

The Influence Of Venture Capital On Beijing's Technological Innovation Capacity

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Abstract—Nowadays in the age of knowledge economy, technological innovation, converting ideas into innovative products and technology strengths into competitive advantages, has become the core during enterprise development. As an innovative financial tool, venture capital, integrating financing and investment, capital supply and management services supply, focusing on the high-tech fields which contain high risk as well as high yield, is the incubator of high-tech enterprises. Beijing, with the capital effect, has become the top pick for domestic and foreign investment, and the center of private equity investment. In theory, venture capital promotes the technological innovation of enterprises in Beijing from all aspects, while in practice, the effect is not significant.

On the basis of carefully combing related literatures, this paper expounds the venture capital mechanism systematically first, then describes and analyzes the investment environment of Beijing, exploring the environmental effect on risk investment, and the adverse effects of enterprise age and scale on venture capital investment function. Thirdly, this article uses 129 listed companies based in Beijing as research objects, carries on the empirical analysis from input and output aspects of technological innovation. The conclusions are: the investment environment of Beijing is in the first echelon; Increase venture capital amount did not significantly affect the enterprise innovation output, but the value-added services show positive effect, far beyond the influence of pure capital; The most significant factor affecting innovation is R&D investment; In addition, enterprise age and enterprise scale are inversely proportional to venture capital effectiveness. Finally in this paper, based on the analysis of research results, relevant countermeasures and suggestions are put forward.

Keywords—Beijing, High-Tech Enterprises, Technological Innovation, Venture Capital

1. INTRODUCTION

1.1 Venture capital characteristics

Venture capital, a benefit-sharing and risk-sharing investment form, refers to the professional investment institutions or investors, provide capital to the high-tech enterprises with good prospects, under the premise of taking a great risk, offering long-term investment and value-added services, and eventually drain the capital out after the investee enterprises well developed, through equity transfer like listing and mergers to get high returns.

Different from the traditional financing, venture capital integrates financing and investment, capital supply and management service supply into one, has the following characteristics:

Table 1: *Venture Capital VS Traditional Financing*

	Venture Capital	Traditional Financing
Investee	Start-up SMEs	Grown-up enterprises
Capital Attributes	Equity capital	Loan capital
Guaranty	No guarantee	Premium mortgage or third-part guarantee required
Investment Horizon	Mid-and-long term	Short term
Specialization Level	Specialized investors Procedural progress	No requirements
Management Intervention	Being entitled to decision intervention	Pure credit behavior, no intervention rights
Investment Motives	Excess returns	Interests

1.2 The significance of technological innovation

Enterprise economic growth depends on three factors: production factors, management structure and technological innovation. The significance of technological innovation is to improve production

efficiency, in addition, by overcoming diminishing marginal return, catalyzing high value-added industries, to affect the first two factors positively. Technological innovation in high-tech enterprises plays a leading role, it helps to get competitive advantages after being applied to production activities, which in turn pay back long-term excess profits that far exceed the R&D costs and time costs, as a reward for innovative behavior. Then a new round of investment to innovation can be promised, such benign circulation will definitely bring better development.

1.3 How venture capital helps technological innovation

For enterprises, the most common bottleneck in innovation process is the issue of capital and management, so we start from these two aspects, respectively analyze how venture capital helps during the process of technological innovation.

1. Restrained innovation capacity due to financing difficulties

Technological innovation enterprises are generally SMEs (small and medium-sized enterprises), in the early development stages, often faced with the plight of insufficient funds, enterprise liquidity and solvency are limited, traditional financial institutions, due to uncertain risks, are unwilling to invest such business, thus sources of corporate funds are confined. Technological innovation requires a large amount of R&D investment, if there is no enough capital accumulation to support to get the corresponding factors, both the initial phase and follow-up phase of innovation are going to be inhibited, high-tech achievements are difficult to realize industrialization and commercialization.

Venture capital is just in line with the financing needs of technological innovation enterprises. Once investors are optimistic about the business philosophy and market prospects, they will inject long-term abundant capital into enterprises. With capital support early innovation is full-powered, enterprises have access to further research and develop new products and new technologies which with great potential, so as to carry out innovation activities successfully and promote technological development fundamentally.

2. Lack of professional management skills and specialists

Compared to professional institutions, enterprises in the early stage have risk cognition less comprehensive and intensive, easy to generate myopia to risk management. Venture capital can be a good solution to this problem, professional management skills and specialists come along with capital, investors get equivalent equity in return, if the capital quantity is large enough to give access to management layer, they will get right to speak when making corporate development strategy, and then implement scientific management, effectively solve

problems from research, production and sales, reduce the risk of loss at different stages. Scholars have conducted an empirical research based on 153 listed SMEs, the result shows that: the more technical background managers, the stronger its technological innovation ability.

Venture capital feeds enterprises with new vitality, giving full play to their own strength, transforming technological advantages to competitive advantages, is the high-tech business incubator and cradle.

1.4 The current situation of venture capital and innovation in Beijing

As a capital city enjoys exceptional political and cultural privileges, Beijing attracts large numbers of financial and insurance institutions set up here as headquarters; the central government vigorously supports the venture capital industry and obtains effective returns, massive equity investment institutions registered in Beijing. According to a report released by the Martin Prosperity Institute, Beijing is the most popular destination in Asia for venture capital investment. In 2015, Beijing financed venture capital funds ranking 1st in Asia and 9th in the world by investment value; in 2016, China's deal count more than halved in the past three years, but investment tripled from 2014's \$12bn. Beijing alone attracted \$37.3bn in venture capital since that year, including \$18.5bn in 2016.¹

In theory, venture capital has a positive effect on technological innovation. It provides funds as well as value-added services, significantly enhances enterprises innovation ability and profitability, furthermore catalyzes technological innovation activities. Corresponding to massive high-quality investees and investors should be a dramatic improvement in innovation ability. Here we take patent applications state in recent years as a manifestation, specific content shows as table 2.

Table 2: Beijing patent applications and grants

	Applications			Grants		
	yr. 2011	yr. 2014	yr. 2016	yr. 2011	yr. 2014	yr. 2016
Tertiary institutions	10499	13574	-	5698	6823	-
Research institutes	9840	12884	-	4413	7165	-
Business	43747	94998	-	22887	52181	-
Organ group	1039	1556	-	495	777	-
Total	77955	138111	189129	40888	74661	100578

(Source: Beijing Municipal Intellectual Property Office)

¹ "China gets record \$31bn in venture capital investment in 2016 despite global woes" Business Day, 13 January, 2017

Calculate according to Table 2: In 2011, the patent efficiency (patent grants divided by the patent application) was 52.5%; In 2014, it was 54.1% and became 53.2% in 2016. Although increasing but still far below the average level 70% of international city's. What's more, Beijing ranks 30th according to innovation cities index 2016-2017, despite it runs top 1 in patent applications worldwide.

Those statistics show an imbalance between financial support and innovation capacity. Scholars have conducted an empirical research, shows that venture capital in Beijing has negative effect on technological innovation. Theoretically it should be impellent from all aspects, but it doesn't in fact, and the reasons are remain to be verified.

2. RESEARCH OBJECTIVE AND RESEARCH QUESTION

Capital investment, especially venture capital investment, as innovative booster, with its professional strength different from that of traditional financing, to a certain extent, affects the breadth and depth of innovation, which is closely related to the realization of enterprise value. Scholars have concerned about the impact of venture capital on technological innovation ability for a long time, but there are not many researches concern Beijing district, as a growing international city, it deserves people's attention and the negative effect of venture capital on technological innovation in Beijing has yet to be verified. In the previous academic discussion, venture capital as an entire variable, represented by capital stock as an external indicator, is rarely being subdivided to underline how the professional characteristics of venture capital works. The truth is when venture capital enters enterprises in the real economy, besides the form of capital stock, management skills, techniques, networks and other resources also included. The entry time, the shareholding ratio that capital quantity pays back also impact. In addition, enterprise age and scale in turn determine the extent of its demand for venture capital.

