

Digital Economy and Enterprise Debt Financing Cost

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Abstract

As a milestone scientific and technological transformation in human history, the development of the digital economy is a key factor driving the operation of the economy. The fixed effect and impact mechanism test of panel data of A-share listed companies in China from 2011 to 2021 shows that the development of the digital economy can significantly reduce the cost of corporate debt financing. It is suggested to strengthen the construction of digital infrastructure, improve the degree of data sharing, data openness and digital support services, guide the development of digital economy on the basis of quantity growth to the path of quality development, and enhance the effectiveness of digital economy in reducing the cost of enterprise debt financing.

Keywords

Digital Economy; Enterprise Debt Financing Cost; Financing Constraints.

1. Introduction

With the arrival of the information age in the 21st century and the continuous innovation of internet technology, China's digital economy has opened up a new development pattern. Unlike the traditional economy, the development of the digital economy is changing rapidly, combining with land, agriculture, industry, technology, etc., greatly expanding the scale and scope of economic construction, and becoming the backbone of promoting China's economic development. According to the "White Paper on the Development of China's Digital Economy" released by the Chinese Academy of Social Sciences, the proportion of China's digital economy to GDP has reached about 40%, and the overall development scale and speed of the digital economy will continue to grow. Driven by the development of the digital economy, it has played a positive guiding role in China's physical enterprises and financial system. The unique HP characteristics of the digital economy can tilt towards low-income groups, cover a wider range, and provide convenience for more vulnerable groups.

Funds are the lifeblood of enterprise operation, directly determining the survival and development of enterprises. However, the large number of domestic enterprise groups always face financing difficulties. Since China entered a new stage of development, the overall focus of economic development has shifted from quantity to quality, which has brought greater challenges to the economic development of enterprises. As an indispensable part of China's economic development, the level of activity of enterprises is related to local economic growth issues. Good enterprises can provide a large number of job opportunities to solve local employment problems. Innovation, environmental protection, and economic development of enterprises are also of great help to local construction. However, most enterprises generally face financing constraints and lack corresponding financing services, which brings difficulties to their capital turnover and business operations. Moreover, financing problems vary due to different stages of enterprise development, regions, and business scales. Debt financing is a way for enterprises to make loans or issue bonds to financial institutions such as banks or some private non-financial institutions in a flexible and simple way, and repay the principal and interest at maturity to obtain financing. Debt financing has become a necessary means for enterprises to obtain funds in their daily production and operation as well as to expand their

production scale. However, debt Financing may cause enterprises to face bankruptcy due to excessive interest while alleviating the shortage of funds and improving the leverage effect of enterprises. It can be seen that if enterprises want to achieve high-quality development, how to make rational use of debt Financing as working capital for enterprises has become a top priority. This paper takes China's A-share listed companies in 2011-2021 as the research sample, empirically analyzes the impact of the digital economy on the cost of corporate debt Financing, and the results are still stable after a series of tests.

