

To Go Solo or To Syndicate^{*} :
Determinants of Tie Formation in
The U.S. Venture Capital Industry

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ABSTRACT

Despite the importance of investment syndicates for the Venture Capital (VC) industry to function, surprisingly little is known about the motives for syndication. In this study, I build on Entrepreneurial Finance studies that present uncertainty and risk associated with the investment as the main drivers of syndication. I then examine two important but less emphasized factors that affect syndication strategies: characteristics of the social structure and position of the actor in the social structure. I conceptualize the VC industry syndication network as a social exchange network and argue that actors accumulate social debts and assets as they receive syndicate invitations and initiate syndicates. From this, I primarily claim that the syndication history of a VC firm as well as the balance of his accumulated social liabilities and assets affects the likelihood of initiating syndicates. By analyzing syndication patterns in the US VC industry from early 1970s until 2004, I show that VC firms with net social liabilities, that is, VC firms that have received more syndicate invitations than they have initiated, are more likely to initiate a syndicate.

INTRODUCTION

Economists and sociologists alike have long studied the advantages of alternative forms of organizing under specific conditions. We know, for example, that network forms of organization have advantages in facilitating learning, managing resource dependence, obtaining status and legitimation, and gaining economic benefits (Podolny and Page, 1998). However, research on drivers of using network form and determinants of variance that we see in usage of network form is still rare. Podolny and Page (1998) point out how little insight we still have regarding the decisions on whether to form a network tie or not in inter-industry and intra-industry contexts. In this study, in an attempt to explain the observed variance in utilization of network form, I focus on the following rather unattended but important question: “How do social structure and actors’ positions in the social structure affect their decisions to initiate network ties?”

I study this question in the context of the US Venture Capital (VC) Industry. The VC industry, and syndication networks therein, provides a unique opportunity to analyze social structural and actor related motives in one model, while still attending to characteristics of the transaction under consideration. VC firms may invest in a target company alone (a solo investment) or with others through forming a syndicate. When performed as a solo investment, the VC firm uses only its own financial and human capital resources for the investment and mentoring process. On the other hand, when the investment is carried out through an investment syndicate, all actors in the syndicate contribute. Syndicates, simply put, are a form of interfirm alliances in which two or more VC firms co-invest in a target company and share a joint payoff (Wright and Lockett,

2003). Hence, performing a solo investment is analogous to carrying out the transaction in a hierarchy, whereas the investment syndicate mimics the network form. I specifically examine the syndication of investments and the decision of the lead VC firm of the investment whether to initiate a syndicate or not. The lead actor in the syndicate, whether VC firm or Investment Bank, is the one who decides whether to form the syndicate as well as whom to invite to and include in the syndicate (Song, 2004). Deciding between investing alone versus leading a syndicate and how to syndicate are important decisions for VC firms to make (Manigart, et. al. 2004).

Syndication as a form occurs in a number of domains, including investments in VC industry, IPO offerings by Investment Banks, bond issuing, and real estate development. It was even the main organization form for railroad building in late 19th century (Pichler and Wilhelm, 2001). Thus, VC syndication is just one example of a general phenomenon in which one party decides to bring in partners (Brander, Amit, and Antweiler, 2002). Insights of analyses presented in this study, therefore, have implications for and contribute to better understanding of the network form of organizing.

In line with Podolny and Page's observation, despite the importance of syndication dynamics for the VC industry to function, surprisingly little focus has been placed, and still little is known, on the motivations for syndication. Lerner (1994) argues "Syndication has been little scrutinized in the corporate finance literature. The reason may lie in the difficulty of analyzing syndication patterns empirically and the complexity of motives behind syndication." And, almost a decade after Lerner's study, Brander, et.

al. (2002) claim that “Aside from Lerner (1994), we are unaware of any published academic papers in which the rationale for VC syndication is the central focus, although some of the existing literature on VC finance does bear on the syndication question”. Finance-oriented explanations dominate the field where adverse selection, moral hazard, uncertainty, and risk sharing drive the syndication decision. These studies mainly focus on why are some transactions more likely to be performed through the network form by emphasizing how characteristics of transactions would affect syndication patterns.

In this study, I depart from entrepreneurial finance studies and examine the syndication decision by bringing back in actor and social structural characteristics. I discuss how social structure and a VC firm’s position within it affect the propensity of syndication. For this purpose, I conceptualize the VC industry syndication network as a social exchange network, and syndications as circulation of gifts and favors between VC firms. I analyze how history of exchanges of VC firms, especially how social liabilities and social assets the VC firms accumulate as they initiate and receive invitations for syndicates, affect their syndication strategies.

Through empirical analyses using all first round investments of US VC firms in target companies from early 1970s until end of 2004, I confirm that uncertainty and risk associated with investing in a particular target company increase the likelihood of syndication. Furthermore, I show that those VC firms deeply embedded in the VC industry syndication and social networks are more likely to initiate syndicates, although the more experienced VC firms prefer going solo. Lastly, I analyze how the balance of

overall social exchanges for a VC firm affects the syndication decision. I find that the VC firms who have net social liabilities (those who have been invited to more syndicates than they had initiated) are, on average, more likely to initiate syndicates than those VC firms with net social assets (those who have initiated more syndicates than have been invited to). I also find that this positive effect of net social liabilities on syndication decision is stronger for firms in more cohesive social substructures.

The paper is organized as follows. In the next section, I briefly introduce US Venture Capital industry and the syndication patterns, and discuss experience and social structure related factors of syndication. In the third section, I describe the data, the analyses methodology, and the variables including the control variables informed by finance literature. The fourth section presents and discusses the results. The last section concludes the study and lays the ground for future studies.

MOTIVES FOR SYNDICATION IN THE US VENTURE CAPITAL INDUSTRY

The US VC industry starts with the founding of American Research and Development Corp. (ARD) and J.H. Whitney & Co., both in 1946. General Georges Doriot of ARD, who laid out most of the basic principles of investing as a VC firm, is considered the founding father of the US VC industry. The most commonly used VC firm form in the industry is the venture capital limited partnership, with the first limited partnership VC being Draper, Gaither and Anderson (DGA), established in 1958 (Gompers and Lerner, 2001). The US VC industry, however, is composed not only of private equity VC (PEVC) firms like ARD or DGA, but also of Corporate Venturing Programs (CVP),

Investment Bank affiliated VC firms (IBVC), and Small Business Investment Companies (SBIC). First IBVCs and CVPs were established in early 1960s and SBICs came to existence by the 1958 Small Business Investment Act.

Essentially, VC firms act as brokers between otherwise disconnected investors and entrepreneurs. Investors include pension funds, universities and rich individuals for PEVCs and SBICs, their affiliated investment banks for IBVCs, and corporate headquarters for CVPs. Investors in PEVCs and SBICs invest in the funds formed by these VC firms as limited partners. In turn, VC firms invest these funds in entrepreneurial companies, usually for equity stakes. At the end of the life cycle of the fund, the VC firm dissolves the fund and distributes the returns to its investors after taking out management fees and a portion of the return. The success of previous fund(s) is one of the key determinants of the size of a new fund that VC firm may be able to raise in the future (Gompers and Lerner, 1998). In the mean time, the quality of investments and investment decisions determine the success of funds. Similarly, the success of investments of CVPs and IBVCs affects whether corporation or investment bank would continue with its venture capital program. The investments have direct and indirect effects on the life chances of the VC firms. The ability to choose among investment opportunities, therefore, is crucial for VC firms.

