

The Impact of Fintech on China's Corporate Financing Constraints - Analysis based on the perspective of enterprise life cycle

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Abstract. SMEs, as the cornerstone of the real economy, face greater financing difficulties in accessing traditional financial services, which constrains their further development. In recent years, with the rapid development of the digital economy and the continuous innovation of financial technology, new ideas and solutions have been provided to solve the financing difficulties of SMEs. This paper uses the financial and related data of A-share listed companies from 2010-2022 to construct a regression model and a moderating effect model, which are used to analyse the impact of fintech on financing constraints and the moderating role of life cycle in it. The findings of the study show that, on the whole, fintech significantly alleviates the financing constraints of Chinese enterprises, and the degree of financing constraints varies with the life cycle of the enterprises; further analysis of the moderating effect reveals that the life cycle of the enterprises in the growth and decline periods will play a positive moderating role in the financing constraints of the enterprises affected by fintech. After analysing the heterogeneity, it is found that the development of fintech in the eastern region has a stronger role in alleviating the financing constraints of SMEs, and the role of fintech in alleviating the financing constraints of enterprises with a low degree of science and technology is better than that of enterprises with high technology.

Keywords: Fintech, Financing Constraints, Life Cycle, Moderating Effect.

1. Introduction

In the current development process, enterprises still face financial problems such as poor cash liquidity and irrational asset structure, as well as operational problems such as unsound development models and imperfect information disclosure. These problems make it difficult for financial institutions to accurately assess the cash flow and asset status of enterprises, thus creating information asymmetry and causing enterprises to face greater financing difficulties in accessing traditional financial services.

In order to alleviate the problem of enterprise financing difficulties, China's government has vigorously promoted the development of fintech, which uses digital technologies such as big data, blockchain and artificial intelligence to innovate diversified financial products and effectively integrate technology and finance. On the one hand, fintech efficiently and conveniently collects and mines enterprise information through its technological advantages, helping banks and other financial institutions make better credit decisions and reduce the risk of default; on the other hand, the new financing model breaks the high threshold of the traditional financial model and broadens the financing channels of enterprises. In this context, whether fintech helps to alleviate the financing constraints of enterprises has become an issue worthy of in-depth discussion.

Enterprises in different life cycle stages have different effects of fintech application, which in turn affects the extent of their alleviation of financing constraints. Enterprise life cycle theory explores the process from growth to extinction and its cyclical characteristics. Chen Zhenquan Chen Fei et al. (2021) analysed the effect of fintech on driving enterprise digitisation is more pronounced for mature firms and weaker for growth stage firms; Xiaoyue Gao (2020) points out that financing constraints of growth stage SMEs are sequentially greater than those of mature and declining SMEs; Yu Lei (2023) found that fintech can increase the total factor productivity of firms by reducing the level of financing

constraints; Chen Zhongfei et al. (2021) find that fintech promotes growth enterprises more obviously[1-5]. Therefore, on the basis of theoretical analysis, this paper uses the financial data of A-share listed companies and related data from 2010-2022 to construct regression models and moderating effect models, which are used to analyse the impact of fintech on financing constraints and the moderating role of life cycle in it.

The contribution of this paper is mainly reflected in the following points: firstly, this paper verifies empirically that the development of fintech can significantly alleviate the financing constraints of enterprises, which not only enriches the theoretical discussion of fintech in the field of enterprise financing, but also proves the positive role of fintech in reducing the cost of enterprise financing and improving the efficiency of financing. Secondly, this paper introduces the enterprise life cycle as a regulating variable, discusses in depth the differences in the impact of fintech on financing constraints in different life cycle stages of enterprises, reveals the importance of enterprise life cycle in the application of fintech, and promotes the application and expansion of enterprise life cycle theory in fintech research. Again, by analysing the heterogeneity of high-tech enterprises and different regions, this paper finds that fintech is more effective in alleviating the financing constraints of high-tech enterprises and enterprises in the eastern region, which provides targeted suggestions for policy formulation, which should take into account the regional and industrial variability in order to better play the role of fintech.

