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The Dynamics of VC Firm Network Position and Performance in the United States 1980-2001

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Abstract

Using a unique data set on venture capital firm book values and cash payouts to limited partners, we estimate a dynamic model relating firm status, measured as centrality in the venture capital syndication network, to three kinds of VC performance (book value, payouts to the partners and startup IPOs). Centrality is measured in terms of a firm?s score on the first eigenvector of the network, a conventional measure of organizational status. Our model tests the generally accepted assumption that more central firms have stronger operating capabilities and possess better investment opportunities which tie status to performance closely over time. We pose this assumption against an

alternative: status leads to a larger portfolio size that in itself increases the probability of positive outcomes and therefore to higher payouts. The results show that the alternative hypothesis, not the received wisdom, is true. High eigenvector centrality increases the size of the firm?s portfolio of investments over time, and the portfolio size, but not centrality, predicts the firm?s performance. Thus the performance effect of a firm?s status is due to the portfolio?s higher option value and not to its higher quality. We also find that status is not predicted by the firm?s prior performance and is strongly serially correlated. Economic factors thus do not determine network structure which is inertial. The data are comprised of VC firms in the U.S. from 1980 to 2001.

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Introduction

The purpose of this study is to contribute to two separate but related research programs: 1) studies of the antecedents and consequences of organizational status (for a recent discussion see Jensen, Kim and Kim, 2011) and 2) studies of network dynamics (Ahuja, Soda and Zaheer, 2011). These bodies of research are linked through the use of status measures derived from network structure, most often an organization's network centrality (Bonacich, 1987). In the status literature, more central firms are deemed higher status and are hypothesized to benefit in various ways from their superior positions through higher performance (see Hochberg et al, 2007). Moreover, better performance should reinforce these positions, creating a feedback loop though which the status hierarchy is perpetuated. The network dynamics literature in turn is concerned with the perpetuation of network structure (see e.g., Powell, White and Koput, 2005) and has focused in part on the persistence of a firm's centrality within the network (see Gulati and Gargiulo, 1999). Since a firm's performance may influence its opportunities for future alliances (see e.g., Shan, Walker and Kogut, 1994; Gulati, 1998), it may also affect the evolution of network structure. Thus, although the motivations of these two research programs differ, the programs share a common focus on the relationship between firm status and performance over time.

In this paper, we develop and test a full model of the dynamics of organizational status, as network centrality, and organizational performance by investigating their intertemporal relationship in the U.S. venture capital industry from 1980 to 2001. We use a unique data set that reports the financial performance of venture capital firms in terms of both their distributions to their limited partners and the book value of their investment portfolio. Using other data on the structure of syndications in the industry, we can then tie the financial performance of these firms to their network positions over time, both as a predictor and as an outcome. This design is an advance

on previous studies of status and its outcomes in that it allows us to test for feedback between them while controlling for their persistence due to other factors. We also follow earlier research on venture capital firms by distinguishing between first and later rounds of financing (see e.g., Podolny 2001).

Theory

Organizational Status and Performance. In their discussion of status research, Jensen, Kim and Kim (2011) reference a broad supporting literature on the status-performance relationship, where performance is conventionally defined in terms of the quality of the relevant outcome. Examples of such outcomes are higher levels of innovation output (Ahuja 2000), growth rates (Hsu 2004), sales margins (Benjamin and Podolny, 1999), and cross-selling (Jensen, 2003). The arguments for the effect of status on performance are threefold. The first is that an organization's status is associated with a firm's capability (Podolny, Stuart and Hannan, 1996). In this case, high status often offers an observable benefit, such as product quality or design, to customers, suppliers or others that might gain from transacting with the firm. Second, status may be associated with a benefit that is unobservable yet important for potential transactors with the firm - e.g., more efficient execution, more effective distribution, superior problem solving (Podolny, 1993, 2001; Stuart, Hoang and Hybels, 1999; Benjamin and Podolny, 1999; Higgins and Gulati, 2003; Jensen 2003). Last, status may be based on superior bargaining power in transactions (Stuart, 1998; Guler, 2007) which raises performance for the firm.

