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Digital Transformation of Commercial Banks, Risk-Taking, and the Short-Term Borrowing and Long-Term Utilization by Technology-based SMEs

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Abstract: Under the context of a strong science and technology nation, SMEs face difficulties in meeting banks' long-term credit review standards due to their relatively small scale and single profit model, leading to a severe phenomenon of using short-term debt for long-term purposes. A disruption in the funding chain can severely impact the innovation drive and vitality of these enterprises, hinder the cultivation of high-tech enterprises, and affect the transformation of China's economy towards high-quality development. The Third Plenary Session of the 20th CPC Central Committee proposed establishing a technology finance system that aligns with scientific and technological innovation, emphasizing enhanced financial support for national major S&T tasks and small and medium-sized technology enterprises, and improving policies supporting long-term capital investment in early-stage, small-scale, long-term, and hard S&T ventures. It is significant to explore whether and how the digital transformation of commercial banks can curb the practice of using short-term debt for long-term purposes among small and medium-sized technology enterprises. Based on panel data from Growth Enterprise Market companies between 2017-2021, this paper constructs a two-way fixed-effects model to investigate the impact and implementation paths of commercial banks' digital transformation on such enterprises' use of short-term debt for long-term purposes. The results indicate that the digital transformation of commercial banks indirectly curbs this practice by enhancing proactive risk-taking before lending, and its effectiveness is moderated by the ESG performance of small and medium-sized technology enterprises. The findings provide empirical insights for alleviating financing difficulties for small and medium-sized technology enterprises and addressing mismatches in investment and financing term structures for commercial banks; they also offer policy references for accelerating the realization of high-level S&T self-reliance and comprehensive green transformation of economic and social development.

Keywords: Digital Transformation of Commercial Banks; Short-term Debt for Long-term Use; Risk-taking; ESG Performance; Theory of Liquidity Creation.

1. Introduction

The Third Plenary Session of the 20th Central Committee of the Communist Party of China identified "strengthening the principal role of enterprises in scientific and technological innovation" as a crucial aspect of deepening the reform of the science and technology system. Technology-based small and medium-sized enterprises (SMEs) are highly dynamic innovation entities. In 2023, there were 500,000 technology-based SMEs nationwide, contributing over 70% of technological innovations, and 465,000 high-tech enterprises, with an invention patent industrialization rate of 57.6%. However, technology-based SMEs generally face the issue of using short-term debt for long-term purposes, which limits their research and development investment and innovation vitality, highlighting the shortcomings of traditional financial services in supporting the real economy. According to the "Third Quarter Monetary Policy Implementation Report of China in 2024," the loan approval rate for technology-based SMEs was only 46.8%, while that for high-tech enterprises was 55.7%, indicating insufficient financing availability. In the first three quarters of 2024, the average interest rate on inclusive loans to small and micro enterprises was 4.42%, higher than the benchmark short-term loan interest rate for the same period, resulting in high financing costs that hinder enterprise innovation and development. Technology-based SMEs, due to their small scale, singular profit model, limited assets for guarantee and mortgage, and higher operational risks, often fail to meet bank credit review standards. They face difficulties in obtaining loans from commercial banks, with loans being expensive and of limited duration, leading to a serious issue of using short-term debt for long-term purposes. Essentially, this phenomenon represents a mismatch in the term structure of corporate investment and financing, where companies continuously roll over short-term debt to support long-term asset investments. Although this behavior can maintain the flexibility of corporate capital allocation, it can easily lead to tight capital flows or even a broken capital chain, dampening the innovation momentum and vitality of technology-based SMEs, hindering the cultivation of high-tech enterprises, and affecting China's transition towards high-quality economic development.

As a key indirect financial entity, commercial banks' operation and risk control models profoundly influence corporate investment and financing behaviors. The Third Plenary Session of the 20th Central Committee of the Communist Party of China proposed the establishment of a technology finance system tailored to technological innovation, strengthening financial support for technology-based small and medium-sized enterprises. In 2023, the Central Financial Work Conference outlined "five major initiatives" to provide policy guidance for banks' digital transformation. There is a divergence of views in academia regarding the relationship between banks' digital transformation and enterprises' short-term debt utilization. Negative views argue that under digital technology, banks are

more likely to capture negative signals from enterprises, tighten long-term loans to avoid risks, and exacerbate maturity mismatch . At the same time, fintech intensifies industry competition and inhibits financing for SMEs. Positive views emphasize that the "inclusive effect" of digitization can reach groups that are difficult to serve by traditional finance, and big data risk control can reduce financing thresholds and optimize credit decisions, thereby mitigating short-term debt utilization [1].

