

Study of Fintech and Corporate Risk Based on the Perspective of Objective Financial Dilemma and Subjective Risk Appetite

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Abstract. The rapid development of fintech will have an important impact on corporate risks. This paper takes A-share non-financial listed companies from 2011 to 2020 as the research object to study the impact of fintech development level on the risk bearing level and financial risk. The results show that: (1) There is a U-shaped relationship between the development level of fintech and the level of enterprise risk taking and financial risk as well. (2) At present, China is in the period of rapid development of fintech, and the increase of enterprise risks caused by it is worth noticing, and the relevant departments should strengthen external supervision. (3) Fintech can have an impact on enterprise risks by alleviating financing constraints, promoting enterprise R & D and innovation, and reducing the market competition degree. (4) The regulatory effect of corporate governance level can be claimed as: the higher the level of corporate governance, the more considerable the influence of fintech on improving the level of enterprise risk bearing, and the less considerable the impact of reducing financial risk.

Key words: fintech, enterprise risk taking level, financial risk, U-type effect

1. Introduction

The CPC 20th report states that we should deepen the reform of financial system, improve the modern financial supervision system and improve the level of financial risk prevention; attach importance to the role of direct financing and improve the rural financial system. The 14th Five-Year Plan clearly calls for accelerating the digital transformation of financial institutions and the steady development of fintech. On the executive level, the people's bank of China established the financial science and technology development plan (2022-2025), making it clear that after financial technology's top design of "four beams eight columns" was built up, today's focus is to solve the problem of inadequate and unbalanced development of fintech, and to exert the potential of financial technology in boosting the real economy.

The imbalance between financing mode and financial supply and demand is the key factor that restricts the effect of China's financial service to the real economy. As a "financial innovation driven by technology", fintech can play an important role in solving structural problems such as the mismatch between financial services and the real economy at the present stage (Tang Song et al., 2020), and is becoming an important engine driving financial reform and promoting the sustainable development of the real economy.

As the economic main body, enterprises acts as a prominent player in promoting economic and social development (Ma Lianfu, 2021), as well as the main body of using fintech. At present, fintech mainly has an impact on enterprises by issuing credit, and the impact is mainly reflected in the changes of financial risks of enterprises. For example, with the help of innovative technologies such as the Internet and big data, banks can accelerate the transformation in designing credit products, accumulating customer data and strengthening credit risk management, thus promote enterprise credit structure reform, and alleviate the risk of leverage ratio of non-financial corporate sector (Ren Biyun et al., 2023).

Therefore, it is of great significance to study the impact of fintech on enterprise risks when exploring the fintech's current development status and figure out how to better promote the development of the real economy in the future. The innovations of this article are as follows: Firstly, this paper divides enterprise risk into subjective risk-taking level and objective financial risks, include

the two in one common discussion framework, and compare the impact of fintech on them each. Secondly, this paper builds a U-shaped relationship model between fintech and enterprise risk, explain the different impacts of fintech at different levels of development. Thirdly, by using the mediation effect model, this paper considers the main mechanism of fintech on corporate risks from the three dimensions of financing constraints, enterprise research and development, and market competition degree. Lastly, this paper connects external fintech with internal corporate governance, studying heterogeneity of the impact of fintech on enterprise risk from the aspect of corporate governance competence.

2. Related literature review

Enterprise risks cover a wide range of risks, such as debt default risk (Zhang Xinyue, et al., 2022), performance loss risk (Zheng Shuxia, et al., 2022), etc. However, these risks can be roughly divided into two categories, that is subjective risk preference (i. e., risk-taking level) and objective risks. The risk-taking level reflects the willingness and tendency of enterprises to pay the price for high profits, and is further reflected in the venture investment decisions of enterprises (Zhang Min et al., 2015). Proper risk taking not only helps to enhance corporate profitability, achieve the prominent goal of maximizing shareholders' wealth, and provide enterprises with a long-term competitive advantage (Nakano & Nguyen, 2012), but also helps to promote technological progress, accelerate the capital accumulation and economic expansion of the whole society, and improve social productivity (John et al., 2008).

The good financial situation supports the stable management and sustainable growth of the company, and the impact of fintech on the objective risk of the enterprise is also mainly reflected in the financial risk. Therefore, this article limits the objective risk of enterprises as the financial risk. Enterprise financial risk refers to the possibility of the actual financial performance deviation from the expected target, resulting in the enterprise to experience economic losses. The imbalance of capital structure and irrational investment decisions are important reasons for the financial risk of the enterprise (Feng Suling et al., 2021).

In terms of the influence of fintech on the risk bearing level of enterprises, most studies believe that fintech has a positive effect, and its analysis ideas mainly include three aspects: resource effect, information effect and agency theory. Resource effect believes that digital finance can expand financing channels and methods for enterprises, reduce financing costs, and improve credit mismatch (Jagtiani & Lemieux, 2018), so as to ease the financing constraints faced by enterprises (Tang Song et al., 2020). Information effect believes that with the common support of various technical models, the speed, depth and breadth of processing and absorbing information has been improved (Wu Fei et al., 2020), and the costs have been greatly reduced (Comber et al., 2018). Due to the resource effect and information effect of the above fintech, the availability of capital and information is greatly improved, which can effectively improve the information asymmetry problem (Mocetti et al., 2017; Huang Hao, 2018), reduce adverse selection, moral hazard and agency issues (Demertzis et al., 2018), reduce the decision conservatism and risk avoidance tendency of managers (Yu Minggui et al., 2013), and improve the risk taking level of enterprises.