With few exceptions these studies have examined the influence of status on performance in cross-section, without referencing potential dynamics in their relationship. In those studies where such dynamics are not an issue (Jensen, 2003; Hsu, 2004; Azoulay, Stuart and Wang, 2011), performance (market diversification, equity financing, paper citation) is measured after status and

has no obvious feedback effect on the status variable itself. Yet for status to reflect an implicit promise of higher performance, performance itself must predict status (Podolny, 1993). Podolny and Phillips (1996) find such an effect in their study of investment banking firms, even as status persists over time. Yet their result masks an important issue: that the relationship between status and performance over time may not be consistent with theory because each follows an evolutionary path that is subject to its own set of independent forces. This assertion is particularly important when status is measured in terms of network centrality, as is now described.

Network Dynamics. The literature on network dynamics has burgeoned over the past fifteen years, as more data on interfirm relationships over time has been analyzed in this framework. One part of this literature has focused on how network structure influences the formation of ties between firms (Gulati and Gargiulo, 1999; Baum, Rowley, Shipilov and Chuang, 2005; Powell et al, 2005; Sorenson and Stuart, 2008) while other studies have examined the evolution of network structure itself (Walker, Kogut and Shan, 1997; Walker, 2007; Zaheer and Soda, 2010). These two agendas overlap when network structure replicates itself through its influence on partner choice, particularly in the tendency of high status firms to choose each other as partners systematically over time (Gulati and Gargiulo, 1999; Rosenkopf and Padula, 2008), a process called assortative matching in studies of the development of small worlds (Watts, 2004).

Given the strong evidence of structural persistence in interfirm networks, including significant autocorrelation in network centrality, one may ask what role firm performance plays in the evolution of network structure. Performance is in part an outcome of firm agency (Emirbayer and Goodwin, 1994). By agency is meant firm actions that occur independently of the network but which determine in part how the network develops over time. For example, investments in product quality or affiliations with higher status firms would be examples of agency that improve the

organization's network position. Alternatively, investments that degrade quality or affiliations with lower status firms might weaken the firm's network position (see Jensen, Kim and Kim, 2011). These effects on network position should be net of inertia in network structure. Notably, these ideas have not yet been tested, even though the importance of investigating the effect of agency on network has been emphasized (Stuart and Sorenson, 2007).

Organizational Status and Performance in the U.S. Venture Capital (VC) Industry. Venture capital firms serve as investment vehicles for institutions (e.g., pension funds, hedge funds, university endowments) and private individuals who are willing to take the risk of buying equity in startup organizations that are in the early stages of development. For this purpose, VC firms create and manage venture funds in which the investors are limited partners. Each fund has an investment portfolio whose book value increases or decreases over time with changes in the fortunes of the startups, but limited partners only receive a return on their investment when a startup issues its shares to the public in an IPO or is sold to another firm. Given the uncertainty of returns to entrepreneurial ventures, VC firms have an interest in sharing the risk of their investments and do so through repeatedly syndicating them. These syndications constitute a network whose structure can be determined and tracked over time, allowing the identification of network positions and therefore a status hierarchy in the industry.

The VC industry thus offers a useful opportunity to examine the dynamic relationship between organizational status, indicated by network position, and performance. First, the VC industry has been extensively used to test theory regarding the effects of networks on partner choice (Sorenson and Stuart, 2001, 2008) and firm performance (Hochberg et al, 2007). The network in this industry is constructed of syndicated investments in startup companies in a wide range of typically growth stage industries (examples: computer hardware and software,

communications, biotechnology, internet hardware and software). Centrality in the syndication network has then been assumed to indicate VC firm status (Podolny, 2001; Sorenson and Stuart, 2001). Performance in turn has been construed as the proportion of successful IPOs or trade sales of the startups in the portfolio (Hochberg et al, 2007).

