

## ABSTRACT

Title of dissertation: DO INVESTOR CAPABILITIES INFLUENCE THE INTERPRETATION OF ENTREPRENEUR SIGNALS? THEORY AND TESTING IN THE PRIVATE EQUITY SETTING

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Informing outsiders of the potential and quality of the organization in a way that will benefit the organization and avoid putting it at risk is a challenging task in competitive settings. Under conditions of uncertainty, in which external entities are imperfectly informed about the organization, outsiders will seek for signals of quality. Current research of interfirm signaling has focused on the sender's ability to generate signals. In this dissertation, I propose that receivers of signals are heterogeneous in their ability to interpret signals and that this heterogeneity significantly influences the outcome of the interaction between signaler and interpreter. I apply this insight in an entrepreneurial setting to explain differences in signaling to venture capitalist and informal private equity investors (business angels) over the early stages of a firm's lifecycle. The findings have strong implications for entrepreneurial firms' strategy and, generally, to signaling theory.

I argue that signals are multifaceted. Outsiders may base their decisions on two aspects of signal: the informative aspect, which relays direct information on the capabilities of the organization; and, the legitimizing aspect, which conveys legitimacy through actions of third-party entities. The use of each aspect is determined by the abilities of the sender to generate the signal and the receiver to interpret it. I posit that the informative aspect of the signal will be prominent when both the sender's and the receiver's abilities are high. When either the sender's ability to generate a signal, or the receiver's ability to interpret it, is limited, the legitimizing aspect of the signal will be prominent. When both the sender and the receiver possess low signaling abilities, the interpretation will be based on idiosyncratic data.

This dissertation explores the differences between these two facets of signals, and the usefulness of each signal aspect when considering the organization's target audience. The first essay explains the purpose of the two signal aspects for stakeholders and the recursive nature of interpretation. The two following essays test the theory by utilizing two large datasets of private equity investment solicitations. The second essay evaluates the effectiveness of the legitimizing aspect of the signal as a mechanism for screening startups' funding solicitations. The third essay compares the informative and legitimizing aspects of signals as decision making mechanisms for both angel and venture capital investors.

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OF ENTREPRENEUR SIGNALS?  
THEORY AND TESTING IN THE PRIVATE EQUITY SETTING

by

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## DEDICATION

I dedicate this dissertation to my family. Particularly to my wife Sharon, whose patience and understanding were invaluable in overcoming all the hurdles of this voyage, and to our son Johnathan, who reminded me to pay attention to the basics. I also thank my parents, Rochik and Kobi Gera, for their continuous support of all things educational and for pushing me to go higher, and to my sister, Hadas Heller, for shouldering the lion's share of family mayhem across the ocean. Finally, I dedicate this work to my late grandmothers: Ida Greenwald and Mina Ronen, both of whom believed in diligence, hard work, science, art, and the pursuit of excellence.

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# CHAPTER 1:

## INTRODUCTION

All organizations face the challenge of communicating effectively with external entities. This challenge is amplified in competitive settings since the organization is encouraged to create and maintain information asymmetry. Under conditions of uncertainty, when outsiders are imperfectly informed about the quality of the organization, they will infer this quality from signals they believe are correlated with the underlying quality of the organization (Spence, 1973). For the most part, organizational signaling research has focused on the organization's ability to generate signals, signal typology, and the influence of different signal types on the decision-making of outsiders. To a large extent, the characteristics of outsiders, and the influence of these characteristics on the ability to interpret signals is ignored in previous research. In this dissertation I study the influence of the signal receivers' characteristics on the utilization of signals. Considering the signal's receivers allows for a more complete understanding of signals. A key realization is that the signal's functionality is not necessarily singular. Rather, every signal contains multiple functions, both informative and legitimating in scope. The prominence a certain aspect of the signal has in influencing decision making depends on the interaction between the sender's ability to generate the signals and the receiver's capability to interpret them.

In order to understand how signals influence decision makers, one must consider the three parts of the interaction: the structure of the signal, the signaler, and the receiver. The signaler seeks to convey positive information and establish its legitimacy. Through signals, outsiders search for information that will reduce the degree of uncertainty in their interaction with the signaler. To this end, outsiders use two aspects of a signal: an informative aspect, which relays direct information regarding the capabilities of the signaler, and a legitimizing aspect in which the actions of third-party entities establish the credibility of the sender. In this dissertation I study how variance in receivers' ability to interpret signals influences which aspect of the signal structure will be more influential in determining the outcome of the signaling interaction.

This dissertation is structured into three essays. In the first essay I examine the structure of signals. I explain the purpose of the two aspects of the signal for stakeholders and the recursive nature of the relationship between these aspects. Additionally, I suggest a model which uses the interaction between the sender's ability to generate a signal and the receiver's ability to interpret the signal to predict which aspect of the signal will be most prominent in a sender-receiver interaction. I then test the suggested theory in two empirical essays, which follow thereafter.

Institutional theory suggests organizations operate simultaneously in two types of environments—technical and institutional (Meyer & Rowan, 1977; Scott, 1992). Since signals serve to communicate between organizations, to be effective the signal's structure must match the environment in which the organizations operate. The informative aspect

of the signal conveys the signaling organization's ability to create and exchange its products. Derived from observable decisions of the organization, the informative aspect of the signal gives a direct and codifiable indication of the organization's capabilities. Thus, when the informative aspect of the signal is the prominent aspect it serves to reduce information asymmetry between the sender and receiver. The legitimizing aspect of the signal qualifies the organization's reputation to the outsider. Derived from visible actions and decisions made by third-party entities with regards to the organization, the legitimizing aspect of the signal provides an indirect indication of the sender's underlying quality and serves to establish the sender and his actions. Thus, when the legitimizing aspect of the signal is the prominent aspect it serves to reduce uncertainty (or at least give the perception of lower uncertainty). It should be pointed out that this separation of the signal into informative and legitimizing aspects is recursive. Thus, the legitimizing aspect has an informational component to it and the validity of the informative aspect is determined by its conformity to institutional norms. One needs only to consider Spence's classical job market example (1973) to realize this structural phenomenon. The candidate's resume is the signal in this case, and its informative aspect is the education and past experiences outlined therein. The legitimizing aspect is realized through the applicant's adherence to the resume writing norms of the relevant industry. If, as Spence did in his example, we focus on the educational background, which is one level 'down' the recursion, the degree and accomplishments of the candidate are the informative aspect at this level while the reputation of the degree-giving institution serves as the legitimizing aspect. Obviously, the number of potential recurrence levels depends on the complexity of the original signal. Understanding the recursive nature of the signal's structure may

explain how “deep” the receiver will search before finding the actual signal that allows her to make a decision.

As stated by Spence (1973), the sender’s abilities are negatively correlated to the cost of generating a signal of quality. The same logic can be implemented regarding the quantity of signals a sender can generate, i.e. the sender’s abilities are negatively correlated to the cost of sending multiple signals. These statements implicitly assume all receivers are identical in their ability to interpret the signal(s). If one would reverse the focus of Spence’s statement from the sender to the receiver, the falsity of the assumption of similarity would be revealed. Thus, to distinguish between receivers on the ability to interpret the signal, the cost of interpreting the signal must be negatively correlated to the receiver’s ability. Additionally, the cost of interpreting multiple signals must be negatively correlated to the receiver’s ability. Otherwise, all senders would be motivated to invest in the signal to the same extent so that receivers would fail to distinguish between them based on the signal.

Consider the simplest segmentation into high and low abilities. A sender with a high level of signaling abilities will generate more signals, while a low level signaler will produce fewer signals. Similarly, a receiver with higher interpretation abilities will be able to utilize more from each received signal. Hence the receiver will have more potential information to interpret from the sender with high abilities; however, the usefulness of the signal depends on the receiver’s abilities. Thus, it is not clear that a

higher number of signals is always beneficial for the low level receiver. In fact, one can easily come up with a scenario where such an example would end with information overload. Rather, I suggest the four different combinations of sender's and receiver's abilities in each of the quadrants determine the prominence of signal aspect. When both the sender's and the receiver's abilities are high, the technical aspect of the signal, which provides direct information about the organization, will be prominent in influencing the receiver's decision. When the sender's abilities are low and the receiver's abilities are high, or when the sender abilities are high and the receiver's abilities are low, the legitimizing aspect of the signal will be prominent in influencing the receiver's decision. When both parties' abilities are low the decision will be based upon idiosyncratic information, thus no conclusions can be made regarding future decisions of the receiver or about the sender himself.

In the first empirical essay (Chapter 3), I evaluate how the legitimizing aspect of the signal influences decision making by a receiver with limited signal interpretation abilities. Studies have identified social ties, business concept, the entrepreneur's capabilities, and the general fit with the VC's preferences (Hall and Hofer, 1993; MacMillan et al., 1985; Shane and Cable, 2002; Shepherd, 1999) as the criteria VCs use to select which startups to fund. VC firms sift through hundreds of proposals a year while funding only a handful of startups (Goldfarb et al., 2005; Metrick, 2007). In VCs, usually a small group of partners makes all of the investment decisions. Hence, the attention of the venture partners is a scarce resource and its allocation is central to the success of the VC. I argue that due to their limited attention resources at the screening stage, VCs'



decision makers focus on the legitimizing aspect of the received signals. Since social mediation is both observable and legitimizing (Podolny, 1994) it will be used as a selection criterion at the initial selection screen.

I use the attention-based view of the firm (Ocasio, 1997) to study the influence of network ties as a solicitation mechanism on VC's initial screening of solicitations. I test my hypotheses by using a large sample of funding solicitations from a single VC firm (hereafter the Focal VC) over a period of two years. I observe the soliciting startups' signal, which includes the social network, the submitted documentation type and content, the Focal VC initial reaction to the signal, and, whether the startup was funded. The data include the solicitation characteristics as recorded by the Focal VC. Hence, the data represents the Focal VC's decisions in situ. This setting enables me to test the proposition that a limitation in the receiver's abilities to interpret signals will enhance the usefulness of the legitimizing aspect of the signal by identifying which cue influences the VC's decisions at the initial stage of the funding process.

In this setting the network tie for which the solicitation referral is attributed acts as the legitimizing aspect of the signal, while the informative aspect of the signal consists of the documents submitted in the solicitation package. Social mediation occurs when an investment opportunity is referred to a venture capitalist by a third party with prior ties to the investor. I observe both direct and indirect social interaction as the result of social referrals. Direct referrals occur when an intermediary introduces the startup and the VC

prior to the submission of an investment solicitation. In indirect referrals a third party submits the solicitation to the VC before a direct interaction takes place. Both introduction types constitute endorsements and confer legitimacy.

I show that due to severe constraints on the availability of attention resources at the VC's screening stage the legitimizing aspect of the signal takes prominence in influencing the decision. Moreover, I show that having a direct network tie between the startup and the VC prior to the solicitation of funding, which creates an opportunity for transferring additional alternative information, is more influential than any other type of social referral. Additionally, I test in this chapter the proposition that variance in the receiver's ability will influence the importance of the legitimizing aspect. I proxy the VC's available attention resources for screening incoming solicitations by measuring the workload of the VC. The results are in the opposite direction to the suggested hypotheses.

In the second empirical essay (Chapter 4), I test how the informational and legitimizing aspects of the signal influence the decisions of different types of receivers. I suggest that the greater the similarity between the signaler and the receiver the greater the influence of the informative aspect of the signal. I use the structural differences between private equity investors' types to determine which aspect of the signal will be prominent in influencing their investment decisions. Due to the inherent information asymmetry between young startups and private equity investors, and the uncertainty of investment outcome, potential investors tend to ignore some of the information the startup provides

due to concerns of omission or misrepresentation (Spence, 1976). One of the main methods startups use to provide information early in the solicitation process is to submit planning documentation, such as business plans, to the solicited investors (Kirsch, Goldfarb, & Gera, 2009; Tyebjee & Bruno, 1984).

The third study utilizes a separate dataset of startups' funding solicitations from both angel and venture capital investors. When reading the submitted documents, investors may treat statements regarding the potential of the venture cautiously and search for valid alternative signals of value (Downes & Heinkel, 1982; Spence, 1973). In top echelon research, studies of Top Management Team (TMT) and Board of Directors (BOD) structures suggest that the structure and composition of the firm's top echelon serves both as a resource and as a signal of legitimacy to potential investors. While both TMT and BOD description is usually part of the documentations startups submit to potential investors, its verifiable nature makes it useful for reducing information asymmetry. The fact that most of the information within the biodata of top echelon members consists of past experiences to the soliciting venture turns it into an alternative signal to the quality of the venture. Extant research has shown investors rely on management and board size and composition as a valuable signal when deciding on IPO investments. Top echelon structure affect the success of an IPO through recruiting prestigious underwriters (Higgins & Gulati, 2003), influencing the IPO's underpricing (Cohen & Dean, 2005), IPO size (Finkle, 1998), IPO performance (Hillman & Dalziel, 2003), and creating alliance opportunities (Eisenhardt & Schoonhoven, 1996).

I use the differences in the solicitation documentation, and in particular the differences in description of the top echelon, to study how the informational and legitimizing aspects of the signal attract different types of investors, specifically angel investors and VCs. The definition of angel investors in the literature ranges from successful entrepreneurs who cashed in to affluent individuals with no prior experience in venture investing (Freear, Sohl and Wetzel, 1994; Lerner, 1998). According to this definition, angel investors differ from venture capitalists in terms of experience, expertise and preferred investment size. I assert that the differences between angel investors and venture capital firms make different aspects of the signal more effective to one group over the other. Specifically, I suggest that angels' investment decisions are more likely to be influenced by the informative aspect of the signal than VC investment decisions. Brought together, my theory suggests signals are target specific. The results show that VCs investment decisions are influenced by different signals than those influencing angels.

## CHAPTER 2:

# THE MULTIFACETED AND RECURSIVE NATURE OF SIGNALS' STRUCTURE AND THE INFLUENCE OF RECEIVERS' VARIANCE ON SIGNAL INTERPRETATION

### ABSTRACT

This essay studies how the interaction between the ability of the sender to generate a signal and the ability of the receiver to interpret the signal determine how the signal will be used. I define two aspects of the signal for stakeholders and review their interactive and recursive nature. Outsiders can base their decisions on two aspects of signal: the *technical* aspect, which relays direct information on the capabilities of the organization, and, the *legitimizing aspect*, which conveys legitimacy through actions of third-party entities. Current research ignores the influence of receivers' heterogeneity on a signal's effectiveness. I argue that the interaction between the sender's ability to generate signals and the ability of receiver to interpret signals determines which aspect of the signal will be prominent. I develop a model of this interaction and propositions for empirical testing. The proposed theory suggests that, independent of the sender's underlying quality, the receiver's capabilities to discern this quality are significant in determining the signal's influence on the receiver's decision. Thus, in effect, signals are target specific.

Keywords: Signaling theory

## **Introduction**

No firm is an island, to paraphrase John Donne. Firms interact and communicate with their stakeholders all the time and must do so in order to thrive. These interactions often take the form of signals, i.e. communiqués that relay particular information with a specific intention. Signaling the potential and quality of the firm to outsiders is a significant challenge in competitive setting. On one hand the signal has to convey valuable information to be effective (Spence, 1973), but on the other hand the signal should not reveal too much information (Heil & Robertson, 1991). The task of determining how much information to reveal is even more significant when considering nascent firms. Mature firms can generate a plethora of information for outsiders to analyze. Examples of available information range from historic and recent stock performance for public firms, professional investment analysis and new coverage, to visible firm actions such as product announcements, M&A activity, the release of letters to investors, SEC filings, press releases and media coverage (Fombrun and Shanley, 1990; Shepherd, 1999; Zuckerman, 1999). Only a few of these sources are available to entities interested in younger organizations at the Initial Public Offering (IPO) stage (Stuart, Hoang, & Hybels, 1999) and even less is available to private equity investors and others interested in nascent organizations (Shepherd, 1999; Tyebjee & Bruno, 1984). As an organization develops and progresses through the organizational life cycle from birth through growth to maturity (Quinn & Cameron, 1983), it will accumulate private and public evidence of potential. However, external parties with interests in nascent organizations are forced to rely more heavily on statements made by the entrepreneur. Given that young startups typically have fewer, if any, measurable achievements and they

often operate in new industries, these statements are generally more difficult to verify. The inherent information asymmetry in the interaction can cause concerns for misrepresentation and omission (Akerlof, 1970) which can hinder the startup's attempt to attract necessary resources from outsiders.<sup>1</sup> To overcome the scarcity of information, outsiders will search for alternative signals (Spence, 1973).

Signaling theory states that a signal is a course of action that conveys information to an external entity by systematically varying with the signaler's quality. The effectiveness of a signal depends on the inherent credibility of that signal. Specifically, for the signal to be valuable it must be costly to obtain and difficult to imitate (Spence, 1976). The theory suggests that the higher the quality of the sending startup the cheaper it will be to generate the signal. If several startups are trying to solicit funds from an external investor, the startup with the highest quality will be able to generate a signal of threshold effectiveness at a lower cost than the other startups. Hence, for each receiver of the signal, the sender's cost of generating a signal is negatively correlated to the sender's reputation (Podolny, 1993; Shapiro, 1982, 1983). Under conditions of information asymmetry, decision makers facing uncertain outcomes tend to mistrust and therefore ignore information supplied directly by the opposing side (Downes & Heinkel, 1982). When investors cannot ascertain the value of a venture from its actions, they will search for signals of quality (Spence, 1973). For instance, rather than evaluating the product design from a startup, institutional acceptance, via the participation of prominent actors in

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<sup>1</sup> In this work I treat information asymmetry as if resulting from the entrepreneur's optimism and naivety. Since information asymmetry is considered as given, the inclusion of agency considerations will not enhance the theoretical discussion. Therefore I take a positive (and naïve) point of view.

the specification of the relevant standards, can be a useful signal for a potential investor (Podolny, 1993). Research shows that to alleviate uncertainty, outsiders use both informational and institutional signals at the IPO stage (Downes et al., 1982) and for mature firms (Fombrun and Shanley, 1990). Current scholarly discussion treats these signals as separate classes. Moreover, scholars have explicitly indicated the greater importance of institutional as opposed to other types of signals (Oliver, 1991; Podolny, 1993). However, this classification of signals into two or three broad types ignores the fact that these “separate” signal types are actually derived from a single source and are therefore actually aspects of a single signal. The signaling typology also masks the underlying heterogeneity of the sender and the receiver. This heterogeneity determines the relative importance of informative and institutional signals.

## **Theory and Background**

As mentioned before, the sender’s abilities are negatively correlated to the cost of generating a signal of quality (Spence, 1973). The same logic can be implemented regarding the quantity of signals a sender can generate, i.e., at any given level of expense, a signaler of higher quality will be able to produce a larger number of signals than a signaler of lower quality. Thus, sender’s abilities are also negatively correlated to the cost of sending multiple signals. So far, the statements focused only on the abilities of sender. This suggests an implicitly assumption that receivers possess similar abilities to interpret signals. For the most part this inherent assumption regarding the homogeneity of signal receivers is ignored in research. Only a couple of studies consider the capabilities of the receiving side—even then the consideration is surprisingly limited. In his review of 25



years of signaling theory research in the field of economics, Riley's (2001) only reference to the role of receivers is that more capable receivers are theorized to act sooner than less capable receivers. In their work on signals between competitors, Heil and Robertson (1991) propose that the more capable a receiver is in generating signals the higher the number of relevant signals he will identify and interpret correctly as a receiver, and, that higher similarity between sender and receiver will increase the accuracy of signal interpretation. In these propositions the signaling interaction is based on the sender or the abilities of the receiver as a sender. However, in many, if not most, signaling interactions the receivers' signal interpretation abilities have no relation with their signal generating abilities. Clearly, the role of the receiver in the signaling interaction has not been explored to the same degree as the role of the signaler. Nor do these propositions suggest how the heterogeneity of receivers influences the preference for, or the interpretation of, informational and institutional signals. Admittedly, the assumption of receivers' homogeneity is not without benefit; it serves to simplify the interaction, allowing the researcher to focus her attention and reach deeper understandings of the signaler while assisting in the management of experiments, natural and laboratory. However, the falsity of the receivers' homogeneity assumption can be easily revealed. To start considering the influence of the receiver's signal interpretation abilities on the signaling interaction, one only needs to switch the focus of Spence's original job market propositions from the sender to the receiver, i.e. the interpretation abilities of the receivers' vary with their quality while the senders' abilities are homogeneous. Using this reversed focus on the signaling interaction provides a solid starting point for studying the role of receivers. In this scenario the higher the interpretation ability of the receiver, then easier it will be for

him to identify the relevant signal and interpret it accurately. Thus, the cost of interpreting the signal is negatively correlated to the receiver's ability. In the same manner, the cost of interpreting multiple signals is negatively correlated to the receiver's ability. To cement the appropriateness of these assumptions, let us consider the opposite situation. If the assumptions of receivers' heterogeneity do not hold, then all receivers will interpret the signals in the same manner, i.e. they will have the same probability of interpreting the signal correctly regardless of their signaling interpretation capabilities. This will lead to competitive parity among receivers. At the extreme receivers will only be able to distinguish between those with or without a signal but will not be able to rate or differentiate between signals and signalers. This will encourage all signalers to generate the same signal, the minimal indication noticeable by the receivers, regardless of the cost to generating said signal. This case may create a "lemons" problem (Akerlof, 1970). Assume the interpreter will not be able to differentiate between the signaler with high quality and the one with low quality based on the signal. Thus, all signalers will appear to the receiver to be of the same quality. Due to this interpretation homogeneity more capable senders will not be able to secure higher returns based in their signal. Additionally, with interpretation homogeneity the senders will not be able to distinguish between receivers, i.e. the sender will not be able to identify which of the receivers rewards her for being of higher quality. If this fact is understood by the high quality sender she may lose her motivation to generate the signal altogether, leaving signaling only to signalers with lower quality, which will cause the signaling market to fail. Thus, it becomes clear that for the signaling interaction to function both senders and receivers of signals need to be heterogeneous.

Accordingly, the following discussion assumes that both senders and receivers vary, respectively, in their abilities to generate and interpret signals and that these abilities are negatively correlated to the cost of creating and utilizing the signals. Furthermore, I argue that the utilization of a signal depends on the location of the sender-receiver dyad on the combined ability map. Specifically, the determination of which aspect of the signal, informative or legitimizing, will grab the receiver's attention and facilitate his decision depends on both the receiver's and the sender's abilities. That is, signals are targeted to specific audiences.

### **The informative and legitimizing aspects of signals**

Institutional theory suggests organizations operate simultaneously in two types of environments—technical and institutional (Meyer & Rowan, 1977; Scott, 1992). Since signals serve to communicate between organizations, to be effective the signal will have aspects corresponding with the environments in which the organizations operate. In their technical environments organizations concentrate on their structure and procedures, buffer their processes from external influence, and are rewarded for being effective and efficient (Scott, 1991). By definition, in their technical environment, organizations produce and exchange a product or service in a market. Thus, the part of the signal that conveys direct information about the firm's structure, procedures, and products serves to inform the receiver of the technical aspect of the organization. This informative aspect of the signal communicates direct and factual data. For example, in the informative aspect a

startup will convey to the receiver the venture's ability to create and exchange its products through the description of its R&D plan and its planned manufacturing routine.