2. Journals Reviewed

2.1. Research on Digital Economy

In the era of digital economy, new technologies in the digital economy are constantly emerging and integrating with each other, leading enterprises in technological innovation and application innovation. First, if enterprises want to maintain long-term advantages, adapt to the new economic environment, and carry out thorough innovation and reform, Digital transformation is the strategic adjustment they must make. The Digital transformation of enterprises has changed the original operation mode and integrated internal business processes with external digital technologies. This process needs more R&D investment and more innovative activities as support. In addition, enterprises can also carry out Digital transformation through customer experience, operation process and business model, and innovate by acquiring a large number of digital information resources, developing digital technology and participating in employee participation. It can also be used for preventive maintenance, and obtain information for research and development of new processes. Secondly, the digital economy has characteristics such as openness and emphasis on value co creation. With the evolution of the digital economy technology paradigm, innovative organizational methods are shifting towards ecology. In the innovation ecosystem, innovation entities are not just enterprises, but innovation activities rely more on the collaborative efforts of enterprises, universities, research institutes, governments, and even users. On this basis, the networked innovative organizational approach has created excellent conditions for the output of new knowledge and technology. In terms of collaborative innovation, the digital economy has broken down barriers to collaborative innovation, increased opportunities for collaborative innovation, and thus incentivized enterprises to increase collaborative innovation. With the rise of internet platforms for technology systems such as big data and cloud computing, the geographical limitations of enterprise innovation have been broken, and the potential for cooperation among innovation entities has been unleashed. Thirdly, in the industrial system, new digital technology will change the original production process, management mode and service mode, and promote the development of intelligent manufacturing. Digital new technology leads customized research and development design, achieving personalized customization. Enterprises can use big data to accurately predict customer behavior and match demand. Digital technology helps enterprises accurately identify customer needs, achieve data-driven product development, improve innovation efficiency, and motivate enterprises to increase their research and development efforts. All activities carried out by enterprises are aimed at increasing corporate profits and gaining value appreciation, and R&D investment will ultimately be transformed into R&D outputs such as product innovation, technological innovation, and patents. Research by Wang Hongxia and others has shown that R&D investment is an important condition for innovation, and the promotion effect of the digital economy on enterprise R&D investment can improve enterprise innovation. With the progress of R&D and innovation activities and the transformation of innovation achievements, a normal pattern of innovation leading the development of enterprises will gradually be formed, and the sustainable development ability of enterprises will also be improved. Finally, in the digital economy environment, digital technology enhances the

dissemination of knowledge, and knowledge sharing occurs in various innovative activities within and outside enterprises. Through knowledge sharing, enterprises enhance their knowledge absorption capacity and innovation level.

2.2. Research on the Cost of Enterprise Debt Financing

The common way of debt Financing for enterprises is to make loans or issue bonds to banks or non-financial institutions. In the process of borrowing and lending, some capital costs paid to obtain funds are often called enterprise debt Financing costs. At present, domestic and foreign scholars' research on the cost of debt Financing is reflected in the impact of corporate financial behavior.

From the perspective of corporate financial behavior, the relationship between it and the cost of debt Financing can be analyzed and discussed mainly from corporate social responsibility, information disclosure, internal control, etc. First, from the perspective of social responsibility, the more social responsibilities most enterprises assume, the better their reputation and reliability are, and the cost of debt Financing is correspondingly small. Rosa et al. (2017) selected relevant data from non-financial companies in Europe from 2007 to 2017 to explore the relationship between their social performance and financing costs, and ultimately found a reverse effect between the two. In domestic research and analysis, taking the data of enterprises in Shanghai Stock Exchange from 2010 to 2015 as an example, it is found that enterprises with poor governance level generally face the problem of high debt Financing costs, because the governance level is directly linked to corporate social responsibility, which in turn relates to the cost of debt Financing of enterprises (Zhou Hong et al., 2014). Secondly, in information disclosure, Ni Juan et al. (2016) took heavily polluting enterprises as an example to analyze and found that adequate information disclosure can enable banks and other external institutions to understand the situation of enterprises in a timely manner, reducing the drawbacks of information asymmetry, increasing the trust of financial institutions in enterprises, and thus reducing the cost of debt Financing. Xing Yusong et al. (2021) found that there is a reverse relationship between the credit rating of listed companies and the cost of corporate debt Financing, which will be more obvious in the case of unstable market. Finally, from the perspective of internal control, taking some enterprises with internal control defects as an example, after the correction of internal control, it was found that the cost of debt Financing of enterprises dropped significantly, so it was concluded that the lower the internal control risk, the lower the financing cost (Lin Zhonggao, 2017). After controlling for other variables, Kim et al. (2021) found that companies with good internal controls had an average 28% lower financing cost compared to companies with vulnerabilities.

