Bargaining power and project risk in Venture Capital investments

George Geronikolaou[a] and George Papachristou[b]

[a]Democritus University of Thrace, Dept. of Economics.
Email: gegeronik@hotmail.com
[b]Aristotle University of Thessaloniki, Dept. of Economics.
Email: gpapahr@econ.auth.gr

Abstract

This paper examines the link between Venture Capitalist competition and investment risk as a possible explanation of the differences in the Venture Capital activity among countries. In a double-sided moral hazard framework we model the effect of bargaining between risk neutral Venture Capitalists and risk averse entrepreneurs on the risk profile of the investees. The entrepreneurs' bargaining power is assumed to be directly determined by the number of Venture Capitalist financiers in the market and the implicit competition among them. We show that as the entrepreneurs' bargaining power increases, they enjoy higher rents which allow the Venture Capitalists to finance risky projects that they would otherwise avoid. The theoretical findings are then tested empirically using a European dataset of 22 countries for 2007-2012 where we find a positive effect of the number of investors on the magnitude of risky early stage Venture Capital investments.

Keywords: Venture Capital; bargaining power; investor competition; moral hazard
JEL codes: G24; L1

1. Introduction

Venture Capitalists (henceforth VCsts) are investors that provide equity to novel entrepreneurial activities, participating actively in the management of their investees. A number of papers have tested empirically the determinants that affect both the Venture Capital (henceforth VC) investment activity as well as the fundraising process (Gompers and Lerner, 1998; Jeng and Wells, 2000; Da Rin et al. 2006; Geronikolaou and Papachristou, 2011). Factors like the ease of liquidation through IPOs, the supply of funds from external investors such as pension funds, the extent of innovation activities such as patenting and R&D as well as macroeconomic factors like GDP and interest rates are included among the determinants. Market characteristics such as competition among VCsts have received scarce attention.

In this paper we argue that VCst competition, through its effect on the distribution of bargaining power between the entrepreneurs and the investors, may influence the contractual deal by diluting the VCsts' bargaining power or equivalently, by strengthening the entrepreneurs' position in the negotiations. The idea behind this is rather simple. A great number of incumbent VCsts offers the entrepreneurs the opportunity to approach many different investors and seek for the best deal by rejecting bad offers or by demanding more favorable contract terms. It is therefore expected that abundance of VCsts and the induced competition among them, gives the entrepreneurs a bargaining advantage over each individual investor. We show both theoretically and empirically that an increasing bargaining advantage of the entrepreneurs will allow for the financing of riskier investees.

The success of the bargaining between an entrepreneur and a VCst is not exclusively determined by the quality of the project or the size of the investment. The agreement includes a number of important elements such as the type of the provided securities, the allocation of cash-flow rights, liquidation rights and control rights (Kaplan and Stromberg, 2003). Particularly, the literature assumes that the control that the VCst will exert on the new project will be the outcome of negotiations and not simply determined by the VCst's financial contribution in the project. Kirilenko (2001) for example, shows that in order to alleviate potential adverse selection issues the VCst requires control rights disproportionally higher that his equity contribution. Hellman (1998) shows that the entrepreneur may even voluntarily resign some of his control rights when he is wealth-constraint. Marx (1998) shows that the optimal contract between a VCst and an entrepreneur is a debt-equity combination formed by the trade-off between the VCst's incentives to interfere actively in the management of the investee firm and the entrepreneur's loss of control.

Our theoretical model is a typical Venture Capital double-sided moral hazard model as in Kanniainen and Keuschnigg (2003, 2004), Casamatta (2003) and Repullo and Suarez (2004). All these papers assume that the success of the project depends on both the entrepreneur's and the VCst's non-contractible managerial efforts and consequently, a moral hazard problem arises from both parts of the deal. Our model differs from the previous theoretical literature in that we do not seek for the optimal financing instruments or portfolio size but we rather focus on the effect that bargaining power may have on the risk-profile of the invetsee. Our model is also related to Koskinen et al. (2014) who show that adverse selection considerations as well as the distribution of bargaining power between the VCst and the entrepreneur may affect the allocation of cash-flow rights or the tendency to overinvest in the project.