Therefore, the main research objective of this paper is to further explore the correlation between venture capital and technological innovation, define the role of each part. In an explicit mathematical way to express the relationship between venture capital and technological innovation and to provide empirical evidence for management after venture capital entering the enterprise.

Based on the research objective above, the research questions are: the impact of venture capital stock on technological innovation; the impact of venture capital value-added service on technological innovation; the relationship between enterprise age, enterprise scale and venture capital utility. Following is the logical research framework:

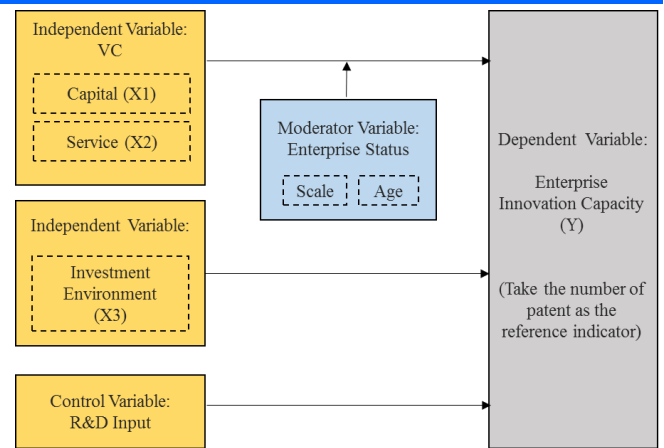


Figure 1: Research Framework

3. LITERATURE REVIRW

On the relationship between venture capital and enterprise technological innovation, the mainstream view held by scholars is that venture capital can provide more comprehensive support for technological innovation with its unique advantages such as capital, management and service. Ueda and Himkawa (2014) take the labor productivity, total factor productivity and patent as measures of innovation, get through the empirical analysis that venture capital does not affect the total factor productivity, but can increase the number of patents, indicating that the support of venture capital is less likely to strengthen enterprise's ability to develop new technologies or new industries. The study also found that venture capital is positively related to labor productivity, but this may be because venture capital enters a sector with less labor and greater energy consumption, and that technological substitution also plays a role.

Dobloug (2010) argues that venture capital contains capital in form of money for enterprise technological innovation, it also participates in management besides provides financial support, such as decision-making, strategy planning. Peneder (2007) also believes that venture capital can be a good incentive to business success. Venture capital supports companies are mostly small and medium-sized enterprises, which suffer difficulties to obtain financing from the traditional channels in the beginning. Venture capital not only provide capital for enterprises, but also provide supervision, management, advice, network support and other non-capital services. Through venture capital, investee enterprise gets financial support, as well as lots of extremely beneficial services and experience for its development.

Hasan and Wang (2006) validated the impact of venture capital on technological innovation based on US companies with OLS estimate research method, which research objective was the regional labor market. As take the metropolitan area as the regional division standard can only partially cover, this study selected a classification criteria which is suitable for study the impact of venture capital investment in the

labor market. The result shows that venture capital has a significant positive effect on patents.

Keuschning (2004) argues that experienced investors are very important to venture capital industry and can improve the efficiency of technological innovation. Venture capitalists provide management experience and capital to enterprises, entrepreneurs provide key technologies, to get a mutual promotion and to achieve a relatively balanced state. What's more, the author also proves that the government can adjust the tax policy to stimulate venture capital, which can promote technological innovation.

Tykvova (2000) has studied the venture capital of the United States and Germany, and on this basis, he argues that venture capital investment is indispensable to enterprise technological innovation. Compared with other newly established enterprises, the technological innovation enterprises have more obvious advantages. However, these enterprises are hard to get loans from traditional banks, they are reluctant to support out of risk consideration, and even if they do, simply a small amount, cannot meet the needs of enterprises. While venture capital favors such enterprises, so it has become the ideal source of financing channels. With the support of venture capital, in order to achieve the established target income, enterprises will increase the intensity of innovation, and constantly develop new products, so that enterprises grow up quickly. After enterprises achieved fixed profitability, venture capital can also benefit from it. Gebhardt (2000) says that venture capital can make innovation projects financially effective, motivating innovation and business growth.

However, few scholars believe that venture capital has no significant impact on technological innovation. For example, Mollica (2006) divides functional economic zones and based on that he gets an empirical result that venture capital has no significant positive effect on patents. Engel Dirk (2006) used a statistical matching process to confirm that the number of patent applications of venture capital investment enterprises is higher than that of non-risk investment-backed enterprises, but in fact those patents have been acquired before the venture capital. Venture capital invests objects that some already have the fruit of innovation, the number of patent applications did not increase significantly after the entry, but the company's performance growth rate has a more significant change. This illustrates the improvement of innovation is contributed by the early selection process before the entry of venture capital, rather than the venture capital itself.

In China, the academic community generally believe that venture capital plays a positive role in promoting technological innovation. Cheng Siwei (1999) says that venture capital provides financial support to entrepreneurs, also participates in monitoring and management through staff selection and finance arrangement. Lu Wei (2002) argues that venture capital is a new organizational mechanism

and contract approach, which breaks through the shortcomings of the traditional enterprise organization form in the commercialization of high-tech achievements. This breakthrough greatly improves the supportive ability of venture capital. Zhu Xiaozhong (2008) used OLS regression estimation method to study the cross section and mixed section samples of 27 provinces and cities in China. It is concluded that venture capital has a positive effect on technological innovation, but less than the effect of R&D input. Wu Qiaozhen (2009) thinks that venture capital promotes innovation by providing capital support and value-added services for innovative technology companies, facilitating the integration of capital and technology, participating in enterprise management processes and diversifying risks. Yang Xiaoyan, Long Yong (2009) selected the high-tech product export volume and the number of patent applications as two indicators to describe the technological innovation ability, and conducted correlation analysis by using these two indicators and R&D funds as well as venture capital respectively. The conclusion is: patent applications are positively affected by R&D inputs and venture capital, that is, venture capital and technological innovation capacity are positively correlated. Wang Yurong and Li Jun (2009) found that the number of patents applied by companies with venture capital background was much higher than that without venture capital investment. Venture capital had a relatively positive impact on technological innovation activities, but there is no significant correlation between the results of independent innovation. Zhang Suodi, Chen Ye (2010) studied the efficiency of venture capital investment in technological innovation. The result shows that venture capital has played a role in the technological innovation of enterprises in various regions of China and it's increasingly strong.

While, different voices exist. Wang Jianmei and Wang Faping (2011) adopted the method of elemental and binary linear regression analysis, and selected the number of patents, venture capital and R&D expenditure in China from 1994 to 2008. Through a linear regression analysis they found that the number of patents is positively related to R&D inputs and venture capital. Through the binary linear regression, they found that the impact of R&D inputs on the number of patent applications is significant, but there is no significant correlation between the amount of venture capital and the number of patent applications. The final conclusion is R&D investment is more obvious than the role of venture capital in promoting technological innovation in China. Chen Jianli (2012) used 134 firms listed on the GEM (Growth Enterprises Market) of the Shenzhen Stock Exchange before October 30, 2010 as research samples, to study the impact of venture capital on the growth performance of the GEM. The conclusion is that the growth of business performance with the background of venture capital investment is obviously higher than that of non-risk investment enterprises. But the increase of venture capital doesn't obviously improve the growth performance of GEM. And when the proportion of

venture capital holdings is more than 30%, the growth performance of the GEM companies becoming worse. Gou Yannan and Dong Jing (2013) take SME board listed companies as samples, found that the earlier venture capital enters, the more positive effects it brings. But in general, investors prefer a mature entry time, thus shift focus to the packaging market, ignore the cultivation of enterprise technology innovation ability.