In this study, I distinguish between two types of investment strategies: going solo or forming a syndicate. Specifically, when an entrepreneur approaches a VC firm and the VC firm decides to pursue the deal, two alternatives arise regarding how to proceed. First

is the alternative to invest alone in the target company (a solo investment). Second is the choice to invite other VC firms to invest with him and form a syndicate (a syndicated investment) (Fried and Hisrich, 1994; Tyebjee and Bruno, 1984). In solo investments, the VC firm uses its own financial and human capital resources for the investment and mentoring process. In syndicated investments, on the other hand, all actors in the syndicate take part in the process. A particular VC firm called the lead VC firm is usually in charge of the syndicate. Syndicates are formed by the initiatives of these lead VC firms, who coordinate activities of all VC firms in the syndicate (Song, 2004). The managing partner(s) of the lead VC firm is the main mentor of the entrepreneur(s) in the target company.

Both investing alone and initiating a syndicate have their advantages and disadvantages. Advantages of solo investment, however, have been paid rare attention in the literature, compared with the discussions on advantages of syndication. First, solo investment enables a VC firm to be able to retain all the returns from investing. When the investment is performed solo, the VC firm is not giving up potential return and does not need to share the returns with any other VC firms (Manigart, et. al., 2004). Second, when a VC firm invests alone, he can more easily mentor the entrepreneur(s) and help them develop a strategic direction for the company. As opposed to complications and slowdowns that syndication may bring together in guiding a target company, solo investments shortens the company's strategic decision making process (Lockett and Wright, 2001; Wright and Lockett, 2003). Furthermore, through performing the investment alone, the VC firm eliminates the possibility of a disagreement among the syndicate members regarding the

direction and strategy of the target company. Such a disagreement may cramp the target company's growth and hence lower the return on investment. Lastly, investing solo eliminates management and coordination costs among the syndicate members that would happen in a syndicated investment.

On the other hand, researchers emphasized many benefits to and reasons for syndication especially in the financial contracting literature. For instance, a stream of studies looks at syndication as a mechanism to perform better deal selection through reduction of uncertainty associated with the investment (Lerner, 1994; Tyebjee and Bruno, 1984; Bygrave, 1987). According to these studies, as uncertainty of investment increases, the investment is more likely to be undertaken through syndication and the lead VC firm is more likely to initiate a syndicate. Another motive for syndication discussed in the literature is due to the risk of the investment; syndication is driven by the need to diversify risk and have a balanced portfolio (Brander, Amit and Antweiler, 2002; Lerner, 1994; Robert J. Kunze of Hambrecht and Quist, quoted in Lerner 1994). Nevertheless, the literature is silent on how the social structure of syndication network - who is inviting whom for which deals and when - and how previous syndication behavior of VC firms would affect their syndication strategies.

Social Structure and Syndication Strategy

Investment syndicates define and represent the social structure within the VC industry. In turn, local or global social structure VC firms participate in, and social relations of the VC firms affect their syndication strategies. Drivers of syndication other than uncertainty

and risk can be uncovered by looking at the syndication network as a social exchange network and syndicates as gifts and favors in social exchanges circulating among VC firms. When a VC firm invites others to an investment syndicate, the lead VC firm is giving a gift to those being invited, since the lead VC firm is the one who decides whether to syndicate and with whom to syndicate. Hence, syndication results in a social exchange relation between the lead VC firm and co-investor VC firms in the syndicate.

When syndication is perceived as a gift, initiating a syndicated investment as the lead VC firm is similar to hosting a party, where actors are hosting parties in turn. The gift, however, brings together a set of obligations to the receiver. The receiver needs to respond to each syndicate invitation under the norm of reciprocity or she may face the risk of accusations of dishonesty and untrustworthiness by the gift giver or other actors (Blau, 1964; Bothner, Meadow and Ozdemir, 2005). As Blau (1964, p. 16) states: “A person who fails to reciprocate favors is accused of ingratitude. This very accusation indicates that reciprocation is expected, and it serves as a social sanction that discourages individuals from forgetting their obligations to associates.” Nonreciprocation, on the other hand, results in accusations of dishonesty and untrustworthiness by the gift giver or other actors in the social structure. Unreciprocated exchanges obligate the receiver to conform to the requests of the initiator or other actors in the social structure (Blau, 1964). The obligations that come with receiving, therefore, become a social liability for the receiver.

Social exchange network includes information about the reputation capital of the actors (Robinson and Stuart, 2005) and shapes this reputation capital by allowing the flow of stories and gossip, which establishes trustworthiness or untrustworthiness of actors (Rousseau et al. 1998, Podolny, 2001). The exchange history of an actor, therefore, serves as a signal of trustworthiness and reputation capital, enabling other actors to form an opinion about the actor. To secure and enhance one's reputation in the social structure, a receiver would need to give gifts to the initial gift giver or to another actor the gift giver or the social structure would designate. The receiver, therefore, needs to act upon this liability of receiving a gift, even though it may not be her first choice to do so. This results in a potential conflict for the receiver between reciprocation and doing what she might want otherwise (Meeker, 1971). In VC industry, this conflict would equate to initiating a syndicated deal when the VC firm would like to have invested solo.

Receiving gift imposes constraints on the receiver's decisions on social exchange, while relieving the giver from some constraints. Thus, it is important for actors in the social structure to tally the gifts they have given and received. In this sense, initiating a syndicated deal is an example of group-focused generalized exchange and can be analyzed using the theories of generalized exchange (Ekeh, 1974). In the context of generalized exchange, a record that counts the overall balance of exchanges of the focal actor will be in order. This "balance sheet" is suitable for generalized social exchange, where actors strive for and care about a global exchange balance among actors in the social structure (Messick and Cook, 1983).

Applying this argument to the formation of syndicates in the VC industry, I claim that the “social balance” between a VC firm’s syndicate invitation givings and receivings affects his decision to initiate a syndicate. Having net social assets on one’s social balance sheet means that the focal VC firm has led more syndicates than he has been invited to.

Alternatively, having net social liabilities imply that the VC firm has received more syndicate invitations than he has initiated. Whether VC firm has net social asset or net social liability plays an important role in the syndication decision.