In terms of the impact of fintech on the financial risks of enterprises, due to the different effects of fintech in different situations, the academic circle has not yet formed a relatively unified conclusion on this issue. In addition to the above mentioned above, the positive impact of fintech on corporate risks can also be developed from the macro, industry and micro dimensions (Feng Suling, 2021). At the macro level, fintech helps to improve regional total factor productivity (Tang Song et al., 2019), thus promoting economic growth (Qian Haichao et al., 2020) and creating a favorable external environment for business operations. At the industry level, fintech has intensified the competition between banks (Sun Xuran et al., 2020), transformed the traditional lending technology, and enhanced the banks' ability to supply credit to enterprises (Sheng Tianxiang et al., 2020). At the enterprise level, fintech has changed the financing and payment methods (YIN et al., 2019; Sunderaraman et al., 2020),

which helps to solve the lack of trust between the two parties (Heiskanen, 2017), expands the financial service boundary to the "long tail" enterprises ignored by the "law of large numbers", and also helps to promote the effective deleveraging of enterprises (Zhang Binbin et al., 2020) to reduce financial risks.

The negative impact of fintech on corporate financial risks is mainly reflected in non-standard or excessive financial innovation, which will lead to market chaos and even financial crisis. The reasons are illustrated as follows. Firstly, fintech itself cannot eliminate the inherent financial risks, instead excessive reliance on them will cause new operational risks. Secondly, in the context of fintech, the competitive advantage of large enterprises is more obvious, (Feng Suling, 2021). Thirdly, the cross-regional and cross-industry characteristics of fintech weaken the effect of regional and industry regulation (Shi Guang et al., 2020). Lastly, fintech will produce new long tail risks (Chen Hong, et al., 2020), which lacks professional background knowledge and decision-making ability of long-tail customers, which may produce irrational behavior. Therefore, the effectiveness of fintech is largely dependent on the effectiveness of regulation.

3. Theoretical analysis and research hypothesis

3.1 Fintech and corporate risk

3.1.1 Fintech and risk-taking level

According to the previous literature, the influencing factors of the enterprise risk taking level mainly contain the internal and external aspects, specifically for the external economy, operating environment, the company's internal governance level and system design.

According to the prospect theory (Tversky & Kahneman, 1992), the enterprise has stronger motivation to take risks to gain high returns and reverse financial difficulties. Under good operating condition, the investment strategy is often more conservative, more willing to stabilize the operation, and the risk-taking level is relatively low. According to the literature review above, the development of fintech is conducive to alleviating the financing constraints and information asymmetry, broadening the financing channels of enterprises and reducing the financing costs. These effects of fintech will not only help to improve the business conditions of enterprises and help them out of their financial dilemmas, but also can further improve the market environment and create new opportunities of making profits and investments for enterprises. In short, under the positive impact of fintech on the company's financial position, the risk-taking level of enterprises has declined.

Meanwhile, from the perspective of corporate governance, fintech has improved the transparency level of the company's internal information (such as the source and use of funds for investment and financing projects), and the alleviation of information asymmetry makes shareholders' supervision of management more timely and effective. When making decisions, the management gives more reference to the overall goal of maximizing shareholders' interests, which is helpful to alleviate the risk avoidance problem of the management in the face of the principal-agent problem, that is, urging the management to lead the company to maximize its investment efficiency within the risk bearing range, and thus improve the risk-taking level of the enterprise.

Comparing the above two effects of financial technology on the enterprise risk-taking level, this paper thinks the first one of more direct and significant, in contrast to the influence of corporate internal governance level has lag, and due to the complex constraints of corporate internal governance level, the role of financial technology is limited.

Therefore, based on the above analysis, this paper make the following proposition.

H1: Before reaching a certain level of development, fintech will decrease enterprise's risk-taking level. And fintech will increase enterprise's risk-taking level beyond this certain level of development.

3.1.2 Fintech and financial risk

As written in the literature review above, fintech has an obvious two-way impact on the financial risks of enterprises. Within a certain limit, fintech can effectively reduce the financial risks faced by enterprises by releasing economic vitality, easing financing constraints, reducing financing costs and helping enterprises to deleverage. However, when fintech exceeds a certain limit, especially the regulation cannot keep up with the speed of technology development, fintech will have "savage growth" and cause serious financial risks and increase the probability of enterprises falling into financial crisis and even bankruptcy.

Therefore, based on the above analysis, this paper make the following proposition.

H2: Before reaching a certain level of development, fintech will decrease corporate financial risk. And fintech will increase the corporate financial risk beyond this certain level of development.

3.2 The impact path of fintech on enterprise risk

Financing constraints are mainly reflected in the few financing opportunities and high financing costs. Fintech has expanded both direct and indirect financing channels. From the perspective of direct financing channels, fintech includes the long-tail group into the scope of financial services, stimulates investors' investment demand in the securities market, and improves the capital supply level of the capital market to enterprises (Huang Rui et al., 2020). From the perspective of indirect financing channels, fintech not only enables banks and other traditional financial institutions to increase their liquidity support for enterprises, but also provides other alternative financing solutions for enterprises.

Banks have made two major changes with fintech. First, fintech has intensified the competition between traditional commercial banks and increased the liquidity creation efficiency of banks (Li Xuefeng, et al., 2021). In addition, the use of data resources and models has also improved the efficiency of banks' business handling, making it possible to expand the credit scale and serve more financial vulnerable groups and small and micro enterprises. Second, fintech uses data mining technology to comprehensively capture enterprise credit data, reduce the degree of information asymmetry between enterprises and the market, reduce the cost loss caused by the risk of inter-period debt mismatch, and improve the overall safety factor of bank assets enable enterprises to finance at a lower cost.

Based on this, this paper proposes that:

H3: Fintech will influence corporate risk by easing the financing constraints.

