Journal of Economics, Finance and Accounting Studies
ISSN: 2709-0809
DOI: 10.32996/jefas
Journal Homepage: www.al-kindipublisher.com/index.php/jefas

JEFAS
AL-KINDI CENTER FOR RESEARCH AND DEVELOPMENT

| RESEARCH ARTICLE

The Impact of Sci-Tech Finance on Technology Entrepreneurship: Empirical Evidence from China

Xueying Zou
PhD candidate in Finance, Faculty of Finance, City University of Macau, Macao, China
Corresponding Author: Xueying Zou, **E-mail**: f20092100241@cityu.mo

| ABSTRACT
Based on provincial panel data from 2010-2019, this paper uses the entropy method to measure the development level of technology entrepreneurship in China and then empirically analyzes the effect of sci-tech finance on technology entrepreneurship. The results show that, nationwide, only bank lending has a positive effect on technology entrepreneurship among the different sci-tech finance indicators, and government and enterprise R&D spending has a negative impact. Meanwhile, there is regional heterogeneity in the effect of sci-tech finance on entrepreneurship in the technology sector. Both banks and venture capital have significant positive effects on technology entrepreneurship in areas with high levels of technology entrepreneurship development, while venture capital does not have significant effects in areas where technology entrepreneurship is developing at medium and low levels. The impact of government investment in science and technology and corporate investment in research and development on technology entrepreneurship is either negative or negligible. Finally, the paper offers some suggestions based on empirical findings.

| KEYWORDS

Entropy Method; Technology Entrepreneurship; Sci-Tech Finance; Regional Heterogeneity

| ARTICLE INFORMATION

ACCEPTED: 01 September 2022 **PUBLISHED:** 08 September 2022 **DOI:** 10.32996/jefas.2022.4.3.9

1. Introduction

The role of new technology-based firms has become prominent in the economy in modern times. However, the success rate in creating them is limited (Aldrich and Martinez, 2001; Rojas and Huergo, 2016). Especially in China, according to the GEM 2016 report, the innovation capacity of Chinese entrepreneurs is much lower than that of developed countries, and the type of entrepreneurship is still mainly survival entrepreneurship. Given that China has the highest number of patent applications for inventions in the world, according to China National Development and Reform Commission, there is much room for improvement in Chinese technology entrepreneurship.

Currently, the fundamental strategy for China's economic transformation and development is to accelerate the transformation of the economic development model into an innovative economy and innovation-driven. Among them, technology entrepreneurship has become the main way of the effective output of the economic results of science and technology innovation and is the fundamental driving force of modern economic growth. Technology entrepreneurship is inseparable from the support of sci-tech finance; therefore, it is particularly necessary to investigate the relationship between sci-tech finance and technology entrepreneurship in China and explore the allocation of various capital factors to achieve the optimal support effect for technology entrepreneurship.

2. Literature Review

In the current literature, the impact of sci-tech finance on technology entrepreneurship is not directly investigated, and scholars mainly focus on the impact of finance on entrepreneurship and the impact of finance on innovation. In recent years, some Chinese scholars have also begun to focus on the impact of sci-tech finance on innovation.

2.1 Impact of finance on entrepreneurship

Findings from countries around the world suggest that financing constraints are one of the most significant barriers that inhibit potential entrepreneurs from starting a business (Kerr and Nanda, 2009). Empirical evidence from micro data suggests that financial availability can alleviate entrepreneurs' financing constraints and significantly facilitate entrepreneurial activity and market entry of new firms. Paulson and Townsend (2004) found that households with more wealth were more likely to engage in entrepreneurial activity. Anton and Boston (2017) found a positive relationship between access to finance and entrepreneurial activity by studying the impact of finance on entrepreneurial activity in 25 EU member states from 2007 to 2013. At the macro level, however, the expansion of the financial sector does not necessarily increase the financial accessibility of entrepreneurs. Competition among financial institutions may also discourage entrepreneurship (Petersen and Rajan, 1995). Therefore, the impact of finance on entrepreneurial activity is not theoretically certain.

