

Research on the Interaction between Finance and Innovation Factors of Technological Industry in China

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Abstract. Finance and technology are the two major driving forces of national economic development [1]. While the research on the interaction mechanism between sci-tech finance and the elements of sci-tech innovation is still at a blank stage[2].In this paper, we first constructs a basic time series model, and then adopts econometric methods like cointegration test and Granger causality test to analyze the relationship between sci-tech finance and sci-tech innovation The test results show that the development of sci-tech finance can promote the progress of sci-tech innovation in China, but the effect is not obvious or significant enough. Finally, this study proposes the development strategies of sci-tech finance and sci-tech innovation in China.

Introduction

In recent years, technology finance industry has continued to develop in China. According to Accenture data, as of July 2016, Asian technology finance companies raised a total of 9.6 billion dollars, more than 90% of which is raised by Chinese companies [3]. In recent years, China has initially established an interactive mechanism for the complementary advantages of sci-tech finance and sci-tech innovation, and the efficient integration of scientific and technological financial resources in the field of sci-tech innovation [4]. The establishment of sci-tech finance and sci-tech innovation areas in which science and technology resources are concentrated throughout the country has a relatively strong development momentum [5]. This paper will carry out an empirical study on the interactive development of sci-tech finance and sci-tech innovation from a national perspective, which provides theoretical support for the next step to promote the improvement of technology innovation capability in China, and promote the sustained and steady growth of the knowledge economy.

Literature References

Judging from the current research, foreign scholars rarely have the connotation of the definition of science and technology finance, and only have similar terms such as financial support for technological innovation. In foreign countries, Alexandra Guarnieri concluded that the company's innovation activities are subject to financial support [6]; Gary Kitakyushu and others proposed that venture capital is an important part of a company's overall innovation strategy [7]; Bash Siddhartha believe that financing constraints reduce R&D investment, which affected the innovation of enterprises [8]. In China, Du Jiang et al used the Spatial Durbin Model (SDM) to find that the technological innovation capability of each region has obvious spatial effects, and that technology finance can significantly promote technological innovation [9]; Zhang Meng and Wang Guangfeng have found that the impact of various science and technology financial inputs on technological innovation has a significant role in promoting [10].

Equation and Variable Selection

In this paper, regression equations are established based on existing sample data. Cointegration test is used for non-stationary time series, first judged by a single order, and then assumed the equation.

On the basis of that, the Granger causality test is carried out, and the causal relationship between the variables is more comprehensive and accurate.

This paper divides the main factors of sci-tech finance into market and public sci-tech finance, and sci-tech innovation into sci-tech innovation investment and sci-tech innovation output. Based on the availability of data and the current research experience, this paper selects the following indicators, as shown in Table1. The data comes from the second-hand materials such as China Science and Technology Statistical Yearbook, China High-tech Industry Statistical Yearbook, and China Venture Capital Investment Development Report.

Table 1 Primary and secondary indicators

Order parameter	Primary indicators	Secondary indicators
Sci-tech finance	Market sci-tech finance	Venture Capital Institution Capital Management Scale (X_{11})
	Public sci-tech finance	Government Sci-tech Financial Allocation (X_{12})
Sci-tech innovation	Scientific and technological innovation investment	Industrial R&D Expenditure (Y_{11})
	Technological innovation output	High-tech Industry Main Business Income (Y_{12})

Data Measurement And Inspection

ADF Test Model. The ADF unit root test showed that the original sequences were non-stationary and could not be directly analyzed. After the difference, X_{11} , X_{12} and Y_{12} reject the null hypothesis at the 1% confidence level, and Y_{11} rejects the null hypothesis at the 10% confidence level, which is a stationary time series. The test results are shown in Table 2.

Table 2 ADF test results

variable	ADF test statistics	Critical value	Probability
X_{11}	-10.207	-8.235	0.005
X_{12}	-9.02	-8.235	0.0072
Y_{11}	-4.95	-4.187	0.066
Y_{12}	-7.036	-7.006	0.002

Cointegration Test Model. This paper uses the Engle-Granger two-step test between two variables. X_{11} , X_{12} , Y_{11} , and Y_{12} are naturally logarithmically transformed to LX_{11} , LX_{12} , LY_{11} , and LY_{12} , respectively. By comparing the ADF test statistic values of each sequence with the corresponding critical values, LX_{11} , LX_{12} , LY_{11} , and LY_{12} are non-stationary sequences, and the respective first-order difference sequences ILX_{11} , ILX_{12} , ILY_{11} , and ILY_{12} are stable. Judging from that, LX_{11} , LX_{12} , LY_{11} , and LY_{12} are first-order single-integer sequences, which satisfy the premise of cointegration test.

