

Theoretical Research and Empirical Test on the Influence of China's Scientific and Technological Innovation on the Development of Digital Finance

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Abstract. With the development of big data and Internet, digital finance has become an important development trend of the financial industry, and it has been widely concerned by the public. At present, China's scientific and technological innovation has initially determined its leading position, and many indicators are among the best, but we still need to pay attention to the problems in its development. This paper matches the provincial and municipal data of Peking University Digital inclusive finance from 2011 to 2013 with the panel data of 30 provinces and cities in China from 2011 to 2020, and empirically tests the influence of technological innovation on the development of digital finance by using the fixed effect model. The results show that, firstly, the internal expenditure of R&D funds and the number of patent applications accepted have a significant positive effect on the development of digital finance; Second, the sales revenue of new products and the number of patent applications granted have a significant obstacle to the development of digital finance, indicating that China still needs to invest more energy in scientific and technological innovation, thus promoting the development of digital finance; Thirdly, the heterogeneity analysis shows that the level of scientific and technological innovation in the western region is relatively backward compared with other regions, so it is more important to support the development of scientific and technological innovation in the western region and enhance the creative ability of new technologies, thus affecting the development of digital finance. This paper enriches the related research on the influence of scientific and technological innovation on digital finance, and provides theoretical basis and policy reference for it.

Keywords: Scientific and Technological Innovation; Digital Finance; Financial Technology; Balanced Regional Development.

1. Introduction

In 2022, the Guiding Opinions of the General Office of China Banking and Insurance Regulatory Commission, China on the Digital Transformation of Banking and Insurance pointed out that it is necessary to deepen the structural reform of the financial supply side, promote the high-quality development of banking and insurance through digital transformation, and build a new pattern of digital finance adapted to the development of modern economy. The Fourth Plenary Session of the 19th CPC Central Committee proposed to "improve the modern financial system with high adaptability, competitiveness and HP star". While supporting high-quality economic development, we should prevent and resolve all kinds of risks in time and promote the sustained and healthy development of the financial industry. With the deep combination of technological innovation and finance, digital finance is booming, which brings huge potential risks while prospering the economy, so we must pay full attention to it.

At present, many domestic scholars have done theoretical and empirical research on scientific and technological innovation, digital finance and other variables such as carbon emissions, education economy and regional economy. Some scholars have studied the influence of economic growth and technology and finance on digital finance, and some scholars have taken a single region as an example to study the relationship between them. This kind of research is too one-sided for scientific and technological innovation and digital finance.

Based on the above considerations, this paper uses the data from China Statistical Yearbook of Science and Technology, China Statistical Yearbook, Provincial Yearbook, China Financial Yearbook and Peking University Hewlett-Packard Index of Digital Finance from 2011 to 2020 to

study the influence of internal expenditure of R&D funds, sales revenue of new products, number of patent applications accepted and number of patent applications granted on digital finance in various provinces and cities across the country. Compared with the existing literature, the possible innovations of this paper are as follows: 1. Few domestic scholars have studied the relationship between scientific and technological innovation and digital finance, which is basically the relationship between scientific and technological innovation under the background of digital finance of the research department. This paper studies the relationship between scientific and technological innovation and digital finance from this perspective based on the national perspective; 2. This paper divides the whole country into three regions: the east, the middle and the west, and respectively studies the influence of the development degree of scientific and technological innovation in these three regions on digital finance.

The structure of the rest of this paper is as follows: The second part is literature review, which mainly introduces the domestic scholars' definition of technology and finance and financial technology, the development of digital finance, the influencing factors of technological innovation and the related literature on the relationship between digital finance and technological innovation; The third part mainly introduces the data source and its preprocessing, the selection and construction of variables, and the descriptive statistics of scientific and technological innovation and digital finance; The fourth part mainly puts forward the model and estimation method used in this paper, and tests the model to get the existing problems and solutions; The fifth part is the empirical analysis results, which are divided into overall result analysis and heterogeneity analysis; The sixth part draws conclusions and policy suggestions based on the analysis of this paper.