Innovation is a resource-consuming activity of enterprises, and innovation decisions have strong uncertainty, high adjustment cost and failure probability. Therefore, the development of innovation activities requires enterprises to have a high tolerance of failure, which also means that enterprises need to take higher risks (Yu Wenlei et al., 2019). Fintech helps enterprises to obtain abundant funds and meet the large amount of capital needs generated by innovation activities (Ma Hong and Li Xiaoping, 2022; Wang Ping and Wang Kai, 2022), thus enhancing the motivation and ability of enterprises to carry out innovation activities.

Based on this, this paper make the following proposition.

H4: Fintech will influence corporate risk by promoting enterprise R&D.

Although China's fintech is more inclusive (Guo Feng, 2020), which will form a certain capital preference for small and micro enterprises, objectively speaking, large-scale enterprises can make more efficient use of fintech to play their maximum role based on their accumulated customer, information, technology and capital advantages. In contrast, small and medium-sized enterprises are less sensitive to fintech, lack of relevant operational experience and prospect awareness, and are often in a passive position. As a result, fintech will intensify the platform monopoly.

Based on this, this paper make the following proposition.

H5: Fintech will influence corporate risk by reducing the market competition degree.

4. Research Design

4.1 Model Setting and Variable Description

4.1.1 Model Building

This paper mainly studies the influence of the development level of fintech on enterprise risk bearing and objective risk facing. In order to describe the non-linear relationship between fintech and enterprise risk in hypothesis 1 and hypothesis 2, the secondary term of the fintech development level index is introduced into the model, and the regression model is constructed as follows.

$$Zscore = \beta_0 + \beta_1 \times Fintech + \beta_2 Fintech^2 + \beta_i \times Controls + \varepsilon \quad (1)$$

$$Risk = \beta_0' + \beta_1' \times Fintech + \beta_2' \times Fintech^2 + \beta_i' \times Controls + \varepsilon' \quad (2)$$

4.1.2 Dependent Variable

Risk-taking level (*Risk*). Previously commonly used measures include surplus volatility, volatility of stock return, asset-liability ratio, etc. As China's stock market is not mature and cannot accurately reflect the risks of enterprises and other reasons, the volatility of surplus is mostly used to indicate the level of risk taking of Chinese enterprises. This paper refers to the practice of He Ying (2019), and the standard deviation of ROA is calculated in a cycle of 3 years, in which ROA is the profit before interest and tax divided by the total assets. The industry average is then subtracted from the individual standard deviation to mitigate the impact of industry cyclical fluctuations. The specific calculation formula is shown in (3) and (4). The bigger Risk, the higher the level of risk taking.

$$Adj_Roa_{i,t} = \frac{EBIT_{i,t}}{ASSET_{i,t}} - \frac{1}{X} \sum_{k=1}^X \frac{EBIT_{i,k}}{ASSET_{i,k}} \quad (3)$$

$$Risk = \sqrt{\frac{1}{T-1} \sum_{t=1}^T (Adj_Roa_{i,t} - \frac{1}{T} \sum_{t=1}^T Adj_Roa_{i,t})^2} | T = 3 \quad (4)$$

Corporate Financial Risk (*Zscore*). This paper uses the five-variable risk Z-value method proposed by Altman (1968). This index involves the profit risk, liquidity risk and market risk of the enterprise, so it can effectively judge and predict the financial risk of the enterprise. In general, the smaller this value, the higher the probability of companies getting into financial trouble. The specific calculation formula is shown in (5).

$$\begin{aligned} Zscore = & 1.2 \times \frac{WC}{ASSET} + 1.4 \times \frac{Retained\ Earnings}{ASSET} + 3.3 \times \frac{EBIT}{ASSET} \\ & + 0.6 \times \frac{Equity\ Value}{Liability\ Value} + 0.999 \times \frac{Sales}{ASSET} \end{aligned} \quad (5)$$

4.1.3 Independent Variable

In this paper for regional financial technology development index (Fintech), reference to the common practice of academia, using "Peking University digital pratt & whitney financial index", said the index by Beijing university digital pratt & whitney financial center based on the ant gold build user data, the total index by digital financial coverage breadth, digital financial depth and pratt & whitney financial digital degree three dimensions (guo, etc., 2020). Considering the comprehensiveness and comprehensiveness of the measurement indicators, this paper selects the total index at the prefecture-level level to measure the development level of regional fintech.

4.1.4 Controlled Variable

In order to overcome the influence of missing variables as much as possible, this paper selects several control variables from the firm and regional level. *Size* represents the enterprise size, measured by paid-in capital. *ROE*, return on equity, is the net profit divided by the average balance of shareholders' equity to measure the firm's profitability. *Growth* represents the company's growth capacity, as measured by the annual growth rate of net profit. *Capex* is the proportion of the net capital expenditure to the total assets at the end of the period, which is used to measure the capital expenditure level of the company. *DA* is the asset-liability ratio, namely the total liabilities divided by the total assets, which is used to measure the leverage ratio of the company. *LnGDP*, the logarithm of the per capita GDP, measuring the economic development level where the company is located. This paper also sets up year and firm virtual variables to take the year and firm fixed effects, where the company variable is the stock code of the listed company.

4.2 Sample selection and data source

The core independent variable Fintech Development Index (*Fintech*) in this paper is taken from the data of "Peking University Digital Financial Inclusion Index", covering 337 cities above the prefecture level, with a time span from 2011 to 2020. Therefore, the study time of this paper was established as 2011-2020. Given the calculation of corporate risk-taking level (*Risk*) needs data of two years before, data for this variable starts from 2009.

