

How Digital Finance Can Alleviate Financing Constraints for Enterprises: A Discussion Based on Data from Listed Companies

Hefeng Xu^{1,*}

¹ School of Business, Hunan University of Science and Technology, Xiangtan, Hunan, 411201, China

* Corresponding Author

Abstract: This article is based on the demand of China's transition from virtual to real, and combined with the current background of encouraging financial services for the development of the real economy, explores the impact of digital finance on corporate financing constraints. On the basis of theoretical analysis of the transmission mechanism and path of the impact of digital finance on corporate financing constraints, further utilizing econometric models and methods such as the bidirectional fixed effects model, by matching the data of listed companies from 2015 to 2020 with the digital inclusive finance index, empirical testing of the mechanism path of the impact of digital finance on corporate financing constraints. Research has shown that digital finance can alleviate corporate financing constraints in terms of coverage, depth of use, and degree of digitization; This mitigation effect shows heterogeneity among enterprises in different regions and industries.

Keywords: Digital finance, financing constraints, high-tech certification, two-way fixed effects.

1. Introduction

Since 2020, the COVID-19 has spread all over the world, which has brought considerable impact to the real economy. Countries have also sought new development models to break the restrictions of space on economic development. As a result, digital technology has been developed. Due to the inconvenience caused by the epidemic, various small and micro enterprises that were unable to achieve their sales targets have achieved unexpected profits on digital platforms. The financial industry is also able to breathe a sigh of relief. When target customers cannot be contacted offline due to epidemic control, only a portion of financial institutions conduct financing business to small and medium-sized enterprises through internet platforms (Huang Yiping, 2021). It is not difficult to see that the digitization of the financial industry has an effective supporting effect on the real economy.

With the popularization of digitization, the Chinese economy has shown a highly digitized characteristic. China aims to achieve high-quality development of the real economy, with enterprises as the foothold for economic development, providing inexhaustible driving force for high-quality economic growth. Digital finance has had a significant impact on the business activities of enterprises, and their investment and financing habits are gradually changing. However, the problem of "difficult and expensive financing" has always been a key obstacle to the sustainable development of enterprises. Although governments at all levels and relevant departments have introduced a series of policies and plans to support enterprise financing, significant results have not been achieved. The World Bank pointed out in its 2018 report on the financing gap of small and medium-sized enterprises in China that the potential financing gap for small and medium-sized enterprises is as high as 12.54 trillion RMB, with a gap proportion of 43.18%.

Therefore, how to alleviate corporate financing constraints and reduce corporate financing gaps is undoubtedly a major

issue for high-quality development at present. This raises the question of how the digitalization of financial services in the new era can alleviate the financing constraints faced by enterprises, and what heterogeneity exists in this impact.

Based on the background of assisting digital finance in serving the real economy, this article explores the relevant issues of alleviating corporate financing constraints, and systematically analyzes the impact, internal mechanisms, and heterogeneity of digital finance on alleviating corporate financing constraints, which has certain practical significance.

Finance is an important core competitiveness of a country, and the financial system is an important fundamental institution in economic and social development. Examining the impact of digital finance on financing constraints can help unleash greater digital dividends in promoting economic growth. This study provides an in-depth analysis of how to alleviate financing constraints, fully understanding the impact, internal mechanisms, and heterogeneity of digital finance in alleviating corporate financing constraints. Targeted and focused policy measures are proposed for regions with different development levels, providing clearer policy implications for helping digital finance better serve the high-quality development of the real economy.

2. Theoretical Analysis and Hypothesis Formulation

Theoretical analysis and hypothesis formulation: Firstly, we integrate and sort out the existing theoretical research on the financing constraints of digital finance in China, and propose theoretical hypotheses.

In recent years, the COVID-19 and Sino US relations have been evolving, and the international situation is grim, leading to a global economic deadlock. The downturn in the international economy has also led to matching issues between the domestic economic development cycle and the digital finance cycle. As a new economic development trend that supports the "dual circulation", digital finance has constructed a long-term symbiotic and collaborative

relationship channel between financial institutions and various entities in the industrial chain (Pu Ganlin, 2021).