2.2 Impact of finance on innovation

In terms of the impact of finance on innovation, the earliest research on the relationship between finance and innovation can be traced back to Schumpeter (1934), the originator of "Innovation Theory" in the early 20th century, who argued that to achieve technological innovation, factors of production, including bank loans and other capital, need to be introduced into it. Meierrieks (2014) finds that higher levels of financial development lead to stronger innovative activity. Ullah (2019) finds that formal finance is more effective than informal finance in promoting firm innovation and that formal finance is more effective in promoting innovation in developing countries. Scholars have studied different agents that influence innovation: First is the impact of bank loans on innovation, Kim et al. (2016) found that financing channels with bonds and the stock market are more effective than bank loans in promoting technological innovation activities of Korean listed companies; Second, the impact of government on innovation, Howell (2017) found that government subsidies have a positive impact on corporate patents and revenues; Third, the impact of venture capital on innovation, Rossi (2015) finds that venture capitalists and angel investors can play an important role in Italian small enterprises' innovations.

2.3 Technology entrepreneurship

Technology entrepreneurship is a special form of entrepreneurship with both generalized and specific characteristics of entrepreneurship. Compared to other types of entrepreneurial enterprises, the entrepreneurial resources and opportunities covered by technology-based entrepreneurial enterprises are slightly different, mainly in the following ways: (1) Technology resources are more adequate. Technology-based entrepreneurial enterprises are mainly engaged in the research and development of high-tech fields and the production and sales of related products, most of which rely on a certain high-tech business, on the basis of which they upgrade and transform it and provide customers with technical services and consulting and other content. Therefore, technical resources are relatively abundant. (2) Financial resources are more scarce. Due to the uniqueness of the products of technology-based start-ups, attracting and obtaining investment from external venture capital with technological resources becomes the key to the success or failure of technology-based start-ups (Katila et al., 2008). (3) Human resources are more scarce. In the early stages of entrepreneurial enterprises, it is difficult to attract excellent technical and managerial talents because their own management mechanisms and systems are not yet mature and stable (Schjoedt, 2013). Entrepreneurs are also mostly scientific and technical personnel and need to employ a large number of highly educated and skilled scientific and technical personnel to form a core research and development team to provide technical support for the enterprise, which will lead to an even greater scarcity of human resources for technology-based start-ups.

2.4 Sci-tech finance

Zhao et al. (2009) clearly define the concept of "Sci-Tech Finance", which is a system composed of various subjects such as government, enterprises, markets, social intermediaries, and their behavioral activities in the process of financing science and technology innovation. This is an important element of the national innovation system of science and technology and the financial system. Based on this concept, scholars in China have investigated the role of sci-tech finance in supporting innovation. According to Zhang and Zhao (2015), financial investment in science and technology was significantly positively related to short-term science and technological innovation using provincial data. Zheng and Zhang (2018) use a panel threshold model to conclude that the impact of science and technology finance on science and technological innovation in each Chinese region has a U-shaped relationship.

2.5 Synthesis

It can be seen that the conclusions reached by the above-mentioned scholars are not universal. China has large differences between regions, and it is not enough to analyze the relationship between sci-tech finance and innovation only from a country-specific perspective or province-specific viewpoint. Meanwhile, scholars have only explored the role of sci-tech finance on innovation or entrepreneurship, but there is no empirical evidence to support how each sci-technology finance indicator affects technology entrepreneurship.

Hence, this paper will to some extent, fill the research gap on the impact of sci-tech finance on technology entrepreneurship by using panel data from 30 provinces and cities in China as a sample to empirically analyze the impact that sci-technology finance has on technology-related entrepreneurship and to make targeted suggestions.

3. Methodology

3.1 Measure the level of development technology entrepreneurship using entropy method

According to the existing studies, it is found that there is no similar standard for indicators in the quantification of entrepreneurship in the relevant studies. There are two main perspectives of measurement, one demographic and one corporate. Audretsch and Evans (1992), for example, measure entrepreneurial activity as the number of business owners per 1000 inhabitants in a population survey, and Gartner and Shane (1995) express entrepreneurial activity in terms of the number of organizations per capita in a statistical perspective. For a complex phenomenon such as entrepreneurship, measuring it in one dimension clearly does not reflect the whole situation, so some scholars have taken a comprehensive approach. According to Ding et al. (2016), the entrepreneurship index should consider the level of entrepreneurial development and development of demographic, economic, and social indicators. By combining multiple indicators, this method of measuring regional entrepreneurial activity overcomes the limitation of a single indicator alone.

