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Evaluation and Countermeasures of Science-And-Technology Finance Development of Liaoning Province in China

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Abstract

Liaoning province is one of China's important industry province, the science-and-technology finance development is one of the important factors to enhance the local economy. Based on the principle of construction of evaluation system, builds regional science-and-technology finance development evaluation system; and establishes a corresponding evaluation model with factor analysis method to evaluate objectively the development level of science-and-technology finance in Liaoning province. Statistical data of 31 provinces (cities, autonomous regions) in China is used to make quantitative analysis of science-and-technology finance development of Liaoning province. Through further comparison explores gaps, analyzes the reasons, and puts forward the corresponding countermeasures.

Keywords: Liaoning Province; science-and-technology finance; Evaluation; Countermeasures

1. Introduction

Science-and-technology finance, that is Sci-Tech finance, belongs to industry financial category, mainly refers to the integration of science and technology industry and financial industry. Economic development depends on science and technology promotion, and science and technology industry development needs financial boost.

Zhao Changwen(2010) proposed that science-and-technology finance is a series of financial instruments, financial system, financial policy and financial service system, which promote technology development, achievements transformation and high-tech industry development. It is an important component of the national innovation system and financial system.
Classical economics theory says that technology, capital and human resources are the key factors economic growth. Science-and-technology finance is the integration of technology and capital. China is in the economic transformation stage, the goals now are changing the extensive economic growth mode, optimizing and upgrading the industrial structure, and building a conservation-oriented society. These goals depend on the technology innovation and high-tech industry development. Integration of technology and capital can accelerate the goals attainment.

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International experience shows that the technology innovation ability and financial environment are the important factors of regional economic development. Hu Yuancheng and Wu Jiangtao(2012) suggest that different countries' economic growth gaps are mainly due to different countries' technological progress gaps. Developed countries' technical progress contribution to GDP increased from 5%-20% in early twentieth Century to 60%-80% in twenty-first Century, while the contribution of technological progress in developing countries was only 10%-20%. Therefore, developing the science and technology and promoting the innovation of the financial industry have become the government decision-making departments at all levels in China.

Science-and-technology finance is an important factor to promote the upgrading of the industrial structure and the innovation construction. Research on science-and-technology and finance can be traced back to Schumpeter, Schumpeter (1911) proved the important influence of monetary, credit and interest and the independent innovation, financial institutions could help the enterprises those have development capacity, so as to promote the innovation of science and technology. Joseph Schumpeter (1934), in his "theory of economic development" stated the relationship between innovation and economic development, considered the core of the economic development is the new credit demand of enterprises, the bankers' need for new technology can play the role. Hicks (1996) pointed out that in the industrial revolution period, illiquid long-term capital is the premise of new technology innovation and application, and the financial market is the source of long-term capital. Boy and Smith (1998) proposed that at a relatively low level of economic development, market-oriented financial system can promote economic development. According to Gale and Allen (2000), the bank leading financial system could realize the mature technology dissemination, and financial markets tend to diffusion of innovative technology. Demirgüç-Kunt & Maksimovic（1998，2002）proved that under the developed financial markets conditions, financial institutions' financing could promote the growth of enterprises and development of the industry, this view was also approved by Claessens & Laeven (2003). Carlota (2002) believed that because the risk investors wanted to obtain high profits, they would make rapid investment in the new techniques early rise period, so there would be a highly couple of financial capital and technology innovation in the end. Calderó n & Liu (2003) proved that the financial development could promote technology progress, so it could also promote economic growth. Ross Levine (2007) from the view of financial function perspective proposed that the financial structure division has little significance, the key is whether the financial system can provide comprehensive financial service function, leading technology to promote economic growth. Fang hanting (2010) suggested that the science-and-technology finance was deepening the financial work, and was able to provide financing arrangements for the enterprises. Duan Shide and Xu Xuan (2010) suggested science-and-technology finance promoted the strategic industry development, and discussed the development mode. Wang Weibin etc. (2012) studied the promoting role of science-and-technology finance by empirical analysis.