2. Theoretical analysis and research hypotheses

2.1. Impact of fintech on corporate financing constraints

Fintech, as an emerging development model of technology-enabled finance, has further changed the traditional financing methods through emerging technologies such as big data, cloud computing, blockchain, artificial intelligence, and other emerging technologies to provide more convenient financing channels at a low cost to meet the funds required by small and medium-sized enterprises (SMEs) in the course of their development[6]. Based on the established literature, this paper argues that there are two main paths for fintech to alleviate the financing constraints of enterprises:

First, improve financing constraints by alleviating information asymmetry. In the credit market, fintech can effectively attenuate the problem of adverse selection by using its signalling system and screening mechanism. At the same time, the reputation mechanism of fintech helps to circumvent the moral hazard problem, thus reducing the information asymmetry between cooperative subjects as a whole. Specifically, fintech improves information transparency by acquiring and analysing a large amount of enterprise data in real time, enabling financial institutions to more accurately assess the credit status and business risks of enterprises. This information symmetry environment makes the financing process smoother and more efficient.

Second, it improves financing constraints by reducing transaction costs. Fintech significantly reduces financing transaction costs by optimizing business processes, automating operations and reducing human intervention. For example, the application of smart contracts and blockchain technology has reduced the intermediary links and red tape in traditional financial transactions, thus speeding up the flow of funds and improving financing efficiency. This not only reduces the financing cost of enterprises, but also enables financial institutions to provide financing services at a lower cost. Based on the above analysis, this paper proposes the following hypotheses:

H1: Fintech may effectively alleviate the problem of corporate financing constraints.

2.2. The impact of enterprise life cycle on financing constraints

Listed companies in different life cycle stages still exist financing constraints, the process of enterprise from prosperity to decline as a life form, through the growth, maturity and decline of three stages, in different stages of the enterprise, its financial characteristics, organizational form there are significant differences between the different life cycle of different enterprises due to the different needs of funds faced by the degree of financing constraints there are also differences, which requires

enterprises to combine their own advantages to develop to Get rid of the enterprise financing difficulties[7].

In the growth period, profit growth lags behind revenue growth, and the financial characteristics of the enterprise show that the net cash from operations is negative, while the increasing foreign investment and a small amount of capital recovery make the enterprise's net cash flow from investment negative. The ability to raise funds cannot meet the needs of daily operations and expansion investment, which makes the growing enterprises lack of cash flow and face serious financing constraints. The profitability and market share of the products of the enterprise in the recession period are constantly replaced, the financial and operating conditions of the enterprise are declining, and the internal cash flow is gradually shrinking. In order to get out of the predicament, enterprises in recession must look for new profit growth points, but the investment in research and development of new products will further aggravate the financial difficulties of enterprises, and more uncertainties will arise in the production and operation of enterprises. Therefore, the degree of financing constraints is deeper for enterprises in the growth and decline periods.

After entering the maturity stage, the market share reaches the highest level, and at the same time has a wide range of financing channels, the trend of capital expansion gradually slows down, and the enterprise's demand for capital gradually relaxes. The financial characteristics of the maturity stage are remarkable. The profitability and operating cash flow of the enterprise in the maturity stage show a stable trend, and a large amount of internal surplus funds have been accumulated, and the enterprise also gradually recovers the funds invested in the previous period, and the net investment cash flow begins to increase. Internal surplus and sufficient operating cash flow for the maturity of the enterprise escort, to ensure that the enterprise capital needs, and thus the degree of enterprise financing constraints is relatively weak. Therefore, the hypothesis is proposed:

H2: The degree of financing constraint varies with the life cycle in which the enterprise is located.

2.3. Relationship between fintech and firm life cycle and corporate finance constraints

For enterprises in the growth stage, their main goal is to expand market share and improve enterprise competitiveness, and therefore they need a large amount of external funds to maintain operations and investments. By utilizing fintech, these firms are able to better showcase their operations and increase their credit and visibility in the form of guarantees. Fintech can transmit the enterprise's operation information to the bank in real time, which serves as an important guarantee for the bank's risk control and reduces the information asymmetry between the bank and the enterprise, thus effectively alleviating the enterprise's financing constraints.

