How Does Digital Finance Affect the Burden of Real Enterprises: Evidence from China

Zhihao Huang

Tianjin University of Commerce, Tianjin, China

huangzhihao@stu.tjcu.edu.cn

Abstract. By mainly studying how digital finance affects the burden of real enterprises, this paper utilizes the two-way fixed effect model to test whether the burden of industrial enterprises above the designated size can be largely reduced by digital finance. The following results are found: (1) Digital finance can generally reduce the cost ratio by a large margin. (2) The breadth and depth of digital finance enable a positively significant influence on decreasing the cost rate of enterprises, but the degree of digitalization is the opposite. (3) Among the eastern, central, and western regions in China, only the industrial enterprises above the designated size in the eastern regions are significantly affected by digital finance, which reduces their cost ratio. On this premise, this paper aims to leverage the advantages of digital finance to help related industries and enterprises as well as strengthen regional synergy. Besides, relevant government departments need to provide suggestions on digital financial supervision and innovation assistance. This paper offers a reference that makes a difference for the research pertinent to digital finance.

Keywords: Digital Finance; Enterprise Development; Financial Investment; Economic Growth and Inhibition.

1. Introduction

In recent years, more entities have increased their attention and investment in digital fields, such as big data, block-chain, and artificial intelligence. During the epidemic, compared with restricted offline entities, digital finance was favored by enterprises. To obtain greater profits and stronger competitiveness, some enterprises choose to divide the original business and turn to real estate or other industries, which expands the virtual economy and breaks the balance between virtual and real economies.

Entity enterprises are the cornerstone of national development. However, with the continuously expanding influence of digital finance, enterprises are not only adapting to the times for transformation and upgrading, but also tapping new development momentum, so as to enhance market competitiveness. After a period of explosive growth, digital finance is moving towards standardization, with more and more entity enterprises jumping into the bandwagon of the virtual economy. Meanwhile, Internet technology is increasingly mature, such as cloud computing technology proposed in 2007, block-chain emerging in 2008, and the AI trend triggered by Google in Go in 2016. With the current application of big data, cloud technology, and ChatGPT, digital finance is organically combined with Chinese modernization, which leads digital finance to a new era against Chinese modernization.

Given the combination of digital finance and the traditional real economy, it is practically vital to study the financial investment behavior of real enterprises. Therefore, this paper mainly explores how current digital finance affects the burden of real enterprises from the perspective of cost ratio.

2. Literature Review

In contrast to traditional finance, digital finance is advantageous in reducing geographical factors, information asymmetry, and related costs. It not only reduces some risks of traditional financial investment, but also retains the advantages of high returns and quick realization, which contributes to enterprises' deviation from the real economy and transformation into the virtual one.

Li Zhipeng et al. (2021) [1] find that when one party in the supply chain of an enterprise has capital constraints, both supply and demand sides often use internal trade financing such as prepayment and delayed payment to alleviate the capital constraints, investment risks, and costs. However, the domestic competitive market is increasingly severe and the demand for financing scale is on the rise day by day. Moreover, capital constraints between supply and demand are more frequent. Under this circumstance, if enterprises only rely on internal financing, too limited dividend payments and small-scale financing transactions cannot adapt to the current investment market. At this time, enterprises must complete external financing to alleviate the financing pressure.

Since the difficulty in building a complete capital market in the financial field, under the condition of balanced credit rationing, if entrepreneurs use external financing to relieve the financing pressure, their marginal cost will approach positive infinity. However, if entrepreneurs mean to change credit rationing by reducing investment spending, they will make their income close to infinity and tend to cut their investment spending as a result. Therefore, the traditional financing means held by banks are bound to conflict with the interests of entrepreneurs, which will lead to the differences between internal and external financing caused by incomplete capital markets and profit-seeking. (Liu Kangbing et al, 2007) [2].