4. RESEARCH METHODS

a. Qualitative - Literature research

Collect, read and sort relevant literature, extract the valuable information, analyze the logical structure of writing, learn from its scientific research methods, data acquisition channels, analysis mode, model setting, etc., to form a meaningful reference.

b. Quantitative - Empirical analysis

The multiple linear regression model is an empirical method to consider the relationship between explained variable, explanatory variable, moderator variable and control variable comprehensively, through stepwise regression and iterative algorithm to explore how variables effect the model. This paper collects and collates related data of 129 listed technology companies with venture capital background, and builds a multiple linear regression equation based on venture capital and innovation ability (which I take the number of patents as the embodiment of innovation ability) by stepwise regression. Then use the SPSS software to do the regression job and empirical test, gradually sort out the impact of venture capital on innovation.

c. Data collection technique and sample size

In this paper, the sample is composed of 129 technological enterprises listed on the GEM (Growth Enterprises Market) and SME Board (Small and Medium-sized Enterprises Board) up to the end of 2015. The reasons for selecting these 129 samples are: first, most of the enterprises are high-tech enterprises; second, most of them have venture capital background; third, the selected samples cover communication, electronics, medical, biopharmaceutical, energy and other fields, can more comprehensive and reasonable display how venture capital works on technological innovation. The data used in this paper mainly comes from the official website of the enterprise, the IPO prospectus, the latest annual report of the enterprise, the China Venture Capital Yearbook, the Beijing Statistical Yearbook and financial website like Zero2IPO, Chinaventure and so on.

Among all the 129 enterprises, 59 of them are aged 16 to 30, 70 of them are aged 1 to 15. They generally have a large scale since listed; 116 of them have venture capital background, among which, 54 have a venture capital shareholding ratio less than 5%, 57 have it between 5% and 10% and 18 have it more than 10%; The average number of patents with

venture capital background is 45, which is higher than the average obtained by enterprises without venture capital investment; In terms of R&D investment, enterprises with venture capital background is 1.3% much higher.

5. RESEARCH CONTENT

5.1 Beijing Environment Overview

The capital effect brings a lot of advantages to Beijing, first, large numbers of domestic and foreign enterprises and their headquarters were attracted and settled in Beijing, high quality investors and investees coexist, venture capital industry development is relatively perfect with strong financial intermediation. Second, numerous high-end talents, domestic and foreign scientific research institutions, large R&D investment give rise to a top-tier scientific research strength. Third, Beijing has the most comprehensive policy concerns, covering enterprise development, special funds, tax incentives, talents attraction and patent protection, macro policy concessions create a good environment for technological innovation. While a fact is most of the venture capital come from government special investment, this government-led model leads to rent-seeking behavior, which causes low innovation efficiency. But on average, Beijing's investment environment brings way more benefits than others.

5.2 Theoretical analysis of venture capital effectiveness

a. Venture capital provides funding to technological innovation

To get a foothold in highly competitive markets, high-tech enterprises should meet, even create and lead the mainstream appeal. In high-tech fields, what the audience most concerned about are technological content and price of products, so innovation itself should be fully regulated, innovation activities should consider the feasibility of innovative programs, product novelty and practicality, market potential and prospects. To meet these requirements, human resource, material resource and time resource are needed, the greater innovation intensity, the higher demands for resources, thus the higher support costs will be. After being invested in, capital is bundled at each innovation stage, leading to less capital mobility and flexibility, plus long time return and uncertain risk, for those seeking short-term high returns like traditional financial institutes, these kinds of enterprises are less attractive to be ideal investees. Moreover, the operating conditions and credibility make it difficult for SMEs to obtain public capital market funds. While venture capital can provide corresponding financial support in each innovation stage, to help innovation ideas come true.

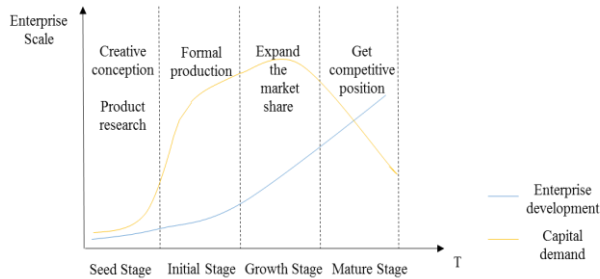


Figure 2: Entrepreneurship development stage

b. Venture capital share risks with enterprises

Enterprise, from entrepreneurial thinking into successful economic entity, is a fruit of coordination development between various factors. Entrepreneurs strive to be prudent, industry conditions, market changes, the composition and quality of the management team, corporate finance, local environmental policy, all these factors need to be carefully scrutinized in the business process, any error can bring fatal strike. Enterprises themselves face the risk of failure, correspondingly, venture capital institutions will bear the loss of investment failure. Innovation is a process of continuous experimentation, it stressed high product quality and technical standard, requires sufficient, continuous financial support, after successful innovation, marketization and commercialization problems will follow, if end up with failure, all become useless work.

Venture capital flows into enterprise in a form of equity participation, the interests of investors and investees linked together, so do the risks. Venture capital investors are diversified and institutionalized, its ability to take risks is higher, which is more conducive to innovation activities; Venture capital institutions set up rigorous project evaluation process, technical projects get reasonable evaluation, not only improve the feasibility of technological innovation, but also to a certain extent, reduce the risk of innovation; Venture capital institution is a comprehensive organization, with professionals and rich case handling experience in various fields, plays a guiding role during enterprises development, reinforces the capacity of absorbing external knowledge and new technologies, increases the probability of innovation success.

R&D investment affects the overall situation, which means investors can drive the enterprises to invest more in technological innovation through the ownership stake, giving the follow-up motivation and a big chance to success.

In order to avoid risks, venture capital institutions actively participate in business operation, their professional management teams give support in multi respects, for instance, network building, strategy making. Venture capital is a professional investment that directly involved in enterprise management, investors participate in short-term or long-term business development planning, marketing, production, also create new channels of funding, look

for resources or market for enterprises, coordinate the relationships with suppliers and customers, take part in capital operations. Entrepreneurs along with investors corporately deal with financial risk, management risk and decision risk, reducing the risk as well promoting enterprise growth.

In addition, venture capital institutions enjoy a wide range of network and information network, they could offer consulting and other service, enable enterprises to have access to shared resources, like specialists, technology, market and other aspects of information, all in all minimize risks.

c. Venture capital provides value-added services

In project screening process, venture capital institutions will focus on and investigate the condition of enterprise, including its market share, competitiveness in this industry, management ability and entrepreneur's quality, through which, venture capital institutions can identify the strengths and weakness of the investee, laying a foundation for management intervention. This management is all-round and multifaceted, covering the R&D, production, marketing and marketization, talents equipment and training, organizational structure adjustment, strategy design and operation planning.

Venture capital specialists join in management layer could significantly impact business operations. Managers in enterprises with venture background can be instructive, with excellent professionalism and wealthy investment management experience, they can offer direct and effective advices in vital node. Moreover, venture capital managers are familiar with the entrepreneurial innovation process, they know the demands for talents in all stages, arrange the right one for the right job, maximize the value of human resources. Venture capitalists involved in enterprise management will help enterprises to build a good corporate governance structure that conducive to listing.

At the same time, out of the principal-agent relation between investors and investees, venture capitalists will strictly regulate the daily business, supervise the board's decision and participate in the company's major deployment, indirectly affect the enterprise's technological innovation through monitoring and management.

d. Venture capital effectively solves the problem of information asymmetry

General investors will appraise enterprise value based on the information they get from the outer channel and this enterprise, and then give the final decision, invest it or not. The fact is enterprise, for information privacy and interests, will selectively disclose the information it wants to pass to investors, communication issue occurs. The previous part have mentioned that venture capital institutions will do preparatory work before investment, after capital enters in and become equivalent equity, these two

parts share common interests, it means the furthest information sharing. Investors can directly get the comprehensive and true information, effectively solve the information asymmetry between investors and technological innovation enterprises, and optimize the resources allocation.