In this paper, the Shanghai and Shenzhen A-share listed companies excluding ST and financial industry (according to the industry classification of 2012 CSRC) are selected as the research objects. All data were obtained from the CSMAR database, except the explanatory variable (*Fintech*). Referring to the practice of Liu Xing et al. (2016), the abnormal samples with ROA outside the (-4,4) interval were excluded. To alleviate the interference of outliers, all continuous variables experience winsorization by 1% at both ends. In order to improve the uniformity and comparability of the regression coefficient, all the variables are standardized for the regression analysis.

Data analysis was performed through Stata 17.0 in this paper.

4.3 Descriptive statistics of the main variables

The descriptive statistics of the main variables are shown in Table 1, it can be seen that the difference of enterprise risk-taking level (*Risk*) is significant (Yu Minggui et al., 2013), the minimum value is 0.2259 and the maximum value is 25.7738, which is consistent with the existing research results. The mean value is greater than the median, so the data is roughly right skewed distributed, indicating that risk-taking willingness of most Chinese enterprises is not high (Qiao Kunyuan, 2014), and the risk taking level of a few enterprises is much higher than the market average.

Zscore's statistical results are generally consistent with those of *Risk*, which is right-skewed distributed and covers a large range. However, the smaller the *Zscore*, the greater the actual risk enterprises bear. Therefore, the meaning of the two results is completely opposite. That is, most enterprises are faced with greater operational risks, and only a small number of enterprises have relatively good risk response ability.

Table 1: Descriptive Statistical Results[ROE, Growth, DA are in% and Capex is]

Variable Name	Observations	Mean	Standard deviation	Median	Minimum	Maximum
<i>Risk</i>	23,493	3.0544	3.272	2.3137	0.2259	25.7738
<i>Zscore</i>	23,493	4.7885	6.0992	2.9437	-2.0089	60.8237
<i>Fintech</i>	23,493	217.3715	69.8759	228.3349	33.21	334.4781
<i>Size</i>	23,493	1.1317	1.9555	0.5488	0.0756	14.5248
<i>ROE</i>	23,486	44.3582	21.3458	43.8784	4.7429	128.6918

<i>Growth</i>	21,142	-41.884	412.8071	6.9972	-3806.38	1440.676
<i>Capex</i>	22,559	432.6487	455.2532	305.7881	-664.586	2626.872
<i>DA</i>	23,486	44.3582	21.3458	43.8784	4.7429	128.6918
<i>LnGDP</i>	23,190	11.369	0.4844	11.4689	9.6738	12.2011

In this paper, the data of each year and region are selected to describe the regional development differences of fintech level. As shown in Figure 1, the regional differences in the development level of fintech are not very significant, and between 2012-2017, the growth rate of relatively backward areas was greater than that of high-level areas, and the regional differences were narrowing. But after 2018, the growth rate of high-level regions has surpassed that of more backward regions, indicating that the recent trend of narrowing regional differences may slow down.

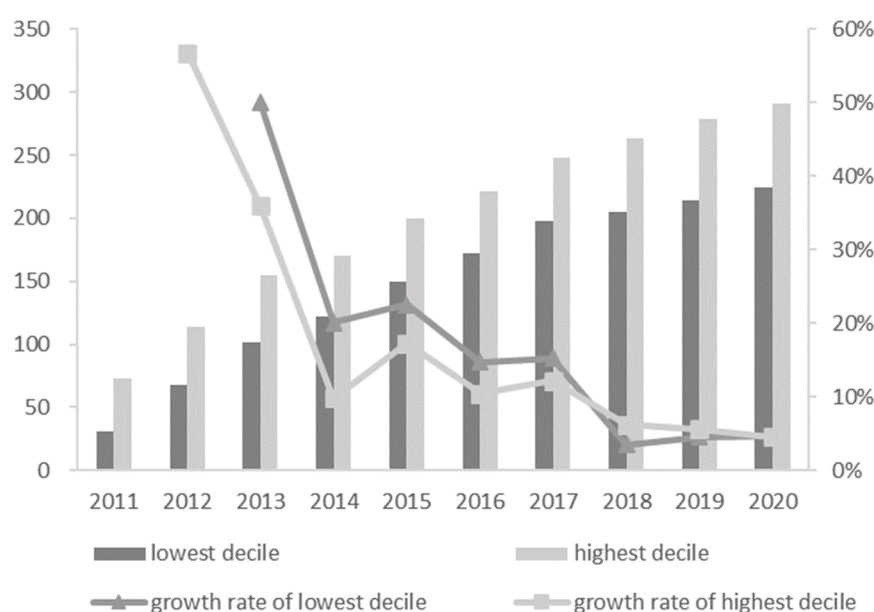


Figure 1 Comparison of the Upper and Lower Decile Level and Growth Rate of the Fintech Development Index

5. Empirical Test

5.1 Analysis of the Basic Regression Results

Table 2 reports the basic regression results under the dual fixed effect of firm and year. The estimated coefficients of *Fintech* and *Fin2* (the quadratic term of *Fintech*) were significant. After further U-type test, the results showed that there is indeed a U-type relationship between *Fintech* and *Risk* and *Zscore*.

In column (4), the coefficient of *Fintech* is significantly negative, while the coefficient of *Fin2* is significantly positive. The development level of fintech has a significant U-shaped effect on the risk taking level of enterprises. This indicates that fintech can significantly reduce corporate risk-taking before reaching a certain level, and increase corporate risk-taking afterwards. So Hypothesis 1 holds, and the impact of fintech varies significantly at different levels. Studies have shown that the development of the market will affect the enterprise risk-taking level (Yu Wenlei, 2019), at the beginning developmental phase of the financial technology, supporting regulations, investor protection mechanism has not yet been established, combined with the development prospect of financial technology is not clear, enterprises more conservative, wait-and-see attitude, so before reaching a certain degree of development, financial technology will reduce the enterprise risk-taking

level. As fintech gradually gets on the right track and the breadth and depth of application continue to develop, it will help release economic vitality, reduce financing costs and improve investment efficiency. In these favorable trading environments, the level of risk taking of enterprises will be improved.

