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Investment Performance and Venture Capital Networks in Transitional Economics

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Abstract: Transitional economics are in the process of institutional change and improvement. So, uncertainties in the system environment bring greater risk and instability to venture investment. However, superior network cooperation relations can achieve complementariness to resources of institutions in venture capital. Thus it is favorable for transmission of internal information. Moreover, it helps to overcome the adverse effect caused by the instability of system environment. 1593 Chinese start-ups invested by venture capital firms in 1989~2012 were adopted as the study sample. And 7151 venture capital events were used to construct a panel data model, proving the important role in the Transitional economics of venture capital firms network position on investment performance.

Key words: Venture capital, social network, performance, Transitional economics

INTRODUCTION

Many scholars crown venture capital (hereinafter referred to as "VC") as "the engine of economic growth" (Yao *et al*., 2011). Because VC firms will use professional knowledge to find high-quality entrepreneurial enterprises and help their growth by investment (Large and Muegge, 2008; Fitza *et al*., 2009; Hochberg *et al*., 2007, 2010). VC has the economic characteristics of externality. As a long-term equity investment in start-ups, it is of high risk, low liquidity, diseconomies of scale. Therefore, it will lead to high transaction cost in the course of its operation in the market. Reasonable and optimized system can save the transaction costs so as to improve the allocation of resources (North, 2012). However, the system is in the process of changing and improving in the transitional economy. It further increases the risk of VC. The social network theory built a bridge between macro and micro behavior study (Granovetter, 1973). In addition to passively accepting the system, the enterprise can also expand invisible boundary against this background. They can reduce transaction costs and improve their performance by cooperation network. Network development is a prominent feature of the VC industry (Hochberg *et al*., 2007). Every VC firms will actively or passively engage in the network development. They will use network to seek investment opportunities, sharing investment risk and to maximize enterprise value and their performance (Hochberg *et al*., 2007; Abell and Nisar, 2007; Ewens, 2010; Zhou and Song, 2012). In recent years, many scholars have studied the effects of VC network on investment performance in developed countries. However, few of them studied it in the Transitional economics.

VC firms investing in the Transitional economics with the institutional changing will have to face more uncertainties. Based on social network theory and by using 1593 Chinese start-ups invested by VC firms in 1989~2012 and 7151 VC events as the study sample, the important role of VC networks in the Transitional economics on investment performance is proved. Research results show that the more cooperation among the investment institutions in the network, the higher investment performance they will have; the better mediating capability of VC firms, the better ability to control others. If VC firms have stronger influence in the network, they are likely to have better investment performance.

THEORETICAL ANALYSIS

Networks are widespread in many financial markets (Ljungqvist *et al*., 2005; Hochberg *et al*., 2007, 2010). A prominent feature of the VC industry is their networks. Moreover, VC firms tend to invest in syndicate (Lerner, 1994; Hochberg *et al*., 2007). Venture investment can establish a syndicated network to sharing innovation, technology, personnel and other resources. In this way, they respond to the venture investment's uncertainty better (Bygrave, 1987). Furthermore, the position of VC firms in networks is very important in the Transitional economics (Ahlstrom and Bruton, 2006).

The theory of social network referred to resource view theory for its analysis method and the analysis frame. Concepts such as network resource network capability were proposed. (Ritter and Gemunden, 2003; Hagedoorn *et al*., 2006). The theory explained the source of competitive advantage and sustainability of the