Based on the above discussion, in order to scientifically evaluate the development level of technology entrepreneurship in China and its regional differences, this paper chooses to compile the "Technology Entrepreneurship Index" by the method of Ding et al. (2016). Namely, the number of technology entrepreneurship per unit of population, the amount of technology entrepreneurial activity per unit GDP, and the number of technology entrepreneurship in each province per unit urbanization rate were calculated from 2010 to 2019, and their comprehensive weights and indexes were calculated by the entropy method. They are important in enhancing scientific and technological innovation capacity, supporting sustainable economic development, and expanding social employment. We, therefore, choose the number of science and technology-based SMEs in each province and city as the number of entrepreneurship in science and technologies.

In order to construct this index, Shannon's (1948) entropy was used. The greater the uncertainty, the greater entropy. In other words, greater certainty implies a higher level of development.

The initial data matrix is $X = \{X_{\lambda ij}\}$, representing the ith province's jth indicator in the λth year, where $1 \le \lambda \le h, 1 \le i \le m, 1 \le j \le n$.

The normalized matrix: $Y_{\lambda ij} = (X_{\lambda ij} - X_{min}) / (X_{max} - X_{min})$

The weight of the jth indicator of city i in the λth year: $P_{\lambda ij} = \frac{Y_{\lambda ij}}{\sum_{\lambda=1}^{h}\sum_{i=1}^{m} Y_{\lambda ij}}$

The jth indicator's entropy: $E_j = -(\frac{1}{\ln (h * m)}) \sum_{\lambda=1}^{h}\sum_{i=1}^{m} P_{\lambda ij} \ln P_{\lambda ij}$.

The jth indicator's contribution to the development level: $W_j = \frac{1-E_j}{\sum_{j=1}^{n}(1-E_j)}$.

Finally, the ith province's development level of technology entrepreneurship in the λth year is obtained, $S_{\lambda i} = Y_{\lambda ij} * \frac{1-E_j}{\sum_{j=1}^{n}(1-E_j)}$.

3.2 Multiple regression to assessing the impact of sci-tech finance on technology entrepreneurship

3.2.1 Data

(1) Indicators of sci-tech finance

According to Lu & Han (2015), sci-tech finance was divided into public sci-tech finance and market sci-tech finance. The article, based on the research of relevant scholars, defines sci-tech finance as a set of financial instruments used to promote science and technology development and high-tech industry development through an investment and financing system consisting of government and related departments, financial institutions, venture capitalists, and companies. In market sci-tech finance, loans from financial institutions, venture capital, and investment from companies R&D are the major providers. In view of the data availability, this paper will use the balance of loans from financial institutions (BANK), amount of venture capital (VC), and R&D investment of firms (CORPORATE) to reflect market sci-tech finance. The government is the main provider of public sci-tech finance, and this paper will use government spending on science and technology R&D to represent it.

(2) Control Variables

Since there is less discussion on the influential factors of technology entrepreneurship, the selection of control variables in this paper focuses on the influence variables of entrepreneurship that is more widely agreed upon among scholars. Thus, the control variables in this paper are each province's and city's GDP (billion RMB) to represent economic development, years of education per capita (EDU) to depict education level, the proportion of secondary and tertiary industries (IND) to proxy industry structure, annual per capita income (INCOME) to reflect income level, and the number of patents granted in each province (PATENT) to portray the degree of technological development. All data are collected from statistical yearbooks of each region.

Table 1: Data description

	Symbol	Variable	Specific Indicator
Dependent Variable	TECHEN	Technology Entrepreneurship	The index calculated in section 3
Independent Variable (Sci-tech variables)	GOV	Public Sci-tech Finance	Government's expenditure in science and technology R&D
	BANK	Market Sci-tech Finance from Banks	Balance of loans from financial institutions
	VC	Market Sci-tech Finance from VCs	The amount of venture capital investments
	CORPORATE	Market Sci-tech Finance from Corporates	Corporate R&D investment
Control variables	EDU	Education Level	Years of education per capita
	IND	Industrial Structure	The proportion of secondary and tertiary industries
	INCOME	Level of Income	Annual income per capita
	PATENT	Technological Development	The number of patents granted

3.2.2 Hypotheses

There are usually two main sources of funding for start-ups: banks or venture capitalists. However, start-up financing channels are still dominated by bank lending (Zhang and Liao, 2011). Moreover, since Chinese venture capital institutions focus primarily on enterprises in their maturity stages, venture capital institutions are unable to play their due role in promoting entrepreneurship (Lu and Han, 2015).