In column (8), the coefficient of *Fintech* is significantly positive, and the coefficient of *Fin2* is significantly negative. The development level of fintech has a significant U-shaped effect on the financial risk of enterprises.[Fintech has an inverted U-shaped relationship with Zscore, and the value of Zscore is opposite to its actual meaning. Therefore, the development level of fintech has a U-shaped relationship with the financial risk of enterprises.] This indicates that fintech can significantly reduce the financial risk of companies before reaching a certain level, which instead increases the financial risk. So the hypothesis 2 is true. In the initial stage of fintech development, with the continuous integration of digital technology and financial field and the increasing improvement of digital infrastructure construction, on the one hand, fintech helps to expand knowledge spillover effect and promote coordinated economic development (Yin Yingkai, et al., 2020); on the other hand, it helps to bridge information deviation and alleviate the liquidity constraint of enterprises, so its utility of reducing enterprise financial risk is constantly highlighted. After entering the mature period, financial technology in improving the efficiency of information flow also lead to financial risk spread and spread more hidden, combined with the financial regulation of science and technology lag (Feng Suling, 2021), makes the financial technology to reduce the role of enterprise financial risk, if not timely adjustment measures, eventually may even increase the enterprise financial risk.

Table 2. Basic Regression Results

	(1) <i>R isk</i>	(2) <i>R isk</i>	(3) <i>R isk</i>	(4) <i>R isk</i>	(5) <i>ZScore</i>	(6) <i>ZScore</i>	(7) <i>ZScore</i>	(8) <i>ZScore</i>
<i>F intech</i>	-0.034 (.072)	- 0.361** (00).14	- 0.373** (00).14 *	-.457** * (0.154)	- 0.255** * (0.068)	0.377** * (0.131)	0.363** * (0.131)	0.308** (0.137)
<i>F in2</i>		0.181** * (0.067)	0.188** * (0.067)	0.228** * (0.073)		- 0.35*** (0.062)	- 0.343** * (0.062)	- 0.276** * (0.065)
<i>Size</i>			- 0.049** * (0.018)	- 0.044** (0.019)			- 0.057** * (0.017)	- 0.059** * (0.017)
<i>ROE</i>			0.011** (0.005)	0.009 (0.006)			0 (0.005)	0.005 (0.005)
<i>G rowth</i>				-0.001 (0.006)				0.057** * (0.005)
<i>C apex</i>				-0.009 (0.007)				- 0.028** * (0.006)
<i>LnGDP</i>				-0.006 (0.028)				0.001 (0.024)
<i>C ons tants</i>	-0.094 (0.151)	- 0.477** (0.206)	- 0.505** (0.207)	0.624** * (0.225)	- 0.582** * (0.141)	0.156 (0.193)	0.124 (0.193)	0.148 (0.199)

Observations	23,493	23,493	23,486	20,097	23,493	23,493	23,486	20,097
R-squared	0.002	0.002	0.003	0.003	0.078	0.079	0.08	0.091
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES	YES	YES

Note: ① *, ** and *** are significant at 10%, 5% and 1%, respectively, with standard error in parentheses, the same in the following tables. ② The asset-liability ratio (*DA*) is omitted due to collinearity. In the following tables, the reason for the missing variables is the same. ③ *Fin2* represents the quadratic term of the *Fintech*.

It is calculated that the *Fintech* values reaching the extreme values of the two regression equations are 1.002 and 0.559 respectively (both standardized values). They divide the development level of fintech into three intervals. Table 3 shows the direction of *fintech* on the risk taking level and financial risk of the enterprise in each interval. It can be seen that with the rapid development of fintech in recent years, the interval distribution of samples has changed greatly. In 2016 and before, all samples were located in the range less than the first threshold of 0.559, and the corporate risk taking level and financial risk were both reduced by the effects of fintech. Since then, the proportion of samples in interval 2 and 3 has been increasing, and in 2020, the proportion of samples in the interval interval 3 has reached 66.98%. Corresponding to this change, the role of fintech in reducing risks has been continuously weakened. This prompts us, perhaps due to financial regulation does not reach the designated position, the current financial technology to reduce enterprise risk effectiveness weakened, relevant departments should cause attention, by improving the financial technology layout, optimize the allocation of resources, establish a more reasonable and effective supervision mechanism, prevent financial "savage growth" of science and technology, increase the risk of enterprise.

Table 3 Three Intervals with Different Effects of Fintech

	The range	Sample coverage	application direction
1	<i>Fintech</i> < 0.559	In 2016:100% In 2018:32.87%; In 2020:9.12%.	Reduce the level of enterprise risk bearing and financial risk.
2	0.559 < <i>Fintech</i> < 1.002	In 2018:45.74%; In 2020:23.81%.	Reduce the level of enterprise risk bearing and increase the financial risk.
3	<i>Fintech</i> > 1.002	In 2018:21.40% In 2020:66.98%.	Increase the level of enterprise risk bearing and financial risk.

5.2 Endogenous Testing

Although this paper includes the variables that measure the size of the company, profitability, growth ability, leverage ratio, economic development level and other dimensions into the control variable system, there is still the possibility of variable omission, leading to the existence of endogeneity. In addition, corporate risk and fintech may have two-way causal effects. For example, corporate risk reduction, good operating conditions, and improved operating efficiency may in turn provide financial support for the development of fintech and expand its development space. Therefore, an endogenous test is necessary.