Although there are many benefits to syndication, once we control for the deal selection, uncertainty and risk diversification related motives, syndication brings together many disadvantages and a unique advantage. The disadvantages include giving up the extra profit of the deal and incurring coordination costs, as mentioned previously. The advantage is the possibility to receive reciprocated deals from those firms that focal VC firm has invited to syndicates. When the VC firm has net social assets, the advantage of forming a syndicate is not fulfilled, although disadvantages remain. In particular, this indicates that the focal VC firm is not receiving enough syndicate invitations in return for the syndicates he “gave” to other VC firms. In contrast, if the VC firm has net social liabilities, this indicates that the focal VC firm has not initiated enough syndicates to pay back his obligations incurred due to receiving syndicate invitations. Ultimately, actors in the social structure do not like leeches that do not reciprocate gifts and this dislike for free riders is true for VC industry as well (Ozdemir, 2005b). Therefore, I hypothesize that:

Hypothesis 1: *VC firms with net social liability are more likely to initiate a syndicate.*

The net social liability, however, may not affect each VC firm similarly; VC firm's position in the social structure might shape his attitude towards his obligations to reciprocate an invitation he has received. For example, in their study on reciprocation patterns, Bothner, et. al. (2005) show that if there are third parties that can watch the exchange of gift, hence encircle the social exchange, the receiver actor becomes more likely to reciprocate. The social network of the receiving VC firm, therefore, acts as an enforcing mechanism for the social liabilities of the VC firm (also see Coleman, 1988; Bradach and Eccles, 1989; Burt; 2001). If the VC firm is in a cohesive subgroup, where every VC firm is a friend of the other, the VC firms in the subgroup can coordinate their actions. They can collectively force the VC firm to carry out his socially understood duties, which involves attending to his social liabilities. Otherwise, the VC firm may face degradation of his reputation, as the other VC firms gossip on how the VC firm does not follow the norms of social exchange (Robinson and Stuart, 2005; Burt, 2001). Therefore, I predict that:

Hypothesis 2: *The effect of net social liabilities on syndication decision is greater for VC firms in cohesive social substructures.*

This difference-based account of the history of exchange relations of an actor (computed by subtracting initiations of and receivings invitations for syndicates) complements and extends the current approaches in the social exchange and alliance formation literatures.

Studies on alliance formation that take into account the exchange history limit their focus to how deeply embedded (loosely defined) the actor is in the alliance network. These approaches focus on the cumulative history of exchanges, presented by the total number of previous alliances and exchanges. Similar to results of alliance formation studies (Stuart, 1998; Gulati, 1995), as ties of a VC firm with other VC firms increase and strengthen, the incentives of the VC firm to enter further syndication relations also increases (Sorenson and Stuart, 2001). In addition, applying the norm of reciprocity to VC industry, inviting others would be returned with invitations by others (Gouldner, 1960; Bothner et. al. 2005; Ozdemir, 2005a). Past syndicate partners and past syndication decisions, therefore, become conduits of various investment opportunities for the lead VC firm. The higher the number of investment syndicates a VC firm leads and joins in, the wider the span of its network will be, highlighting the VC firm's acceptance in the syndication networks (Bygrave, 1987).

Beside social structure that comes through syndication networks, VC firms can also form social relations in the VC industry through local or national venture capital associations. Since VC associations organize meetings and conferences for its members to socialize, the fact the VC firm is a member of a VC association also signals how deeply embedded the VC firm is in VC industry social networks. Therefore, I claim that:

Hypothesis 3a: *VC firms with more “strong ties” are more likely to syndicate.*

Hypothesis 3b: *VC firms with more syndication experience are more likely to syndicate.*

Hypothesis 3c: *VC firms with venture capital association memberships are more likely to syndicate.*

Experience and Syndication Strategy

Investment experience of a VC firm also affects how the VC firm approaches the solo vs syndicated investment decision. When a VC firm does not have enough investment experience, syndication is advantageous on two dimensions. First, through comparing his decision with other VC firms and obtaining those VC firms' contributions in the investment decision process, a VC firm will be able to perform better deal selection. As one practitioner puts it succinctly: "venture capital firms prefer syndicating most deals for a simple reason - it means that they have a chance to check out their own thinking against other knowledgeable sources. If two or three other funds whose thinking you respect agree to go along, that is a double check to your own thinking as well as diversifying out the risk over several funds. However, syndicating does not mean that you defer to the judgment of others." (George Middlemas, Citicorp venture capital portfolio manager at the time of the comment, quoted in Perez, 1986). Second, syndication brings together learning (Podolny and Page, 1998; Hamel, 1991). Through syndication, the inexperienced VC firm will be able to be acquainted with and follow through the deal evaluation and selection strategies employed by more experienced firms. Importance of these factors, however, diminishes as the VC firm gains more investment experience. With each investment, the VC firm becomes more competent in performing reliable evaluations of business proposals by him. He also becomes more experienced at other activities, like

monitoring and mentoring of entrepreneurs, reducing the need for other VC firms' involvement. Therefore, I propose that:

Hypothesis 4: *Inexperienced VC firms are more likely to initiate syndicate investments.*

DATA AND METHODS

Using the SDC VentureXpert database of Thomson Financial, I have prepared a comprehensive panel of investments that VC firms performed in the US VC industry from early 1970s until 2004. The level of investment activities in the VC industry only took off after the 1958 Small Business Investment Act and became considerable starting with late 1960s, although the VC industry traces its origins to the establishment of American Research and Development Company in 1946. In order to give a leeway for the development of social structure in the VC industry and due to information regarding deals before 1970 is being at best incomplete, I have selected to start the analyses from 1975.

Dependent Variable

The analyses investigates a single event: whether a lead VC firm invested in a target company alone or formed a syndicate with other VC firms. The unit of analysis is VC firm and the target company pair. In the case of a syndicated deal the pair consists of the lead VC firm and the target company and for a solo deal the pair consists of the solo investor VC firm and the target company. The dependent variable is a dummy variable indicating whether the lead VC firm initiated a syndicate (coded 1), or invested solo

(coded 0). The VentureXpert data set has information regarding which VC firms invested in a target company at a particular round of investment at a given time and which VC firm is the lead. I classify the investment as a syndicated investment if another firm or other firms invested with the lead VC firm in the target company at a given round, and as a solo investment if the lead VC firm was alone in investing. I focus only on decisions of the lead VC firms in the first round, since the first round is where the lead VC firm has real power to decide whether to go solo or invite others. Once a syndicate is formed, friends of VC firms who already invested in the target company may become involved in the target company without lead VC firm's invitation and sometimes even against the will of the lead VC firm.

Net Social Liability

To calculate net social liability of a VC firm, I start with counting the number of syndicated investments a particular VC firm has ever been invited to and has ever initiated. The difference between the number of syndicates the VC firm joined as a co-investor and the number of syndicates the VC firm initiated represents the invitations the VC firm has not paid back yet. Mathematically

$$NSL_i = \sum_{d \in d_{t,i}} I_{d, \text{follower}} - \sum_{d \in d_{t,i}} I_{d, \text{lead}}, d_{t,i} \subseteq D_i \quad (1.1)$$

where D_i represents all deals of VC firm i and $d_{t,i}$, a subset of D_i , includes all deals of VC firm i until time t . $I_{d, \text{follower}}$ and $I_{d, \text{lead}}$ are indicator functions that turn on if VC firm i was invited to and initiated the syndicate for deal d , respectively. A positive NSL_i signifies that VC firm i has obligations unfulfilled (the VC firm has net social liabilities),

whereas a negative number indicates that other VC firms have obligations to the VC firm i (the VC firm has net social assets). As stated in hypothesis 1, as the net social liability of a VC firm becomes more positive, I expect the VC firm to be more likely to initiate a syndicate.

