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## Dynamic Relevance of High-tech Industry and Venture Capital of China

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**Abstract:** By selecting high-tech industry as a representative of strategic emerging industries, this study empirically analyzes its current development status and the long-run equilibrium relationship and short-term fluctuations impact between China's strategic emerging industries and the development of venture capital with co-integration analysis and Granger causality test. The empirical results show that there is co-integration relationship between China's strategic emerging industries and venture capital for the long term. However, only venture capital has promoted the development of strategic emerging industries, the benefits of strategic emerging industries haven't covered venture capital. For the short term, the risk of investment volatility would make strategic emerging industries dramatic fluctuations, but such fluctuations don't play substantive role in promoting the long-term development of high-tech industry.

**Key words:** High-tech industry, venture capital, co-integration

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### INTRODUCTION

The fundamental driving forces for the development of strategic emerging industries are innovation and technological progress. From the view of the seven strategic emerging industries announced by Chinese government, most of the high-tech industries are included in strategic emerging industries and high-tech is the most important feature. As its high-tech, high innovative and high risk features, it is difficult to obtain traditional financing support. However, its potential growth and income space is huge, which makes the risk investment become an important financing method of strategic emerging industries. Throughout the Western developed countries, the venture capital has become an essential incubator for the development of new high-tech industries. For example, the rise of venture capital had made the bio-pharmaceutical industry and information industry in the United States gradually rise and become mature, which had promoted the steady growth of the U.S. economy during the late 20th century to the early 21st century.

On the other way, the high yield brought by the development of new high-tech industry had also promoted the growth of venture capital. The average profit cycle of venture capital in U.S biomedicine, network information industry was 7-10 years and the average annual rate of return was over 17%, which was much higher than that in traditional financial markets for the same period. The development of the emerging high-tech industries had promoted the development of U.S. venture capital market and gave birth to the world's first NASDAQ

mainly serving for venture capital. Between venture capital and the development of new high-tech industries, it had formed symbiotic coordinative, mutually promotive relations.

Clearly, China's strategic emerging industries can not be separated from the support of venture capital. The first venture capital company established in 1985, called "China New Technology Venture Investment Corporation". Its mission was to support the development of high-tech emerging industries. However, in recent years, China's development has shown that venture capital is increasingly popular in the field of traditional industries. Even if it invested, it would shift the investment as late as possible, which to some extent made no support to the development of new industries. Therefore, this study selects the high-tech industry as a representative of the emerging strategic industries, empirically analyzes whether there is symbiotic and harmonious relations between strategic emerging industries and venture capital in China as that in Europe and the United States.

### ANALYSIS OF STRATEGIC RELATIONS BETWEEN HIGH-TECH INDUSTRY AND EMERGING INDUSTRIES

The concept of high-tech industry has been put forward by the foreign scholars in 1980s. Yulin (2012) summed up the definition of high-tech industry introduced by Chinese and foreign scholars, pointed out that the high-tech industry is significantly higher in R and D investment, efficiency, income and risk and it is

in the start-up period and growth period in the life cycle of the industry. The main features were “eight high”: High R and D intensity, high innovative, high-intelligence-intensive, high correlation, high income elasticity of demand, high-yield, high-risk. Since 1995, China's high-tech industry has experienced a rapid development period. It has made a positive contribution to promote China's economic growth, upgrade the industrial structure and decrease energy consumption.

The decision of the State Council on accelerating the development of strategic emerging industries in China in 2010 formally proposed the concept of strategic emerging industries, which based on major technological breakthroughs and significant development needs and played a significant leading role on overall economic and social development for the long-term. Since then, many scholars have proposed their own understanding of the concept of strategic emerging industries (Jing and Jinyi, 2011; Guoqing, 2012), but they were not as good as that proposed by the State Council. Xiaohua and Tie (2010) suggested that the emerging industries had uncertain and complex characteristics and positive external influences. Dapeng and Xin (2010) believed that strategic emerging industries were sophisticated and strategically uncertain and they had bright market prospects. They were related to economy and national security. Hongchang (2011) regarded that they had following characteristics, such as strategic, innovative, growing, oriented and risky.