In this paper, the robustness of the regression results is tested using the replacement variable method. Columns (1) and (2) show the regression results after replacing the explanatory variable *Fintech* with Coverage, a sub-dimensional indicator of "Digital Financial Inclusion in Peking University". Columns (3) and (4) show the regression results after replacing the explanatory variable *Risk* with the standard deviation of ROA calculated on a 4-year rolling basis and the extreme deviation of ROA calculated on a 3-year rolling basis, respectively. Column (5) shows the regression results after replacing the explanatory variable financial exposure (*Zscore*) with *Oscore*, which is a method

of portraying the level of financial risk of the firm. Its calculation method is shown in equation (6), with higher values indicating higher levels of risk.

$$\begin{aligned} Oscore = & -1.32 - 0.407SIZE + 6.03TLTA - 1.43WCTA \\ & + 0.0757CLCA - 2.37NITA - 1.83FUTL \\ & + 0.285INTWO - 1.72OENEG - 0.521CHIN \end{aligned} \quad (6)$$

$$TLTA = \frac{\text{Total Asset}}{\text{Total Liability}}, WCTA = \frac{\text{Working Capital}}{\text{Total Asset}}, CLCA = \frac{\text{Current Liability}}{\text{Current Asset}}, NITA = \frac{NI}{\text{Total Asset}}, FUTL = \frac{CFO}{\text{Total Liability}}, CHIN = \frac{NI_t - NI_{t-1}}{|NI_t| + |NI_{t-1}|}.$$

The regression results in Figure 5 show that the significance and sign significance of the coefficients of the core explanatory variables are consistent with the original regression results, indicating that the original regression results are more robust.

Table 4 Regression Results of Replaced Variables

	(1) <i>Risk</i>	(2) <i>Zscore</i>	(3) <i>Risk2</i>	(4) <i>Risk3</i>	(5) <i>Oscore</i>
<i>Fintech</i>			-0.223** (0.093)	-0.233** (0.112)	-0.442*** (0.058)
<i>Fin2</i>			0.121** (0.052)	0.142** (0.064)	0.327*** (0.033)
<i>Coverage</i>	0.110** (0.047)	0.083* (0.043)			
<i>Cov2</i>	0.015* (0.008)	-0.022*** (0.007)			
<i>Controls</i>	YES	YES	YES	YES	YES
<i>Constants</i>	0.121 (0.207)	0.243 (0.191)	56.453*** (0.537)	-0.301 (0.236)	-0.608*** (0.125)
Observations	20,362	23,480	17,362	20,363	20,105
Year FE	YES	YES	YES	YES	YES
Industry FE	YES	YES	YES	YES	YES
Firm FE	NO	NO	NO	NO	NO

5.3 Analysis of the Regression Results of the Impact Mechanism

The results of the main effect analysis show that *fintech* at a certain level can significantly reduce the risk bearing level and financial risks of enterprises, and then conduct a regression analysis on its impact path. Referring to previous literature, this paper will explore whether *fintech* has an indirect impact on enterprise risks by affecting the degree of financing constraint, enterprise R&D, and the level of market competition. The SA index constructed by Hadlock & Pierce (2010) represents the degree of financing constraint. The SA index value is generally negative, and a greater number represents a higher degree of financing constraint. *Rex* is the proportion of R&D expenditure in total revenue. The Lerner index represents the market competition, and the larger the index, the lower the market competition.

$$SA = -0.737 \times Size + 0.043 \times Size^2 - 0.040 \times Age \quad (7)$$

$$Lerner\ Index = (Sales - COGS - SG \& A\ Expense) / Sales \quad (8)$$

Referring to the practice of Guo Ye et al. (2020), the mediation effect model is used for testing and analysis. The following formula generally illustrates the influence mechanism of the mediation variable.

$$Y = \beta_0 + \beta_1 \times Fintech + \beta_2 Fintech^2 + \beta_i \times Controls + \varepsilon \quad (9)$$

$$Z = \gamma_0 + \gamma_1 \times Fintech + \gamma_i \times Controls + \varepsilon \quad (10)$$

$$Y = \delta_0 + \delta_1 \times Fintech + \delta_2 Fintech^2 + \delta_3 \times Z + \delta_i \times Controls + \varepsilon \quad (11)$$

If β_1 , γ_1 , δ_3 are all significant, the mediation effect exists. If β_1 is significant, but at least one in γ_1 and δ_3 is not significant, Sobel test is required. If the test passes, the mediation effect is considered to exist, in other cases, the mediation effect is not considered to exist (Su Qin et al., 2022).

Table 5 reports the regression results of the impact mechanism of fintech on enterprise risk bearing level. The results show that *Fintech* is significantly related with *SA* and *Lerner*, but not with *Rex*. In the regression equation including the core explanatory variable and mediation variable, only the coefficient of the mediation variable *Lerner* is still significant. Therefore, a further Sobel test should be done for *SA* and *Rex*. They both pass the test, thus the mediation effect of *SA*, *Rex*, and *Lerner* all exists.

Further observe the signs of the variable coefficient to analyze the role of the mediating variables. *Fintech* is significantly positively correlated with *SA* at the level of 1%, indicating that the fintech development will ease financing constraints and optimize the financing environment for enterprises, mainly through financing cost reduction and offering stable and reliable capital sources, which improves the willingness and ability of enterprises to take risks to seek higher profits. Additionally, *Fintech* has a positive correlation with *Rex*, indicating that fintech will encourage enterprises to increase investment in innovation and research, improve technology level and operational efficiency, and hold a more positive attitude towards high-risk innovation decisions. Lastly, *Fintech* has a significant positive correlation with *Lerner* at 1% which indicates that fintech will improve the level of enterprise risk taking by reducing market competition and boost monopoly.