Embeddedness Measures

I measure embeddedness of a VC firm in the VC industry syndication networks with 3 variables: (i) the total number of syndicated deals the lead VC firm invested in, (ii) number of strong ties the VC firm has, and (iii) whether the lead VC firm is a member of VC association. I calculate the total number of syndicated investments of a VC firm by summing up the number of syndicates the VC firm led with the number of syndicates the VC firm invested as a co-investor. This variable captures the total number of unique target companies the VC firm ever invested in a syndicate with other VC firms. The second variable shows the count of VC firms the focal VC firm has invested together more than once. I calculate this variable by counting the number of unique VC firms the focal VC firm invested together more than once in target companies. Each unique target company contributes 1 to this measure, similar to the procedure in the total number of deals measure. For a VC firm to be considered as a strong tie of the focal VC firm, the two VC firms would need to co-invest in at least two different target companies. Lastly, I use a dummy variable that shows whether the VC firm is member of a VC association. This variable also captures the embeddedness of the VC firm in VC industry social relationships. As predicted in the hypothesis 3c, VC firms with VC association memberships are more likely to initiate syndicate than other VC firms.

Investment Experience

In order to capture investment experience of a VC firm, I count the number of unique target companies the VC firm has ever invested in, either alone or in a syndicate. The number of syndicated investments is a measure of embeddedness of the VC firm since syndicated investments make VC firms in the syndicate closer to each other in the social space through formation and continuation of social relationships. On the other hand, the total count of investments is used as a measure of experience of the VC firm. Whether it is with a syndicate or alone, each investment performed enables the VC firm to develop and polish the routines of preinvestment, investment, and post-investment activities that VC firms carry out in their investments.

Estimation and Controls

I model VC firms' choice between initiating a syndicate or investing solo using logistic regression model. Since same VC firm may appear more than once as the lead VC firm or solo investor VC firm, I perform conditional logistic regression analyses controlling for unobserved VC firm level effects through clustering on the VC firm. The estimation equation, including all independent and control variables, is:

$$\text{logit}(Y_{d,i,t}) = \beta_0 + \beta_1 NSL_{i,t} + \beta_2 NSL_{i,t} \times TC_{i,t} + \mathbf{E}\gamma + \mathbf{C}_U\lambda_1 + \mathbf{C}_R\lambda_2 + \mathbf{C}_{SS}\lambda_3 + \mathbf{C}_O\lambda_4 + e_{d,i,t} \quad (1.2)$$

where $Y_{d,i,t}$ represents whether the lead VC firm i initiated deal d at its first round at time t and $NSL_{i,t}$ and \mathbf{E} are the net social liability, experience and embeddedness variables explained above. To test hypothesis 2, I have interacted the net social liability of VC firm i with his cohesion in the social structure, represented by $TC_{i,t}$. To calculate the cohesion of lead VC firm's ego network, I extract the ego network of the VC firm and count the

number of realized ties among the VC firms in that ego network. The ratio of the number of realized ties to the number of all possible ties gives the cohesion of VC firm's ego network. If this ratio is high (maximum would be 1), then actors connected to the VC firm are also likely to connect to one another. On the other hand, if the ratio is low (theoretical minimum is 0), then partners of the VC firm do not invest with each other.

Also included in the model are variables that control for additional reasons of and motives for syndication:

Uncertainty and Syndication Strategy

The matrix C_U in Equation (1.2) includes variables that control for uncertainty.

Entrepreneurial finance literature mainly looks at syndication as a mechanism to perform better deal selection through reduction of uncertainty associated with the investment.

According to these studies, as uncertainty of investment increases, the investment is more likely to be undertaken through syndication and the lead VC firm is more likely to initiate a syndicate. Most of the target companies seeking capital have little operating history and this results in the need to double check the quality of investment (Tyebjee and Bruno, 1984). The lead VC firm can overcome the adverse selection and information asymmetry problems between the firm and the target company through forming a syndicated investment. Therefore, as uncertainty of investment in the target company due to adverse selection and information asymmetry increases, the lead VC firm becomes more likely to initiate a syndicate.

Information asymmetry is especially high when target company is young and early in its development stage. The target company still does not have a financial or operating history the VC firm can use to objectively evaluate the potential of the investment opportunity (Kaplan and Stromberg, 2004). The target companies that VC firms invest in can be classified in 5 categories according to their development stages. The first category is the seed stage target companies. In this stage, there is not a real product and the organization and the product are ideas in the entrepreneurs' mind. The second category is the early stage target companies, where the company has been established and started working on a "prototype" of the idea. The third category is comprised of target companies in the expansion stage. These companies need financing to grow their operations. The fourth category is the target companies that need capital for IPO, called later stage or bridge financing. The last category is those target companies that need capital for an MBO or merger and acquisition. As the stage of the investment increases from seed to bridge financing or MBO, objective criteria to evaluate the performance of the target company become available. In contrast, in the early stage investments, the evaluation criteria are mostly subjective and whether the entrepreneur will be able to deliver the potential of the investment is highly questionable. In such a case, the entrepreneur has every incentive to sell his big idea to VC firm maybe by exaggerating the appeal of it. This increases the information asymmetry and elevates moral hazard problems, which results in higher uncertainty associated with the investment. Therefore, I included the age of the target company and the dummy variables for the stage of the target company in the C_U matrix. I used the MBO financing stage as the base category. I expect the coefficient on other stage dummy variables to be positive, showing an increase

in the likelihood of initiating a syndicate. In addition, the coefficients should be larger for the dummy variables representing earlier stages than those representing later stages. I measure the age of the target company by subtracting the month and year of investment from the founding date of the company. As the age of the target company increases, the VC firm should be less likely to initiate a syndicate for investing in the target company, since the uncertainty would be lower for older firms.

Technology, industry and innovativeness of target company also drive the uncertainty associated with investment in the company. Bygrave (1987) argues that, on average, companies in high technology industries are more uncertain, and quoting Pfeffer and Salancik's (1978) resource dependence theory, he concludes that syndication formation is primarily a function of the degree of uncertainty the investment presents. In the C_U matrix, I also included a single dummy variable showing whether the target company is operating in one of communications, computer hardware/software, internet related, semiconductor or biotechnology industries. Medical and health, consumer related, industrial and energy, and financial and business services industries comprise the base category. As operational uncertainty of a target company rises, I expect the propensity of the lead VC firm to initiate a syndicate to increase.

Lastly, regarding uncertainty encircling the investment, early periods of an industry represent a relatively more uncertain environment compared with the periods when the industry is mature. Routines of carrying out activities in an industry, how to invest in case of VC industry, are not fully established when the industry is young (Carroll and Hannan,

2000). In these early periods, neither VC firms, nor entrepreneurs or limited partners have comprehensive knowledge on the dynamics of investment process or how to structure the deals or oversee the investments. Therefore, VC firms will be more likely to invest in syndicates in these early periods. In addition, syndication in the early history of VC industry, as a form of active mutualism, results in quicker establishment of legitimacy of the VC investment form (Ozdemir, 2005b).