Current studies on the VC syndication network and performance offer several opportunities for expanded research. First, although centrality has been shown to predict performance, this effect is only in cross-section (Hochberg et al, 2007), raising questions about its robustness when performance is specified as endogenous and firm effects are included. Further, the feedback loop from performance to centrality has not been closed empirically. If centrality is not predicted by performance over time, then the arguments linking performance to network structure need to be restated to include theory regarding how the network evolves. Third, the VC industry, in combination with our unique data on financial performance, has two characteristics that make it possible to test important extensions of the status-performance dynamic.

The first of these features offers the potential of testing a broadened interpretation of what Merton (1957) called the Matthew effect (simply put: to those that have, more shall be given). This assertion was important background for Podolny's seminal article on status and performance (Podolny, 1993). Yet there are two ways of interpreting it: first, as argued above, higher status will engender better outcomes; but second status may lead to a greater number of opportunities for success and that given the larger sample and cherry-picking, the size and probability of success is higher. In this way, VC firm status attracts more and more upstream deals (Podolny, 2001; Gould, 2002; Hsu, 2004; Hochberg et al, 2007) and more and better deals mean more potential positive outcomes and fewer bankruptcies. The first interpretation can be considered the "direct" effect of status on performance and the second interpretations an "indirect" effect. We test both here.

The second feature concerns the two arguments that have tied VC firm status to startup performance. The first argument is that higher status may affect performance through influencing startup management (Hochberg et al, 2007). That is, status is correlated with a superior capability for managing nascent businesses and better startup management should engender more successful outcomes. Second, VC firm status may act as a signal of startup quality for other investors (Benjamin and Podolny, 1999; Stuart, Hoang and Hybels, 1999). In this sense, investors are more likely to support the IPO of startups with prominent VCs.

We are able to separate and test these arguments independently by measuring the effect of network position in two ways: first through the book value of a VC firm's portfolio and second through the incidence of successful startup outcomes (IPO or trade sale). Changes in portfolio book value reflect improvements in the operating performance of startups while they remain privately held and therefore the influence of the VC firm on management strategy and procedure. As a measure of performance, therefore, book value should be related to VC firm status if it represents strong management capabilities. On the other hand, successful startup outcomes, net of superior startup operating performance, are linked to status as a signal of future quality. If status acts as a signal, not a determinant, of a startup's performance, while it is still privately held, then a VC firm with a more prominent network position should have more successful startup outcomes.

But predicting startup performance by VC firm status is only half the feedback loop. We also are concerned with the reverse effect of performance on status. The question here is where new syndications come from. Do they arise from judgments of startup outcomes, which are publicly observable? Or from judgments of the portfolio's book value, which is observable only by the VC firm's current syndication co-investors and the entrepreneurs running the startups? Or from assessments of the cash distributions to limited partners, which are observable only to co-

investors and to the limited partners themselves? As these performance measures vary in their observability, so do they imply alternative sources of new syndications for the VC firm that may lead to higher or lower status.

Hypotheses

Given the arguments above we state the following hypotheses:

The Direct Effect of VC Status on Performance:

If organizational status, as indicated by the firm's network position, implies strong capabilities related to the operating performance of startups in the firm's investment portfolio, then these three hypotheses follow:

H1a: VC firm status, as indicated by its network position (eigenvector centrality), increases the number of successful outcomes for the startups in the firm's portfolio

H1b: VC firm status, as indicated by its network position (eigenvector centrality), increases the book value of startups in the firm's portfolio

H1c: VC firm status, as indicated by its network position (eigenvector centrality), decreases the number of unsuccessful outcomes for the startups in the firm's portfolio

The Indirect Effect of VC Status on Performance:

If organizational status, as indicated by the firm's network position, acts as a strong attractor of new deals, then this hypothesis follows:

H2: VC firm status increases the number of startups in the firm's portfolio.

In turn, more upstream startups in the portfolio should raise the likelihood of successful outcomes and decrease that of unsuccessful outcomes. The hypotheses follow:

H3a: The number of companies in a VC firm's portfolio will positively influence the number of successful startup outcomes.

H3b: The number of companies in a VC firm's portfolio will negatively influence the number of unsuccessful startup outcomes.