Under the traditional credit model, technology-based SMEs, due to their long innovation cycles and high risks, are contrary to the operating principles of banks, leading to low willingness of banks to bear risks and insufficient credit inclination, which traps enterprises in the dilemma of using short-term debt for long-term purposes. The Third Plenary Session of the 20th Central Committee of the Communist Party of China proposed the establishment of a technology finance system that is compatible with technological innovation, where the characteristics of corporate scientific and technological innovation and ESG performance can become important bases for bank credit decisions. In the new digital-enabled financial ecosystem, there is still considerable room for research on how to rely on the characteristics of scientific and technological innovation and ESG performance to optimize long-term bank credit allocation, alleviate the short-term debt for long-term use of enterprises, and build a "technology-industry-finance" cycle. In the context of becoming a technological powerhouse and green transformation, it is of great significance to clarify the mechanism of bank risk-taking and explore the moderating effect of ESG performance on the relationship between bank digital transformation and the short-term debt for long-term use of technology-based SMEs.

This paper empirically examines how commercial banks' digital transformation inhibits the level of short-term debt used for long-term purposes by technology-based SMEs by enhancing their proactive risk-taking before lending, through collecting data on GEM listed companies and bank-enterprise matching relationships from 2017 to 2021. Furthermore, the ESG performance of technology-based SMEs positively moderates the relationship between commercial banks' digital transformation and the short-term debt used for long-term purposes by technology-based SMEs, as well as positively moderating the mediating effect of bank risk-taking on this relationship. The marginal contributions of this paper are mainly reflected in the following three aspects: 1) It reveals the mechanism through which commercial banks' digital transformation affects the short-term debt used for long-term purposes by technology-based SMEs from the perspective of risk-taking, enriching and supplementing research on the influencing factors of the phenomenon of enterprises using short-term debt for long-term purposes. 2) This paper studies the impact of banks' digital transformation on their risk-taking and credit business, providing empirical evidence for financial technology to empower banks and achieve "rejuvenating the bank through technology". 3) It focuses on the role of enterprises' ESG performance in bank-enterprise lending behavior. Enterprises' ESG performance helps commercial banks select and identify enterprises to better support green and low-carbon development policies, encouraging enterprises to cultivate sustainable development capabilities for their own positive economic outcomes.

2. Theoretical Analysis and Research Hypothesis

(1)Research hypothesis 1

According to modern financial intermediation theory, banks play the role of risk conversion and liquidity creation . Their liquidity creation serves the real economy by transforming high liquidity liabilities into low liquidity assets[2]. Under the background of digitalization, it is of great significance to explore whether commercial banks can optimize risk-taking with the help of financial technology, serve technology-based small and medium-sized enterprises, and curb their short-term debt and long-term use.

Based on the theoretical framework of liquidity creation proposed by Berger and Bouwman, the transmission mechanism can be explored from both assets and liabilities. On the asset side, the extensive growth of traditional banks and geographical restrictions have made technology-based SMEs "long tail customers" and difficult to obtain long-term credit[3]. In addition, the high supervision cost of long-term borrowing leads to the low proportion of long-term financing, which induces the long-term use of short-term debt[4]. The digital transformation of banks can optimize the asset side from three aspects and increase the supply of long-term credit.

Small and medium-sized technology-based enterprises are characterized by high digitalization and asset light [5][6]. In terms of lending mode, banks rely on AI, blockchain and other technologies to achieve refined lending. Blockchain can determine data assets, identify enterprise innovation ecology, and AI and big data alleviate information asymmetry [7] [8] [9], digital settlement eliminates artificial bias, optimizes credit reporting and financial products, and increases long-term credit. In terms of lending costs, digitalization improves information transparency[4], reduces supervision costs, and improves supply willingness. In terms of loan availability, digitalization breaks through geographical restrictions, reaches long tail customers and improves the availability of long-term credit.