This informative aspect derives from the organization's observable actions, decisions, evidence of the formation of organizational structure, and/or the codification of routines. The *informative* aspect of the signal gives a direct, codified and explicit indication of the capabilities of the organization. Since signals serve to alleviate information asymmetry under conditions of uncertainty, the informative aspect of the signal provides the signal interpreter with additional information about the sender. The directness of the informative aspect assists the receiver with forming an opinion about the sender. For example, when soliciting funds startups typically submit potential investors with documents that provide background information about the venture and its founders. These documents, typically in the form of business plans or executive summaries, describe the market in which the startup operates, identifies competitors and potential customers, defines the product's value proposition and may include description of the founders' education, professional experience, and significant achievements. The biodata increases the interpreter's knowledge of the capabilities of the founders and the other sections describe the structure of the venture and provide information on the product. Thus, by providing direct and codifiable indications of the quality of the sender, the role of the informative aspect of the signal is to allow the receiver to evaluate information that otherwise would be difficult to attain. Formally:

**Proposition 1:** *The informative aspect of the signal reduces the information asymmetry between the sender and the receiver.*

In institutional environments, organizations are subjected to isomorphising processes and conform to rules and requirements in order to receive support and legitimacy (Scott, 1991). The rules' source can be coercive, mimetic, or, normative (DiMaggio & Powell, 1983; Meyer et al., 1977). Regardless of source, to be rewarded in with a stamp of approval the organization must conform to the prevailing norms in their institutional environment. Research of institutional signals has shown that signals, which convey status, legitimacy and acceptance, have a positive influence on performance (Stuart, 1999; Higgins and Gulati, 2003; Zott and Huy, 2007). I suggest that these are not separate signals but rather a different aspect of the same signal. Hence, this *legitimizing* aspect of the signal qualifies the organization's reputation for the signal interpreter. The legitimizing aspect of the signal is derived from observable actions and decisions of third-party entities with regards to the organization. To accept the signal as credible an outsider who focuses on the legitimizing aspect of the signal must assume that the decision of the third-party entity was either based on valid information that is not currently available in the signal's informative aspect, or, that the third-party's analytical skills are superior. In the solicitation package to potential investors, startups often describe their advisory board and board of directors. The ability to affiliate the venture with prominent outsiders is a strong legitimizing signal for nascent organizations (Stinchcombe, 1965). Moreover, descriptions of validating actions by external entities such as awards won, validation of adherence to industry standards, and even the securing of patents all confer legitimacy to the startup. In addition, the form in which the informative aspect was submitted can legitimize the sender. For example, a startup whose

PowerPoint presentation to VC partners adheres to Guy Kawasaki's 10/20/30 rule (2005) is signaling to its immediate audience that it is at the appropriate stage for VC funding. Therefore, the legitimizing aspect of the signal provides indirect and tacit indication of the sender's underlying quality and serves to validate the sender and his actions. Since signals intend to assuage information asymmetry under conditions of uncertainty, the legitimizing aspect of the signal qualifies the signal's information for the receiver. The indirectness of the legitimizing aspect serves to establish the sender's reputation. Thus, when the legitimizing aspect of the signal is the prominent aspect, it serves to reduce the ambiguity of future interactions with the sender by validating the sender and the information within her signal.

**Proposition 2:** *The legitimizing aspect of the signal reduces the perceived ambiguousness of the sender's quality.*

### **The recursive nature of signal interpretation**

The previous arguments suggest that signals are multifaceted and that each signal facet answers a specific need for the receiver. The combined effect of both aspects allows the interpreter to overcome the information asymmetry in the relationship and the uncertainty in his decision outcome. Once the two aspects of the signal are recognized one must consider the relationship between them. One difficulty with the description of signals as multifaceted is determining where one facet ends and the next one begins. In fact, one can argue that what is legitimizing for one interpreter may be informative for another. For example, Higgins and Gulati (2003, 2006) have studied how the past

experiences of a startup's top echelon, described in the IPO prospectus, legitimize the startup's IPO to underwriters and potential investors. Let us consider these managerial backgrounds at an earlier stage in the startup's life. It is well known that VCs take an active role in appointing (and often replacing) of the startup's top management team. Conservatively, we can assume that at least one of the members of startup's top echelon was approved, introduced, or recruited for the startup by the VC. At such a time, when the manager was reviewed by the VC partner for a position in the startup, the same past experiences, described this time in her CV, helped the recruiter to evaluate if she had the necessary skills and knowledge for the position. Thus, the same information that was legitimizing for the IPO underwriters and investors served as the informative aspect of the signal for the VC. The reason that a particular facet of the signal can be viewed as either informative or legitimizing by different signal receivers is that signals can be interpreted recursively.

Recursion is a method of defining functions in which the function being defined is applied within its own definition. This simply means that a recursive function is a function that one of its options is calling itself with a subset of the original input. The recursive characteristic of the signal's structure can be demonstrated using the previously described example of a startup soliciting funding from a VC (see Figure 2.1 for a graphic illustration of the following description). To begin the solicitation the startup submits its solicitation documents as the signal. To simplify the description of the interpretation I

assume that the VC can focus its attention on just one of the aspects at any given time<sup>2</sup>. The startup can submit the documents using an intermediate social network node who will refer the solicitation or over the transom. At this stage, the social reference is the legitimizing aspect of the signal and the solicitation documentation is the informative aspect. At this stage we have two passable paths going one level deeper into the recursion: the VC can choose either the solicitation's documents or the method in which these documents were submitted. Let us assume the VC has decided to follow the informative aspect of the signal. First the VC needs to decide if this aspect, i.e. the method of submitting the solicitation is sufficient to make a decision. If so, the function ends with either a positive or a negative ruling. If the informative aspect was necessary but not sufficient the VC will analyze the aspect (documentation) as a signal. At this level the document type is the legitimizing aspect of the signal while the topics of data contained within the documentation is the informative aspect. Again, the VC will decide which aspect is more relevant and if this aspect is sufficient for making a decision. Let us assume that this time the informative aspect was selected again and that, again, the aspect was necessary but not sufficient. As figure 2.1 describes, we can continue in this path, selecting the legitimizing aspect at the next two stages (Board of Directors and Education Institution). At this point the VC learns that the startup has connections to Stanford University, which, in this particular example, is a necessary and sufficient legitimizing signal, thus, the signal interpretation function will return Stanford as the signal influencing its decision.

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<sup>2</sup> Obviously, it is possible for the VC (and any other signal interpreter) to attend to both aspects of the signal. Appendix 2A contains a more formalized version of the simple recursive function *Signal Interpretation*, which is described in the text above.



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Insert Figure 2.1 about here

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The challenge, resulting from the multifaceted and multilayered structure of the signal, is determining which recursive atom the signal receiver will use to base his decision. I suggest that the receiver's ability to interpret the signal will determine the direction and depth of the signal used to make the decision. In their theory of competitive market signaling, Heil and Robertson (1991) propose that signaling ability of the signal receivers determines their ability to identify signals. Additionally they propose that the higher the similarity between the signaler and the interpreter the higher the accuracy of the interpretation. Similarly I, propose that a) the higher the receiver's interpretation ability the higher the number of recursions he can take into the signal, and, b) the higher the similarity between the signaler and the receiver the higher the likelihood that the receiver will base his decision on the informative aspect of the signal.

### **The influence of receivers' heterogeneity on signal interpretation**

In their study on how informational, institutional, and strategic signals build the reputation of firms, Fombrun and Shanley (1990) suggest that different stakeholders attend to different features of firms' actions. They show that external publics construct the reputations of firms on the basis of information about the firms and the firms' relative structural positions within organizational field. One limitation of the study is that Fombrun and Shanley (1990) do not discuss the significant correlations found between

separate signals, specifically between informational and institutional signals. As discussed earlier, this separation appears artificial and dependent on the study's data structure. In this study the separation of the signal into different types is instrumental in establishing the importance of institutional aspects of firms' behavior to the creation of (positive) reputation. Another limitation of that study is that it focused squarely on the sender's abilities to generate signals and did not consider the abilities of the receivers to interpret the signals. Scott and Meyer (1991) propose that organizations will succeed in their technical and institutional environments to the extent that they are able to acquire types of personnel, develop structural arrangements and production processes that create efficient production activities, and conform to the specifications of established norms in that sector. In a signaling context, an organization that possesses or develops higher signaling abilities will be more successful in its technical and institutional environments. This, of course, is true for the organization generating the signal as well as the one interpreting it.

According to Heil and Robertson (1991) the receiver's interpretation ability depends mainly on the receiver's experience. They suggest that experienced receivers can be considered as experts, i.e. possessing higher signaling interpretation capabilities. Additionally, they suggest that similarity between the sender and the receiver increases the accuracy of signal interpretation. An expert receiver should be familiar with the environment in which he operates and have a better understanding of the factors contributing to success. A receiver who knows and understands the environment will be familiar with the legitimizing opportunities in the startup's market. Arguably, such a

receiver will be familiar with the social network and will be more centrally located than a lesser receiver would be. The receiver's experience should also allow him to both understand the informative aspect of the signal and quantify the legitimizing aspect of the signal more accurately. On the other hand, similarity between the signaler and receiver, or shorter distance, means the receiver has more relevant knowledge of what is needed for the signaler to be successful. Hence, a closer receiver is less dependent on legitimizing actions of third parties, which should allow her to better understand the informative aspect of the signal. Thus, expertise should help the receiver in interpreting both aspects of the signal, while similarity should assist the interpreter in evaluating the informative aspect. For the purpose of this study I consider interpretation ability as the combination of both expertise and 'distance'. Building on Heil and Robertson (1991) I suggest that signal receivers with higher abilities will be able to interpret more signals at any given time and do so more accurately. Incorporating the recursive nature of signal interpretation I propose:

**Proposition 3:** *The higher the signal interpretation abilities of the receiver the deeper he will be able to delve in the signal.*

Consider the simplest segmentation into high and low levels of signaling abilities. At a certain cost level, a sender with a high level of signaling ability will generate more signals, while a sender with a lower signaling ability will produce fewer signals. Similarly, a receiver with higher signaling interpretation abilities will be able to utilize more from each received signal. Together, the four combinations of sender's and

receiver's abilities in each of the quadrants determine the prominence of signal aspect. Thus, the four different sender-receiver signaling abilities dyads suggest that signals are target specific. In the following section I elaborate on each of the four dyads and propose how the signals are structured and utilized. To assist the discussion on the usefulness of the signal's informational and legitimizing aspects, the following sections will utilize more examples of private equity investment decisions in nascent organizations as the facilitator for the creation and utilization of signals. Investment decisions are a particular instance of interfirm interaction in which the receiver's decision is based on the signals she receives from the sender. Early stage investment decisions are useful mechanisms to study the effectiveness of the aspects of signals because they are visible, distinct, measurable, and, can be anchored in time. Focusing on the entrepreneurial stage of the organizational life cycle (Kimberly, 1980) and the inherent scarcity of information helps to distinguish which of the used signal's aspects is more prominently reflected in a given decision.

### **High signal generating and receiving abilities**

Extant research of signaling at the IPO stage shows that startups benefit from both aspects of the signal. Ventures used the informative aspect of signals to relay direct information to investors such as the proportion of equity ownership retained by entrepreneurs (Downes et al., 1982), top management team abilities (Shepherd, 1999), the achievement of milestones (Eckhardt, Shane, & Delmar, 2006), and the role of past experiences of the top management team (Higgins & Gulati, 2006). Studies have also demonstrated how startups use institutional signals to gain legitimacy such as the

prominence of strategic alliance partners (Stuart, 2000; Stuart et al., 1999) or the prestige of the IPO underwriters (Higgins & Gulati, 2003). However, these studies also point to the dependency of the legitimizing aspect upon the informative aspect (Higgins et al., 2003; Podolny, 1993) which may suggest that at more advanced stages of the organizational life cycle signals are likely to have higher recursion levels.

Signals are observable attributes of the underlying quality of the signal sending organization (Spence, 1973). The main function of signals is to communicate information to the receiver and build a reputation for the sender (Fombrun and Shanley., 1990; Shapiro, 1982, 1983) . The ability of the sender to generate multiple signals at more advanced stages of the organizational life cycle reduces the receiver's concern that the information communicated in the informative aspect of the signal is due to noise. Thus the proliferation of signals reduces the ambiguity of the signals and with it the need for indirect legitimacy. Since the goal of the receiver is to gather as much information as possible from the signals to alleviate the information asymmetry between her and the sender, when the sender's signaling ability is high, if the receiver's signaling interpretation ability is also high, the receiver will concentrate her efforts on the informative aspect of the signals.

**Proposition 4:** *When both the sender's signal generating and the receiver's interpretation abilities are high, the direct informative aspect of signals will be more prominent than the indirect legitimizing aspect of signals.*

### **Low signal generating ability – High signal interpretation ability**

Research focusing on pre-IPO stage ventures suggest that venture capitalists utilize both aspects of the signal (Shepherd, 1999). However, unlike studies of IPO's, which focus on a well defined time frame, studies of venture capital investments generally fail to correlate the used signal to an exact time frame within the investment selection process. Therefore it is difficult to determine from these studies the relative importance of the aspects of each signal within the venture capital selection process.

As the firm matures signals are more likely to be performance related and therefore the firm will be able to produce multiple signals. Moreover, these signals' structure will be complex, i.e. each aspect can be recursively analyzed as signal. Hence, for mature firms any individual signal aspect may effectively proxy another. This is not necessarily the case at earlier stages. Due to the increased level of uncertainty and the scarcity of relevant information, an individual signal aspect might not provide the receiver with sufficient information at pre IPO stages. To give an effective signal a venture must emit a signal in which the legitimizing aspect enhances, or even masks, the informative aspect. In previous work, Kirsch, Goldfarb and Gera (2008) found that VCs use business plans as an institutional signal serving a ceremonial role, rather than as an informational signal serving a communicative role. Assume that the startup is aware of a normative requirement of submitting business plans when soliciting funds from a venture capitalist. This suggests that although the startup attempted to produce an informational signal the outside observer might ignore the informative aspect of the signal due to uncertainty while recognizing the effort to produce the signal as an effort to conform to

the norms governing the institutional environment. Alternatively, since nascent organizations lack track records their signals are more ambiguous than the signals of mature organizations. In particular, young ventures have untested capabilities and the match between their internal structure and the environment is unclear. Moreover, the inherent uncertainty in exploring new markets - often the domain of new ventures - is high. As the venture matures the more information arrives, and this information quality improves. Thus, in the aforementioned example, the external observer's interpretation expertise allows her to recognize that at such an early stage the accuracy of the information within the business plan is limited; however, the effort to formalize the venture structure and procedures stands as an indicator of relative maturity and therefore as a legitimizing signal.

When moving backwards, toward earlier stages of the venture's life when information is relatively sparse, the increased uncertainty of the startup's future enhances the need for the legitimizing aspect of the signal to compensate for the limited data within the informative aspect (Podolny, 1994). Thus I propose that at earlier stages of venture life when uncertainty is high, the legitimizing aspect of the signal will be used to validate the venture and will be more prominent than the informative aspect of the signal.

**Proposition 5:** *The relative scarcity of signals will enhance the prominence of their legitimizing aspect.*

### **High signal generating ability – Low signal interpreting ability**

In the third dyad, the sender's high signal generating ability creates a significant number of signals, yet the external observer does not have the ability to interpret the signals. This inability can result from lower interpretation expertise, lack of analysis capabilities or lack of attention resources (Ocasio, 1997), or it can stem from the receiver being dissimilar to the signaler—for example, a hedge fund who invests in an IPO as part of its portfolio. Instead of investing her attention resources on the taxing evaluation of informational signals the external observer will wait for a third-party, an entity external to the dyad, to endorse the signaler, and then act on this legitimizing indirect aspect of the signal. For example, the fund can check which investment bank is underwriting the IPO (Higgins and Gulati, 2003). The receiver assumes that the third-party is privy to the signal she received, if not more. As the receiver values the reputation of the third-party, its signal-based decision qualifies the information embedded within the informative aspect. In effect the legitimizing aspect replaces the informative aspect for the receiver. Since the receiver delays her decision and makes it dependent on action by a third-party entity, she should expect to garner a lower return on her investment. The receiver hopes to compensate for her losses in terms of return on investment due to its delayed entry and secondary position by reducing its expenses and risk.

Thus I propose that receivers who are not intimately knowledgeable about young ventures and/or do not have the ability to spend the attention to become knowledgeable will base their decisions on the legitimizing aspect of signals even in the presence of multiple signals with an adequate informative aspect.



**Proposition 6:** *Receivers with lower signal interpretation abilities will base their decision on the legitimizing aspect of the signal.*

### **Low signal generating and signal interpretation abilities**

At first glance the last quadrant may appear unimportant. If the sender can only generate limited signals and the receiver's abilities of interpreting these few and far between signals are limited or non-existent then no investment decisions will be made. This impression is misleading, as the evidence showing investments of family and friends at the very first stage of the organizational life cycle (Kimberly, 1980) suggests that this communication dyad does facilitate investment decisions. While the case for investment-relevant communication is limited or even non-existent, there is a case for other, possibly idiosyncratic, communication within the dyad. In fact, the closer the dyadic members are to each other personally, the higher the level of information the receiver has on the sender. This personal familiarity might substitute professional similarity. In a study of similar settings, Sorenson and Waguespack (2006) show that film distributors prefer carrying films involving key personnel with whom they had prior relations; moreover, they tend to favor these filmmakers when allocating scarce resources such as opening dates and promotion efforts. The study also found that relationship-based decisions yielded poor results. Thus, while such idiosyncratic signals may be useful for a single interaction they do not increase the receiver's expertise for a repeated game scenario.

**Proposition 7:** *When both the sender's ability to generate signals and the receiver's signal interpretation abilities are low, neither aspect of the investment-related signal will facilitate the decision, rather, the receiver will base her decision on idiosyncratic information about the sender.*

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Insert Figure 2.2 about here  
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## **Discussion**

This study takes a new look at the structure of interfirm signaling. To understand the structure of signals I started with examining the environments in which organizations act. The premise that organizations interact in two parallel environments (Scott, 1991), or perhaps dimensions, implies that the signals exchanged between organizations will correspond with both technical and institutional dimensions. Prior research has shown several types of signals significantly influence decision making. I suggest these studies have artificially separated each signal into several signals. When considering that organizations interact on multiple dimensions one realizes that each signal conveys a complex message. Each signal delivers both an informative and a legitimizing message from the sender to the receiver. If, for example, we take Spence's classical example of job market signaling: when a job applicant informs a potential employer of his education, his signal has both an informative component and a legitimizing one. The subject, level of degree and grades provide for the employer a direct, informational signal about the underlying potential of the candidate. At the same time, the institution in which the degree was received, its reputation as a school and propensity to send graduates to the receivers' arena creates an indirect, legitimizing signal about the job candidate. Thus, I argue that the past focus on single aspects of signals is a result of convenience rather than

one which enhances our understanding. Furthermore, I posit that this signal has multiple layers of information and therefore its interpretation is recursive. For example, the format in which the job applicant's resume was constructed is a legitimizing aspect in which the former description is embedded. If the applicant used an academic resume style when applying for a position in an investment bank the hiring manager may ignore the application since the applicant's signal is not conforming to the norm. The recursive nature of signal interpretation increases the difficulty of analyzing signal interpretation and challenges the researcher effort to identify correctly which 'atom' signal was responsible for the interpreter decision.

Previous studies of signaling activities also tended to focus on one side of the sender-receiver dyad. This limitation might stem from the nature of the available research data. This study considers both sides in an attempt to better understand the structure of signals. Using the perspective that signals are multifaceted, I argue that the combination of the sender's abilities to generate signals and the receiver's abilities in interpreting these signals determines which aspect of the signal will be more influential in the decision-making process. Assuming that the signaler is aware of her signaling abilities and the receiver's signal interpretation abilities, I argue that signals are target specific. Specifically, when the sender can generate multiple signals and the receiver's interpretations skills are high, the informative aspect of the signal, i.e. the direct and technical facet of the signal, will be more influential. However, the legitimizing aspect of the signal, meaning the indirect and validating facet, will be more influential when one member of the dyad is not as capable as the other member. If the sender can not generate

multiple signals while the receiver is very proficient in deciphering signals, or if the sender can produce multiple signals yet the receiver is not capable of processing them, then the legitimizing aspect of the signal will become more prominent. Last, if both dyad members' abilities in generating and interpreting signals are low, then the decision will be based on idiosyncratic information. This last interaction poses a limitation on repetitive transactions, since the receiver cannot expect to have idiosyncratic information about all possible senders and the sender should not expect all receivers to decide in the same way.

The four sender-receiver signaling ability dyads create a potential explanation to the time segmentation of investments in nascent organizations and in particular the typology of the private equity investments market. The ability of a young startup to provide effective signals is limited by the scarcity of its accomplishments and immaturity of its organizational structure when compared to older startups. Additionally, there is a clear distinction between the investors' types at different stages of the startup's life. Research shows that, initially, nascent ventures receive funding mostly from friends and family, i.e. non professional investors. Furthermore, among professional private equity investors, venture capital firms tend to invest in ventures that are older and solicit larger amounts than do individual angel investors (Ibrahim, 2007; Wilmerding, 2003). Last, investment banks and institutional investors typically wait until the startup is close to becoming public or actually offer shares in an IPO. Since decision makers focus their attention on alternatives they believe they can control (March & Shapira, 1987, 1992) the

type of investor an organization can expect to solicit successfully at any given time may depend on the type of signal the nascent organization can emit at any point in time.

The theory in this study suffers from several limitations. First, it is possible each signal has more than two aspects. In fact, past research has suggested signal typologies with three (accounting, institutional, and strategic) types of signals (Fombrun and Shanley, 1990). The astute reader can probably think of additional aspects of the information within the signal which the receiver can find useful. Since the role of signals is to facilitate communications between entities, the existence of the additional aspects would need to be supported by providing the correlating dimension in which the organizations communicate. Another limitation is the lack of baseline hierarchy between the informative aspect and the legitimizing aspect of the signal. Initially one can expect the informative aspect to be of higher significance since it is closer in nature to raw information, the lack of which being the *raison d'être* of signals. However, this logic is not easily supported theoretically; one can argue that the reason the legitimizing aspects of signals are more useful when one of a dyad's members signaling abilities are lower is because they are more powerful than the informative aspect of the signal.