Also, there is an indirect effect of status on the book value of the VC firm's portfolio through the incidence of successful and unsuccessful startup outcomes. The hypotheses follow:

H4a: The number of successful outcomes in a VC firm's portfolio will raise its book value.

H4b: The number of unsuccessful outcomes in a VC firm's portfolio will lower its book value.

The indirect effect of status on financial performance also flows through the effect of the portfolio book value on distributions to limited partners. Consequently, we test H4a and H4b on these distributions as well.

Feedback from Performance to Status:

If status is to be related to performance over time, then high (low) performance must increase (decrease) status over its expected level. But, as discussed above, this effect is contingent on the observability of performance, whether to limited partners, syndication partners, entrepreneurs in the startups, or the general public. Testing the effect of status on a type of performance tied to a particular degree of observability allows us to estimate the origins of new deals that enhance (or damage) status. Consequently, we hypothesize:

H5: The number of successful startup outcomes in a VC firm's portfolio will increase the firm's status.

H6: The book value of the firm's portfolio will positively influence the firm's status.

H7: The firm's distributions to its limited partners will positively influence the firm's status.

Data

The unit of analysis in this study is the VC firm-year. The analysis is based on a unique data set covering 1429 venture capital firm and their investments from the beginning of 1980 to the end of 2001. The uniqueness comes from a subsample of 249 of these firms for which there are data over time on a firm's aggregate book value for the firm's portfolio of investments and the firm's cash distributions to its limited partners (e.g., pension funds, hedge funds, private and public

institutions). These data come from a proprietary source, and their summary characteristics have been reported elsewhere (Phalippou and Gottschalg, 2007). Other than these two variables, the data are the same as those found in Thompson's VentureXpert, a database that has been used extensively in studies of venture capital firms (Kogut, Urso and Walker, 2007; Sorenson and Stuart, 2008). The data contains 13501 startups and 20874 first or later round investments involving one or more venture capital firms. There are 4651 IPOs or trade sales in the data, and 1147 bankruptcies and shut-downs.

Measures

Theoretical Variables. The following variables are measured separately for startups in which the VC firm invested in the first round and those that it invested in later rounds:

1) Network position: Following a host of earlier studies on organizational status from a network perspective (Podolny, 1993, 1994, 2001; Stuart, 1998; Benjamin and Podolny, 1999; Sorenson and Stuart, 2001; Jensen, 2003; Guler, 2007), this variable is measured as a VC firm's eigenvector centrality (Bonacich, 1987) in the venture capital syndication network in year t. The syndication network is constructed in two year windows starting in 1980.
2) Startup success: Startup success is measured as the number of occurrences of an IPO or trade sale for the startups in a VC firm's portfolio in year t.
3) Startup failure: Parallel to startup success, startup failure is measured as the number of occurrences of a bankruptcy for the startups in a VC firm's portfolio in year t.
4) Portfolio size: This variable is measured as the number of startups in a VC firm's portfolio in year t.
5) Book value: This variable is the total book value of the VC firm's startup portfolio at the end of year t.

6) Distributions: This variable is defined as the total payout to the venture capital firm's limited partners in US dollars in year t.

Control Variables:

1) Firm Size is the US dollar amount of assets under management (in millions) in year t. The variable is logged.
2) Firm Age is the number of years since the firm's inception or since 1980. This variable is also logged.
3) Entropy measures the extent to which the extent to which the VC firm is concentrated in one or a few industries. The measure follows Jacquemin and Berry (1979).
4) Time Effects are included as dummy variables for each year, 1980-2001.
5) Industry effects are included as the number of a firm's startups in each of eight industries at the two-digit VEIC level, using Thompson's coding scheme in VentureXpert.
6) Because the data on financial performance (book value, distribution to limited partners) are a subset of the overall data, we create a selection variable in which a firm's inclusion in the subsample is predicted by size, age, and network position using probit regression. We use the predicted value from this regression to control for selection bias in those equations where the financial performance variables are present, either as dependent or independent variables.