In our paper the risk averse entrepreneur has a minimum acceptable share on the project's return which is an increasing function of the risk neutral VCsts population. The minimum acceptable share is measuring the entrepreneur's bargaining power in the deal. The way we model bargaining is similar to assuming that the entrepreneurs are protected by a type of limited-liability constraint preventing very low proceeds. We show that a high enough minimum share induces rents for the entrepreneurs and given their risk aversion, riskier projects can be feasible as long as their participation constraint is not violated. Although the model does not directly refer to competition, it is assumed that the number of active VCsts is directly linked to the intensity of competition among them.

Our theoretical prediction is then tested empirically using a country level European dataset for 2007-2012. We test the hypothesis that the number of active VCsts in each country is positively related to the total size of risky investments. To do so we split VC investments to early stage and later stage VC. Early stage VC constitute by definition riskier investments since the respective investees are at the very early stage of their development, not established in their market yet. Controlling for a number of variables, we show that the count of active VCsts is a significant positive determinant of both early stage and later stage investments. However, the effect on later stage VC is unambiguously smaller indicating that the size of the VC market, as measured by the investor population, induces relatively more high-risk VC investments as compared to low risk VC.

2. The model

2.1. Setup

There is a continuum of risk averse entrepreneurs with a concave utility function *V*(.) and *N* risk neutral VCsts with a linear utility function *U*(.). Each entrepreneur is endowed with a project $\theta \in [\theta^L, \theta^H]$. All projects have the same expected return *R* distributed according to a continuous, twice differentiable function $F(R;\theta,e,a)$ with density $f(R;\theta,e,a)$ where *e* and *a* are the non-contractible efforts of the entrepreneur and VCst respectively. We assume that

$$\int_{R^L}^{R} F(R;\theta^{'},e,a) \leq \int_{R^L}^{R} F(R;\theta^{''},e,a) \quad \forall \theta^{''} \geq \theta^{'} \text{ and } R^L \leq R \leq R^H \tag{1}$$

that is, $\theta^{''}$ is a mean preserving spread of $\theta^{'}$ which implies that any risk averse agent prefers $\theta^{'}$ over $\theta^{''}$. Moreover, we assume that a greater effort by either the E or the VCst increases the project's return in the sense of first order stochastic dominance:

$$F_e(R;\theta,e,a) \leq 0 \text{ and } F_a(R;\theta,e,a) \leq 0 \tag{2}$$

where subscripts denote derivatives. Efforts are costly and we denote the corresponding costs with $c(e)$ and g(*a*) which are such that

$$c_e(e) > 0, g_a(a) > 0, c_{ee}(e) > 0, g_{aa}(a) > 0 \tag{3}$$

The timing of the game is as follows:

1: an entrepreneur E approaches one out of the *N* active VCsts and asks for financing

2: the VCst requires a share 1-*s* of the project's return in order to incur the investment cost *I*

3: after the deal is agreed, the VCst and the E choose simultaneously the lever of their efforts

4: the investment proceeds are realized and shared.

2.2 One VCst

Assume there is only one VCst in the market (N=1). The VCst faces the following maximization problem

$$\max_{s} \Pi^{VC} = \int_{R^L}^{R^H} U\big((1-s)R\big) f(R;\theta,e,a)dR - I - g(a) \tag{4}$$

s.t.