According to Zhang Yihao et al. (2007) [3], the reason why a large amount of capital flowed into the mainland and real estates excessively expand is that the marketization of interest rates in China accelerated during 2002-2005 and many foreign capitals received investment signals. On the premise of interest rates higher than foreign ones, international short-term capital was induced into China in large quantities, thus realizing the “arbitrage” of capital. Deng Mingmao (2016) [4] thinks arbitrage mechanism is often concealed to some extent, which can help major shareholders avoid the restrictions of market supervision on business behavior. By making use of the information inequality with minor shareholders to exploit listed companies by harming minority shareholders, major stakeholders maximize their interests. Entity enterprises with cross-industry arbitrage not only significantly inhibits enterprise innovation, but also damages entity capital investment. Although the current financial situation of enterprises can be improved through cross-industry arbitrage, there is still insufficient evidence to show that the financing constraint of capital investment can be alleviated. (Wang Hongjian et al., 2016) [5].

Hu Yiming et al. (2017) [6] believe that the allocation of financial assets by enterprises is based on the motivation of “reservoir”. In other words, aiming to avoid uncertain factors in operation and reduce external financing pressure, enterprises use cash or financial assets with strong liquidity as reserves. This motivation is particularly evident in the cash holdings of enterprises. According to Duan Junshan et al. (2021) [7], this allocation by non-financial enterprises to obtain high utilization will occupy and consume the resources and energy of enterprises. Influenced by the “reservoir” effect, the profits obtained by entities through cross-industry investment behavior cannot even offset the negative impact on technology R&D and innovation under the “crowding out effect”. Zhang Chengsi et al. (2016) find that when the income and risk of fixed assets are determined, the smaller the relative risk, the greater the income of financial assets, and the more enterprises will use the investment of fixed assets for the benefit of financial assets. Meanwhile, the higher the degree of financialization, the more sensitive enterprises are to the changing financial market returns and risks, and the weaker the dependence on endogenous financing.

According to Xue Ying et al. (2020) [9], financial technology can promote the service and supply of small and high-frequency inclusive financing through credit information technology of big data. For example, the information asymmetry between investors and investors can be reduced through credit information technology in China, so that enterprises or individuals can choose less risky schemes when investing. Tang Song et al. (2020) [10] find that the development of digital finance stimulates “structural” innovation on the technological innovation of enterprises to a large degree because digital finance fills the gap in the advance of traditional finance. For instance, digital finance can improve local financial services, promote local financing, and drive the regional economy in areas lacking the banking development,.

Zhang Xun et al. (2019) [11] believe that the third technological revolution is another major revolution after the invention of the steam engine and the electricity usage in human civilization. Digital finance relies on Internet technology. With its rapid development, the sharing of resources is more accessible and the service of finance is improved and more convenient.

According to Liang Bang et al. (2019) [12], digital inclusive financing can broaden the financing channels of SMEs and improve the availability of innovative financing by cutting the costs of SMEs. In addtion, Qian Haizhang et al. (2020) [13] also find that digital finance is conducive to economic growth, with its coverage breadth, usage depth, and digital self-sustaining degree promoting economic development.

As for early digital finance, Huang Yiping (2020) [14] thinks that China's economic growth and financial stability are excellent, but many changes have taken place in recent years. For example, many small and micro enterprises and private enterprises complain that financing is difficult and expensive, and scholars believe that it is hard for the real economy to combine with the financial sector. According to Gao wenyu et al. (2022) [15], digital finance can inhibit "zombie enterprises", whose driving force comes from the coverage and usage depth of digital finance. In addition, it is found that investment costs, risks, and information asymmetry can be decreased, and total factor productivity can be boosted, so as to finally inhibit the emergence of "zombie enterprises".

Wang Dingxiang et al. (2009) [16] believe that digital inclusive financing is a combination of traditional finance and information technology. Matching with the development of a real economy, financial development will accelerate the matching efficiency between financial capital and real capital of real enterprises, thus promoting industrial development. Because real enterprises can get more financing opportunities at lower financing costs, matching digital finance with the real economy can avoid the trap of "hollow industry" and reduce the negative impact of the "crowding out effect" on technological innovation.

This paper makes contributions from two aspects: 1. Innovation from the theme and perspective: from the perspective of digital finance influence and entity enterprises' burden, this paper studies the cost rate, which provides a new reference for the existing research. 2. This paper provides some important enlightenment as follows: Digital finance can augment the burden of real enterprises with regional heterogeneity, so different and targeted policies should be formulated for different regions.