On the contrary, the market share and product profitability of enterprises in the recessionary period are declining, and they face financial and operational risks that are difficult to control. At this stage, firms usually recoup upfront investments to increase cash flow to meet operational needs. In serious cases, they may need to sell their assets for asset restructuring or even withdraw from production and operation, which makes it more difficult for enterprises in decline to obtain credit funds through bank evaluation and assessment. However, banks are willing to develop financial products to provide credit support to high-tech enterprises and banks due to their long-term and stable relationships with them. By utilizing fintech, the recessionary enterprises can pass the bank's evaluation and assessment, thus helping them to obtain loans and effectively alleviate their financing difficulties [8]. Based on the above analysis, the following hypotheses are proposed:

H3: Firms' life cycle in the growth and recession periods may positively moderate fintech's impact on firms' financing constraints.

3. Empirical Research

3.1. Variable Selection and Interpretation

3.1.1. Explained Variables

The explanatory variable is financing constraints. Referring to the research of Wang Hongjian (2017) and others, this paper adopts the FC index to measure the constraints of financing on enterprises [9]. FC index focuses on the impact of the company's internal cash flow on the demand for financing, which is comprehensively calculated through the degree of financing constraints and other market environment factors, and the specific calculation formula is as follows:

Financing Constraint Index = Financing Constraint Degree * Market Environment Factor 1 + Financing Constraint Degree * Market Environment Factor 2 + ...

Among them, the market environment factor is determined according to the actual situation, which can include the macroeconomic environment, industry development status, policies and regulations and other factors. Calculation of financing constraint index also needs to consider whether to exclude ST or *ST or PT stocks, whether to exclude companies listed for less than one year, which have been delisted or suspended, and whether to exclude companies listed on the Beijing Stock Exchange[10].

3.1.2. Explanatory variables

The explanatory variable is financial technology. Fintech is a form of applying technology to financial services, using cloud computing, big data, blockchain, artificial intelligence and other technologies to improve the efficiency of the financial industry and reduce costs. According to the definition of the Global Financial Stability Board (FSB), fintech promotes financial innovation through technological means and has a significant impact on financial services and markets. This article searches 'fintech', 'cloud computing', 'big data' and 'blockchain' on the website of 'EyeBall'. 'Blockchain', 'Artificial Intelligence', 'Internet of Things' and other keywords, in order to obtain the industrial and commercial registration information of relevant companies. To avoid character matching coincidences, only samples with the above keywords appearing in the company name or business scope are retained, and companies with less than 1 year of operation time or abnormal status are excluded. In order to accurately identify fintech companies, this paper uses regular expressions to filter samples containing keywords such as 'finance', 'insurance', 'credit', 'clearing', 'payment', etc., based on the company's scope of business and the classification of the Basel Committee on Banking Supervision, and removes irrelevant fields. Eventually, the number of fintech companies in prefecture-level cities per year is counted as an indicator of the level of fintech development, with larger values representing a higher level of development [11].

3.1.3. Control Variables

In order to be able to more accurately identify the independent impact of fintech on corporate financing constraints, so as to exclude other factors that may interfere with the results, and to improve the reliability and validity of the research conclusions, this paper refers to the existing studies and combines the selection of the following eight control variables: the gearing ratio (LEV), the net profitability of total assets (ROA), the current ratio (CR), the cash flow ratio (CFR), the number of first-largest shareholders' shareholding number of total shares (Top1), second largest shareholders' shareholding ratio divided by first largest shareholders' shareholding ratio (Top10), price-to-book ratio (PBR), and firm size (Size). The above variables represent various characteristics of firms' financial status, liquidity, equity structure and market performance, which may affect the firms' financing constraints.