3. Theoretical Analysis and Hypothesis Formulation

With the rapid development of China's digital economy, the total number of internet users has shown a geometric growth. The popularization of third-party and electronic payments has provided great convenience for the public, and the HP characteristics of the digital economy have provided more extensive financing channels for enterprises. In traditional financial institutions, bank loans are the main channel for enterprise financing. However, due to the uneven scale and level of enterprises in China, credit discrimination and information asymmetry are prevalent in the financial market, which brings high financing costs to most enterprises (Wang Xueping et al., 2019). The Internet effect of the digital economy is increasingly evident in achieving economic benefits for enterprises. The establishment of network platforms has improved the information transparency of enterprises, and there is a wider range of options to participate in financial activities. Most importantly, compared to traditional economies, the threshold for digital economy based on the Internet is lower. When a large number of enterprises combine the digital economy with their own development, the

overall average cost of the digital economy will decrease, and enterprises can choose flexible financial products and services according to their own needs. Through the development of new financial products and new financial service technologies, the digital economy can improve the financial market and enhance financial vitality, provide "incremental supply" for high-quality development of enterprises, and effectively reduce the cost of enterprise debt Financing (Guo Xiaoshun et al., 2021). The digital economy can also promote the rational allocation of financial resources. With the help of new data analysis software such as artificial intelligence, it provides guarantees for enterprises that need innovation and structural upgrading with lower financing funding needs. The combination of big data and financial markets, based on consumer preferences and transaction records, has more accurately targeted customer needs, changing the traditional offline trading mode. It not only provides convenience, reduces capital costs, but also stimulates customer consumption. This shows that the digital economy can bring new development opportunities to different enterprises by providing business opportunities, which can provide enterprises with a strong ability to create profits, thus alleviating the problem of high cost of debt Financing. Based on this, this article proposes research hypothesis 1:

H1: There is a negative correlation between the digital economy and the cost of enterprise debt Financing.

4. Research Design

4.1. Variable Definition

Explained variable: enterprise debt Financing cost. This paper chooses the ratio of financial expenses and total liabilities in the financial statements of enterprises to measure the cost of debt Financing of enterprises.

Table 1. Variable Definition

Variable type	Variable	Variable Symbol	Variable Definition
Explained variable	Enterprise debt Financing cost	Y	Financial expenses/total liabilities
Explanatory variable	Digital Economy	X	Digital Economy Development Index at the Municipal Level
Control variable	company size	Size	Natural logarithm of annual total assets
	Net profit margin of total assets	ROA	Net profit/average balance of total assets
	Operating revenue growth rate	Growth	Current year's operating revenue/previous year's operating revenue - 1
	Tobin Q value	TobinQ	(Value of circulating stock market+number of non circulating shares) × Net assets per share+carrying amount of liabilities/total assets
	Shareholding ratio of institutional investors	INST	The total number of shares held by institutional investors divided by the circulating share capital
	Management fee rate	Mfee	Management expenses divided by operating income
	book-to-market	BM	Book value/total market value
	Number of directors	Board	The number of directors is taken as natural logarithm
	industry	Industry	Industry Classification by China Securities Regulatory Commission in 2012
	Year	Year	

Explanatory variable: level of digital economy development. Using the digital economy index as the explanatory variable. The data is sourced from the "Digital China Index Report" released annually by Tencent Research Institute.

4.2. Model Building

In order to verify the impact of the digital economy on the cost of enterprise debt Financing, the following benchmark regression model is constructed:

$$Y_{1,i,t} = \alpha_0 + \alpha_1 X_{j,t} + \sum \alpha_i \times \text{Controls}_{i,t} + \sum \text{Year} + \sum \text{Industry} + \varepsilon \tag{1}$$

Y represents the cost of enterprise debt Financing, X represents the digital economy index, and ε is a random interference term.

5. Empirical Results and Analysis

5.1. Descriptive Statistics

Table 2 shows the descriptive statistics of the main research variables in this article. The standard deviation of the explanatory variable digital economy is 0.766, with a minimum value of 0.567 and a maximum value of 3.453, indicating significant differences in the digital economy index among different prefecture level cities. The average value of enterprise debt Financing cost Y is 0.029, the median is 0.050, the maximum value is 0.310, and the minimum value is -0.825. There is a significant difference between the maximum values, indicating that some enterprises need higher costs for debt Financing.