Furthermore, information asymmetry between a target company and the lead VC firm is especially substantial when the specific industry the target company is operating in is new to VC industry and prospects of investing in that industry remain unclear. Because of the newness of the industry, VC firms are simply not yet fully equipped with the analytical tools and the know-hows to judge investments in the target company's industry. Since they are not experienced in reviewing investments from that industry, they would need validation of other VC firms to corroborate that the investment opportunity is worth their human and financial capital.

I measure the early periods of VC industry by VC industry age, calculated from 1946, the founding year of ARD and JH Whitman. The age of VC industry is calculated as the number of years from first investment in VC industry until the date of the investment, and used as a proxy for the generation of established investment routines and procedures. I measure the newness of target company's operating industry by the years of investment that VC firms performed in that industry. Age of target company's industry variable shows the years passed from the first investment in that industry by VC firms and is a

proxy for the complexity VC firms may face in evaluating the potential of target companies. For example, the first investment in a target company in biotechnology happened in 1977, whereas, the first investment year is 1968 for computer hardware industry and 1969 for energy industry. I expect that in the early periods, when the age of VC industry or the number of investing years in the target company's operating industry is small, VC firms will, on average, be more likely to initiate syndicates. Therefore, I expect negative coefficients for age of industry and years of investing variables.

Risk and Syndication Strategy

The matrix C_R in Equation (1.2) includes variables that control for risk. Another motive for syndication is due to the risk of the investment. According to this view, syndication is driven by the need to diversify risk and have a balanced portfolio (Brander, Amit and Antweiler, 2002; Lerner, 1994; Robert J. Kunze of Hambrecht and Quist, quoted in Lerner 1994). The reason syndication decreases risk is that size of investment funds of VC firms is not unlimited. Hence, VC firms need to be careful on how they spend their resources, since performance of their fund is what drives the size of the next fund they can raise (Gompers, 1995). On average only 10% of portfolio companies of a VC firm ends up being a real success, with close to 50% of their investments just breaking even or losing money. In an attempt to hold a well-diversified portfolio, VC firms invest in syndicates. Syndication enables them to commit less financial resources to each investment and perform more investments with the same amount of limited funding.

The risk associated with an investment is especially high if the target company requires a significant amount of capital. Rather than investing alone and betting such a large amount of capital on a single company, the VC firm would be more likely to initiate syndication. Syndication will also enable the VC firm to invest his remaining capital on other investments and achieve a better diversified portfolio of target companies. Therefore, in matrix C_R I include the total amount of capital invested in the target firm in the first round. I expect that the lead VC firm will be more likely to syndicate investments in a target company that seeks a larger amount of capital.

The overall state of the economy would also effect the syndication strategies. As the economy enters boom periods, slowdowns, and recessions, capital inflow to VC industry fluctuates. In economic boom periods, VC firms are able to raise larger funds, since expected returns on investments are higher (Gompers and Lerner, 1998). This enables VC firms to spread the risk more easily even by solo investments and diminishes the importance of syndication to achieve portfolio diversification (Gompers and Lerner, 2001). On the other hand, in periods of low capital inflow to VC industry, VC firms are more uncertain about their life chances, which depend on their ability to raise the next fund successfully. VC firms can bear low capital inflow to VC industry through syndication, since performing syndicated investments necessitates less amount of capital than performing the investment alone. Therefore, in matrix C_R I also include the total amount of capital raised by all the new funds in the previous year. I expect the lead VC firm to be less likely to syndicate investments when the capital is abundant in the VC capital industry and money is chasing the deal.

Position in Syndication Networks and Syndication Strategy

The matrix C_{SS} in Equation (1.2) includes variables that control for VC firm i 's position in the syndication networks. These variables include the cohesion of ego network of VC firm i that I have discussed previously and the social status of the lead VC firm. I calculate status score of the lead VC firm using formulation in Bonacich (1987) on a syndication network that is generated through a 5-year moving window. I normalize the status scores of VC firms so a VC firm with average status receives a status score of 1. As discussed by Bonacich (1987), this enables comparability of status scores across different syndication networks at different periods.

The matrix C_O in Equation (1.2) includes other variables that control for VC firm i 's propensity to syndicate. For example, VC firms' inherent characteristics may also affect their investment strategy. The VC industry is not comprised of a single type of firm, but many different types. These include private equity limited funds (PEVC), corporate venturing programs (CVP), investment bank affiliated venture programs (IBVC), and government affiliated small business investment companies (SBIC). Different types of VC firms may have different motives and expectations on the investments they perform. Motivations such as earning multiples of original investment are shared by all VC firms. Some type of VC firms, however, may place less emphasis on this compared with how the target company fits their general strategy, while other type of VC firms may make return on investment the main purpose of investing. For this purpose, I include a set of dummy variables representing the type of VC firm, with SBIC's being the base category.

In addition, Lerner (1994) hypothesized that VC firms may try to invest in later rounds of promising firms. Those VC firms can then claim that they invested in successful companies, called “window-dressing” by VC firms, after Lakonishok, Shleifer, Thaler, and Vishny’s (1991) term for the pension funds that were intentionally adjusting their portfolios at the end of quarters. I claim that this strategy will be more pronounced when the VC firm’s fund is coming close to its liquidation date. This is the time period when the VC firm will be trying to generate its next fund and will be more interested in impressing the limited partners. Therefore, in order to test for the “window dressing” effects, I have included the age of the fund the lead VC firm used for investing in the target company. I expect the likelihood of syndication will increase as the age of the fund used increases.

The cost of overseeing and the difficulty of mentoring the target company is also affected by the geographical distance between VC firm and target company. Although VC firms invest in target companies a few thousand miles away, their day-to-day involvement in the strategic decisions of target companies is greatly hampered by the physical distance between them (Sorenson and Stuart, 2001; Lerner, 1995). In an interview with VC firms, Tyebjee and Bruno (1984) found that 9 out of 46 VC firms used the geographic location of a target company as a strict screening criterion to maintain travel time and expenses to a manageable level. And, Florida and Smith (1993) point to a survey reporting that VC firms prefer to be close to their investments to screen, monitor, and assist target company’s management. Therefore, in the C_O matrix, I also include control variables for the target company’s and the lead VC firm’s geographical locations.

The last set of control variables included in the C_O matrix are the age of the lead VC firm, the number of VC firms at the time of the investment, and the number of VC firms when the lead VC firm was founded. I measure the age of the lead VC firm as the months passed from the founding date until the investment month. The number of VC firms at the time of the investment measures the availability of other VC firms the lead VC firm can invite. Lastly, the number of VC firms when the lead VC firm was founded measures developed routines toward syndication. If the firm is founded when there were a handful of VC firms around, the VC firm would be more likely to try to develop resources for handling investments all by himself. He would intrinsically be more likely to perform solo investments. Therefore, I expect positive effects for the number of VC firms at the founding variable.

