# The Impact of Fintech on Systemic Financial Risk

## ——Empirical Research Based on Time Series Data

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**Abstract:** In the context of rapid development of emerging technologies, FinTech with artificial intelligence, blockchain, cloud computing, big data as the core technologies continue to promote financial innovation and improve the efficiency of financial services. But at the same time, it also makes financial risks more complex, which brings challenges to supervision. This paper will analyze the impact of FinTech on systemic financial risk from five aspects of innovation, development index, financial supervision, policy support and technology maturity of FinTech, and select 120 periods of data from January 2009 to December 2018 as samples to construct regression model for empirical test. The empirical results show that we should prevent the rise of systemic financial risk caused by the innovation of FinTech products in time, and at the same time, we should increase the financial policy support for FinTech and innovative financial supervision, which can effectively reduce the financial risk.

## 1. Introduction

FinTech, according to the definition of FSB, refers to the business model, technology application, process and products that promote financial innovation through technical means and have a significant impact on financial markets, institutions and financial services. It is a combination of Finance and technology. Among them, AI, Blockchain, Cloud and Big Data is the four core technologies of FinTech[1-2]. On the one hand, traditional financial institutions rely on these technologies for transformation and development, such as open banking, insurance technology, etc., to improve the efficiency and service level of traditional financial business, and better meet the personalized needs of customers; on the other hand, new fields emerge with the support of these technologies, such as intelligent investment consulting, third-party payment, large Data credit system and regulatory technology further promote financial innovation and break the limitations of traditional financial business model[3-5].

FinTech has formed a competitive situation in the world's major economies, and China has also made strategic deployment in the development of FinTech. In 2017, the people's Bank of China established the FinTech Commission[6], which aims to strengthen the research planning and overall coordination of financial science and technology work. In 2018, China's total investment[7-9] in FinTech is about US $47.361 billion, ranking first in the world. Beijing, Shanghai, Shenzhen, Hangzhou and other provinces have become the most important places for the development of FinTech in China. They have good prospects and potential for the development of FinTech, and have successively issued policies and measures to support the development of FinTech. In 2019, the people's Bank of China issued the FinTech Development Plan (2019-2021)[10], which clarifies the FinTech work in the next three years and further promotes the development of China's FinTech. According to the financial times, China has become the world's second largest FinTech country with the most potential.

With the rapid development of FinTech and the improvement of financial service efficiency, the complexity of financial risk is also increased. The application of science and technology makes the risk contagion faster, and produces some unique risks of FinTech, which aggravate the vulnerability of financial system . The long-term accumulation of systemic risks will have a significant impact on

the financial industry, but also put forward new challenges to the FinTech supervision. In view of the major risks that may be caused by the rapid development of FinTech, the exploration and Research on FinTech risks and supervision are gradually emerging in the global scope[11]. The impact of FinTech on systemic financial risks cannot be ignored. Whether FinTech increases systemic risks and how to balance innovation and stability has become an important topic in the development of FinTech[12].

## 1.1. Research Status

2017 is known as the first year of FinTech. With the rapid development of FinTech, while promoting financial innovation, risks are constantly emerging. The risk, supervision and how to balance innovation and risk of FinTech has become a research hotspot since 2017[13].

On the impact of FinTech on risk, on the one hand, from the essence of FinTech, FinTech can effectively reduce risk. [14] believed that FinTech will transform the financial system into a less leveraged one; [15] believed that the emergence of FinTech is to optimize risk control, improve value and reduce risk. Only by returning to the essence of its technical tools can FinTech exert lasting influence and vitality. On the other hand, FinTech belongs to the category of finance, which does not eliminate the inherent risks of finance, but also because its unique risks further increase the systemic risks. [15] proposed that due to the small risk-taking capacity of investors in financial technology's online lending and other fields, it will enlarge the procyclicality of Finance and lead to more systematic risks.[16] pointed out that FinTech enterprises are very vulnerable to adverse shocks, and they have many ways to spread the shocks to other market entities. [17] proposed that the causes of FinTech risks are information asymmetry, long tail effect and the vulnerability of financial science and technology itself. Comprehensive consideration, [18] quantifies the risk transmission path of FinTech from the perspectives of innovation, relevance and regulatory avoidance; [19] proposed that the development of FinTech has both positive and potential negative systematic effects in maintaining financial stability. Financial stability is the basic premise of any financial innovation and financial development, including financial technology.