The biggest characteristic of digital finance is its inclusiveness, which provides financial services to groups that have long been excluded from traditional financial services through the combination of emerging technologies, electronic devices, and digital platforms (Yang Hong, Wang Qiaoran, 2021). Through digital platforms and innovative financial products, digital finance has lowered the entry threshold for finance, provided wealth management opportunities to the general public in remote areas, and also added new financing windows for financial institutions. In addition, Internet finance has improved the availability of user information through big data information search and integration technology, reduced the investment risk of financial institutions, and created the possibility of financing for small, medium-sized and micro enterprises by building a new risk assessment system, which is conducive to reducing the financing cost of enterprises.

The development contradiction between China's financial system and the real economy presents a coexistence of "asset shortage" and "fund shortage", resulting in the dilemma of poor connection between "financial supply financing demand". Specifically reflected in reality, on the one hand, traditional finance has a slow development, a large system but lacks efficiency, and financing channels are relatively lacking (Allenal, 2007; Lin Yifu and Sun Xifang, 2008; Lin Bin et al., 2018), especially in terms of scale, function, and rules in the capital market (Claessens&Tzioumis, 2006; Liu Liya et al., 2015), resulting in low quality and efficiency of financial services, Unable to fully meet the financing needs of the real economy.

However, Zhang Qingjun and Huang Ling (2021) believe that the development of digital inclusive finance can make up for the blind spots in traditional financial services, and promote the upgrading and transformation of the industrial structure in the central region, thereby alleviating the inhibitory effect of digital inclusive finance on economic development; Sun Qian and Xu Zhangyong (2021) proposed that due to differences in county-level endowments between non poverty-stricken and relatively poor counties, the development of digital inclusive finance can promote industrial structure upgrading, but its effect on relatively poor counties is not significant. The development of digital finance has brought possibilities for solving financing problems.

Firstly, digital finance enhances the information gathering ability of finance as an intermediary. Whether a company can obtain sufficient funds to sustain innovation activities depends on its own financing ability and the effectiveness of the external financial environment (Jie Weimin, Fang Hongxing, 2011). Under the assumption of a sound financial market, a company's investment decisions and financing decisions are independent of each other (Modigliani and Miller, 1959). However, in reality, the existence of information asymmetry in financial markets leads to the generation of information and transaction costs, which constrain the external financing behavior of enterprises (Myers and Majluf, 1984). The academic community generally believes that information asymmetry is one of the main reasons for corporate financing constraints (Kaplan and Zingales, 1997). Love (2003) found through analyzing data from over 40 countries and regions that reducing information asymmetry can alleviate corporate financing constraints. Digital finance relies on big data to achieve rapid matching of

information between different entities, and carries out relatively accurate risk assessment for enterprises (Huang Hao, 2018).

In addition, digital finance utilizes information technology to capture behavioral data from different industries, enterprises, and individuals, effectively integrating data and establishing a reliable third-party credit reporting system. All of the above have alleviated the problem of information asymmetry in the market, providing investors with more information about corporate investment and financing decisions, and thus providing high-quality enterprises with the necessary funds for production and operation activities.

Meanwhile, the role of digital finance in alleviating financing constraints for enterprises is more evident in private enterprises where financing difficulties are more common. On the one hand, this is caused by the unique ownership attributes of state-owned enterprises, and on the other hand, it is caused by information asymmetry issues. There are differences in strategic goals and management methods between state-owned enterprises and private enterprises. Compared with private enterprises, state-owned enterprises have to some extent taken on social roles such as improving people's livelihoods and ensuring employment. Therefore, they have received more policy and funding support from the government and state-owned banks for a long time. The state-owned background also gives them more credit incentives and financing channels. In addition, the ownership structure of private enterprises results in higher information costs in the market and more severe information asymmetry, leading to differences in external financing costs between them and state-owned enterprises.