enterprise in network environment. Different positions of VC firms in the venture investment network mean their different abilities to obtain network source. Therefore, VC firms can form four types of network source in the cooperation network. The first one is the share of human capital. Different VC firms have advantages in different areas of investment, including district, industry and investment stage. Human capital can be shared between the VC firms by establishing the network relations of cooperation (Bygrave, 1987). Moreover, human capital sharing would use all resources to analyze the future of the investment projects (Hochberg *et al*., 2007). The second one is the share of social capital. VC firms typically have some long-term cooperation with mutual trust to the external stakeholders as partners, including government officials, lawyers, accountants, investment banks, large institutions, university and so on. And this kind of trust can be passed on through the network so as to realize the sharing of social capital between VC firms (De Carvalho *et al*., 2008). The third one is the share of information resources. High qualities of entrepreneurial projects are scarce resources to the VC firms. Investment institutions may exchange good investment opportunities through venture investment network. Therefore, the network can be an important source of venture enterprise information (Bygrave, 1987). The fourth one is the share of fund pool. When the enterprise needs substantial financial support in their rapid growth, they can acquire financial support from partners through the trust mechanism in the network. If those enterprises are VC firms with high quality network position, they can acquire financial support faster and more easily. All these resources will help the VC firms get mutual support. So, enterprises can overcome uncertainty in the process of economic transformation and achieve better performance. In addition, VC is not all about venture investment, it also include the post management of its investment so as to provide value-added services for enterprises. Using social capital accumulated by the VC firms in the network can drive service providers to provide services and help to the enterprises (Hochberg *et al*., 2007). Reputation, intangible assets of enterprises and inspection and certification of enterprises are passed on through the network. In this way, relationship network formed in long-term cooperation with the stakeholders can provide promotional activities and negotiation for the enterprise in business transaction (Large and Muegge, 2008). These are the venture investment mechanism of post investment management. They are also highly valued content when enterprise gets VC. The increases of enterprise value reflect the good investment performance of investment institutions.

Therefore, high quality positions of VC firms in the venture investment network can bring more network resources. And those positions are helpful to the increase of enterprise value, ultimately enabling them to successfully exit venture enterprises and obtain higher investment performance.

RESEARCH DISIGN

Sample and data: Data analyzed in this research were mainly obtained from the CVsource database of China Venture group. And the missing data were added from Zero2IPO database. Data sources of the financial market were obtained from China financial database in Wind database.

Social network analysis was adopted to build the VC network, with UCINET6.289 software being used to calculate indicators related to the network and Network diagram drawn by Netdraw2.097 Software. And Stata12.0 software was used to process statistical analysis.

In this study, VC firms that invested start-ups in China before December 31, 2012 were adopted as the research sample. Imbalance panel data regression model was built by using data of per year as the study point. And the effect of network position on the investment performance was tested. Sample data include a total of 7151 VC events of 5069 start-ups funded by 1593 VC firms. 455 events were excluded due to missing data. Finally, 6696 VC events and 10841 relations (ties) were collected. Among them, 26.146% of the events were funded by syndication. And 38.651% of the start-ups were funded by syndication.

The occurrence time of VC events is the time for investment data measurement. The period covers 1st January 1989 to 31st December 2008. The period used to measure performance of VC events data was before January 25th 2013. In this way, the period between January 1st 2009 and January 25th 2013 is the time for observing performance of investment events happened before December 31st 2008. Table 1 shows the exit mode and time of VC firms in chinese market.

Data before the period December 31st 2012 were used to build China VC networks. Hochberg *et al*. (2007, 2010)

Table 1: VC firms exit period in China before January 25, 2013

	Exit period (day)		
Exit mode	Mean	Std. Dev.	Freq.
M and A	1199.75	875.60	454
Open market holdings	1724.58	739.72	695
Writes off	1108.11	684.90	36
IPO	988.24	712.76	1281
Trade resell	1157.00	1036.65	78
cash bonus	1398.15	795.15	789
Total	1272.87	819.40	3333

method was adopted in this study to construct annual directed and undirected network diagrams. And the positions of VC firms are described in the diagram. Annual network is built by using joint investment relationships in the past 5 years. Actors in the network are VC firms. And ties refers to the joint investment of VC firms (Hochberg *et al*., 2007, 2010; Abell and Nisar, 2007; Meuleman *et al*., 2009; Ewens, 2010). Since, the VC events occurred before 1996 were too less, the VC network in 1996 consists of 50 VC events involving 29 VC firms from 1989-1996. From 1997-2012, we construct a new network for each year t, using data on syndications from the 5 years ending in t. We construct the directed network and undirected networks every year. Directed network is mainly used to distinguish the leader from co-investors in each funded round of a start-up in VC network. Joint venture relationships refer to co-investment relationship in the same round of investment. The arrows of the ties are from the leader to co-investors. The leader refers to the VC firm invested the most capital in this round. The rest of that round is co-investors. The relationships in undirected network refer to syndicate relations of the VC firms that invest the same start-up in the network, without distinction between investment rounds (Fig. 1 and 2).

Variable measurement: The main frame model were selected from Hochberg *et al*. (2007) and Nahata (2008) method. Their research results of the VC performance were adopted as control variables such as the experience of VC firms, investment risk, VC industry investment opportunities and competition. A panel data model the study was constructed is focusing on the effects of network position on investment performance.