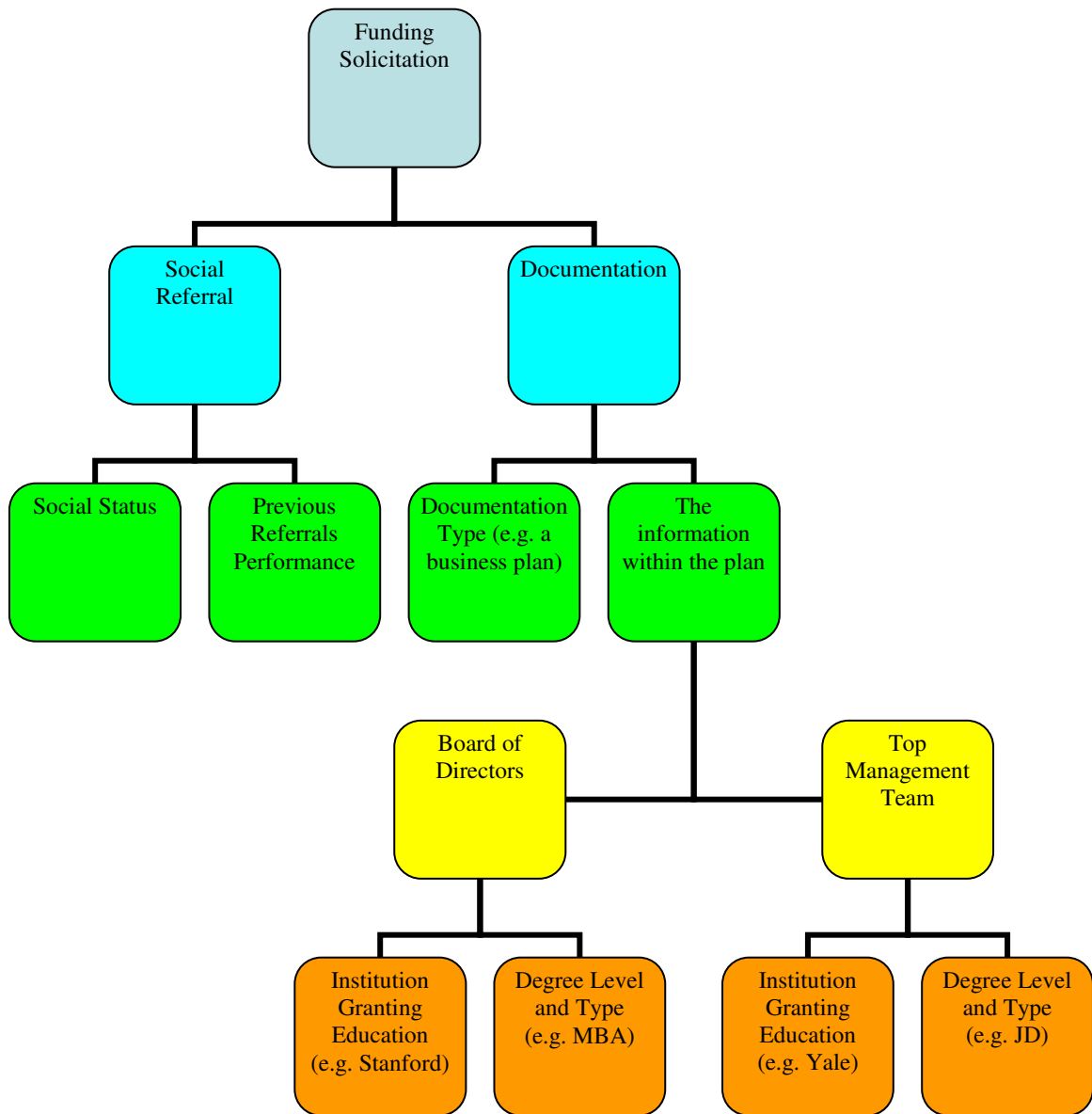
This study leaves several unanswered questions regarding the structure of signals. In their discussion of the environments in which organizations operate, Scott and Meyer (1991) propose a linear relationship between the complexity or uncertainty of the environments and the complexity of the internal structures. This may suggest that the

signal's aspects are mutually dependent, which in turn may further explain the recursive nature of signal structure. A more complex structure alludes to moderating interaction between the aspects. Another issue that should be considered is what theory can predict how deep into the recursion a signal receiver will go before she finds the appropriate signal atom for assisting her decision making. An experiment in a controlled environment, or laboratory, might be the appropriate testing method of the recursive nature of signals.

**Figure 2.1**

Figure 2.1 test

\* The legitimizing aspect is described in the left branch, the informative aspect is described in the right branch.



**Figure 2.2**

		Resources to interpret Signals	
		High	Low
Ability to generate Signals	High	Signal Type – <i>Informative</i> Example: mature startup VC sales data	Signal Type – <i>Legitimizing</i> Example: startup at IPO IPO investors underwriters
	Low	Signal Type – <i>Legitimizing</i> Example: early stage startup Business angels patent approval	Signal Type – <i>Idiosyncratic</i> Example: early stage startup family & friends patent pending



## **Appendix 2 A – Signal Interpretation Recursive Routine**

Function: *Signal\_Interpretation* (signal)

```
{  
    aspect = Influential (informative, legitimizing);  
    if Satisfied (aspect) then Return (aspect)  
        else if Disenchanted (aspect) then Return (null)  
        else Signal_Interpretation (aspect);  
}
```

## CHAPTER 3:

### COMPETITION FOR VC ATTENTION: SIGNALS AS A MECHANISM FOR FACILITATING DIRECT INFORMATION DELIVERY

#### ABSTRACT

This paper studies the role of social referrals by applying the attention-based view of the firm to the problem of fast decision making under conditions of uncertainty. Firms use comprehensive decision making processes to reduce the risk embedded in such decisions. Yet, in dynamic settings, firms use fast decision making processes. I theorize that under uncertainty in dynamic environments, firms base their decisions on salient signals of legitimacy, such as social referrals, rather than on in-depth analysis of information. I test the theory using the selection stage of the Venture Capital funding process. My findings show that social referrals serve as strong legitimizing signals. However, I also find the startups whose referrals were attributed to key members of the VC team fared better than all other startups.

Keywords: Signals, Attention-Based View, Social Referrals, Venture Capital

## Introduction

In this paper, I use the attention-based view of the firm (Ocasio, 1997) and network theory (Granovetter, 1973) to study how social mediation influences Venture Capital (VC) firms' opportunity selection. Similar to other opportunity selection processes such as network television prime time program development (Bielby and Bielby, 1994) and underwriter's selection of IPOs (Higgins and Gulati, 2003), the VC funding process, and within it the selection stage in particular, is an example of fast decision making under conditions of ambiguity and uncertainty. Extant research on how VCs decide which startups to fund has shown that several parameters of the startup solicitation package influence VCs' decision process. Studying the VCs' decision process inputs and outcomes, scholars have identified the criteria used to select startups as (1) social ties, (2) business concept, (3) the entrepreneur's capabilities, and (4) the general fit with the VC's preferences (Hall and Hofer, 1993; Hisrich and Jankowicz, 1990; MacMillan *et al.*, 1985; Shane and Cable, 2002; Shepherd, 1999; Shepherd *et al.*, 2000). One criticism of these studies is their inability to identify when in the process these criteria influence the VC decision and why a certain criterion is more or less influential at a particular stage of the process. I take a first step towards understanding the relative importance of these criteria by studying the influence of reference networks on decision making under conditions of uncertainty. I argue that in order to avoid wasting attention resources on solicitations it will not fund, a VC's first priority is to reduce the number of evaluation targets. Therefore, at the beginning of the funding process decision makers will prefer simple, cheap, and observable legitimizing criteria to deselect solicitations. Of the four previously identified criteria, social ties are the easiest criterion to observe due to

their dichotomous nature. In addition, when the potential value or quality of an opportunity is uncertain, decision makers shift their focus from the opportunity itself to the potential partner's social structural position and its given legitimacy (Podolny, 1994). I suggest that since social mediation is both observable and legitimizing it will be used as a selection criterion at the initial selection stage. I find strong support for my arguments that social mediation is used as a selection criterion at the initial stage of the VC funding process. Moreover, I find that direct social interaction prior to the selection stage is more beneficial than indirect interaction.

VC firms sift through hundreds of proposals a year while funding only a handful of startups (Goldfarb *et al.*, 2005; Metrick, 2007). Typically in a VC firm a small group of partners makes all of the investment decisions. Hence, the attention of the venture's partners is the scarce resource and its allocation is central to the success of the VC. The tension between the VC size limitations and the need to quickly reduce the number of targets results in severe constraints on the VC's attention (Hansen and Haas, 2001). Hence, it is not surprising that many VC's review submitted business plans in ten minutes or less (Hall and Hofer, 1993). To overcome the time constraints on decision making, VC's use heuristics to test whether the soliciting startup is a legitimate candidate for venture funding. Therefore, identifying the appropriate signals (Spence, 1974) available in a startup's solicitation packet at the initial stage of the selection process is paramount for understanding how a startup can capture the VC's attention and thereby increase the likelihood that the solicitation progresses to the next stage of the process.

Since organizations have limited resources, the firm's decision makers will give their attention to potential business opportunities only as long as they believe that the potential associated with the opportunity is profitable. In rational decision making processes, to limit the allocation of resources to opportunities the firm will not pursue, decision makers will strive to eliminate most of the opportunities as soon as possible (Langley *et al.*, 1995; Mintzberg *et al.*, 1976). Since VCs' resource limitations are common knowledge, and since it is already established that, in the selection stage, VCs screen solicitations prior to valuating the offers (Tyebjee and Bruno, 1984), it is likely that startups will make significant efforts to stand out in the competition for VC attention. Therefore, I frame my theoretical arguments in terms of competition for the resource of attention (Ocasio, 1997). I hypothesize that under conditions of high uncertainty in the selection process, a startup is more likely to succeed in attracting the attention of the VC firm if it employs signals that convey legitimacy (Aldrich and Fiol, 1994), rather than provide more information.

I test my hypotheses by using a large sample of funding solicitations from a single VC firm (hereafter the Focal VC) over a period of two years. I observe the soliciting startups' social network and the initial reaction by the Focal VC to the funding request. The data include the solicitations' characteristics as recorded by the Focal VC. Hence, the data represents the Focal VC's decisions in situ and enable me to identify the cues influencing the decisions at the initial stage of the funding process.

In this context, social mediation occurs when an investment opportunity is referred to a venture capitalist by a third party with prior ties to the investor. I observe both direct and indirect social interaction as the result of social referrals. Direct referrals occur when an intermediary introduces the startup to the VC prior to the submission of an investment solicitation. In indirect referrals a third party submits the solicitation to the VC before a direct interaction takes place. Both introduction types constitute endorsements and confer legitimacy. My findings suggest that social mediation serves as a strong legitimizing signal to the decision makers. I find that endorsement is essential for catching the screening VC's attention and that unendorsed requests for funding are much less likely to receive the venture's attention. I interpret this to mean that, consistent with other entrepreneurship research (Fried and Hisrich, 1994; Sorenson, 2003; Stuart, Haong and Hybels, 1999), social networks are a necessary condition for the acquisition of venture capital funding. I also find that startups whose referrals were attributed to key members of the VC team fared better than all other startups regardless of their referral source.

The study proceeds as follows: First, I develop hypotheses for social mediation's influence of selection. Second, I introduce the data and discuss the opportunities and limitations therein. Third, the testing method and results are shown, followed by a discussion, conclusions, and an outline of future avenues for research.

## Theory and Background

The theory of attention builds on Simon's (1960) assertion that organizations provide decision makers with both the stimuli and the intermediate objectives necessary for taking action. Individuals and organizations cannot attend to all facets of their environment due to cognitive and material limitations and the environment's ambiguity (Simon, 1997). To mitigate the problem, institutional logics guide the issues and solutions upon which organizational actors focus their attentions (Ocasio, 1997). The issues and solutions the firm focuses on depend on the context. The context, or the frame of the decision maker (Tversky and Kahneman, 1981), depends on the firm's allocation of its resources to different issues according to the firm's rules and regulations. Attention is defined as "*the distinct focus of time and effort by the firm on a particular set of issues, problems, opportunities, and threats, and on a particular set of skills, routines, programs, projects, and procedures*" (Ocasio, 1997: 188). Thus, the screening routine in the opportunity selection process is a point of activation of institutional logic. Those opportunities whose solicitation parameters align with institutional selection criteria become legitimate targets, and the selecting organization will spend attention resources to evaluate them.

In the VC setting, the VC faces an abundance of funding requests with an uncertain future. In the VCs funding process a few managing partners make all strategic decisions, typically in a committee fashion. Thus, the VC firm allocates specialized

resources to select the startup it will fund in the form of the VC partners' time and effort. Given the one-to-many relationship between the VC and the soliciting startups, the startup needs to win the competitive battle for the VC's attention and other resources vis-à-vis other potential investment targets in the same pool of solicitations. The VC's size and decision making routine structure of "decision by committee" limits the attention resources (i.e. time and effort) the VC's partners can spend on each incoming solicitations (Hall and Hofer, 1993), thereby forcing the decision makers to significantly reduce the number of solicitations admitted into the process. In short, the startups compete for the VC's attention while the VC wishes to limit the attention spent on solicitations, which, for the most part, it will not fund.

To limit the amount of attention, or the amount of selective cognitive work invested in a task (Kahneman, 1973), the firm can base its decision making on heuristics rather than in depth analysis of the available information (March and Shapira, 1987, 1992; Miller and Shapira, 2004). The cue's salience, i.e. the extent to which an attention grabbing stimulus stands out relative to others in their environment (Fiske and Taylor, 1991), determines the signal's effectiveness in influencing a decision. Cues that are novel, unexpected, goal relevant, negative, and repetitive are more salient. Salient signals stand out as selection criteria to the decision maker, grasp her attention, and therefore increase the speed at which a decision is made. Thus, salient cues reduce the amount cognitive resources firms spend on selection decisions.



Extant research of VC solicitation evaluation focused on the criteria by which venture capitalists select ventures for funding. These studies have identified such criteria combinations as follows: fit with the VC's investment guidelines and industry characteristics (Hall and Hofer, 1993); management uniqueness and return (Hisrich and Jankowicz, 1990); the perceived quality of the entrepreneurs experience and exit opportunities (MacMillan *et al.*, 1985); social ties (Shane and Cable, 2002); and probability of survival, lead time, and competitive environment (Shepherd, 1999). Put together, I identify four general selection criteria: (a) the deal origin, (b) the business concept, (c) the entrepreneurs' capabilities, and, (d) the solicitation's fit with the VC's preferences.

While scholars have observed the results of the VC funding decision process and the criteria leading to these results, we still know little about the process itself. Examples of previous research of opportunity selection processes in other areas reveal a similar trend: TV prime time pilot selection legitimacy (Bielby and Bielby, 1994), the impact of security coverage by analysts on stock performance (Zuckerman, 1999), the influence of managerial experience on securing prestigious underwriter backing (Higgins and Gulati, 2003), and the effect of organizational structure on technology partnership development (Qing and Gupta, 2007). On one hand, the empirical entrepreneurship studies mentioned above suggest that the VC opportunity selection is a rational decision making routine similar to selection processes in other industries. On the other hand, venture capitalists reject efforts to systemize their decision process (Podolny, 2001; Hallen, 2007; Kirsch *et al.*, 2009). As a result, attempts to map the VC decision making process are rare, and we

have only a vague notion of where within the funding process VCs use the aforementioned four criteria. Based on retrospective reporting, Tyebjee and Bruno (1984) modeled the VC funding process as a five stage process: (1) Deal Origination, (2) Deal Screening, (3) Deal Evaluation, (4) Deal Structuring, and, (5) Post-Investment Activities. According to this model, all of the VC's screening activities take place between generation and evaluation of the deal. It would seem that every solicitation that passes the screening stage is evaluated in an attempt to structure a funding deal. However, when considering the criteria found to influence the selection of funding targets this separation is not as clear. For example, as a parameter, social ties represent a screening effort prior to the screening stage. Additionally, such criteria as proposal uniqueness and industry competitiveness seem to fit better with screening during the deal evaluation stage rather than earlier as the model suggests. In an effort to understand the "quick and dirty" stage of opportunity selection I focus my attention on finding which criteria influence the initial screening within the VC funding decision process.

Studies of the speed of decision processes have yielded interesting, if sometimes inconsistent, results (Baum, and Wally, 2003; Hough and White, 2003). Judge and Miller (1991) have shown a positive relation between decision makers' speed in dynamic environments and performance, and a negative relationship in stable environments. The relationship between the decision process comprehensiveness: "*the extent to which organizations attempt to be exhaustive or inclusive in making and integrating strategic decisions*" (Fredrickson, and Mitchell, 1984) and performance was also found to have a contradicting effect on performance depending on the environment. In unstable

environments decision process comprehensiveness was found to lower performance (Fredrickson, and Mitchell, 1984) while at stable environments comprehensiveness was found to generate increased performance (Fredrickson, 1984). Eisenhardt found that both speed and comprehensiveness increase firm performance in dynamic environments (Bourgeois and Eisenhardt, 1988; Eisenhardt, 1989). To summarize, decision making speed influence on performance is environment dependent. Studies suggest that emphasizing speed in dynamic environments behooves the firm while comprehensive processes suite more stable situations.

The key resource VCs invest in selecting funding targets is time. In particular, time of the VC's partners in which they focus their efforts and talents on the solicitation. VCs value time as a critical component for reducing the risk of investments (Shepherd, 1999). Since VCs operate in unstable environments (Shepherd, 1999) and fund startups operating at the fringe of existing markets or in yet to be established markets, venture screening is a typical case of decision making in a dynamic environment. To overcome the problem of limited attention resources, VCs make an effort to minimize the time they give each solicitation before dismissing it as an unattractive investment target. In fact, VCs often invest only a few minutes for reviewing each solicitation before making a decision whether to discard it or continue its evaluation (Hall and Hofer, 1993). Therefore, in the initial stage of screening, when the ambiguity regarding the solicitations is high, VCs will prefer criteria that allow for fast decision making. The need to limit the attention given to unfunded solicitations crystallizes when considering the order of

magnitude difference between the hundreds of solicitations the VC receives each year versus the handful of startups it funds in a year (Goldfarb *et al.*, 2005; Metrick, 2007).

While the VC rejects solicitations throughout the funding process, the need to avoid spending valuable attention resources on startups it will not fund drives VCs to deselect as many solicitations as possible as early as possible with the lowest possible investment of attention resources. Thus, VC will screen first based on simple, observable, and broad criteria.

Typically, opportunities originate through one of three sources (Tyebjee and Bruno, 1984). First, members of the firm participate in professional forums, business plan competitions, etc. and invite presenters whose potential and fit seem appealing to submit a funding request with the VC. Second, the firm's referral network recommends an opportunity by either introducing the startup to the VC or submitting a solicitation on behalf of the startup. Last, unsolicited funding requests arrive to the firm. The three solicitation sources fall into two categories: referred and cold-call. Referred solicitations originate through premeditated channels of the organization. Cold-call solicitations arrive without the involvement of either firm members or their social network. The dichotomous distinction between the two source categories creates an easy to determine and broad screening tool, fulfilling the need of the VC at this selection stage.

Previous studies show VCs prefer to fund referred solicitations rather than cold-call solicitations. Apparently, VC's expect cold-call solicitations to be of lower quality

(Tyejee and Bruno, 1984). Network theory supports the VCs point of view. Network analysis studies the pattern and content of interaction that takes place between social units. Network scholars use the term “tie type” to identify the relationship between network members (Granovetter, 1973). The distinction between strong and weak ties types is useful for analyzing the social ties’ role as suppliers of information. A tie’s strength is a function of three factors: (1) frequency of contact, (2) reciprocity, and, (3) friendship. Thus, strong ties are frequent contacts between actors that may create mutual benefits and are generally conducted in a friendly, positive manner. Weak ties are infrequent, or new contacts. The importance of weak ties comes from their ability to provide the actor with information that is novel to the network (Granovetter, 1973). Decoupled from the bridging effect, stronger ties are more beneficial to decision makers than weak ties since repetition generates a greater volume of information between ties (Burt, 1992). In a study of strategic alliances Gulati (1995b) has shown that firms prefer to generate new alliances with partners of previous alliances, if such a partner is ill equipped for the demands of the new cooperation the firm will prefer to interact with a partner of the partner rather than search for a partner without a recommendation. In addition, referred solicitations have in them an embedded screening mechanism. Managers define and react to risk based on their focus of attention, and managers focus their attention on alternatives they believe they can control (March and Shapira, 1987, 1992). Thus, inviting solicitations based on active search by VC members in entrepreneurial forums or receiving a solicitation through an established contact is an attempt by the VC to reduce the uncertainty within the solicitation and control the level

of risk. Thus, a solicitation arriving through a social referral is perceived to be legitimate and therefore will have more success than cold-call solicitations. Formally:

**Hypothesis 1:** *Social mediation will positively influence the likelihood of a solicitation successfully passing the initial screening, ceteris paribus.*

Under conditions of uncertainty, decision makers focus their attention on the social standing of a partner (Podolny, 1994). The social standing, or status, of a social tie is derived from past experiences with the actor, i.e. the stronger the tie the higher its status. For example, repeated cooperative interaction between firms shape the reputation of the partners and foster trust in each other's abilities (Ring and Van de Ven, 1992; Gulati, 1995a). The status of firm's network ties has a positive influence on its financial performance (Carter and Manaster 1990; Higgins and Gulati, 2003; Hallen, 2007). Securing the backing of a higher status organization is especially important for young organizations since they lack legitimacy in their environment (Rao, 1994). In an asymmetric information decision process, the increased volume and perceived quality of information received from strong ties help decision makers to reduce uncertainty (Podolny, 2001).

Thus, network theory defines stronger ties as having higher status and predicts that under uncertainty the status of a tie legitimizes the information it passes. However, using past terms associated with strong ties to decide which referred solicitation will be perceived as more legitimate is difficult. A referred solicitation can arrive in one of three ways: (1) through an active participation of the VC in an entrepreneurial forum or

competition, (2) an existing social tie can introduce a startup to a VC partner thereby creating a new direct tie, and, (3) an existing tie can mediate between the startup and the VC, hence, the solicitation is submitted indirectly. Solicitations where the VC has interacted with the startup prior to the actual submission are direct in nature and mediated referrals are indirect in nature. These venues differ on two aspects of tie's strength: repetition and distance. Mediating ties have a preexisting history with the VC and therefore have a higher repetition value than direct ties. On the other hand, the proximity of direct ties allows the VC to glean more information about the solicitation. In effect, the presoliciting interaction offers the decision maker the opportunity to screen the startup prior to the official solicitation. While distance is the most commonly used term in operationalizing the concept of strong and weak ties, it is usually based on personal familiarity rather than directness (Granovetter, 1973; Uzzi, 1996; Greve and Salaff, 2003). In the context of legitimacy of information, repetition and history are frequently used as means for operationalizing the strength of social ties (Burt, 1992; Krackhardt, 1992; Podolny, 1994, 2001). Only a single study (Greve, 1995) used direct ties as strong and indirect ties as weak. Since managers prefer to focus their attention on alternatives they can control (March and Shapira, 1987, 1992) I argue decision makers prefer to prescreen opportunities themselves rather than counting on a mediator.

**Hypothesis 2:** *Given social mediation, direct interaction will have a stronger positive influence on the likelihood of a solicitation successfully passing the initial screening than indirect mediation, ceteris paribus.*

VC partners are busy people. According to the VC funding process model, beyond selecting promising solicitations VC partners engage in originating, evaluating,

and structuring deals (Tyebjee and Bruno, 1994). Additionally, partners devote a significant portion of their time to post investment activities such as guidance, management recruiting, finding future investors, and managing the VC's exit strategy (Lerner 1994, 1995). VCs spend between seven and thirty-five (35) hours per month per investment pending on the importance VCs put on their post investment activities (Elango *et al.*, 1995). The additional workload stemming from the number of solicitations that already passed the screening stage reduces the amount of attention resources available for selecting new incoming solicitations (Shepherd *et al.*, 2005).

VCs do not have exclusivity on incoming solicitations. The same solicitation that arrived at the Focal VC could have been sent to a competitor at the same time. Thus, if the Focal VC decides to keep processing new solicitations, it cannot postpone screening to a later time when its workload is lower. Therefore, when processing new solicitations, VCs use a First-In First-Out (FIFO) queue for screening the arriving solicitations. Theory suggests that to maximize their profitability VCs balance the allocation of attention on pre and post investment activities (Shepherd *et al.*, 2005). Selection is only one of the pre-investment stages in the VC funding process. Thus, the higher the number of solicitations in the pre-investment stages, the lower the need for adding new solicitations to the funding process and the lower the amount of available attention resources for selection. While VCs appear to be risk inclined when considering product technology, they are actually risk averse when evaluating investment solicitations (Gompers, 1995, 1996; Shepherd, 1999). Hence, as the level of available attention resources declines, the



VC will look for more reasons to reject arriving solicitations and will base its rejection decisions on the most salient cues. Formally, I hypothesize:

**Hypothesis 3:** *The workload of preexisting solicitations that passed initial screening will decrease the likelihood of current solicitations successfully passing initial screening, ceteris paribus.*

**Hypothesis 3a:** *The workload of preexisting solicitations that passed initial screening will strengthen the effect of social mediation on passing the initial screening, ceteris paribus.*

## Data

I study competition for attention by looking at how VCs select investment opportunities for further evaluation. I use a large sample of solicitations submitted to a single American venture capitalist based in the Northeast (the Focal VC). The Focal VC operated between April 1999 and February 2002 and partnered with a major internet portal. Over 89% of the solicitations proposed to create Dot Com firms. Thus, the solicitations in the complete sample were submitted during the peak of the Dot Com bubble and its immediate aftermath. However, the focal VC started coding the solicitations' network references sporadically in early October 2000 and consistently from November 11<sup>th</sup>, 2000, thus, the sample pertinent to this study should not suffer from the 'gold rush' effect of the bubble. Rather, the test sample represents the behavior of VCs during a depressed market. Discussions with the Focal VC's partners suggest that the Focal VC's funding process resembles a sophisticated version of the model suggested by Tyebjee and Bruno (1984). Hence, I consider popular concerns regarding the investment selection and evaluation methods of Dot Com investment opportunities during the Dot Com bubble period to be extraneous to this sample.