2. Literature Review

2.1 Financial Technology and the Definition of Technology and Finance

At present, scholars at home and abroad think that financial technology and technology and finance are two different concepts.

The following is the definition of financial technology by scholars. Lu Minfeng and Huang Baihui (2019) believe that Internet finance is replaced by financial technology and exists in financial activities with a new concept and form. Financial technology mainly promotes the innovation of traditional financial products and services with the help of big data, cloud computing, Internet of Things, artificial intelligence, blockchain and other technologies, and its service target is financial enterprises, which belongs to the technical category[1]. Yan Dong and Wu Hua (2022) believe that financial technology is the combination of finance and technology, and advanced technology is used to promote the development of financial field. At present, the market's understanding of financial technology is not only at the level of "internet plus Finance". With the continuous progress of technology, the financial industry has gradually transformed into digital, changing the original logic and service methods[2]. He Yong and Xie Lei (2022) defined financial technology from three angles: they think technology is the foundation, finance is the core, and integration is the essence[3]. Sun Mingrui (2020) believes that financial technology can be used in the "fund-raising" platform to collect and pay funds on the Internet through crowdfunding, and directly find investors to invest without going through banks; Combination of cryptocurrency and blockchain; Pay money on the internet; Financial technology is integrated into the insurance industry, forming insurance technology; Budget procedures, consumers can master their own consumption and income; Robot consulting and stock trading procedures can recommend portfolios through algorithms and reduce costs[4].

The following are scholars' definitions of technology and finance. Zhao Changwen, Chen Chunfa and Tang Yingkai (2009) believe that the purpose of technology and finance is to promote the construction of an innovative country, to innovate financial products, improve service models, build a service platform, and serve enterprise innovation and scientific and technological progress. It is a combination of finance as a means and science and technology as the purpose, and it is also a key part that has an important impact on economic development[5]. Fang Hanting (2010) thinks that

technology and finance is a process of transforming a kind of science and technology into capital, and financial capital promotes scientific and technological innovation, which is a transformation process of creating wealth by science and technology and becomes the source of economic development[6]. Zhang Mingxi, Wei Shijie and Zhu Xinle (2018) started with technology and finance from five aspects, built his theoretical system, and deeply discussed its evolution mechanism, essence and functional orientation[7]. Zhang Qingshu (2015) put forward that technology and finance is a combination of science and technology and finance, and deeply analyzed technology and finance from five aspects: First, we should pay attention to function and seek the value discovery function of the market for scientific and technological achievements; Second, it is necessary to analyze the efficiency of technology and finance's promotion of technological innovation from different industries and fields; The third is to realize that there is no HP-style security system in technology and finance; Fourth, we should encourage innovation and promote the development of technology and finance to make up for the shortcomings of traditional financial institutions; Fifth, we should make rational use of China's resources and have a long-term awareness of technology and finance's development[8].

2.2 Development Course of Digital Finance

Huang Yiping and Tao Kunyu (2019) believe that the rapid development of China's digital financial industry mainly has three important factors: First, the supply of traditional financial services is insufficient. At the end of 1978, when China began its economic reform, there was only one China People's Bank, but in the following decades, China developed an extremely large financial sector [9]. In China, small and medium-sized enterprises and low-income people are the main clients. Therefore, when there is a serious supply shortage in traditional financial institutions, the emergence of digital finance can make up for the shortcomings of traditional financial institutions, reduce the cost of financial services and promote the innovation and development of financial products. Second, the supervision of the digital finance industry is relatively loose. Since 2005, our government has been promoting Hewlett-Packard Finance, and many microfinance companies have been established, but the effect is little. China's financial regulatory authorities have been supervising by industry. After the emergence of digital finance companies, a relatively relaxed regulatory environment has been formed, which provides opportunities for digital finance innovation and promotion of financial products. The third is the rapid development of digital technology. The widespread possession of smart phones helps to promote the innovation of combining various applications with digital finance. Under the background of big data era, financial companies can provide financial services to a large number of customers online. Jiao Jinpu, Huang Tingting, Wang Tiandu, Zhang Shaohua and Wang Xuan (2015) pointed out that the practice of HP in China can be divided into four categories: public microfinance (1990s), developmental microfinance (2000-2005), comprehensive HP finance (2006-2010) and innovative Internet finance (2011-present) [10].

