

Digital Transformation and Financing Constraints: Empirical Research on Listed Companies in China

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ABSTRACT

With the development of digital technology advancement and digital transformation proceeding, the relationship between the degree of digital transformation and financing constraints of Chinese listed companies deserves to be further explored. This research explores the effect of digital transformation and financing constraints through empirical research, taking the Chinese listed companies from the year 2013 to 2020 as the research sample. The research reveals that there is a significant negative effect between digital transformation and financing constraints.

Keywords: Digital Transformation, Empirical Research, Financing Constraints.

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I. INTRODUCTION

In May 2020, the Chinese National Development and Reform Commission released the Digital Transformation Partnership Initiative, advocating that the government and the whole society should work together to promote the digital transformation of businesses, accelerate the creation and construction of digital enterprises, cultivate digital ecology, and form a digital ecological community to support high-quality economic development.

In fact, the concept of digital transformation was actually first introduced in 2012. The initiative of the Chinese National Development and Reform Commission has also brought digital transformation to the attention of the whole society. At present, a number of enterprises in China have already started their digital transformation and hope to improve their development capabilities through digital transformation.

At the same time, it is worth noting that financing constraints, as one of the factors limiting the development of enterprises, will have a negative impact on the ability of enterprises to develop in the long term. In order to reduce the financing cost of enterprises, the Chinese government established the Beijing Stock Exchange in September 2021 to enhance the financing capacity of enterprises.

Based on this, this paper conducts empirical research on digital transformation and financing constraints of Chinese listed companies. The possible innovations of this paper are mainly reflected in the following two aspects: One is that it proves that there is a negative effect between digital transformation and financing constraints of Chinese listed companies. The other is empirical research provides a theoretical basis for companies to promote digitalisation. The following section will illustrate the above research process and contributions: Part II is a literature review, Part III is the research design, Part IV is the empirical research, and Part V is the conclusion.

II. LITERATURE REVIEW

Sheng and Xu (2022) argue that digital transformation will help improve the information environment and business environment of firms and act as a pathway through this influence mechanism, thereby alleviating the financing constraints of firms. Also, Wang *et al.* (2022) also believe that digital transformation will significantly reduce the risk of debt default through financing constraints as a mediating effect. In general, current research related to digital transformation and financing constraints all suggest that there is a positive effect for digital transformation to alleviate the risk of enterprises.

Furthermore, there are currently several ways of quantifying the degree of digital transformation. Chen *et al.* (2020) summarised some production changes after the digital transformation of enterprises as the characteristics of digital transformation, but it is used for qualitative research mainly, which is difficult to be a quantitative reference for quantitative research. Wang *et al.* (2017), on the other hand, advocated measuring the degree of digital transformation in terms of the percentage of information employees, but informatisation cannot be equated with digitalisation, so this way of quantifying the degree of digital transformation may not be desirable. He and Liu (2019) suggest using the percentage of digitisation-related intangible assets to measure the degree of digital transformation. However, digitisation-related intangible assets are often subject to the degree of capitalisation of R&D expenditure, or even accrual earnings management behaviour, which may bias and affect the empirical results.

By contrast, Wu *et al.* (2020) and Zhao (2021) argue that the information related to digital transformation disclosed in the annual reports of listed companies sub-quantifies the degree of digital transformation, and the annual reports of listed companies often have a certain information content, which to a certain extent can reflect the development strategy

of the de-enterprise. Thus, it is feasible and somewhat objective to adopt the digitalisation-related vocabulary disclosed in the annual reports of listed companies to sub-quantify the degree of digital transformation of listed companies.

Therefore, based on the above literature review, this paper develops empirical research on the effect between digital transformation and financing constraints of Chinese listed companies.

III. EMPIRICAL DESIGN

Based on the above analysis, this paper proposes the following hypothesis.

H0: The degree of digital transformation of enterprises is positively related to financing constraints. In other words, the higher the degree of digital transformation of enterprises, the greater the financing constraints.

H1: The degree of digital transformation of enterprises is negatively correlated with financing constraints. In other words, the higher the degree of digital transformation of enterprises, the smaller the financing constraints.