$$\Pi^{\mathrm{E}} = \int_{R^L}^{R^H} V(sR)\, f(R;\theta,e,a)dR - c(e) \geq 0 \tag{5}$$

$$a = \arg\max \int_{R^L}^{R^H} U\big((1-s)R\big) f(R;\theta,e,a)dR - g(a) \tag{6}$$

$$e = \arg\max \int_{R^L}^{R^H} V(sR)\, f(R;\theta,e,a)dR - c(e) \tag{7}$$

where (5) is the entrepreneur's participation constraint and (6) and (7) are the entrepreneur's and VCst's incentive compatibility constraints. The game is solved by backward induction. Optimal efforts a^* and e^* are given by the first order conditions of (5) and (6) that define a simultaneous move game:

$$\int_{R^L}^{R^H} U\big((1-s)R\big) f_a(R;e,a)dR - g_a(a) = 0 \tag{9}$$

$$\int_{R^L}^{R^H} V(sR)\, f_e(R;e,a)dR - c_e(e) = 0 \tag{10}$$

The second order conditions are also fulfilled if $F_{aa}(R;\theta,e,a) \geq 0$ and $F_{ee}(R;\theta,e,a) \geq 0$, commonly referred to by the principal-agent literature as the convexity of the distribution function conditions[1] (Hart and Holmstrom, 1987). Since the VCst's profits decrease with share s $(\partial\Pi^{VC}/\partial s < 0)$, constraint (5) will be binding. In other words, the VCst will offer the entrepreneur a share s^* that guarantees at least non-negative profits. Moreover s^* is an increasing function of project risk θ. By totally differentiating the entrepreneur's profit function (5), assuming that it binds and accounting for the envelope theorem for the effects of s and θ on profits through the efforts e^* and a^*, we get $\partial s^*/\partial\theta = -(\partial\Pi^{E}/\partial\theta)/(\partial\Pi^{E}/\partial s^*)$ which is positive because $\partial\Pi^{E}/\partial\theta < 0$ (due to risk aversion) and $\partial\Pi^{E}/\partial s^* > 0$.

Therefore, the VCst's profits are decreasing with project's risk because risk induces a higher share for the entrepreneur and consequently a smaller share for the VCst. The VCst thus, would always prefer to finance a project as safe as possible, in order to offer a small share s*.

2.3. VCst competition

Assume that there are N active VCsts in the market. We model the entrepreneurs bargaining power during the deal with a VCst by assuming that E demands a minimum share $s(N)$ of the project's surplus, such that $ds(N)/dN > 0$. Hence, an increase in the number of active financiers, rises the entrepreneur's bargaining power who demands a greater minimum share of the project he presents to a particular VCst. The VCst's maximization problem has the following additional constraint:

$$s \geq s(N) \tag{11}$$

Given that the VCst's profits fall with s, she will offer the smallest possible share and therefore constraint (11) will bind. Thus, the entrepreneur's participation constraint will be slack[2] and the entrepreneur will enjoy rents. Because the entrepreneur is risk averse, her rents decrease with θ meaning that entrepreneurs endowed with riskier

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[1] Integrating the left part of (9) by parts, together with $F_a(R^H;\theta,e,a) = 0$, we get:

$-U\left((1-s)R^L\right)F_a(R^L;e,a) - (1-s)\int_{R^L}^{R^H} U_R\left((1-s)R\right)F_a(R;e,a)dR - g_a(a)$ which is concave if

$F_{\alpha\alpha}(R;\theta,e,a) \geq 0$. Equivalently, for (10)

[2] We ignore the trivial case where the minimum acceptable share $s(N)$ is low enough, and the participation constraint (5) is binding and (11) is slack.

projects enjoy lower rents. Denote with θ^* the marginal feasible project that makes the participation constraint (5) binding implying that the risk neutral VCst is indifferent between financing any project $\theta \in [\theta^L, \theta^*]$. We pose the following proposition:

Proposition 1

The range feasible project $[\theta^L, \theta^*]$ is increasing in *N*, that is, $d\theta^*/dN > 0$.

Proof: a higher *N* will raise the entrepreneur's rents in (5) because $ds(N)/dN > 0$, and therefore riskier projects can be financed without violating the entrepreneur's participation constraint.

