)
Occupy	0.034** (2.4535)	-2.489*** (-4.1948)	0.032** (2.3061)
_cons	0.083*** (10.8957)	2.204*** (8.9634)	0.085*** (11.0888)
Year	Yes	Yes	Yes
Industry	Yes	Yes	Yes
N	18469	18469	18469
Adjust-R ²	0.206	0.102	0.207

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The values in parentheses are t-statistics.

5.5. Heterogeneity Analysis

Columns (1) and (2) of Table 8 present the subgroup regression results by geographical region. The results show that digital transformation has a significantly negative effect on the cost of equity capital for firms located in the eastern region, whereas the regression coefficient for firms in the central and western regions is negative but statistically insignificant. One possible explanation is that, compared with the eastern region, the central and western regions have a smaller sample size, which may affect the regression results. More importantly, however, compared with the central and western regions, the eastern region has a stronger economic foundation, providing sufficient financial support for digital investment. In addition, the eastern region has taken the lead in optimizing and upgrading

its industrial structure, with higher proportions of high-tech industries and the service sector, making it easier for firms to achieve deep integration with digital technologies and generate new sources of economic growth. Meanwhile, the eastern region has a greater concentration of talent and a more favorable innovation environment, which facilitates the rapid development and application of digital technologies and further enhances the benefits of digital transformation.

Columns (3) and (4) of Table 8 follow the approach of Jiang et al.^[38], using the ratio of the total compensation of the three highest-paid executives to the total compensation of all executives as a proxy for managerial overconfidence. The full sample is then divided according to the 75th percentile. The results indicate that when managers exhibit overconfidence, digital transformation is more effective in reducing firms' cost of equity capital. Managerial overconfidence refers to managers' tendency to overestimate their own abilities, which often leads them to underestimate objective risks and may consequently weaken the quality of internal control. Through multiple channels—including improving risk management capabilities, strengthening internal controls, optimizing financing structures, enhancing information transparency, improving decision-making processes, and increasing regulatory efficiency—digital transformation can effectively mitigate the negative effects of managerial overconfidence on firms.

Table 8. Heterogeneity Analysis

	(1) Eastern Region PEG	(2) Central and Western Regions PEG	(3) Managerial Overconfidence PEG	(4) Managerial Non- overconfidence PEG
Dig	-0.001*** (-5.9845)	0.001 (1.1837)	-0.002*** (-5.9240)	-0.000 (-0.9922)
Size	0.002*** (4.2869)	0.003*** (4.7964)	0.000 (0.8370)	0.004*** (7.9694)
Lev	0.043*** (18.8430)	0.041*** (10.8300)	0.050*** (16.6698)	0.036*** (14.6737)
ROA	0.014** (1.9798)	0.019* (1.6642)	0.008 (0.8368)	0.025*** (3.1033)
Growth	0.002** (2.0987)	0.000 (0.1749)	-0.001 (-1.0393)	0.003*** (2.8289)
Board	-0.010*** (-5.1709)	-0.017*** (-5.3069)	-0.014*** (-5.6181)	-0.012*** (-5.5501)
Indep	0.000 (0.0564)	-0.030*** (-2.8163)	-0.004 (-0.4875)	-0.013* (-1.6884)
Top1	-0.024*** (-11.3199)	-0.023*** (-6.4129)	-0.027*** (-10.1916)	-0.021*** (-8.4597)
ListAge	-0.005*** (-9.0405)	-0.004*** (-4.3269)	-0.001 (-1.3822)	-0.007*** (-11.8729)
Dturn	0.001** (2.1240)	-0.000 (-0.0908)	-0.002** (-2.0823)	0.003*** (3.3091)
Occupy	0.028* (1.7447)	0.060** (2.1115)	0.060** (2.5665)	0.015 (0.8393)
_cons	0.085*** (9.7466)	0.075*** (5.0726)	0.124*** (9.7580)	0.053*** (5.0351)
Yea	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
N	13534	4935	7387	11082
Adjust-R ²	0.216	0.186	0.212	0.213

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively. The values in parentheses are t-statistics.

6. Summary

Against the backdrop of digitalization, firms need to undertake digital transformation in order to seize development opportunities. To examine the practical effects of digital transformation, this study conducts an empirical analysis using a sample of non-financial listed firms in China from 2014 to

2023. The main findings are as follows. First, an increase in the degree of corporate digital transformation significantly reduces the cost of equity capital. Specifically, digital transformation can reduce firms' cost of equity capital by mitigating information asymmetry and improving corporate governance. Moreover, the effect of digital transformation on reducing the cost of equity capital is more pronounced among firms located in the eastern region and firms with overconfident senior executives.

Based on these findings, this study proposes the following recommendations. First, firms should promptly develop awareness of the importance of digital transformation, update their development strategies, and adapt to changing circumstances. In addition, firms should strengthen the development of organizational structures that are compatible with digital transformation and innovate their operating mechanisms in accordance with the characteristics of digital technology development. Second, firms should proactively improve the quality of information disclosure and enhance their existing internal control systems to improve internal control quality. Firms should ensure the authenticity, completeness, and timeliness of disclosed information so as to enhance transparency and maintain the trust of investors and other stakeholders. At the same time, firms should further improve internal management efficiency and risk prevention capabilities by systematically reviewing business processes, identifying and assessing potential risks, formulating targeted control measures, and establishing sound monitoring and feedback mechanisms. Third, the government should actively guide firms in undertaking digital transformation at the level of national development strategies, promote the digitalization of firms, and help firms develop a correct understanding of the impact of digital transformation. Greater policy support and financial assistance should be directed toward the central and western regions, particularly in areas such as infrastructure development, technological innovation, education, and healthcare, in order to attract more capital and talent to these regions.

Due to limitations in the author's capabilities and objective research conditions, this study has several limitations regarding the relationship between corporate digital transformation and the cost of equity capital. First, in terms of sample selection, this study uses data on listed firms in the Shanghai and Shenzhen stock markets in China from 2014 to 2023, but does not further examine how the effects of digital transformation vary across industries and firm sizes, which constitutes a limitation of the study. Future research could employ more comprehensive sample data and investigate the effects of digital transformation in greater detail by region, industry, and stage of development. Second, in terms of variable selection, this study adopts a widely used existing indicator system for measuring corporate digital transformation but does not further refine or improve the measurement framework. Future studies could develop more diverse and targeted measurement approaches to conduct more comprehensive empirical analyses. Third, in terms of timeliness, this study does not consider the effects of temporal dynamics. Future research could examine time trends and dynamic effects to determine whether the empirical results vary over time. Finally, in terms of regression analysis, this study controls only for year and industry fixed effects and does not further investigate other fixed effects, such as province- and firm-level fixed effects. In addition, the robustness tests and heterogeneity analyses employed in this study are relatively conventional. Future research could explore more diverse testing and analytical approaches to make the empirical findings more comprehensive and scientifically robust.

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