Overall, under the existing financial environment and policy background in China, state-owned enterprises often face smaller financing constraints than private enterprises (Yu Minggui et al., 2019). When the financial environment is improved, the effectiveness of improving financing constraints varies among different enterprises, and the changes in business decisions are also different. State owned enterprises face more relaxed financing constraints, and when the financial environment is better, the adjustment of their business decisions is relatively small. For private enterprises, driven by the goal of maximizing profits, they will make more efficient allocation of external financing for efficiency improvement in management and research and development innovation (Shen Hongbo et al., 2010).

This article proposes the hypothesis that digital finance can effectively alleviate the financing constraints of enterprises.

3. Econometric Models and Variable Descriptions

3.1. Econometric model (fixed effects model)

This article first analyzes the benchmark impact of digital finance on alleviating corporate financing constraints. The regression model is shown in equation (1):

$$Fin_constraint_{ijt} = C + \alpha_1 index_{jt} + \alpha_2 control_{ijt} + \epsilon_{ijt} \quad (1)$$

In the formula(1), the subscripts i, j, and t of the variables represent the company, city, and year, respectively. The dependent variable $Fin_constraint_{ijt}$ is the financing constraint of the enterprise, and the explanatory variable

$index_{jt}$ is the digital finance inclusive index. $control_{ijt}$ is a series of control variables that may have an impact on corporate financing constraints. Referring to existing literature, the enterprise level control variables added in this article include: (1) debt to asset ratio, represented by the ratio of total liabilities to total assets at the end of the period; (2) The logsize of the enterprise is represented by the natural logarithm of the total assets of the enterprise; (3) The establishment time age of the enterprise is represented by the difference between the observation year and the establishment year of the enterprise.

To minimize the impact of other factors such as the location of the enterprise on corporate financing, as well as to avoid changes in corporate financing constraints caused by other macro factors during the observation period, the benchmark regression in this article uses a two-way fixed effects model, fixing the year effect (Year) and city effect (City).

3.2. Variable Description

3.2.1. Core explanatory variable

The Internet Finance Research Center of Peking University, together with Ant Financial, has collected massive digital financial data, providing reliable data support for research in the field of digital inclusive finance. This article selects the 2015-2020 urban level digital inclusive finance index as the main explanatory variable in the empirical model. In order to further investigate which dimension of digital finance has an impact on alleviating corporate financing constraints, this article also adopts three sub dimensions of indicators: the breadth of coverage, depth of use, and degree of digital support services of digital inclusive finance.

3.2.2. Explained Variable

The financing constraints faced by enterprises cannot be directly obtained from observable data. Kaplan and Zingales (1997) first proposed the idea of measuring corporate financing constraints: based on corporate financial indicators, qualitatively divide the financing constraints faced by

enterprises, and further measure the relationship between financing constraints and enterprise indicator variables to obtain the financing constraint index. There are several measurement methods for corporate financing constraints in existing literature, including: (1) constructing an internal cash flow model of the enterprise and using model coefficients to measure the financing constraints of the enterprise; (2) Construct relevant indices by integrating various indicators of the company, such as KZ index, WW index, and SA index; (3) Survey data based on subjective perception of financing status by management; (4) The proportion of interest expenses, i.e. the proportion of enterprise interest expenses to total liabilities (Yu Minggui et al., 2019). This article selects the SA index with strong exogeneity to measure the financing constraints of enterprises. The SA index was proposed and constructed by Hadlock and Pierce (2010), and its calculation formula is:

$$SA = -0.737 \times Size + 0.043 \times Size^2 - 0.04 \times Age,$$

It has been widely applied in the domestic academic community (Jiang Fuxiu et al., 2016; Zhang Xuan et al., 2017). To demonstrate that the conclusion of this article is not affected by the selection of financing constraint indicators, in the robustness test, this article uses KZ index and FC index instead of SA to measure corporate financing constraints for further testing.

3.2.3. Data sources

This article uses the following data: (1) Peking University Digital Inclusive Finance Index, published by the Peking University Digital Finance Research Center. (2) The relevant information on financing constraints and other enterprise level control variables of A-share listed companies in China from 2015 to 2020 is sourced from the China Securities Market (CSMAR) database and the Tonghuashun Information Financial Terminal System. This article excluded the data of listed companies with ST for three consecutive years, and finally constructed panel data with 3405 samples and 15818 observations.