RESULTS AND DISCUSSION

Table 1 presents results from 5 regression models predicting whether the lead VC firm will initiate a syndicated investment or invest solo in the target company. The models are estimated using logistic regression with clustering on the lead VC firm. To ensure that the estimates are robust to different specifications of the discrete choice model, I start with two models where I only include the hypothesized variables and no controls. These results are presented in Models 1 and 2, and test hypotheses 1 through 4. Then, in Model 3, I present the estimation results with control variables only. Models 4 and 5 introduce all main and control variables discussed in the data section. If my thesis is correct, the higher the net social liabilities of the lead VC firm, the more likely the lead VC firm will be to initiate a syndicate.

As shown in Model 3, the control variables measuring the uncertainty of investment in the target company have the expected effects. The stage dummy variables are positive and decreasing as the target company becomes a later stage company. The lead VC firm is 12 [= $\exp(2.4842)$] times more likely to syndicate a seed stage, 6.36 times more likely to syndicate early stage, 3.48 times more likely to syndicate expansion stage, and 3.3 times more likely to syndicate later stage target company compared with syndicating a target company requiring an investment for a MBO or LBO. Similarly, the age of the target company is negative and significant, indicating the lead VC firm is less likely to syndicate older target companies. Each additional age of the target company decreases likelihood of syndication by 5%.

In addition, whether the target company is in a high technology industry or not also has a positive and significant coefficient. This confirms that as operational uncertainty of target company increases, the lead VC firm becomes more likely to initiate a syndicated investment. A switch from investing in a low technology company to a high technology company increases the likelihood of initiating a syndicate by 28.6%.

Age of VC industry has a significant and consistent effect among models, as well as the size of the investment required and the total capitalization of new funds. Each additional year of the VC industry decreases propensity of syndication by 10.1% and each additional log million dollars generated by the new funds decreases overall syndication propensity by 26%. On the other hand, with each additional log million dollars needed by

the target company, the lead VC firm becomes 3.5 times more likely to initiate an investment syndicate.

The number of all VC firms at the time of the founding of the lead VC firm has a positive and significant effect (z-value of 2.8). This implies that when there are only a few firms around when they are founded, VC firms develop routines that enable them perform all of the investment procedures by themselves. When there are many firms around at the time of the founding, however, VC firms internalizes routines that make them more easily invest in syndicates. Each additional VC firm at the time of the founding increases intrinsic syndication propensity of the lead VC firm by 0.4 basis points.

Lastly among the control variables, the age of the fund used by the lead VC firm has a positive and significant effect on the likelihood of syndication. Each additional year into funds life increases the likelihood of syndication by 4%, supporting the “window dressing” argument.

Model 4 presents the coefficients of main variables when alternative motivations of syndication are controlled for and tests Hypotheses 1, 3, and 4. As predicted in Hypotheses 3a-c, the positive and significant coefficients for number of strong ties of the lead VC firm, total ties of VC firm and whether VC firm is a member of a VC association signify that as the lead VC firm becomes more embedded in the syndication networks and in the social structure of the VC industry he becomes more likely to initiate a syndicate. Each strong tie of lead VC firm increases the likelihood by 0.7%, whereas each additional

syndication experience of the VC firm increases the likelihood of syndication by 1.3%. Furthermore, the VC firm that is member of at least one VC association is 54% more likely to initiate a syndicate compared to a VC firm with no such membership. This also confirms the social matchmaking role of VC associations in addition to their educative and lobbying roles.

In contrast to embeddedness effects, the experience of VC firm in investment process decreases his likelihood of initiating a syndicate, as measured by the deals ever performed by the VC firm variable. This variable has a negative and significant effect implying that each additional investment performed by the lead VC firm makes him 1.5% less likely to initiate a syndicate. Therefore, one can interpret that, as the number of investments of the lead VC firm increases and the number of friends of the firm is kept constant, the VC firm becomes less likely to initiate a syndicate (the experience effect). However, as the number of friends of the lead VC firm increases controlling for the number of investments of the VC firm, the VC firm becomes more likely to initiate syndicate (the embeddedness effect).

The net social liabilities variable is positive and significant lending support to Hypothesis 1. As net social liabilities of the lead VC firm increase, the lead VC firm become more likely to initiate a syndicate in an effort to clear his unpaid social obligations towards others. Each additional unpaid social liability of the lead VC firm increases the propensity of syndication by 1.2%. This also shows that the generalized reciprocity dynamics as described by Ekeh (1974) are in effect in VC industry. The syndication

invitations the lead VC firm received previously, but did not reciprocate yet, places a constraint on the syndication strategy of the VC firm, thus making the firm more likely to initiate a syndicate. This is true even after other motives of syndication are taken into account, in which case a rational VC firm should prefer to invest solo, since there is no financial motive to do so.

The last hypothesized motivation of syndication was the interaction effect of net social liabilities variable with the position of VC firm in the syndication network social structure, as measured by the cohesion of his ego network. Model 5 shows that, in addition to positive and significant main effect of net social liabilities (z-score of 3.71), the interaction is also positive and significant. This implies that for actors in cohesive substructures in the social structure, each additional unpaid social liability becomes a more important determinant of the syndication strategy. Figure 1 shows the effect of net social liabilities when the cohesion score of the lead VC firm is 0 and 1. The lead VC firm in a fully cohesive substructure is 3 times more attentive to his net social liabilities than when his ties are not connected to each other ($0.0112 + 0.0251 = 0.0363$) vs. 0.0112, confirming prediction of Hypothesis 2.

CONCLUSION

In this study, I aimed to contribute to the literature on interorganizational networks and alliance formation. For this purpose, I introduced two concepts complementing each other, called social liability and social asset. Using arguments borrowed from social exchange theory (Blau, 1964; Homans, 1958) and social capital theory (Coleman, 1988),

I have argued that actors accumulate social assets when they give a gift or do a favor for another actor, whereas the gifts they receive become a social liability for them, constraining their action and decision choices. I have shown an example of such constraining. Arguing that syndication networks are indeed social exchange networks and syndicate invitations are gifts and favors circulating among VC firms, I found that a lead VC firm with net social liabilities is more likely to initiate a syndicate, even though it may not be rationally preferable to do so. I have defined that a VC firm has net social liabilities if the VC firm has received more syndicate invitations than he has initiated, that is he has unpaid gifts under the norm of reciprocity. I have also shown that this effect of net social liabilities is stronger for firms that are in cohesive substructures. This finding lends further support to recent studies that focus on the norm enforcing functions of social structures and social networks (Bothner et. al., 2005; Coleman, 1988; Burt, 2001).

The findings that social structure and especially the net social liabilities of a VC firm affects syndication strategies of the VC firm are surprising for such economically motivated actors like VC firms. Once the financial and economic reasons of syndication are accounted for, it would be preferable for VC firms to invest alone. Investing through a syndicate would mean that the lead VC firm is giving up potential return that it could have generated if invested alone in the target company (Manigart, et. al., 2004). In addition, as opposed to complications and slow downs that syndication may bring together in guiding a target company, solo investments would have shortened the strategic decision making process of the company (Lockett and Wright, 2001; Wright and

Lockett, 2003). Furthermore, through performing the investment alone, the VC firm would have eliminated the possibility of a disagreement among the syndicate members regarding the direction and strategy of the target company. Lastly, investing solo also would have eliminated management and coordination costs among the syndicate members that would happen in a syndicated investment. However, the finding becomes clear once we include receiving investment syndication invitations into the picture. The choice between initiating a syndicate and investing solo describes only half of the investment dynamics in the VC industry. As Ozdemir (2005b) shows, the VC firms that do not attend to their social liabilities, and do not initiate syndicates to clear them, receive fewer syndicate invitations, increasing their mortality rates. Therefore, although VC firms may not need to initiate syndicates from the finance perspective, they need to initiate syndicates. Through syndicates they do clear their social liabilities and are able to continue their participation in the syndication networks of VC industry.