Method

We test the hypotheses separately for startups in which the VC firm invested in the first round and those for investments in later rounds. All hypotheses are tested using Granger's (1969) definition of causality so that the dependent variable is predicted by its lagged value and the lagged values of the independent variables. A lagged value for centrality is appropriate since the autocorrelation of the eigenvector measure has been found to be substantial (Mariolis and Jones,

1982; Gulati and Gargiulo, 1999). This suggests that the relative stability of a firm's network centrality may be associated with the stability of the network itself. In turn, a lagged value for performance is consistent with a range of studies that find significant serial correlation in performance measures due to the effects of enduring industry structure and constancies within the firm (Mueller, 1985; McGahan and Porter, 2003). We specify one period lags only.

We use a generalized method of moments estimator to test the hypotheses in a linear dynamic panel format. This model removes time-invariant firm effects through first differencing and includes levels of the independent variables as instruments to address the problem of weak instruments in the lagged coefficients (Arellano and Bover, 1995; Blundell and Bond, 1998). This technique is appropriate for our analysis since the coefficients of the lagged dependent variables are quite high in many of our equations, suggesting that weak instruments may be present. Also, this technique is designed for data sets with many more panels (the VC firms) than time periods, as found here. A criterion for applying this moments estimator is the absence of serial correlation in the higher order error terms of the differencing equation. We tested for this condition in each equation and found it to hold. Finally, we correct for clustering in the error term by using Huber-White robust standard errors.

Results

Table 1 shows results for H1a and H3a. The regressions are shown for first and later rounds separately. It is apparent that for first rounds the hypothesis does not hold and the estimates are unstable for later rounds. It is simply not safe to say therefore that higher status, as defined in terms of network position, leads to more successful startup outcomes. Notably, Table 1 also shows that the number of companies in a VC firm's portfolio increases the likelihood of an IPO or trade sale for all round levels, indicating an indirect effect of status on this definition of performance and thus supporting H3a. VC firm age and entropy affect startup outcomes, both negatively. Also,

outcomes are negatively autocorrelated, perhaps because of swings in the distribution of opportunities for success in the portfolio at any point in time.

Table 2 presents the findings for regressions on unsuccessful startup outcomes. Supporting H3c, larger portfolios are less likely to contain bankruptcies, indicating the presence of cherry picking by higher status firms as they build their syndication networks. This result is robust across both first and later rounds. Status also reduces the likelihood of bankruptcy, but only for first round investments, indicating an ability to keep firms alive, supporting H1c. The results are consistent with those of portfolio size.

In Table 3, this line of interpretation is expanded. Here H2 is supported for first round investments, but not for later rounds. So the path from status to portfolio size to outcome success (and failure) is robust for first round startups but not for those in which the VC firm invested at a later point in time. Portfolio size is strongly autocorrelated, so the significant effect of status on portfolio size is net of expectation. The control variables are all significant for later but not first round startups. Smaller, younger, more focused firms are more likely to have later round investments. The importance of separating the round stages is thus clear.

In Table 4 we see the results of predicting financial performance. The regressions for book value and limited partner distributions are presented in adjacent columns. First, there is no effect of status on the VC firm's book value. The argument that status is associated with stronger operating capabilities (H1b) is therefore not supported. However, portfolio size is positively related to book value, again suggesting that larger portfolios are skewed to contain a higher percentage of strong startups. As expected first round startup successes (failures) raise (lower) the portfolio's book value. This is not true for later round startups, however. H4a and H4b are therefore partially supported. As for distributions to the limited partners, again portfolio size, but not status, is

statistically significant, even when controlling for book value. So VC firms with larger portfolios distribute more cash from their books of business than smaller VCs. Interestingly, distributions, but not the VC firm's book value, are significantly autocorrelated. This difference indicates that book value reflects operating vagaries in valuation that contrast with VC firm's smoothing of distributions in order to manage limited partners expectations of return.