The action mechanism of venture capital on enterprise technological innovation can be summarized as follows:

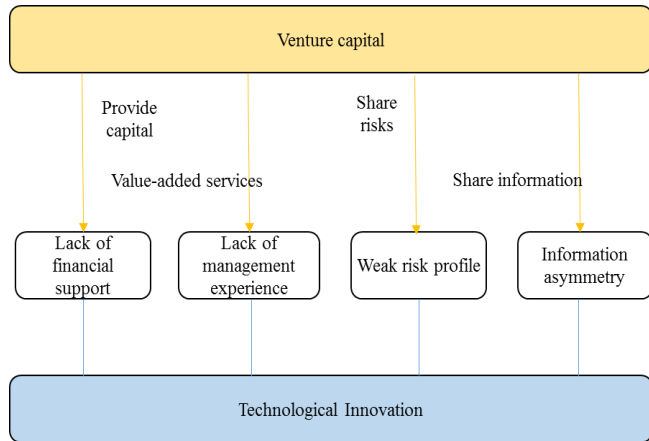


Figure 3: How venture capital works on technological innovation

Through analysis above, we get venture capital can provide strong financial support and meet the technical needs of enterprises in different periods of technological innovation, can share the risk of innovation and offer management and other value-added services, can solve the information asymmetry problems between investors and investees, promoting enterprise technology innovation to be successful in many ways.

5.3 Empirical analysis of the effect of venture capital on technological innovation

5.3.1 Enterprise state partially impact venture capital effectiveness

Enterprise benefits from venture capital undoubtedly, but how motivated venture capital can be depends on enterprise development level and its actual demand. Ideally, we believe as the theory articulates that venture capital works in every aspect, it directly hits the weak parts in innovation progress. While we sometimes ignore that enterprise state can affect venture capital's effectiveness, actually, enterprise age, enterprise scale, entrepreneur's quality and even the nature of the enterprise, the industry can limit the venture capital's effectiveness.

This paper selects 129 technical enterprises listed in Beijing, and observes separately the relationship between enterprise age, enterprise scale and shareholding ratio that venture capital holds, discusses the impact of the two factors on venture capital effectiveness.

Enterprise age: In theory, an enterprise is not strong enough in the early stage to supply all the

resource needed for development, it needs the guidance of venture capital institutions. With business developed, enterprise system and operation system gradually perfected, talent matching and capital efficiency improved, technology and network tend to be mature, profitability and financing capacity significantly enhanced, the overall strength of enterprise dramatically increased. Generally, the resource richness is positively proportional to the enterprise age, longer development time comes with abundant resources. The function of venture capital is to provide financial intermediation and management technology, to share business risk, if the enterprise itself can solve these problems, then the role of venture capital is not so prominent.

According to the data of 129 enterprises, calculate the average of the shareholding ratio that venture capital holds in each age level, reflect the relationship between the enterprise age and the shareholding ratio, draw the logarithmic trend line, as shown in Figure 4:

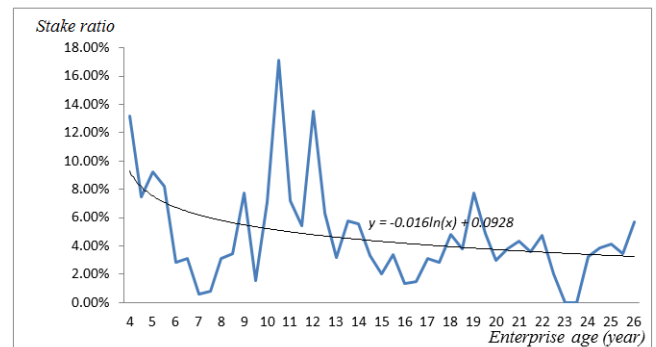


Figure 4: The relationship between enterprise age and shareholding ratio

Take the median age of the enterprise, 15 years as dividing point, 4 to 15 years is shorter period, 15 to 26 years is longer period. It can be seen from the figure that the proportion of venture capital shareholdings is generally low at the age of 15-26 years, the weighted average is 3.31%. At the age of 4 to 15 years, the proportion of venture capital holdings is higher and the weighted average is 5.95%.

The logarithmic function is more sensitive to tiny distinction, it can compress the variable size without changing the nature and correlation of the data. Thus here takes the logarithm of the enterprise age to calculate the relationship:

$$y = -0.016\ln(x) + 0.0928$$

Here, Y is venture capital shareholding ratio, X is the enterprise age.

The linear relationship between the two factors can be seen from the trend line: the younger the enterprise, the higher the proportion of venture capital in enterprise. This shows that the theoretical relationship about the enterprise age and venture capital is still applicable to the reality, the longer enterprise developed, the more resources it

possessed, the demand for venture capital is relatively low, venture capital is not significant for them.

Enterprise scale: Enterprise scale can be classified by staff number, more intuitive way is, according to the total amount of assets listed on the IPO, take its natural logarithm, as the indicator embodying enterprise scale. In general, the older the firm, the larger the firm, which means that the relationship between the enterprise age and venture capital above may be applied here, that is, the larger the firm, the lower the demand for venture capital, the less effective of venture capital.

This assumption has certain basis, for large enterprise, resources are well equipped, scale is developed, business model is optimized, enterprise goes after stability, which the current technical level can keep it normal, under this situation, enterprise relies on scale benefit.

But technological innovation means additional investment, and the innovation results and the applicability of new technology are difficult to accurately estimate. Since keeping existing state can be beneficial, venture capital intervention is not necessary.

As above, using the data of 129 enterprises, take the average of enterprise scale in each age level, calculate the relationship between enterprise scale and shareholding ratio that venture capital holds, and draw a logarithmic trend line, as shown in Figure 5:

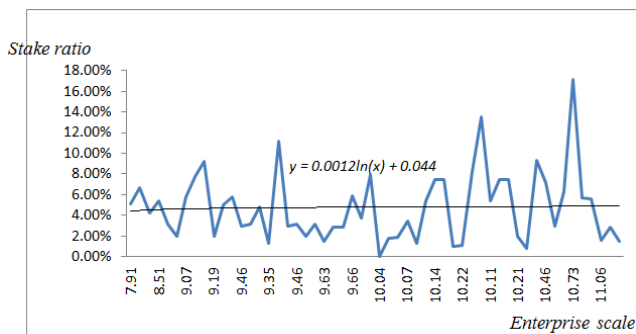


Figure 5: The relationship between enterprise scale and shareholding ratio

Actual survey shows enterprise listed usually has a large scale, listing indicates that the enterprise has certain competitiveness in the industry.

It can be seen that the logarithmic trend line is flat, the correlation between the two factors is not significant, but the proportion of venture capital and the enterprise scale have the same trend, that is, the larger the scale of enterprise, the higher venture capital shareholding ratio, although this trend is weak, but contrary to theoretical predictions. This shows that the large-scale enterprise may also need venture capital support for some reasons; small-scale enterprises may run well, do not need venture capital support. The specific relationship needs to be discussed further in the next empirical analysis.

Other factors: Besides enterprise age and scale, factors affect venture capital also include entrepreneur quality, industry nature and so on.

Entrepreneur quality involves many aspects: (1) young entrepreneurs are adventurous and innovative spirit, they are willing to accept venture capital to promote business innovation; (2) entrepreneurs have leadership and market insight, make situation judgment quickly and accurately, weigh the advantages and disadvantages of venture capital investment, optimize the decision-making, and then decide to accept venture capital or not; (3) Experienced entrepreneurs clearly know the most potential and the most effective development direction, if entrepreneurs think venture capital is coincide with business plan, they will take it in; (4) Entrepreneurs with broad and long-term vision value creative technology a lot and willing to absorb venture capital to develop technology, to get a place in market.