On the liability side, according to the liquidity creation theory, the financial supplier uses liquidity liabilities to finance non current assets[10]. The inclusive and long tail effects of digital transformation of banks broaden the scope of services, increase the deposit increment, provide financial support for long-term lending, meet the long-term financing needs of enterprises, and curb the long-term use of short-term debt.

Accordingly, this paper puts forward: research hypothesis 1: the digital transformation of commercial banks can increase the supply of long-term credit and inhibit the short-term debt and long-term use of technology-based SMEs.

(2)Research hypothesis 2

Specifically, the digital transformation of commercial banks mainly improves the level of pre loan risk-taking through technology spillover effect and external competition effect, and then inhibits the long-term use of short-term debt of technology-based SMEs.

In terms of technology spillover effect, on the asset side, digital transformation has changed the way banks create and obtain value [11], formed a new credit ecosystem for science and technology-based small and medium-sized enterprises relying on emerging technologies, weakened bank risks and improved risk-taking[12]; The technology spillover of fintech helps banks improve their technological innovation ability, enhance their confidence in asset side services, and actively

improve their prior risk-taking[13]. The higher the risk-taking, the more banks tend to long-term high return and high-risk projects [14], thereby increasing long-term credit and inhibiting long-term use of short-term debt. On the liability side, the digital transformation of banks promotes the collaborative digital evolution of the industrial chain [15], promotes the digitization of technology-based SMEs, and its "digital footprint" helps banks to play their digital efficiency[16]; The improvement of digital inclusiveness can reduce the default rate, improve the availability of loans, improve bank risk-taking, and meet the long-term financing needs of enterprises.

In terms of external competition effects, digital transformation has changed the paradigm of bank customer interaction, broken the relationship loan model, and intensified bank competition[17]. On the one hand, in order to stabilize market share and expand customers, the bank reduced the credit review standard, adopted aggressive credit strategy[13], and enhanced the long-term credit ex ante risk bearing of technology-based SMEs; On the other hand, performance incentives encourage banks to increase their willingness to take risks[18][19], issue long-term loans on the premise of ensuring safety[4], and ease the long-term use of short-term debt.

Accordingly, this paper proposes: research hypothesis 2: the digital transformation of commercial banks enhances the risk-taking level of commercial banks and inhibits the long-term use of short-term debt of technology-based SMEs through technology spillovers and external competition channels.

(3)Research hypothesis 3

Based on signal transmission theory, the outside world can judge the potential ability of the transmitter by observing the signal. The ESG performance of technology-based SMEs is the embodiment of long-term effective supervision, and its social responsibility information can reflect the management's attention to long-term development and convey the long-term business orientation of enterprises[20][21]. Enterprises with ESG advantages can establish stable commercial cooperation through this signal, and can also obtain preferential policies such as tax incentives and financial subsidies, so as to enhance the trust of commercial banks and other entities, make it easier to obtain long-term credit and curb the long-term use of short-term debt.

Good ESG performance also has a positive impact on commercial banks, helping banks to accumulate reputation capital, play the role of reputation insurance during the crisis [22], and improve risk tolerance[23]. On the contrary, when outsiders' supervision on enterprises is insufficient, they tend to urge them to invest in short-term projects and reduce their willingness to take risks[24]. ESG information disclosure can reduce the opportunistic behavior of management, help enterprises overcome hidden barriers[25], win the trust of stakeholders, improve operational efficiency[26], and then improve the risk-taking level of commercial banks, help enterprises obtain long-term credit and curb short-term debt and long-term use.

Research hypothesis 3: the ESG performance of technology-based SMEs positively moderates the relationship between the digital transformation of commercial banks and the long-term use of short-term debt of technology-based SMEs, and positively moderates the intermediary relationship between the bank's risk-taking level, that is, the better the ESG performance of technology-based SMEs, the stronger the intermediary effect of the risk-taking level of commercial banks.

3. Research Design

(1)Sample selection and data sources

This paper selects the data of GEM listed companies from 2017 to 2021 as the research sample. The reasons for selection are as follows: (1) since 2017, many commercial banks have implemented the action of building smart finance, and the pace of digital transformation of commercial banks has accelerated; (2) GEM undertakes the strategic task of serving the innovative development of the capital market and the high-quality development of the economy. It mainly serves the growth oriented innovation and entrepreneurship enterprises and is close to the connotation of technology-based small and medium-sized enterprises.