Therefore, this paper presents hypothesis 1:

H1: Bank lending plays a stronger role in supporting technology entrepreneurship than venture capital.

Entrepreneurial intention is a mindset in which entrepreneurs want to create a new venture. According to Cardon (2013), entrepreneurial passion is an antecedent of entrepreneurial intentions and is measured through two dimensions: positive emotions and identity. Government R&D funding can provide scientists with strong R&D positivity and identity. To some extent, receiving government R&D funding is a recognition and incentive for scientists and enhances their positive feelings about participating in R&D. As a result, the higher the government's expenditure on science and technology, the greater the opportunity cost for science and tech staff to leave their jobs and start their own businesses, which consequently reduces their willingness to start their businesses. Moreover, financial investment in science and technology has a positive and significant contribution to labor compensation, especially in the tertiary sector (Liu et al., 2013). The results of the R&D investment of firms are similar to those of financial investment in the sciences. Furthermore, Tang et al. (2009) found a significant positive relationship between executive compensation incentives and firm investment in R & D. Given that income has a significant inhibiting effect on entrepreneurial intentions; this paper proposes hypothesis 2:

H2: Government spending on science and technology and corporate R&D investment have a negative effect on technology entrepreneurship.

Cheng and Li (2011) argue that the level of entrepreneurship varies from region to region, and policymakers may need to adapt to local circumstances. With respect to China, venture capital is mainly concentrated in Beijing and several major provinces and

cities like Shanghai, Guangdong, Zhejiang, and Jiangsu, while other provinces have relatively low levels of venture capital development. Therefore, this article proposes hypothesis 3.

H3: There is regional heterogeneity in the impact of technology finance on technology entrepreneurship.

3.2.3 Model Construction

In this paper, panel models were constructed for the whole country (30 provinces and cities), regions with a high level of technology entrepreneurship development (11 provinces and cities), medium regions (9 provinces and cities), and low regions (10 provinces and cities), and the models are as follows:

National Panel Model.

$$\ln\mathrm{TECHEN}_{i,t-1} = \alpha_i + \beta_1 \ln\mathrm{GOV}_{i,t} + \beta_2 \ln\mathrm{BANK}_{i,t} + \beta_3 \ln\mathrm{VC}_{i,t} + \beta_4 \ln\mathrm{CORPORATE}_{i,t} + \beta_5 \ln\mathrm{CONTROLS}_{i,t} + u_{i,t}, \quad i = 1, 2, 3\cdots, 30$$

Panel model for regions with high levels of technology entrepreneurship.

$$\ln\mathrm{TECHEN}_{i,t-1} = \alpha_i + \beta_1 \ln\mathrm{GOV}_{i,t} + \beta_2 \ln\mathrm{BANK}_{i,t} + \beta_3 \ln\mathrm{VC}_{i,t} + \beta_4 \ln\mathrm{CORPORATE}_{i,t} + \beta_5 \ln\mathrm{CONTROLS}_{i,t} + u_{i,t}, \quad i = 1, 2, 3\cdots, 11$$

Panel model for regions with medium levels of technology entrepreneurship.

$$\ln\mathrm{TECHEN}_{i,t-1} = \alpha_i + \beta_1 \ln\mathrm{GOV}_{i,t} + \beta_2 \ln\mathrm{BANK}_{i,t} + \beta_3 \ln\mathrm{VC}_{i,t} + \beta_4 \ln\mathrm{CORPORATE}_{i,t} + \beta_5 \ln\mathrm{CONTROLS}_{i,t} + u_{i,t}, \quad i = 1, 2, 3\cdots, 9$$

Panel model for regions with low levels of technology entrepreneurship.

$$\ln\mathrm{TECHEN}_{i,t-1} = \alpha_i + \beta_1 \ln\mathrm{GOV}_{i,t} + \beta_2 \ln\mathrm{BANK}_{i,t} + \beta_3 \ln\mathrm{VC}_{i,t} + \beta_4 \ln\mathrm{CORPORATE}_{i,t} + \beta_5 \ln\mathrm{CONTROLS}_{i,t} + u_{i,t}, \quad i = 1, 2, 3\cdots, 10$$

Where, i denotes each province and city; t denotes the year (t = 2010,...2019), and since the impact has a lag, the dependent variable is the one-period lag term of the level of technology entrepreneurship development in each province and city. β_1、β_2、β_3、β_4 are the coefficients of the explanatory variables, and β_5 are the coefficients of the control variables. This paper used Stata for the empirical analysis.