3.1.4. Moderating Variables

In this paper, Corporate Life Cycle (LC) is used as a moderating variable. As this paper takes listed companies as the object of study, such companies have already possessed a more complete organizational and operational system and crossed the start-up stage through IPO registration and listing. Referring to Zhao Hao's (2021) method of cash flow portfolio for division, the corporate life

cycle is divided into three stages: growth, maturity, and decline [12]. Based on the above discussion, this study combines the advantages of the scoring method and the industrial economy method, and selects four indicators (see Table.1.), including sales revenue growth rate, retained earnings rate, capital expenditure rate and enterprise age, to classify the stage of development of the enterprise; in the specific operation, the factor of the difference between industries is taken into account, i.e., based on the total scores of the four indicators, the total samples are ranked in descending order by subindustry, in which each sample of the industry is divided into three parts according to the size of the total score, with about one-third of the highest-scoring enterprises in the growth stage, about one-third of the lowest-scoring enterprises in the decline stage, and the middle part in the maturity stage. Finally, the classification results of each industry are aggregated to obtain the sample classification results of the life cycle of all listed companies [13].

Table 1. Criteria For Classifying Enterprise Life Cycle Stages.

Variables	Sales Revenue Growth Rate		Retained Earnings Ratio		Capital Expenditure Ratio		Business Age	
Development Stage	Characteristics	Assigned	Characteristics	Assigned	Characteristics	Assigned	Characteristics	Assigned
Growth stage	High	3	Low	3	High	3	Low	3
Mature Stage	Medium	2	Medium	2	Medium	2	Medium	2
Decline stage	Low	1	High	1	Low	1	High	1

3.2. Empirical modelling

First, this paper uses a regression model to test the impact of fintech on corporate finance constraints. The basic form of the model is as follows:

$$FC_{it} = \alpha_0 + \alpha_1 Fintech_{it} + \alpha_2 Control_{it} + \sum year + \sum industry + \varepsilon_{it} \quad (1)$$

Where denotes the degree of financing constraints of the enterprise's industry i in year t , and denotes the level of fintech development in the enterprise's region as a set of control variables, including enterprise size (Size), gearing ratio (LEV), net profitability of total assets (ROA), etc., as error terms.

To further explore the moderating role of enterprise life cycle in fintech affecting financing constraints, this paper constructs a moderating effect model. The enterprise life cycle is divided into growth period, maturity period and decline period. The basic form of the model is as follows:

$$FC_{it} = \alpha_0 + \alpha_1 Fintech_{it} + \alpha_2 Moderate_{it} + \alpha_3 Fintech_{it} \times Moderate_{it} + \alpha_4 Control_{it} + \sum year + \sum industry + \varepsilon_{it} \quad (2)$$

Where denotes the life cycle stage of industry i in year t , is an interaction term to examine the moderating effect of the firm's life cycle on fintech's impact on financing constraints, and is a random error term.

3.3. Sample selection and data sources

This paper selects all A-share listed companies from 2010-2022 as the research sample, the basic characteristics of listed companies, financial data from the Wind database and CSMAR database, the annual sales value data of enterprises from the China Statistical Yearbook of previous years industry classification data from the official website of Shenwan Hongyuan Securities, the number of fintech companies at the level of prefectural or municipality was obtained from the website of 'Tianyancha'. Following the practice of the existing literature, this paper deletes the samples of financial companies, insolvent companies, companies whose stocks are subject to special treatment by the Securities and

Futures Commission, and the samples with missing main variables, and finally obtains 25,531 research samples. In order to remove the effect of extreme values on the regression results, we shrink the selected data at the 1% and 99% levels.

3.4. Correlation analysis

In this paper, correlation analysis is performed for all the variables in the model (Table.2.). In order to avoid multicollinearity, this paper conducts a VIF test, and the VIF values of all variables are less than 3, indicating that there is no multicollinearity problem in the model.

Table 2. Data Correlation.