A. Sample

In this paper, data from Chinese listed companies from 2013 to 2020 (data from the CSMAR database) were selected for analysis. The sample was screened according to the following criteria: ① excluding special treatment companies; ② excluding the financial sector samples; ③ excluding listed companies with incomplete data research and abnormal data during the sample period, resulting in 494 sample companies with a total sample size 3,952.

B. Variables

Predicted variable: financing constraints (CONSTRAINTS), referencing (Ju *et al.*, 2013) and (Hadlock *et al.*, 2010) to develop a SA financing constraints model to measure the degree of financing constraints of the enterprises.

Explanatory variable: Digital Transformation (DT), referencing (Wu *et al.*, 2020) and (Zhao, 2021), the degree of digital transformation is measured by the number of disclosures of digital transformation keywords in the annual reports of listed companies in the fields of artificial intelligence technology, blockchain technology, cloud computing technology, big data technology and digital technology applications, such as the number of occurrences of keywords such as artificial intelligence, digital currency, in-memory computing, big data and mobile internet, and the word frequency statistics all exclude expressions with negative words such as "none", "none" and "no" before the keywords.

Control variables: Referring to (Sheng & Xu, 2022) the following variables were controlled for ①asset (SIZE); ②asset-liability ratio (LEV); ③return on equity (ROE); ④increase rate of gross revenue (GROWTH); ⑤nature of ownership (SOE) and ⑥listed age (LA). Also, this paper conducts dummy variables to control for year and industry: ①year (YEAR) and ②individual (IND).

C. Variables Description and Models

Equation (1) is the equation and description of the SA financing constraint model.

$$SA = -0.737 * Size + 0.043 * Size^2 - 0.040 * Age \quad (1)$$

Size is the natural logarithm of the total asset size of the business; Age is the length of time the business has been in operation.

TABLE I: VARIABLES DESCRIPTION

Type of variable	Variable name	Description
Predicted variable	CONSTRAINTS	Model (1)
Explanatory variable	DT	Ln_{DT}
Control variable	SIZE	Ln_{Assets}
Control variable	LEV	$\frac{Liabilities}{Assets}$
Control variable	ROE	$\frac{Net\ profit}{Owner's\ equity}$
Control variable	GROWTH	$\frac{Gross\ revenue_n}{Gross\ revenue_{n-1}} - 1$
Control variable	SOE	First major shareholder is state-owned=1, else=0
Control variable	LA	$Ln_{Firm\ age}$
Dummy variable	YEAR	-
Dummy variable	IND	-

IV. EMPIRICAL RESEARCH

This paper uses STATA16 software for statistical processing. For the sake of excluding outliers from interfering with the empirical results, this paper has shrunk the tails of continuous variables at 0~1% and 99%~100% of their distributions and performed variance inflation factor (VIF) diagnostics on all explanatory and control variables entering the model. The results show that the maximum value of VIF is 1.790 and the mean value is 1.380, so there is no multicollinearity problem.

A. Linear Regression Model

For the purpose of checking whether the digital transformation has a significant impact on financing constraints, this paper develops an OLS multiple linear regression model to conduct empirical research, model (a) is given in (2).

$$Y = \alpha_0 + \alpha_1 DT + \alpha_2 Controls + \alpha_3 YEAR + \alpha_4 IND + \mu \quad (2)$$

Y represents the predicted variable *CONSTRAINTS* for the selected sample. α_0 represents the intercept terms. α_1 is the regression coefficient of the explanatory variable *DT*. *Control* represents the control variables selected for this paper. *YEAR* and *IND* are the dummy variables year and industry respectively. μ is the random disturbance term.

B. Descriptive Statistics and Matrix of Correlations

Table II provides descriptive statistics for the variables involved in the research. The predicted variable (CONSTRAINTS) is concluded to be normally distributed by drawing a histogram.