3. Empirical Design

3.1 Design of the Econometric Model

Adopting a two-way fixed effect model, this paper makes an empirical study of the relationship between digital finance and the burden of entities from the perspective of cost ratio. We can study the influence of a variable or a combination of multiple variables on the results through this model. In addition, this paper considers regional heterogeneity and studies the data differences between different regions.

According to the previous theoretical analysis and research on the application threshold model, the following model of how digital finance affects the burden of entities is constructed:

$$Y_{it} = \beta_0 + \beta_1 X_{1it} + \ldots \beta_k X_{kit} + \partial_i + \pi_t + u_{it}$$

In this formula, $Y_{it}$is a dependent variable referring to the burden of entity enterprises, which is expressed by the cost rate of industrial enterprises above the designated size (Rate).

$X_{1it} \ldots X_{kit}$ is the core explanatory variable of digital finance, which uses the data provided by the Digital Finance Center of Peking University, including Breath, Depth, Level, and Index of digital finance (Index).

$\beta_1 \ldots \beta_k$ is the control variable.

β_0 is a constant term.

u_{it} is a random error term.

∂_i is the time effect of control variables.

π_t is the regional effect of control variables.

3.2 Description of Variables

Core variable: the burden of entity enterprises, which is expressed by the cost ratio of industrial enterprises above the designated size (main business income/main business cost).

The usage depth index also includes business sub-indices such as payment, credit and loan, insurance, credit, investment, and money fund. However, the index of credit and money funds in 2019 and 2020 has not been released.

In addition, among the control variables, the technical level (Rd) uses the investment intensity of research and experimental development funds. Environmental regulation (Environment) uses pollution control projects to complete investment/GDP. Government intervention (Government) uses general budget expenditure/GDP. Trades of import and export (Importexport) use the import and export amount of goods/GDP. Invest uses the whole society's fixed asset investment/GDP.

3.3 Data Sources and Explanations

The research object is industrial enterprises above the designated size. Because it is difficult to obtain data from Hong Kong, Macao, Taiwan, and Tibet, the above four regions are excluded when studying how the burden of real enterprises is affected by the digital finance. In order to eliminate the influence caused by the large size difference between individual data and individual extremum, each variable is treated with a logarithm in the study, with the research time limit set from 2011 to 2020. Besides, the data mainly come from the *Statistical Reports of China Statistical Yearbook*, *China Environmental Statistics Yearbook*, and *China Science and Technology Statistics Yearbook.*

4. Empirical Analysis

4.1 Full Sample Analysis

Table 1. Baseline Estimates

	Cost (1)	Cost (2)	Cost (3)	Cost(4)
Index	-0.066*** (-7.02)	-0.059 *** (-6.27)	-0.059*** (-6.22)	-0.055*** (-5.90)
Invest		-0.021*** (-3.60)	-0.021*** (-3.54)	-0.027*** (-4.64)
Environment			0.002 (-3.54)	0.002 (0.89)
Government			-0.015 (-1.30)	-0.018 (-1.58)
Importexport				-0.001 (-0.14)
Rd				0.049*** (4.72)
Time Effect	Control	Control	Control	Control
Regional Effect	Control	Control	Control	Control
Constant Term	0.440*** (12.86)	0.404*** (11.59)	0.394*** (10.20)	0.587*** (10.69)
R2	0.320	0.352	0.358	0.411
Obs	300	300	300	300

It can be seen that the coefficient of digital finance to cost ratio is significantly negative from Table 1, indicating that digital finance alleviates the burden of industrial enterprises above the entity scale. Considering whether each control variable will influence each other and thus affect the final result, this paper controls the control variables. It can be seen from Table 1 that environmental regulation and technical level are not conducive to reducing the burden on enterprises. Government intervention and import and export trade are effective but not significant in reducing the burden on enterprises. Investment can significantly reduce the burden on enterprises, which is because that improving

infrastructure construction, the coverage of digital finance, and digital finance in balanced areas can better develop digital inclusive financing, thus helping to solve capital constraints of commercial circulation enterprises, especially small and medium-sized circulation enterprises under low threshold conditions. By improving social employment and economic development, the social income level will also be improved, which will enhance the social consumption capacity with a positive impact on the profits of enterprises, making the social and economic situation in a virtuous circle (Mei Yuan and Bian Lina 23) [17].