View from the above, there are something in common between high-tech industry and strategic emerging industries. They were both introduced in the period that the old industrial structure system was difficult to sustain and new industrial structure need to be constructed to maintain the country's strong economic competitiveness in the future. Conceptually, they have both stressed the importance of innovation and sophisticated technology and both of them were in the emerging stage of the life cycle. From the view of the industry, both were with high industrial relevance, economic strategy and the risk of industrial development. From the context of industrial development, combined with manpower, resources, capital and other factors, both of them were subject to market demand and government regulation (Liu *et al.*, 2012) by grafting, fission and fusion of high-tech (Xuejun, 2012). At present except for information on chemical manufacturing all the high-tech industry can be classified into new energy, bio-medicine, high-end equipment manufacturing and new generation of information technology. So, it can be concluded that the high-tech industry could stand for the strategic emerging industry development status at the current stage.

## THE STRATEGIC COLLABORATIVE DEVELOPMENT MECHANISM BETWEEN VENTURE CAPITAL AND EMERGING INDUSTRIES

### **Analysis of the development mechanism of strategic emerging industries promoted by venture capital:**

Technology innovation is the main driving force for the development of strategic emerging industries and it is also a process accompanied by risks: The risks of technology research and development, operation risks and market risks met by new products (Hongzhou, 2012). The uncertainty of technological innovation from information asymmetry caused higher moral hazard. Whether indirect financing or indirect financing, either would gave up investment in strategic emerging industries because of high cost and monitoring costs. Nevertheless, in order to pursue high returns, financial innovation in the form of venture capital has solved the contradiction between innovative risks for new industries and the tight liquidity position. Jerry (1988) studies showed that, the emergence of the venture capital had promoted the great development of emerging high-tech industries. Venture capital had played a role in promoting the development of strategic emerging industries from two aspects mechanisms: financing mechanisms and financial intelligence.

**Financing mechanism:** The basic function of venture capital is funding for innovation. Compared with traditional investment, the advantage of venture capital is better in risk control. It strictly controls risk from the raise, use and reclaim of funds. First, in terms of raise funds, there are two ways: Venture capital sets up funds, or setting an investment company to raise funds. There is access to adequate sources of social capital in a short period of time by using funds. Raise funds in private will ensure the absolute control of the few venture capitalists for venture capital activities, which is to ensure scientific and rational decision-making. And limited partner will restrict loss limitations of the venture capitalists to their investment, giving the risk a clear boundary.

Before the use of the funds, venture capitalists are interested in rigorous assessment with the proposed investment object. They will select a good growth, high success rate of new technology. Because of this rigorous selection mechanism, venture capital has a recognition function (Ber and Yafeh, 2007). Once venture capital exits successfully, it will attract other funds to actively follow up, which will promote the high-tech emerging industries to achieve a smooth transition from growing to maturity. In the process of funding, it usually adapts the way of several rounds of investment, gradually financing the

proposed investment object. On one hand, it controls the investment risk to a minimum, on the other hand, it forces invested enterprises to strictly accord with the standard of venture capital operators to avoid ex post moral hazard. By exercising several rounds of investment, it will achieve the highest capital efficiency with the lowest risks, which thus promotes the sustainable development of the high-tech emerging industries.

**Financial intelligence mechanism:** As an equity investment, venture capital will get the returns only if it ensures the development of emerging high-tech industries. As a macro point of view, venture capital promotes the development of new industries to drive the economy continued to grow with innovation by guiding technology and talent to flow to emerging high-tech industries. Youtie and Shapirab (2008) find that the Georgia Tech University has been always an innovative central role with the help of venture capital for the economic transition. Tsukagoshi (2008) took Japan as an example, pointed out that due to the advantages of technology and knowledge, it had been regarded that Japan's University developing of high-tech enterprises had been more and more as a means of an innovative breakthrough. In order to achieve the successful development, the role of venture capital is hard to be replaced by traditional financing models.

