

Research on the Impact of Digital Financial Inclusion on SMEs' Innovation

-- Evidence from Chinese Listed Companies

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Abstract

In the critical period of transition to "innovation-driven", the innovation level of SMEs is related to the successful implementation of innovation development strategy. Based on the sample of 324 listed companies in China from 2015 to 2019, this paper studies the relationship between digital financial inclusion and SME innovation by using the mediating effect model, analyzes the differences of the impact of each dimension on enterprise innovation, and further explores the impact mechanism of digital financial inclusion on enterprise innovation. The results show that digital financial inclusion can play a positive role in the innovation of SMEs in China, but there are differences in the impact of various dimensions on enterprise innovation, among which the promotion of coverage breadth plays a stronger role. Mechanism analysis shows that digital financial inclusion promotes SEMs' innovation by alleviating the financing constraints. This study provides a theoretical basis for the development of digital financial inclusion.

Keywords

Digital Financial Inclusion; Enterprise Innovation; Financing Constraints.

1. Introduction

The 14th Five-Year Plan calls for that China will pursue Innovation-Driven Development and shape new development advantages, so as to further enhance the innovative consciousness and technological innovation ability of enterprises. As an important part of China's national economy, SMEs play an important role in absorbing employment, improving people's livelihood, supplementing and improving the market economic system, and their innovative activities play a vital role in improving the quality and efficiency of economic growth and promoting the transformation of the mode of economic development. Under the traditional financial system dominated by banks, it is difficult for SMEs to obtain financial services, especially credit services, and their innovative activities are restrained. In order to improve financing channels of SMEs and support their sustainable and healthy development, China vigorously promotes the development of inclusive finance to alleviate the "financial exclusion" faced by them. At the same time, with the development of digital technologies such as big data, artificial intelligence, block chains and cloud computing, the integration of digital technology and inclusive finance, the G20 Summit formally propose "Digital financial inclusion". Digital financial inclusion is the combination of inclusive finance and financial technology, which can overcome the weaknesses of traditional inclusive financial services, such as limited channels, lack of innovation and poor sustainability, so as to better play the role of traditional inclusive finance and provide equal, efficient and convenient financial products and services for the vast number of people, especially urban low-income people, rural population and small and medium-sized enterprises.

Therefore, the development of digital financial inclusion will also have an impact on the behavior and decision-making of enterprises.

Under the above background, this paper aims to study whether the development of digital financial inclusion can promote the innovation of SMEs in China, and further analyze the mechanism of the impact. Are there any differences between three dimensions of digital financial inclusion in promoting SMEs' innovation? Compared with previous studies, the main contributions of this paper are as follows: First, focusing on the special group of small and medium-sized enterprises, this paper discusses the role of digital financial inclusion from the perspective of innovation. The existing literature on digital financial inclusion focuses more on the macro level of urban-rural income gap and economic growth, and less on the micro level of enterprises. Compared with large enterprises, SMEs have their particularity and importance, so we should focus on the study of SMEs in China, not only on large enterprises. Secondly, with the help of Digital financial inclusion Index, this paper makes an empirical analysis of the role and mechanism of Digital financial inclusion in the innovation of SMEs in China, thus enriching the theory and method of financial support for innovation.