4.2 Dimensional Test

Table 2. Test Results of Three Dimensions

	Cost (1)	Cost (2)	Cost (3)
Breath	-0.019*** (-4.93)		
Depth		-0.047*** (-6.80)	
Level			0.030*** (5.03)
Invest	-0.028*** (-4.73)	-0.030*** (-5.35)	-0.032*** (-5.56)
Environment	0.002 (0.94)	0.002 (0.96)	0.001 (0.70)
Government	-0.016 (-1.38)	-0.012 (-1.04)	-0.005 (-0.42)
Importexport	-0.002 (-0.33)	-0.004 (-0.79)	0.003 (0.48)
Rd	0.050*** (4.68)	0.037*** (3.54)	0.048*** (4.52)
Time Effect	Control	Control	Control
Regional Effect	Control	Control	Control
Constant Term	0.455*** (9.15)	0.514*** (10.48)	0.293*** (5.14)
R2	0.388	0.433	0.390
Obs	300	300	300

Table 2 reports the test results of digital finance in three dimensions, which can be seen that the usage depth and coverage breadth of digital finance is significantly negative, while digitalization is significantly positive. It shows that when the depth and breadth increase, the cost ratio of digital finance will decrease, and so is the burden on enterprises.

Its coverage breadth and usage depth can affect the cost-expense ratio because when the coverage base is large enough, it will be easy for enterprises to borrow from financial institutions. Meanwhile, a series of matching digital finance services and businesses will be improved, so that enterprises can better get due financial support and finally alleviate the burden of enterprises. However, when the degree of digitalization increases, it will lead to an increase in the cost rate, which means that the development of digital finance can give priority to both breadth and depth of use.

4.3 Regional Heterogeneity Analysis

It can be seen from Table 3 that digital inclusive financing in the central, eastern, and western regions of China has great differences in the impact on the cost ratio. For example, digital finance is significantly negative in the eastern region, significantly positive in the central region, and not significant in the western region. This is also in line with the views of Wang Ping and Xu Zhaoyi (2023) [18]. In their opinions, there are obvious geographical differences in policy inclination and economic growth rate when prospering the digital inclusive financing in China.

Digital finance is advantageous in optimizing resource allocation and reducing information asymmetry. The eastern region, especially the eastern coastal areas, has a huge financial volume. Thus, the improvement of financial credit brought by digital finance can help enterprises in the eastern region to carry out corporate financing and improve the economic structure through financial aggregation, so as to reduce costs.

As for the western region, there are few channels for digital inclusive financing to affect the development of private enterprises, which mainly promotes the growth of private enterprises by easing financing constraints. The related industrial chain is still underdeveloped and the assumption of promoting private enterprises by improving payment convenience is not valid (Zhang Lin et al., 2023) [19], so the result is not significant.

Table 3. Inspection Results in Central, Eastern, and Western Regions

	Eastern Regions (1)	Central Regions (2)	Western Regions (3)
Index	-0.058*** (-4.63)	0.096* (1.87)	-0.025 (-0.98)
Invest	-0.015*** (-3.28)	-0.052 (-3.49)	-0.026 (-1.66)
Environment	-0.00003 (-0.02)	-0.008*** (-1.34)	0.006 (1.27)
Government	0.022 (1.52)	-0.054** (-2.15)	-0.014 (-0.55)
Importexport	-0.022** (-2.18)	0.044*** (2.76)	-0.0004 (-0.04)
Rd	0.011 (0.82)	0.033 (1.35)	0.069*** (3.79)
Time Effect	Control	Control	Control
Regional Effect	Control	Control	Control
Constant Term	0.462*** (6.44)	-0.052 (-0.24)	0.663*** (5.68)
R2	0.641	0.563	0.511
Obs	110	80	110

The central region has a large population and developed transportation, while the general public has little contact with financial credit. Thus, digital finance will increase the burden on enterprises in this region.

