

The Venture Capital Investments and the Firms' Patenting Performance

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Abstract: In the western countries, venture capital has been proven by many scholars to have positive impact in stimulating the new-high technology innovation and invention. The venture capital industry in China has developed rapidly in recent years. But there is a little effective empirical research about VCs' contribution to the technology performance of venture firms. This paper builds the OLS regression models combined with the explanatory dummy variable *vcpe* (whether the firms have venture-backing), and the regression results show that compared to the firms without venture backing, those venture backed firms applied more in the number of invention patents by 31.9% and more in the sum of invention patents and utility models numbers by 45.3%.

Introduction

Venture capital is generally defined as "the professional investor" targeting in making strategic equity investments in ventures with big prospects and growing potentials[1]. The world's first venture capital firm founded in 1946 in America, which marks VC into a mature organization and institutionalization stage. Venture capital industry has changed the way of technological innovation in American, which greatly promoted the sustained US economic growth. VCs started in the 1990s in China[2]. It has gradually embarked on the development track after those years. The progressing in the technological innovation can promote the whole economic structure upgrading and enhance the industry competitiveness[3-5]. From the micro level, those high-tech enterprises who receive venture capital support will be further improved of their internal governance, and business ability has also been further enhanced to truly help improve business performance[6]. So with our China's sustained rapid economic growth, venture capital will continue to maintain rapid growth, and it will create greater technical and economic value in future. Related research on Venture capital has been developed fast now. Venture capital investments in start-ups generally 3-5 years after exiting, which certainly calls for high expectation of a huge return on investment to bear the investment risk, and these tendencies may keep companies from investing in long-term technology development activities. Meanwhile, Foreign and domestic researches on "the effect of venture capital on technology innovation" did not get the same conclusion until now. The conventional wisdoms hold that the venture capital investment can spur innovation in the following aspects: first, the financial support from VC can greatly alleviate the financial constraints for the start-up firms to implement the technology inventions[7-8]; secondly the monitoring incentive of VCs can prevent the entrepreneurial firms to hazard risks[9]; thirdly the extra financial value-adding services of VCs such as the advisory and networking etc. can help the venture firms establish the marketing channels of the technology innovation outcomes and products quickly and effectively[10-12]. On the contrary, some literatures have also proven the insignificant or negative role of VC investments. Due to the incentive of make the exit the investments as soon as possible, the VC investments

usually invest in the traditional industries with average technological performance but great potential prospect. In this case, the purpose of VC investments does not focus on the technology innovation progress but the fast IPO process. Moreover, some corporate Venture Capital firms have the motivation to steal from the core technology of the funded firms, in order to promote its own technological competitiveness. We learn from both theoretical and empirical research that the ultimate conclusion is different when selected angle, samples and other indicators are different. We still need more effective mathematical derivation and empirical research about the impact of VC on company technology innovation. So on the basis of our predecessors; we make some explorations of those.

The Empirical analysis

With the intensification of market competition, technological innovation has become an important weapon of high-tech enterprises to grow [10]. VCs tend to invest in high-tech business. And technical innovation has characteristics of high-risk with high-return and high-potential gains. At the same time, venture capital has "screening" effect to high-tech enterprises [11]. VCs not only provide funds, but also offers non-capital value-added services [12]. This paper tries to estimate the function mechanism of VC in the new economy of China's context.

Research data and variables. Since the opening of GEM in 2009, it has become the main exit channel for the VC investments. In fact there are more than 322 companies (excluding st shares, the delisted companies and other firms with unclear property) listed on the GEM board by June 30, 2014, with 245 of them are backed by VC firms. The financial data of our sample firms are from WIND database, and the detailed information of VC backing is from the Zero2ipo database and the patenting data of firms are collected from the database of the State Patent Office website. In China, the patents applications are mainly classified into three categories: invention patents, utility models, industrial design. While in order to reflect the technological performance of the firms, the dependent variables are measured by the number of invention patent (indexed by $lnpat$) and the total number of patents of both invention patents and utility modes (indexed by $lnpatent$) respectively in model 1-4.

Table 1 shows about the definition of keys variables in regression models.

Table 1 the definition of variables

Variables	Definition
$lnpatent$	The logarithm of total number of patent applied by the listed firms before listing on Shenzhen GEM, including the both invention or utility patents
$lnpat$	The logarithm of total number of invention patents applied by the listed firms before listing on Shenzhen GEM
$vcpe$	Which equals to 1, if the firm is VC backed, 0 otherwise
$lnsize$	The logarithm of total assets of firms
rd	Ratio of R&D expenditure to the revenue
lev	Asset-liability ratio
$\Sigma Inddummy$	Here we set up 12 dummies to represent for 13 different industries of listed firms
$\Sigma Yeardummy$	Here we set up 4 dummies to represent for 5 different listing years of listed firms
$\Sigma Provincedummy$	Here we set up 27 dummies to represent for 28 different provinces of listed firms