The digital transformation index of commercial banks used in this paper is from the digital finance research center of Peking University[27]; Huazheng ESG rating data is from wind database; The data of loan correspondence between banks and enterprises and the financial and governance characteristics of other enterprises are from CSMAR database. This paper deals with the sample according to the following standards: (1) eliminate listed companies in the financial and insurance industry; (2) Eliminate all st and *st listed companies; (3) Eliminate the samples with more missing data, and carry out linear interpolation for a small amount of missing data; (4) Logarithm processing is applied to relatively large continuous variables and 1% and 99% tailing are applied to the main continuous variables to reduce the impact of extreme values. Firstly, the loan records are consolidated into a data set of "enterprise year commercial bank name", with a total of 14288 entries. Then, the data set is matched with the digital transformation index and enterprise financial data of commercial banks over the years, and the comprehensive digital transformation index of commercial banks is weighted according to the loan contribution ratio of commercial banks, and the data of "enterprise year digital transformation index of commercial banks - risk bearing level of commercial banks - long-term use level of enterprise short-term debt" is obtained. Finally, 235 consecutive samples of enterprises were obtained, and a total of 1175 enterprise year bank records were used for inspection.

(2) Variable definition

This paper uses the difference between the proportion of short-term liabilities (Current Liabilities/total liabilities) and the proportion of short-term assets (current assets/total assets) to measure the long-term use of enterprises' short-term debt . The larger the index, the more serious the phenomenon that enterprises continue to roll short-term debt to support long-term asset investment.

This paper uses the construction method of "Peking University Commercial Bank digital transformation index" to build an index system from three dimensions of commercial banks' strategic digitization, business digitization and management digitization, which can comprehensively and objectively measure the digital transformation of banks[27]. Due to the phenomenon that the same enterprise borrows from multiple banks in the same year, this paper uses the loan amount between banks and enterprises to calculate the contribution coefficient of the level of short-term debt and long-term debt caused by each bank, multiplies the contribution coefficient by the digital transformation index of actual commercial banks, and then gets a digital

transformation index of virtual commercial banks after weighting. The larger the indicator, the deeper the digital transformation of commercial banks. In the robustness test part, this paper uses the average method to calculate the digital transformation index of commercial banks in the borrower.

At present, the proxy variables about the risk-taking level of commercial banks mainly include: non-performing loan ratio and the proportion of risk weighted assets[28][29], expected default frequency[30], Z value[31]. Among them, the non-performing loan ratio reflects the level of banks' passive risk-taking, which is an ex post measure of risk-taking, and can not fully reflect the changes of banks' risk preference and risk behavior; Due to the relatively backward domestic credit rating, the expected default frequency data are almost unavailable; Z value only reflects the bankruptcy risk of commercial banks, and cannot reflect the bank's active risk-taking choice. From the perspective of bank risk-taking, this paper emphasizes that the level of risk-taking is a kind of risk preference before bank loans, and the weighted proportion of risk assets is an indicator that mainly reflects the active risk-taking of commercial banks, so this paper uses the proportion of risk-weighted assets to measure the risk-taking level of commercial banks. The larger the indicator, the higher the willingness to take business risks.

This paper uses Huazheng ESG rating to measure the level of technology-based SMEs' ESG performance. China Securities ESG evaluation system is based on the core meaning of international ESG and combined with China's national conditions and company characteristics to build a comprehensive index evaluation system covering all a shares. Compared with other ESG ratings in China, Huazheng ESG index evaluation system has the advantages of more comprehensive coverage and higher update frequency. The larger the index, the better the ESG performance of the enterprise.

Referring to the research of liyifei and Huang Jing, in order to eliminate the influence of other factors on the regression results, this paper controls the enterprise size, cash flow level, growth rate of operating income, board size, dual, ROA, Inddirect and age of listing.