The perfect financial system can bring harmony and stability of the financial operation, through improvement of the capital market, efficiently allocate financial resources, let financial capital flows to the most efficient production department and promote the development of economy. Science-and-technology finance can boost the technological innovation, promote the achievement transformation and play financial system in high-tech industries.

In the new round of international order adjustment background, if Liaoning province of China wants to accelerate transformation of economic development mode, enhance the capability of independent innovation and industrial competitiveness, it must take the science and technology innovation as the pioneer, supplementing by perfect financial supporting system, make science-and-technology and finance develop at the same time. This is not only the fundamental solution to solve the difficulty of science-and-technology enterprises financing.

2. The Construction Of Evaluation System

2.1 The Principle Of Construction Of Evaluation Systems

The construction of evaluation system of science-and-technology finance development is a complex process, and needs careful selecting index. Because it relates to the economic, social, policy and other several aspects, should follow the following principles:

(1) The scientific principle. The evaluation system must meet the requirements of economic and social development. From the science point of view, systematically and accurately grasp the true meaning of science-and-technology finance and state the situation of regional science-and-technology finance development.

(2) The overall principle. Evaluation system must be able to fully reflect the whole situation of regional science-and-technology finance development, must have the characteristics of wide coverage and high level, and must optimize the selected indicators avoiding missing cases because too little indicators.

(3) The measurable principle. Selected indicators must be the objective existence and quantified indicators, maximum avoiding the effect of subjective judgment to the science-and-technology finance development; in addition, the choice of indicators should be able to get the authority data.

2.2 The Design Of Evaluation System

Following the principles, from the resources, science-and-technology finance development expenditure, the output rate of science-and-technology finance and other aspects designs the evaluation system of science-and-technology finance development of Liaoning province of China(see Table 1). Q1 to Q14 are used to signify the indicators in the evaluation system.

Table 1 Evaluation system of science-and-technology finance development of Liaoning province

Indicator name	Indicator calculation	Indicator expression
scientific and technological human resources	number of scientific and technological human resources / total regional population	Q1
institution of higher learning resources	Number of institution of higher learning /total regional population	Q2
financial expenditure	financial expenditure on science-and-technology / financial expenditure	Q3
R & D	R & D expenditure / regional GDP	Q4
Science and technology funds	Science and technology funds expenditure / regional GDP	Q5
Loans of financial institutions	financial institutions loans / regional GDP	Q6
Insurance support	Insurance expenses/ original premium income	Q7
R & D output rate	Number of R & D project / R & D expenditure	Q8
Regional patent output rate	Quantity of patent authorization / R & D expenditure	Q9
Technology market turnover rate	contract amount of technology market turnover/ R & D expenditure	Q10
The export rate of output	high-tech products export/ R & D expenditure	Q11
The new product output rate	new product project number/ R & D expenditure	Q12
Industrial enterprise patent output rate	effectively invention patent number of industrial enterprises/ R & D expenditure	Q13
Openness	total import and export / regional GDP	Q14

3. Empirical Analysis

In order to evaluate the science-and-technology finance development of Liaoning province, this paper selecting 31 provinces (cities, autonomous regions) of China as samples, comprehensively compares Liaoning province science-and-technology finance development and others. The data are from the provinces (cities, autonomous regions) statistical yearbook 2012, the national economic and social development statistical bulletin in 2012, China Statistical Yearbook and data from the relevant ministries.