TABLE II: DESCRIPTIVE STATISTICS

Variable	Observation	Mean	Std.Dev.	Min	Max
CONSTRAINTS	3952	-3.816	0.248	-4.460	-3.216
DT	3952	2.451	1.301	0	5.268
SIZE	3952	22.442	1.240	20.099	26.244
LEV	3952	0.402	0.192	0.055	0.836
ROE	3952	0.070	0.103	-0.424	0.339
GROWTH	3952	0.141	0.310	-0.523	1.703
SOE	3952	0.348	0.476	0	1
LA	3952	2.374	0.606	0.693	3.434

A. Linear Regression Results

Table III represents the linear regression results. Regression models OLS (a), shows the significance between digital transformation and financing constraints. As can be seen from Table IIV, digital transformation has a significant positive effect on financing constrain. Thus, the previous hypothesis H1 is verified.

TABLE III: LINEAR REGRESSION RESULTS

Variable	CONSTRAINTS	CONSTRAINTS
DT	-0.004***(0.001)	-0.003***(0.001)
SIZE	-	0.016***(0.004)
LEV	-	-0.038***(0.011)
ROE	-	-0.020***(0.009)
GROWTH	-	-0.005*(0.003)
SOE	-	-0.016***(0.005)
LA	-	-0.108***(0.007)
YEAR	control	control
IND	control	control
Constant	-3.096***(0.045)	-3.159***(0.112)
N	3952	3952
R ²	0.975	0.979

Note (the same below): *, ** and *** indicate significance at the 10%, 5% and 1% levels respectively; Standard Error of Mean between brackets.

B. Robustness Tests

For the sake of testing the robustness, this paper referred to (Zhang *et al.*, 2017) and (Chen & Zheng, 2020) to replace the predicted variable FC with FC Model.

Equation (3) and (4) are the equation and description of the FC financing constraint model.

$$P(\text{QUFC} = 1 \text{ or } 0 \mid Z_{i,t}) = \frac{e^{Z_{i,t}}}{1+e^{Z_{i,t}}} \tag{3}$$

$$Z_{i,t} = \alpha_0 + \alpha_1 size_{i,t} + \alpha_2 lev_{i,t} + \alpha_3 \left(\frac{CashDiv}{ta}\right)_{i,t} + \alpha_4 MB_{i,t} + \alpha_5 \left(\frac{NWC}{ta}\right)_{i,t} + \alpha_6 \left(\frac{EBIT}{ta}\right)_{i,t} \tag{4}$$

Firstly, standardize the three variables (company size, company existing years, and cash dividend payment rate) by year ($y_i = \frac{x_i - \bar{X}}{s}$, $\bar{X} = \frac{1}{n} \sum^n X_i$, $s = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (X_i - \bar{X})^2}$) , and arrange the listed firms in ascending order according to the mean value of standardized variables, and take tertile as cutoff points of financing constraints to determine the financial constraint dummy variable QUFC. Listed firms of top 33% quantile are defined as low financing constraint group, QUFC = 0, and listed firms of bottom 66% are defined as high financing constraint group, QUFC=1. Secondly, perform Logit regression on model (2.2) to calculate the financing

constraint occurrence probability P of each year and define it as the financing constraint index FC (with a value between 0 and 1). The larger FC index is, the more serious the financing constraint problem of the enterprise is.

Size is asset scale of the company (natural logarithm of total assets), lev is financial leverage ratio of the company, CashDiv is cash dividends paid by the company in the current year, MB is market-to-book of the company, NWC is net working capital, EBIT is earnings before interest and taxes and ta is total assets.

As can be seen from the regression results in Table IV, the negative effect of digital transformation on financing constraints remains significant which indicates that the regression results are robust.

TABLE IV: FC MODEL LINEAR REGRESSION RESULTS

Variable	CONSTRAINTS
DT	-0.006***(0.003)
SIZE	-0.158***(0.006)
LEV	-0.259***(0.024)
ROE	0.085***(0.027)
GROWTH	-0.012***(0.006)
SOE	0.036***(0.016)
LA	-0.074***(0.013)
YEAR	control
IND	control
Constant	4.550***(0.151)
N	3952
R ²	0.900

For the purpose of avoiding the omission of variables from the empirical research results, this paper uses a fixed effects model to explore the endogeneity issue. As can be seen from the regression results in Table V, the regression results remain significant.