The complete sample consists of 2,669 solicitations seeking venture capital funding. Unfortunately, the focal venture capital firm did not save all of the information for all of the submissions. I dropped seventeen solicitations that had no decision indication or erroneous date information. Out of the 2,652 solicitations, only 1,016 solicitations have referral information; of those 1,003 were received after November 11, 2000, which is when the VC started saving reference information. These 1,003 solicitations are the base for this study. Of these solicitations, 514 were referred solicitations and 489 were unsolicited solicitations. Out of the 514 referred solicitations, 211 had indirect referral. These include 7 solicitations whose source was unidentified, 152 who were referred by professional contacts such as investment bankers, lawyers, and accountants, and 52 who resulted from connections with regional representatives 'appointed' by the Focal VC. There are 303 solicitations with a direct referral. Of those, 77 are attributed to entrepreneurial conferences and 226 are solicitations whose submission is attributed directly to the partners.

During the period from October 2000 to February 2002 the Focal VC actually received 1,181 solicitations. The 165 solicitations were without referral specification and the 13 solicitations with referral data arriving prior to November 11, 2000 were instrumental in calculating workload variables but otherwise did not participate in the regression analysis. Each week, the VC received between 4 and 42 solicitations (average 19.10) and admitted as many as 13 into its evaluation stage (see Figure 3.1). Only 32% of the total solicitation sample (847 out of 2,652) successfully passed the selection stage to

receive further attention from the Focal VC. The study's sample of 1,003 has a slightly better success ratio of ~36%. Ideally, I would compare the attributes of the studied soliciting population to those of a representative sample of the general population along the observable dimensions. Unfortunately, I know of no representative sample of firms seeking venture capital funding.

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Insert Figure 3.1 about here

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My data timeframe follows the Dot Com era, defined as the period between the Netscape IPO and the peak of the NASDAQ in March 2000. This poses two important problems. First, even after the bubble burst, this is an era of early industry emergence. There was no tried and true “way of doing business” on the internet during this period (See Goldfarb *et al.*, forthcoming). Second, the sample is internet specific. It is not known to what extent my results generalize to selection processes of mature industries or in other emerging industries, nanotechnology for example. This problem is mitigated as my sample only includes solicitations received during the post-bust era when the industry was somewhat more mature and, more importantly, less appealing to investors. Hence one can expect investors to be more cautious. Third, I established through interviews that the funding process utilized by the focal VC closely resembles the model suggested in literature (Tyebjee and Bruno, 1984). While it is fashionable to criticize funding in the

Dot Com bubble era for investing in internet startups without executing any process of due diligence, I do not have any reason to suspect the Focal VC strayed from their process before, during or after the Dot Com era, or that their method of selection varied over time. Moreover, the process used by the Focal VC had additional safeguards on top of the model suggested in the literature. Therefore, since the model suggested by Tyebjee and Bruno is not industry specific, I believe my sample is generalizable to other venture capital firms' investment selection processes and informative to selection processes in other dynamic environments as well.

### **Dependent Variable**

*Selection.* I use a binary variable to capture the result of the screening process, where 1 indicates the startup was selected for further evaluation and 0 means the Focal VC has decided to pass on the opportunity and will give no further attention to the soliciting startup. Each week the Focal VC assigned new solicitations to “champions”. Every Monday a selection meeting was conducted in which the “champions” presented the solicitations that arrived during the prior week. After a roundtable discussion, a decision was made, either to begin evaluating the solicitation or to dismiss it from the Focal VC's pipeline. Out of the 1,003 solicitations, only 359 passed the screening stage. Between November 2000 and February 2002 an average of 6.65 (Std. 3.06) solicitations passed the Focal VC's screening every week.

## **Independent Variables**

*Referral:* The Focal VC tracked the source of the requests for funding after November 11<sup>th</sup>, 2000. (This date is associated with a refinement of internal processes of the Focal VC). 1,003 requests for funding that arrived after this date were socially mediated – in the sense that they were either requested by the venture capitalist, socially mediated by an acquaintance of the venture capitalist, or encountered in an investment forum. This action in itself indicates the importance of social networks to the VC firm decision making. I created a binary variable (*d\_all\_ref*), which takes the value of 1 when the solicitation had a referral and 0 when the solicitation arrived over the transom. I also created a set of binary dummy variables for each referral type and an ordinal variable that ranked the solicitations by the type of referral. Since the results do not differ significantly between the ordinal variable and the binary set, I use the binary variables, which do not assume linearity.

From my interviews with the VC partners I learned the VC had four types of referral sources: (a) regional representatives (b) professional contacts (c) entrepreneurship forums and competition, and (d) members of the Focal VC firm. The VC had made specific efforts to establish referral venues by designating entrepreneurs with which they had previous relationships. These were identified by the Focal VC as regional representatives. The dummy variable *d\_rep\_ref* has a value of 1 when the solicitation arrived through a regional representative and 0 if the referral came through any other type or there was no referral. The second type of referral represents solicitations that arrived from professional acquaintances of members of the VC, such as

investment bankers, lawyers, accountants and other professionals. The dummy variable *d\_pro\_ref* takes the value of 1 when a solicitation arrived through this venue and 0 in any other event. The dummy variable *d\_forum\_ref* represents solicitations that arrived after a member of the Focal VC participated in an entrepreneurship forum (or competition) and encouraged a participating startup to submit a solicitation. In such an event, the dummy variable takes the value of 1 otherwise it is zero. The dummy variable *d\_personal\_ref* takes the value of 1 when the solicitation referral was attributed directly to a member of the Focal VC otherwise it is zero. Only seven referred solicitations do not have a specific source, for these solicitations I created the dummy variable *d\_other\_ref* (see Table 3.1 for more details).

I created two additional dummy variables as proxies for referral directness. Based on the role of the Focal VC in creating the solicitation, the previously described five referring types can be categorized as either an external or internal reference type. An internal referral is one where a member of the VC was in direct contact with the soliciting startup prior to the solicitation, thus the Focal VC member had an active role in generating that particular referred solicitation. A solicitation with an external referral has arrived from a referent external to the Focal VC. Hence, referrals correlated with the personal and forum dummy types represent internally referred solicitations and are grouped into the dummy variable *d\_int\_ref*. Solicitations who were referred by regional representatives, professionals, and other referrals are designated as external referrals and

grouped into *d\_ext\_ref*. VC members are directly responsible for 303 of the 520 referred solicitations, while the other 211 referral arrived through external sources.<sup>3</sup>

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Insert Table 3.1 about here

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*Workload.* Through interviews of the Focal VC's partners, I learned that on average it took the Focal VC six weeks to evaluate a solicitations and twelve weeks to finalize a deal. Thus, the workload variable is the sum of the solicitations in the evaluation stage plus the current number of solicitations waiting for selection. Solicitations at the evaluation stage are those that successfully passed the selection stage in the six weeks preceding the solicitation's recorded arrival date.<sup>4</sup> During its busiest period, the workload consisted of 90 solicitations (in both the evaluation and screening stages). On average the six-week workload was 57.17 solicitations (Std. 15.43).

*Workload interactions.* I created workload interaction variables to test for the effect of previously selected solicitations and their burden on the VC's attention

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<sup>3</sup> The social network of founders associated with referred solicitations, by definition, included venture capitalists. Strictly speaking, I can only conclude that the social networks of entrepreneurs associated with unsolicited requests did not include the Focal VC. However, it is possible that these social networks did not include venture capitalists in general. Alternatively, submission of an unsolicited request for funding may be indicative of the general naiveté of the entrepreneur.

<sup>4</sup> While a twelve-week load variable is also feasible, I argue that such a measurement will result in a poor representation of reality. Most of the solicitations in the evaluation stage are weeded out before the end of the evaluation stage and do not continue to deal negotiations. Hence, using a twelve-week load will result in a skewed measurement. Additionally, I tested a one-week and four-week load variables, but, since the yielded outcomes were similar to the six-week variable, I did not include them in the analysis.

resources availability. I calculated an interaction term for each of the previous independent variables.

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Insert Table 3.2 about here

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### **Control Variables**

*Meeting load.* I interviewed a partner of the Focal VC and learned that selection decisions were made during a weekly selection meeting. Every Monday the Focal VC members met to screen the solicitations that arrived in the previous week. Thus, to control for meeting time constraints I measured weekly density as the number of solicitations processed in the weekly selection meeting. Between 4 and 42 solicitations arrived each week, the average number of solicitations per week being 19.10 (Std. 7.95). Since only one week had more than 30 solicitations I used the logged meeting load<sup>5</sup>.

*Investment round.* The VC collected investment round indicators for 976 of the solicitations. I used VentureXpert data to verify the existence of prior venture funding rounds. The round code (A, B, C, etc.) was translated to a responding ordinal numeric values with Seed=0, A=1, B=2 and 3 for all other rounds. On average the soliciting startups had 2.09 earlier rounds of investment (Std. 0.78).

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<sup>5</sup> In unreported tests I used a sample in which I dropped the week with 42 incoming solicitations (incidentally, the week in question is the first week of the current data). The results did not differ in any significant way. Hence I kept the sample intact.



I created several additional variables to assist in controlling for the difference in investment mindset and the effect of external events. The following variables were created for each solicitation by using its submission date as a place finder.

*VC transactions.* I captured the monthly number of VC rounds recorded and the number of startups funded each month as recorded at VentureXpert. On average 717.19 startups were funded each month during the period.

*VC investments.* Additionally, I captured the monthly sum of VC investments (in billions) as recorded at VentureXpert and the quarterly sum of VC investments (in billions) as recorded on PriceWaterhouseCoopers MoneyTree. On average VCs invested 6.48 billion dollars every month and 12.32B\$ per quarter. These indexes result in significantly different average investment sums per VC round – 9.03M\$ according to VentureXpert and 5.72M\$ according to PWC.

*Stock exchange.* I created three variables of the NASDAQ stock exchange to further help controlling the effect of time, industry, and external factors. First I captured the weekly closing position of the NASDAQ; second I captured the maximum position of the NASDAQ at each week, and last, I estimated the weekly trend by calculating the difference between the NASDAQ starting and closing position each week. (See table 3.2).

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Insert Table 3.3 about here

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## Analysis and Results

Table 3.2 reports the descriptive statistics and table 3.3 reports the correlations of all the hypothesized as well as control variables. There is a strong positive correlation between the dependent variable (DV) *d\_select* to all of the reference variables, including interactions, and to the control variable *invst\_round*; there is also weaker negative correlation between the DV and the NASDAQ control variable. However, the workload measurements (*workload*, *log\_meeting*) are not correlated with the DV. The strong positive correlation between the DV and the referral indicators suggests H1 will be supported. Additionally, the noticeable strength difference between the internal and external referral indicators ( $r=0.360$  and  $0.196$  respectively) suggests H2 will also be supported. Moreover, it is clear that the use of the VC members' personal network is preferred over any other referral type as *d\_personal\_ref* is about 2.5 times bigger than the next indicator.

As one would expect, there is also strong negative correlation within the referral variables. Only one referral indicator—*other\_ref*—is not significant, probably due to the small number (7) of observations. Interestingly there is a significant positive correlation between *workload* and the referral indicators, which is in the opposite directions

suggested by hypotheses 3a. The *invst\_round* control variable, which indicates the number of previous investments, has a strong and positive correlation with the DV as well as with various referral indicators. This correlation is strongest with the professional and personal referral indicators ( $r=0.148$  and  $0.180$  respectively). Only workload is strongly correlated to the rest of the control variables.

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Insert Table 3.4 about here

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Table 3.4 reports the results from the logistic regressions. Model 1 is the regression run on the control variables only. This model shows the Focal VC preferred solicitations from startups who have secured investments in their past ( $\beta_{invst\_round}=0.707$ ,  $p<.01$ ). Model 2 shows that submitting a solicitation through a referral has a positive and significant effect on being selected for further evaluation ( $\beta=2.327$ ,  $p<.01$ ), supporting H1. The marginal effect of having a referral is very strong, a solicitation with a social referral is 45% more likely to pass the screening stage than a solicitation without a referral ( $\beta=0.454$ ,  $p<.01$ ). This finding supports the notion that social referrals are the key signal the VC partners look for when screening solicitations.

Model 3 tests if referrals arriving from external sources are more effective than internally generated referrals. The external referral variable *d\_ext\_ref* includes referrals arriving from professional network nodes (investment bankers, lawyers, etc.), regional

representatives and other referrals. The internal variable  $d\_int\_ref$  consists of referrals where the VC members had direct interaction with the startup prior to the solicitation submission. Both external referrals and internal referrals are positive and significant with internally generated solicitations slightly stronger in both power and significance ( $\beta_{ext}=2.147, p<.01; \beta_{int}=2.471, p<.01$ ). The results suggest that internally generated solicitations are at least as effective as external referrals. A Wald test shows the coefficients are statistically marginally different ( $\chi^2=2.84, p<.09$ ), therefore solicitations arriving due to internal referrals are more likely to pass the screening stage for further evaluation than indirectly referred solicitations, but the results of this test are not sufficient to fully support H2. Model 4 compares the five individual referral types<sup>6</sup>. All referral types are significant and have strong marginal effect, with personal referral indicator being the strongest. A Wald test confirms the coefficients are significantly different from each other ( $\chi^2=12.98, p<.005$ ). This suggests that solicitations whose referral was attributed to internal members of the Focal VC fared better in the screening stage than other solicitations, with or without referral. To further test this notion I created an additional indicator ( $d\_notpers\_ref$ ) representing all referrals that are not directly attributed to members of the VC firm. Model 5 tests this relationship, both personal and all other referrals are significant and strong ( $\beta_{personal}=2.653, p<.01; \beta_{notpers}=2.093, p<.01$ ) and a Wald test confirms the indicators are different ( $\chi^2=8.58, p<.003$ ). The marginal effects test shows that having a referral from an entity external to the VC will improve the likelihood of passing the screening stage by about 46% while creating relationship with a member of the VC prior to submitting a solicitation will increase it by almost 58%.

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<sup>6</sup> The variable  $d\_other\_ref$  was automatically dropped in all models as it perfectly predicts failure.

These results support the suggestion that personal referrals are a stronger signal than other referral types in the Focal VC screening process<sup>7</sup>. Thus, H2 is supported.

I test the influence of the VC workload on the Focal VC screening stage in Table 3.5. Model 6 tests the effect of combined workload, i.e. the number of solicitations previously selected for further attention and current density of solicitations screened in the weekly meeting, on being successfully selected. The results show workload does not influence selection significantly. In an unreported regression I tested a model where solicitations that previously passed the screening stage were separated from the solicitation discussed in the meeting, however that model yielded similar results. As model 6 shows the current (weekly) density of solicitations does not have a significant influence on the chances of a solicitation passing the screening stage. Therefore, H3 is rejected.

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Insert Table 3.5 about here

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Hypothesis 3a suggests that the VC's workload will increase importance of salient cues, such as solicitation referrals, on the chance of being selected for further attention. I test H3a in models 7 through 10. The interaction effects of the VC's workload on having

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<sup>7</sup> Some Wald tests in unreported regressions suggested that actually the regional representative indicator (*d\_rep\_ref*) is undistinguishable from the VC personal indicator (*d\_personal\_ref*). I tested this possibility by creating alternative internal and external reference indicators where *d\_int\_ref* was the combination of *d\_personal\_ref* and *d\_rep\_ref* rather than using *d\_forum\_ref* as described in the data section. Nevertheless, the results are similar. It appears that the instigator is the personal referral type *d\_personal\_ref*.

a referral oppose my suggested theory. In model 7 both main effects are positive and significant ( $\beta_{\text{ref}}=3.773$ ,  $p<.01$ ;  $\beta_{\text{wload}}=0.035$ ,  $p<.10$ ), however, the interaction effect is negative and significant ( $\beta_{\text{ref}}=-0.025$ ,  $p<.05$ ). In model 8 I tested the interaction effect of workload on external versus internal references. Similarly to model 3, both internal and external referrals main effects are positive and significant ( $\beta_{\text{ext}}=3.954$ ,  $p<.01$ ;  $\beta_{\text{int}}=3.603$ ,  $p<.01$ ), additionally, the workload main effect is significant but small ( $\beta_{\text{wload}}=0.037$ ,  $p<.05$ ). While the interaction effects for both internal and external referrals are negative, only the interaction effect on external referrals is significant ( $\beta_{\text{ext}*\text{wload}}=-0.032$ ,  $p<.05$ ). Interestingly, the power of workload is so small that the interaction effect on external referrals negative effect almost cancels it. Model 9 tests each of the referral indicators individually. The results show that the main effect for all indicators are positive and that while all interactions are negative in direction, only the interactions of indirect referrals are significant ( $\beta_{\text{pro}*\text{wload}}=-0.030$ ,  $p<.05$ ;  $\beta_{\text{rep}*\text{wload}}=-0.054$ ,  $p<.05$ ). Similar to model 5, model 10 compares personal referrals with all other types while adding the interaction effect of preexisting workload, the results are essentially the same as models 8 and 9, Therefore, H3a is rejected.

To understand better the role of different referral type as signals, I used a subset of the data which includes only solicitations with referrals ( $n=496$ ). The marginal effects for the regressions of this subset are presented in Table 3.6. The odd model numbers test each referral indicator alone; in the even models the interaction with workload is added. Models 11 and 12 compare internal and external referrals. This segmentation of reference types has only marginal significance ( $\beta=0.082$ ,  $p<.10$ ). When adding the interaction

effect the model is no longer significant, suggesting the separation into internal and external is crude (see footnote 5 for more details). Models 13 and 14 compare the regional representative referral type—*d\_rep\_ref0*—with all other referral types. While the effect of this referral type is positive, it is not significantly different from other referral types. Models 15 and 16 compare indirect solicitations arriving from professional sources, and models 17-18 do the same for solicitations that resulted from VC members participating in an entrepreneurship forum. Both referral types have a significant negative marginal effect when compared with all other referrals ( $\beta_{\text{pro}} = -0.145, p < .01$ ;  $\beta_{\text{forum}} = -0.116, p < .10$ ), suggesting that solicitations with these referral types fare worse than other referral solicitations in the screening stage. Models 19 and 20 compare solicitations arriving through the VC members’ personal network, the results show that these solicitations fare better than any other referred solicitation ( $\beta_{\text{personal}} = 0.134, p < .01$ ). Hence, startups whose interaction with members of the VC prior to submitting a solicitation is such that the solicitation referral is attributed to members of the VC directly, and are 13% more likely to pass the screening stage and receive further attention from the VC. It should be noted that none of the interaction effect models showed any significance. These additional tests strengthen the previous analysis conclusion that the Focal VC is more likely to pass solicitations into the evaluation stage if the solicitation arrival was attributed to one of the VC members.

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Insert Table 3.6 about here

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## **Discussion**

In this study, I focus on fast decision making under uncertainty in dynamic environments and study why startups vary in their receipt of attention from institutional venture funders. VC firms are a central funding source for young organizations and therefore are often faced with a large number of potential investment opportunities at any given time. Recognizing the limitations on a VC's attention resources in selecting investment opportunities for evaluation, I assert that startups need to send legitimizing signals to the VC if they are to successfully pass the screening stage. Legitimizing signals are signals that confer the status or reputation of a third party to the signaler, in this setting, the soliciting startups benefits from the reputation of the social referent. Prior research has already demonstrated the significant role of social networks in increasing the chances of success (Higgins and Gulati, 2003; Shane and Cable, 2002). I corroborate the theory that the use of social referrals for submitting solicitations is a signal conveying legitimacy and demonstrate that this is especially important at the initial screening stage of the VC funding process.

This study evaluates an important class of signals. I found that social mediation is strongly associated with catching the attention of decision makers. Additionally the results show that solicitations whose referral is attributed internally are more likely to receive the VC's attention. Previous research has found that the startups who were most successful in raising venture capital had cultivated a relationship with the members of the VC firm prior to soliciting funding (Hallen, 2007). My results suggest that the established



relationship is critical in successfully passing the screening stage. Future research can test the effect of direct social interaction prior to solicitation on the interpretation and evaluation of information in later stages of the VC funding process. In the interim, entrepreneurs seeking venture capital funding should cultivate social contacts with venture capitalists prior to funding solicitation.

Several findings in my study add to extant literature. A recent study of investment selection found that internal investment decisions made by the founders of firms were based on perceptions while consequent investment decisions made by external investors were based on objective information (Eckhardt, Shane and Delmar, 2006). My findings suggest that this separation is contextual and that the initial selection conducted by external investors may be similarly based on perception of legitimacy rather than information. Second, I find that startups that interacted directly with members of the VC firm prior to submitting a solicitation were more likely to pass the selection stage than were startups who submitted their solicitations indirectly. Theory suggests that network prestige has a positive effect on young firms' success (Higgins and Gulati, 2003; Hallen, 2007) since the status of the startup's network help to legitimize the startup. Additionally, status has been found to be correlated with expectations of quality (Podolny, 1993). Hence, according to network theory solicitations with prestigious referrals should fare better in the screening stage than other solicitations, with or without referrals, since the VC views these startups to be of higher quality and therefore deserving of further attention<sup>8</sup>. While I find a positive influence of prestigious referrals on success, my results

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<sup>8</sup> A test of the content and quality of the documentation in the dataset's solicitations failed to find significant differences between solicitations arriving with or without social referrals (Kirsch *et al.*, 2006)

show that having a direct connection to the decision makers is more important than prestige as measured by external referral. This is potentially an important finding for entrepreneurs, startups, and other organizations with lower levels of social capital. First, under conditions of uncertainty, to receive the support of prestigious players the entrepreneur needs to have similar status (Podolny, 1994), a tall order for most young firms due to the liability of newness. From a tactical perspective, this finding implies that when seeking access to a potential venture backer, an entrepreneur will be better served asking for an introduction rather than an indirect referral of a business plan. This conclusion is strengthened when considering the effect of any other workload on the demand for attention..

Comparing the influence of direct and indirect ties on decision making can contribute to the literature of brokerage. Brokerage is a process in which intermediary an entity facilitates the movement of information or resources between other entities in need of access (Marsden, 1982). Gould and Fernandez (1989) partition brokerage behavior in social systems into five mutually exclusive subgroups. Two of these subgroups: liaison and gatekeeper are relevant for the discussion of this study's results. A liaison is a broker between two separate entities who acts in between them, i.e. each of the three actors is independent of the other two. In this study both the 'representative' and 'professional' referrers conform to the liaison typecast. A gatekeeper is defined as an actor who selectively grants outsiders access to members or resources of his group. Both 'personal' and 'forum' referral types in this study belong to this type of broker. A study of government organizations acting as brokers showed that liaison type brokers are

influential only if the broker stays impartial, on the other hand, gatekeeper brokers were more effective when they took a stand (Fernandez and Gould, 2003). The results of this study show that gatekeeper brokers are more influential than liaison brokers are when the outsiders are competing for the attention of the gatekeeper's organization. Moreover, this is true for both types of gatekeeper referrals.

In general, the results of my test for the influence of increased demand for attention resources have yielded more questions than answers. Theory suggests that given the need to balance the funding process, with an increased workload in its evaluation process the VC will reduce the number of solicitations that pass the screening.