2.3 Influencing Factors of Scientific and Technological Innovation

Lai Xiaolu (2020) studied the innovation ability of agricultural science and technology in Liaoning Province, and concluded that agricultural science and technology innovation still needs to be tapped. The shortage of scientific research funds and human resources will restrict the development of agricultural scientific and technological innovation; The conclusion that the platform construction for popularizing scientific and technological innovation achievements is still not perfect [11]. Xu Feifei (2011) studied the development of scientific and technological innovation in Hebei Province from the aspects of capital investment and human input, and obtained the influencing factors of scientific and technological innovation in Hebei Province by empirical analysis: the number of scientific and technological personnel activities, the expenditure of scientific and technological funds, the internal expenditure of R&D funds and various parts of policies [12]. Shao Zuoren (2014) summarized the main factors affecting the endogenous motivation of scientific and technological innovation in Zhejiang enterprises into five factors: the quality of foreign capital, the management level of

enterprises, the advanced technology, the government's policies and regulations and the quality of practitioners [13]. Wang Yifeng and Cao Yu (2013) used meta-analysis method to explore the main influencing factors of business model innovation of small and micro science and technology enterprises, and divided the influencing factors into surface direct influencing factors, middle indirect influencing factors and deep fundamental influencing factors, and obtained the enlightenment that the support of innovation policies and the independent innovation ability of enterprises are deep and fundamental influencing factors[14]. An Xiaotong (2015) used the least square principle to analyze the relationship between the number of patent applications for inventions and utility models from 1995 to 2013 and the expenditure on research and experimental development, the number of research and development personnel and the data of book publishing. Finally, it was found that the number of research and development personnel was negatively correlated with the number of patent applications, and there was no obvious correlation between scientific books and the number of patent applications [15].

2.4 Research Status

Scholars at home and abroad have discussed the relationship between digital finance and technological innovation, and conducted research under the background of digital finance. Hu Chenglai, Tu Lifeng and Qiao Guiming (2022) believe that under the background of digital finance, it can provide a necessary and more open information sharing environment for innovation. The innovation activities of enterprises are more easily influenced by external investment and financing, and a good digital financial environment can also play a certain role for traditional financial institutions to support the innovation of science and technology enterprises[16]. They made an empirical study on the digital financial environment, and the results show that the digital financial environment will promote financial support for urban innovation; A good digital financial environment will increase the innovation output level of the city. Jiao Qingxia and Liu Yueze (2022) believe that digital HP finance can help promote industrial integration in rural areas, ease the constraints of rural credit, improve the level of rural financial services, and promote farmers to increase their income. They studied the development level of digital HP finance, and finally concluded that digital finance can promote industrial integration in rural areas; Agricultural scientific and technological innovation plays an intermediary role in digital finance promoting rural industrial integration; The promotion of technological innovation to rural industrial integration will be affected by the threshold effect of digital finance[17]. Yang Nan, Wang Yiqian and Cai Xiaochun (2021) believe that digital finance can improve the efficiency and accuracy of financial financing services, reduce the cost of financial services, and effectively alleviate the financing difficulties in Northwest China to some extent [18]. Therefore, they believe that digital finance can promote scientific and technological innovation in northwest China. They studied the digital finance index, the core explanatory variable, and finally came to the conclusion that digital finance plays a significant positive role in scientific and technological innovation in northwest China. Wan Jiafa, Zhou Qin and Xiao Yi (2020) believe that digital finance can promote enterprise innovation by alleviating the financing constraints of enterprises, the development of digital finance can expand the sources of funds and promote the rational allocation of financial resources, and digital finance can also alleviate the information asymmetry in the market, provide investors with more investment and financing information, and finally promote enterprise innovation; Digital finance promotes enterprise innovation more obviously in small and medium-sized enterprises; The role of digital finance in promoting enterprise innovation is more obvious in private enterprises. They studied the HP index of digital finance, an explanatory variable, and finally concluded that digital finance played a significant positive role in enterprise innovation [19].