TABLE V: FIXED MODEL LINEAR REGRESSION RESULTS

Variable	CONSTRAINTS
DT	-0.003***(0.001)
SIZE	0.016***(0.006)
LEV	-0.038***(0.014)
ROE	-0.020*(0.009)
GROWTH	-0.005(0.004)
SOE	-0.016***(0.003)
LA	-0.108***(0.006)
YEAR	control
IND	control
Constant	-3.260***(0.133)
N	3952
R ²	0.976

For the sake of avoiding the problem of sample bias. This paper referred to (Zhao *et al.*, 2022) to explore the robustness of the regression results by using the propensity-matching score method. According to the propensity matching score result, it is known that the mean value of the error after matching is 3.9%, the maximum value is 4.8% and the minimum value is -6.9%; and the figure for the t-test is basically greater than 0.005, which can pass the equilibrium test. Moreover, the figure for ATT shows that the figure for t-stat is -2.090, so the result of the propensity matching score method is significant at the 5% level. Thus, hypothesis H1 is verified.

TABLE VI: PSM LINEAR REGRESSION RESULTS

	MATCHED BIAS	P> t
SIZE	-6.90%	0.004
LEV	2.50%	0.282
ROE	-3.20%	0.170
GROWTH	4.80%	0.030
SOE	0.90%	0.693
LA	-5.00%	0.025
ATT	-3.818**	

V. CONCLUSION

This paper uses data from the sample of Chinese listed companies selected from 2013 to 2020 as the research sample and analyses the impact effect between digital transformation and financing constraints through empirical research, proving that digital transformation of Chinese listed companies has a significant negative effect with financing constraints. As a result, the digital transformation of listed companies can help to promote the alleviation of financing constraints, provide favourable conditions for enterprises to expand the scale of development, and also improve the ability to raise funds, alleviate the problem of capital chain tensions and reduce operational risks.

CONFLICT OF INTEREST

The author declares that he does not have any conflict of interest.

REFERENCES

- Chen, J., Huang, S., & Liu, Y. (2020). From empowerment to enablement - Enterprise operation management in the digital environment. *Management World*, (02), 117-128.
- Chen, J., & Zheng, H. (2020). Financing constraints, customer bargaining power and corporate social responsibility. *Accounting Research*, (08), 50-63.
- Gu, L., & Wang, H. (2020). Social trust, financing constraints and firm innovation. *The Economist*, (11), 39-50.
- Hadlock, C. J., & Pierce, J. R. (2010) New Evidence on Measuring Financial Constraints: Moving Beyond the KZ Index. *Review of Financial Studies*, 23(5), 1909-1940.
- He, F., & Liu, H. (2019). Assessment of the performance-enhancing effect of digital change in real enterprises from the perspective of the digital economy. *Reform*, (04), 137-148.
- Ju, X., Lu, D., & Yu, Y. (2013). Financing constraints, working capital management and the sustainability of corporate innovation. *Economic Research*, (01), 4-16.
- Sheng, S., & Zhan, X. (2022). Regional digital economy development and corporate financing constraints. *Industrial Technology Economics*, (01), 21-28.
- Wang, S., Xu, X., & Liu, Y. (2022). Will digital transformation of enterprises reduce the risk of debt default. *Securities Market Herald*, (04), 45-56.
- Wang, Y., Kuang, X., & Shao, W. (2017). Informatization, firm flexibility and capacity utilization. *World Economy* (01), 67-90.
- Wu, F., Hu, H., Lin, H., & Ren, X. (2021). Corporate digital transformation and capital market performance-Empirical evidence from stock liquidity. *Management World*, (07), 130-144.
- Zhao, C. (2021). Digital Development and Service Transformation - Empirical Evidence from Listed Manufacturing Companies. *Nankai Management Review*, (02), 149-163.
- Zhang, Y., Zhang, F., & Li, Y. (2017). Accounting robustness, financing constraints and investment efficiency. *Accounting Research*, (09), 35-40.
- Zhao, Y., Hou, H., & Miao, X. (2022). Government environmental subsidies, institutional incentives and corporate green innovation-An empirical analysis based on propensity score matching method. *Local Finance Research*, (01), 49-62.