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Table 1: Logistic Regressions for Whether Lead VC Firm Performed Investment as Solo or with a Syndicate.

The period of analyses is from 1970 until end of 2004 on a dataset prepared using VentureXpert dataset of SDC Platinum. The unit of analysis is lead VC – target company pairs. The dependent variable is a dummy variable indicating whether the lead VC firm invested in the target company alone, a solo investment, coded 0, or with other VC firms, a syndicated investment, coded 1. Logistic regression analyses controlling for unobserved VC firm level effects through clustering on the lead VC firm are performed, since same VC firm may appear more than once. Net social liabilities of VC firm is obtained by subtracting number of investment syndicates focal VC firm led for other VC firms from number of syndicates the VC firm joined as a non-lead member.

Independent Variables	Dependent Variable: Whether Investment is Performed as a Syndicate				
	Model 1	Model 2	Model 3	Model 4	Model 5
Net Social Liabilities of VC Firm	0.0053*	0.0055*		0.0122***	0.0112***
	[2.02]	[2.11]		[3.99]	[3.71]
Interaction (Total Constraint x Net Social Liabilities)		0.0247**			0.0251*
		[2.96]			[1.99]
Number of Strong Ties VC Firm Has	0.0077***	0.0052***		0.0064**	0.0059**
	[5.62]	[4.25]		[2.96]	[2.66]
Total Ties of VC Firm (as lead or led)	0.0059*	0.0074*		0.0133***	0.0130***
	[2.05]	[2.51]		[3.97]	[3.90]
Is VC Firm Member of a VC Association	0.4309***	0.3787***		0.3293**	0.3355**
	[6.24]	[5.67]		[3.17]	[3.26]
Deals Ever Performed by VC Firm	-0.0082**	-0.0095***		-0.0147***	-0.0146***
	[-2.97]	[-3.35]		[-4.40]	[-4.35]
Stage Dummy (Seed)			2.4842***	2.4410***	2.4358***
			[20.2]	[19.7]	[19.6]
Stage Dummy (Early)			1.8508***	1.8330***	1.8214***
			[15.5]	[15.4]	[15.2]
Stage Dummy (Expansion)			1.2465***	1.2280***	1.2178***
			[10.5]	[10.5]	[10.4]
Stage Dummy (Later)			1.1943***	1.2254***	1.2108***
			[6.58]	[6.94]	[6.86]
Age of Target Company			-0.0518***	-0.0522***	-0.0522***
			[-7.38]	[-7.33]	[-7.37]
Is Target Company in High Tech			0.2521***	0.2449***	0.2445***
			[4.19]	[4.09]	[4.08]
Age of VC Industry			-0.1055**	-0.1095**	-0.1100**
			[-3.19]	[-3.23]	[-3.24]
Age of Target Company's Industry			0.0449	0.0352	0.0357
			[1.46]	[1.12]	[1.13]
Age of Target Company's Industry (Squared)			-0.0012+	-0.001	-0.001
			[-1.91]	[-1.58]	[-1.58]
Size of Investment Amount in the Round (logged)			1.2354***	1.2531***	1.2537***
			[32.6]	[34.2]	[34.4]
Total Capitalization of New Funds (logged)			-0.2993***	-0.3156***	-0.3104***
			[-3.40]	[-3.56]	[-3.49]
Total Constraint of VC Firm		-1.2879***	-0.7886***	-0.6543***	-0.6493***
		[-10.2]	[-4.24]	[-3.61]	[-3.53]
Social Status of VC Firm			0.0154*	-0.0118	-0.0109
			[2.07]	[-0.62]	[-0.58]
Number of All VC Firms			-0.0015**	-0.0015**	-0.0014**
			[-2.81]	[-2.69]	[-2.64]

Number of All VC Firms (Sq)			0.0000***	0.0000***	0.0000***
			[4.25]	[4.32]	[4.23]
Number of All VC Firms (At Founding)			0.0004**	0.0004**	0.0004*
			[2.80]	[2.63]	[2.56]
Age of Fund VC Firm Used			0.0373**	0.0411**	0.0402**
			[2.67]	[2.90]	[2.86]
Age of Fund VC Firm Used (Squared)			-0.0005	-0.0008	-0.0007
			[-1.14]	[-1.61]	[-1.55]
Age of VC Firm			0.0039	0.0086	0.0084
			[0.38]	[0.80]	[0.80]
Private Equity VC Firm (Dummy)			-0.5270**	-0.5109**	-0.5032**
			[-3.06]	[-2.91]	[-2.87]
Corporate Venturing Program (Dummy)			-1.0713***	-1.0542***	-1.0486***
			[-5.00]	[-4.88]	[-4.86]
Investment Bank Affiliated VC Firm (Dummy)			-0.7792***	-0.8001***	-0.7957***
			[-3.91]	[-3.94]	[-3.92]
Is Target Company in CA			0.4360***	0.4138***	0.4094***
			[5.19]	[5.01]	[4.98]
Is Target Company in NE			0.0224	-0.0018	0.0024
			[0.21]	[-0.016]	[0.022]
Is VC Firm in CA			0.0433	-0.0698	-0.0673
			[0.34]	[-0.54]	[-0.52]
Is VC Firm in NE			-0.7194***	-0.6819***	-0.6788***
			[-4.96]	[-5.05]	[-5.14]
Is Target Company and VC Firm in CA			-0.7091***	-0.6671***	-0.6626***
			[-4.22]	[-3.99]	[-3.98]
Is Target Company and VC Firm in NE			0.3779*	0.3684*	0.3618*
			[2.35]	[2.27]	[2.23]
Is Target Company and VC Firm in Same State			0.4563***	0.4753***	0.4743***
			[5.27]	[5.38]	[5.45]
Time Piece #1 (1980 - 1984)			0.9345***	0.9433***	0.9417***
			[3.78]	[3.88]	[3.88]
Time Piece #2 (1985 - 1989)			1.5133***	1.3428***	1.3448***
			[4.55]	[3.98]	[3.98]
Time Piece #3 (1990 - 1994)			1.4735***	1.3622***	1.3713***
			[3.68]	[3.35]	[3.38]
Time Piece #4 (1995 - 1999)			1.9030***	1.8873***	1.8981***
			[4.01]	[3.92]	[3.96]
Time Piece #5 (2000 - 2004)			1.3008**	1.2199*	1.2368*
			[2.58]	[2.40]	[2.45]
Constant	0.4364***	0.4481***	-5.5589***	-5.5949***	-5.6262***
	[8.39]	[8.56]	[-8.87]	[-8.52]	[-8.54]
Observations	19012	19012	18079	18079	18079
Log Likelihood	-11373.847	-11364.1584	-6205.2457	-6135.5979	-6130.583
Wald Chi2 Statistics	111.261	121.963	1977.095	2232.308	2237.725
Pseudo R2	0.0227	0.0236	0.416	0.423	0.423
Number of Variables	5	6	34	39	40
Robust z statistics in brackets, *** p<0.001, ** p<0.01, * p<0.05, + p<0.1					