Dependent variables: The dependent variable is the VC firms' performance. The performance was measured by annual successful exit rate of VC firms. For example, VC firms invested start-ups in quantity n in the t year. The investment performance of VC firms in the t year is the proportion of the ventures which VC firms exited by an IPO or a sale to another company (M and A) before January 25, 2013. If enterprises are getting continued investment ,it means successful exit also. Hochberg *et al*. (2007), Abell and Nisar (2007), Zarutskie (2008), Nahata (2008) and Ljungqvist *et al*. (2005).

Explanatory variables: Network position. With regard to the measurement on network position of VC firms, (Hochberg *et al*., 2007; Abell and Nisar, 2007) methods were used with five centrality indexes from different various perspectives.

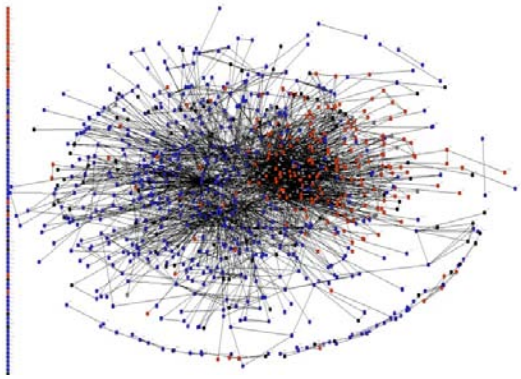

Fig. 1: Network of VC firms in China, 2007-2011, red dots are Chinese nature VC firms, blue dots are foreign VC firms

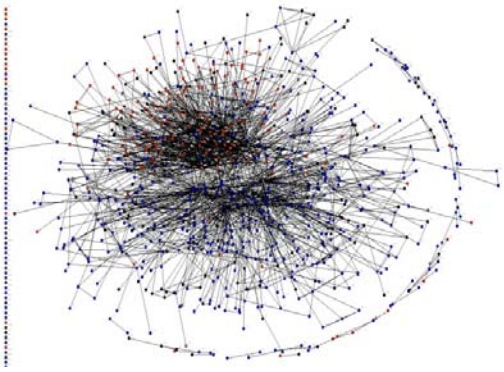

Fig. 2: Network of VC firms in China, 2008-2012, red dots are Chinese nature VC firms, blue dots are Foreign VC firms

In order to make networks of different sizes comparable, all five network measures are standardized (Freeman, 1979). Five centrality indexes from different perspectives to measure the same VC firm on the network will produce multicollinearity. So they will be introduced in five different models to analyze.

Degree centrality refers to the number of VC firms that had direct cooperation with the VC firm in five years on the network. The greater the degree of centrality, the more resources and information VC firm have on the network and the higher status VC organization has on the network. The degree centrality is also known as the local centrality (Nieminen, 1974). Freeman (1979) put forward with the concept of Normalised degree centrality in order to compare the different sizes of network degree centrality. It refers to the proportion of definite degree centrality to the maximum possible degree centrality in the network. Formula refers to (1):

$$C_{Rdi} = \frac{\sum_{j} p_{ij}}{n-1} \quad (1)$$

Out-degree counts the number of other VC firms a VC firm has invited into its own syndicates. It measures a VC firm's ability to generate future coinvestment opportunities by inviting others into its syndicates today. In-degree refers to the times that a VC firm is invited to coinvest in other VC firm's deals (Hochberg *et al*., 2007). The calculation formula of standardized index refers to (2), (3):

$$C_{Routdi} = \frac{\sum_{j} p_{i\to j}}{2(n-1)} \quad (2)$$

$$C_{Rindi} = \frac{\sum_{j} p_{i\leftarrow j}}{2(n-1)} \quad (3)$$

Betweenness centrality views a VC firm as being in a favored position to the extent that the VC firm falls on the geodesic paths between other pairs of VCs in the network. It also refers to the extent to which VC firms' ability to control others (Marsden, 1982). Freeman (1979) adopted Betweenness Centrality to measure the degree of a VC firm on controlling resources. He believed that if a point is always on others shortest route, it has a high betweenness centrality. Higher betweenness centrality leads to the stronger dependence of the other points on this point. So, this point is "structural holes" and has stronger ability to control others on the network (Freeman, 1979; Burt, 1992). The calculation formula of normalized betweenness centrality refers to (4):