Industry nature also plays a significant role. Generally, emerging industries are more willing to accept venture capital, contrarily the demand for technology in traditional industries is limited, their main purpose to develop technology is to improve labor efficiency and productivity. If current technology is easy to implement and has a long application time, the demand for labor is higher than new technologies, therefore, the needs for technological innovation in traditional industries are limited, the same for venture capital. But emerging industries, emerging enterprises are mainly engaged in high-tech business, on the one hand the demand for funds is great, on the other hand, strict technical requirements exist, technology need to be continuously optimized, and the emerging industry market prospects are not clear, venture capital can help enterprises investigate the external environment, to develop business strategy.

5.2.2 Hypothesis and Empirical Analysis

a. Hypothesis

Through previous study, we have learned that venture capital institutions prefer enterprises with fast growing, high competitive and innovation abilities, give financial support to promising enterprises, help realize the transition from innovation ability and product development capacity into productivity and products. Here, this paper makes the first assumption, hypothesis 1: venture capital provides enterprises with innovative capital that promotes technological innovation.

Besides financial support, venture capital helps in many ways, such as management, marketing, improve the efficiency of innovation directly or indirectly. By participating in management, it plays a role in supervision, also promotes capital appreciation, to a large extent favors in technological innovation. Therefore this article makes the hypothesis 2: venture capital services positively impact technological innovation.

In theory, we believe that the impact of venture capital on innovation is positive, venture capital flows into the enterprise, fully works on innovation activities and innovation output. But in fact, how effective venture capital is can be limited by enterprise state, such as enterprise age, enterprise scale, ample resource leads to lower demand for venture capital, thus, this paper presents hypothesis 3: enterprise age and scale affect venture capital's effectiveness.

b. Variable selection and description

Explained Variables: Enterprise Innovation Ability. To measure the technological innovation ability of enterprises, we can take the number of innovation awards, the number of patents, the new product sales revenue and other indicators. Among them, patent data is most intuitive.

It has shortcomings, but the patent data is easy to obtain and it means the highest technological content, reflects the enterprise's innovation output. Therefore, this article takes the number of patents grants as the explained variable, measuring enterprises innovation ability.

Explanatory variable: Venture capital. Enterprises need financial supports in research, production, market development, enterprise packaging and many other parts. Due to self-limiting, it's hard for them to get capital from traditional channel. Different from that, venture capital powers innovation with sufficient capital support. The dimension of business operation depends on enterprise scale, as long as the capital is sufficient to maintain the corresponding scale of enterprise development, its big input. Therefore, the investment of venture capital can be expressed by the proportion of equity that venture capital accounts, which is shareholding ratio. This paper refers to the shareholding state of the top ten shareholders in enterprise. Venture capital not only provides financial support, but also participates in management and decision-making, sharing the risk of technological innovation and offering value-added services. In order to detect the impact of venture capital services on technological innovation, this paper sets the service as observable variable, 1 represents have service and 0 represents no service.

Control variables: R&D investment. It is the basis for technological innovation, to a large extent affects innovation activities running smooth or not. R&D investment directly works on technological innovation activities, both the basic research and the experimental trial need constantly accumulate knowledge to extract the value parts for innovation, to improve the innovation efficiency. Therefore, this paper selects the proportion of R&D investment accounts for total revenue as R&D investment indicator.

Adjustment variables: Enterprise age and enterprise scale. Technological innovation is inseparable from financial, material and human support. A large enterprise with long term

development normally has sufficient human resource, technical, capital backups, the demand for venture capital is not intense. This paper takes its life span as the enterprise age, the natural logarithm of the total assets in prospectus or annual reports as the enterprise scale, to find out how these two factors effect venture capital.

Table 3: Variable selection and description

	Type	Name	Symbol	Description
Explained variable	Innovation ability	Patent quantity	P	Patent grants enterprise has
Explanatory variable	Venture capital	Venture capital amount	VCshare	VC shareholding ratio among top 10 shareholders
		Value-added service	Service	VC service involved in or not
Control variable	Technological innovation input	R&D input	RD	The proportion of R&D input in total revenue
Adjustment variable	Enterprise state	Enterprise age	Age	Enterprise lifespan
		Enterprise scale	Scale	The natural logarithm of the total assets in prospectus or annual reports

c. Model description

In order to verify the impact of venture capital on technological innovation, this paper selects patent quantity as an indicator to conduct empirical test. We can consider only venture capital and patent quantity in theory, directly study the relationship between the two. But we cannot ignore the interrelationship between things, the effectiveness of venture capital may be amplified, may also be weakened subject to certain factors. Therefore, this paper uses unary linear regression and multiple linear regression methods, to integrate main factors influencing the enterprise's innovation in one model to discuss the correlation degree and the causal relationship between variables. Based on the research focus of this paper, the linear regression model proposed in this paper is as follows:

The first assumption of this paper states that venture capital can provide enterprises with innovative

capital to promote enterprise technological innovation, therefore, here we measure the relationship between venture capital and patent quantity, according to the hypothesis, set the model as:

$$P = \beta_0 + \beta_1 VCshare + u \text{ Equation (5-1)}$$

According to the data of 129 listed companies, the linear regression of the model leads to the following relationship:

$$P = 22.501 + (-0.2416) * VCshare + 6.311$$

From the equation we see that the effect of venture capital on the technological innovation is negative, contrary to the hypothesis, which is consistent with the view that venture capital is negative for Beijing's technological innovation in the existing literature.

The second hypothesis of this paper is that the venture capital service has a positive effect on the technological innovation of enterprises. Therefore, we measure the relationship between VC service and patent quantity. Here the model is:

$$P = \beta_0 + \beta_1 Service + u \text{ Equation (5-2)}$$

Plug sample data into equation, we get:

$$P = 16 + 1.172Service + 3.159$$

The equation shows the effect of venture capital service on enterprise innovation is positive, that the venture service can improve the innovation output of the enterprise, it is consistent with the hypothesis.

The third hypothesis assumes that enterprise age and scale adversely affect the effectiveness of venture capital, according to the assumption, the model focus on the relationship between these three:

$$VCshare = \beta_0 + \beta_1 Age + \beta_2 Scale + u \text{ Equation (5-3)}$$

Put sample data into and we get:

$$VCshare = 17.449 + (-0.31)Age + (-0.823)Scale + 3.70887$$

Table 6: Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	β	Std. Error	Beta		
Constant	-23.606	11.662		-1.435	.039
Age	-.021	.084	-.003	-1.080	.027
Scale	-.652	0.564	-.013	1.41	.043
R&D	21.247	2.209	.861	10.970	.006
Service	7.605	3.006	.082	8.82	.038
VCshare	-1.413	.812	-.104	-3.067	.049

The equation shows, the larger the enterprise age and scale, the lower effective of venture capital.

Independent separate research of each factor can visually reflects the interrelationship among variables, but interrelation determines that integration thinking is the right way to study how venture capital works under the combined influence of multiple factors. Therefore, put main factors together in one model and analyze comprehensively, the ultimate model is:

$$P = \beta_0 + \beta_1 Age + \beta_2 Scale + \beta_3 VCshare + \beta_4 Service + \beta_5 RD + u \text{ Equation (5-4)}$$

6. DATA ANALYSIS AND RESULTS

6.1 Calculation results

This paper carries out multiple linear regression on related indicators based on model, the measurement results are as follows:

$$P = -23.606 - 0.021Age - 0.652Scale - 1.413VCshare + 7.605Service + 21.247RD + 7.409$$

Table 4: Model Summary^b

Model	R	R Square	Adj.R Square	Std. Error of the Estimate
1	0.889 ^a	.790	.764	7.409

Table 5: ANOVA^b

Model	Sum Squares	of	f	Mean Square	F	Sig.
Regression	84578.383	5		16915.677	7.158	0.008 ^b
Residuals	22502.922	27		562.573		
Total	107081.304	32				

6.2 Validity of the Model and Data Analysis

Validity of the proposed model: according to Table 6-1, the coefficient of determination R^2 of the model is 0.790, close to 1, the fitting degree belongs to the middle level, and the independent variable in the model can explain 79% of the dependent variable. Therefore, this model effectively explains the relationship between venture capital and innovation ability.