Table 5 Regression Results for the Mechanism of Risk-taking Level (Risk)

	(1) <i>SA</i>	(2) <i>Risk</i>	(3) <i>Rex</i>	(4) <i>Risk</i>	(5) <i>Lerner</i>	(6) <i>Risk</i>
<i>Fintech</i>	0.089*** (0.025)	-0.46*** (0.154)	0.047 (0.061)	-0.528*** (0.164)	0.169*** (0.061)	-0.452*** (0.154)
<i>Fin2</i>		0.232*** (0.073)		0.297*** (0.076)		0.227*** (0.073)
<i>SA</i>		-0.038 (0.025)				
<i>Rex</i>				0.006 (0.013)		
<i>Lerner</i>						-0.018* (0.01)
<i>Size</i>	0.267*** (0.006)	-0.034* (0.02)	0.034** (0.015)	-0.019 (0.022)	0.016 (0.014)	-0.044** (0.019)
<i>ROE</i>	-0.001 (0.002)	0.009 (0.006)	-0.004 (0.004)	0.005 (0.006)	-0.004 (0.004)	0.008 (0.006)
<i>Growth</i>	-0.004** (.002)	-0.001 (.006)	-0.047*** (.004)	0 (.006)	0.222*** (.004)	0.003 (0.006)
<i>Capex</i>	-0.002 (0.002)	-0.009 (0.007)	0.035*** (0.005)	-0.023*** (0.008)	0.036*** (0.005)	-0.008 (0.007)
<i>LnGDP</i>	0.017* (0.009)	-0.005 (0.028)	0.041** (0.019)	-0.009 (0.029)	0.016 (0.021)	-0.006 (0.028)
Constants	1.072*** (0.052)	-0.592*** (0.226)	-0.049 (0.128)	-0.688*** (0.247)	0.431*** (0.125)	-0.613*** (0.225)
Observations	20,070	20,070	15,633	15,633	20,097	20,097
R-squared	0.809	0.003	0.041	0.004	0.158	0.003
Year FE	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES

Table 6 reports the regression results of the impact mechanism of fintech on enterprise risk bearing level. The results show that *Fintech* is significantly correlated with *SA* and *Lerner* but not *Rex*; in the regression equation including the core explanatory variables and mediation variables, the coefficients of the three mediation variables are significant, so only *Rex* needs a further Sobel test, and it pass the test. Therefore, in the influence of fintech on the financial risks of enterprises, the three variables of *SA*, *Rex* and *Lerner* all play an intermediary effect.

Fintech is positive correlated with *SA*, *Rex* and *Lerner*, indicating that fintech can have an impact on the financial risks faced by enterprises by alleviating financing constraints, promoting enterprise innovation and reducing market competition. Hypothesis 3,4,5 holds to some extent.

Table 6 Regression results of the impact mechanism of enterprise risk (Zscore)

	(1) <i>SA</i>	(2) <i>ZScore</i>	(3) <i>Rex</i>	(4) <i>ZScore</i>	(5) <i>Lerner</i>	(6) <i>ZScore</i>
<i>Fintech</i>	0.089*** (0.025)	0.341** (0.135)	0.047 (0.061)	0.313* (0.165)	0.169*** (0.061)	0.291** (0.136)
<i>Fin2</i>		-0.315*** (0.064)		-0.298*** (0.077)		-0.272*** (0.064)
<i>SA</i>		0.428*** (0.022)				
<i>Rex</i>				0.072*** (0.013)		
<i>Lerner</i>						0.054*** (0.009)
<i>Size</i>	0.267*** (0.006)	-0.173*** (0.018)	0.034** (0.015)	-0.014 (0.022)	0.016 (0.014)	-0.06*** (0.017)
<i>ROE</i>	-0.001 (0.002)	0.005 (0.005)	-0.004 (0.004)	0.009 (0.006)	-0.004 (0.004)	0.005 (0.005)
<i>Growth</i>	-0.004** (0.002)	0.059*** (0.005)	-0.047*** (0.004)	0.057*** (0.006)	0.222*** (0.004)	0.045*** (0.005)
<i>Capex</i>	-0.002 (0.002)	-0.027*** (0.006)	0.035*** (0.005)	-0.038*** (0.008)	0.036*** (0.005)	.03-00*** (0.006)
<i>LnGDP</i>	0.017* (0.009)	-0.008 (0.024)	0.041** (0.019)	-0.023 (0.029)	0.016 (0.021)	0 (0.024)
<i>Cons tants</i>	1.072*** (0.052)	-0.229 (0.198)	-0.049 (0.128)	.3000 (0.248)	0.431*** (0.125)	0.116 (0.199)
Observations	20,070	20,070	15,633	15,633	20,097	20,097
R-squared	0.809	0.112	0.041	0.112	0.158	0.093
Year FE	YES	YES	YES	YES	YES	YES
Firm FE	YES	YES	YES	YES	YES	YES

5.4 Fintech, Corporate risk and Corporate governance level

The level of corporate governance means the completeness and effectiveness of corporate internal governance. The improvement of corporate internal governance can effectively supervise and motivate the management, make them give priority to the interests of the company owners (Zhou Qian et al., 2020), thus influencing the strategic decisions of the company. The above paper focuses on the effect of fintech, an external environmental factor, on enterprise risks, but the impact of corporate internal governance cannot be ignored. In fact, even under the same fintech level, different companies have different subjective risk taking levels and objective financial risks due to different governance levels. Therefore, it is necessary to incorporate the important factor of corporate governance level into the research framework.