Proposition 1 states that as the number of VCsts increases, the range of projects that make the VCst indifferent rises by including even riskier investments. Therefore, the model predicts that an increasing bargaining power on the part of the entrepreneur, as induced by VCst competition, makes riskier projects equally attractive as safer investees.

3. Data and empirical methodology

The empirical approach consists in testing the theoretical prediction that VCst competition makes risky investments more attractive. Specifically, we evaluate the effect of the VCsts population on the financing of high-risk projects and compare the results with the respective effect on safer VC investments. We employ panel data for 22 European countries for the period 2007-2012. All data were retrieved from the European Venture Capital Association (EVCA). The number of VCsts can be assumed to be relatively constant for each country (given our small time interval). Thus, for each country we take the 2012 reported number of investors as the actual number of active VCsts in our sample. Table 1 presents some descriptive statistics.

Table 1
VC activity and Innovation in Europe (average values for 2007-2012)

	No of VCsts	Early VC*	Later VC*	Total VC*	New Funds Raised*	Patent Grants
Austria	17	36816.8	26126.49	62943.24	261.965	1221.2
Belgium	26	74250.5	45422.42	119673	66.367	546.1667

Bulgaria	2	1147.4	1771.838	2919.223	6.907	209
Czech	1	2793.3	14384.22	17177.53	3.008	1007
Denmark	23	69542.9	56094.6	125637.5	177.130	185.3333
Finland	20	63966.0	37173.95	101140	132.488	928.8333
France	71	326694.8	489434	816128.8	968.148	11079.5
Germany	132	417734.3	343151.2	760885.5	865.338	14368.5
Greece	5	6039.2	7836.225	13875.39	9.833	398
Hungary	10	16639.2	7818.158	24457.4	44.448	431.6667
Ireland	15	45301.5	28898.61	74200.12	83.695	273.8333
Italy	14	48286.5	38325.39	86611.86	52.107	10035.67
Luxemburg	5	3301.1	6590.358	9891.477	58.438	66.5
Netherlands	41	120480.1	87006.46	207486.6	262.847	2034.833
Norway	29	92229.0	65664.95	157893.9	221.520	1600
Poland	15	6604.7	14989.15	21593.84	7.427	3280.333
Portugal	10	27517.1	19290.82	46807.89	74.697	149.166
Romania	1	7327.2	8021.443	15348.62	0	552.5
Spain	73	80765.8	154605.6	235371.4	223.830	2641.833
Sweden	70	160410.7	129047	289457.7	212.080	1196.167
Switzerland	36	130269.7	72886.33	203156	555.670	676.1667
UK	132	434969.5	583094.2	1018064	877.543	6058.167

* in thousand €
Early VC = seed VC+start-up VC
Total VC = early VC+later VC

Early stage VC is the sum of seed and start-up investments which both comprise the financing of small firms at their very early stage of their development. Contrary, later stage investments are directed to firms that have already gone through their seed and start-up stages and seek to expand their activities (European Venture Capital Association). Therefore, early stage investments are by definition riskier than later stage ones. The former (latter), will be our empirical proxy of high-risk (low-risk) projects. We estimate the following linear model:

$$VC_{it} = c + b_1 N_i + b_2 GDP_{it} + b_3 Rate_{it} + b_4 Patents_{it-1} + b_5 Funds_{it}$$

where *i* denotes country, *t* denotes time, *N* is the number of active VCsts, *Rate* is the 10 year bond rate, *Patents* is the lagged count of patent grants and *Funds* is the new funds raised every year per VCst. We prefer to use the lagged patent count in order to avoid possible endogeneity issues that arise from the direction of causality between innovation and VC investments (Faria and Barbosa, 2014). The variable *Funds* is included in order to control for any effect that the availability or scarcity of funds may have on the investments. *VC*, *N*, *GDP* and *Patents* are in logarithmic scale.