Table 2. Descriptive Statistics

Variable	N	Mean	p50	SD	Min	Max
Y	16492	0.029	0.050	0.160	-0.825	0.310
x	16492	2.157	2.222	0.766	0.567	3.453
kz	16492	1.662	1.784	2.084	-11.350	13.660
Size	16492	22.620	22.430	1.339	20.170	26.210
ROA	16492	0.032	0.031	0.056	-0.222	0.177
Growth	16492	0.177	0.109	0.401	-0.554	2.378
TobinQ	16492	1.823	1.473	1.056	0.857	6.939
INST	16492	0.423	0.433	0.229	0.003	0.877
Mfee	16492	0.083	0.067	0.063	0.009	0.384
BM	16492	1.361	0.888	1.364	0.087	7.074
Board	16492	2.150	2.197	0.199	1.609	2.708

5.2. Correlation Analysis

Table 3. Correlation Analysis

	x	Y	Size	ROA		
x	1					
Y	-0.175***	1				
Size	0.258***	0.107***	1			
ROA	-0.069***	-0.180***	0.039***	1		
Growth	0.015*	-0.00600	0.030***	0.266***		
TobinQ	-0.00800	-0.103***	-0.425***	0.148***		
INST	0.023***	0.021***	0.460***	0.127***		
Mfee	-0.097***	-0.113***	-0.387***	-0.185***		
BM	0.121***	0.111***	0.654***	-0.189***		
Board	-0.123***	0.00400	0.228***	0.031***		
Growth	TobinQ	INST	Mfee	BM	Board	

Growth	1					
TobinQ	0.042***	1				
INST	-0.020**	-0.027***	1			
Mfee	-0.127***	0.335***	-0.179***	1		
BM	-0.045***	-0.500***	0.244***	-0.314***	1	
Board	-0.034***	-0.133***	0.200***	-0.084***	0.148***	1

After descriptive statistics, the correlation analysis of each variable in this paper is carried out. According to the correlation analysis coefficient in Table 3, the correlation coefficient between the explanatory variable digital economy and the cost of corporate debt Financing is -0.175, which indicates that the development of digital finance can inhibit the rise of corporate debt Financing costs, which preliminarily proves that Hypothesis 1 is tenable; In addition, from the perspective of control variables, company size, ROA, etc. are negatively correlated with the cost of debt Financing. The above correlation analysis has laid a certain foundation for the regression analysis in this article and provided a basis for demonstrating the conclusions of this article.

5.3. Regressive Analysis

Table 4. Benchmark Regression Results

	(1) Y	(2) Y
x	-0.062*** (-5.349)	-0.050*** (-4.387)
ROA		-0.910*** (-20.976)
Growth		0.026*** (4.414)
TobinQ		-0.003 (-1.092)
Size		0.006** (2.218)
INST		-0.007 (-0.621)
Mfee		-0.460*** (-11.392)
BM		-0.006** (-2.286)
Board		-0.008 (-0.650)
_cons	0.037* (1.672)	-0.013 (-0.201)
N	16492.000	16492.000
r2	0.035	0.067
r2_a	0.033	0.065
Year	Yes	Yes
Industry1		

Table 4 shows the regression results of the fixed effect of the digital economy on the cost of enterprise debt Financing. In column (1), the digital economy is taken as the explanatory variable and the cost of enterprise debt Financing is taken as the explanatory variable. The analysis does not include all control variables except the year and industry. The regression result is a significant negative correlation at the level of 1%, which preliminarily shows that the development of the digital economy can reduce the cost of enterprise debt Financing. Column (2) adds control variables such as company size and ROA to examine the relationship between the digital economy and the cost of corporate debt Financing. The regression coefficient is -0.050, which shows that whether other control variables are added or not, the development level of the digital economy can significantly alleviate the cost of debt Financing, which verifies the research hypothesis 1 of this paper.

5.4. Robustness Test

This paper conducts the following robustness tests: ① Replace the explained variables, and this paper uses the ratio of financial costs to long-term borrowings, short-term borrowings to measure the cost of corporate debt Financing (Y_1). ② The explanatory variable of the digital economy lags for one period. ③ Only manufacturing and partial year data were retained.