4. Results and Discussion

4.1 Results of the level of technology entrepreneurship

According to the calculation result of the entropy method, this paper divides 30 provinces (Tibet Province is not included in the model because of data lacking) into three groups: high, medium, and low levels of technology entrepreneurship development. The provinces with high development levels are: Guangdong, Jiangsu, Shandong, Zhejiang, Sichuan, Henan, Shaanxi, Anhui, Jiangxi, Beijing, and Shanghai; the provinces with medium levels are: Shanxi, Tianjin, Hubei, Fujian, Hunan, Hebei, Liaoning, Heilongjiang, and Yunnan; the provinces with low development level are: Guangxi, Chongqing, Jilin, Guizhou, Xinjiang, Gansu, Ningxia, Hainan, Neimenggu, and Qinghai. The table below shows the average value.

Table 2: Technology entrepreneurship development level index by region, 2010-2019

Region (High)	Score	Region (Medium)	Score	Region (Low)	Score
Guangdong	195.7448	Shanxi	32.5581	Guangxi	9.1155
Jiangsu	171.7773	Tianjin	31.7971	Chongqing	8.3494
Shandong	84.8257	Hubei	31.0624	Jilin	7.3152
Zhejiang	74.4675	Fujian	30.8265	Guizhou	6.1492
Sichuan	64.8749	Hunan	30.4570	Xinjiang	4.6440
Henan	64.6670	Hebei	29.5143	Gansu	4.1923
Shaanxi	44.8768	Liaoning	24.9113	Ningxia	3.3436
Anhui	42.8081	Heilongjiang	13.6493	Hainan	2.5572
Jiangxi	40.9963	Yunnan	13.3027	Neimenggu	1.7631
Beijing	39.6340			Qinghai	1.5810
Shanghai	39.0390				

4.2 Results from regressions

Table 3: Descriptive statistics

Symbol	Obs	Mean	Standard Deviation	Min	Max
TECHEN	300	38.36	47.78	0.95	263.31
BANK	300	30571.04	26273.97	1823.81	167213.00
CORPORATE	300	81.79	160.41	0.04	1204.03
GOV	300	113.73	146.98	3.76	1168.79
VC	300	205.39	620.92	0.03	5528.24
GDP	300	23367.87	19189.38	1013.00	107671.00
PATENT	300	49325.26	73531.54	264.00	527390.00
EDU	300	9.08	0.93	6.76	12.78
IND	300	90.15	5.17	73.80	99.70
INCOME	300	21561.24	10579.70	6952.70	69331.60

Table 4 Empirical results

Dependent variable: lagged term of the Technology Entrepreneurship Development Level Index					
	Variable	National	High	Medium	Low
Sci-Tech Finance Variables	BANK	0.515***	0.398***	0.812***	0.625***
	VC	0.002	0.023***	0.007	-0.005
	GOV	-0.089***	-0.096*	-0.168**	-0.087
	CORPORATE	-0.037**	-0.059	0.103*	-0.039
Control Variables	GDP	0.040	0.246	-0.049	-0.009
	PATENT	-0.008	0.044	-0019	0.06
	EDU	0.874**	0.434	0.789	0.902*
	IND	-0.407	-1.553	-2.727***	1.541*
	INCOME	0.635***	0.653***	0.258	0.29
	Constant	-8.499	-3.083	3.904	-16.214***
	Within R-squared	0.8641	0.973	0.918	0.943
	F-test	155.27	322.441	78.342	130.448

*** p<.01, ** p<.05, * p<.1

In the national panel model, bank lending has a significant positive impact on national technology entrepreneurship, while venture capital is insignificant, which is consistent with Hypothesis 1. The government funding of science and technology and the investment in R&D of firms both have a significant negative impact on technology entrepreneurship. In addition to possible structural problems in the allocation of government research funds, the investment may also increase the opportunity cost of entrepreneurship for people in the technology sector, thus reducing their willingness to start a business. This also fits hypothesis 2.