Analysis of variance: F value is the mean squares between groups, larger F value indicates greater difference between groups. The F value in this model is 7.158, the P value is 0.008, less than 0.05, and the linear relationship between the variables is significant at the significance level of 5%.

Significance of regression coefficient: at the significance level of 5%, the P value of explanatory variables are $0.039 < 0.05$, $0.027 < 0.05$, $0.043 < 0.05$, $0.006 < 0.05$, $0.038 < 0.05$, $0.049 < 0.05$. The corresponding coefficient of the variable is the effective coefficient, which can explain the causal relationship and the influence extent between independent variables and dependent variables.

6.3 Results

This paper takes technology-based enterprises listed on the SMEs and GEM as of the end of 2015 as research objects, to study the impact of venture capital on technological innovation, conducts empirical research from the perspective of patent output with a total quantity of 129 samples, analyzes how enterprise age, enterprise scale, venture capital equity shareholding and venture capital service impact on technological innovation. The results are:

(1) Enterprise age and enterprise scale by affecting the absorption of venture capital, affect the enterprise's innovation output, their coefficients are -0.021 and -0.652, indicating that with the growth of enterprise age and scale, its resource acquisition capacity promoted, the demand for venture capital decreased. The impact of enterprise scale is bigger, but overall, both of their influence on the enterprise's innovation capacity is not significant.

(2) The coefficient of venture capital shareholding ratio is -1.413, and the coefficient of venture capital service is 7.605, which means the effect of venture capital on innovation is negative, but counter to that, the effect of venture capital service is more significant. The amount of venture capital increases cannot enrich the resource neither improve the innovation output. This phenomenon is likely to be caused by short-sighted behavior of venture capitalists. The main reasons drive short-sight are: venture capital institutions are supposed to screen out enterprises with good future, assist in finance, marketing, network building and many other aspects to strength enterprise competitive ability, which in turn improves business performance, to realize capital appreciation and enterprise value increment. However, many

investment institutions simply focus on capital operation, put energy on enterprise packaging and normally exit after listing, enhancing the technological innovation ability is not their core concerns; another possible reason related to the entry time of venture capital. Through the network of venture capital institutions, enterprises can obtain information, knowledge, human resources, technology and other resources from the outside, so as to boost the rapid development of enterprises. From this point of view, the early the venture capital entering the enterprise can more significantly affect the technological innovation, those who enter in the late stage of enterprises development emphasis on low risk and financial returns, rarely works on innovation ability.

(3) R&D investment coefficient reaches more than 20, indicating that R&D investment has an impact on the ability of innovation and more significant than other variables. From the perspective of research and development, we can suppose another reason for non-significance of venture capital, that is the capital was used in other areas, such as market development, enterprise packaging, not the research and development part.

7. CONCLUSION

This paper expounds the theory of venture capital and technological innovation, examines the current situation of venture capital and enterprise technological innovation in Beijing and the investment environment of Beijing, and deeply studies the impact mechanism of venture capital on enterprise technological innovation. At the same time, this paper takes 129 technological enterprises listed on the GEM as research objects, taking the number of patents as the index of innovation output, analyze the influence of venture capital, venture service, enterprise age and scale, R&D investment and other factors on enterprise innovation, and finally puts forward some policy suggestions on the venture investment to promote enterprise technological innovation. To sum up, the main conclusions of this paper are as follows:

On the theoretical side, first, the technological innovation of small and medium-sized enterprises has great uncertainty, it is difficult to obtain financing from the conventional channels. Venture capital can alleviate the financing difficulties and provide strong financial support to meet the capital demand of enterprises in technological innovation. Second, venture capital has diversified sources of investment, its project selection process is specialized, venture capital participates in the way of equity participation in enterprises can share the risk of innovation. Third, venture capital can also offer value-added services, including management, marketing, and other aspects, the combination of financing and management improved the innovation capacity of enterprises. Fourth, venture capital helps investors and entrepreneurs to obtain more effective information, asymmetric problems have been ameliorated, resource allocation has been optimized. Thus, venture

capital brings technological innovation the marginal output effect, capital increase effect and value-added service effect.

From the perspective of empirical research, the impact of venture capital on the technological innovation of enterprises involves two aspects: the "capital" and the "service". Venture capital increases cannot significantly affect the innovation output and even cause the negative effect, nevertheless, the effect of venture capital service is positive, far beyond the impact of capital. This may be related to the situation of business operations, external network gradually improved during enterprise development, financing becomes easy than previous, but the enterprise management and technical level still have some defects, so when venture capital enters into the enterprise, the effect of the service is more significant than that of capital.

R&D investment has the greatest impact on the enterprise's innovation and output, the more R&D funds, the more patent quantities, which in part explained why the "capital" is not significant, it may be used in enterprise packaging rather than research and development part. Another possible reason is that the ultimate goal of venture capital institutions is listing, its focus is to obtain excess profit rather than to improve the innovation ability. The empirical results of the control variables show that the technological innovation of the enterprise is affected by the venture capital and the R&D investment, but also affected by the enterprise scale and the enterprise age. The greater the age and scale of the enterprise, the lower the demand for venture capital, the less significant the role of venture capital in the enterprise. Among them, the impact of enterprise scale is higher than that of enterprise age, but both are not significant.

8. LIMITATIONS

For indicator selection, patent quantity only represents part of technological innovation ability, but innovation itself is a complex and a combined-effect product, the use of a single patent indicators, although it is possible to carry out research, inevitably to certain extent, will reduce the accuracy.

Technological innovation is affected by many factors. In this paper, R&D investment is the only one control variable selected, but factors such as industry nature, the maturity of venture capital institutions, the entry time of venture capital have not considered. Venture capital as a private equity investment, the details of it are rarely disclosed, limited data access and then relevant research, the future study can take these data into consideration.

Current sample selection does not cover all the enterprises, some failed cases are not taken into account, which may have a certain impact on the empirical conclusions, the future study can consider to increase the sample data for a comprehensive analysis.

9. RECOMMENDATIONS

Technological innovation has a profound influence on today's society, it has made great changes to the social life and the whole world, and the future will remain so. Venture capital is a creative way of investment transforming innovation into productivity which dramatically helps. Combining with the conclusion of theoretical research and empirical research, this paper gives the following suggestions in order to give full play to the impetus of venture capital investment to technological innovation.

a. Reduce government control and optimize the investment environment

Government-led venture capital for enterprises brings the most powerful financial protection and policy benefits, but the inadequacy is the government control leads to strong rent-seeking, government personnel lack of professional risk investment management experience, easy to cause low efficiency of resource allocation and other issues, affecting the effectiveness of venture capital. Therefore, in terms of venture capital in Beijing, it is appropriate to increase the participation of the government in the form of venture capital, allocate project funds for energy-based or environment-based enterprises, and provide information that some non-governmental organizations cannot obtain, more opportunities, more favorable conditions, but meanwhile, reduce the government's control, decentralize to the professional management staff to improve the management and innovation efficiency, such as the government can hire professional investment brokers to supervise guide fund utilizing and invested enterprises, requiring professional investment brokers to report regularly to the government about the state of enterprises.