From the microscopic point of view, venture capital has promoted the growth of innovative high-tech enterprises as shareholders by actively involving in business management, standardizing business rules and promoting the formation of corporate culture. Besides, it directly plays the market influence to promote high-tech companies to quickly adapt to the market. Welpé and Kollmer (2006) and Hsu (2006) empirical studies had shown that entrepreneurial enterprise had promoted the commercialization of new technologies through participation in strategic alliances or technology licensing with the support of venture capital. Sheu and Lin (2007) selected IT company in China Taiwan as research object, compared the venture-backed companies with no venture capital background companies in the board members and ownership structure. The results showed that venture-backed company had more independent governance structure and more transparent information disclosure channels. Pollock *et al.* (2010) selected 257 IPO sample in software industry to conduct empirical research with signal transmission theory and the results showed that the well-known venture-back companies brought returns to investors with rising curve form. Davila *et al.* (2010) study found that team management venture capital would ensure the implementation of an effective system

and help enterprises with 50-100 employees to smoothly get through entrepreneurship crisis, thus help them to transfer from personal management to team management.

**Feedback of strategic emerging industry on the development of venture capital:** The returns brought by strategic emerging industries to venture capital are huge. Das *et al.* (2002) studies showed that the profit multiples of U.S. venture capital when it exited lied in 1.12-5.12 from 1980-2000. Besides, the earlier venture capital got into the business stage, the higher profit multiples it would get. International Data Group (IDG) invested \$ 1.2 million with 4.9% stake in Baidu in 1999. The company listed on NASDAQ in 2005, IDG sold the stake and existed from the secondary market while getting a high return of a billion U.S. dollars (Chunyang, 2007). It demonstrated that new high-tech industries had brought huge returns to venture capital.

Although, the experience of the developed countries had indicated that the success rate of venture capital was not high (about 20%), with the stimulation of the high returns, the momentum of social capital concentrating on risk investments was very rapid. In the United States, for example, along with the development of emerging high-tech industry such as the biomedicine, network information, the scale of U.S. venture capital and private equity fund had expanded from \$ 50 billion in 1980-300 billion dollars in early 2001 (Lerner, 2001). The size of venture capital investment for the year increased from \$ 80 billion in 1995-\$ 29.3 billion in late 2011. Not only that, some venture-backed enterprises have also engaged in the industry. Large emerging network enterprises such as Yahoo, Google and Amazon have set up their own venture capital fund.

It shows that there is an interdependence, mutual promotion and common prosperity relationship between the strategic emerging industries and venture capital. Western developed countries have formed a virtuous cycle that venture capital promotes the development of new industries and vice versa to a greater extent. For the positive relationship between venture capital and emerging high-tech industries, countries around the world attaches great importance to promote the development of venture capital so as to promote the development of new industries.

China's strategic emerging industry development can not be separated from venture capital, as Liu *et al.* (2006) pointed out that, under the environment of China's financial reform, risk capital has great significance for China's economic restructuring and development and upgrading of the industrial structure. As mentioned earlier, to achieve symbiotic coordination between

venture capital and strategic emerging industries, the way is to form a benign interaction cycle. Therefore, this study selects high-tech industry as a representative of emerging strategic industries, empirically analyzes whether there is a good interactive and symbiotic relationship between the current development of China's strategic emerging industries and venture capital with the co-integration analytical method and puts forward the suggestions according to empirical analysis.

**EMPIRICAL ANALYSIS: DATA, MODEL**

**Data selection and stationary test:** This study selects high-tech industry value-added (time series: HTAV) in 1995-2010 as an indicator of the development of high-tech industry, the scale of venture capital (time series: SAC) over the years as an indicator of the development of venture capital. In order to eliminate heteroscedasticity, the original data are taken the natural logarithm. The timing variation of the original data and the data after taking the number is shown in Fig. 1 and 2.