2. Literature Review and Research Hypothesis

2.1. Literature Review

There has been a wealth of research on digital financial inclusion at home and abroad since its concept was formally proposed. In the early stage, scholars found that digital financial inclusion was affected by economic development level, geographical factors, financial literacy of residents and Internet usage. In addition to the influence of macro and micro factors, the government's support for digital financial inclusion will also enable more groups to benefit from digital financial inclusion. Since then, with the popularization of digital inclusive financial index measurement, the research on its impact on economic activities has become increasingly abundant. Existing literature has confirmed that the continuous development of digital financial inclusion has played a positive effect on promoting economic growth, narrowing the urban-rural gap, stimulating residents' entrepreneurship and improving residents' consumption level. In recent years, scholars have focused their research on enterprises and discussed the impact of digital financial inclusion on enterprises, such as exploring the impact of digital financial inclusion on enterprise market value, corporate leverage ratio, financing constraints, and the financialization of enterprises. Among them, there are many articles discussing the impact of digital financial inclusion on SMEs from the perspective of financing constraints. Liang B and Zhang J H (2018) [1] have discussed the impact and mechanism of financial inclusion on the financing constraints. However, there are few studies on the role of digital financial inclusion in enterprise innovation. Liang B and Zhang J H (2019) [2] distinguished different dimensions of digital financial inclusion for in-depth analysis, and the results showed that all dimensions of digital financial inclusion can have a significant impact on enterprise innovation input. From the perspective of enterprise heterogeneity, Yu P and Dou J X (2020) [3] pointed out that for enterprises with high information asymmetry, poor internal quality environment and good institutional environment, the development of digital financial inclusion plays a greater role in promoting their innovation activities. Teng L and Xu L (2020) [4], in addition to finding that all three dimensions will have an impact on enterprise innovation input, further study found that this impact will be different due to the differences in the nature of enterprise property rights. Compared with state-owned SMEs, digital financial inclusion has a more significant impact on private enterprises.

Through the above literature review, it can be seen that previous studies on digital financial inclusion have paid less attention to the special group of SMEs. Compared with large enterprises, SMEs have their own particularity and importance. When researching the digital financial

inclusion of SMEs, most scholars focus on the effect of financial inclusion on their financing constraints, while there are few literatures directly studying the impact on SMEs' innovation.

2.2. Research Hypothesis

Innovation is the primary driving force of enterprise development, and the capital constraints faced by enterprises are the main factors restricting their innovation behavior, which will not only hinder the sustainability of enterprise innovation investment, but also reduce the confidence of enterprises in future innovation investment (Banerjee and Duflo, 2010) [5]. Compared with large enterprises, financing constraints play a more significant role in hindering SMEs' innovation (Guo L and Wang Y, 2020) [6].

Digital financial inclusion can influence enterprise innovation activities in two aspects: First of all, the development of digital financial inclusion can provide more financing channels for SMEs, thereby enhancing the innovation capital of enterprises. Digital financial inclusion based on financial technology can use cloud computing, big data and other technologies to mine, aggregate and analyze massive data, which is conducive to enhancing the understanding of both the supply and demand sides of funds, thus effectively alleviating the problems caused by information asymmetry (Demertzis et al, 2018) [7]. For SMEs, the development of digital financial inclusion can dredge the "market-enterprise" information channel, alleviate the information asymmetry between them and financial intermediaries, strengthen the effective judgment of financial institutions on their credit status, improve the efficiency of credit approval, reduce the degree of risk aversion, and thus optimize the allocation of financial resources. As a result, SMEs can get more financing from financial institutions. In addition, the development of digital finance, including crowdfunding lending model, micro-credit platform and P2P platform, also provides more financing channels for enterprises.

Secondly, digital financial inclusion can reduce the capital cost of SMEs to obtain credit, which is conducive to enhancing their innovation ability. Digital financial inclusion can also reduce the cost of credit funds for SMEs, thereby enhancing their innovation power. Compared with traditional inclusive finance, digital financial inclusion cannot be restricted by geographical areas and hardware facilities to a certain extent, and can use emerging technologies to rely on network platforms to complete auditing, pricing and trading, thereby reducing the business costs of financial institutions. The decrease in the cost of financial services leads to the corresponding decrease in the financing cost of SMEs. If the financing cost are lower, enterprises will invest more capital from general production activities to innovation activities, thus enterprise innovation will be promoted.

To sum up, the easing of enterprise financing restrictions may be a key channel for digital financial inclusion to promote innovative investment in small enterprises. Firstly, digital financial inclusion can expand its financing channels and provide more financial support for enterprises, thus creating favorable conditions for enterprises to innovate. Secondly, digital means can reduce the cost of financing for enterprises, which can further stimulate enterprises to invest more funds in innovative projects, and further enhance enterprise innovation.

Based on the above analysis, this paper puts forward the following two assumptions:

H1: Digital financial inclusion can promote enterprise innovation.

H2: Digital financial inclusion can ease the financing constraints of SMEs', thereby promoting enterprise innovation.