We turn now to the regressions that close the loop between performance and status. These results are presented in Table 5. Here as expected, eigenvector centrality is very highly autocorrelated, consistent with earlier research. But there are no other stable findings. The significant coefficients for successful and unsuccessful outcomes and for portfolio size are clearly conditional on the inclusion of financial performance variables and so must be interpreted in that context. Further the sign on portfolio size changes across specifications. H5 is supported only provisionally. It is noteworthy moreover that the financial performance variables – book value and limited partner distributions – have no effect on status, disconfirming H6 and H7. We can argue then that positive performance outcomes do not lead to deals that strengthen the VC firm's network position, no matter who the performance is observed by: the public (IPOs and trade sales); startup entrepreneurs and limited partners (book value); or limited partners alone (distributions).

Discussion

Our motivation in this paper is to connect research on the dynamics of status with research on the dynamics of networks. Both include performance as both an outcome and cause of the development of network structure, albeit with different logics. Although our hypotheses have been framed in terms of issues current in status research, our conclusions also have implications for studies of network evolution.

First, we find conclusively that status has a direct effect on performance only by reducing the number of bankruptcies, not by increasing the number of IPOs or trade sales. Arguments that invest higher status VC firms with greater capabilities for startup growth by improving startup operations are not supported here. But higher status firms do have larger portfolios of startups, and our results show that this leads to a number of benefits.

Our results support the conclusion that central firms attract more, and more promising, deals – but only in the first round of financing. Later rounds offer no advantage to status, since VC firms with stronger positions do not attract these deals, allowing for their serial correlation. This result stands in contrast to that of Podolny (2001) who found that higher status firms tended to participate more in later rounds, when structural holes were controlled for. Significantly, Podolny measured an average of round participation rather than the incidence of early and later rounds per se and did not include a lag in the dependent variable to capture expectations. His sample was also smaller and used different controls.

An important finding here is that there is no feedback from performance to status in these data. Status in network terms appears to be more a result of network evolution than of a loop of positive reinforcement tying performance to network position over time. Firm centrality is strongly autocorrelated and has no robust relationship with other potential influences. One logical interpretation of this disconnect is that central positions are determined by a combination of initial conditions and with subsequent partner choice tying central firms to each other. What is remarkable is that the larger portfolios these firms build through repeated syndication represent viable options for achieving more successful outcomes and preventing unsuccessful ones.

Network position persists, consistent with the literature on assortative matching in partner choice. But it also erodes a little as the firm ages and grows, presumably as the network changes

due to a shifting opportunity structure. Therefore, the more central firm must rely on the autocorrelation of its portfolio size to retain an influence on successful outcomes. In this regard, our results strongly suggest that status, in terms of network structure, is more an artifact of network evolution than of demonstrated firm superiority in operations.

Finally, we should highlight how different our measures of performance are in terms of their own dynamics. Success is negatively autocorrelated; distributions positively autocorrelated; and both failures and book value not autocorrelated at all. These differences reflect the distinct administrative and economic factors that influence how these variables develop over time. We believe our results regarding these measures are interpretable in the light of these differences. However, they also highlight the difficulty of tying concepts like status to meaningful outcomes in an empirical setting with changing opportunities and players.

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Figure 1

Path Diagram of the Hypotheses

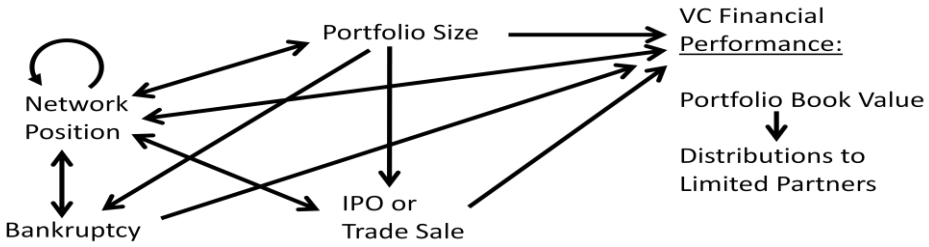
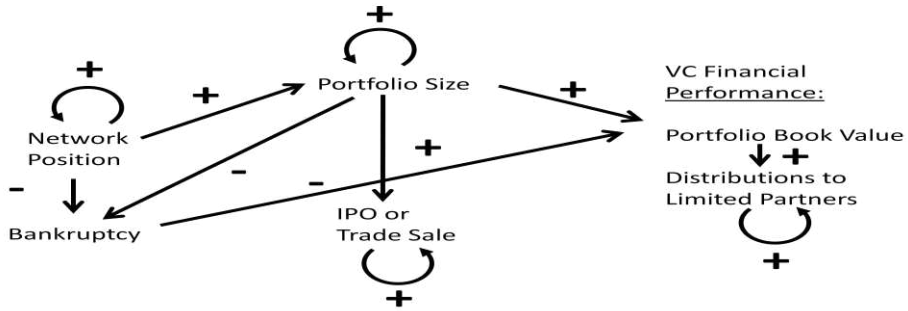