(3) Model setting

Based on the above analysis, this paper uses the two-way fixed effect model to estimate the impact of the digital transformation of commercial banks on the short-term debt and long-term use of technology-based SMEs. This paper establishes the following model 1to test hypothesis 1. If α_1 <0, hypothesis 1 is true. Due to the obvious defects of causal inference in the three-stage mediation mechanism test , referring to the practice[32], we test the mediation mechanism model by adding mediation variables to regress the explained variables separately, and further judge the regression results through Sobel test, so as to enhance the completeness and reliability of the mechanism test. The following model 2 is established to test the intermediary effect hypothesis 2. The higher the risk-taking level of commercial banks, the more banks tend to choose investment projects with longer return cycles and higher risks[33]. The lower the level of short-term debt and long-term debt, so if β_1 >0, hypothesis 2 is true. The following models 3 and 4 are established to test hypothesis 3 of regulatory effect. If γ_2 >0 and ϕ_2 >0, hypothesis 3 is true.

$$LS_{it} = \alpha_0 + \alpha_1 DT_{it} + \sum \alpha_k Control_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

$$RWA_{it} = \beta_0 + \beta_1 DT_{it} + \sum \beta_k Control_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (2)$$

$$LS_{it} = \gamma_0 + \gamma_1 DT_{it} + \gamma_2 DT_{it} \times ESG_{it} + \gamma_3 ESG_{it} + + \sum \gamma_k Control_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (3)$$

$$RWA_{it} = \phi_0 + \phi_1 DT_{it} + \phi_2 DT_{it} \times ESG_{it} + \phi_3 ESG_{it} + + \sum \phi_k Control_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (4)$$

In the model, LS_{it} indicates the level of short-term debt and long-term debt of technology-based SMEs I in year t, DT_{it} represents the digital transformation variables of commercial banks corresponding to the technology-based SMEs I in year t, RWA_{it} is a mediation variable, ESG_{it} is the adjustment variable, Control represents the control variable vector of the model, μ_i and λ_t respectively control the unobservable heterogeneity at the enterprise level and the impact at the year level. ε_{it} is a random disturbance term.

4. Empirical Analysis

(1) Descriptive statistics

The descriptive statistical analysis of variables is shown in Table 1. The mean and standard deviation of technology-based SMEs are 0.148 and 0.195 respectively, and the extreme values are -0.374 and 5.271 respectively, which means that during the sample period, most enterprises have the phenomenon of short-term debt and long-term debt, but there are significant differences between different enterprises. The mean and standard deviation of commercial banks' digital transformation are 4.808 and 0.872 respectively, and the extreme values are 2.839 and 5.271 respectively, indicating that the degree of digital transformation of commercial banks is obviously unbalanced and the polarization is serious.

Table 1. Definition and descriptive statistics of main variables

Variable symbol	mean	sd	min	max
LS	0.148	0.195	-0.374	0.553
DT	4.808	0.330	2.839	5.271
Size	21.832	0.872	20.186	24.457
Cash	0.042	0.059	-0.116	0.246
Growth	0.206	0.409	-0.496	2.184
Board	2.041	0.192	1.609	2.397
Dual	0.434	0.496	0	1
Roa	0.026	0.091	-0.370	0.252
Inddirect	0.387	0.051	0.333	0.5
Age	1.864	0.549	0	2.565
RWA	0.646	0.098	0.083	0.807
ESG	4.274	0.086	4.005	4.426

(2) Benchmark regression analysis

Table 2 (1) shows the benchmark regression results, which fix the individual effect and the year effect. From the regression results, it can be seen that the impact of the digital transformation of commercial banks on the short-term debt and long-term debt of technology-based SMEs is significantly negative at the 5% level, indicating that the improvement of the digital transformation level of commercial banks has a significant negative impact on the short-term debt and long-term debt of technology-based SMEs. Hypothesis 1 is proved.

(3)Endogenous test

The core explanatory variable of the digital transformation of commercial banks may be related to the error term due to reverse causality, which makes the model contain endogenous problems. The variable lag method can solve the estimation error problem of reverse causality in the model. It can be considered that the digital transformation of banks can inhibit the long-term use of short-term debts of enterprises, but the higher the proportion of long-term loans of enterprises, the optimization of bank credit mechanism will also be reflected,

and the more fully the application effect of digitization will be. Therefore, there may be a two-way causal problem between the two. Therefore, this paper further verifies the benchmark regression by lagging the explanatory variable by one period. The regression results are shown in column 3 (2) of Table 3.