$$C_{Rbi} = \frac{2\sum_{j}\sum_{k} b_{jk}(i)}{n^2 - 3n + 2} \quad (4)$$

Closeness centrality refers to the proximity degree of a point to the other points on the network. Provided that the degree of centrality refers to the number of direct correlation a VC organization has, betweenness centrality degree may refer to controlling capabilities of a VC company on the network. And closeness centrality refers to ability of investment institutions to resist control (Hochberg *et al*., 2007). The point that is closer to all other points in the network has stronger influence. The calculation formula of normalized closeness centrality refers to (5):

$$C_{Rci} = \frac{\sum_{j} (d_{max} - d_{ij})}{(n-1)} \quad (5)$$

Control variables: Other than the explanatory variables indicating VC firm's experience, investment risk, competition for deal flow and investment opportunities, we also needed to control them in our model.

The model: In order to test the influence of network position on investment performance, a general model of panel data was constructed to test the research:

$$Performance_{it} = \alpha + \beta Centrality_{it} + \sum_{j=1}^{k} \gamma_i Control_{jit} + \varepsilon_{it} \quad (6)$$

The dependent variable $Performance_{it}$ represents the investment performance of NO.i VC firm in the t year. It is expressed by the firm's successful exit rate of all investment business in the t year. Explanatory variable $_{Centrality}$ represent the network position of NO.i VC firm in the t year. It is measured from five network centrality indicators: the normalized degree centrality, normalized out-degree centrality, normalized in-degree centrality, normalized closeness centrality and normalized betweenness centrality $_{control}$. represents a control variable while ε represents the random error term. α, β, γ represent parameters to be estimated.

In this study, the appropriate regression test was chosen from the models of mixing panel regression, variable intercept panel regression with fixed effect and variable intercept panel regression with random effect in following steps.

First of all, a choice need to be made between mixing panel regression and variable intercept panel regression with fixed effect. Variable intercept panel regression with fixed effect model was adopted to run the regression test. And F test was adopted to test the return results. The null hypothesis tested is: the constant term of different VC firms are equal. The reject of null hypothesis means variable intercept panel regression with fixed effect should be chosen.

Secondly, the random effects panel regression need to be compared with the variable intercept panel regression with fixed effect model. LM test was applied to the random effects model regression results, testing the null hypothesis: Vai (v_i) = 0. If the null hypothesis is rejected, there should be a disturbance reflecting the individual characteristics in the original model, variable intercept panel regression with random effects model should be chosen.

Finally, the Hausman test (Hausman, 1978) was applied to judge whether to use a fixed effects model or random effects model. Hansman test was applied to test the null hypothesis: Additional orthogonality condition imposed by the estimator obtained by random effects

model is effective. If the Regressor and individual effects of VC firms are related, the fixed effects models remain the same. But the random effects model estimator is inconsistent. So, fixed effects model should be chosen. If the Regressor and individual effects of VC firms are not related, the fixed effects model still remains the same. So, the random effects model estimator is consistent and effective and thus should be chosen (Baltagi, 2011).

REGRESSION RESULTS

Descriptive statistics of variables: The descriptive statistics of the variables are shown in Table 2. Results show that on the Chinese VC market: (1) The successful exit rate of VCs in China is 58.8%. It have a relatively high rate of successful exits. And different VC's successful exiting rates vary widely. From IPO number it can be seen that more than half of VC firms have never exited through IPO, while VC firms with good performance exited through IPO up to 17 times a year; (2) the experience of China's VC firms investing in venture enterprise is obviously insufficient. Analyzing from the view of number of days after the first investment it is found that the U.S. VC is 1,701 days (Hochberg *et al*., 2007) while China's are 923.4 days and Analyzing from the view of investment rounds it is found that China's are 6.6 times while The United States VC are 76.6 times, (3) Analyzing from the view of three indicators measuring investment risk it is found that there is little differences between China's VC and VC investment in the United States. Time of venture investments is both four years and more. And most enterprises are in development and expansion, (4) The network centrality index of VC firms in China is far less than the United States (Hochberg *et al*., 2007). For example, the mean of standard degree centrality is 0.113% in China, while 4.237% in the U.S., (5) analyzing VC competition from the view of average annual inflow of VC funds in the industry it is found that the inflow of China is $ 8494.38 million while U.S. $23,842 (Hochberg *et al*., 2007). the U.S. VC funds are ample but much more competitive than China's, (6) analyzing from the view of investment opportunities it is found that price-earnings ratio of China's secondary securities market is 28.087 times. It proves that investment opportunities of China are much more than that of the United States (according to Hochberg, average price-earnings ratio of the United States is 16.4). And the standard deviation of China's average price-earnings ratio (14.5) is also much larger than the United States (3.7). It shows that China is a rapidly growing emerging country with many investment opportunities and certain risks.