Figure 2

Path Diagrams of the Results

A. First Round Investments



B. Later Round Investments

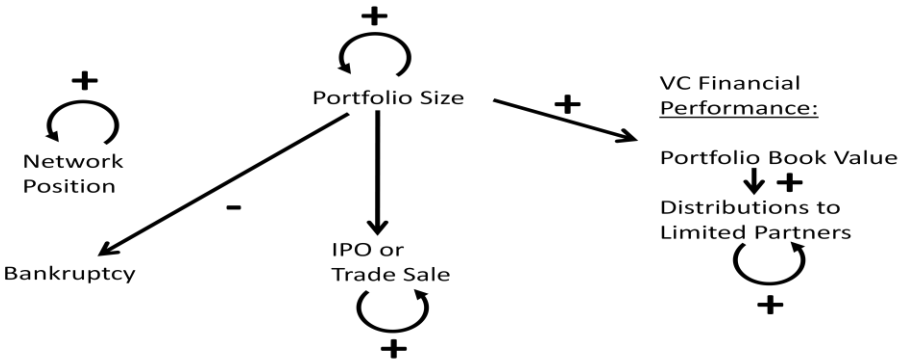


Table 1 Dependent Var: Successful Startup Outcome (IPO or Trade Sale)				
	First Round Investments		Later Round Investments	
	I	II	III	IV
Lag successful Outcomes	-0.16*** (0.046)	-0.159*** (0.0485)	-0.104*** (0.0199)	-0.105*** (0.02)
Lag eigenvalue centrality	3.656 (2.132)	3.018 (2.171)	1.671 (2.167)	5.287** (1.711)
Lag number of companies in portfolio	0.032*** (0.006)	0.0349*** (0.0098)	0.0469*** (0.0064)	0.0239* (0.011)
Lag log firm size		0.0694 (0.0567)		0.083 (0.058)
Lag log firm age		-0.252** (0.083)		-0.255* (0.104)
Lag entropy		0.0097 (0.0133)		-0.063*** (0.014)
Industries	Sig.	Sig.	Sig.	Sig.
Years	Sig.	Sig.	Sig.	Sig.
Constant	-0.592*** (.0469)	-1.458*** (0.396)	-0.357* (0.168)	-1.251** (0.411)
Observations	11133	10466	11133	10466
**** p < .001, ** p< .01, * p<.05 – two-tailed tests				

Table 2 Dependent Var: Unsuccessful Startup Outcome (Bankruptcy)				
	First Round Investments		Later Round Investments	
	I	II	III	IV
Lag unsuccessful Outcomes	0.378 (0.192)	0.417 (0.213)	-0.255 (0.169)	-0.221 (0.135)
Lag eigenvalue centrality	-8.204*** (1.523)	-5.731*** (1.477)	-3.038* (1.447)	-1.466 (0.86)
Lag number of companies in portfolio	-0.065*** (0.0049)	-0.0748*** (0.018)	-0.514*** (0.00538)	-0.0638* (0.0167)
Lag log firm size		0.0039 (0.061)		-0.0001 (0.0214)
Lag log firm age		-0.313** (0.065)		-0.045 (0.098)
Lag entropy		-0.026 (0.032)		-0.030*** (0.026)
Industries	Sig.	Sig.	Sig.	Sig.
Years	Sig.	Sig.	Sig.	Sig.
Constant	-0.154*** (.058)	-0.422*** (0.455)	-0.15* (0.06)	-0.233 (0.153)
Observations	11133	10466	11133	10466
**** p < .001, ** p< .01, * p<.05 – two-tailed tests				