To sum up, few people have studied the impact of the development of scientific and technological innovation on digital finance. This paper studies the relationship between scientific and technological innovation and digital finance from this perspective.

3. Data Processing and Descriptive Statistics

3.1 Data Source and Processing

In order to obtain the data, the data sample of internal expenditure of variable R&D funds used in this paper comes from China Statistical Yearbook of Science and Technology from 2011 to 2020. The data of patent application authorization, patent application acceptance, industrial structure (IS), government intervention (GOV), expenditure level of science and technology (INV) and sales revenue of new products all come from China Statistical Yearbook and provincial yearbooks from 2011 to 2020. In this paper, the ratio of deposits to loans of financial institutions represents Finance, and its data are all from China Financial Yearbooks. In this paper, the index to measure digital finance (Dfin) refers to the Peking University Digital Finance Hewlett-Packard Index (2011-2020). Except for the lack of numerical values in Tibet in the industrial structure (IS) data, individual missing values are predicted and supplemented by the geometric average method according to the changing trend of the data.

3.2 Selection and Construction of Main Indexes

(1) The interpreted variable. In this paper, digital finance (Dfin) is selected as the explained variable, measured by dividing Peking University Hewlett-Packard Financial Index by 100, and the total index (index_aggregate) is selected for research.

(2) Explain variables. The internal expenditure of R&D funds includes basic research, applied research and experimental development, which is used to measure the investment of provinces in scientific and technological research.

As the final product in the process of innovation, the sales revenue of new products can well reflect the stage of goods and the research stage of scientific and technological innovation, so as to study the relationship between digital finance and its influence.

The number of patent applications granted indicates the number of patents finally granted by the state, which can effectively indicate the level of scientific and technological innovation in each province and clearly show the independent innovation ability of each province.

The number of patent applications accepted can quantitatively reflect the situation of scientific and technological innovation in various provinces. By analyzing the data, we can explore the relationship between digital finance and its influence.

Table 1. Define variable

Variable type	Variable type	variable symbol
Explained variable	Digital inclusive finance total index	index_aggregate
Explanatory variable	Internal expenditure of R&D funds	X1
	Sales revenue of new products	X2
	Number of patent applications accepted	X3
	Number of patent applications granted	X4
Control variable	Financial structure	FS
	Degree of government intervention	GOV
	Science and technology expenditure level	INV
	Industrial structure	IS

(3) Control variables. Financial structure (Finance), this paper represents the financial structure by the ratio of the deposit balance of financial institutions to the loan balance of financial institutions.

Degree of government intervention (GOV): The data is obtained by dividing the fiscal revenue data of each province by the total regional output value.

Industrial structure (IS): Ratio of industrial added value to GDP.

Science and technology expenditure level (INV): Proportion of science and technology expenditure of provinces to fiscal expenditure in each year.

3.3 Descriptive Statistic

. sum index_aggregate X1 X2 X3 X4					
Variable	Obs	Mean	Std. Dev.	Min	Max
index_aggr~e	310	216.2352	97.03032	16.22	431.9276
X1	310	508.113	612.5618	1.15296	3479.883
X2	310	5.31e+07	7.58e+07	17728.3	4.43e+08
X3	310	98260.85	142402.6	170	967204
X4	310	56727.57	88508.18	121	709725

Fig 1. Using Stata16.0 software, the explanatory variables and the explained variables are statistically described

By using Stata16.0 software, the explanatory variables and the explained variables are statistically described. From the chart, it can be seen that the observation number is 310, the maximum value of the total index (index_aggrate) is 431.9276, the minimum value is 16.22, and the average value is 216.2352. The maximum value of internal expenditure (X1) of R&D funds is 3479.883, the minimum value is 1.15296, and the average value is 508.113; The maximum sales revenue (X2) of new products is 4.43e+08, the minimum is 17,728.3, and the average is 5.31e+07;; The maximum number of patent applications accepted (X3) is 967204, the minimum is 170, and the average is 98260.85; The maximum of patents granted (X4) is 709725, the minimum number is 121, and the average is 56727.57.