	FC	Fintech	LC	LEV	ROA	CR	CFR	Top1	Top10	PBR	lnSize
FC	1										
Fintech _h	-0.228***	1									
LC	0.113***	-0.036***	1								
LEV	-0.651***	0.104***	0.080***	1							
ROA	0.124***	-0.078***	0.154***	0.331***	1						
CR	0.445***	-0.059***	0.071***	0.624***	0.199***	1					
CFR	-0.038***	-0.005	0.078***	0.163***	0.384***	0.021***	1				
Top1	-0.156***	0.033***	0.070***	0.058***	0.145***	0.022***	0.092***	1			
Top10	0.072***	0.016**	0.037***	0.071***	0.023***	0.068***	-0.005	0.587***	1		
PBR	0.079***	-0.011*	0.106***	0.025***	0.058***	0.073***	0.035***	0.082***	0.046***	1	
lnSize	-0.795***	0.263***	0.121***	0.455***	0.057***	0.312***	0.085***	0.223***	0.053***	0.368**	1

Note: *, ** and *** indicate significant at the 10 per cent, 5 per cent and 1 per cent levels, respectively, as below.

3.5. Analysis of regression results

The results of the benchmark estimation in this paper are shown in Table.3., where column (1) shows the regression results without controlling any influencing factors, column (2) shows the regression results with a series of control variables introduced on the basis of column (1), and column (3) shows the regression results with further controlling the time and industry fixed effects.

According to the regression results, it can be seen that in the baseline model (1), the coefficient of the level of development of financial technology fintech is -0.005, and is significant at the 1% level, which is negatively correlated with the enterprise financing constraints, indicating that the use of fintech by enterprises effectively reduces the asymmetry of information and transaction costs between the banks and enterprises, and reduces the constraints on enterprise financing, and hypothesis 1 is established. In the test model (2), enterprise life cycle LC and financing constraints FC show a positive correlation, the coefficient of LC is 0.003, and it is significant at 1% level, indicating that there are differences in financing constraints when enterprises are in different life cycles, and financing constraints of enterprises in the growth period are the largest, followed by enterprises in the decline period, and financing constraints of enterprises in the maturity period are the smallest, and the hypothesis 2 is established. In the test model (3), the coefficient of the interaction term between fintech and enterprise life cycle is -0.002, and it is significant at 1% level, indicating that the enterprise

life cycle has a moderating effect on the fintech to alleviate the enterprise financing constraints, and enterprises in the growth period and the decline period are more conducive to the use of fintech to show their business conditions and pass the bank audit to obtain financing, and the hypothesis 3 is established.

Table 3. Regression Results.

VARIABLES	(1) FC	(2) FC	(3) FC
lnFintech	-0.005*** (-2.70)		-0.005*** (-2.76)
LC		0.003*** (2.85)	0.002** (2.21)
c.c_LC#c.c_lnFintech			-0.002*** (-3.14)
LEV	-0.405*** (-47.42)	-0.407*** (-48.35)	-0.404*** (-47.26)
ROA	0.490*** (34.73)	0.499*** (35.30)	0.496*** (34.79)
CR	0.004*** (7.02)	0.004*** (6.62)	0.004*** (6.87)
CFR	-0.083*** (-7.06)	-0.087*** (-7.52)	-0.083*** (-7.12)
Top1	0.002*** (11.72)	0.001*** (11.62)	0.002*** (11.97)
Top10	0.038*** (7.14)	0.036*** (6.99)	0.039*** (7.34)
PBR	-0.015*** (-45.32)	-0.015*** (-45.51)	-0.015*** (-44.95)
lnSize	-3.598*** (-87.97)	-3.606*** (-89.83)	-3.597*** (-87.47)
Constant	11.742*** (94.33)	11.752*** (96.07)	11.733*** (93.54)
Observations	24,875	25,531	24,875
R-squared	0.608	0.608	0.608
Number of id	3,784	3,792	3,784
company FE	YES	YES	YES

3.6. Robustness tests

In order to ensure the reliability of the previous conclusions, this paper will also conduct further robustness tests by replacing the explanatory variables and changing the estimation method.

3.6.1. Replacement of explanatory variables

In order to avoid the possible impact of different measures of the explanatory variables on the estimation results, this paper chooses the financing constraint kz index to replace the financing constraint (FC) index constructed in this paper for the robustness test. The results show that the estimated coefficient of fintech is significantly negative, indicating that there is an obvious inverse relationship between fintech and corporate financing constraints, which still proves the robustness of the previous conclusion.