Table 2. benchmark regression results

	(1)
	LS
DT	-0.054**
	(-2.013)
Size	-0.015
	(-0.989)
Cash	-0.027
	(-0.336)
Growth	-0.047***
	(-4.379)
Board	-0.047
	(-1.002)
Dual	0.002
	(0.152)
Roa	0.149***
	(2.624)
Inddirect	-0.298*
	(-1.907)
Age	0.081***
	(2.941)
_cons	0.824**
	(2.175)
Time effect	Yes
Individual effect	Yes
N	1175
R^2	0.052
F	3.903
***p<0.01, **p<0.05, *p<0.10	

Table 3. regression results of independent variable lagging by one period

	(1)	(2)
	LS	LS
DT	-0.054**	
	(-2.013)	
Size	-0.015	-0.066***
	(-0.989)	(-3.522)
Cash	-0.027	-0.108
	(-0.336)	(-1.245)
Growth	-0.047***	-0.027**
	(-4.379)	(-2.363)
Board	-0.047	-0.049
	(-1.002)	(-0.909)
Dual	0.002	0.013
	(0.152)	(0.841)
Roa	0.149***	0.132**
	(2.624)	(2.340)
Inddirect	-0.298*	-0.300*
	(-1.907)	(-1.721)
Age	0.081***	0.231***
	(2.941)	(4.673)
LDT		-0.074**
		(-2.437)
cons	0.824**	1.749***
	(2.175)	(3.946)
Time effect	Yes	Yes
Individualeffect	Yes	Yes
N	1175	940
R^2	0.052	0.083
F	3.903	5.212
***p<0.01, **p<0.05, *p<0.10		

The regression coefficient of the digital transformation of commercial banks lagging behind the first phase on the short-term debt and long-term debt of technology-based SMEs is -0.074, which is significant at the 5% level. Therefore, the regression results are consistent with the benchmark regression results, which further verifies the hypothesis 1.

(4)Robustness check

This paper uses the average method to calculate the digital transformation index of the borrower's commercial banks, which is expressed in DT. The regression results are shown in column 4 (1). It can be seen that the regression coefficient of the digital transformation of commercial banks on the short-term debt and long-term debt of technology-based SMEs obtained by the average method is -0.063, and is significantly negatively correlated at the 10% level. This result is consistent with the benchmark regression result above, that is, the digital transformation of commercial banks can inhibit the short-term debt and long-term debt of technology-based SMEs to a certain extent.

Table 4. regression results of alternative explanatory variables

	(1)
	LS
dt	-0.063*
	(-1.690)
Size	-0.013
	(-0.828)
Cash	-0.036
	(-0.450)
Growth	-0.048***
	(-4.503)
Board	-0.047
	(-0.996)
Dual	0.002
	(0.167)
Roa	0.145**
	(2.546)
Inddirect	-0.283*
	(-1.812)
Age	0.069**
	(2.548)
cons	0.827**
	(2.119)
Time effect	Yes
Individual effect	Yes
N	1175
R^2	0.051
F	3.806
***p<0.01, **p<0.05, *p<0.10	

The gem samples include the samples of warehousing, animal husbandry, textile, fishery and other industries. The technological characteristics of these enterprises are relatively weak, which may interfere with the final result of the digital transformation of commercial banks on the short-term debt and long-term use of technology-based SMEs. This paper recalculates the samples of Internet and related services, computer, communication and other electronic equipment manufacturing, software and information technology services, railway, ship, aerospace and other transportation equipment manufacturing, and pharmaceutical manufacturing enterprises in the gem from 2017 to 2021. The results are shown in Table 5. At this time, the regression coefficient of DT to LS is -0.087, which is significantly negatively correlated at the 10% level, consistent with the original conclusion.

(5) Mediating effect test

Due to the obvious defects of causal inference in the three-stage mediation mechanism test, referring to the practice[32], we test the mediation mechanism model by adding mediation variables to regress the explained variables separately, and

further judge the regression results through Sobel test, so as to enhance the completeness and reliability of the mechanism test.