Additionally, due to the higher volume at the evaluation stage the increased demand for VC attention, resources will increase the need of the decision maker to rely on effective heuristics, such as referrals. However, my results showed the opposite effect. While the main effect of referrals was positive, so was the effect of workload, i.e. the higher the workload the more likely a solicitation was to pass the screening stage. Moreover, the interaction between referrals and workload was negative, thus weakening the influence of referrals on the chance to pass the screening stage successfully. Additionally, I find that externally-mediated solicitations were more subject to this effect than were those whose referral was attributed to members of the VC team. One explanation is that VCs use the preceding interaction with the entrepreneur as an interview, thus adding an additional screen to the venture selection process. The solicitation of funds would therefore indicate that the entrepreneur had already succeeded in passing the first selection hurdle.

Alternatively, the VC was looking to keep its options open at a time when it could not

spend a sufficient level of attention resources on screening, thus blurring the line between the screening and evaluation stages. Another possibility in the increased workload is due to an effort by the VC to increase the number of incoming solicitations at a particular time. This explanation is somewhat supported by the positive correlation between workload and solicitations referred by the VC's members and regional representatives as well as solicitations stemming from forums, as these types of referrals are assumed to require more activity from the VC.

Another interesting finding is the relatively high effectiveness of catching the VC's attention through participation in entrepreneurial forums. Of all the referral types, forum represents the lowest level of resource spending from both the VC and the startup. Neither the startup nor the VC has to spend any social capital in order to participate in the forum and the monetary expense is relatively small. The effectiveness participation in entrepreneurial forums is relatively high for such a small expense. Model 17 in table 3.6 shows that forums are only 11% worse when compared to all other referral types. This result is actually better than the number suggests since this negative effect is mainly due to the strong influence of referrals by members of the VC. Since nascent organizations are relatively starved when it comes to social capital (Stinchcombe, 1965), and considering the extended amount of time and effort necessary to create a useful direct relationship with a member of the VC (Hallen, 2007), startups who take advantage of entrepreneurial forums as a mechanism to grab investors attention may be able to avoid spending critical resources and create a competitive advantage.

## **Conclusions**

This paper connects entrepreneurial research with the attention-based view of the firm and makes theoretical contributions to the decision-making literature. First, this study is one of the few in the entrepreneurship domain to explore the theoretical underpinning of the VC funding process as a rational decision-making process. The internal structure of the venture capital funding process is difficult to observe, thus most studies have overcome this limitation by trying to identify and study the criteria that affected final funding decisions (Hall and Hofer, 1993; Hisrich and Jankowicz, 1990; MacMillan *et al.*, 1985; Shane and Cable, 2002; Shepherd, 1999; Shepherd *et al.*, 2000). These studies can be grouped under four general selection criteria: (a) deal origin, (b) the business concept, (c) the entrepreneurs' capabilities, and, (d) the solicitation's fit with the VC's preferences (Elango *et al.*, 1995; Gupta and Sapienza, 1992; Kirsch *et al.*, 2009; Smith, 1999). To my knowledge, no other study has tested where in the funding process the influence of these criteria is realized. The findings of this study support the hypotheses that social referrals serve as signals at the initial screening stage of the VC funding process. Future research can further test the effect of direct social interaction prior to solicitation by observing its influence on later stages of the VC funding process.

Second, I use attention theory in conjunction with institutional theory to explain how firms tackle the conflicting demands of uncertainty and dynamic environments on decision-making processes. Firms use comprehensive decision-making processes to reduce the risk embedded in decision making under conditions of uncertainty (Fredrickson and Mitchell, 1994). However, in dynamic settings firms engage in fast

decision making (Judge and Miller, 1991). I suggest that when a dynamic setting prevents the firm from using a comprehensive process, signals of legitimacy are used instead. Previous research has shown that legitimizing signals affect the outcome of decision-making processes (Shepherd, 1999). This contributes to our understanding of decision-making processes by suggesting when such signals are beneficial and why.

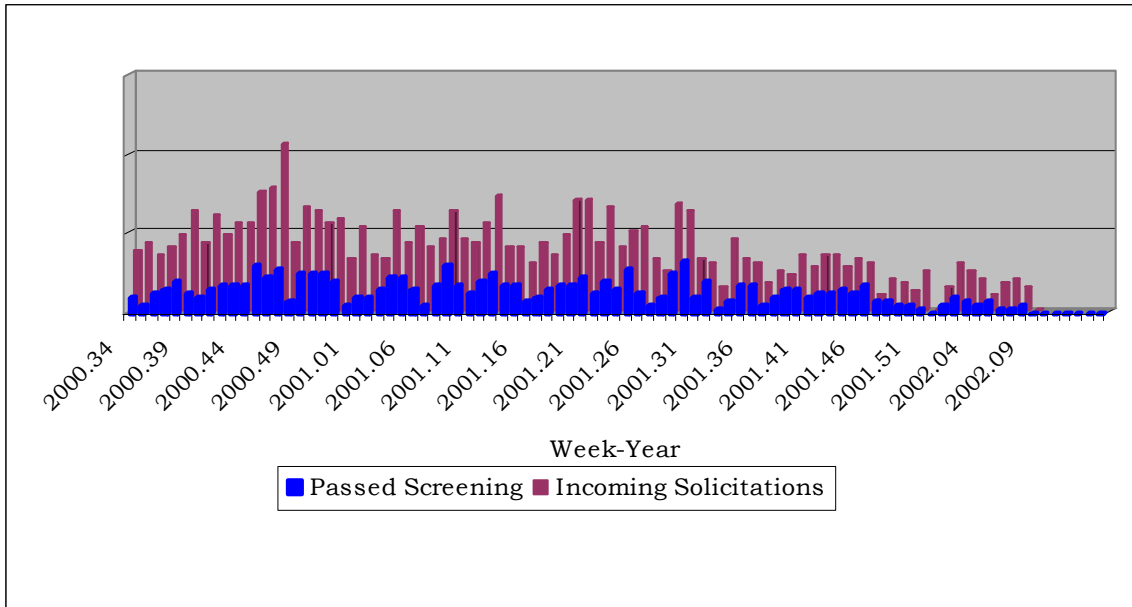
This study suffers from several limitations. The finding that an increased workload, and therefore an increase demand for the constrained attention resources of the firm, results in a reduced reliance on signals is interesting. An alternative explanation can stem from a limitation of this study. First, I tested only one out of the four identified general criteria for VC decision-making. While the role of social referral as a legitimizing heuristic diminishes under increased demand for attention resources, it is possible that the importance of other criteria will increase. An answer might lie in a future study designed to compare decision-making processes based on more than a single criteria.

The data used in this study is industry specific. The fact that the industry used in this study was still in its early stages decreases the generalizability of the findings. An empirical solution to this problem would be to test data from several industries with different levels of maturity. One of the first problems facing such a study, beyond the accumulation of the data, will be to find a decision-making process that is similar enough across several industries. Last, since this study is set within a single organization's decision process, the findings may be regarded as firm specific. Although the model of VC decision process described in the literature (Tyejee and Bruno, 1984) is similar to

the one used by the Focal VC, differences in fund structure and the dynamic settings within which VCs operate, may influence the allocation of attention.

Finally, my study has applied the attention-based view of the firm to the phenomenon of VC screening and selection. While I have provided initial evidence demonstrating the role legitimizing signals have in attracting the attention of decision makers under conditions of uncertainty, future research can continue in this path to further enrich our understanding of decision-making processes in dynamic environments. For example, while I emphasize the role of sending legitimizing cues, future research can test the role of signals of non-conformity on decision makers in similar settings. Taken as a whole, my results are most supportive of the premise that social ties are the signal VCs look for when screening solicitations. While other selection criteria may still play a role in the competition for attention, the results show that the likelihood solicitations with referrals will receive further attention from the VC is 45% higher. Additionally, the results show if the entrepreneur can arrange meaningful direct interaction with the VC prior to solicitation she will fare better by 13% than other soliciting entrepreneurs, regardless of the status of her competition's referral.

**Figure 3.1**





**Table 3.1: deal origin**

<b>Origin</b>	<b>#</b>
Focal VC Partner	229
Entrepreneurial Forums	77
Focal VC regional Representatives	53
Professionals (Banker, Lawyer, etc)	153
Other contact of Focal VC	8
Unsolicited requests	496
Unspecified origin	1,636
Total:	2,652

**Table 3.2: descriptive statistics**

	<b>Variable</b>	<b>Obs.</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
DV	d_select	1,003	0.358	0.480	0	1
	d_all_ref	1,003	0.512	0.500	0	1
Independent variables	d_int_ref	1,003	0.302	0.459	0	1
	d_ext_ref	1,003	0.210	0.408	0	1
	d_other_ref	1,003	0.007	0.083	0	1
	d_pro_ref	1,003	0.152	0.359	0	1
	d_rep_ref	1,003	0.052	0.222	0	1
	d_forum_ref	1,003	0.077	0.266	0	1
	d_personal_ref	1,003	0.225	0.418	0	1
	workload	1,003	57.165	15.433	14	90
	all_refXwload	1,003	29.982	31.100	0	90
	ext_refXwload	1,003	12.012	24.517	0	90
	int_refXwload	1,003	17.970	28.254	0	90
	other_refXload	1,003	0.410	5.119	0	76
	pro_refXwload	1,003	8.376	20.856	0	90
	rep_refXwload	1,003	3.226	14.266	0	90
	forum_refXwload	1,003	4.657	16.366	0	77
	personal_refXwload	1,003	13.313	25.584	0	90
Control Variables	log_meeting	1,003	2.858	0.447	1.386	3.738
	wy_admitted	1,003	6.651	3.058	1	13
	invst_round	976	2.087	0.779	0	3
	vc_rounds	1,003	718.295	170.215	452	1087
	funded_startups	1,003	717.189	169.756	452	1085
	vc_funds	1,003	6.483	2.207	3.006	11.739
	mt_invest	1,003	12.318	4.754	6.895	22.131
	Nasdaq	1,003	2,179.179	382.208	1,423.190	3,027.190
	nasdaq_change	1,003	-21.839	125.617	-334.640	254.870
nasdaq_max	1,003	2,286.630	421.616	1,528.330	3,208.950	

**Table 3.3: correlations**

	1	2	3	4	5	6	7	8	9	10
1 d_select	1									
2 d_all_ref	0.4911***	1								
3 d_int_ref	0.3603***	0.6417***	1							
4 d_ext_ref	0.1963***	0.5034***	-0.3396***	1						
5 d_other_ref	0.0873***	0.0818***	-0.0552*	0.1624***	1					
6 d_pro_ref	0.1253***	0.4122***	-0.2781***	0.8188***	-0.0354	1				
7 d_rep_ref	0.1256***	0.2281***	-0.1538***	0.4530***	-0.0196	-0.0988***	1			
8 d_forum_ref	0.0816***	0.2813***	0.4383***	-0.1488***	-0.0242	-0.1219***	-0.0674**	1		
9 d_personal_ref	0.3440***	0.5260***	0.8197***	-0.2784***	-0.0452	-0.2279***	-0.1261***	-0.1555***	1	
10 workload	0.0066	0.0837***	0.0977***	-0.0074	0.0211	-0.0537*	0.0654**	0.0784**	0.0574*	1
11 all_refXwload	0.4225***	0.9209***	0.6142***	0.4375***	0.0836***	0.3318***	0.2361***	0.2883***	0.4913***	0.3511***
12 int_refXwload	0.3456***	0.6282***	0.9790***	-0.3325***	-0.0540*	-0.2722***	-0.1506***	0.4430***	0.7936***	0.1990***
13 ext_refXwload	0.1837***	0.4988***	-0.3365***	0.9908***	0.1663***	0.7980***	0.4683***	-0.1475***	-0.2758***	0.0579*
14 other_refXload	0.0872***	0.0818***	-0.0552*	0.1624***	1.0000***	-0.0354	-0.0196	-0.0242	-0.0452	0.0214
15 pro_refXwload	0.1196***	0.4104***	-0.2768***	0.8151***	-0.0353	0.9955***	-0.0984***	-0.1213***	-0.2269***	-0.016
16 rep_refXwload	0.1232***	0.2280***	-0.1538***	0.4528***	-0.0196	-0.0988***	0.9995***	-0.0674**	-0.1261***	0.0728**
17 forum_refXwload	0.0812**	0.2810***	0.4378***	-0.1487***	-0.0241	-0.1217***	-0.0674**	0.9990***	-0.1554***	0.0881***
18 personal_refXwload	0.3366***	0.5204***	0.8109***	-0.2754***	-0.0447	-0.2255***	-0.1248***	-0.1539***	0.9893***	0.1233***
19 log_meeting	0.0158	0.1411***	0.1832***	-0.0334	0.003	-0.0690**	0.0491	0.1973***	0.0756**	0.8007***
20 invst_round	0.2491***	0.3160***	0.2003***	0.1628***	0.0419	0.1482***	0.0445	0.0638**	0.1798***	0.0012
21 vc_rounds	0.0029	0.0283	0.0302	0.0007	0.005	-0.0447	0.0716**	0.0178	0.0218	0.6508***
22 funded_startups	0.0008	0.0272	0.0291	0.0005	0.005	-0.0452	0.0723**	0.0183	0.0203	0.6555***
23 vc_funds	-0.0242	0.0211	0.0249	-0.0022	0.0014	-0.0609*	0.0938***	0.0355	0.0048	0.7577***
24 mt_invest	-0.0269	0.0456	0.0405	0.0103	-0.0075	-0.0477	0.0989***	0.045	0.0158	0.7710***
25 Nasdaq	-0.0552*	-0.0016	-0.0105	0.0099	0.0168	-0.05	0.0928***	0.0073	-0.0162	0.5646***
26 nasdaq_change	-0.0113	0.0139	0.0593*	-0.0497	-0.0298	-0.0315	-0.0293	-0.0067	0.0694**	-0.0981***
27 nasdaq_max	-0.0513	0.0073	-0.0207	0.0323	0.0207	-0.0307	0.1012***	0.0164	-0.0333	0.5922***

Pairwise correlations reported.

\* Significant at the 10% level \*\* Significant at the 5% level \*\*\* Significant at the 1% level

	11	12	13	14	15	16	17	18	19	20
11 all_refXwload	1									
12 int_refXwload	0.6588***	1								
13 ext_refXwload	0.4694***	-0.3294***	1							
14 other_refXload	0.0838***	-0.0540*	0.1664***	1						
15 pro_refXwload	0.3509***	-0.2710***	0.8050***	-0.0353	1					
16 rep_refXwload	0.2401***	-0.1505***	0.4701***	-0.0196	-0.0983***	1				
17 forum_refXwload	0.2935***	0.4466***	-0.1473***	-0.0241	-0.1212***	-0.0673**	1			
18 personal_refXwload	0.5230***	0.8117***	-0.2729***	-0.0447	-0.2245***	-0.1247***	-0.1537***	1		
19 log_meeting	0.3532***	0.2613***	0.0201	0.0033	-0.0371	0.0547*	0.2038***	0.1279***	1	
20 invst_round	0.2768***	0.1888***	0.1587***	0.042	0.1466***	0.0436	0.0630**	0.1734***	0.0315	1
21 vc_rounds	0.1946***	0.0928***	0.0416	0.0053	-0.0202	0.0752**	0.0242	0.0632**	0.3838***	-0.0623*
22 funded_startups	0.1953***	0.0924***	0.0418	0.0053	-0.0204	0.0758**	0.0246	0.0624**	0.3912***	-0.0627*
23 vc_funds	0.2182***	0.0923***	0.0501	0.0018	-0.0303	0.0990***	0.0402	0.0517	0.5644***	-0.0574*
24 mt_invest	0.2448***	0.1056***	0.0661**	-0.0071	-0.0152	0.1048***	0.0505	0.0598*	0.6200***	-0.0376
25 Nasdaq	0.1465***	0.0359	0.0515	0.0169	-0.0267	0.0976***	0.0053	0.0229	0.5349***	-0.0456
26 nasdaq_change	-0.0156	0.0538*	-0.0612*	-0.0299	-0.0367	-0.0314	-0.0108	0.0713**	-0.0680**	-0.0039
27 nasdaq_max	0.1629***	0.0282	0.0764**	0.0208	-0.0058	0.1065***	0.0156	0.0061	0.5544***	-0.046

Pairwise correlations reported.

\* Significant at the 10% level \*\* Significant at the 5% level \*\*\* Significant at the 1% level

	21	22	23	24	25	26	27	28	29
21 vc_rounds	1								
22 funded_startups	0.9995***	1							
23 vc_funds	0.8060***	0.8131***	1						
24 mt_invest	0.7226***	0.7305***	0.9134***	1					
25 Nasdaq	0.4490***	0.4604***	0.7633***	0.7632***	1				
26 nasdaq_change	-0.0565*	-0.0609*	-0.0925***	-0.2182***	0.0352	1			
27 nasdaq_max	0.4755***	0.4871***	0.7871***	0.8101***	0.9768***	-0.1241***	1		

Pairwise correlations reported.

\* Significant at the 10% level \*\* Significant at the 5% level \*\*\* Significant at the 1% level

**Table 3.4: logistic regression analysis**

	main1	mf1	main2	mf2	main3	mf3	main4	mf4	main5	mf5
d_all_ref			2.327*** (12.980)	0.454*** (16.010)						
d_ext_ref					2.147*** (10.290)	0.485*** (11.820)				
d_int_ref					2.471*** (12.400)	0.537*** (14.980)				
d_pro_ref							1.948*** (8.630)	0.448*** (9.580)		
d_rep_ref							2.529*** (7.560)	0.554*** (10.770)		
d_forum_ref							1.940*** (6.700)	0.450*** (7.650)		
d_personal_ref							2.650*** (12.450)	0.578*** (15.900)	2.653*** (12.480)	0.579*** (16.030)
d_notpers_ref									2.093*** (10.690)	0.464*** (12.100)
log_meeting	0.456** (2.140)	0.102** (2.150)	0 0.000	0 0.000	-0.075 (-0.31)	-0.016 (-0.31)	-0.005 (-0.02)	-0.001 (-0.02)	-0.039 (-0.16)	-0.008 (-0.16)
invst_round	0.707*** (7.020)	0.158*** (7.150)	0.357*** (3.300)	0.074*** (3.300)	0.361*** (3.330)	0.075*** (3.330)	0.357*** (3.260)	0.074*** (3.270)	0.358*** (3.290)	0.074*** (3.290)
vc_rounds	-0.046 (-0.52)	-0.01 (-0.52)	-0.041 (-0.41)	-0.009 (-0.41)	-0.043 (-0.42)	-0.009 (-0.42)	-0.023 (-0.22)	-0.005 (-0.22)	-0.026 (-0.25)	-0.005 (-0.25)
funded_startups	0.046 (0.520)	0.01 (0.520)	0.041 (0.400)	0.008 (0.400)	0.042 (0.410)	0.009 (0.410)	0.022 (0.210)	0.005 (0.210)	0.025 (0.250)	0.005 (0.250)
vc_funds	0.196 (1.310)	0.044 (1.310)	0.253 (1.490)	0.053 (1.490)	0.238 (1.400)	0.05 (1.400)	0.23 (1.340)	0.048 (1.340)	0.231 (1.350)	0.048 (1.350)
mt_invest	-0.088 (-1.61)	-0.02 (-1.61)	-0.110* (-1.78)	-0.023* (-1.78)	-0.102 (-1.63)	-0.021 (-1.63)	-0.109* (-1.73)	-0.023* (-1.74)	-0.106* (-1.69)	-0.022* (-1.70)
nasdaq	-0.003 (-1.59)	-0.001 (-1.59)	-0.002 (-0.93)	0 (-0.93)	-0.002 (-0.92)	0 (-0.92)	-0.002 (-1.09)	0 (-1.09)	-0.002 (-0.97)	0 (-0.97)
nasdaq_change	0.001 (0.990)	0 (0.990)	0 (0.330)	0 (0.330)	0 (0.260)	0 (0.260)	0 (0.360)	0 (0.360)	0 (0.220)	0 (0.220)
nasdaq_max	0.002 (1.380)	0.001 (1.380)	0.002 (0.860)	0 (0.860)	0.002 (0.870)	0 (0.870)	0.002 (1.020)	0 (1.020)	0.002 (0.920)	0 (0.920)
_cons	-2.327*** (-3.17)		-2.147*** (-2.59)		-2.050** (-2.46)		-2.053** (-2.43)		-2.106** (-2.51)	
N	976	976	976	976	976	976	970	970	976	976
ll	-598.552	-598.552	-493.798	-493.798	-492.377	-492.377	-484.161	-484.161	-489.443	-489.443
chi2	68.437	68.437	277.944	277.944	280.786	280.786	284.602	284.602	286.655	286.655

DV - d\_select, main and marginal effects are reported.