3.6.2. One period lag

As a financial policy, the economic consequences of science and technology finance have a certain time lag, so in order to ensure that the difference between the benchmark regression results and the

reality of the situation is minimised, this paper will be the lagged period of the fintech index (fintech1) after taking the logarithm of the explanatory variables introduced into the benchmark model for the estimation of the systematic generalized moments to test the reliability of the previous conclusions, which is also able to mitigate the endogeneity problem associated with reverse causation. The results show that the regression model passes the robustness test and the coefficient value of the fintech index lagged one period is significantly negative, indicating that fintech can still significantly alleviate corporate financing constraints and the previous conclusion is reliable.

3.7. Heterogeneity test

3.7.1. Heterogeneity in the degree of technology

Heterogeneity exists in the effect of fintech on the mitigation of corporate financing constraints due to differences in firms' foundations and the speed of technological upgrading. For firms with a low degree of technology, fintech significantly alleviates financing constraints. The effect of fintech is significant among firms with slower technological upgrades, but not among firms with faster technological upgrades. High-tech firms provide digital technology themselves, and the marginal effect of fintech on them is insignificant; whereas traditional industries have slower technological updating and need to absorb cutting-edge technology, so fintech more significantly alleviates their financing constraints.

3.7.2. Regional heterogeneity

Due to different resource endowments, there are differences in economic development, population distribution and institutional policies among regions in China [14]. In order to study the regional differences of fintech in alleviating corporate financing constraints, this paper divides the full sample into eastern and central and western regions. The results show that fintech significantly alleviates corporate financing constraints in the eastern region. This may be due to the fact that the eastern region has a developed economy, sufficient financial market resources, and good supporting facilities, which can provide better financial support and infrastructure for enterprises and attract high-quality talents, which is conducive to the development of enterprise financing.

4. Conclusion

This paper explores the mitigating effect of fintech on China's corporate financing constraints, using panel data of China's A-share listed companies from 2010-2022, and combining the empirical analysis with the perspective of corporate life cycle, and draws the following conclusions: firstly, fintech provides SMEs with a way to finance, reduces the information asymmetry and transaction costs, and effectively mitigates the financing constraints; Second, the effect of adopting fintech to alleviate financing constraints is significantly different for enterprises with different life cycles. Growing and declining enterprises have a positive moderating effect on financing constraints under the influence of fintech, especially declining enterprises, fintech helps them to obtain funds due to the long-term cooperation with core enterprises and banks; third, fintech is more effective in alleviating financing constraints for enterprises with a low degree of science and technology, and fintech has a better mitigating effect on financing constraints for enterprises in the eastern region than in the central and western regions.

5. Policy Recommendations

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

First, we should actively promote the development of fintech. Currently, global fintech is in a period of rapid development, and deepening financial innovation with its technological advantages has an obvious promotion effect on alleviating corporate financing constraints. Therefore, measures should be taken at the policy level to further promote fintech-enabled financial innovation by

incentivising the development of fintech and breaking through institutional and institutional barriers in the application and transformation of fintech achievements.

Secondly, it is necessary to formulate a differentiated strategic orientation, fully grasp the characteristics of the various development stages of the enterprises themselves, and improve the adaptability of policy implementation to the life cycle stages of the target enterprises [15]. Through innovative online credit product development, provide a variety of financing channels for enterprises in the maturity stage, effectively reduce the cost of resource matching, and formulate a reasonable development strategy, in order to better play the life cycle of the enterprise financial Technology's regulating effect on the alleviation of enterprise financing constraints.

Third, the government should strengthen the top-level design and play a leading role [16]. Accelerate the construction of science and technology financial system in the central and western regions, dredge the channels of the influence of financial science and technology on the financing constraints of enterprises, ensure that the loan funds flow to the enterprises that really need them, enhance the independent innovation ability of enterprises in the central and western regions, stimulate the potential of financial science and technology in these regions, improve the efficiency of financing, and reduce the cost of financing, so as to strengthen the mitigating effect of financial science and technology on the financing constraints of enterprises.

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