As can be seen, venture capital has a significant positive effect on technology entrepreneurship only in areas with high levels of technology entrepreneurship but not in areas where the development of technology entrepreneurship is moderate or low. Meanwhile, the coefficient of 0.398 for the bank variable is lower in high-level regions than in medium and low-level areas. This suggests that venture capital plays an active role only in areas with high levels of technology entrepreneurship, while areas with medium and low levels of technology entrepreneurship are more dependent on bank loans. This is consistent with hypothesis 3.

Among the three regions with high, medium, and low levels of technology entrepreneurship, government spending on science and technology, and corporate R&D investment, only government spending on science and technologies in the medium region has a negative effect on technology entrepreneurship at the 5% significance level. This may be due to structural problems in the allocation of government research spending and corporate R&D investment. This is partly consistent with the second hypothesis.

5. Conclusion

The author should clearly explain the important conclusions of the research highlighting its significance and relevance.

Given the current gap in empirical research on the impact of sci-tech finance on technology entrepreneurship, this paper used entropy method to construct a technology entrepreneurship development level index in 30 provinces and cities in China and divided the 30 provinces and cities into three groups with high, medium, and low technology entrepreneurship level development according to the index, to empirically analyze the effect of sci-tech finance on technology entrepreneurship. Nationally, only bank lending has a positive effect on technology entrepreneurship among the different sci-tech finance indicators, while government and corporate R&D spending have a negative effect on tech entrepreneurship. Meanwhile, there is regional heterogeneity in the impact of sci-tech finance on technology entrepreneurship. Banks and venture capital in regions with high levels of technology entrepreneurship development have a significantly positive impact on technology entrepreneurship, while those with medium and low levels of technology entrepreneurship development do not have significant effects. The effect of government spending on science and technology and corporate R&D investment is negative or insignificant regionally.

On the basis of the above findings, this paper proposes the following recommendations for government, technology-based SMEs, and market sci-tech finance respectively: 1) The government should improve the way it invests in science and technology, set up a government-guided fund to leverage social capital, optimize post-subsidy policy to stimulate entrepreneurial activities of enterprises, so that scientists have both innovation atmosphere and entrepreneurial conditions, and avoid the negative impact of science and technological investment on science and technologies from entrepreneurship situation. (2) SMEs based on technology should actively search for venture capitalists. In addition to helping technology-based SMEs to solve the capital shortage problem, venture capital can give full play to their management experience to help technology companies realize value-added services. 2) Banks should actively explore support for science and innovation enterprises, continuously optimize the mode of operation of investment and loan linkage, and decrease the financing threshold of innovative enterprises. 4) Giving in to the role of venture capital, creating a more open funding environment, learning from developed countries' venture capital models, such as the limited partnership organization form and diversified funding sources in the United States, to expand funding source channels and continuously improve venture capital management structure, so as to infuse funds into science and innovation enterprises more efficiently.

Funding: This research received no external funding.

Conflicts of Interest: The authors declare no conflict of interest.

Publisher's Note: All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers.

References

[1] Aldrich, H.E., & Martinez, M.A. (2001). Many are called, but few are chosen: an evolutionary perspective for the study of entrepreneurship. *Entrepreneurship Theory and Practice*, 25(4), 41-56.

[2] Babaei, M., Khozain, A., Ziyae, B., & Ashrafi, M. (2020). Designing a model of technological entrepreneurship financing ecosystem in knowledge-based business case study: Information technology and communication. *Accounting and Auditing Research*, 12(48), 177-192.

[3] Cardon, M.S., Gregoire, D.A., Stevens, C.E., & Patel, P.C. (2013). Measuring entrepreneurial passion: Conceptual foundations and scale validation. *Journal of Business Venturing*, 28(3):373-396.

[4] Cheng, S., & Li, H. (2011). Spatially Varying Relationships of New Firm Formation in the United States. *Regional Studies*, 45(6):773-789.

[5] Dahlstrand, A.L. (2007). Technology-based entrepreneurship and regional development: the case of Sweden. *European Business Review*, 19(5), 373-386.

[6] Ding, X., Ye, L., & Guo, Q. (2016). The Study of Compiling and Statistics of Public Business Index. *Journal of Harbin University*, 37(12), 7.