3.1 Descriptive Statistics And Factor Analysis

Describes the 14 indicators to the statistical analysis, the results in Table 2:

Table 2 Descriptive statistical analysis

	N	Minimum	Maximum	Mean	S.D.
Q1	31	0.000722	0.371339	0.123830	0.113989
Q2	31	119.348315	189903.400000	11126.662200	33715.248480
Q3	31	0.388643	5.641203	1.754013	1.349593
Q4	31	0.027021	1.864084	0.868671	0.504938
Q5	31	0.190000	5.760000	1.379677	1.054566
Q6	31	0.650040	2.440356	1.132144	0.414211
Q7	31	0.201447	0.439474	0.282719	0.044454
Q8	31	0.159825	0.977398	0.433434	0.160106
Q9	31	0.322390	8.674404	1.458401	1.481933
Q10	31	0.000000	11.466375	0.937486	2.037239
Q11	31	0.005856	2.715915	0.486229	0.640979
Q12	31	0.114683	0.960594	0.476073	0.183418
Q13	31	0.066559	3.543067	0.383195	0.607066
Q14	31	0.553039	23.969829	4.986003	6.148958

Before the factor analysis, it is necessary to test whether or not it is suitable for factor analysis. Use the KMO value to express the suitability. If the KMO value is greater than 0.7, which means the data is suitable for factor analysis. As shown in Table 3, KMO value is 0.768, which shows this group data is suitable for factor analysis. In addition, the Bartlett sphere chi-square test statistic probability is 0.000, less than 1%, and also shows it is suitable for factor analysis.

Table 3 KMO value and sphere chi-square test

Kaiser-Meyer-Olkin		0.768
Bartlett sphere chi-square test	Approximate Chi-Square	559.461
	df	91
	Sig.	0.000

3.2 Extraction Of Common Factors

Using SPSS18.0 software analysis gets the Correlation coefficient matrix, computing characteristic values of the correlation matrices (Table 4). In Table 4, except the first column, there are two parts in the table. The left part expresses the initial characteristic value; the right part expresses the extraction of load. Here uses the right part to select the factor. According to the feature values greater than 1 standard, using Principal Components Analysis extracts factors. In Table 4, 4 characteristic values are more than 1. The 4 characteristic values contribution rate is 87.994%, indicating that these 4 characteristic values contain enough information.

Table 4: Characteristic value and variance contribution rate

Component	Initial characteristic value			Extraction of load		
	Total	Variance %	Accumulation %	Total	Variance contribution rate %	Accumulate variance contribution %
1	5.455	38.966	38.966	5.455	38.966	38.966
2	4.019	28.705	67.671	4.019	28.705	67.671
3	1.529	10.919	78.590	1.529	10.919	78.590
4	1.317	9.404	87.994	1.317	9.404	87.994
5	0.622	4.440	92.435			
6	0.437	3.121	95.556			
7	0.306	2.186	97.742			
8	0.104	0.746	98.488			
9	0.074	0.531	99.019			
10	0.054	0.382	99.402			
11	0.044	0.318	99.719			
12	0.021	0.148	99.868			
13	0.009	0.068	99.935			
14	0.009	0.065	100.000			

3.3 Factor Rotation And Factor Interpretation

In order to explain the factor contribution，puts the initial factor loading matrix to orthogonal rotation. (Table 5)

In the factor load matrix after rotation, in accordance with the absolute values greater than 0.6 standard, screens corresponds to each principal component standardized variables to construct the principal component expressions. The first common factor has greater load on the indicators of Q1, Q3, Q4, Q11 and Q14, indicating that these 4 indicators have strong correlation, so as the first factor, and named it " resources and openness factor ", reflecting the regional endowment on science-and-technology finance and regional openness; the second common factor has greater load on the indicators of Q2, Q7, Q9 and Q13, so it is classified into second factors, named " technology and service factor ", reflecting the technology and service support in regional science-and-technology finance; third common factor has greater load on Q5, Q6 and Q10, so it is classified into third factors, named as " financial support factor ", reflecting the area fund condition of regional science-and-technology finance development; fourth factors have a greater load on the indicators of Q8 and Q12, so it is classified into fourth factors, named " the development potential factor ", reflecting the regional science-and-technology finance development potential status.