From Fig. 1 and 2, the time series of the original data or the data after taking the natural logarithm, the two sets data have a significant growth trend and non-stationary characteristics over time. In order to make co-integration analysis, first should examine the respective integration order of the two variables time sequence. This study adapts the ADF method to make single integration order test in accordance with the Akaike Information principles, the test results are shown in Table 1.

The results in Table 1 show that two variables-LN\_HTAV and LN\_SAC are both under the 5% significance level, indicating the second-order stationary series, which means that they are subject to the time sequence of the I (2) process. Because they are of the same order single whole process, so the co-integration analysis can be continued.

**Co-integration analysis:** As the original sequence of LN\_HTAV and LN\_SAC is not smooth, in order to avoid spurious regression, two variables can not be directly made regression analysis to analyze the correlation. Co-integration analysis method is a common tool to analyze whether the long-run equilibrium relationship exists between non-stationary time series. There are only two variables involved, so Engle and Granger two-step test, which is called EG test, can be chosen for co-integration test. According to the EG method, first select LN\_HTAV as the dependent variable, LN\_SAC as independent variable to make least squares regression, estimation is as the following Equation:

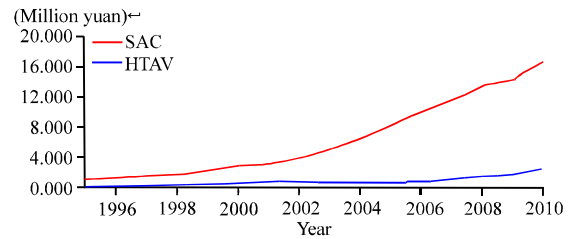


Fig. 1: Line graph of raw data of time series HTAV and SAC

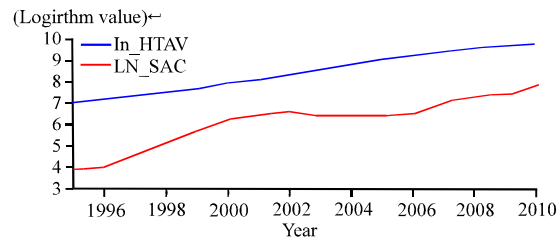


Fig. 2: Line graph of the natural logarithm data of time series HTAV and SAC

Table 1: Stationary test of LN\_HTAV and LN\_SAC

Variables	Inspection form(c,t,n)	ADF value	p-value	Conclusion
LN_HTAV	(c,t,1)	0.46465	0.7927	Nonstationary
1d_LN_HTAV	(c,t,0)	2.76000	0.2516	Nonstationary
2d_LN_HTAV	(c,t,1)	6.96916	0.0307	Stationary
LN_SAC	(c,t,2)	3.96529	0.1377	Nonstationary
1d_LN_SAC	(c,t,0)	1.86573	0.3934	Nonstationary
2d_LN_SAC	(c,t,1)	7.23146	0.0269	Stationary

Table (C, T, N), c represents a test containing intercept term, t represents the test containing time trend, n represents the lag project determined by Akaike information criterion, 1d and 2d, respectively represents first difference and the second-order difference, LN\_HTAV and LN\_SAC represent the natural logarithm data of time series HTAV and SAC, respectively

$$LN\_HTAV = 3.86 + 0.7424 * LN\_SAC \tag{1}$$

$$t = (7.4778) (8.9412)$$

$$p = (0.0000) (0.0000)$$

$$R2 = 0.851 \quad F = 79.95 \quad DW = 0.3106$$

In accordance with the procedures of EG two-step process, the next step is to carry out unit root tests on the estimated residuals regressed by Eq. 1. By plotting time sequence diagram for the residuals Fig. 3, it can be seen that the residual sequence fluctuates around the zero-mean, so that the sequence neither contained trend item nor constant project. Therefore, use ADF test to judge the stationary of the residual sequence. The value of ADF is 8.72912, the probability accepting the assumption that the residual sequence has unit root assumed is 0.0127. So, the assume can be refused, the sequence is a stationary sequence.