Based on the impact of FinTech on financial risk can not be ignored, how to supervise FinTech has become another research hotspot of domestic scholars. On the one hand, we should balance risk control and financial innovation. [20] proposed that the high-quality development of FinTech requires the integration of FinTech supervision to encourage innovation and prevent risks.[21] thinks that the future development of FinTech is mainly to find the balance between financial innovation and risk control, so as to give full play to the greatest advantage of FinTech and suppress the potential risks it brings. On the other hand, we should innovate the way of supervision. [22] proposed to actively develop Regtech; [23] proposed to adhere to the principle of regulatory consistency to avoid regulatory arbitrage distorting resource allocation. [24] believed that it is necessary for China's FinTech to combine with China's basic national conditions in the development process and launch a regulatory sandbox with Chinese characteristics in the new era. At the same time, we should balance the relationship between FinTech enterprises and regulatory departments. Through game analysis, the research group of Maanshan central sub branch of the people's Bank of China (2018) pointed out that only by properly handling the balance between FinTech innovation and regulatory authorities can China's financial market achieve sustainable and stable development. [7] set up a two subject evolutionary game model between FinTech companies and regulatory authorities, and proposed that the regulatory mode should be further changed and the "incentive" regulatory concept should be established.

## 1.2. Theoretical Basis

### 1.2.1. Impact of FinTech innovation on risk

The development of FinTech has given birth to a large number of FinTech companies, which to a certain extent squeeze some market funds with low risk and strong liquidity. On the one hand, some online financing platforms adopt "T + 0 to account" and "collect first but not pay" methods, which are easy to cause liquidity shortage and increase liquidity risk. At present, there is no strict net

capital supervision index in the field of FinTech, and inadequate supervision will further enlarge the risk. On the other hand, the management of credit risk will be more difficult due to the large number of long tail customers in FinTech business. According to the research results of U.S. Department of Treasury (2016), due to the lack of complete credit cycle data accumulation, the accuracy of credit risk model based on these data needs to be tested. The probability of penetration of the model increases, which leads to the increase of non-performing assets of FinTech companies, and the reputation is seriously affected. Once there is a "run on Phenomenon" similar to the traditional financial institutions, it will spread in the whole field of FinTech, making the upstream and downstream enterprises connected damaged and inducing systemic financial risks.

### 1.2.2. The impact of the development of Fin Tech on risk

The application of big data, cloud computing, blockchain, artificial intelligence and other technologies in the financial field constitutes a subversive impact on traditional finance. On the one hand, real FinTech is conducive to risk prevention. The high-quality development of financial technology plays a positive role in risk prevention. The financial supervision department uses emerging technologies to improve the accuracy of risk identification and the effectiveness of risk prevention, and the emergence of regulatory digital agreements effectively reduces compliance costs and improves compliance efficiency in an automated way. On the other hand, the development of FinTech is not mature at present, and the construction of financial system is not perfect. The progress of science and technology makes the connection degree of traditional financial institutions, FinTech companies and other related upstream and downstream enterprises rise, increasing the possibility of cross infection risk. When a single FinTech institution has problems, it is easy to affect the entire financial system through channels such as funds.

### 1.2.3. The impact of Fin Tech technology on risk

The emerging science and technology is the foundation of the development of FinTech, and the resulting technological risk is the new risk that FinTech is different from traditional finance. First, data disclosure. The use of big data and other technologies enables FinTech companies to master a large number of user information, and the risk of data information disclosure increases. Financial institutions may have illegal acts of selling user information, and may also have price fraud, using big data to obtain the consumer surplus of all consumers. Second, technical loopholes. Technical loopholes such as algorithm failure or parameter error may paralyze the system, and algorithm error may lead to excessive price fluctuation, which leads to serious market risk. Third, algorithm convergence. In quantitative trading, the same algorithm and model will get the same strategy, which will lead to the selling or buying of artificial intelligence, the sharp fluctuation of price, the market panic, the rapid spread of risk to stock, bond and other capital markets, and then lead to serious systemic financial risks.