Table 5: Orthogonal rotation after the factor loading matrix

	component			
	1	2	3	4
Q1	0.947	-0.09	0.121	0.007
Q2	-0.07	0.972	-0.088	0.081
Q3	0.83	-0.004	0.501	0.037
Q4	0.918	-0.239	-0.019	-0.086
Q5	0.609	-0.086	0.723	0.034
Q6	0.298	-0.057	0.777	0.099
Q7	0.025	0.778	0.068	-0.16
Q8	-0.123	0.607	-0.05	0.75
Q9	0.033	0.924	0.023	0.231
Q10	0.051	0.013	0.955	-0.016
Q11	0.816	0.19	0.157	0.06
Q12	0.057	-0.009	0.097	0.968
Q13	-0.035	0.965	-0.073	0.123
Q14	0.791	0.121	0.541	-0.043

3.4 Main Factors Ranking And Comprehensive Score

In order to calculate the factor scores, using the regression method puts the main factor for the linear regression, and obtains coefficients' least squares estimation, namely the factor score coefficient matrix, as shown in Table 6. ZQ1 to ZQ114 are used to signify the indicators in the Component Score Coefficient Matrix.

Table 6: Component Score Coefficient Matrix

Indicator	Factor			
	1	2	3	4
ZQ1	0.291	-0.014	-0.155	0.027
ZQ2	0.009	0.268	-0.024	-0.072
ZQ3	0.165	0.009	0.076	0.015
ZQ4	0.311	-0.047	-0.221	-0.01
ZQ5	0.038	-0.014	0.246	0.009
ZQ6	-0.078	-0.017	0.343	0.041
ZQ7	-0.001	0.247	0.048	-0.216
ZQ8	-0.01	0.072	-0.03	0.43
ZQ9	0.021	0.236	0.004	0.033
ZQ10	-0.204	0.018	0.503	-0.06
ZQ11	0.243	0.058	-0.105	0.022
ZQ12	0.013	-0.13	-0.01	0.656
ZQ13	0.019	0.261	-0.026	-0.042
ZQ14	0.143	0.056	0.112	-0.059

According to the product of factor score coefficient and standardization value of the original variable, gets the factor scores function, and calculate the main factor score and science-and-technology finance conditions of Liaoning and other 30 provinces (cities, autonomous regions) in China.

Table 7: Areas' main factor score

area	main factor score			
	F1	F2	F3	F4
Beijing	0.417945	0.331392	4.942592	0.06493
Tianjin	1.612792	-0.27003	-0.13064	0.887121
Hebei	-0.50876	-0.26268	-0.11957	-0.388
Shanxi	-0.56079	-0.49891	0.423558	-1.0258
Neimenggu	-0.64137	-0.16542	-0.41732	-1.82876
Liaoning	0.163597	0.067172	-0.06212	-1.5405
Jilin	-0.64915	-0.37963	-0.28126	0.157631
Heilongjiang	-0.38492	-0.21814	-0.39381	0.331922
Shanghai	2.701442	0.572467	0.748912	-0.51967
Jiangsu	2.030655	0.016125	-0.77165	-0.27409
Zhejiang	1.320211	-0.03854	-0.07357	1.420556
Anhui	0.041361	-0.14823	-0.34608	0.984311
Fujian	0.581064	-0.06369	-0.39592	-0.75682
Jiangxi	-0.39815	-0.13974	-0.38871	-0.69624
Shandong	0.714263	-0.47643	-0.67092	-0.68922
Henan	-0.19825	-0.64271	-0.72938	-0.09867
Hubei	-0.0163	-0.73644	-0.44598	-0.09254
Hunan	-0.24953	-0.37357	-0.61799	-0.22941
Guangdong	2.216275	0.208344	-0.68745	-0.58018
Guangxi	-0.62493	-0.37213	-0.32784	0.611805
Hainan	-0.71287	0.189335	0.156379	1.050387
Chongqing	-0.141	-0.31944	-0.06876	0.441698
Sichuan	-0.26197	-0.02926	-0.16008	2.499162
Guizhou	-0.84513	-0.15706	0.037478	0.667909
Yunnan	-0.93974	0.200764	0.261946	0.073454
Xizang	-0.70122	5.16719	-0.6528	0.058673
Shanxi	-0.5367	-0.4067	0.33096	0.298759
Gansu	-0.97176	-0.30249	0.413012	0.155277
Qinghai	-1.12381	-0.18308	0.608144	-2.07194
Ningxia	-0.56701	-0.435	-0.04475	1.864704
Xinjiang	-0.76625	-0.13345	-0.13634	-0.77646