Table 5. regression results of adjusting sample size

	(1)
	LS
DT	-0.087*
	(-1.798)
Size	-0.013
	(-0.468)
Cash	-0.120
	(-0.999)
Growth	-0.022
	(-1.273)
Board	-0.133**
	(-2.031)
Dual	-0.036
	(-1.633)
Roa	0.116
	(1.251)
Inddirect	-0.491**
	(-2.243)
Age	0.144***
	(3.526)
_cons	1.112*
	(1.658)
Time effect	Yes
Individual effect	Yes
N	480
R^2	0.108
F	3.468
***p<0.01, **p<0.05, *p<0.10	

Table 6. regression results of intermediary effect of commercial banks' risk-taking level

	(1)
	RWA
DT	0.154***
	(11.648)
Size	-0.009
	(-1.167)
Cash	0.034
	(0.862)
Growth	0.003
	(0.615)
Board	0.024
	(1.036)
Dual	-0.000
	(-0.048)
Roa	-0.034
	(-1.212)
Inddirect	0.040
	(0.515)
Age	0.008
	(0.603)
cons	0.044
	(0.235)
Time effect	Yes
Individual effect	Yes
N	1175
R^2	0.165
F	14.119
***p<0.01, **p<0.05, *p<0.10	

The first step is to test the impact of the independent variable digital transformation of commercial banks on the dependent variable short-term debt and long-term debt of technology-based SMEs, which has been proved by the above benchmark regression; The second step is to use model (2) for regression to test the impact of independent variable commercial bank digital transformation on intermediary variable commercial bank risk-taking level. From column (1) of table 6, it can be seen that the impact coefficient of commercial bank digital transformation on commercial bank risk-taking level is 0.154, which is significant at 1% level; As the higher the risk-taking level of commercial banks, the banks tend to choose investment projects with longer return cycles and higher risks[33], the lower the long-term level of short-term debt. Therefore, the digital transformation of commercial banks can promote the risk-taking level of commercial banks, and the risk-taking level of commercial banks can inhibit the technology-based SMEs. Hypothesis 2 is true.

(6)Regulatory effect test

In order to verify the regulatory role of ESG performance of technology-based SMEs in the process of digital transformation of commercial banks inhibiting the long-term use of short-term debt of technology-based SMEs, regression analysis was conducted by using model (3); In order to verify the regulatory role of ESG performance of technology-based SMEs in the process of promoting the risk-taking level of commercial banks through the digital transformation of commercial banks, regression analysis was conducted by using model (4), and the results are shown in Table 7. From column (1), it can be seen that the regression coefficient of the interaction between the digital transformation of commercial banks and the ESG performance of technology-based SMEs on the short-term debt and long-term debt of technology-based SMEs is 0.027, which is significantly positive at the 10% level, indicating that the ESG performance of technology-based SMEs helps to enhance the inhibitory effect of the digital transformation of commercial banks on technology-based SMEs.

Table 7. regression results of regulatory effect of technology-based SMEs

	(1)	(2)
	LS	RWA
DT	-0.084***	-0.085***
	(-2.670)	(-31.278)
ESG	0.034	0.003
	(0.452)	(0.494)
DT×RWA	0.027*	0.216***
	(1.873)	(170.780)
Size	-0.016	0.002
	(-0.991)	(1.100)
Cash	-0.029	0.015**
	(-0.362)	(2.143)
Growth	-0.047***	-0.001
	(-4.372)	(-0.943)
Board	-0.050	0.008*
	(-1.059)	(1.931)
Dual	0.002	-0.001
	(0.169)	(-0.856)
Roa	0.154***	0.002
	(2.710)	(0.364)
Inddirect	-0.302*	0.029**
	(-1.934)	(2.118)
Age	0.081***	0.006***
	(2.948)	(2.582)
cons	0.754*	0.310***
	(1.698)	(8.048)
Time effect	Yes	Yes
Individual effect	Yes	Yes
N	1175	1175
R^2	0.056	0.974
F	3.637	2341.795
***p<0.01, **p<0.05, *p<0.10		

From column (2), it can be seen that the regression coefficient of the interaction between the digital

transformation of commercial banks and the ESG performance of technology-based SMEs on the risk-taking level of commercial banks is 0.216, and both are significantly positive at the 1% level, indicating that the enhanced ESG performance of technology-based SMEs strengthens the impact of the digital transformation of commercial banks on the risk-taking level of commercial banks. Hypothesis 3 is true.