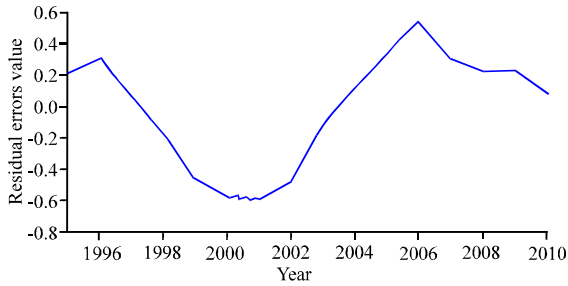


Fig. 3: Line graph of residual errors' value from Eq. 1's regression analysis

Table 2: Results of Granger causality test

Null hypothesis $H_0$	Lag length	f-value	p-value	Conclusion
<b>LN_SAC does not Granger cause LN_HTAV</b>				
	1	0.62801	0.4435	Accept $H_0$
	2	4.37055	0.0472	Reject $H_0$
	3	2.33923	0.1729	Accept $H_0$
	4	11.03371	0.0372	Reject $H_0$
<b>LN_HTAV does not Granger cause LN_SAC</b>				
	1	1.25923	0.2837	Accept $H_0$
	2	2.37936	0.1481	Accept $H_0$
	3	3.33331	0.1030	Accept $H_0$
	4	4.76851	0.1150	Accept $H_0$

The results of co-integration analysis show that long-run equilibrium relationship exists between the value-added of high-tech industry and the scale of venture capital. From the long term, the growth of venture capital has a positive contribution to the growth of high-tech industry. Once the scale of venture capital increases by 1%, the value of high-tech industry will increase by 0.74%. The result is the same as the majority of former literature. Even in such a financial system as China, venture capital is also an important factor influencing the development of high-tech industry.

**Granger causality test:** The co-integration test demonstrates that long-run equilibrium interconnected relationship exists between variables, but this relationship doesn't explain which variable cause changes in another variable. To further study whether the risk capital promotes the development of high-tech industry or on the contrary, or whether there is a feedback mechanism and positive interaction between the two, empirical research should be made. The most commonly used statistical test is Granger causality test. The Granger test results are shown in Table 2. The venture capital often takes several rounds of investment and it pursues for no short-term benefits. So, in order to represent the lag effect between the two, this study reports all lag results when making Granger causality test.

The test results in Table 2 shows that, under the 5% significance level, lag two and lag four venture capital is

Granger reason for the development of high-tech industry, which indicates that China's venture capital is really an important driving force for high-tech industry. Venture capital takes many rounds of investment strategy and participate the company management, which has supported the high-tech enterprises.

Even if the significance level is relaxed to 10%, in the 1-4 lag inspection, the assumption that the development of high-tech industry is not the Granger reason for the development of venture capital can't be refused. Thus, the development of China's high-tech industry does not play a nurturing role for venture capital and the revenue of venture capital does not basically depend on high-tech industry. The conclusion is consistent with China's reality that venture capital avoids risks and is more inclined to invest in mature companies. It shows that China's high-tech industry does not form a symbiotic and coordinated interaction with venture capital and the high-tech industry doesn't form feedback mechanisms to venture capital.

### CONCLUSION

This study makes empirical research on the co-integration relationship between China's venture capital and development of strategic emerging industry by choosing the value-added of China's high-tech industry and the scale of venture capital as indicators. The conclusions are as follows:

- China's venture capital and strategic emerging industries have a long-term balanced relationship, further confirms that the development of venture capital is the Granger reasons for the development of strategic emerging industries through Granger causality test. Venture capital doesn't only bring capital for strategic emerging industries; more importantly, it brings management, system, culture and market. Therefore, China should vigorously develop the risk capital for the development of strategic emerging industries
- Although, venture capital is the main force to promote China's emerging strategic industries, the strategic emerging industries themselves don't bring feedback mechanism to venture capital. Granger causality test shows that the development of strategic emerging industries is the Granger reason for the development of venture capital. This reflects the status that China's venture capital often keen to invest in traditional industries. Under the premise that China's financial market is not sound, such as imperfect exit mechanism, imperfect credit system and

no property rights trading market, China's venture capital faces more risks than developed countries. On the other hand, the current economic development in China is still not free from investment. Under the policy that using the scale of investment in exchange for economic development, venture capital will get high-yield while investing in traditional industries. Therefore, strategic emerging industries with relatively high risks are naturally difficult to obtain greater development and then they would be unable to provide more rewards to venture capital