4. Measurement Model and Estimation Method

4.1 Benchmark Model

In order to estimate the impact of China's scientific and technological innovation on digital finance, this paper adopts the following benchmark measurement model.

$$\text{index_aggregate} = \alpha_i + \alpha_j + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 GOV + \beta_6 INV + \beta_7 IS + \beta_8 Finance + \varepsilon_i.$$

Among them, index_aggregate is the explained variable related to digital finance. In this paper, the total index is mainly selected to study the influence of technological innovation on digital finance. α_i and α_j are regional fixed effect and time fixed effect respectively, X_1 is the internal expenditure of R&D funds, X_2 is the sales revenue of new products, X_3 is the number of patent applications accepted, X_4 is the number of patent applications granted. GOV, INV, IS, Finance are the control variable, GOV uses the ratio of fiscal revenue to regional gross output value to express the degree of government intervention; INV uses science and technology expenditure divided by financial expenditure to indicate the level of science and technology expenditure; IS uses industrial added value divided by GDP to represent industrial structure; Finance uses the balance of deposits of financial institutions divided by the balance of loans to represent the financial structure. $\beta_1, \beta_2, \beta_3, \beta_4$ are the coefficient of explanatory variables, $\beta_5, \beta_6, \beta_7, \beta_8$ are the coefficient of control variables, ε_i is a random error term.

4.2 Estimation Method

In this paper, the selection of fixed effect and random effect models has the following considerations. Intuitively, the data used in this paper is the national provincial panel data, which represents almost the whole research sample except for the lack of data in special areas, and the

comprehensiveness of the data can be guaranteed; On the other hand, the random effect model regards the individual effect as a disturbing part, which requires that the explanatory variables are not related to the individual effect, but this is not suitable for this study. At the same time, Hausman test is used in this paper, and the generated chi2 value is 110.97, and the P value is 0.0000, so this hypothesis is rejected at the significant level of 0.01. Therefore, this paper uses the fixed effect model.

4.3 Possible Problems and Solutions of the Model

4.3.1 Multicollinearity

In this paper, variance dilation factor (VIF) is used to test multicollinearity.

. estat vif		
Variable	VIF	1/VIF
X3	43.25	0.023123
X4	27.38	0.036523
X2	16.49	0.060634
X1	12.97	0.077091
INV	2.70	0.370972
GOV	1.80	0.556278
Finance	1.63	0.611722
IS	1.61	0.620804
Mean VIF	13.48	

Fig 2. Variance dilation factor (VIF) is used to test multicollinearity

The empirical test shows that the VIF of the model is 13.48, which is between 10 and 100, indicating that although there are multicollinearity problems, the degree of multicollinearity is weak, so it can pass the multicollinearity test.

4.3.2 Robustness Test

Table 2. The robustness test method of sub-sample

	Eastern region (except Tianjin) index aggregate	Central region (except Heilongjiang Province) index aggregate	Western region (except Gansu Province) index aggregate
X1	0.00254 (0.31)	0.0349*** (3.33)	0.0287*** (2.86)
X2	-0.000000117* (-1.95)	-0.000000193*** (-2.78)	0.000000291*** (4.80)
X3	-0.0000812* (-1.88)	-0.000154*** (-2.65)	-0.0000701 (-1.41)
X4	0.000123** (2.14)	0.000204* (1.85)	-0.000126 (-1.04)
GOV	-132.9** (-2.12)	-44.79 (-1.03)	-83.99*** (-11.15)
INV	1688.6*** (11.65)	795.5*** (6.22)	-539.1*** (-3.49)
IS	-75.63* (-1.90)	-13.65 (-0.62)	38.28*** (3.43)
Finance	-26.46*** (-3.09)	-7.585 (-1.66)	-11.99*** (-2.89)
_cons	291.1*** (9.99)	219.8*** (13.23)	230.0*** (27.25)
N	100	90	80