Regression analysis of panel data: The above-mentioned methods were adopted to find the most suitable model for panel data-random effect regression model. The results are shown in Table 3 and 4.

Table 3 shows that the random effects model is the most appropriate model for this study. Table 4 illustrates the effect of network variables on performance. It is found that network variables have a significant positive impact

Table 2: Descriptive statistics of variables

	Obs.	Mean	Std.	Min.	Median	Max.
Panel A:						
Investment performance						
Successful exit rate(%)	2074	0.588	0.426	0	0.667	1
Dollar exit rate)%)	2048	0.595	0.437	0	0.793	1
No. of IPO	2075	0.630	1.061	0	0	17
No. of M and A	2075	0.590	1.223	0	0	15
VC firm's experience						
No. of rounds VC has participated in sofar	2076	6.599	12.529	1	3	243
Days since VC first imvestment	2075	923.412	1154.626	0	450.290	5996
Investment risk						
Venture age	2005	1641.673	1465.711	0	1375.500	9243
No. of rounds venture have been invested	2076	1.432	0.716	0	1	5
Venture stage	2068	2.113	0.710	0	2	4
Panel B:						
Venture capital network						
Normal outdegree (%)	6203	0.060	0.302	0	0	10.345
Normal indegree (%)	6203	0.060	0.234	0	0.008	6.897
Normal degree (%)	6203	0.113	0.426	0	0.013	7.432
Normal betweenness (%)	6203	0.208	0.781	0	0	13.066
Normal closeness (%)	6203	32.683	23.555	0	45.260	62.696
Competition for VC industry						
VC inflows in invest year (M$)	5674	8494.384	4088.025	83.750	9508.390	14167.700
Aggregate amount VC in maket (M$)	5674	3580.942	1948.130	2.240	3647.480	6637.720
Investment opportunities						
Average P/E ratio in invest year	6235	28.087	14.542	13.190	23.630	61.070
Average B/M ratio in invest year	6235	0.345	0.130	0.120	0.334	0.559

Table 3: Using hausman test to choose a random-effects model or fixed-effects model

	(1)	(2)	(3)	(4)	(5)	(6)
Chi2 (10)	7.18	13.28	9.31	9.14	7.27	11.42
P value	0.6186	0.2084	0.5029	0.5190	0.6993	0.3254
Panel model	random-effects	random-effects	random-effects	random-effects	random-effects	random-effects

Table 4: Random effects panel regression and LM test

	Successful exit rate					
Variables	(1)	(2)	(3)	(4)	(5)	(6)
VC firm's experience						
No. of rounds VC has participated in sofar	0.0002	-0.0000	0.0000	-0.0007	-0.0005	-0.0010
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)
Days since VC first imvestment	0.0790***	0.0885***	0.0798***	0.0819***	0.0777***	0.0781***
	(0.030)	(0.030)	(0.030)	(0.030)	(0.029)	(0.030)
Investment risk						
Venture age when had been invested	0.0531***	0.0526***	0.0500***	0.0487***	0.0555***	0.0511***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
No. of rounds venture have been invested	0.0990***	0.0875***	0.0977***	0.0959***	0.0860***	0.0997***
	(0.022)	(0.022)	(0.022)	(0.022)	(0.021)	(0.022)
Venture stage when had been invested	-0.0444	-0.0430	-0.0415	-0.0453	-0.0517	-0.0442
	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)
Competition for VC industry						
Aggregate amount VC in maket	-0.0494*	-0.0148	-0.0406	-0.0243	-0.0907***	-0.0412
	(0.028)	(0.029)	(0.028)	(0.028)	(0.028)	(0.028)
VC inflows in invest year	0.0244	0.0236	0.0331	0.0348	0.0148	0.0272
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
Investment opportunities						
Average P/E ratio in invest year	0.0002	0.0003	0.0003	0.0003	0.0004	0.0002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Network position						
Nrmdegree		0.1317***				
		(0.034)				
Nrmoutdeg			0.0718**			
			(0.036)			
Nrmindeg				0.1914***		
				(0.053)		
Ncloseness					0.0059***	
					(0.001)	
Nbetweenness						0.0305***
						(0.012)
Constant	0.8766***	0.6564***	0.7398***	0.6201***	1.0440***	0.7809***
	(0.222)	(0.226)	(0.227)	(0.229)	(0.225)	(0.225)
Observations	616	614	614	614	614	614
Number of VC	252	252	252	252	252	252
Chi2 (1) H0: Var (u)= 0	14.33	11.42	14.98	14.83	4.31	12.69
p-value H0: Var (u) = 0	0.0002	0.0007	0.0001	0.0001	0.0379	0.0004
Mixing panel model or the radom-effects model	radom-effects model	radom-effects model	radom-effects model	radom-effects model	radom-effects model	radom-effects model