### REFERENCES

- Ber, H. and Y. Yafeh, 2007. Can venture capital funds pick winners? Evidence from Pre-IPO survival rate and post-IPO performance. *Israel Econ. Rev.*, 5: 23-46.
- Chunyang, Z., 2007. Venture capital funds: A new model of the growth of cultural industries. *News Sentinel*, 9: 13-15.
- Dapeng, J. and G. Xin, 2010. Status analysis of China's strategic emerging industries. *Sci. Technol. Prog. Policy*, 9: 65-70.
- Das, S.R., M. Jagannathan and A. Sarin, 2002. The private equity discount: An empirical examination of the exit of venture backed companies. Working Paper Series, 2002.
- Davila, A., G. Foster and N. Jia, 2010. Building sustainable high-growth startup companies: Management systems as an accelerator. *California Manage. Rev.*, 52: 79-106.
- Guoqing, H., 2012. Research and theoretical issues of strategic emerging industries. *J. Shanxi Univ.*, 35: 229-239.
- Hongchang, L., 2011. The principle of choice and fostering policy-oriented research on China's strategic emerging industries. *Sci. Sci. Technol. Manage.*, 3: 87-92.
- Hongyu, L., P. Fuyang and W. Chuansheng, 2012. The formation mechanism and growth path of strategic emerging industries. *Sci. Technol. Prog. Policy*, 6: 46-50.
- Hongzhou, L., 2012. Strategic emerging industries and venture capital system. *Financial Res.*, 4: 22-29.
- Hsu, D.H., 2006. Venture capitalists and cooperative start-up commercialization strategy. *Manage. Sci.*, 52: 204-219.
- Jerry, W., 1988. Impact of venture capital on high-tech industries. *Rev. Bus.*, 10: 5-6.
- Jing, Z. and H. Jinyi, 2011. Research on statistical standards of strategic emerging industries. *Stat. Res.*, 28: 3-8.
- Lerner, J., 2001. Venture capital and private equity: A course overview. Working Paper Series, Harvard Business School, 2001.
- Liu, M.M., J.A. Zhang and B. Hu, 2006. Domestic VCs versus foreign VCs: A close look at the Chinese venture capital industry. *Int. J. Manage.*, 34: 161-184.
- Polloek, T.G., G. Chenb, E.M. Jackson and D.C. Hambriek, 2010. How much prestige is enough? Assessing the value of multiple types of high-status affiliates for young firms. *J. Bus. Ventur.*, 25: 6-23.
- Sheu, D.F. and H.S. Lin, 2007. Impact of venture capital on board composition and ownership structure of companies: An empirical study. *Int. J. Manage.*, 24: 573-581.
- Tsukagoshi, M., 2008. The expected roles of business angels in seed/early stage University Spin-offs in Japan: Can business angels act as Saviours? *Asia Pac. Bus. Rev.*, 14: 425-442.
- Welpe, I.M. and H. Kollmer, 2006. Bio-entrepreneurs and their investors: A mutually beneficial relationship? *Int. J. Biotechnol.*, 8: 304-318.
- Xiaohua, L. and L. Tie, 2010. Characteristics and policy oriented research of strategic emerging industries. *Macroeconomic Res.*, 9: 20-26.
- Xuejun, L., 2012. Development and formation model of strategic emerging industries. *China Soft Sci.*, 2: 26-34.
- Youtie, J. and P. Shapirab, 2008. Building an Innovation Hub: A Case study of the transformation of university roles in regional technological and economic development. *Res. Policy*, 37: 1188-1204.
- Yulin, Z., 2012. *High-Tech Industrial Economics*. Science Press, Beijing, China.