t statistics in parentheses, * p < 0.1, ** p < 0.05, *** p < 0.01

1) The endogenous problem is a part of the robustness problem. For the endogenous problem of missing variables, this paper adopts the panel fixed effect model, which is an important way to solve the endogenous problem. This paper selects four control variables: the degree of government intervention (GOV), the level of science and technology expenditure (INV), industrial structure (IS) and financial structure (Finance) to overcome this problem.

2) Robustness test examines the robustness of the explanatory ability of evaluation methods and indicators, that is, whether evaluation methods and indicators still maintain a relatively consistent and stable explanation of evaluation results when some parameters are changed. In this paper, the robustness test method of sub-sample is adopted. According to the region, the sample is divided into three regions: east, middle and west, and then Tianjin is removed from the eastern region, Heilongjiang Province is excluded from the central region and Gansu Province is excluded from the western region. Results Except for a few indicators, the panel is still significant as a whole as shown in the following table, which shows that the index interpretation ability of this paper has certain robustness.

Table 3. The robustness test method of the whole sample

	index_aggregate	coverage_breadth
X1	0.0217*** (5.53)	0.0259*** (5.60)
X2	-0.000000160*** (-4.64)	-0.000000197*** (-4.87)
X3	-0.000139*** (-4.51)	-0.000140*** (-3.88)
X4	0.000238*** (5.80)	0.000231*** (4.79)
GOV	-72.38*** (-8.90)	-59.83*** (-6.27)
INV	1116.6*** (15.49)	1274.2*** (15.05)
IS	-44.90*** (-4.29)	-51.01*** (-4.15)
Finance	-12.57*** (-3.26)	-19.20*** (-4.24)
_cons	245.3*** (29.10)	231.4*** (23.38)
N	300	300

t statistics in parentheses, * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

3) In this paper, the robustness test method of the whole sample is adopted. In this paper, the coverage_breadth is used to replace the original index_aggregate of the explained variables, and the results are still significant in the following table, which shows that the explanatory ability of the indicators in this paper is robust to some extent.

5. Empirical Analysis Results

5.1 Overall Result Analysis

In this paper, the explained variables and the explained variables are separately tested for fixed effects, and the explained variables, the explained variables and the controlled variables are tested for fixed effects again, so that the overall heterogeneity analysis is carried out and the results are as follows.

Table 4. Overall heterogeneity analysis

	(1)	(2)
	index_aggregate	index_aggregate
X1	0.0519*** (12.67)	0.0217*** (5.53)
X2	-0.000000139*** (-2.95)	-0.000000160*** (-4.64)
X3	-0.000151*** (-3.16)	-0.000139*** (-4.51)
X4	0.000216*** (3.39)	0.000238*** (5.80)
GOV		-72.38*** (-8.90)
INV		1116.6*** (15.49)
IS		-44.90*** (-4.29)
Finance		-12.57*** (-3.26)
_cons	199.9*** (155.22)	245.3*** (29.10)
N	310	300

According to the data in the table, the coefficient of internal expenditure of R&D funds is 0.0519, which has a positive role in promoting digital finance. It shows that every unit of research investment in scientific and technological innovation in various provinces and cities will increase digital finance by 0.0519, which shows that internal expenditure of R&D funds is of great significance to the development of digital finance. The coefficient of new product sales revenue is -0.000000139, which indicates that the sales revenue of new products has a negative correlation with digital finance, which means that the period when new products are put into the market is in its infancy, and it is not smooth sailing for new products to enter the market, and they will certainly encounter various problems; The

coefficient of the number of patent applications accepted is -0.000151, which is negatively related to digital finance, indicating that we have not invented and innovated new products well. We should seize the opportunity given by the state to innovate, invent better products and improve our innovation consciousness. The coefficient of the number of patent applications granted is 0.000216, which is positively related to digital finance, indicating that the government supports encouraging innovation and attaches importance to scientific and technological innovation. After that, four control variables, namely, the degree of government intervention (GOV), the level of science and technology expenditure (INV), industrial structure (IS) and financial structure (Finance), are added. The results show that the explanatory variables still have a significant impact on digital finance.