\* p<0.10 \*\* p<0.05 \*\*\* p<0.01

**Table 3.5: continued logistic regression analysis**

	main6	mf6	main7	mf7	main8	mf8	main9	mf9	main10	mf10
d_all_ref			3.773*** (5.160)	0.669*** (7.450)						
d_ext_ref					3.954*** (4.890)	0.751*** (9.600)				
d_int_ref					3.603*** (4.290)	0.715*** (6.710)				
d_pro_ref							3.623*** (4.240)	0.707*** (8.100)		
d_rep_ref							5.859*** (3.740)	0.759*** (23.040)		
d_forum_ref							3.990** (2.370)	0.710*** (6.510)		
d_personal_ref							3.509*** (4.020)	0.704*** (6.600)	3.521*** (4.030)	0.706*** (6.690)
d_notpers_ref									3.934*** (4.960)	0.754*** (8.750)
workload	-0.001 (-0.06)	0 (-0.06)	0.035* (1.950)	0.007** (1.960)	0.037** (2.040)	0.008** (2.050)	0.033* (1.800)	0.007* (1.810)	0.033* (1.840)	0.007* (1.850)
all_refXwload			-0.025** (-2.06)	-0.005** (-2.07)						
ext_refXwload					-0.032** (-2.34)	-0.007** (-2.35)				
int_refXwload					-0.02 (-1.41)	-0.004 (-1.41)				
pro_refXwload							-0.030** (-2.05)	-0.006** (-2.06)		
rep_refXwload							-0.054** (-2.25)	-0.011** (-2.24)		
forum_refXwload							-0.034 (-1.25)	-0.007 (-1.25)		
personal_refXwload							-0.015 (-1.05)	-0.003 (-1.05)	-0.015 (-1.06)	-0.003 (-1.06)
notp_refXwload									-0.032** (-2.41)	-0.007** (-2.43)
log_meeting	0.471 (1.390)	0.105 (1.390)	-0.374 (-0.95)	-0.077 (-0.95)	-0.48 (-1.22)	-0.1 (-1.22)	-0.339 (-0.84)	-0.07 (-0.84)	-0.364 (-0.93)	-0.076 (-0.93)
invst_round	0.707*** (7.010)	0.158*** (7.140)	0.345*** (3.180)	0.072*** (3.190)	0.349*** (3.210)	0.072*** (3.210)	0.342*** (3.100)	0.070*** (3.110)	0.345*** (3.150)	0.072*** (3.160)
vc_rounds	-0.046 (-0.51)	-0.01 (-0.51)	-0.059 (-0.57)	-0.012 (-0.57)	-0.061 (-0.59)	-0.013 (-0.59)	-0.032 (-0.31)	-0.007 (-0.31)	-0.039 (-0.37)	-0.008 (-0.37)
funded_startups	0.045 (0.510)	0.01 (0.510)	0.057 (0.560)	0.012 (0.560)	0.06 (0.580)	0.012 (0.580)	0.031 (0.300)	0.006 (0.300)	0.038 (0.370)	0.008 (0.370)
vc_funds	0.196 (1.310)	0.044 (1.310)	0.257 (1.510)	0.053 (1.510)	0.247 (1.440)	0.051 (1.440)	0.223 (1.280)	0.046 (1.290)	0.241 (1.400)	0.05 (1.400)
mt_invest	-0.087 (-1.54)	-0.019 (-1.54)	-0.125* (-1.94)	-0.026* (-1.95)	-0.118* (-1.82)	-0.024* (-1.83)	-0.112* (-1.70)	-0.023* (-1.70)	-0.118* (-1.83)	-0.025* (-1.84)
nasdaq	-0.003 (-1.59)	-0.001 (-1.59)	-0.002 (-0.77)	0 (-0.77)	-0.002 (-0.83)	0 (-0.83)	-0.002 (-1.10)	0 (-1.11)	-0.002 (-0.94)	0 (-0.94)
nasdaq_change	0.001 (0.990)	0 (0.990)	0 (0.190)	0 (0.190)	0 (0.140)	0 (0.140)	0 (0.290)	0 (0.290)	0 (0.130)	0 (0.130)
nasdaq_max	0.002 (1.380)	0.001 (1.380)	0.001 (0.740)	0 (0.740)	0.002 (0.830)	0 (0.830)	0.002 (1.050)	0 (1.050)	0.002 (0.910)	0 (0.910)
_cons	-2.340*** (-3.02)		-2.755*** (-2.77)		-2.630*** (-2.64)		-2.611*** (-2.59)		-2.684*** (-2.68)	
N	976	976	976	976	976	976	970	970	976	976

ll                    -598.55 -598.55 -491.051 -491.051 -488.971 -488.971 -479.746 -479.746 -485.988 -485.988  
chi2                    68.44    68.44    283.439 283.439 287.598 287.598 293.431 293.431 293.564 293.564  
DV - d\_select, main and marginal effects are reported.  
\* p<0.10 \*\* p<0.05 \*\*\* p<0.01

**Table 3.6: additional logistic regression analysis**

	<b>mfxf11</b>	<b>mfxf12</b>	<b>mfxf13</b>	<b>mfxf14</b>	<b>mfxf15</b>	<b>mfxf16</b>	<b>mfxf17</b>	<b>mfxf18</b>	<b>mfxf19</b>	<b>mfxf20</b>
workload		0.003 (0.600)		0.004 (0.940)		0.005 (1.010)		0.003 (0.670)		0.001 (0.310)
d_int_ref0	0.082* (1.720)	-0.085 (-0.46)								
int_ref0Xwload		0.003 (0.930)								
d_rep_ref0			0.063 (0.850)	0.355** (2.150)						
rep_ref0Xwload				-0.007 (-1.19)						
d_pro_ref0					-0.145*** (-2.85)	-0.075 (-0.39)				
pro_ref0Xwload						-0.001 (-0.39)				
d_forum_ref0							-0.116* (-1.75)	0.054 (0.140)		
forum_ref0Xwload								-0.003 (-0.42)		
d_personal_ref0									0.134*** (2.960)	-0.103 (-0.54)
personal_ref0Xwload										0.004 (1.260)
log_meeting	-0.02 (-0.27)	-0.11 (-0.92)	0.014 (0.190)	-0.065 (-0.55)	-0.03 (-0.40)	-0.117 (-0.99)	0.038 (0.510)	-0.021 (-0.18)	-0.004 (-0.05)	-0.066 (-0.56)
invst_round	0.057* (1.840)	0.056* (1.820)	0.056* (1.830)	0.054* (1.770)	0.058* (1.880)	0.058* (1.870)	0.054* (1.740)	0.053* (1.710)	0.055* (1.780)	0.054* (1.740)
vc_rounds	-0.044 (-1.46)	-0.047 (-1.54)	-0.043 (-1.42)	-0.044 (-1.45)	-0.045 (-1.47)	-0.048 (-1.55)	-0.038 (-1.25)	-0.04 (-1.30)	-0.039 (-1.27)	-0.04 (-1.29)
funded_startups	0.044 (1.450)	0.047 (1.530)	0.043 (1.420)	0.044 (1.440)	0.044 (1.460)	0.047 (1.540)	0.038 (1.240)	0.04 (1.290)	0.038 (1.260)	0.039 (1.280)
vc_funds	0.110** (2.170)	0.113** (2.220)	0.117** (2.300)	0.112** (2.220)	0.108** (2.120)	0.110** (2.140)	0.118** (2.320)	0.118** (2.320)	0.109** (2.140)	0.113** (2.210)
mt_invest	-0.044** (-2.35)	-0.049** (-2.54)	-0.048*** (-2.60)	-0.049** (-2.56)	-0.044** (-2.35)	-0.049** (-2.54)	-0.050*** (-2.71)	-0.053*** (-2.78)	-0.046** (-2.46)	-0.050*** (-2.59)
nasdaq	0 (0.160)	0 (0.170)	0 (0.100)	0 (0.130)	0 (0.140)	0 (0.220)	0 (0.030)	0 (0.110)	0 (0.100)	0 (0.040)
nasdaq_change	0 (-0.96)	0 (-1.04)	0 (-0.81)	0 (-0.91)	0 (-0.93)	0 (-1.04)	0 (-0.82)	0 (-0.91)	0 (-1.00)	0 (-1.06)
nasdaq_max	0 (-0.13)	0 (-0.10)	0 (-0.09)	0 (-0.09)	0 (-0.10)	0 (-0.14)	0 (-0.03)	0 (-0.09)	0 (-0.06)	0 (-0.00)
N	496	496	496	496	496	496	496	496	496	496
ll	-324.599	-323.759	-325.735	-324.6	-322.016	-321.509	-324.54	-324.253	-321.82	-320.814
chi2	24.109	25.79	21.838	24.107	29.276	30.289	24.227	24.802	29.668	31.678

DV - d\_select, main and marginal effects are reported.  
 \* p<0.10 \*\* p<0.05 \*\*\* p<0.01



## CHAPTER 4:

### TARGETED SIGNALS: HOW DO VENTURE CAPITAL FIRMS AND ANGEL INVESTORS DIFFER IN SIGNAL INTERPRETATION

#### ABSTRACT

This essay tests whether signals are target specific. I use startups' solicitation of funding from both Angel investors and Venture Capital firms to learn the respective roles of the legitimizing and informative aspects of interfirm signals. The test considers the structure of the signal and the differences between the two types of private equity investors. I show that the structure of the signal predicts which type of receiver is likely to respond favorably to the solicitation.

Keywords: Signals, Angel Investors, Venture Capital

## **Introduction**

Due to the inherent information asymmetry between young startups and early investors, and the uncertainty of investment outcome, potential investors tend to ignore some of the information a startup provides due to concerns over misrepresentation or omission (Spence, 1976). One of the main methods startups use to provide information early in the solicitation process is to submit planning documentation, such as business plans or executive summaries, to the solicited investors (Kirsch, Goldfarb, & Gera, 2009; MacMillan & Narasimha, 1987; Tyebjee & Bruno, 1984). Upon reviewing the submitted documents, investors may treat statements regarding the potential of the venture cautiously and search for valid alternative signals of value (Downes & Heinkel, 1982; Spence, 1973). When the quality or potential value of investment opportunities is uncertain, investors cannot select investment opportunities by comparing the startups themselves (Podolny, 1994). Instead, investors will rely on signals of economic value that they perceive as genuine, and disregard suspicious information. A signal is a course of action by a seller that conveys information to the buyer by varying systematically with the product quality. The effectiveness of a signal depends on the inherent credibility of that signal. Specifically, for a signal to be valuable it must be costly to obtain and difficult to imitate (Spence, 1973). In top echelon research, studies of Top Management Team (TMT) and Board of Directors (BOD) structures suggest that the structure and composition of the firm's top echelon serves both as a resource and as a signal of legitimacy to potential investors. While both TMT and BOD descriptions are usually part of the documentation submitted during solicitation, the verifiable nature of biodata makes it useful for reducing information asymmetry. Moreover, the fact that most of the

information within the biodata of top echelon members consists of experiences accumulated prior to joining a soliciting venture converts it into a signal to the quality of the venture. Extant research has shown that investors rely on the size and composition of both the TMT and the BOD as valuable signals when deciding on IPO investments. Top echelon structure affects the success of IPOs through recruiting prestigious underwriters (Higgins & Gulati, 2003), influencing the IPO's underpricing (Cohen & Dean, 2005), increasing IPO size (Finkle, 1998), advancing the initial offering performance (Hillman & Dalziel, 2003), and creating alliance opportunities (Eisenhardt & Schoonhoven, 1996).

In this essay I use the solicitation documentation and in particular the description of the startups' top echelon, to study how signals attract different types of investors. I suggest that the differences between the signal interpretation abilities of business angel investors and venture capital firms determine which signal aspect will be more effective in influencing their investment decisions. Thus, I suggest signals are target specific.

## **Theory and Background**

Researchers of private equity investors suggest there are several distinct types of investors. Broadly, private equity investors can be segmented in two groups: formal and informal (Fenn, Liang, & Prowse, 1995). The dominant form for formal private equity investment is commonly known today as venture capital (VC) investment. These organizations are usually formed as limited partnerships, where institutional investors are the limited partners and the investment managers are general partners. Informal investors are private investors, which are further segmented into two groups: accredited and non

accredited individual investors. Accredited individual investors are wealthy individuals whose personal assets exceed US\$1,000,000 or whose yearly income in the past two years was more than US\$200,000<sup>9</sup>. Unaccredited individual investors are investors whose income is below the aforementioned threshold. Typically the unaccredited segment consists of family and friends of the entrepreneur.

Accredited investors are also known as angel investors, a term that is still vaguely defined. In some circles the definition of an angel investor relates only to professional investors, those accredited investors whose business is to invest in nascent firms; this definition excludes affluent people who do not invest the majority of their effort in searching for and interacting with entrepreneurs. Hence, the CEO of a Fortune 1000 firm, who is also an accredited investor in a startup, will not be considered a business angel according to this definition. Under this view business angels are typically successful entrepreneurs who invest in the startup financially and professionally, i.e. after funding the startup monetarily the angel uses her business acumen and experience as a successful entrepreneur to help the startup succeed. On the other hand, the opposite perception also exists. In this opposite view angel investors are seen as unsophisticated, or casual investors whose sole function is to provide the startup with funds that will allow it to survive until it receives some future investment from a formal investor. This point-of-view separates informal investors based on their professional distance from the entrepreneur and perhaps the magnitude of the investment, rather than their accreditation or profession. Thus, in this view the Fortune 1000 CEO would be considered an angel

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<sup>9</sup> Note that formal investors are also considered accredited investors by the SEC. See Appendix A for the complete SEC definition of an accredited investor.

investor. I view VC funds as representatives of formal private equity investors and angel investors as informal investors. For the purpose of this essay I define angel investors as all non accredited investors, and accredited investors whose investment was not depicted as VC investment in investment tracking databases such as VentureXpert. I select this definition for methodological reasons rather than theoretical ones. The definition of the exact typology of angel investors is beyond the immediate scope of this study. The goal of this study is to determine if VCs and business angels differ in their signal interpretation capabilities and how this influences the relative solicitation results.

Between the two types of investors, the angel investor is the more common source of private equity financing, especially with smaller rounds of financing, typically less than US\$500,000. Fenn and Liang (Fenn & Liang, 1998) find that 60% of entrepreneurs receive funding from angel investment while only 10% receive VC funds. It might be harder to identify an angel investor than a VC fund, since wealthy individuals do not routinely advertize their existence or investment intentions. However, soliciting the funds from both sources is challenging. The deal process of angel investors is shorter than that of VC firms, and financing with angels is less expensive for the startup (Freear, Sohl, & Wetzel, 1995). Venture capital funds usually fund later in the startup's life cycle than angel investors and with bigger investments (Freear & Wetzel, 1990). While most of the time angels and VCs invest in complementing funding rounds, some rounds' fundraising targets are reached by a combination of angels and VC financing (Harrison & Mason, 2000), although angels are usually absent from the better-performing large deals (Goldfarb, Hoberg, Kirsch, & Triantis, 2008).

Recent research supports the argument that angel investors and venture capital firms differ in their investment selection criteria. Business angels often take bigger risks, accept lower rewards, and receive weaker controls than venture capitalists do, and have longer exit horizons (Lerner, 1998; Freear, Sohl and Wetzel, 1994; Sohl, 1999, 2003). These findings suggest that VCs' returns on investments are better than those of business angels. As individual investors, angels have limited resources for signal interpretation when compared to VC firms. While the VC's limited partners rely on the expertise of their investment partners, and other hired personnel, for evaluation of investment opportunities, angel investors have to rely on their own personal experience and judgment of the startup and its potential. While venture capitalists are considered highly experienced experts in their fields, business angels are much less homogeneous as a group (Lerner, 1998; Freear, Sohl and Wetzel, 1994), which implies that their venture investment skills will be lower on average. According to signaling theory the findings that VCs' ROI is better than business angels' ROI and that it is achieved at a lower risk level imply that VCs have higher signal identification and interpretation abilities than business angels. Given that VCs invest in later stages than business angels do, one can expect that startups at this stage will be able to produce more signals and that these signals will be clearer. If VCs' signal receiving abilities are indeed higher than those of angel investors, then according to proposition 4 (chapter 2) VCs will base their investment decisions on the informative aspect of the signal.

**Hypothesis 1a:** *the informative aspect of the signal will have a higher impact on VCs' investment decisions than the legitimizing aspect of the signal.*

According to one view of angels, business angels are experienced entrepreneurs with successful and profitable past ventures who continue to yearn for excitement (Sohl, 1999). When compared to VCs, angels' investments are typically in markets with technologies that are similar to the angels' experience, and in situations in which the angel investor will be able to be a value-adding investor and exercise a hands-on approach (Prasad, Bruton, & Vozikis, 2000). Angels also prefer investments that are closer geographically. Thus, business angels can be seen as relatively similar to the entrepreneur both geographically and professionally. Heil and Robertson (1991) propose that the higher the similarity between the signaler and the receiver the higher the number of signals the receiver will identify, and the higher the accuracy of the signals' interpretation will be. This suggests that one reason business angels are willing to take higher risks is because their signal interpretation abilities are high. However, there is other evidence that suggests that as a group business angels are not homogeneous in their capabilities (Freear, Sohl and Wetzel, 1994; Lerner, 1998). According to this view a business angel is any informal investor in early stage ventures. For example, an angel can be an affluent individual without experience in venture funding who seeks to diversify his investments and invests in a particular startup due to geographical proximity. It appears that separating professional angel investors from other individual investors, including those who fall under the definition of friends and family, is problematic. Since in this study I group all investments who are not recognized as VC funding as angel investments I must subscribe to the latter view of angel/ Thus, I assume that on average the professional distance of angels from entrepreneurs might be higher than that of

professional venture capitalists. This suggests that angel investors will be less likely to interpret signal correctly, i.e. on average, business angel investors have lower signal interpretation skills than professional venture capitalists. According to proposition 2 (chapter 2) interpreters with lower abilities will rely more on the legitimizing aspect of the signal, hence, I propose that angel investment decisions will be more influenced by the legitimizing aspect of the signal rather than the informative aspect of the signal.

Since the debate on the signal interpretation of angels can be taken in both directions, pending on the definition of business angels as a group, it is important to consider the relative position on the venture life cycle that angels and VCs take. Business angel investors typically invest in earlier stage startups (Sohl, 1999, 2003). Younger ventures are typically less accomplished than more mature ventures. Hence, the younger startup will be able to generate a lower number of signals, which, in accordance with proposition 5 (chapter 2), will enhance the prominence of the legitimizing aspect of the signal. Thus it appears that even if we consider angel investors' signal interpretation abilities to be similar to those of VCs, the timeframe in the venture life-cycle in which they invest will enhance the influence of the legitimizing aspect of the signal. Therefore, I suggest that angels will base their decisions on the legitimizing aspect of the signals.

**Hypothesis 1b:** *the legitimizing aspect of the signal will have a higher impact on business angels' investments decisions than the informative aspect of the signal.*

To summarize, angel investors differ from VC firms in terms of demographics, preferences of investment selection criteria, size of investment, investment terms, and



post investment activities. In addition, business angels invest earlier in the life of startups than VCs. Thus, angels and VCs differ in the signals they look for and the types of targets they seek. Moreover, due to the inherent differences in size, structure, and expertise between formal and informal private equity investors, angels and VCs differ in their signal interpretation abilities. Due to the differences in entity size and structure, VCs' signaling resources are more abundant and potentially superior in ability. Additionally, by definition, the demographics of business angels consist of a much wider group than those of VC investment managing partners, which would suggest a wider disparity in signaling interpretation abilities. Thus, I suggest that VCs, who (when compared to business angels) have more available resources for signal interpretation, and therefore according to proposition 3 (chapter2) VCs will be able to delve deeper into the signal's interpretation recursion than business angels would. Formally:

**Hypothesis 2:** *VC investment decisions are more likely to be influenced by deeper recursion level signal than business angels are.*

## **Data**

To test if interfirm signals are indeed target specific I look at how nascent ventures offer investment opportunities to private equity investors. I use a sample of funding solicitations submitted to an investment broker between January 1998 and February 2003. The investment broker was working for an investment management firm located in the U.S. Northwest. Over 70% of the solicitations were from technology based startups, which reflects the time and region in which the broker resided. Nonetheless, the

sample contains solicitations from startups in a variety of industries including aerospace, retail, banking, fishery, internet security, and sports. According to the findings of chapter 3, the solicitations in this sample have a better than normal chance of receiving attention from the potential investors since all of the startups in this sample are utilizing a network referral (the broker) in their solicitation.

The sample consists of 830 funding requests for which the broker maintained either paper or electronic records. These records include a log of incoming solicitations, business plans, power point presentations, and other documents. All records were preserved as part of the broker's internal processes and donated to research.

Three hundred twelve of these requests contained some sort of documentation; 72 submitted a full business plan and 199 an executive summary (23 submitted both). One hundred ten solicitations included other documents, and 62 of those did not have either a business plan or an executive summary. From these 312 requests, I coded data from any document that was submitted to the venture capitalist. Two hundred forty eight of these 312 requests contained management team information. These 248 requests describe 1,541 individuals. 957 served in managerial roles, 342 served on boards of directors and 352 on advisory boards, only 2 served in multiple roles yet 82 people appear without a clear purpose. 229 individuals are noted as founders. The average management team had 3.86 individuals, while the largest had 16 people. The largest number of people described in the documentation was 25.

To identify which solicitation received private equity funding, and of what type, I retrieved SEC’s archives for submissions of Form D by the soliciting startups within the appropriate time frame. When making private offerings of stock, firms need to conform to the SEC regulation D. Regulation D aims to protect the investors and stipulates the necessary divulging of information based on the accreditation of the investor. Not all of the solicitations described the type of investor they are searching for, but all of those who did searched for “accredited investors” only. Accredited investors are either investment organizations or individuals whose personal wealth is larger than a minimum set by the SEC (See Appendix A for the complete definition). Two hundred and thirteen firms received investment in the 6 months following their interaction with the investment broker, 49 of these investments were made by VCs and are found in VentureXpert. The biggest investment was \$54.7M. The average received investment was \$2,687,481. On average each investment was raised by about 16 entities, and the largest investment team had 170 investors. Only 11 investments in the sample were made by non accredited investors. The average accredited investor invested almost \$365,000 while the average non accredited investor contributed less than \$40,000. (See table 4.1 for more details).

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Insert Table 4.1 about here  
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## Dependent Variable

*Investment.* I test whether a startup succeeded in soliciting an investor using a binary dummy variable—*d\_invst*—that indicates if a form D was submitted to the SEC in the 180 days following the date of solicitation. The six month period was specified in several solicitation documents as the target to concluding the round.

*VC Funding.* The dummy variable—*d\_vc*—receives the value of 1 if the Form D funding event was reported in VentureXpert as a VC funding round, and 0 if the funding event was not found in VentureXpert or if the startup did not secure any funding. Forty nine of the funding events are reported as VC rounds.

*Angel Funding.* The dummy variable—*d\_angel*—receives the value of 1 if the Form D funding event was not reported in VentureXpert, and 0 if the funding was made by a VC (per *d\_vc*) or the startup failed to secure funding. One hundred and sixty four of the funding events are reported as angel rounds.

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Insert Table 4.2 about here

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## Independent Variables

Kirsch at al (2009) tested a different dataset of funding solicitations with similar documentation characteristics. Although the particular usage of the variable is not

completely similar, the following variable description follows their variable identification where appropriate.

*Previous Investment.* For each of startups in the solicitation who received funding I coded previous funding events by using Form Ds submitted from January 1997 onward. Thus, I was able to capture if the startup had previously received funding. As noted earlier, 213 of the 830 solicitations secured funding. Of those, 168 have reported previous investments to the SEC, 15 of which were made by VCs according to VentureXpert.

*Document Type:* While there is significant variance in the types of documents within the funding requests, a single dummy variable is used to test if the type of submitted document serves as a signal. The use of an executive summary or a full business plan as a solicitation document became the standard due to coercive, mimetic and normative isomorphism (DiMaggio and Powel, 1983). VCs regularly ask for a business plan on their web sites. Business plans are commonly used in entrepreneurship contests and business schools' entrepreneurship seminars emphasize its importance. Thus, a startup might use the document's format to legitimize the information it wants to transfer to the potential investor. Thus, the document type is the first layer of the signal's recursion. Out of the 312 solicitations that contained documents, 72 have submitted a business plan and 199 submitted an executive summary; 23 of those submitted both. The dummy variable  $d_{bp\_es}$  takes the value of 1 if the solicitation contained a business plan(s) and/or an executive summary, and 0 for all other document types.

*Document Substance.* To capture the informative aspect of the submitted documentation, the documents of each solicitation were graded for clarity. I graded each of the solicitations on the presentation of the following subjects: (1) the Product or Service Process; (2) the Target Market/Industry Analysis; (3) the Value Proposition (i.e., why the product or process was an appropriate solution to a problem in the target market); (4) the startup's Competition and its Competitive Advantage; (5) the current Business Stage; (6) the Top Management Team and Boards; (7) the Marketing Plan; (8) the startup's Financials and (9) the Revenue Model. These nine sections are commonly referred to in entrepreneurship textbooks (cf., Timmons and Spinelli, 2007, 229 or Baron and Shane, 2005, 169). Each section received a score between 0 and 5 based on the depth and clarity of the topic's description. Thus, I was not trying to assess the accuracy or correctness of the presented data, rather I aimed to see if the startup covered the important issues in each topic and if after reading the section I have understood the subject. A section was scored 0 if it was not covered at all and 5 if it was complete and easy to understand. For example, the management team section received a score of 1 if it contained only a list of names or if most of the names did not have a title, if the description consisted of names and functions for all team members it received a score of 2. The section received a score of 3 if each individual had rudimentary description attached (e.g. "Joe has 12 years of experience in commercial banking"). If the person's history included the names of previous employers, position titles and education history (including institution) the score was either 4 or 5. A score of 5 was given if all the team members were described to this level and 4 if the description of some was lacking, which is similar to the difference between the scores of 1 and 2.

The variable *overalldoc* sums the solicitation's documents' grade as a whole on the scale of 0 to 5. The score is calculated as the combined score of all the sections, divided by the number of sections that exist in the solicitations' documents. I also created the variable *plan\_comp*, which is the sum of the score of all nine sections. Since the goal of this variable is to capture the informative aspect of the submitted documentation as a signal I use *overalldoc*, whose interpretation is less ambiguous<sup>10</sup>.

*Financial Information Representation.* This variable grades the representation of the startup's financial revenue and profit model. Documentation which contained only text received a score of 1 while those who's financial section included tabulation conforming to accounting reporting norms were graded as 5. This grades only the form of the financial model and excludes the coder's reservations concerning the validity of the assumptions within the model. Thus, this variable represents the legitimizing aspect of the financial information within the solicitation's documentation.