(1): Standard errors in parentheses, (2): * p<0.1, **p<0.05, ***p<0.01

on the investment performance of VC firms by controlling variables such as VC investment experience, risk, industry competition and market opportunities. Six models are listed in Table 4. Model: (1) is a framework model of this study, testing various control variables. The results are mostly in line with theoretical expectations. The results show that the more investing experience, the greater the investment performance and the higher investment risk. And the greater the competition is in the industry, the worse investment performance is. Moreover, opportunities in investment market has no significant impact on investment performance because the development of secondary securities market in China started late with less maturity. The result is also related to ineffective reflection of earnings ratio on investment opportunities. Five network variables were successively added in Model 2-6. Every model shows that occupying high quality network position can significantly improve investment performance. So, assumption H is confirmed. Among five explanatory variables, the standardized closeness centrality affected the investment performance the most. For each more standard deviation on closeness centrality, successful exiting rate can be significantly increased by 13.898 points. This shows that the closer VC firms are to the other VC on the network, the stronger ability to resist control and the greater closeness on the

Table 5: Performance persistence test

	Successful exit rate					
Variables	(1)	(2)	(3)	(4)	(5)	(6)
VC firm's experience						
No. of rounds VC has participated in sofar	-0.0014	-0.0013	-0.0013	-0.0017	-0.0018	-0.0023
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Days since VC first imvestment	0.0398	0.0516	0.0468	0.0485	0.0415	0.0437
	(0.034)	(0.034)	(0.034)	(0.034)	(0.033)	(0.034)
Investment risk						
Venture age when had been invested	0.0519***	0.0510***	0.0489***	0.0514***	0.0557***	0.0487***
	(0.019)	(0.018)	(0.019)	(0.019)	(0.018)	(0.019)
No. of rounds venture have been invested	0.0768***	0.0684***	0.0776***	0.0741***	0.0681***	0.0797***
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
Venture stage when had been invested	0.0002	0.0012	0.0003	0.0029	-0.0179	-0.0029
	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)	(0.035)
Competition for VC industry						
Aggregate amount VC in maket	-0.0390	-0.0103	-0.0244	-0.0278	-0.0736**	-0.0258
	(0.031)	(0.032)	(0.032)	(0.031)	(0.031)	(0.031)
VC inflows in invest year	0.0158	0.0088	0.0165	0.0236	-0.0028	0.0107
	(0.027)	(0.027)	(0.027)	(0.027)	(0.026)	(0.027)
Investment opportunities						
Average P/E ratio in invest year	0.0006	0.0005	0.0006	0.0006	0.0006	0.0005
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Performance persistence						
A phase lag successful exit rate	0.0095	0.0047	0.0063	0.0026	-0.0234	0.0066
	(0.045)	(0.044)	(0.044)	(0.045)	(0.044)	(0.044)
Network position						
Nrmdegree		0.1317***				
		(0.034)				
Nrmoutdeg			0.0718**			
			(0.036)			
Nrmindeg				0.1914***		
				(0.053)		
Ncloseness					0.0059***	
					(0.001)	
Nbetweenness						0.0305***
						(0.012)
Constant	0.8766***	0.6564***	0.7398***	0.6201***	1.0440***	0.7809***
	(0.222)	(0.226)	(0.227)	(0.229)	(0.225)	(0.225)
Observations	616	614	614	614	614	614
Number of VC	252	252	252	252	252	252
Chi2(1) H0: Var(u) = 0	14.33	11.42	14.98	14.83	4.31	12.69
P value H0: Var(u) = 0	0.0002	0.0007	0.0001	0.0001	0.0379	0.0004
Mixing panel model or the radom-effects model	radom-effects model	radom-effects model	radom-effects model	radom-effects model	radom-effects model	radom-effects model

