

A Literature Review of Technology and Finance

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Supported by the Fundamental Research Funds for the Central Universities Project “National Debt Issuance Costs and National Debt Market Segmentation” (SWU1509318).

Received 12 August 2015; accepted 16 October 2015
Published online 26 November 2015

Abstract

The rational allocation of financial resources in the technology and finance research process of economic development in recent years has become a major focus of attention theorists. From the scientific and technological research in the field of financial, research priorities, system configuration, operation mechanism and efficiency measures and other aspects, the study gives the views of carding, and further study of science and technology to give the prospect of financial issues, designed to study the financial problems of science and technology scholars provide a useful reference.

Key words: Technology and Finance; Innovation; Risk

Li, S. Z. (2015). A Literature Review of Technology and Finance. *Canadian Social Science*, 11(11), 89-93. Available from: <http://www.cscanada.net/index.php/css/article/view/7842>
DOI: <http://dx.doi.org/10.3968/7842>

INTRODUCTION

In China, the technology and finance proposed in the early 1990s focused on the economic development process of rational disposition of technology and financial resources, according to China's economic development and scientific and technological reform process, progress and theories of technology and finance can be divided into four stages: From 1978 to 1985, during which a preliminary economic

reform in science, technology and financial system is still a planned economy, and government R&D funding relied on national funding model inputs. From 1986 to 2005, the central government proposed that banks should carry out science and technology credit business actively which caused people began to explore a wide range of channels to raise funds for scientific research, such as the financial discount loans, corporate bonds, venture capital, development finance, technical assistance loans, and venture capital, so as to promote the intermediation of corporate funds. And from 2006, government implemented *Long-Term Science and Technology Development Plan (2006-2020)*, the central government gave attention and supported to financial development, science and technology and financial integration in taxation, finance, science and technology policy, science and technology in high-tech zones across the country to innovative approach and rapid development. From 2010 up to now, technological innovation and financial innovation are further integrated, and theoretical results continue to emerge the practice further innovation. Technological finance is the result of China's economic and social development at a certain stage, but also China's major strategic choice to build an innovative country faced. Thus, technological finance theory has a distinctive Chinese characteristic. Scholars on science and technology have carried out the financial problems from different angles corresponding research and discussion. The paper combed and induced the connotation of technology finance, financial contribution of science, presented the mechanism and system, the path and pattern, as well as the benefits and risks of science and technology and financial issues dynamic research. Also, this paper studied the literature of science and technology finance research in the last 20 years, in order to provide reference for the development of science and technology finance theory and practice, and to provide reference for the same kind of research.

1. THE DEFINITION OF THE CONCEPT OF TECHNOLOGY AND FINANCE

For the study of science and technology finance, research scholars don't have the same perspective. The foreign scholars' research on the financial discussion of scientific and technological innovation first appeared in the Western economist Schumpeter (1912) theory of credit creation, in his *Theory of Economic Development*, a book demonstrates the monetary, credit and interest rates and other financial variables on economic innovation and significant economic development. He also stressed that a fully functional bank can promote technological innovation by identifying and supporting entrepreneurs who can successfully use new products and production processes. Gurley (1960) and other researchers found out the impact of banking system (including commercial banks and the central bank) on a country's economic development. Saint-Paul (1992) believed that by allowing the economic entities to the used technology which has greater risk but also has higher productivity can promote technological progress from the risk perspective of the financial market. King (1993) thought that in order to support the development of modern finance, scientific and technological achievements, the society also needs financial support, and the use and value-added financial development needs funds—intelligence which is to support science and technology.

In the 1980s, China's science and technology activities in the form of loans to practice technology and finance have occurred, but the technology finance as a complete vocabulary appeared in 1992, even though their intention is still abbreviation technology and finance. In the same year, we set up in Guangzhou China technology and finance association, marking the technology finance official on stage. However, the concept of using technology finance in the true sense is the first proposed in the first council of Nanning Guangxi China Science and Technology Association in 1994, the academic research in this field since then gradually expands. Shang (1997) emphasize science and technology development, the transformation and industrialization process of the one-way demand for financial instruments, financial policy and financial services; Research project on the combination of science and technology and finance in Shenyang (1995) found out that technology finance is financial support for high-tech industries; Wang (1996) proposed technology finance should be a new concept, is to study mutual adaptation between science and technology and financial discipline in the middle, the extension involving science and finance. By the end of 2009, Zhao (2009) proposed a more precise definition which was recognized by some scholars. Science and Technology Finance is a series of financial instruments, financial institutions, financial policies and financial services system, innovative arrangement, which is

composed of government, enterprise, market, society and so on that can provide financial resources.