[7] Entezari, Y. (2015). Building knowledge-based entrepreneurship ecosystems: Case of Iran. *Procedia Social and Behavioral Sciences*, 195, 1206-1215.

[8] Evers, N., Cunningham, J., & Hoholm, T. (2014). Technology Entrepreneurship: Bringing Innovation to the Marketplace. *Springer*.

[9] Fernandez-Serrano, J., J.A., & Romero, I. (2019). The entrepreneur in the regional innovation system. A comparative study for high-and low-income regions. *Entrepreneurship and Regional Development*, 31(5-6), 337-356.

[10] Groen, A., Cook, G., & Van der Sijde, P. (2015). New Technology-Based Firms in the New Millennium. *Emerald Group Publishing*.

[11] Hosseininia, G., Yaghoubi Farani, A., & Afshar, S. (2014). Environmental factors affecting technological entrepreneurship in Electric Industry. *Iranian Electric Industry Journal of Quality and Productivity*, 3(1), 8-17.

[12] Katila, R., Rosenberger, J.D., & Eisenhardt, K.M. (2008). Swimming with sharks: technology ventures, defense mechanisms, and corporate relationships. *Administrative Science Quarterly*，53（2）: 295-332.

[13] Keikhakohan, J., Akbari, M., & Hejazi, S.R. (2020). Identifying barriers to development of regional technological entrepreneurship (case study: Sarbaz county). *Journal of Rural Research*, 11(1), 124-139.

[14] Kerr, W. R., & Nanda, R. (2009). Financing constraints and entrepreneurship. *Harvard Business School Working Papers*.

[15] Liu, L., Dong, W., & Xu, X. (2013). The effect of fiscal R&D input on industrial structure: from perspective of labor share in urbanization process. *Journal of Shanghai University of Finance and Economics*, 15(4):73-80.

[16] Lu, F., & Han, S. (2015). Research on the Impact of Science-finance on Technological Innovation Based on Panel Data Model. *China Soft Science*, (06),139-147.

[17] Machnik-Somka, J. , & Kordel, P. (2016). Significance of technological entrepreneurship and creativity in metallurgical enterprises. *Metalurgija*, 55(4), 855-858

[18] Paulson, A., & Townsend, R. (2004). Entrepreneurship and financial constraints in Thailand. *Journal of Corporate Finance,* 10(2), 229-262.

[19] Petersen, M. A. , & Rajan, R. G. . (1994). The effect of credit market competition on lending relationships. *NBER Working Papers*.

[20] Petti, C., & Zhang, S. (2011). Factors influencing technological entrepreneurship capabilities: Towards an integrated research framework for Chinese enterprises. *Journal of Technology Management in China*, 6(1),7-25.

[21] Phan, P.H., Mian, S.A., & Lamine, W. (Eds) (2016). Technology Entrepreneurship and Business Incubation: Theory, Practice, Lessons Learned. *World Scientific Books*.

[22] Rojas, F. and Huergo, E. (2016), "Characteristics of entrepreneurs and public support for NTBFs", *Small Business Economics*, *47*(2). 363-382

[23] Schjoedt, L., Monsen, E., Pearson, A., Barnett, T., & Chrisman, J. J. . (2013). New venture and family business teams: understanding team formation, composition, behaviors, and performance. *Entrepreneurship: Theory and Practice*, 37(1), 1-15.

[24] Shannon, C. E. (1948). A mathematical theory of communication. *The Bell System Technical Journal, 27*(3), 379-423.

[25] Tang, Q., & Zhen, L. (2009). Management Risk Preference、Compensate Incentive and R&D Investment: Based on Chinese Listed Company. *Economic Management Journal*, 31(05):64-72

[26] Zhang, X., & Liao, L. (2011). VCs' Backgrounds、IPO Underpricing, and Post-IPO Performance. *Economic Research Journal*, 46(06),118-132.

[27] Zhang, Y., & Zhao, L. (2015). The effect of sci-tech finance investment on sci-tech innovation in China: An empirical research based on the static and dynamic panel data model. *Studies in Science of Science*, 33(2),9.

[28] Zhao, C., Chen, C., & Tang, Y. (2009). Sci-tech finance. *Science Press*.

[29] Zheng, L., & Zhang, W. (2018). The Non-linear Influence of Tech-finance on Tech-innovation: A U-shaped Relationship. *Soft Science*, 32(7), 5.