Table 1. Descriptive Statistics

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
code	15,818	287,876	262,912	2	688,399
age	15,818	23.48	5.386	7.329	64.98
year	15,818	2,018	1.674	2,015	2,020
index	15,818	257.5	39.96	62.67	334.5
coverage_breadth	15,818	251.7	41.70	69.57	326.5
usage_depth	15,818	255.8	47.15	20.65	349.7
digitization_level	15,818	280.1	36.28	70	437.9
logsize	15,818	22.28	1.299	17.81	28.64
debt	15,818	0.414	0.199	0.00836	2.123
hightech	15,818	0.356	0.479	0	1
KZ	15,818	0.717	2.302	-11.34	11.38
SA	15,818	-3.832	0.250	-5.600	-2.113
FC	15,818	0.482	0.293	0	0.987

4. Empirical Result Analysis

4.1. Analysis of benchmark regression results

Firstly, according to equation (1), regression is performed. Table 2 reports the benchmark results of the development of digital finance on corporate financing constraints. The regression results show that the coefficient of digital finance is significantly positive at the 1% level, indicating that digital finance has a significant alleviating effect on financing

constraints. Compared with column (5), the lagged result of SA is still significantly positive, excluding endogeneity. Hypothesis is valid.

Due to the fact that the digital finance index consists of three primary sub dimensions, the next step is to further explore the mitigation effects under each sub dimension of digital finance. The breadth of coverage, depth of use, and support for digital services are respectively substituted into equation (1) for re estimation, and Table 2 columns (2) to (4)

are obtained. It can be seen that each sub dimension of digital finance significantly alleviates financing constraints. Specifically, the extension of digital finance coverage can reach areas and groups that traditional finance is difficult to cover; The increasing depth of use of digital finance has

enriched the diversified demand for financial products and services; The increase in support for digital finance and digital services has increased the convenience of payment, reduced the cost of financial services, and brought about huge digital dividends.

Table 2. Benchmark Regression Results

VARIABLES	(1) SA	(2) SA	(3) SA	(4) SA	(5) SA
index	0.000*** (6.44)				-0.000** (-2.09)
L.SA					0.992*** (557.61)
coverage_breadth		0.000*** (6.27)			
usage_depth			0.000*** (6.04)		
digitization_level				0.000*** (2.76)	
age	-0.038*** (-196.90)	-0.038*** (-196.79)	-0.039*** (-197.17)	-0.039*** (-197.48)	-0.000*** (-3.11)
logsize	0.035*** (35.87)	0.035*** (35.89)	0.035*** (35.92)	0.035*** (36.02)	0.008*** (34.22)
debt	-0.041*** (-6.76)	-0.042*** (-6.88)	-0.041*** (-6.62)	-0.043*** (-7.07)	0.008*** (6.01)
Constant	-4.002*** (-153.16)	-3.995*** (-154.44)	-3.986*** (-155.77)	-3.984*** (-145.28)	-0.235*** (-25.96)
Observations	15,818	15,818	15,818	15,818	12,306
R-squared	0.746	0.746	0.746	0.745	0.990
F test	0	0	0	0	0
r2_a	0.744	0.744	0.744	0.744	0.990
F	542.6	542.5	542.4	541.0	14630

Robust t-statistics in parentheses

*** p<0.01, ** p<0.05, * p<0.1

From the perspective of controlling variables, both enterprise size and enterprise age are significantly negatively correlated, indicating that compared to large and long-term

state-owned enterprises, digital finance can better help small and medium-sized enterprises overcome financing constraints.