3. Study Design

3.1. Sample Selection and Data Sources

This paper selects the small and medium-sized board and GEM companies from 2015 to 2019 as the research objects, whose registered places cover all provinces in the country. This paper

deals with the data as follows: (1) excluding the listed companies in the financial industry; (2) deleting the ST and ST * enterprises; (3) excluding the samples with missing data. Finally, 342 samples of listed companies were obtained. The data on digital financial inclusion in this paper comes from the Digital financial inclusion Index provided by the Digital Research Center of Peking University. The professional indicators of small and medium-sized enterprises, including the number of annual patent authorizations and financial data of enterprises, are from the CASMA.

3.2. Definition of Variables

3.2.1. Enterprise Innovation

This paper mainly reflects the innovation capability of enterprises from the perspective of innovation input. Referring to previous literature, this paper selects the proportion of R & D expenditure in the operating income of SMEs, and evaluates their innovation input.

3.2.2. Digital Financial Inclusion Index

We use the Peking University Digital financial inclusion index as a proxy variable for the development of digital financial inclusion. The index, compiled by the Digital Finance Research Center of Peking University, can give a comprehensive description of digital finance in various regions of China.

3.2.3. Financing Constraints

According to the idea of "the development of digital financial inclusion-the alleviation of financing constraints-the increase of R & D investment", this paper refers to Li B and Zhu T (2020) [8] to select SA index as the proxy variable of enterprise external financing constraints. SA index is constructed according to the size of enterprises and the year of operation of enterprises. The larger the value of SA index, the greater the financing constraints faced by the company. Formulate (1) is the calculation method of SA index.

$$SA = -0.737 * Size + 0.04 * Size^2 - 0.04 * Age \quad (1)$$

3.2.4. Control Variable

In this paper, other variables are introduced as control variables in order to eliminate the influence of dependent variables. It mainly includes the financial data of the enterprise, such as the size of the enterprises, the return on assets (roa), the growth rate of business income (growth), the combination of two positions (dual, when the chairman and the general manager are concurrently held by the same person, take 1, otherwise take 0) and the proportion of independent directors (ind).

3.3. Model Design

This paper makes an empirical analysis of the role and mechanism of digital financial inclusion in SMEs' innovation in China. First of all, this paper establishes model (2) to empirically analyze the role of digital financial inclusion in SME innovation.

$$innov_{i,t} = c + \gamma dif_{i,t} + \Theta X_{i,t} + \mu_i + \varepsilon_{i,t} \quad (2)$$

Among mode (2), $innov_{i,t}$ is the innovation input of enterprise i in period t, and $dif_{i,t}$ is the explanatory variable of this paper, which is the digital financial inclusion index of the province where enterprise i is located. Several control variables are also introduced in the model, and the fixed effects (μ_i) of individual enterprises are controlled. Secondly, we use the mediating effect model to examine whether the financing constraints are the mechanism of digital financial inclusion affecting enterprise innovation. The regression model is set as follows:

$$innov_{i,t} = c_1 + \alpha dif_{i,t} + \Theta_1 X_{i,t} + \mu_i + \varepsilon_{i,t} \quad (3)$$

$$SA_{i,t} = c_2 + \beta dif_{i,t} + \Theta_2 X_{i,t} + \mu_i + \varepsilon_{i,t} \tag{4}$$

$$innov_{i,t} = c_3 + \alpha' dif_{i,t} + \delta SA_{i,t} + \Theta_1 X_{i,t} + \mu_i + \varepsilon_{i,t} \tag{5}$$

Model (3), (4) and (5) are the mediating effect test procedures. This paper tests the mediating effect test method proposed by Wen Zhonglin. SA is the intermediary variable, which indicates the transmission channel of digital financial inclusion affecting enterprise innovation.