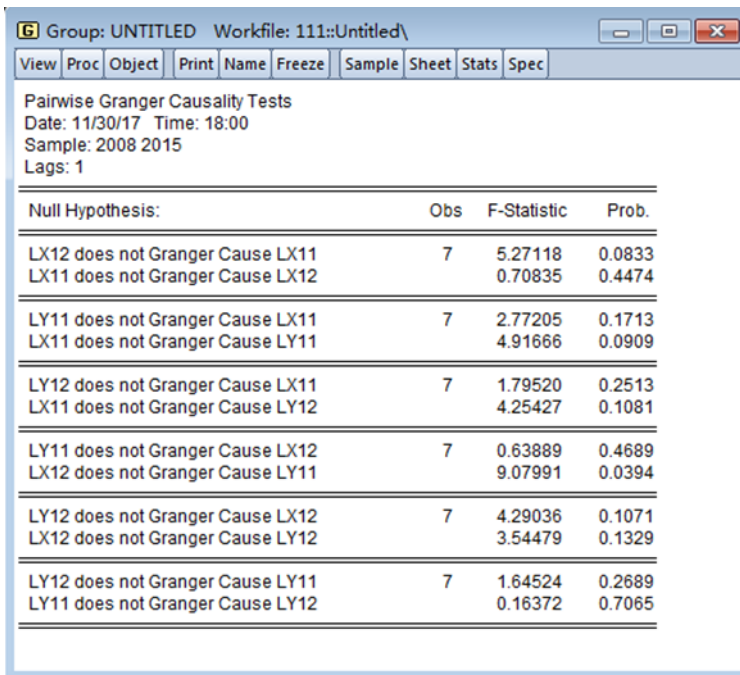
Table 3 LX_{11} , LX_{12} , LY_{11} , LY_{12} unit root test results

ADF test	T test	Probability	1% level	5% level	10% level	Test results
LX_{11}	3.784	0.998	-2.937	-2.006	-1.598	Non-stable
LX_{12}	14.35	1.000	-2.937	-2.006	-1.598	Non-stable
LY_{11}	3.823	0.998	-2.937	-2.006	-1.598	Non-stable
LY_{12}	5.382	0.999	-2.937	-2.006	-1.598	Non-stable
ILX_{11}	-5.108	0.061	-8.235	-5.338	-4.187	Stable
ILX_{12}	-15.16	0.0008	-8.235	-5.338	-4.187	Stable
ILY_{11}	-6.915	0.010	-7.006	-4.773	-3.877	Stable
ILY_{12}	-74.22	0.0001	-8.235	-5.338	-4.187	Stable

The least squares regression is performed on the intersection of LX_{11} and LX_{12} with LY_{11} and LY_{12} respectively, and the unit root test is performed on the estimated residual sequence of the four

models. The test statistic of residual E1111 is -5.1156, the test statistic of residual E1112 is -4.298, the test statistic of residual E1211 is -12.03; and the test statistic of residual E1212 is -4.778, both of which are less than the significance level. 10% threshold. Furthermore, it is proved that LX11, LX12, LY11, and LY12 have a cointegration relationship.

Granger test model. The results of cointegration test show that there is a long-term equilibrium relationship between the various variables of sci-tech finance and sci-tech innovation in China during the sample period. But this relationship is not sufficient for causality, and the direction of causality requires further Granger testing. Because the causal relationship is extremely sensitive to the selection of the lag period q , this paper comprehensively considers the lag period according to the AIC. Since the data span of this article is only 8 years, the lag period can only be $q=1$.



Null Hypothesis:	Obs	F-Statistic	Prob.
LX12 does not Granger Cause LX11	7	5.27118	0.0833
LX11 does not Granger Cause LX12		0.70835	0.4474
LY11 does not Granger Cause LX11	7	2.77205	0.1713
LX11 does not Granger Cause LY11		4.91666	0.0909
LY12 does not Granger Cause LX11	7	1.79520	0.2513
LX11 does not Granger Cause LY12		4.25427	0.1081
LY11 does not Granger Cause LX12	7	0.63889	0.4689
LX12 does not Granger Cause LY11		9.07991	0.0394
LY12 does not Granger Cause LX12	7	4.29036	0.1071
LX12 does not Granger Cause LY12		3.54479	0.1329
LY12 does not Granger Cause LY11	7	1.64524	0.2689
LY11 does not Granger Cause LY12		0.16372	0.7065

Fig. 1 Granger test results

The test results show that under the 5% significant level and one lag period, the government sci-tech financial allocation is the reason for the industrial R&D investment, but the sci-tech innovation investment, the sci-tech innovation output and the market technology finance are not the mutual reasons. The results show that in the short term, the government's financial allocation will affect the company's R&D investment significantly. This may be due to the strong externalities and high-risk characteristics of technological innovation. The public sci-tech finance promotes sci-tech innovation investment through the government's financial sector's science and technology plans, policy loans and innovation subsidies.

However, the limitations of this paper are also reflected in the sample data is too small, the test results are only supported when the lag period $q = 1$.

Conclusions and Recommendations

According to the empirical results, we find that the development of sci-tech finance can drive the progress of scientific and technological innovation in China, but the influence is not significant. Then, we propose the following suggestions. Firstly, we should continue to improve the support system and service system for sci-tech finance policies. Based on the analysis of the characteristics of financial products such as venture capital, technology insurance, and technology credit, we should formulate a system that can meet both financing needs and risk. Secondly, we should innovate the financial technology investment methods and mechanisms, and comprehensively apply post-subsidy, risk compensation, and reimbursement financing to leverage the financial funds to guide and drive

social capital and technological innovation. Finally, the role of science and technology finance in China's market for technological innovation output is not significant enough. We should improve the innovation of financial products and services, and build a platform which release investment and financial information for technological and entrepreneurship enterprises, and improve the matching of investment and financing innovation.

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