This paper mainly refers to the practice of Zhou Qian et al. (2020), and uses the principal component analysis method to construct the comprehensive index (*Management*) of corporate governance level from the aspects of supervision, incentive, decision-making, and personal characteristics of managers. The supervision indicators include the proportion of independent board of directors, board of directors size and institutional shareholding ratio, the incentive indicators include executive compensation and executive shareholding, the decision indicators include whether the chairman and the general manager have the positions of men and whether the managers have financial and overseas background. Principal component analysis was used to calculate the first principal component and used to measure the corporate governance index (*Management*). In order to facilitate the analysis and test of subsequent regulation, a new variable *Management_1* is generated, and the median of *Management* is used as the critical value to divide the sample into 2 groups. The *Management_1* above the median is 1, indicating the high corporate governance level. While the *Management_1* below the median is 0, indicating the poor corporate governance level.

Column (1) and column (3) in Table 7 report the direct impact of *Management* on the enterprise risk, and the regression results show that the corporate governance level is significantly and positively correlated with the enterprise risk-taking level and the enterprise financial risk. This may be because companies with higher governance have more complete and efficient supervision, incentive and decision mechanism, which can avoid agency problems to some extent, as well as make decisions conducive to the long-term development of the company by combining more opinions, thus improving the level of enterprise risk-taking (Lewellyn & Muller-kahle, 2012). On the other hand, companies with high governance may be more proactive and prefer to run high-risk projects to maximize the benefits within their competence. Studies have found that companies with higher governance levels are more inclined to use derivatives (Zhou Deliang, 2022), while the use of derivatives has a weak increase effect on both systemic risk and bankruptcy risk (Jia Weiying et al., 2009).

Column (2) and column (4) report the results of including the corporate governance level (*Management_1*) as the regulatory variable in the original regression equation. In column (2), the estimated coefficient of *Management_1* is significantly positive, indicating that for companies with high corporate governance level, fintech can quickly release the operation vitality of enterprises and significantly improve the risk-taking level of enterprises. This is because on the one hand, the improvement of corporate governance can convey the signal of perfect internal governance structure and provide better guarantee, thus taking advantage in utilizing the financing convenience brought by financial technology. On the other hand, the improvement of corporate governance can improve the financial transparency and accuracy of information disclosure, provide diversified information for management decisions, and further strengthen the role of digital finance in weakening information asymmetry (Ma Lianfu et al., 2021).

In column (2), the estimated coefficient of *Management_1* is significantly negative, indicating that the effect of fintech in reducing financial risks for companies with high governance level is not as significant as those with low governance level. On the other hand, it can also show that the mitigation effect of fintech on financial risks does not depend on the level of corporate governance, and the development of fintech can make up for the lack of corporate governance in a way.

Table 7 Regression results of the regulatory effect of corporate governance level

	(1) <i>R isk</i>	(2) <i>R isk</i>	(3) <i>Z s core</i>	(4) <i>Z s core</i>
<i>Management</i>	0.092*** (0.008)		-0.079*** (0.008)	
<i>F intech</i>		-0.216** (0.107)		0.392*** (0.097)
<i>F in2</i>		0.008 (0.078)		-0.251*** (0.071)
<i>Management_1</i>		0.174***		-0.129***

		(0.016)		(0.015)
<i>Size</i>	0.013	0.004	-0.087***	-0.096***
	(0.008)	(0.008)	(0.009)	(0.007)
<i>ROE</i>	0.054***	0.082***	0.002	0.003
	(0.007)	(0.007)	(0.007)	(0.006)
<i>Growth</i>	0.002	0.001	0.086***	0.081***
	(0.007)	(0.007)	(0.007)	(0.006)
<i>Capex</i>	-0.034***	-0.029***	.04-00***	-0.044***
	(0.008)	(0.007)	(0.008)	(0.007)
<i>LnGDP</i>	0.048***	0.108***	0.034***	-0.004
	(0.008)	(0.015)	(0.008)	(0.013)
<i>Constants</i>	-0.024**	-0.512***	0.203*	0.496***

6. Conclusion and Suggestion

This paper finds that fintech has a U-shaped relationship with corporate risk-taking and financial risk, that is, at a certain level, fintech reduces corporate risk-taking and financial risk; beyond this level, it increases corporate risk-taking and financial risk. The paper then divides the level of fintech development into three stages based on the critical values of the two U-shaped relationships, and in each stage, the role of fintech on corporate risk-taking and financial risk varies. After statistically calculating the annual distribution of fintech development level into the three stages, it is concluded that fintech in each region has developed rapidly since 2018, and the proportion of the sample in the third stage has reached the largest in 2020. So the problem of increasing corporate financial risk arising from rapid fintech development deserves attention from all parties.

Through the mediating effect model, this paper finds that fintech can play a role in corporate risk by alleviating financing constraints, promoting corporate R&D innovation and reducing the degree of market competition.

In the effect of fintech on corporate risk-taking level and financial risk, the level of corporate governance has a significant moderating effect. Specifically, the higher level of corporate governance, the more significant the effect of fintech on increasing the level of corporate risk-taking, and the less significant the effect on reducing financial risk.

The findings of this paper are relatively important for clarifying the development level of China's financial technology at this stage, its impact and its internal mechanism. Based on this, the following recommendations are made.

Firstly, the company managers should keep up with the times, pay attention to the understanding and application of fintech, combine fintech with company characteristics, and at the same time pay attention to avoid the financial risks that fintech may bring, so that fintech can push the company to achieve steady growth.

Secondly, government departments should further strengthen the standardized management of fintech currently, enhance the efficiency of regulatory information delivery, and avoid possible irregularities in the development of digital finance, so as to effectively guide fintech to inject momentum into the development of the real economy.

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