### 1.2.4. The impact of Fin Tech regulation on risk

The market activities accompanied by FinTech are mainly presented in a new way. The trend of mixed operation is obvious. The risks of financial innovative products and business models are hidden under the complex transaction structure, It is difficult to identify, and some businesses provided by FinTech are not within the regulatory boundary, so it is difficult to effectively supervise, and the supervision lags behind the development of financial innovation; there are multiple cooperative subjects behind a financial product or business, among which the legal responsibility and risk responsibility are not clear, and the corresponding regulatory constraints are not in place, so that they cannot bear enough responsibility for their own behavior The evasion of FinTech brings challenges to financial supervision, and it is easy to cause systemic financial risks when the regulatory resources are insufficient or the regulatory strength is insufficient.

## 1.3. Variable selection and model design

### 1.3.1. Index selection and description statistics

Explained variable: this paper mainly refers to the index selection of Yang hang (2019). Using Financial Stress Index to measure the systemic financial risk in China. According to the formation factors of systematic financial risk in China, eight variables as shown in Table 1 are selected from five factors of real economy, banking, stock industry, real estate industry and government departments, and the financial stress index FSI is constructed by principal component analysis.

Table 1 FSI variables

| factor | variables | meaning |
|---|---|---|
| real economy | GDP | Gross Domestic Product (-) |
| | CPI | Consumer Price Index(+) |
| | PMI | Purchasing Manager Index(-) |
| banking | Nonperforming loan ratio | Bank financial risk pressure(+) |
| | Deposit loan ratio | Financial risk of bank operation(+) |
| stock industry | Stock value/GDP | Dependence degree of macro-economy and virtual economy(+) |
| real estate industry | Sales area / completed area of commercial housing | Demand degree of real estate market(-) |
| government | Fiscal Deficit / GDP | Financial risk pressure of government sector(+) |

## 1.4. Explanatory variable

Explanatory variables are FinTech innovation, development index, financial supervision, policy support and technology maturity.

### 1.4.1. Innovation

The innovation of FinTech includes financial products and financing methods. The ratio of the balance of household savings deposits to the total source of funds of financial institutions decreases with the increase of the degree of financial product innovation, and the reciprocal is taken as the alternative index of financial product innovation; the number of listed companies is selected as the alternative index of financing mode innovation.

### 1.4.2. Development index

The development index includes not only the growth of the number of FinTech enterprises, but also the related growth of Finance and technology caused by financial science and technology FinTech. Some references in this paper [20] index selection. Four variables as shown below are selected from four aspects of financial industry development level, information technology development level, FinTech enterprises and macro correlation, and the FinTech development index is constructed by principal component analysis.

### 1.4.3. Financial Supervision

Select financial supervision expenditure and total financial expenditure as the index of supervision degree: the greater the proportion of financial supervision expenditure, the greater the degree of supervision.

### 1.4.4. Policy Support

The proportion of national investment in FinTech represents the degree of national support for FinTech. The ratio of national investment in FinTech to total financial expenditure is selected as the indicator of policy support.

### 1.4.5. Technology maturity

Using the hype cycle from 2009 to 2018, select four core technologies of financial science and

technology: artificial intelligence, blockchain, cloud computing and big data, record and weight their technology maturity, and build the technology maturity of FinTech.

Control variables: In addition to the indicators of financial stress index itself, risk is also affected by external shocks. This paper selects the ratio of foreign direct investment to GDP (the greater the attraction of domestic market to foreign investment, the less the financial risk pressure) and the fluctuation ratio of Dow Jones Industrial Average (the greater the fluctuation degree of foreign capital market, the greater the external risk pressure) as the control variables.