These concepts are closely linked to economic and technological development of the country tends made refining and generalization. However, the exact definition of the concept of science and technology finance, the need to progressively completed in the next practice and theoretical deduction, it will change with policy and pattern of the ongoing dynamic adjustment.

2. CONSTRUCTION OF SCIENCE AND TECHNOLOGY OF THE FINANCIAL SYSTEM

2.1 Technology Study of Financial Mechanism

Zhang (2001) considered a national science and technology and financial integration of the model first with a country's economic system and mode of related, but related to the investment and financing system of a country, and from the perspective of the interests of the mechanism, the mechanism of competition, market mechanisms, to Technology and financial integration mechanisms and patterns have been studied. Yang and Chen (2002) discusses the channel feature information age of high-tech corporate finance, its interest mechanism and competition mechanism, as well as the information age

Technology and financial integration of the support system that the era of technology and financial information support system should include a combination of intermediary organizations, capital markets and property rights trading market and improve financial supervision and control (Yang & Chen, 2007).

2.2 Study of the Interaction of Science, Technology and Finance

Yang (2005) went on some research on the intermediaries involved at the stage and mechanism of science and technology in the process of financial integration, the composition and role of the multi-level capital market, refine and improve several aspects of the regulatory aspects and significance of science and technology with the financial support system were combined related research, that the development of science and technology enterprises, is inseparable from the full range of financial support, and complete, multi-level capital market is essential. Towards them, Yao and Xia (2007) explored the scientific and technological progress and from financial innovation mechanism of internal relations, interactive mechanism starting from the financial to promote scientific and technological progress and scientific and technological progress to promote financial innovation and development in the two perspectives study how to promote the technology in the new situation of financial

integration, as well as in technological progress to promote economic growth process more Good play mechanism and function of the financial system. Huang and Kong (2009) discussed the role of the financial mechanism and policy practices to promote technological innovation, the current situation of China's financial development and technological innovation and to analyze the relationship that exists between the two present a certain extent incompatible.

2.3 Study of Whole Development of Technological Finance

Wang (2006) discussed that the policy should be supported from five aspects of the system, capital support system, market support system, management support system, talent support system to build science and technology financial support system. Zhou (2011) analyzed the security mechanism of the development of science and technology, there are still financial system systemic difference, the lower level, imperfect legal deficiencies, Technology and Finance to be fast and stable development, need to break are not conducive to innovative policies and institutional barriers, establish an effective protection mechanism. Lei, Han, and Yi (2011) studied the constituent elements of science and technology financial innovation system, including government, financial services institutions, service agencies and high-tech enterprises 4 categories, financial services institutions in the innovation and technology of financial products, should fully consider the different growth stage technology companies on demand and bear the degree of risk capital, while supporting the need to build appropriate mechanisms and risk prevention mechanisms to support the effective functioning of science and technology financial innovation system.

3. MEASUREMENT OF THE FINANCIAL EFFICIENCY OF SCIENCE AND TECHNOLOGY

3.1 Macro Technology Financial Measurement

Wang et al. (2003) calculated using the AHP evaluation index weights based on science and technology funds after the input-output ratio, for 1991-1999 Technology and Finance Integration Benefits of the empirical analysis that the overall benefits of financial integration in science and technology on the rise, but the rise modest, Technology and Finance Integration operating mechanism has yet to be perfected. Sun et al. (2008) estimated the efficiency and difference of China's regional financial system to promote technological innovation, based on the *Malmquist* production efficiency index method, using 23 provinces and autonomous regions panel data from 2001 to 2004 and the program *version2.1 veap*. The study found that China's

financial development promotes technological innovation to improve the overall output efficiency, there is the impact of structural differences between the number of patent output provincial and municipal financial system. Zhao et al. (2009) constructed a measure of financial efficiency index of science and technology, mainly by technology finance general index, sub-index 3 index and specialized sub-systems, where the total index is within the area of scientific and technological development of the financial situation, the development potential and development Evaluation of trends in the overall index. Yu (2011) found that the main body is divided into regional innovation enterprises, universities and research institutions, the use of regional R&D data input and output panel, select 2002-2008 year and 29 province provincial panel data, using random analysis calculated along the innovation efficiency, and emphasis on the use of spatial econometric models feature an innovative centralized, government support, the impact of institutional factors and human capital on the main innovation of the Innovation Efficiency. The empirical results show that the efficiency of China's scientific and technological innovation has a significant spatial correlation. Cao et al. (2011) built S&T Financial Development Index, including science and technology financial resources index, technology finance funds index, technology finance and technology financial loans output index 4 respects, and detailed definition of the index connotation and weights according to "scientific and technological resources-funding-output efficiency," the idea, using the SPSS16.0 to analyze the scientific and technological financial development index of each region of China over the past years (2001-2008). The study found that increasing investment in science and technology financial resources, technology finance funds index showed an increasing trend, but the technology financial output index declined, particularly in science and technology financial loans has not been fundamentally changed. Xu (2012) dealt with the data in 1994-2008, taking the number of invention patents, government funding for science and technology activities, the amount of scientific and technological loans of financial institutions, the number of science and technology listing corporation, the total market value of science and technology listing corporation and the total investment of venture capital, risk investment institutions as indexes. She used bootstrap simulation method to construct the threshold of statistical inference, it concluded that technology investment, science and technology capital market and venture capital in the framework of science and technology financial system have the promotion effect to the technological innovation.