Empirical research and analysis. As shown in Table 2, the dependent variables in model 1 and 2 are $lnpat$, which measures the number of invention patents applied by the firms. Meanwhile as shown in table 3, the dependent variable $lnpatent$ in models 3 and 4 represent the number of both invention and utility patents applied by firms. In model 1, the coefficient of $vcpe$ is 0.614 and also

significantly positive at the level of 0.01, which reflects that the VC backed firms applied more patents than non-VC backed firms by 61.4% on the average. After the R&D investment, firm size, the industry, location etc. were controlled, the coefficient of vcpe in model 2 is still positive (at the significance level of 0.1), but reduced into 0.319, which reflects that the VC backed firms applied more patents than non-VC backed firms by 31.9% on the average. In model 3, the coefficient of vcpe is 0.755 and also significantly positive at the level of 0.01, which reflects that the VC backed firms applied more patents than non-VC backed firms by 75.5% on the average. After the control variables were introduced, the coefficient of vcpe in model 4 is still positive (at the significance level of 0.01), but reduced into 0.453, which reflects that the VC backed firms applied more patents than non-VC backed firms by 45.3% on the average. To sum up, the significant positive coefficients of explanatory variable vcpe in model 1-4 reflect that generally the firms with VC backing have more patents than firms without VC backing.

Table 2 VC's participation and the number of invention patents

	-1 lnpat	-2 lnpat
vcpe	0.614***	0.319**
	-3.85	-1.86
rd		0.13
		-0.21
lev		-0.022
		(-1.08)
lnsize		0.262***
		-2.61
_cons	1.774***	-4.416***
	-12.76	(-2.10)
Σ Inddummy	Y	Y
Σ Yeardummy	Y	Y
Σ Provincedummy	Y	Y
N	322	322

Note: ***means significant at 5%level, **means significant at 10% level, * means significant at 20%.

Conclusion

Through empirical analysis above, this paper finds that: there is significant positive correlation between the innovation ability and VC's participation. In China, the VC market has started lately and the market operation mechanism is not perfect. First, venture capital market information is opaque, the platform of communication between the VCs and enterprises should be improved, so that the selection between the two parts will be more efficient and have less costs[13]. Second, the leading mechanism of venture investment market itself needs to improve. VCs can't make sure high investment return expectations, so that they just lack the motivation to invest in high tech firms. Therefore, it is more urgent to improve the external institutional environment of VC market and especially promote the foreign and private VCs to better perform the value-adding effect on the technology innovation of entrepreneurial firms, with preferable tax policies and state guidance funding.

Table 3 VC's participation and the sum of invention patents and utility models

	-3	-4
	Inpatent	Inpatent
vcpe	0.755***	0.453***
	-4.77	-2.75
rd		0.151
		-0.25
lev		-0.017
		(-0.84)
lnsize		0.228***
		-2.31
_cons	2.179***	-3.546**
	-15.79	(-1.72)
Σ Inddummy	Y	Y
Σ Yeardummy	Y	Y
Σ Provincedummy	Y	Y
N	322	322

Note: ***means significant at 5%level, **means significant at 10% level, * means significant at 20%.

References

- [1] Ughetto E. Assessing the Contribution to Innovation of Private Equity Investors: A Study on European Buyouts[J] . Research Policy,2010,39(1):126—140.
- [2] Long Yong, Liu Yu-hao. An Empirical Study on Non-financial Value-added Services of Venture Capital and High-tech Enterprises' Technological Capacity[J] . Science & Technology Progress and Policy, 2013, 30(3): 63-67.
- [3] Amit R, Glosten L, Muller E. Challenges to theory development in entrepreneurship research[J]. Journal of Management Studies, 1993, 30(5): 815-834.
- [4] Long Yong, Wang Lu-ge. Study on the relationship between non capital value-added services of venture capital and technological innovation performance [J]. Science & Technology Progress and Policy, 2010(13):13—16.
- [5] Zhang Xue-yong, Liao Li. VCs' Backgrounds ,IPO Underpricing and Post-IPO Performance [J]. Economic Research Journal,2011.6.
- [6] Lerner J. When bureaucrats meet entrepreneurs: the design of effective public venture Capital Programs[J] .Economic Journal,2002,112:73—84.
- [7] Ni H, Luan T, Cao Y, et al. Can venture capital trigger innovation ? New evidence from China[J]. INTERNATIONAL JOURNAL OF TECHNOLOGY MANAGEMENT, 2014,65(1-4SI):189-214.
- [8] Alalwany H, Koshak N, Ibrahim M. Supporting Innovation and Entrepreneurship: Reflections on Two Case Studies From US and UK Universities[M]//Galbraith B. Proceedings of the European Conference on Entrepreneurship and

Innovation. 2014:9-17.

- [9] Srinivasan S, Barchas I, Gorenberg M, et al. Venture Capital: Fueling the Innovation Economy[J]. COMPUTER, 2014,47(8):40-47.
- [10] Rossi M. The role of venture capital funds in financing innovation in Italy. Constraints and challenges for innovative small firms[J]. International Journal of Globalisation and Small Business, 2015,7(2):162-180.
- [11] Dutta S, Folta T B. A comparison of the effect of angels and venture capitalists on innovation and value creation[J]. JOURNAL OF BUSINESS VENTURING, 2016, 31(1):39-54.
- [12] Wadhwa A, Phelps C, Kotha S. Corporate venture capital portfolios and firm innovation[J]. JOURNAL OF BUSINESS VENTURING, 2016,31(1):95-112.
- [13] Chen Wei. The Mechanism Analysis and Empirical Study on the Impact of the Source of Venture Capital on Technology Innovation of Venture Enterprises[J] Journal of Business Economics, 9(263),2013.9.