5.2 Heterogeneity Test

In this paper, the provinces in China are divided into three parts: the eastern part, the central part and the western part, and the conclusions are shown in the following table.

Table 5. Heterogeneity Test

	East region	Central region	West region
	index_aggregate	index_aggregate	index_aggregate
X1	-0.00360	0.0338***	0.0252**
	(-0.43)	(3.59)	(2.61)
X2	-5.03e-08	-0.000000172***	0.000000283***
	(-0.83)	(-2.90)	(4.72)
X3	-0.0000950**	-0.000152***	-0.0000652
	(-2.07)	(-2.79)	(-1.32)
X4	0.000158**	0.000171*	-0.0000898
	(2.62)	(1.73)	(-0.76)
GOV	-178.1***	-56.68	-83.92***
	(-2.96)	(-1.64)	(-11.18)
INV	1343.6***	799.7***	-465.0***
	(10.64)	(6.73)	(-3.15)
IS	-112.8***	4.194	47.06***
	(-2.98)	(0.33)	(4.60)
Finance	-8.440	-8.621**	-12.53***
	(-1.07)	(-2.07)	(-3.15)
_cons	296.5***	215.8***	225.4***
	(10.20)	(16.81)	(29.13)
N	110	100	90

It can be seen from the table that the R&D expenditure and new product sales revenue in the eastern region are not significant, but the two variables, the number of patent applications accepted and the number of patent applications granted, are significant. The reason for this is that the general development in the eastern region is relatively fast, even faster than the national development level, and the level of scientific and technological innovation in individual regions is not up to the average development level in the eastern region, with a large gap, which is likely to turn from prosperity to decline; The four explanatory variables of R&D expenditure, new product sales revenue, number of patent applications accepted and number of patent applications granted in the central region are significant, which will happen as a whole because the overall development level of the central region has increased linearly. The two explanatory variables, the number of patent applications accepted and the number of patent applications granted in the western region, are not significant, but the R&D expenditure and new product sales revenue are significant. Because of geographical reasons, some provinces and cities in the western region are backward in development level and their economies can't keep up with the national development, this situation will occur. We should spend more energy to increase scientific and technological innovation in the western region, and give priority to supporting some areas in the western region to keep their economy and technology up with the pace of the country.

6. Conclusion and Policy Suggestions

The research conclusion of this paper provides effective enlightenment for the development of digital finance by scientific and technological innovation in various provinces and cities in China.

First of all, we should put more energy into the research and development of new products. The sales revenue of new products has a negative correlation with digital finance, which proves that new products are now in the embryonic stage in the market. In this initial stage, it will not be smooth, and its development is a little hindered, even hindering the development of digital finance. Therefore, we should devote ourselves to researching and developing new products, pay attention to the research and development of this technology, and put more new products into the market, so that it will be more conducive to the development of digital finance in China.

Secondly, the state should encourage invention and innovation and provide innovative opportunities for young people; At the same time, as young people, we should seize the opportunity, seize the opportunity, strive to innovate, and contribute to building a strong country in science and technology in terms of invention and creation. There is a negative correlation between the number of patent applications accepted and digital finance, indicating that it will hinder the development of digital finance, indicating that everyone's passion for R&D and innovation is not enough, and the number of people who really invest in invention and creation is far from enough. Therefore, under the premise that the country has supported and encouraged invention and creation, we should devote ourselves to scientific and technological research and development and hand over a perfect answer sheet for the country.