5. Conclusion and Suggestions

Based on the "liquidity creation theory" and "signal transmission theory", this paper discusses the impact mechanism of the digital transformation of commercial banks on the short-term debt and long-term use of technology-based SMEs from the perspective of risk-taking. The results show that: (1) the digital transformation of commercial banks has an inhibitory effect on the phenomenon of short-term debt and long-term debt of technology-based SMEs, and a series of robustness tests show that the result is robust; (2) The digital transformation of commercial banks indirectly inhibits the phenomenon of short-term debt and long-term use of technology-based SMEs by enhancing active risk-taking; (3) ESG of technology-based small and medium-sized enterprises positively moderates the inhibitory effect of digital transformation of commercial banks on short-term debt and long-term use of technology-based small and medium-sized enterprises, and positively moderates the promoting effect of digital transformation of commercial banks on their own risk-taking.

There are three theoretical contributions in this paper. First, the research on the antecedents of short-term debt and long-term debt has been enriched. Previous studies on the long-term use of short-term debt mostly focused on the impact of digital infrastructure construction, fiscal and monetary policies, and the reform of the market structure of financial institutions, but rarely focused on the impact of the digital transformation of commercial banks on the long-term use of short-term debt. Based on the theory of liquidity creation and signal transmission, this paper discusses the positive role of commercial banks after digital transformation in short-term debt and long-term use of technology-based SMEs. Second, it enriches the theory of liquidity creation from the perspective of risk-taking and uncovers the theoretical black box of intermediary mechanism. Previous studies have discussed the impact of digital transformation of commercial banks on short-term debt and long-term use of enterprises from the perspective of information screening and credit financing constraints. This paper discusses the relationship and mechanism between the two from the perspective of risk-taking, and enriches and supplements the regulation mechanism of ESG performance on the loan relationship between banks and enterprises and the level of bank risk-taking. Third, we have deepened the research in the field of technology-based SME lending. In the past, the main body of research on the long-term use of short-term debt mostly stayed at the enterprise level. This paper combined with the characteristics of technology-based small and medium-sized enterprises to explore their relationship with commercial bank credit, which enriched the research on the economic plight of technology-based small and medium-sized enterprises.

At the same time, there are three enlightenments in this paper. First, it will help technology-based small and medium-sized enterprises alleviate the dilemma of short-term debt and long-term use. Small and medium-sized technology-based enterprises need to realize that improving ESG performance can seek positive economic results for themselves, encourage small and medium-sized technology-based enterprises to cultivate sustainable development ability, respond to the national comprehensive green transformation policy to accelerate economic and social development, and promote scientific and technological self-reliance and high-quality economic development. Second, it is helpful for commercial banks to realize "prospering the bank through science and technology". On the one hand, this paper empirically studies the positive impact of the digital transformation of commercial banks, and encourages fintech enabled banks to realize "Prospering banks through science and technology". On the other hand, commercial banks are encouraged to combine digital technology with their own risk management system, give full play to the role of risk management of commercial banks, better serve the lending business of banks and enterprises, and support the supporting policies of early, small, long-term and hard technology investment of long-term capital. Third, provide a powerful starting point for the government and other relevant supervision institutions to create a good environment for innovative financing. The government and other relevant supervision institutions should continue to promote the in-depth development of digital finance, rely on technological innovation, encourage the digital transformation of commercial banks, and constantly improve financial services; We should further establish a sound ESG evaluation and supervision system, legislate to promote ESG information disclosure, and create a good environment for innovative financing of technology-based SMEs.

The inadequacies of the study are as follows: first, in terms of the measurement of the digital transformation of commercial banks, technology-based SMEs may seek loans from commercial bank branches, while there are differences in the degree of digital transformation among bank branches in different regions, but there is a certain measurement error using a unified numerical measurement. Future research can use the specific application of digital financial tools in commercial bank branches to build an index system for more refined measurement. Second, the digital transformation of commercial banks includes three dimensions: Strategic digitization, business digitization and management digitization. This paper does not explore the impact mechanism of different dimensions of digital transformation on technology-based SMEs. Based on the data support, future research can deeply explore the impact of different dimensions of commercial banks' digital transformation on the short-term debt and long-term debt of technology-based SMEs.

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