## 2. Model design

According to the variables, the regression model is set as follows:

$$FSI=\beta_0+\beta_1 FDI+\beta_2 \ln FAI+\beta_3 FTD+\beta_4 REG+\beta_5 POLICY+\beta_6 TECH+\beta_7 FI+\beta_8 DJI+\varepsilon \quad (1)$$

Among them, FSI is the Financial Pressure Index, which measures systematic risk; FDI and FAI are the innovation of financial products and financing methods; FTD is the development index of FinTech; REG is the degree of financial supervision; POLICY is the degree of policy support; TECH is the degree of maturity of FinTech; FI and DJI are the control variables.

Descriptive statistics of relevant variables are shown in Table 2 below:

Table 2 Descriptive statistics of relevant variables

| variable | sample | average | Std. | min | max |
|---|---|---|---|---|---|
| FSI | 120 | -0.0064 | 0.0055 | -0.9405 | 1.1993 |
| FPI | 120 | 2.7112 | 0.0140 | 2.4469 | 2.9938 |
| FAI | 120 | 2576.85 | 51.5696 | 1600 | 3584 |
| FTD | 120 | 4.3892 | 0.1102 | -1.1978 | 6.3189 |
| REG | 120 | 0.0048 | 0.0003 | 0.0014 | 0.02178 |
| POLICY | 120 | 0.0315 | 0.0006 | 0.0178 | 0.0616 |
| TECH | 120 | 0.2513 | 0.0083 | 0.0654 | 0.4933 |
| FI | 120 | 0.0805 | 0.0013 | 0.0570 | 0.1099 |
| DJI | 120 | 9.6267 | 0.0285 | 8.9095 | 10.1744 |

## 2.1. Analysis of empirical results

Eviews is used to estimate the sample data and carry out correlation test. It is found that there is a positive autocorrelation, so the *REG* is lagged behind the first-order processing. The regression results are shown in table 3 and table 4 below.

Table 3 The regression results

| Variable | Coefficient | Std.Error | t-Statistic | Prob. |
|---|---|---|---|---|
| C | -17.19577 | 3.299973 | -5.210881 | 0.0000 |
| FTD | -0.088195 | 0.018308 | -4.817193 | 0.0000 |
| FPI | 5.198376 | 0.318888 | 16.30155 | 0.0000 |
| FAI | -0.582205 | 0.407610 | -1.428340 | 0.1561 |
| FI | -14.42996 | 5.714361 | 2.525209 | 0.0130 |
| POLICY | -19.13372 | 3.514162 | 5.444747 | 0.0000 |
| REG1 | -24.44957 | 13.49058 | -1.812344 | 0.0727 |
| TECH | -2.262998 | 0.372180 | -6.080384 | 0.0000 |
| DJI | 0.711467 | 0.360763 | 1.972116 | 0.0511 |

Table 4 The regression results

| R-squared | 0.894585 | Meandependentvar | 0.001509 |
|---|---|---|---|
| Adjusted R-squared | 0.886848 | S.D. dependentvar | 0.592606 |
| F-statistic | 115.6262 | Prob(F-statistic) | 0.000000 |

From the results, the overall fit of the model is good, and the overall significance is high. Among them, the variables FTD, FPI, POLICY, TECH were significantly higher. The significance of FI, REG and DJI was lower. FAI was not significant. The specific analysis is as follows:

(1) Innovation. FPI and FSI are significantly positively correlated, which is consistent with the hypothesis. Because the innovation of financial products in China is still in the primary stage of exploration, the increase of the degree of innovation of financial products also brings the rise of financial risks. FAI showed negative correlation, but not significant.

(2) Development index. There is a significant negative correlation between FTD and FSI, which is consistent with the hypothesis of this paper. The higher the development of FinTech, the smaller the impact on financial risk. With the real development of FinTech, financial risk management will be more accurate, scientific and efficient, and financial risk will be reduced accordingly. Therefore, the higher the development of FinTech, the more conducive to reducing the level of risk.