3.4. Descriptive Statistics

The definitions and descriptive statistics of the variables used in this paper are shown in Table 1:

Table 1. Sample Descriptive Statistics

Variable symbol	Variable definition	Mean	Standard	Minimum	Maximum
innov	Enterprise innovation input index	5.59	5.44	0.00	51.55
difi	Digital Inclusive Financial Index of the province where the enterprise is located	163.06	66.85	18.33	278.11
coverage	Coverage breadth index	147.47	62.69	1.96	268.39
usage	Usage depth index	168.14	60.81	6.76	280.93
digitization	Digitization level	190.75	116.65	7.58	434.64
SA	Enterprise Financing Constraint Index	3.63	0.91	1.76	7.45
size	Enterprise scale	21.54	0.78	19.59	24.69
roa	Return on total assets	0.06	0.05	-0.63	0.28
growth	Growth rate of income	0.33	1.65	-0.88	60.22
Dural	Combination of two positions (when the chairman and the general manager hold the post concurrently, 1 is taken otherwise 0 is taken)	0.38	0.49	0.00	1.00
ind	Ratio of independent directors to the total number of directors of the enterprise	0.37	0.05	0.30	0.60

4. Study Design

4.1. Benchmarks Regression Results

The regression results of digital financial inclusion and SMEs' innovation is shown in Table 2. Column (1) represents the results without any control variables, we can see that the regression coefficient of digital financial inclusion is 0.00373 from the regression results of column (1), which is significant at the level of 1%, confirming that digital financial inclusion can enhance the innovation level of SMEs. In order to exclude the impact of other variables on innovation activities, we control a series of variables affecting enterprise innovation activities in column (2). The results show that the estimated coefficient of digital financial inclusion on SME innovation is significantly positive at the level of 5%. Comparing the above two results, we can find that the promotion effect of digital financial inclusion on enterprise innovation has good

stability and significance, and the effect of digital financial inclusion on enterprise innovation is still significant when other variables are controlled.

Table 2. Benchmarks Regression

variables	innov (1)	innov (2)
difi	0.00373* (0.005)	0.00502* (0.012)
size		-0.869* (0.059)
roa		-11.97*** (0.000)
growth		-0.0201 (0.670)
dural		-0.269 (0.304)
ind		4.683 (0.112)
constant	4.983*** (0.000)	22.58** (0.023)
Number of samples	1710	1710

Note: *, **, *** mean significant at 10%, 5%, 1% level respectively. P value is in parentheses. The following table is the same.

4.2. Descriptive Statistics

The impact of different dimensions of digital financial inclusion on SME innovation. Considering that there may be differences in the impact of different dimensions of digital financial inclusion on enterprise innovation, this paper selects three dimensions: coverage breadth, usage depth and digitization level to further study the impact of different dimensions of digital financial inclusion on SME innovation. At the level of coverage breadth, the development of digital financial inclusion is reflected by the number of electronic accounts because the Internet can break through the limitation of space. In terms of the usage depth, this paper mainly measures the actual use of Internet financial services. Convenience and cost are two main factors when measuring digital service support (Guo F et al., 2011) [10].

Table 3 reports the regression results. It can be seen from column (1) that the marginal impact of the coverage breadth on enterprise innovation is 0.00557, which is significant at the confidence level of 5%, indicating that the investment of enterprise innovation will increase by 0.5% when the coverage breadth of digital financial inclusion increases by 1%. The estimated coefficient of the usage depth of digital financial inclusion in column (2) is 0.00462, which is significant at the level of 1%, indicating that the improvement of the usage depth will enhance the innovation investment. The regression coefficient of digitization level in column (3) on enterprise innovation is significant at the level of 10%, indicating that digitization level has a positive impact on enterprise innovation investment. By comparing different dimensions, we can find that the development of different dimensions of digital financial inclusion has different impacts on enterprise innovation, and the improvement of coverage breadth has a stronger effect on SMEs' innovation investment.