Using the corresponding variance contribution rate after rotating in the accumulated variance contribution table as the weight of each factor builds the factor comprehensive model, and gets the total score and ranking of 31 provinces (city, autonomous region)(Table 8).

Table 8: the total factor score and main factor ranking

Area	the total factor score and ranking		main factor ranking			
	F score	ranking	F1 ranking	F2 ranking	F3 ranking	F4 ranking
Beijing	0.913437	3	8	3	15	3
Tianjin	0.704695	7	4	20	6	7
Hebei	-0.36729	23	18	19	21	23
Shanxi	-0.46815	28	20	29	28	28
Neimenggu	-0.58521	30	23	16	30	30
Liaoning	**-0.07799**	**12**	**9**	**7**	**29**	**12**
Jilin	-0.42935	26	24	25	12	26
Heilongjiang	-0.25501	16	16	18	10	16
Shanghai	1.420409	1	1	2	22	1
Jiangsu	0.779442	5	3	8	20	5
Zhejiang	0.714737	6	5	10	3	6
Anhui	0.032209	10	10	14	5	10
Fujian	0.106522	9	7	11	26	9
Jiangxi	-0.34454	21	17	13	25	21
Shandong	0.003966	11	6	28	24	11
Henan	-0.3985	25	13	30	18	25
Hubei	-0.31269	19	11	31	17	19
Hunan	-0.33357	20	14	24	19	20
Guangdong	0.902081	4	2	4	23	4
Guangxi	-0.37343	24	22	23	8	24
Hainan	-0.12225	13	26	6	4	13
Chongqing	-0.12797	14	12	22	9	14
Sichuan	0.121673	8	15	9	1	8
Guizhou	-0.34945	22	28	15	7	22
Yunnan	-0.31029	18	29	5	14	18
Xizang	1.300364	2	25	1	16	2
Shanxi	-0.29734	17	19	26	11	17
Gansu	-0.46115	27	30	21	13	27
Qinghai	-0.70334	31	31	17	31	31
Ningxia	-0.19926	15	21	27	2	15
Xinjiang	-0.48275	29	27	12	27	29

4. Countermeasures And Suggestions

From the above empirical analysis results can be seen, the most backward of the science-and-technology finance of Liaoning province is the financial support; the development potential is also backward. In view of this, put forward the following countermeasures:

(1) Increase the science and technology investment in Liaoning province. The proportion of annual investment in science and technology, Liaoning province should increase the investment proportion, in order to make the required technology development funds sufficient, and that can make the region has a rapid development of science-and-technology finance.

(2) Increase loans of financial institutions. The number of financing institutions and the supply of financial services in Liaoning Province were lacking to some degree, Liaoning province should constantly update and develop the financing measures in supporting science and technology development, increase the support of financing institutions and finally support the regional science-and-technology finance development.

(3) Improve the R & D output rate and new product output rate. Increase contact of scientific-and-technological and real output, make achievements of science-and-technology can be quickly converted into actual output; and increase new product development efforts, make achievement of science-and-technology can be transformed into actual output timely. Liaoning province should increase financial support strength in order to enable the achievement of science-and-technology and R&D can be transformed into output, in order to contribute to regional economic development.

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