(3) Financial supervision. REG is negatively correlated with FSI, that is to say, the increase of the degree of financial supervision will reduce the risk, which is consistent with the hypothesis of this paper. The higher the degree of supervision, the more strict the treatment of the relevant illegal enterprises, the more conducive to the decline of risk level. At the same time, based on the regulatory evasion of FinTech, strict financial supervision is also one of the important driving factors to promote the development of FinTech.

(4) Policy support. Policy is negatively correlated with FSI. The more money the government invests in FinTech, the lower the risk level. The financial support for FinTech enterprises can make the enterprise's business strategy change, from paying attention to profit to paying more attention to quality, and accelerating the development and improvement of basic technology.

(5) Technology maturity. TECH is negatively correlated with FSI. This shows that the higher the maturity of technology applied in the field of FinTech, the better the risk prevention. Therefore, the higher the technology maturity, the more conducive to avoid the risk of technical errors, and then better prevent systemic risk.

(6) Control variable. The negative correlation between FI and FSI shows that the higher the degree of opening to the outside world, the greater the attraction of domestic market to foreign investment, the lower the risk level. In fact, the fluctuation of DJI is negatively correlated with financial risk, which indicates that the greater the fluctuation of foreign capital market, the greater the financial risk pressure in China.

## 3. Summary

The innovation of FinTech products will cause the rise of financial risks, so we should prevent the innovation risks of FinTech products in time.

The combination of emerging technologies and finance represented by artificial intelligence, blockchain, cloud computing and big data, and the launch of new financial products are still in the stage of rapid development and trial and error, with great potential risks. We should establish a real-time monitoring system of FinTech risks, discover the defects and risks of innovative products in time, and prevent the unknown systemic financial risks. At the same time, we should respect the development space off Fin Tech innovation, strengthen the construction of FinTech infrastructure, and realize the balance between financial innovation and risk prevention. China is in an important stage from a financial power to a financial power. We must strictly abide by the bottom line that no systemic financial risk will occur, and the level of risk prevention should be in line with the world standard. Drawing on the experience of other countries in the supervision of FinTech, appropriately introducing the sandbox mode of supervision and exploring the supervision system in line with China's national conditions can not only encourage innovation, but also effectively control risks,

and provide a safe test environment for financial innovation.

The development of FinTech and the financial policy support for FinTech will reduce the financial risk, so we should increase the financial investment and policy support for FinTech. The maturity of technology is the premise of large-scale application of FinTech, and the development of technology cannot be separated from the support of funds and policies. The mature development of technology will break through the limitations of existing FinTech applications, launch more mature financial innovation products, and provide more convenient and efficient financial services. The mature application of FinTech will improve the efficiency of internal risk management in the financial industry and effectively reduce financial risks. The high-quality development of FinTech needs the support of capital investment and policy. With the development and application of technology, financial innovation will enter a new stage of integration. The development of technology will balance risk and efficiency, improve the efficiency of asset flow and pricing while improving the level of risk control and supervision.

There is a lag in financial supervision. The higher the degree of supervision, the more conducive to prevent financial risks. We should innovate supervision methods and strengthen the comprehensive supervision system. The traditional financial supervision is usually post supervision, which is lagging behind. The risks brought by FinTech cannot be accurately identified and timely resolved. Regulators should explore the innovation of supervision technology. The application of regulatory technology can make regulators monitor and warn risks in real time, effectively improve regulatory efficiency, reduce institutional compliance costs, and better prevent financial risks. On the one hand, we need to strengthen the top-level design, innovate the supervision mode, strengthen the comprehensive supervision, establish the FinTech and industry standards as well as the corresponding laws and regulations, so that the supervision can be based on the law; On the other hand, optimize micro risk management, master real-time risk information, improve the identification and assessment of risks related to FinTech, at the same time, strengthen cross sector cooperation, realize information data exchange and sharing, and promote the real-time collection, analysis and monitoring of regulatory data.

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