Table 4
Dependent Var:
VC Firm Financial Performance

Table 3
Dependent Var:
Number of Companies in Portfolio

	First Round Investments		Later Round Investments	
	I	II	III	IV
Lag number of companies in portfolio	0.631*** (0.065)	0.958*** (0.0647)	0.836*** (0.039)	1.015*** (0.068)
Lag eigenvalue centrality	28.55** (10.59)	37.56*** (8.84)	8.432 (8.946)	19.732 (10.069)
Lag log firm size		-0.914 (0.349)		-0.709* (.300)
Lag log firm age		-2.83 (1.759)		-1.964* (0.956)
Lag entropy		0.951 (0.511)		0.557** (0.202)
Industries	Sig.	Sig.	Sig.	Sig.
Years	Sig.	Sig.	Sig.	Sig.
Constant	-0.406 (2.987)	-0.0665* (0.0393)	2.232* (0.917)	7.133*** (1.769)
Observations	9170	8889	9479	9111
**** p < .001, ** p< .01, * p<.05 – two-tailed tests				

	Book Value of Startup Portfolio		Distributions to Investors	
	I	II	III	IV
Lag book value	0.066 (0.0462)	.079 (.049)		
Lag Distributions			0.286** (0.111)	.367*** (.089)
Lag eigenvalue centrality	-272514 (293990)	-65755.4 (317640.9)	-441013 (281521)	-190929 (185675)
Lag number of companies in portfolio	4586* (2286)	4922.95** (1611.6)	9789** (3432)	6219** (2188)
Lag successful exits – 1st rounds		18201.2*** (4980.2)		3578 (3827)
Lag successful exits – Later rounds		2261.19 (5813.12)		3172 (5914)
Lag unsuccessful exits – 1st rounds		-38656.9** (11660.5)		-17704 (10827)
Lag unsuccessful exits – Later rounds		20679.1 (11052.2)		26135 (13967)
Lag log firm size		-28421 (22813)		1185 (8452)
Lag log firm age		-25448 (67766)		-33515 (30754)
Lag entropy		6179 (4773)		-3166 (2008)
Book value				.518*** (0.948)
Subsample selection	Sig.	Not sig.	Not sig.	Not sig
Industry effects	Sig.	Sig.	Sig	Sig
Time Effects	Sig.	Sig.	Sig.	Sig.
Constant	15745.5	246964	130194	61141
Observations	3175	3163	3175	3163
**** p < .001, ** p< .01, * p<.05 – two-tailed tests				

Table 5 Dependent Var: VC Firm Eigenvalue Centrality		
Lag eigenvalue centrality	0.867*** (0.0173)	0.673*** (.0285)
Lag successful exits – 1st rounds	0.000153 (0.000226)	0.00116*** (.00026)

Lag successful exits – Later rounds	-0.000491 (0.000262)	-0.00084* (.00037)
Lag unsuccessful exits – 1st rounds	0.000572 (0.00106)	-0.00063 (-.00116)
Lag unsuccessful exits – Later rounds	0.00120 (0.00117)	0.0091 (0.0015)
Lag number of companies in portfolio	0.0000717 (0.0000402)	-0.000187* (0.00008)
Lag log firm size	-0.002*** (0.00033)	-0.00372** (0.00128)
Lag log firm age	-0.00416 (0.000769)	-0.00285 (0.00259)
Lag entropy	.000149* (0000732)	-0.00023 (0.00022)
Lag VC distribution		3.45e-09 2.79e.-09
Lag book value		-2.61e-09 (3.02e-09)
Subsample selection		Sig.
Industry effects	Not sig.	Not Sig.
Time Effects	Sig.	Sig.
Constant	0.026* (0.0218)	0.0473*** (.0126)
Observations	9659	3163
**** p < .001, ** p< .01, * p<.05 – two-tailed tests		