4.4 Robustness Test

Table 4. Robustness Test Results

	Replace Sample (1)	IV-2SLS (2)
Index	-0.048*** (-4.31)	-0.115*** (-5.41)
Invest	-0.025*** (-4.03)	-0.022*** (-3.94)
Environment	0.001 (0.44)	0.001 (0.74)
Government	-0.021 (-1.58)	-0.020 (-1.48)
Importexport	-0.001 (-0.16)	0.001 (0.18)
Rd	0.052*** (4.50)	0.032*** (2.91)
Time Effect	Control	Control
Regional Effect	Control	Control
Constant Term	0.574*** (9.28)	0.932*** (7.28)
R2	0.416	0.885
Obs	260	270

To ensure the accuracy of the results, this paper uses two ways to test its robustness. First of all, this paper carries out the test of changing samples, excluding the data from Beijing, Shanghai, Tianjin, and Chongqing. It is found that the results are still significantly negative, which shows that it can still significantly reduce the burden on entities. Finally, the instrumental variable method is used, using of instrumental variable method can reduce the overlap of variables with related variables, making the use of valid data in conclusions more efficient. Then, the result is still significantly negative.

Therefore, digital finance is effective in reducing the burden on entities stably based on the above-mentioned results,.

5. Conclusion and Suggestions

This paper uses data from Tibet, Hong Kong, Macao, and Taiwan from 2011 to 2020. After the logarithmic processing of variables, the influence of digital inclusive financing on the cost ratio of industrial enterprises above the designated size is studied by a two-way fixed effect model.

The results are in the following: First, digital finance can significantly reduce the cost ratio of industrial enterprises above designated size, and investment (Invest) is significantly negative in all variable combinations, while government intervention (Government) is negative but not significant. However, environmental regulation (Environment) is not affected by technology (Rd) and trades of import and export (Importexport). Among all variables, only technology (Rd) is significantly positive, which shows that technology (Rd) cannot relieve the pressure of industrial enterprises above the designated size in the impact of digital inclusive financing on cost ratio.

Second, the breadth (Breadth) and depth (Depth) of digital finance can significantly reduce the burden on entities, while the level of digitalization (Level) is the opposite. The main reason is that breadth (Breadth) and depth (Depth) is easier to improve the relationship between enterprises and banks, thus strengthening the financing ability of enterprises. However, the level of digitalization (Level) cannot improve their relationship.

Third, by dividing the city into eastern, central, and western regions, it is found that the eastern region is significantly negative. Thus, it's concluded that "the burden of real enterprises is reduced more obviously due to digital finance". The result in the western region is negative and not significant, which shows that it cannot be judged that digital finance can alleviate the burden on enterprises in the western region. The data in the central region is significantly positive, so digital finance in the central region will increase the burden on entities.

Finally, this paper uses two methods to test the robustness, which are replacement sample and instrumental variable method, with all the results significantly negative, which shows that the conclusion of this paper is robust.

Based on the above research conclusions, this paper puts forward the following policy suggestions:

First, the government should further develop digital inclusive financing, strengthen the construction of digital infrastructure, and promote the combination and innovation of digital inclusive financing and emerging technologies. The supervision of government intervention should be strengthened. Besides, it should improve reward and punishment mechanisms and expand government subsidies. In terms of investment, we not only advocate the combination of investment and digital finance, but also develop new investment models and methods, encouraging more investment in emerging scientific and technological innovation enterprises. Technically, the government should encourage enterprises to develop the related science and technology of digital inclusive financing in depth. Enterprises should strengthen the speed of technological innovation and organically combine technological innovation through the rational use of relevant subsidies given by the government.

Second, the government is obliged to balance the development of digital inclusive financing in the central, eastern, and western regions. Given that the degree of digital finance in the central and western regions of China is relatively backward, the government should fully tap the population advantages of the Chinese and Western regions, speed up the popularization of digital inclusive

financing in industrial enterprises, and improve the regional preferential policies related to digital inclusive financing. In addition, it should prevent the situation that digital inclusive financing restricts the development of industrial enterprises due to the imbalance of regional development.