The government can also set up a docking platform according to the characteristics of enterprise in this city for venture capital institutions or investors, both sides through the platform can get to know strengths and weakness of each other, and ultimately the most suitable venture capital institution goes to the most suitable business, maximally solve the problem of information asymmetry.

b. Gradually improve the listing standards

Exchanges should further improve the issuance system and exit system, take enterprise technological innovation ability as an important indicator of listing and delisting, in the evaluation process, not only considering the current profitability of enterprises, but also focusing on growth ability and innovation potential, to drive investors including venture capital investors do pay attention to the enterprise's technological innovation and prospect, to carry out worthy investment, thereby reducing the risk of speculative investment.

c. Improve the value-added services of venture capital institutions

Investee enterprises in the process of growth will encounter a lot of risk, a high level of value-added services is conducive to reducing these risks. Construct a sound value-added service system is the key to improve the value-added service. First, the construction of value-added service system requires the venture capital institution to develop the investment strategy with a global vision, which can well identify the internal resources and further use the external resources. For example, venture capital institutions can make a comprehensive report on the enterprise every six months, including the development advantages and defects of enterprises, as well as the changes after venture capital services intervention, and then develop targeted development plans, make up shorts.

d. Cultivate professional talents, increase R&D investment

Talent is the basis for technology innovation. For enterprises, innovative talents inject fresh blood to enterprises; promote innovation efficiency, so that enterprises get unique advantages to maintain a steady stream of creativity. For venture capital institutions, professionals have a keen perspective and market sensitivity, they can manage venture capital in the most effective way, bring huge profits to enterprises. Therefore, we should vigorously cultivate specialists and provide the most professional support for different economic subjects. For example, enterprises can cooperate with universities to carry out cooperation projects, in the process of project implementation, college talents get a profound understanding of enterprises development, defects, prospects, development target, targeted innovation, innovation success rate and innovation efficiency will achieve the optimal value. At the same time, increase R&D investment, research and development is the most important part of innovation, which can be seen from the empirical results, no matter enterprise or government, must pay attention to researchers and R&D investment.

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11. APPENDIX

Name of enterprise	Age (yrs.)	Total assets in prospectus(\$M)	Scale	Industry	Shareholding ratio	VC service	R&D input %	Patent grants
LTIAN Biopharmaceutical Co.,Ltd	4	39.73	10.22	Biopharmaceutical	0.60%	0	4.05%	19
Beijing UME Communication	4	43.08	10.30	Communication	0.00%	0	4.97%	15
MRT Network Technology Co.,Ltd	4	28.15	9.87	NIS	2.58%	1	5.03%	11
TONG QING Technology	4	43.33	10.31	Software & Computer Services	3.80%	1	5.19%	16
Beijing Qiming Electronics co.,Ltd	4	49.75	10.44	Electronic Manufacture	9.29%	1	6.05%	21
DC Yuanda Communication	5	13.73	9.16	Communication	9.22%	1	3.09%	7
Wenbo Biotechnology	5	16.90	9.36	New Tech	13.17%	1	3.57%	12
Beijing Chuanxing Software	5	42.34	10.28	Software service & manufacture	7.31%	1	4.82%	6
Zhi Yuan Light Energy co.,Ltd	5	48.19	10.41	New energy	4.47%	1	5.21%	18
Senko Electronics	5	12.41	9.06	Electronics	8.21%	1	5.63%	22
Zeien Pharmaceutical	5	11.51	8.98	Pharmaceutical manufacturing	0.00%	0	7.24%	24
Troupe Energy co.,Ltd	6	47.23	10.39	Energy industry	0.59%	1	1.08%	21
Xiang Tai Technology	6	29.42	9.92	NIS	2.35%	1	3.37%	19
Allround Biotechnology	6	24.42	9.73	New Tech	13.12%	1	3.48%	12
Beijing Chi Shen Tech	6	65.74	10.72	Software service	6.32%	1	6.08%	28
Speedy co.,Ltd	6	20.63	9.56	Manufacturing	3.82%	1	7.54%	110
Beijing Xingda	7	94.71	11.0	Energy industry	2.83%	1	4.23%	38

Energy co.,ltd			9				%	
Northern Nav-C	7	33.62	10.0 5	Low voltage	1.00%	0	4.75 %	41
ShiLi Tech co.,ltd	7	32.54	10.0 2	Computer service	3.27%	1	5.59 %	36
Jing Wei Communication	7	24.13	9.72	Communication	5.36%	1	6.03 %	41
Hi Fun Intellectual	7	15.24	9.26	Low voltage	1.48%	0	8.74 %	87
YUNJI Tech	8	34.49	10.0 8	Software service	1.31%	1	5.35 %	22
Beijing Biological Technology Group	8	6.95	8.48	New Tech	5.09%	1	5.63 %	26
Sailing technology co., ltd	8	34.78	10.0 9	Software service& ITS	2.86%	1	6.27 %	52
Yeotong Electronics	8	61.24	10.6 5	Electronic Manufacture	13.54%	1	7.98 %	45
Baiyin Tech co.,ltd	8	92.01	11.0 6	NIS	1.56%	1	15.4 3%	86
Beijing Malan Biological co.,ltd	9	49.53	10.4 4	New Tech	1.78%	0	3.81 %	43
Da Fa Software Company	9	12.73	9.08	Software Manufacturing	3.88%	1	4.48 %	44
Hwanin environment control technology co., LTD	9	14.11	9.18	EPI	0.90%	0	4.65 %	41
Four Continent Biological technology group	9	7.72	8.58	Biotechnology	5.17%	1	5.33 %	56
Xin Sheng technology co., LTD	9	32.38	10.0 1	Computer service	3.49%	1	5.49 %	86
Beijing Dangji materials co., LTD	10	50.27	10.4 5	Manufacturing	7.73%	1	4.40 %	76
Beijing Zhichueng materials co., LTD	10	31.48	9.99	Manufacturing	4.26%	1	4.68 %	39
Sinovel hydropower science and technology (group) co., LTD	10	66.31	10.7 3	New energy	17.43%	1	5.09 %	44

Concentric pharmaceutical co., LTD	10	11.50	8.98	Pharmaceutical manufacturing	0.00%	0	7.23%	74
Prosperity Building Materials co., LTD	10	81.34	10.94	Construction industry	2.64%	1	8.36%	92
For U telecom technology co., LTD	10	80.20	10.92	Communication	2.23%	1	18.23%	271
Beijing Avatar high technology co., LTD	11	26.45	9.81	Technical service	3.64%	1	3.77%	40
Qi He Energy	11	32.11	10.01	Energy industry	0.46%	1	4.09%	51
Beijing Kant composite materials co., LTD	11	103.27	11.17	Manufacturing	6.34%	1	4.78%	39
Navinfo Co., Ltd.	11	50.47	10.46	Computer service	7.34%	1	5.20%	48
Huada technology co., LTD	11	36.18	10.13	Software service	3.23%	1	5.29%	52
New Era environmental technology co., LTD	11	5.75	8.29	EPI	4.24%	1	6.25%	67
Siyi Biotechnology	12	17.33	9.39	New Tech	13.19%	1	3.47%	42
Benedict line software co., LTD	12	41.66	10.27	Software service & manufacturing	7.45%	1	4.12%	36
Donghua software co., LTD	12	77.57	10.89	Software service	5.74%	1	5.06%	47
Beijing Asher electronic technology co., LTD	12	33.93	10.06	Electronics	7.31%	1	5.62%	52
Beijing Comerica Yong Yi technology co., LTD	12	17.85	9.42	Communication	6.98%	1	6.07%	58
Sevenstar Huachuang electronics co., LTD	12	47.33	10.39	Electronic Manufacture	13.65%	1	7.92%	75
Beijing TianXing energy co., LTD	13	39.95	10.22	Energy industry	0.37%	1	3.08%	36

Beijing Zhongke high technology co., LTD	13	21.42	9.60	Technical service	3.19%	1	3.75%	25
Beijing HaoHua energy co., LTD	13	26.56	9.82	Energy industry	5.62%	1	4.73%	36
Beijing New Building Materials Public Limited Company	13	13.75	9.16	Construction industry	2.01%	0	5.12%	37
Beijing Express	13	33.11	10.04	Transportation	8.37%	1	5.40%	45
Kaotian Biological pharmaceutical co., LTD	14	18.82	9.47	Biopharmaceutical	0.80%	0	4.55%	26
SIHUAN PHARMACEUTICAL CO., LTD	14	53.76	10.52	Pharmaceutical manufacturing	0.00%	0	4.55%	43
TSMA technology co., LTD	14	41.56	10.26	Transportation	3.43%	1	5.39%	51
B-Dipper navigation technology co., LTD	14	39.27	10.21	Electronics	0.00%	0	5.97%	70
Seven Stars Electronics	14	49.62	10.44	Electronic Manufacture	9.29%	1	6.04%	95
Beijing Dahao technology co., LTD	15	49.44	10.44	Software service	0.27%	0	4.48%	23
Pavilion computer software co., LTD	15	12.87	9.09	Computer service	6.73%	1	4.80%	33
Crane biological technology group co., LTD	15	3.95	7.91	Bio-manufacturing	5.12%	1	5.43%	41
Bright Oceans Inter-Telecom Corporation	15	16.73	9.35	Communication	1.35%	0	6.31%	61
Puts pharmaceutical co., LTD	15	43.09	10.30	Pharmaceutical manufacturing	0.00%	0	7.26%	59
Friend network technology co., LTD	16	22.06	9.63	IIS	2.86%	0	3.84%	22
Arabian environment control technology co., LTD	16	50.13	10.45	EPI	0.70%	0	4.45%	26