Table 5. Robustness Test

	(1) Y_1	(2) Y	(3) Y
x	-0.011*** (-9.921)		-0.032*** (-3.938)
ROA	-0.119*** (-28.497)	-0.469*** (-19.183)	-0.630*** (-19.658)
Growth	0.001** (2.037)	0.009*** (2.733)	0.022*** (4.857)
TobinQ	0.000 (1.496)	-0.003* (-1.901)	0.004* (1.942)
Size	0.001*** (3.255)	0.004** (2.459)	0.005*** (2.577)
INST	-0.002* (-1.935)	-0.015** (-2.437)	0.003 (0.372)
Mfee	-0.061*** (-15.345)	-0.209*** (-8.791)	-0.322*** (-9.605)
BM	0.000 (0.357)	-0.003*** (-2.639)	0.003 (1.248)
Board	0.000 (0.306)	-0.013** (-1.996)	-0.016* (-1.818)
L.x		-0.026*** (-4.067)	
_cons	0.018*** (2.812)	0.041 (1.158)	-0.033 (-0.738)
N	16492.000	16492.000	16492.000
r2	0.107	0.069	0.077
r2_a	0.104	0.066	0.075
Year	Yes	Yes	Yes
Industry1			

5.5. Mechanism Analysis

The basic regression results have confirmed the negative correlation between the digital economy and the cost of enterprise debt Financing, but the intermediary preaching has not shown it. This paper introduces the intermediary variable of financing constraints to test whether the digital economy can act on enterprise debt Financing by alleviating financing constraints. The results are shown in Table 6.

The correlation coefficient between the digital economy and financing constraints in column (1) is -0.369, indicating that enterprises can help them obtain more funds and alleviate financing constraints by using digital finance; The correlation coefficient of column (2) digital finance and enterprise debt Financing cost is consistent with the basic regression; The correlation coefficient between the financing constraints and the enterprise debt Financing cost in column (3) is 0.027, which means that when the enterprise faces financing pressure, the capital turnover will not be available, which will lead to higher financing repayment costs. The above results show that the negative correlation between the digital economy and the cost of corporate debt Financing can be achieved through the financing constraint path.

Table 6. Intermediary Testing

	(1) kz	(2) Y	(3) Y
x	-0.369*** (-5.937)	-0.038*** (-6.059)	-0.028*** (-4.631)
Size	0.035** (2.341)	0.007*** (4.404)	0.006*** (3.919)
ROA	-20.027*** (-83.331)	-0.595*** (-24.768)	-0.058** (-2.102)
Growth	0.072** (2.291)	0.014*** (4.465)	0.012*** (3.996)
TobinQ	0.593*** (39.817)	0.000 (0.171)	-0.016*** (-10.419)
INST	-0.068 (-1.094)	-0.008 (-1.232)	-0.006 (-0.974)
Mfee	-3.399*** (-14.937)	-0.269*** (-11.810)	-0.178*** (-8.046)
BM	0.302*** (22.189)	-0.004*** (-2.580)	-0.012*** (-8.727)
Board	-0.003 (-0.043)	-0.012* (-1.820)	-0.012* (-1.877)
kz			0.027*** (35.715)
_cons	2.137*** (6.086)	-0.036 (-1.025)	-0.093*** (-2.755)
N	16492.000	16492.000	16492.000
r2	0.465	0.088	0.154
r2_a	0.463	0.086	0.152
Year	Yes	Yes	Yes
Industry1			

6. Inspiration

As the most active and promising economic field in China, the digital economy can drive rapid economic development in various fields of society. The deep integration of digital technology and traditional finance can better build a "digital China", inject vitality into the financial market, and is of great significance for the sustainable development of enterprises. This paper takes A-share listed companies in 2011-2021 as the research sample to empirically test the relationship between the digital economy and corporate debt Financing costs. Through empirical research, it is found that there is a significant negative correlation between the digital economy and the cost of corporate debt Financing, indicating that the better the development of the digital economy, the lower the cost of corporate debt Financing. This conclusion remains unchanged after testing by replacing the dependent variable and retaining the manufacturing sample. Further, in the mechanism test, this paper finds that the negative relationship between the digital economy and the cost of corporate debt Financing can be achieved by easing financing constraints.

Acknowledgments

Anhui University of Finance and Economics Graduate Research Innovation Fund Project (ACYC 2022170).

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