Since the dataset has a panel form, proper panel data techniques have to be used. For the sake of robustness we estimate the model twice, assuming both random and fixed effects. The number of VCsts is for each country constant in our sample and thus, the usual fixed effects approach (Least Squares Dummy Variable estimation) that controls and eliminates any time invariant variables, will not allow estimating its effect. In Least Squares Dummy Variable regression the effect of any time invariant variable, either observable or unobservable, is absorbed by the constant term which is different for each cross section unit. Alternatively, we apply the Hausman-Taylor method (Hauman and Taylor, 1981) which controls for constant over time unobservable individual heterogeneity that may be correlated with the regressors and the dependent variable but at the same time estimates the effect of time invariant variables that are explicitly included in the regression, like *N*. The respective random effects estimation will be the usual GLS regression.

4. Results

Table 2 presents the estimated coefficients of the empirical model. The coefficient of the number of VCsts *N* is positive and significant across all VC stages for the Random effects estimation. However, the effect of *N* is considerably greater on early stage investments (0.918) as compared to the later stage VC (0.341). Moreover, in the fixed effects Hausman-Taylor estimation the effect of *N* on later stage VC is statistically insignificant as opposed to its effect on early stage VC in which the effect of *N* appears to be significant at 1%.

Table 2
Estimated coefficients for random and Hausman-Taylor specifications

	Random effects	Hausman-Taylor

	Early Stage	Later Stage	Early Stage	Later Stage
N	0.918* (0.208)	0.341** (0.160)	1.100* (0.340)	-0.325 (1.025)
GDP	0.639** (0.330)	0.718* (0.272)	0.289 (0.503)	1.803 (1.253)
Rate	0.039 (0.048)	-0.211* (0.051	0.046 (0.049	-0.192* (0.058)
Patents	-0.182 (0.180)	-0. 245 x10^{-4} (0.157)	-0.080 (0.215)	-0.093 (0.272)
Funds	0.304x10^{-4}** (0. 126 x10^{-4})	0.487 x10^{-4}* (0. 139 x10^{-4})	.0000287** (.0000124	.0000578* (.0000142

Standard errors in parenthesis. *Significant at 1%, ** Significant at 5%,

The variable *Funds* (new funds raised every year per investor) is significant and positive across all models and VC stages implying that a greater availability of funds tends to increase all types of investments. GDP is significant and positive for both VC stages in the Random effects whereas the interest rate is significant and negative for later stage VC in both fixed and random effects, indicating a deterrent effect of interest rates for that type of investments.

Summing up, although VC investor population seems to be positively related to all types of VC investments, the respective effect is much higher on risky early stage VC. In agreement with our theoretical proposition, investor competition makes risky VC projects - in a sense - more attractive to investors.

5. Conclusions

The paper's theoretical model presents a link between the number of Venture Capitalists in the market (and the implicit competition among them) and the risk of the chosen investee projects. We assume that the VCst population determines the entrepreneur's bargaining power in the bilateral negotiations with a VCst, allowing the entrepreneur to request better financing terms in the form of a minimum acceptable share over the investment's profits. The theoretical framework is a double-sided moral hazard problem, assuming that the VCsts are risk neutral and the entrepreneurs are risk averse. Technically, the model shows that as the number of

VCsts increases, the consequent increase in the entrepreneur's bargaining power induces her to demand a greater share, which gives rents to the entrepreneur and allows for the financing of riskier investees. The marginal riskier feasible investee is such that the respective entrepreneur's rents disappear. Our model does not predict that VCst competition induces the choice of a riskier investment but simply, that riskier projects can also be considered as a viable investment, equally attractive to safer ones.

The relation between VCst competition and project riskiness is tested empirically with a European panel dataset assuming that early stage VC is riskier than later stage investments, and applying proper panel data methodologies. We show that the effect of VCst population on early stage VC is significantly greater than the respective effect on the unarguably safer later stage VC. In other words, as the number of investors rises, proportionally more early stage projects are financed, indicating a stronger connection between high-risk investments and VCst competition which is in line with the theoretical findings of the paper.

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