Qiming technology co., LTD	16	30.80	9.96	Software service	3.46%	1	5.10%	51
The north ore magnetic technology co., LTD	16	18.52	9.46	Manufacturing	0.00%	0	5.77%	30
TIAN DI SCIENCE & technology Co.Ltd	16	28.60	9.89	Software service & Computer service	5.34%	1	9.28%	210
Forefront of navigation control technology co., LTD	17	54.56	10.54	Electronics	0.60%	0	4.35%	21
Fly crown technology co., LTD	17	36.72	10.14	Computer	3.47%	1	5.20%	46
YouYan new material co., LTD	17	14.11	9.18	Manufacturing	3.12%	1	7.55%	120
The rivers create group co., LTD	17	125.80	11.37	Construction industry	1.54%	1	8.35%	132
Aritime co., LTD	17	23.21	9.68	Low voltage	1.68%	0	8.77%	118
Paocheng technology co., LTD	18	41.64	10.27	Software & Computer Services	5.29%	1	5.28%	29
Newera science and technology co., LTD	18	36.43	10.13	Computer service	2.16%	1	6.24%	92
Wins Tiancheng network co., LTD	18	28.14	9.87	NIS	4.84%	1	6.90%	73
YITENG electronics co., LTD	18	34.98	10.09	Electronic Manufacture	14.64%	1	7.93%	55
Datang telecom technology co., LTD	18	50.02	10.45	Communication	3.26%	1	11.26%	315
Beijing Join-Cheer Software Co.,Ltd.)	19	12.73	9.08	Software service	7.76%	1	4.58%	21
Beijing tiantan biological products co., LTD	19	24.98	9.75	Bio-manufacturing	3.77%	0	5.31%	20
Sail technology co., LTD	19	33.73	10.06	Computer service	1.86%	1	6.28%	63
Yuanto intelligent control co., LTD	19	21.97	9.63	Low voltage	1.61%	0	8.76%	152

Naruto technology co., LTD	19	63.08	8	10.6	Computer service	2.89%	1	11.43%	197
YIKO biological products co., LTD	20	33.94	6	10.0	Bio-manufacturing	3.28%	0	3.51%	14
Allied network technology co., LTD	20	17.69		9.41	Computer service	2.86%	0	3.54%	17
RUITAI MATERIALS TECHNOLOGY CO. LTD	20	29.39		9.92	Software service	4.36%	1	3.76%	29
Changyang energy co., LTD	20	31.81	0	10.0	Energy industry	0.21%	1	4.07%	31
DOYEN Company	20	63.08	8	10.6	Manufacturing	3.46%	1	4.79%	15
Being wind power technology co., LTD	20	33.56	5	10.0	New energy	17.12%	1	5.07%	27
Wu Group building materials co., LTD	20	14.27		9.19	Construction industry	2.41%	0	5.16%	32
LUO ER technology co., LTD	20	35.56	1	10.1	Software service	5.63%	1	5.27%	32
Beijing north latitude communication technology co., LTD	20	22.70		9.66	Communication	5.87%	1	6.02%	45
Gen win technology co., LTD	20	49.59	4	10.4	Software service	6.31%	1	6.06%	38
MingHong software co., LTD	21	36.85	4	10.1	Software service	7.35%	1	4.22%	5
Beijing hi-tech biological co., LTD	21	17.18		9.38	New Tech & Bio-pharmacy	13.18%	1	4.47%	12
Lobo technology co., LTD	21	31.07		9.97	Software service	4.41%	1	5.26%	26
DADAelectronic technology co., LTD	21	46.84	8	10.3	Electronics	2.46%	1	5.61%	27
Beijing Dynamic Power Corporation Limited	21	35.59	1	10.1	Energy industry	1.34%	0	6.36%	88
Beijing source gen electronics co., LTD	21	43.28	0	10.3	Electronics	13.54%	1	7.94%	42

Beijing world energy co., LTD	22	39.95	2	10.2	Energy industry	0.19%	1	5.08%	23
Fly science and technology co., LTD	22	33.75	6	10.0	Software	3.86%	1	6.26%	50
Green Line technology co., LTD	22	20.46		9.56	ITS	4.12%	1	6.80%	63
Beijing PMP communication technology group co., LTD	22	33.91	6	10.0	Communication	1.82%	1	8.67%	99
ZhiYing intelligent control co., LTD	22	16.82		9.36	Low voltage	1.56%	0	8.75%	123
Strong science and technology co., LTD	22	33.94	6	10.0	Computer service & Software service	2.64%	1	12.23%	110
Vying energy co., LTD	23	83.11	6	10.9	Energy industry	5.59%	1	3.73%	22
Beijing vision technology co., LTD	23	50.53	6	10.4	Computer service	0.00%	0	4.42%	9
Beijing Wu Shi technology co., LTD	23	32.67	2	10.0	Software service	8.37%	1	5.30%	31
Silica material technology co., LTD	23	25.80		9.79	Manufacturing	0.00%	0	5.87%	14
Linktone Ltd	23	20.67		9.57	Communication	1.35%	0	6.32%	47
Radar technology co., LTD	23	31.05		9.97	Software service	5.46%	1	9.27%	182
Beijing Gauge co., LTD	24	18.53		9.46	Software service	3.38%	1	3.74%	11
Beijing Xing Ri energy co., LTD	24	43.21	0	10.3	Energy industry	0.12%	1	4.08%	20
Geewong technology co., LTD	24	34.05	6	10.0	IT	3.16%	1	6.25%	53
BGE ENV-Tech	24	10.97		8.93	EPI	4.29%	1	6.26%	36
China National Medicines Corporation Ltd	24	17.85		9.42	Pharmaceutical manufacturing	0.00%	0	7.25%	45
Hengtong telecom technology co., LTD	24	33.57	5	10.0	Communication	2.56%	1	11.23%	248

Dyne biological products co., LTD	25	45.98	6	10.3	Biopharmaceuti cal	2.17%	0	3.59%	10
Stone software co., LTD	25	14.11		9.18	Software service	2.62%	1	4.38%	11
Jin Zhi composite materials co., LTD	25	63.08	8	10.6	Manufacturing	7.12%	1	4.78%	9
China Transinfo Technology Co., Ltd	25	13.74		9.16	Computer service & Software service	7.16%	1	5.10%	18
All technology co., LTD	25	36.21	3	10.1	Software service	5.51%	1	5.25%	22
JZDD biological technology group co., LTD	25	5.78		8.29	New Tech	5.98%	1	5.53%	26
Auspicious feng technology co., LTD	26	35.19	0	10.1	Technical service	6.45%	1	3.16%	19
Net Cross co., LTD	26	18.15		9.44	IT	2.53%	0	3.81%	7
China software and Technical service co., LTD	26	5.08		8.16	Software & Information technical service	6.69%	1	4.70%	18
LuHeng materials co., LTD	26	9.25		8.76	Manufacturing	3.24%	1	7.56%	110
Boomberg Tech	26	7.21		8.51	Technical service	5.41%	1	9.27%	195