Finally, focus on supporting scientific and technological innovation in the western region, especially improving the ability of invention and creation. Due to geographical reasons, scarce resources and insufficient technology development in the western region, digital finance lags behind other regions. At the same time, after research, it is also found that the two explanatory variables, the number of patent applications granted and the number of patent applications accepted, have not shown significant problems in digital finance, which just shows that the level of scientific and technological innovation in the western region still needs to be improved. Therefore, the government should increase its support for the western region, whether it is sending scientific and technological personnel to the western region to provide assistance. Or increase the number of patent applications authorized, can effectively improve the level of invention and creation in the western region, thus improving the overall development level of the western region, and then promoting the development of digital finance in the western region.

References

- [1] Lu Minfeng, Huang Baihui. The next stop of Internet finance: financial technology [J]. Enterprise Research, 2019 (03): 16-18.
- [2] Yan Dong, Wu Hua. Financial technology in the era of digital economy: current situation, risks and preventive strategies [J]. China-Arab Science and Technology Forum (in Chinese and English) .2022 (10): 55-59.
- [3] He Yong, Xie Lei. The connotation, risk and supervision of financial technology in China: a research summary based on literature visualization [J]. Financial Development Research.2022 (04): 82-89.
- [4] Sun Mingrui. Development trend of financial technology and investment risk [J]. International financing. 2020 (12): 39-41.
- [5] Zhao Changwen, Chen Chunfa, Tang Yingkai. technology and finance [M]. Science and Technology Press, 2009:1-16.
- [6] Fang Hanting. Thoughts on technology and finance's Theory, Practice and Policy [J]. China Science and Technology Forum .2010 (11): 5-10+23.
- [7] Zhang Mingxi, Wei Shijie, Zhu Xinle. technology and finance: From concept to theoretical system construction [J]. China Soft Science.2018 (04): 31-42.
- [8] Zhang Qingshu. On the guarantee mechanism of technology and finance's development [J]. Shang .2015 (29): 179.
- [9] Huang Yiping, Tao Kunyu. China's digital financial revolution: development, impact and regulatory implications [J]. International Economic Review .2019 (06): 24-35+5.
- [10] Jiao Jinpu, Huang Tingting, Wang Tiandu, Zhang Shaohua, Wang Tang. China inclusive finance development process and empirical research [J]. Shanghai Finance.2015 (04): 12-22.
- [11] Lai Xiaolu. Analysis of influencing factors of agricultural science and technology innovation in Liaoning Province [J]. Horticulture and Seedling.2020 (08): 59-61.
- [12] Xu Feifei. Empirical analysis of influencing factors of scientific and technological innovation in Hebei Province [J]. Journal of Hebei Agricultural University (Agriculture and Forestry Education Edition) .2011 (01): 86-89.
- [13] Shao Zuoren. Influencing factors and countermeasures of endogenous motivation of scientific and technological innovation of Chinese enterprises [J]. Foreign Trade and Economic Cooperation .2014 (07): 101-102+123.
- [14] Wang Yifeng, Cao Yu. Analysis of influencing factors of business model innovation of small and micro science and technology enterprises [J]. Scientific and technological progress and countermeasures. 2013(18):13-17.
- [15] An Xiaotong. Analysis of the influencing factors of the number of patent applications-based on the data of China's National Statistical Yearbook from 1995 to 2013 [J]. Modern Business.2015 (23): 81-83.
- [16] Hu Chenglai, Tu Lifeng, Qiao Guiming. Analysis of the impact of the digital financial environment in the Yangtze River Delta on regional scientific and technological innovation [J]. Journal of Suzhou University (Philosophy and Social Sciences Edition) .2022 (03): 41-51.
- [17] Jiao Qingxia, Liu Yuez. Digital inclusive finance, Agricultural Science and Technology Innovation and Rural Industry Integration Development [J]. statistics and decision.2022 (18): 77-81.
- [18] Yang Nan, Wang Yiqian, Cai Xiaochun. The impact of digital finance on scientific and technological innovation in northwest China-based on Eviews platform [J]. China Management Informatization.2021 (19): 74-77.
- [19] Wan Jiayao, Zhou Qin, Xiao Yi. Digital Finance, Financing Constraints and Enterprise Innovation [J]. Economic Review.2020 (01): 71-83.