Third, to promote the breadth and depth of digital finance, the government should expand the economic inclusive effect of digital finance premised on respecting regional differences and accurately implementing relevant policies. Besides, the coordination and unification of digitalization degree, breadth, and depth should be promoted, so as to develop balanced digital finance.

References

[1] Li, Z. P., Zhu, S. Z. & Zhang, J. M. (2021). On capital constraint financing strategy of bilateral supply chain under different power structures. Finance and Accounting Monthly, (17), 33-38.

[2] Liu, K. B., Emler Sterken & Yin, B. C. (2007). Imperfect capital market, credit rationing and corporate investment. World Economics Papers, (06), 19-30.

[3] Zhang, Y. H., Pei, P. & Fang, X. M. (2007). China's short-term international capital inflow and its motivation: An empirical study based on the triple arbitrage model of interest rate, exchange rate, and price. Studies of International Finance, (09), 41-52.

[4] Deng, M. M. (2016). The research on large shareholders' holding reduction timing and private placement arbitrage behavior. Journal of Audit & Economics, 31(03), 73-82.

[5] Wang, H. J., Li, M. M. & Tang, T. J. (2016). The driving factors of cross-industry arbitrage and its impact on innovation. China Industrial Economics, (11), 73-89.

[6] Hu, Y. M., Wang, X. T. & Zhang, J. (2017). The motivation for finance asset allocation: reservoir or substitution: Evidence from Chinese listed companies. Economic Research Journal, 52(01), 181-194.

[7] Duan, J. S. & Zhuang, X. D. (2021). Financial investment behavior and enterprise technological innovation: Motivation analysis and empirical evidence. China Industrial Economics, (01), 155-173.

[8] Zhang, C. S. & Zhang, B. T. (2016). The falling real investment puzzle: A view from financialization. Economic Research Journal, 51(12), 32-46.

[9] Xue, Y. & Hu, J. (2020). Fin-tech promotes high-quality economic development: Theoretical logic, practical basis and path choices. Reform, (03), 53-62.

[10] Wang, S., Wu, X. C. & Zhu, J. (2020). Digital finance and enterprise technology innovation: structural feature, mechanism identification, and effect difference under financial supervision. Journal of Management World, 36(05), 52-66+9.

[11] Zhang, X., Wan, G. H., Zhang, J. J. & He, Z. Y. (2019). Digital economy, financial inclusion, and inclusive growth. Economic Research Journal, 54(08), 71-86.

[12] Liang, B. & Zhang, J. H. (2019). Can the development of digital inclusive finance stimulate innovation: Evidence from Chinese cities and SMEs. Modern Economic Science, 41(05), 74-86.

[13] Qian, H. Z., Tao, Y. Q., Cao, S. W. & Cao, Y. Y. (2020). Theoretical and empirical analysis on the development of digital finance and economic growth in China. Journal of Quantitative & Technological Economics, 37(06), 26-46.

[14] Huang, Y. P. Economic analysis of financial reform. New Finance, (05), 4-10.

[15] Gao, W. Y. & Duan, J. S. (2022). The inhibitory effect of digital finance on Zombie enterprises: Evidence from Chinese listed companies. Finance Forum, 27(10), 62-70+80.

[16] Wang, D. X., Li, L. L. & Ran, G. H. (2009). Financial capital formation and economic growth. Economic Research Journal, 44(09), 39-51+105.

[17] Mei, Y. & Bian, L. N. (2023). The role of digital inclusive finance in the development of commercial circulation industry and its regional heterogeneity analysis. Journal of Commercial Economics, (09), 26-29.

[18] Wang, P. & Xu, Z. Y. (2023). Digital inclusive finance, financing constraints, and common prosperity. Friends of Accounting, (10), 33-40.

[19] Zhang, L., Wang, Y. X. & Zheng, Q. (2023). How does digital financial inclusion affect the growth of private enterprises. Research on Financial and Economic Issues, (05), 76-88.