Effect of Net Social Liabilities and Cohesion on Likelihood of Syndication

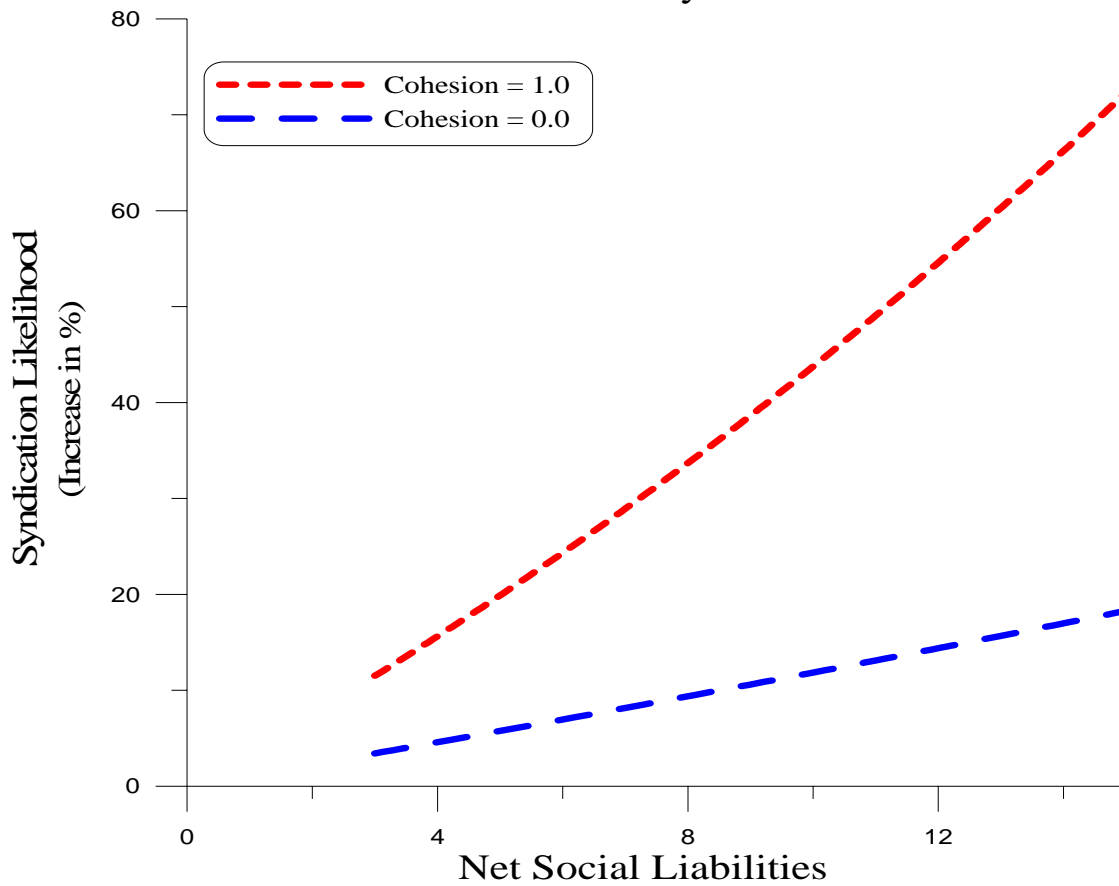


Figure 1: Effect of net social liabilities on the likelihood of initiating a syndicate. The X-axis represents the net social liabilities of the lead VC firm, calculated by subtracting the number of syndicates the lead VC firm ever initiated from the number of syndicates the lead VC firm was a non-lead member. The Y-axis shows the percentage increase in syndication likelihood (20 means 20% more likely to initiate a syndicate).

APPENDIX: DIFFERENCE BASED AND CUMULATIVE EXCHANGE HISTORY

The difference and cumulative based accounts of history can further be distinguished by investigating the snippet of a hypothetical network, depicted in Figure 2. In this network, the actor A0 - represented by rounded rectangle – have 10 total exchanges with each of his alter actors. According to cumulative history, all of these connections are same for A0. Actor A0 is, therefore, equally likely to invite any one of them to a new connection, or reciprocate to an invitation initiated by these actors. The difference based history, however, shows a very different picture in terms of relationships between actor A0 and these actors. For example, actor A0 has 4 (=7-3) net social asset in his relation with A2, whereas he has a balanced relationship - 0 (=5-5) net social asset and liability - with A3, and have 10 (=0-10) net social liabilities to clear in his relationship with A5. In addition, looking at all ties of an actor, one can see that actors A0 and A1 have 50 total connections in their ego networks, which makes them equally likely to initiate a new exchange, if an opportunity to do so exists. The difference based history shows that A0 has a net overall social asset of 21, whereas A1 has 6 overall social liabilities.

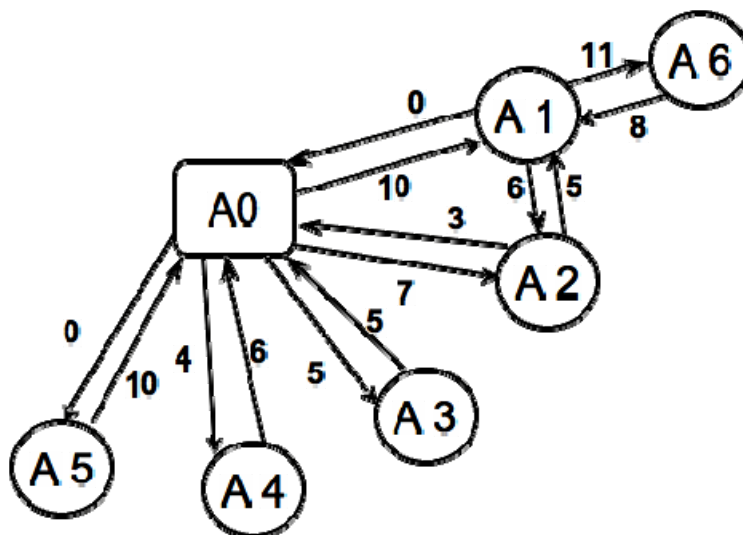


Figure 2: Snippet from a hypothetical exchange network. The round rectangle and the circles represent the actors, the numbers beside the directed arrows show the number of exchange initiations performed by a particular actor that invited the corresponding alter.

¹ Net social asset of 2 for actor A0 is found by $10-0+7-3+5-5+4-6+0-10=2$. Similarly, for A1 the calculation is as: $0-10+6-5+11-8=-6$, i.e. 6 net social liabilities.