(1): Standard errors in parentheses, (2): *p<0.1, **p<0.05, ***p<0.01

network and investment performance is maximized. Secondly, with regard to the standardized degree centrality and standard in-degree centrality, if they increased by one standard deviation, successful exiting rate can be significantly increased by 5.61% points and 4.48% points respectively. That is to say, the more cooperation VC firms with others (degree), the more opportunities it is invited a joint venture (in-degree). And the performance of investment is significantly improved. With regard to the standard Betweenness Centrality and out-degree, if they increase by one standard deviation, successful exiting rate can be increased by 2.38 and 2.17%, respectively. It shows that the stronger ability of VC firms serving as "intermediary" or "bridge" to control network (Betweenness), the more the performance of investment will be improved. However, its economic impact is relatively weaker. In addition, the more invitation (out-degree) lead syndicates gives, the more chances of being invited. And indirect influence on the performance of investment may be greater, while the direct economic impact is relatively weaker.

Reverse causality and performance persistence: Whether significant impact of network variables on investment performance is reverse causality remains unknown. It is possible that a high exiting rate leads to advancement of VC network position instead of advancement of VC network position leading to a high exiting rate. We are using data that was collected five-year before the investment to measure network variables.And investment

performance is measured ten years or longer after the investment. So, it is only possible that the network variable affect investment performance and there is no reverse causality.

To further test whether network variables is an alternative to constancy of investment performance, lagged term of investment performance was added in the model for regression testing. Regression results of first-order lagged investment performance as the control variables are shown in Table 5.

Table 5 shows that lagged term of successful exiting rate has no significant effect on the current term successful exiting rate. It shows that the results shown in the model cannot prove constancy of venture investment in China. On the contrary, it can be proved from the model (2) to the model (6) that after controlling a possible constancy of investment performance. VC on the network variables still has a very significant impact on the investment performance. And it has the same economic impact on venture investment performance. Increases of standard deviation on closeness centrality can significantly improve investment performance-one standard deviation for 13.19% more on successful exiting rate. With regard to the degree of centrality, one standard deviation increase in degree centrality or the middle in-degree or out-degree lead to 2.15 -4.34% increases on investment performance. Thus, the effect of network variables on investment performance is not an alternative to constancy lacked in the model.

Further rubustness tests: Therefore, hypothesis H has been verified that the network position has a significant impact on the investment performance. And high-quality position leads to high investment performance. In order to test the stability of these results, explained variable in the empirical model such as successful exiting rates were replaced by capital-weighted successful exiting rates, IPO number and the number of mergers and acquisitions respectively. And empirical models were re-tested. Test results show that except when capital weighted successful exiting rate were adopted as the explained variable and network out-degree had no significant effect on the rate, the rest of the network variables had very significant effects on explanatory variables. Network out-degree represents times of invitation VC firms give to others for a joint investment as lead syndicates. The purpose of the invitation is usually expectation of good opportunity to a joint investment in the future, so it requires some time to reflect the value. The out-degree has relatively less impact on the investment performance when compared to the other network indexes based on the previous study. In general, the test results show that the significant effect of network position of the VC on investment performance has good stability.

CONCLUSION

Empirical analysis shows that high-quality network position of VC firms leads to high investment performance in Transitional economics. And more cooperation between investment institutions on the network leads to higher investment performance. Moreover, the better mediating capability of VC firms, the stronger they can control others and the higher the investment performance. However, their economic impact may be relatively weaker. In short, VC firms are likely to have better investment performance if they have stronger influence in the network. In addition, the more invitation (out-degree) lead syndicates gives, the more chances of being invited. And indirect influence on the performance of investment may be greater, while the direct economic impact is relatively weaker. Therefore, VC firms in Transitional economics should attach importance to the building of their network positions.

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