Table 3. Robust Test

VARIABLES	(6) KZ	(7) KZ	(8) FC	(9) FC
index	-0.003*** (-5.20)	-0.002*** (-2.94)	0.000* (1.95)	0.000 (1.46)
L.KZ		0.473*** (62.11)		
L.FC				0.285*** (43.99)
age	0.016*** (5.96)	0.006** (2.15)	-0.002*** (-6.77)	-0.001*** (-5.34)
logsize	-0.438*** (-32.20)	-0.278*** (-20.58)	-0.165*** (-126.30)	-0.134*** (-87.77)
debt	7.974*** (93.74)	4.840*** (49.18)	-0.220*** (-26.87)	-0.092*** (-12.72)
Constant	7.413*** (20.45)	5.262*** (14.67)	4.240*** (121.47)	3.371*** (83.36)
Observations	15,818	12,306	15,818	12,306
R-squared	0.424	0.569	0.670	0.798
F test	0	0	0	0
r2_a	0.421	0.566	0.668	0.796
F	136.0	190.1	375.4	567.0

*** p<0.01, ** p<0.05, * p<0.1

4.2. Robust Test

To avoid the impact of different measurement methods on empirical results, common practices are used to replace corporate financing constraints with KZ index and FC index. The test results are shown in Table 3, and the coefficients have appropriate fluctuations after replacement, but the results are significant, Robust t-statistics in parentheses indicating the robustness of the digital inclusive finance index in alleviating corporate financing constraints. The correlation of control variables is basically consistent with the previous text, indicating that for small and medium-sized enterprises and growth oriented enterprises, the alleviating effect of digital finance is more significant.

5. Conclusions and Recommendations

5.1. main conclusion

Digital finance is a strong support for the high-quality development of the real economy, and financing constraints are a major obstacle to efficient resource allocation and innovative development of enterprises. This article proposes its research hypothesis by reviewing existing literature on digital finance and corporate financing constraints, and empirically analyzes the effect of digital finance on alleviating corporate financing constraints based on panel data of A-share listed companies from 2015 to 2020. Research has found that:

Digital finance can effectively alleviate financing constraints for enterprises, and this conclusion still holds after robustness tests such as replacing the dependent variable. This is because on the one hand, digital finance directly improves the financing constraints of enterprises by reducing information asymmetry between financial institutions and small and medium-sized enterprises, as well as between shareholders and managers, enhancing the transparency of enterprise information, and thereby alleviating the financing constraints of small and medium-sized enterprises. On the other hand, digital finance has lowered the threshold for financing for small and medium-sized enterprises, providing them with more convenient ways and improving the accessibility of financing. In addition, the development of digital finance has given rise to numerous financing platforms, which provide more flexible and diversified financing channels for small and medium-sized enterprises, making financing more convenient and flexible for enterprises.

5.2. Policy recommendations

Based on the above research conclusions, this article proposes the following policy recommendations:

Firstly, vigorously promote the development of digital finance. On the one hand, there should be an increase in the construction and investment in new intelligent infrastructure, such as 5G mobile communication networks and data centers, to improve digital financial infrastructure; On the other hand, relevant policies and supporting measures should be formulated to actively promote the digital transformation of financial institutions. At the same time, we will guide fiscal and social capital at all levels to increase their investment in the digital transformation of financial institutions, in order to

accelerate the organic integration of digital technology and the financial services industry.

Secondly, improve the credit reporting system. In the era of digital economy, the development of digital finance helps to effectively address the problem of insufficient credit for individuals and small and medium-sized enterprises. The government can promote the openness of local credit information sharing platforms nationwide and the data sharing of commercial banks and core supply chain enterprises, and improve the level of financial technology. At the same time, we will improve the construction of credit reporting and rating systems, further enhance the professional capabilities of financial institutions in credit risk management, and provide effective guidance for digital finance to support financing for small and medium-sized enterprises.

Thirdly, increase regulatory efforts. The Chinese government has recognized the potential risks of digital finance and is taking measures to control them. Firstly, establish and improve a digital finance regulatory system to regulate various institutional entities and business processes. Secondly, standardize digital financial business, strengthen supervision of business behavior, including strengthening information disclosure and risk warning systems, to improve the transparency of digital financial products. Once again, improve the regulatory system of financial products to ensure their safety and liquidity characteristics. Finally, establish a risk prevention and disposal mechanism, including the construction of effective risk warning mechanisms, monitoring systems, and emergency plans for responding to emergencies.

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