Table 3. Digital financial inclusion and Innovation: Distinguishing different dimensions

variables	innov (1)	innov (2)	Innov (3)
coverage	0.00557** (0.014)		
usage		0.00462*** (0.006)	
digitization			0.00171* (0.075)
size	-0.886* (0.059)	-0.579 (0.111)	-0.562 (0.209)
roa	-12.09*** (0.000)	-12.48*** (0.000)	-12.62*** (0.000)
growth	-0.0205 (0.661)	-0.0229 (0.624)	-0.027 (0.573)
dural	-0.269 (0.304)	-0.293 (0.265)	-0.31 (0.242)
ind	4.782 (0.105)	4.812 (0.100)	4.906 (0.101)
constant	22.91** (0.024)	16.38** (0.037)	16.44* (0.093)
Number of samples	1710	1710	1710

5. The Mechanism of Digital Financial Inclusion Affecting Enterprise Innovation

Table 4. Test of financing constraint channels

variables	innov (1)	SA (2)	Innov (3)
difi	0.00502** (0.012)	-0.000842*** (0.000)	0.00324 (0.502)
SA			-2.109* (0.051)
size	-0.869* (0.059)	1.118*** (0.0000)	1.489 (0.786)
roa	-11.97*** (0.000)	-0.0399** (0.013)	-12.06*** (0.000)
growth	-0.0201 (0.67)	0.0000725 (0.879)	-0.0199 (0.678)
dural	-0.269 (0.304)	0.00303 (0.332)	-0.263 (0.319)
ind	4.683 (0.112)	-0.00928 (0.764)	4.664 (0.116)
constant	22.58** (0.023)	-20.30*** (0.000)	-20.24* (0.055)
Number of samples	1710	1710	1710

The above conclusion shows that the development of digital financial inclusion has a positive impact on the innovation activities. This section will analyze the mechanism of digital financial inclusion on enterprise innovation. The lack of access to innovative capital and the high cost of innovative capital are important factors restricting the innovation of small and medium-sized enterprises, while the development of digital financial inclusion is conducive to the expansion of financing channels for SMEs, reducing the difficulty for enterprises to obtain funds, on the other hand, it can reduce the financing costs of SMEs and enhance their investment in innovative projects. Therefore, the alleviation of enterprise financing constraints may be a key channel for digital financial inclusion to promote SMEs to implement innovative activities.

Based on this, this paper takes enterprise financing constraints as an intermediary variable to examine whether digital financial inclusion can effectively promote the innovation behavior of SMEs by alleviating enterprise financing constraints. The results of the mediating effect test were shown in Table 4. The estimated coefficient of digital financial inclusion in column (2) is significantly negative at the level of 1%, indicating that digital financial inclusion can alleviate the financing constraints faced by SMEs. In column (3), the estimated coefficient of enterprise financing constraint (SA) is significantly negative. Secondly, compared with column (1), after the introduction of financing constraint, the coefficient of digital financial inclusion on enterprise innovation is no longer significant, indicating that enterprise financing constraint is significant as an intermediary variable.

6. Conclusion

This paper studies the relationship between the development of digital financial inclusion and the innovation of SMEs based on the sample of China's small and medium-sized board (SME) and growth enterprise board (GEM) companies. The study finds that the improvement of the level of digital financial inclusion has an incentive effect on the innovation investment of SMEs. Further distinguishing the impact of different dimensions of digital financial inclusion, we can find that the impact of different dimensions of inclusive finance on SME innovation is different, compared with the usage depth and digitization level, the dimension of coverage breadth is more important for SME innovation. Further study on the mechanism of digital financial inclusion in promoting the innovation of SMEs in China shows that digital financial inclusion can effectively reduce the financing constraints of SMEs, thereby promoting the innovation of enterprises.

From the perspective of financing constraint, we explore the positive role of digital inclusive finance in SMEs innovation, which has certain guiding value for alleviating the problems of "financing difficulty", "financing expensive" and insufficient innovation in small and medium-sized enterprises. First, continue to promote the infrastructure of digital financial inclusion. The development of digital financial inclusion will help reduce the financing constraints of SMEs and promote the innovative development of enterprises. The government should continue to improve the basic conditions of digital financial inclusion, make full use of the technologies and platforms of fintech enterprises and Internet enterprises, provide liquidity support for SMEs and reduce their financing constraints. Second, when making innovation-related decisions, governments can focus on small and medium-sized enterprises that are highly innovative. The diversified needs of enterprise groups can be satisfied by formulating specific financial policies. Third, actively promote the development of digital finance to promote the balance of financial resources allocation. Relying on digital technologies, digital financial inclusion has unique advantages in expanding the coverage and application fields of financial services in all regions, especially in less developed regions.

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