*Human capital:* The documents of 248 contain basic information about members of the management team, board of directors, and advisory board. Typically the documents provide the following information: name, title, education, professional background and prior entrepreneurial experience. These biodata allows the creation of multiple variables representing the startups' human capital.

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<sup>10</sup> Since *plan\_comp* accounts for the completeness of the structure and the substance within it, its interpretation as a representative of either the legitimizing or the informative aspect of the signal can be questioned. Generally, the two variables followed the same behavior pattern in the regression models.

*Founder.* The variable *d\_founder* indicates if the startup's founders are still part of the top management team and counts their number. 132 startups had as many as three founders in management positions. On average a startup had less than a single founder (0.86) onboard. This variable represents the legitimizing aspect of the signal; the informative aspect of the founders' contribution to the startup is captured in the variables representing the founders' education and experience. Since none of these informative aspects of the signal were ever significant they were omitted from the regression models and are not reported in this text.

*Team completeness and specialization.* Following Sine et al. (2006), I implement a measure of team completeness (*team\_completeness*) as the number of managerial roles reported in the planning documents. I captured a total of 17 management positions: Chairman; Chief Executive Officer; Business Administration; Chief Financial Officer; Marketing; Corporate Development; Chief Engineering Officer; Human Resources; International Sales; Manufacturing; Management of Information Systems; Purchasing; Quality Control; Research & Development; Sales; Strategic Planning; Technology Transfer; and Nonisomorphic role or Insufficient Information provided for classification. A higher score reflects higher team completeness. The variable *max\_rolls* counts the maximum number of roles a person filled in a startup. The higher the number of rolls a person juggles the lower the specialization of the startup. On average a team member had more than a single area (1.36) under his supervision and a maximum of 4. Since the role of these variables is to represent the informative aspect of the signal, I use the



specialization variable *max\_rolls*, which is less ambiguous of the two, in the regression models.

*Educational Human Capital:* Using the reported educational achievements of the startup's top echelon I created degree counters for the top management team, board of directors, and advisory board. The variable *tmt\_degree* sums the number of university degrees (doctorate, graduate, and undergraduate levels) reported for members of the startup who also hold managerial positions. On average the top management team had 1.57 members with higher education degrees reported (with a maximum of 9). Similarly, the variable *ab\_n\_bod\_degree* captures the same information for members of the board of directors and the advisory board (average of 0.42 and maximum of 7). The TMT's educational capital is a direct indication of the capabilities of the startup, hence it represents the informative aspect of the signal. On the other hand, the BOD educational information relates to entities that are external to the startup and is therefore indirect. Hence it represents the legitimizing aspect of the signal.

*Professional Experience:* From the summary biographies I extracted work histories, professional, and entrepreneurial experience. Experience is calculated as the sum of individual professional experience (in months) the startup has. I created separate counters for the top management team (*total\_tmt\_exp*) and the members of the boards (*total\_bod\_n\_ab\_exp*).

## **Control Variables**

*Stock Exchange.* I created three variables of the NASDAQ stock exchange to further help control the effect of time, industry, and external factors. First I captured the weekly closing position of the NASDAQ; second I captured the maximum position of the NASDAQ at each week, and last, I estimated the weekly trend by calculating the difference between the NASDAQ starting and closing position each week. Since all three variables yield basically the same results, only the closing variable—*nasdaq\_close*—is reported in the regression models.

*VC Investments.* I captured the quarterly sum of VC investments (in billions) as recorded on PriceWaterhouseCoopers' MoneyTree.

*Timing of Request:* I captured the date of funding request. The date is represented by the variable *yr\_qtr*.

## **Analysis and Results**

Table 4.2 reports the descriptive statistics and table 4.3 reports the correlations of all the hypothesized as well as control variables. There is a strong positive correlation between all the dependent variables (DV) and the previous investment indicator *d\_prev\_invst*. The general investment DV (*d\_invst*) is also correlated to the financial presentation variable (*qualpress*) and to the control variables *nasdaq\_close* and

*mt\_qtr\_vc\_amount*. Investment by VCs (*d\_vc*) is negatively correlated to the submission of business documentation (*d\_bp\_es*) and is positively correlated with the management team specialization variable (*max\_rolls*), these directions are supportive to hypothesis 1a. The business angels DV (*d\_angel*), also has a strong positive correlation with the NASDAQ and the PWC MoneyTree control variables, and marginal correlation to the legitimizing variable aspects *d\_founder* and *qualpress*, which supports hypothesis 1b. All other independent variables are not correlated with the DVs. There is a strong and significant correlation between several of the independent variables (IV), specifically between the document type indicator *d\_bp\_es* and the document substance (*overalldoc*) and the financial presentation variable (*qualpress*). This is not surprising, considering the multilayered structure of the signal.

There is also strong positive correlation within the education and experience variables. Only one IV—*d\_prev\_invst*—is not significantly correlated to any of the other IVs. These correlations suggest that using a combination of these variables in a regression model may result in multicollinearity.

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Insert Table 4.3 about here

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Table 4.4 reports the results from the logistic regressions on the investment indicator *d\_invst*. In models 1 through 10 the regression is run on each of the IVs in

combination with the control variables only. These models show that the single most influential predictor of receiving funding is the indication of previous external funding round(s) ( $\beta_{d\_prev\_invst}=2.622, p<.01$ ). These results affirm the findings by Kirsch *et al.* (2009) who found that business plans were not a good predictor of venture capital funding. In models 11 through 18 (see Table 4.5) I gradually combine the IVs in an effort to control for multicollinearity. First I pair the IVs according to relevancy in models 11 to 15; model 16 contains all six variables found within the solicitations' documentation; I then add the initial layer signals (*d\_prev\_invst* and *d\_bp\_es*) one by one in models 17 and 18. This gradual addition allows me to evaluate the possible existence of multicollinearity in each model. The pairwise models (11 -15) do not show dramatic changes from the single IV models. Two significant changes are observed in model 16. First, the document substance variable (*overalldoc*) is almost 8 times stronger in the presence of the other IVs, and it has changed its direction. Second, TMT education variable (*tmt\_degree*) has also changed its sign, although not its size. The addition of *d\_prev\_invst* in model 17 reduces *overalldoc* to a quarter of its previous magnitude. Finally, the addition of the document type indicator flips the sign of *overalldoc* once more, and *d\_bp\_es* itself is stronger, although that should be expected given the presence of signals from deeper recursion levels. While none of these changes is significant, this does indicate that there is a good reason to expect multicollinearity in the complete model (18) and that statistical significance that is only visible in the complete model should be treated as suspect.

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Insert Table 4.4 about here

Insert Table 4.5 about here

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The following regression models for  $d_{vc}$  and  $d_{angel}$  as the DV are structured in the same fashion as the previous test was for  $d_{invst}$  and differ only in the use of the DV. Models 1a through 18a (tables 4.6 and 4.7) utilize the VentureXpert indicator  $d_{vc}$ , this DV takes the value of 1 if the funding event has a corresponding event in VentureXpert, indicating that this is a VC funding. Model 1a tests the influence of document type, a legitimizing aspect of the signal, on the probability of being funded by a VC. The variable  $d_{bp\_es}$  includes both business plans and executive summaries as solicitation documents. The submission of normative business documents has a negative and significant ( $\beta_{d_{bp\_es}}=-1.293, p<.05$ ) influence on receiving VC funding. This result suggests that startups who submit business plans and executive summaries in their solicitations are less likely to receive funding from a VC firm. Model 2a tests the influence of evidence of previous funding, an informative aspect of the signal, on the probability of being funded by a VC. The variable  $d_{prev\_invst}$  indicates whether the startup has reported any past funding round to the SEC. The evidence of a previous round of funding has a positive and significant ( $\beta_{d_{prev\_invst}}=1.932, p<.01$ ) influence on the probability of securing VC funds. The combined results of model 1a and 2a show that the informative aspect of the signal positively influences VC funding decisions while the legitimizing aspect of the signal predicts angel investment or no investment at all, which supports H1a.

The variables document substance, financial model presentation, TMT education and experience, and the boards' members' education and experience (models 3, 4, 5, 7, 9, 8, and 10 respectively) do not show significance. In model 6, team specialization has marginal significance ( $\beta_{\text{max\_rolls}}=1.102$ ,  $p<.10$ ). This indicates that the higher the maximum number of areas a management team member is in-charge of, the higher its likelihood of receiving VC funding. Model 11a (Table 4.7) combines models 1a and 2a. Both indicators keep their direction and continue to be significant, though the significance of the document type variable is reduced to marginal ( $\beta_{\text{d\_bp\_es}}=-1.095$ ,  $p<.10$ ;  $\beta_{\text{d\_prev\_invst}}=1.611$ ,  $p<.01$ ). The TMT specialization variable also keeps its marginal significance with the addition of *d\_founder* (in model 13), and other variables (in models 16-18), while the educational, experience, and documents' content are insignificant in all models. Interestingly, the document type indicator loses its significance in the full model (18a) while the founders' indicator gains marginal significance in the presence of *d\_prev\_invst*. These results further suggest that the informative aspect of the signal has a higher influence on VC funding decisions than the legitimizing aspect of the signal. Therefore H1a is supported.

In models 1b through 18b (tables 4.8 and 4.9) I use as DV the angel investment indicator *d\_angel*, which takes the value of 1 if the funding event doesn't have a corresponding event in VentureXpert. As before, model 1b tests the influence of *d\_bp\_es* on the probability of being funded by a business angel. The variable *d\_bp\_es* includes both business plans and executive summaries as solicitation documents. The submission

of normative business documents is not significant. Model 2b tests the influence of evidence of previous funding, an informative aspect of the signal, on the probability of being funded by an angel investor. The variable  $d\_prev\_invst$  indicates if the startup have reported to the SEC any funding round in its past. The evidence of a previous round of funding has a positive and significant ( $\beta_{d\_prev\_invst}=1.778, p<.01$ ) influence on the probability of securing angel funds, which is in the opposite direction to the suggested theory. The combined results of models 1b and 2b show that the informative aspect of the signal positively influences an angel funding decisions while the legitimizing aspect of the signal does not, which negates H1b.

The variables document substance, financial model presentation, TMT specialization, education and experience and the boards' members' education and experience (models 3, 4, 6, 7, 9, 8, and 10 respectively) do not show significance. In model 5, the founder indicator has marginal significance ( $\beta_{d\_founder}=0.368, p<.10$ ). While indicating that angels are attuned to different signals than VCs, this does not negate the findings from models 1b & 2b. Model 11b (Table 4.9) combines model 1b with 2b. Both indicators keep their direction and significance levels. The significance of  $d\_founder$  is lost in the presence of  $d\_prev\_invst$  in models 17b-18b. The educational, experience and documents' content variables are insignificant in all relevant models. These results suggest that the informative aspect of the signal has a higher influence of angel funding decisions than the legitimizing aspect of the signal. Therefore H1b is not supported.

To supplement these models I created another DV  $d\_ba\_vc$  in which all solicitations without an investment event are dropped. This variable takes the value of 1 when the investment event appears in VentureXpert and 0 if the event is not in VentureXpert. Since the majority of the observations are dropped in this model, the test sample size is relatively small. Thus, these results should be considered as an addendum for the previous results from previous models. Tables 4.10 and 4.11 follow the same model development structure as before. The results in models 1c through 18c help to establish the previous findings. The findings suggest that the informative aspect of the signal ( $\beta_{d\_prev\_invst}=0.658, p<.10$ ;  $\beta_{max\_rolls}=1.250, p<.10$ ) influences the investment decisions of VCs, while the legitimizing aspect of the signal ( $\beta_{d\_bp\_es}=1.341, p<.05$ ;  $\beta_{d\_founder}=-0.965, p<.05$ ) influences the decisions of angel investors. Thus, H1a and b are supported. The result does not change as the prediction models become more complex. However, both  $d\_bp\_es$  and  $d\_prev\_invst$  lose their significance in the presence of deeper layer signals. This finding contradicts hypothesis 2, as there is no evidence that the signals influencing VCs and angels differ in the signal's layer-depth.

## **Discussion and Conclusions**

In this essay I test if receivers differ in their utilization of the received signal. To accomplish this I utilize a new dataset of investment solicitations from nascent ventures. These solicitations were submitted to a single deal broker in the US Northwest between 1998 and 2003. The solicitations' documentation, and especially the description of each startup's top echelon therein, is the signal the venture sends to the receiver. The receivers



of the solicitations are private equity investors. Commonly, private equity investors are segmented into two main groups: angel investors and venture capital firms. Research shows these segments differ on several aspects. Angel investors are wealthy individuals who invest their own money, while VCs are limited partnerships where the managers who make the investment decisions are not the general partners whose money is invested. Typically angel investors do not have a group of professionals to evaluate and scrutinize solicitations. I argue that one of the outcomes of these, and other, dissimilarities between the two investors' types, results in their different ability to interpret the signals they receive from the startups. Furthermore, I suggest that organizations with relatively lower abilities of signal interpretation are more likely to rely on the legitimizing aspect of the signal in their decision making. Hence, I argue angel investors' decisions are more likely to be influenced by the legitimizing aspect of the signal when compared to VC investment decisions. On the other hand, VC investment decisions are more likely to be influenced by the informative aspect of the signal.

To test these arguments I supplemented the solicitation dataset with information from reports the startups submitted to the SEC regarding investments and as a result of the solicitation efforts. In accordance with regulation D, startups are required to submit a description of the investments made in the firm to the SEC, including the number of investors and the size of investment. The data within the SEC's 'Form D' allows me to discern the investor type, hence the complete dataset enables me to find which aspect of the signal attracted angel investors and which attracted venture capitalists.

Until now, research of interfirm signals has focused on the signal itself and how it relates to the underlying quality of the sender. In other words, researchers have tested how the senders' heterogeneity influences the outcome of interactions. At the same time, most researchers have ignored the receiver side altogether, especially in empirical studies. It appears that for the most part current research of interfirm signaling has implicitly assumed all receivers are homogenous. Obviously this assumption is false. Receivers are just as likely to be heterogeneous as senders are. While this assumption simplifies the problem facing the researcher, it also skews our understanding of the actual interaction and detracts from our ability to assist practitioners to manage signals strategically. The results of this essay indicate that the receivers' heterogeneity is an important aspect of the signaling interaction and that further research on the influence of receiver's heterogeneity is necessary to improve our understanding of interfirm signaling. Looking at competitive settings, Heil and Robertson (1991) proposed that entities with higher signal generating capabilities will be also have better signal interpretation capabilities. To my knowledge this study is the first attempt to empirically test the influence of receiver's heterogeneity. Moreover, this study, and the suggested theory in this dissertation, consider a more generic signaling scenario and are not confined within competitive settings (even though, uneven competition can exist in any interaction (Chen, 1996)).

This study suffers from several limitations. As pointed earlier, there is reason to believe the predicting model suffers from multicollinearity. Careful consideration was given to establishing which variables are influenced in the analysis. Further remedy may

come from increasing the sample size, which is currently pursued. Another limitation stems from the definition and identification of angel investors. In this study angels are not identified directly, rather all funding events that are not positively identified as VC funding are assumed to be angel activities. This is a cause for concern. First, at least some of these funding events may be the result of investments by family and friends. This problem is tightly tied to the vague definition of angel investors. Currently little is known about business angels as a group. It is possible that the population of angel investors is inconveniently wide, containing both accredited and non accredited investors, both experienced and successful entrepreneurs and wealthy individuals who casually invest in startups. In this case we will need to redefine angels to improve our ability to study angels empirically. With current events in mind we might see the border between angels and VCs becoming even blurrier than before. There is some evidence that due to the financial crisis and the continuing difficulties in raising future investment funds, VCs recommend to startups in which they invested in the past to go 'down in the food chain' and try and seek angel funding.

**Table 4.1** - Descriptive statistics for observations that received funding

<b>Variable</b>	<b>Obs.</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
total_offered	212	4,342,092	9,214,734	46,382	100,000,000
total_sold	213	2,687,481	5,940,511	6,000	54,700,000
acc_amount	209	3,227,963	9,643,637	6,000	112,000,000
non_acc_amount	11	160,670.600	227,548.800	12,000	768,776
avg_invstment	212	336,223.800	929,823.900	3,286	10,000,000
avg_acc_investment	209	364,571.100	992,274.700	1,000	10,000,000
avg_non_acc_investment	11	38,194.280	38,976.580	8,000	128,367
total_num_investors	212	16.137	22.887	1	170
acc_investors	211	15.948	22.906	1	170
non_acc_investors	11	5.091	6.655	1	24
in_venture_expert	49	1.000	0.000	1	1
ve_amount	213	958,403.800	4,484,991	0	40,700,000
ve_num_invst	213	0.343	1.548	0	17
d_prev_invst	213	0.638	0.482	0	1
num_of_prev_invstments	213	0.995	1.131	0	10
prev_inst_amount	213	1,267,248	5,104,425	0	54,700,000
d_prev_vc	213	0.061	0.240	0	1

**Table 4.2** - Descriptive statistics

	<b>Variable</b>	<b>Obs.</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>
DV	d_invst	830	0.257	0.437	0	1
	d_vc	830	0.066	0.249	0	1
	d_angel	830	0.198	0.398	0	1
IV	d_bp_es	312	0.795	0.404	0	1
	d_prev_invst	830	0.202	0.402	0	1
	overalldoc	312	3.017	0.905	0	5
	qualpress	312	2.804	1.467	0	5
	d_founder	248	0.855	0.883	0	3
	max_rolls	248	1.359	0.505	1	4
	tmt_degree	248	1.573	1.890	0	9
	ab_n_bod_degree	248	0.419	1.084	0	7
	total_tmt_exp	248	28.734	33.302	0	172
	total_bod_exp	248	8.109	15.243	0	104
	Control	nasdaq_close	815	2398.267	842.504	1139.9
mt_qtr_vc_amount		761	11.330	8.548	4.113598	28.31118
yr_qtr		493	2000.019	2.190	1968.1	2008.3

**Table 4.3** - Correlations

	1	2	3	4	5	6	7	8	9	10
1d_invst	1									
2d_vc	0.3869***	1								
3d_angel	0.8446***	-0.1322***	1							
4d_bp_es	-0.0183	-0.1030*	0.0465	1						
5d_prev_invst	0.6377***	0.3359***	0.5106***	-0.0429	1					
6overalldoc	0.0628	-0.0292	0.0737	0.3971***	-0.0643	1				
7qualpress	0.1239**	0.0342	0.1050*	0.4389***	0.0214	0.6191***	1			
8d_founder	0.0539	-0.0977	0.1144*	0.1512**	0.0789	0.1179*	0.1354**	1		
9max_rolls	0.0594	0.1482**	-0.0200	0.1209*	0.0310	0.0980	0.1009	-0.0734	1	
10tmt_degree	-0.0177	-0.0131	-0.0117	0.1185*	-0.0624	0.3168***	0.2472***	0.2028***	0.1850***	1
11ab_n_bod_degree	0.0410	0.0611	0.0098	0.0600	-0.0697	0.2640***	0.1835***	0.0110	0.1011	0.3211***
12total_tmt_exp	-0.0262	0.0207	-0.0403	0.1375**	0.0247	0.2472***	0.2401***	0.1114*	0.1371**	0.3181***
13total_bod_exp	0.0168	0.0281	0.0022	0.1135*	0.0560	0.0693	0.1339**	0.0393	0.2046***	0.0965
14nasdaq_close	0.1574***	-0.0255	0.1734***	0.0018	0.0537	0.0886	0.0311	0.1263**	-0.0034	-0.0190
15mt_qtr_vc_amount	0.3123***	0.0361	0.3056***	-0.0304	0.1834***	0.0885	0.0538	0.0822	-0.0177	-0.0178
16yr_qtr	0.0592	0.0446	0.0298	0.0348	0.0211	0.0793	0.1140*	-0.0873	0.0767	0.0375

\* p<0.10 \*\* p<0.05 \*\*\* p<0.01

	11	12	13	14	15	16
11ab_n_bod_degree	1					
12total_tmt_exp	0.0334	1				
13total_bod_exp	0.1881***	0.4273*	1			
14nasdaq_close	0.0322	0.0149	-0.0788	1		
15mt_qtr_vc_amount	0.0406	0.0093	-0.0375	0.9102***	1	
16yr_qtr	0.0126	0.1314*	0.0401	-0.0748*	-0.1759***	1

\* p<0.10 \*\* p<0.05 \*\*\* p<0.01

**Table 4.4** – logistic regression models

	model 1	model 2	model 3	model 4	model 5	model 6	model 7	model 8	model 9	model 10
d_bp_es	-0.442 (1.21)									
d_prev_invst		2.622*** (10.15)								
overalldoc			0.08 (0.50)							
qualpress				0.07 (0.66)						
d_founder					0.161 (0.92)					
max_rolls						0.218 (0.68)				
tmt_degree							-0.018 (0.23)			
ab_n_bod_degree								-0.059 (0.43)		
total_tmt_exp									-0.007 (1.35)	
total_bod_exp										-0.005 (0.51)
nasdaq_close	0 (0.96)	0.001* (1.85)	0 (0.75)	0 (0.75)	0.001 (1.27)	0.001 (1.34)	0.001 (1.27)	0.001 (1.33)	0.001 (1.39)	0.001 (1.31)
mt_qtr_vc_invst_amount	-0.027 (0.56)	-0.037 (1.02)	-0.014 (0.31)	-0.013 (0.29)	-0.068 (1.27)	-0.072 (1.32)	-0.068 (1.27)	-0.071 (1.31)	-0.075 (1.38)	-0.07 (1.30)
yr_qtr	0.085 (0.70)	0.198** (2.50)	0.074 (0.61)	0.072 (0.59)	0.069 (0.51)	0.055 (0.41)	0.054 (0.40)	0.059 (0.44)	0.07 (0.52)	0.062 (0.46)
_cons	-170.948 (0.71)	-397.536** (2.51)	-150.593 (0.62)	-144.84 (0.59)	-140.239 (0.52)	-112.401 (0.42)	-108.645 (0.40)	-120.209 (0.45)	-141.105 (0.52)	-124.624 (0.46)
N	236	432	236	236	195	195	195	195	195	195
ll	-143.547	-226.469	-144.137	-144.045	-119.054	-119.245	-119.448	-119.379	-118.52	-119.341
chi2	3.239	138.130	2.058	2.242	2.615	2.234	1.828	1.967	3.685	2.043

DV: d\_invst

\* p<0.10 \*\* p<0.05 \*\*\* p<0.01

**Table 4.5** – additional logistic regression models

	model 11	model 12	model 13	model 14	model 15	model 16	model 17	model 18
d_bp_es	-0.173 (0.43)							-0.569 (0.96)
d_prev_invst	2.052*** (5.82)						2.028*** (5.01)	2.030*** (4.99)
overalldoc		0.026 (0.13)				-0.195 (0.81)	-0.052 (0.20)	0.05 (0.18)
qualpress		0.059 (0.45)				0.164 (1.02)	0.149 (0.86)	0.153 (0.89)
d_founder			0.17 (0.96)			0.189 (1.00)	0.083 (0.40)	0.107 (0.51)
max_rolls			0.239 (0.74)			0.299 (0.87)	0.302 (0.81)	0.317 (0.84)
tmt_degree				-0.012 (0.15)		0.008 (0.08)	0.031 (0.30)	0.035 (0.34)
ab_n_bod_degree				-0.055 (0.40)		-0.068 (0.43)	-0.009 (0.05)	-0.022 (0.13)
total_tmt_exp					-0.006 (1.26)	-0.008 (1.33)	-0.009 (1.48)	-0.009 (1.49)
total_bod_exp					-0.002 (0.16)	-0.001 (0.10)	-0.006 (0.43)	-0.005 (0.41)
nasdaq_close	0 (1.02)	0 (0.74)	0.001 (1.31)	0.001 (1.31)	0.001 (1.40)	0.001 (1.43)	0.001 (1.48)	0.001 (1.59)
mt_qtr_vc_invst_amount	-0.02 (0.40)	-0.013 (0.29)	-0.072 (1.31)	-0.07 (1.30)	-0.075 (1.39)	-0.082 (1.46)	-0.074 (1.26)	-0.082 (1.39)
yr_qtr	0.034 (0.25)	0.072 (0.59)	0.069 (0.51)	0.057 (0.42)	0.071 (0.53)	0.093 (0.67)	0.027 (0.18)	0.038 (0.25)
_cons	-69.396 (0.26)	-145.086 (0.59)	-140.332 (0.51)	-115.754 (0.43)	-143.807 (0.53)	-187.864 (0.68)	-56.883 (0.19)	-78.878 (0.26)
N	236	236	195	195	195	193	193	193
ll	-125.018	-144.036	-118.782	-119.367	-118.506	-116.207	-102.357	-101.900
chi2	40.296	2.260	3.160	1.990	3.712	6.831	34.530	35.444