The influence of the bank credit on technology innovation in China is not significant. There is a certain correlation between the development of science and technology capital market and venture capital, and the

development of science and technology capital market can promote the expansion of venture capital.

3.2 Microscopic Technology Finance Measurement

Liu et al. (2008) collected the Yangtze River Delta, Pearl River Delta, the northeast old industrial base and inland Technology circle four science and technology area data above 4 SCIENCE area panel data unit root tests and panel data cointegration SME innovation long-term and short-term relationship between financial support system and empirical research. The results show: The financial system four regions are on the SME innovation have long-term support effect, while a larger regional differences in effect short-term support, which short-term support in the Yangtze River Delta and Pearl River Delta's financial system is remarkable, but there is a set time-delay, short-term support effect northeast old industrial base and inland science and technology circle of the financial system was not significant. Ying et al. (2009) explained the impact of financial development on science and technology innovation in developing countries, and in Guangdong Province, for 100 enterprises and scientific and technological innovation and financing data sort of technological innovation efficiency panel regression studies, the effect of financial sector development for science and technology innovation efficiency of different effects for different enterprises and financial development of scientific and technological innovation in the micro business and financial model based on data from the theory. Chen Jin conducted an empirical research which tested how financial development affects technology through the accumulation of human capital and FDI technology spillover by measuring the scientific and technological progress.

4. RISK RESEARCH ON TECHNOLOGICAL FINANCE

Science and technology enterprises from the seed stage, start-up, growth, expansion, maturity of five phases of its life cycle stage feature corresponding to different stages of different characteristics, face different risks, it creates a different demand for funds and number of needs. Technology finance must seriously consider every stage of the development of technology companies adopts different ways at different stages of financing, determine the different risk-sharing body depending on the type of risk. Like seed stage angel investment and incubators, angel investors and start-up in microfinance, growing short-term loans and venture investments, expansion stage venture capital and technology loans maturing long-term debt and capital markets are fit it features various stages of financing. Life Cycle technology companies from diversified financing approach is fundamentally different stages correspond to differences in the stage

of financial risks, how to share the financial risk is the focus of scientific and technological research in science and technology enterprises throughout the life cycle, by optimizing the allocation of resources, with their own advantages, to weaken and disperse technology financial risks.

Cui et al. (2010) analyzed the DEA evaluation results using the data envelopment analysis (DEA) of the country benefit the provinces, municipalities, autonomous regions and financial investment in science and technology and technological output evaluation, they found Guangdong Science and Technology in conjunction with the financial impact of benefits is mainly due to the lower output stage structure and technology of financial investment in science and technology are not in harmony, and financial investment in resource management efficiency. Zhou (2011) and Pillaiyan (2015) developed that the financial development of science and technology there is a lack of systematic, low-level, guarantee mechanisms are inadequate, lack of information-sharing mechanism, lack of financial innovation mechanism and other issues.

CONCLUSION

In summary, the theorists of science and technology-related issues were more in-depth financial discussion, but the existing research is far from being enough, many questions still no consensus, the relevant research work remains to be further deepened.

Firstly, technological finance researches don't have a clear position. Although the government and scholars has established a science and technology research areas of financial independence, but this positioning is essentially a macroscopic system innovation in areas such as the central bank norms of innovative financial instruments, and in fact technological finance don't only include the macro-technology finance, but also contains micro-finance, such as the analysis of financing which has brought new macro-effects and other aspects of corporate governance structure needs further study. So, this theory is still at the level of innovation only including technological innovation and financial interaction. It's difficult to form their own unique theoretical logical structures and systems.

Secondly, we need to establish a scientific and rational evaluation index system of science and technology system and financial development. At present, there are a lot of macro variables related to the transformation of scientific and technological achievements in the evaluation system and index, while the micro variables related to the enterprises are relatively small. We should combine macro and micro variables to construct a scientific and reasonable evaluation system and index.

Finally, the empirical research studies on relationship and difference comparison between technological finance in different regions and regional economic development

degree are inextricably linked. Carrying out the actual work of the regional level for comparative studies of technology financial development degree has considerable practical significance.

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