DV: d\_invst

\* p<0.10 \*\* p<0.05 \*\*\* p<0.01



**Table 4.6** – additional logistic regression models

	model 1 a	model 2 a	model 3 a	model 4 a	model 5 a	model 6 a	model 7 a	model 8 a	model 9 a	model 10 a
d_bp_es	-1.293** (2.38)									
d_prev_invst		1.932*** (5.22)								
overalldoc			-0.114 (0.42)							
qualpress				-0.055 (0.30)						
d_founder					-0.615 (1.58)					
max_rolls						1.102* (1.85)				
tmt_degree							-0.092 (0.58)			
ab_n_bod_degree								-0.015 (0.06)		
total_tmt_exp									-0.003 (0.38)	
total_bod_exp										-0.002 (0.13)
nasdaq_close	-0.001 (0.64)	-0.001 (1.47)	-0.001 (1.01)	-0.001 (1.02)	0 (0.12)	0 (0.24)	0 (0.02)	0 (0.09)	0 (0.11)	0 (0.08)
mt_qtr_vc_invst_amount	0.037 (0.44)	0.068 (1.31)	0.072 (0.89)	0.073 (0.89)	-0.036 (0.35)	-0.055 (0.49)	-0.032 (0.32)	-0.036 (0.36)	-0.039 (0.38)	-0.036 (0.36)
yr_qtr	0.032 (0.16)	0.114 (1.04)	0.001 (0.01)	0.001 (0.01)	-0.07 (0.32)	-0.034 (0.16)	-0.041 (0.19)	-0.027 (0.12)	-0.02 (0.09)	-0.025 (0.11)
_cons	-64.147 (0.17)	-229.625 (1.04)	-3.801 (0.01)	-4.058 (0.01)	137.607 (0.32)	63.831 (0.15)	79.851 (0.18)	51.106 (0.12)	37.495 (0.09)	47.54 (0.11)
N	236	432	236	236	195	195	195	195	195	195
ll	-57.87	-121.621	-60.389	-60.432	-45.957	-45.644	-47.235	-47.414	-47.338	-47.407
chi2	6.446	36.75	1.409	1.322	3.609	4.235	1.052	0.696	0.846	0.709

DV: d\_vc

\* p<0.10 \*\* p<0.05 \*\*\* p<0.01

**Table 4.7** – additional logistic regression models

	model 11 a	model 12 a	model 13 a	model 14 a	model 15 a	model 16 a	model 17 a	model 18 a
d_bp_es	-1.095* (1.93)							-1.278 (1.43)
d_prev_invst	1.611*** (3.01)						1.965*** (2.79)	1.781** (2.49)
overalldoc		-0.103 (0.30)				-0.094 (0.20)	0.222 (0.46)	0.504 (0.97)
qualpress		-0.012 (0.05)				0.11 (0.35)	0.062 (0.19)	0.044 (0.14)
d_founder			-0.601 (1.53)			-0.548 (1.34)	-0.830* (1.78)	-0.786* (1.66)
max_rolls			1.076* (1.79)			1.182* (1.86)	1.306* (1.92)	1.286* (1.89)
tmt_degree				-0.093 (0.58)		-0.077 (0.41)	-0.05 (0.27)	-0.036 (0.19)
ab_n_bod_degree				0.012 (0.05)		-0.053 (0.20)	-0.021 (0.07)	-0.049 (0.17)
total_tmt_exp					-0.003 (0.36)	0 (0.02)	-0.002 (0.14)	0 (0.01)
total_bod_exp					-0.001 (0.04)	-0.008 (0.34)	-0.004 (0.18)	-0.005 (0.25)
nasdaq_close	0 (0.60)	-0.001 (1.01)	0 (0.19)	0 (0.02)	0 (0.11)	0 (0.18)	0 (0.12)	0 (0.03)
mt_qtr_vc_invst_amount	0.038 (0.46)	0.072 (0.89)	-0.048 (0.42)	-0.032 (0.31)	-0.039 (0.38)	-0.05 (0.44)	-0.001 (-0.01)	-0.014 (0.13)
yr_qtr	-0.02 (0.10)	0.002 (0.01)	-0.094 (0.43)	-0.042 (0.19)	-0.019 (0.09)	-0.092 (0.41)	-0.268 (1.06)	-0.229 (0.90)
_cons	37.847 (0.09)	-4.476 (0.01)	185.366 (0.42)	81.167 (0.19)	36.341 (0.08)	180.846 (0.40)	530.872 (1.05)	452.459 (0.89)
N	236	236	195	195	195	193	193	193
ll	-53.337	-60.387	-44.29	-47.234	-47.338	-43.831	-39.771	-38.79
chi2	15.512	1.411	6.942	1.054	0.848	7.583	15.703	17.666

DV: d\_vc

\* p<0.10 \*\* p<0.05 \*\*\* p<0.01

**Table 4.8** – additional logistic regression models

	model 1 b	model 2 b	model 3 b	model 4 b	model 5 b	model 6 b	model 7 b	model 8 b	model 9 b	model 10 b
d_bp_es	0.107 (0.25)									
d_prev_invst		1.778*** (7.70)								
overalldoc			0.145 (0.82)							
qualpress				0.103 (0.89)						
d_founder					0.368* (1.94)					
max_rolls						-0.138 (0.39)				
tmt_degree							0.009 (0.10)			
ab_n_bod_degree								-0.065 (0.44)		
total_tmt_exp									-0.007 (1.23)	
total_bod_exp										-0.005 (0.48)
nasdaq_close	0.001 (1.37)	0.001*** (2.68)	0.001 (1.38)	0.001 (1.38)	0.001 (1.29)	0.001 (1.32)	0.001 (1.35)	0.001 (1.38)	0.001 (1.43)	0.001 (1.36)
mt_qtr_vc_invst_amount	-0.042 (0.81)	-0.062* (1.76)	-0.042 (0.81)	-0.041 (0.79)	-0.067 (1.14)	-0.066 (1.14)	-0.068 (1.17)	-0.07 (1.20)	-0.073 (1.26)	-0.069 (1.19)
yr_qtr	0.089 (0.64)	0.125 (1.64)	0.088 (0.63)	0.084 (0.60)	0.111 (0.71)	0.08 (0.53)	0.081 (0.53)	0.082 (0.55)	0.092 (0.61)	0.084 (0.56)
_cons	-179.52 (0.65)	-252.112* (1.66)	-178.49 (0.64)	-169.907 (0.61)	-223.397 (0.72)	-162.382 (0.54)	-163.374 (0.54)	-166.311 (0.55)	-184.988 (0.62)	-170.614 (0.56)
N	236	432	236	236	195	195	195	195	195	195
ll	-126.219	-238.095	-125.91	-125.852	-104.842	-106.654	-106.726	-106.632	-105.933	-106.613
chi2	3.829	73.759	4.446	4.562	5.697	2.072	1.929	2.117	3.515	2.155

DV: d\_angel

\* p<0.10 \*\* p<0.05 \*\*\* p<0.01

**Table 4.9** – additional logistic regression models

	model 11 b	model 12 b	model 13 b	model 14 b	model 15 b	model 16 b	model 17 b	model 18 b
d_bp_es	0.404 (0.89)							0.081 (0.13)
d_prev_invst	1.636*** (4.57)						1.574*** (3.94)	1.576*** (3.94)
overalldoc		0.08 (0.36)				-0.173 (-0.66)	-0.065 (-0.24)	-0.08 (-0.27)
qualpress		0.072 (0.50)				0.144 (0.83)	0.131 (0.72)	0.131 (0.73)
d_founder			0.365* (1.92)			0.372* (1.83)	0.312 (1.44)	0.309 (1.41)
max_rolls			-0.094 (-0.26)			-0.066 (-0.18)	-0.113 (-0.28)	-0.11 (-0.28)
tmt_degree				0.017 (0.19)		0.036 (0.35)	0.055 (0.52)	0.054 (0.51)
ab_n_bod_degree				-0.071 (-0.46)		-0.063 (-0.36)	-0.009 (-0.05)	-0.007 (-0.04)
total_tmt_exp					-0.006 (-1.14)	-0.009 (-1.39)	-0.01 (-1.45)	-0.01 (-1.45)
total_bod_exp					-0.002 (-0.15)	0.001 (0.05)	-0.003 (-0.24)	-0.003 (-0.25)
nasdaq_close	0.001 (1.43)	0.001 (1.37)	0.001 (1.26)	0.001 (1.39)	0.001 (1.43)	0.001 (1.39)	0.001 (1.46)	0.001 (1.44)
mt_qtr_vc_invst_amount	-0.036 (-0.68)	-0.04 (-0.79)	-0.066 (-1.12)	-0.071 (-1.21)	-0.073 (-1.26)	-0.077 (-1.27)	-0.071 (-1.16)	-0.07 (-1.13)
yr_qtr	0.047 (0.32)	0.084 (0.60)	0.11 (0.71)	0.085 (0.56)	0.093 (0.62)	0.135 (0.87)	0.098 (0.59)	0.097 (0.58)
_cons	-97.164 (-0.33)	-171.035 (-0.61)	-222.865 (-0.72)	-172.558 (-0.57)	-187.854 (-0.62)	-273.034 (-0.87)	-199.625 (-0.59)	-196.759 (-0.58)
N	236	236	195	195	195	193	193	193
ll	-115.601	-125.787	-104.808	-106.614	-105.921	-102.782	-94.903	-94.895
chi2	25.065	4.693	5.766	2.153	3.539	8.708	24.464	24.482

DV: d\_angel

\* p<0.10 \*\* p<0.05 \*\*\* p<0.01

**Table 4.10** – additional logistic regression models

	model 1 c	model 2 c	model 3 c	model 4 c	model 5 c	model 6 c	model 7 c	model 8 c	model 9 c	model 10 c
d_bp_es	-1.341** (2.03)									
d_prev_invst		0.658* (1.67)								
overalldoc			-0.22 (0.71)							
qualpress				-0.139 (0.70)						
d_founder					-0.965** (2.16)					
max_rolls						1.250* (1.83)				
tmt_degree							-0.092 (0.54)			
ab_n_bod_degree								0.04 (0.12)		
total_tmt_exp									0.001 (0.13)	
total_bod_exp										0.004 (0.17)
nasdaq_close	-0.001 (0.96)	-0.001* (1.92)	-0.001 (1.24)	-0.001 (1.26)	0 (0.25)	-0.001 (0.78)	-0.001 (0.59)	0 (0.45)	0 (0.44)	0 (0.45)
mt_qtr_vc_invst_amount	0.042 (0.44)	0.081 (1.48)	0.074 (0.84)	0.073 (0.82)	-0.009 (0.07)	0.063 (0.50)	0.034 (0.29)	0.017 (0.15)	0.015 (0.13)	0.016 (0.14)
yr_qtr	-0.186 (0.64)	0.016 (0.12)	-0.139 (0.49)	-0.121 (0.43)	-0.383 (1.12)	-0.223 (0.71)	-0.206 (0.61)	-0.129 (0.42)	-0.127 (0.42)	-0.142 (0.45)
_cons	374.567 (0.65)	-31.948 (0.12)	280.111 (0.49)	242.244 (0.43)	766.114 (1.12)	445.331 (0.70)	412.391 (0.61)	257.813 (0.42)	254.57 (0.42)	284.751 (0.45)
N	72	187	72	72	60	60	60	60	60	60
ll	-36.059	-96.409	-37.869	-37.876	-28.096	-29.142	-30.767	-30.908	-30.906	-30.901
chi2	6.586	8.847	2.965	2.952	6.526	4.435	1.184	0.903	0.906	0.917

DV: d\_ba\_vc

\* p<0.10 \*\* p<0.05 \*\*\* p<0.01

**Table 4.11** – additional logistic regression models

	model 11 c	model 12 c	model 13 c	model 14 c	model 15 c	model 16 c	model 17 c	model 18 c
d_bp_es	-1.310*							-1.56
	(1.88)							(1.35)
d_prev_invst	0.086						0.163	-0.025
	(0.14)						(0.21)	(0.03)
overalldoc		-0.14				0.614	0.62	0.877
		(0.36)				(1.01)	(1.01)	(1.37)
qualpress		-0.085				-0.335	-0.328	-0.216
		(0.34)				(0.78)	(0.76)	(0.50)
d_founder			-1.018**			-1.255**	-1.260**	-1.342**
			(2.16)			(2.05)	(2.05)	(2.02)
max_rolls			1.346*			2.064**	2.026**	1.978*
			(1.84)			(2.10)	(2.04)	(1.93)
tmt_degree				-0.115		-0.23	-0.216	-0.186
				(0.62)		(0.88)	(0.80)	(0.67)
ab_n_bod_degree				0.123		0.261	0.248	0.21
				(0.34)		(0.60)	(0.57)	(0.45)
total_tmt_exp					0.001	0.012	0.011	0.014
					(0.07)	(0.74)	(0.72)	(0.86)
total_bod_exp					0.003	0.022	0.021	0.024
					(0.13)	(0.67)	(0.63)	(0.67)
nasdaq_close	-0.001	-0.001	-0.001	-0.001	0	-0.002	-0.002	-0.002
	(0.95)	(1.23)	(0.68)	(0.66)	(0.45)	(1.40)	(1.32)	(1.23)
mt_qtr_vc_invst_amount	0.041	0.071	0.053	0.047	0.016	0.184	0.177	0.163
	(0.44)	(0.80)	(0.40)	(0.38)	(0.14)	(1.17)	(1.11)	(0.98)
yr_qtr	-0.184	-0.13	-0.514	-0.228	-0.14	-0.935*	-0.920*	-1.003**
	(0.64)	(0.46)	(1.44)	(0.66)	(0.44)	(1.95)	(1.91)	(2.00)
_cons	370.414	261.483	1026.694	456.209	278.798	1869.751*	1839.274*	2004.478**
	(0.64)	(0.46)	(1.44)	(0.65)	(0.44)	(1.95)	(1.91)	(2.00)
N	72	72	60	60	60	60	60	60
ll	-36.05	-37.811	-26.297	-30.71	-30.898	-24.633	-24.61	-23.661
chi2	6.605	3.083	10.126	1.299	0.923	13.454	13.498	15.397

DV: d\_ba\_vc

\* p<0.10 \*\* p<0.05 \*\*\* p<0.01

## **Appendix 4 A – The SEC’s definition of Accredited Investor**

Under the Securities Act of 1933, a company that offers or sells its securities must register the securities with the SEC or find an exemption from the registration requirements. The Act provides companies with a number of exemptions. For some of the exemptions, such as rules [505](#) and [506](#) of [Regulation D](#), a company may sell its securities to what are known as "accredited investors."

The federal securities laws define the term accredited investor in [Rule 501 of Regulation D](#) as:

1. a bank, insurance company, registered investment company, business development company, or small business investment company;
2. an employee benefit plan, within the meaning of the Employee Retirement Income Security Act, if a bank, insurance company, or registered investment adviser makes the investment decisions, or if the plan has total assets in excess of \$5 million;
3. a charitable organization, corporation, or partnership with assets exceeding \$5 million;
4. a director, executive officer, or general partner of the company selling the securities;
5. a business in which all the equity owners are accredited investors;
6. a natural person who has individual net worth, or joint net worth with the person’s spouse, that exceeds \$1 million at the time of the purchase;

7. a natural person with income exceeding \$200,000 in each of the two most recent years or joint income with a spouse exceeding \$300,000 for those years and a reasonable expectation of the same income level in the current year; or
8. a trust with assets in excess of \$5 million, not formed to acquire the securities offered, whose purchases a sophisticated person makes.

For more information about the SEC's registration requirements and common exemptions, read the SEC's brochure, [Q&A: Small Business & the SEC](#).

<http://www.sec.gov/answers/accred.htm>



## Appendix 4 B – Revenue Models

<b>Revenue Model Explanations:</b>		<b>Examples*</b>
<b>Commission-based</b>	A fee that is imposed on a transaction by a third party (usually an intermediary)	Inst-cash International Unibarter.com
<b>Fee-for-Service</b>	Pay as you go option, charged for professional service as you use it.	Metalogics, Inc. Flash Gordon
<b>Advertising</b>	Business of attracting public attention to a good or service, achieved through banner ads, pop ups, permanent buttons, etc.	RealTraveling.com Fidget
<b>Subscription</b>	Company charges a flat rate to use a service for a certain period of time.	Tendersys.com Homesmart.com
<b>Referral</b>	Fees for steering customers to another company, can be either a flat fee or a fee per click-through.	E-sitting Insureconnection
<b>Production</b>	Manufacturer sells directly over the Internet, cuts out middleman.	Games Interactive 100x.com
<b>Mark-up Based</b>	The Middleman, business not in production but in resale.	RealLegends.com Smartenergy
<b>Other</b>	Either not enough information to classify, or the revenue model was outside the scheme of an Internet Business.	Avatar Project

\* Given examples are not part of the current study

## CHAPTER: 5

### CONCLUSION AND FUTURE DIRECTION

This dissertation takes a new look at the structure of interfirm signaling and the role of signal receivers' heterogeneity on the interpretation of signals. Prior research has shown several types of signals significantly influence decision making. I suggest that these studies took a simplifying approach to signal structure and separated each signal into several signals. This approach has been useful for illuminating certain aspects of signals. However, I argue that to fully understand how signals influence decisions the researcher should acknowledge that each signal conveys a complex message. Every signal delivers both an informative and a legitimizing message from the sender to the receiver. If, for example, we take Spence's (1973) classical example of job market signaling: when a job applicant informs a potential employer of his education, his signal has both an informative component and a legitimizing one. The subject area, level of degree and grades provide for the employer a direct, informational signal about the underlying potential of the candidate. At the same time, the institution in which the degree was received, its reputation as a school and propensity to send graduates to the receivers' arena creates an indirect, legitimizing signal about the job candidate. In addition to demonstrating the signal's multi aspect structure, this example also exhibits the multiple layers in the signal's structure. At the initial layer, the applicant's resume format is the legitimizing aspect while the information within is the informative aspect of the signal. One layer deeper are the topical sections such as education, experience, and

personal, each providing both aspects as shown above. While past research focus on single aspects of signals was useful in conducting empirical studies it currently limits our understanding of signals. I believe that research in this area is important to anyone who participates in actual signaling. Exploring the complexity of signal can help senders to design more effective signals and receivers to weight on the limitations of depending more heavily on one aspect of the signal.

Previous studies of signaling also tended to focus on one side of the sender-receiver dyad – the signaler. This limitation might stem from the nature of the data available for research and was useful in advancing research. This study considers both sides in an attempt to improve our understanding of signaling interaction. With the perspective that signals are multifaceted and multilayered in hand, I argue that the combination of the sender’s abilities to generate signals and the receiver’s abilities in interpreting these signals will determine which aspect of the signal will be more influential in the decision making process.

Another goal of this dissertation is to extend our understanding of the challenges startups face with regards to outsiders. Specifically I am interested in the interaction between startups and private equity investors. The four sender-receiver ability dyads create a potential explanation to the time segmentation of investments in nascent organizations and in particular the typology of the private equity investments market. The ability of a young startup to provide effective signals is limited by the scarcity of its accomplishments and immaturity of its organizational structure when compared to older

startups. Additionally, there is a clear distinction between the investors' types at different stages of the startup's life. Research shows that, initially, nascent ventures receive funding only from friends and family, i.e. non professional investors. Furthermore, among professional private equity investors, such as venture capital firms, tend to invest in ventures that are older and solicit larger amounts than do individual angel investors (Ibrahim, 2007; Wilmerding, 2003). Last, investment banks and institutional investors typically wait until the startup is close to becoming public or actually offer shares in an IPO. Since decision makers focus their attention on alternatives they believe they can control (March & Shapira, 1987, 1992) the type of investor an organization can expect to solicit successfully at any given time may depend on the structure of the signal the organization can emit at any point of time.

In the first empirical study I demonstrate how the legitimizing aspect of the signal becomes prominent when the receiver's ability to interpret the signal is limited. I find that social mediation is strongly associated with catching the attention of decision makers at the VC's initial screen, a stage when the VC can not afford to spend much of its resources. Several findings in this study add to extant entrepreneurship literature. A recent study of investment selection found that internal investment decisions made by the founders of firms were based on perceptions while consequent investment decisions made by external investors were based on objective information (Eckhardt, Shane and Delmar, 2006). The findings suggest that this separation is contextual and that the initial selection conducted by external investors may be similarly based on legitimacy rather than information. Second, I find that startups that interacted directly with members of the

VC firm prior to submitting a solicitation were more likely to pass the selection stage than were startups who submitted their solicitations indirectly. The results show that having a direct connection to the decision makers is more important than prestige as measured by external referral. This is potentially an important finding for entrepreneurs, startups, and other organizations with lower levels of social capital. From a tactical perspective, this finding implies that when seeking access to a potential venture backer, an entrepreneur will be better served asking for an introduction rather than a referral of a business plan.

I also find that high demand for attention resources reduces the influence of a referral on the probability of being selected. Moreover, under conditions of high demand for attention, I find that externally-mediated solicitations were more subject to this effect than were those that arrived through internal channels. It is possible that VCs use the preceding interaction with the entrepreneur as an interview, thus adding an additional screen to the venture selection process. The solicitation of funds would therefore indicate that the entrepreneur had already succeeded in passing the first selection hurdle.

In the second empirical chapter I test if receivers differ in their utilization of the received signal. To accomplish this I utilize a new large dataset of investment solicitations from nascent ventures. The study compares two types of private equity investors: VCs and business angels. Research shows these segments differ on several characteristics. For example, angel investors are wealthy individuals investing their own money while VCs are limited partnerships where the managers who make the investment

decisions are not the partners whose money is invested. I argue that one of the outcomes of this, and other, dissimilarities between the two investors' types, results in their different ability to interpret the signals they receive from the startups. This allows me to test my proposition that organizations with relatively lower signal interpretation abilities are more likely to rely on the legitimizing aspect of the signal in their decision making, and that organizations with higher signal interpretation abilities will be influenced by the informative aspect of the signal. The study's results support these arguments. I show that angel investors' decisions are influenced by the legitimizing aspect of the signal while VC investment decisions are influenced by the informative aspect. These findings contribute to the development of signaling theory and our understandings of the differences between business angels and VCs.

The research in this dissertation can be expanded in several directions. First, the influence of receivers' heterogeneity should be explored in depth. Future studies can compare how different potential stakeholders of the startup, such as investors and employees, respond to signals. This will further our understanding of when signals should be strategic, and when spending resources to generate a better signal should be avoided. Further attention should also be given to the influence of the signal's aspect on single type of investors. Such a study could revisit Higgins and Gulati's studies of the interaction between startups preparing for an IPO and the underwriting banks supporting the IPO (Higgins and Gulati 2003, 2006).

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