

Signaling and Self-regulation in Venture Capital: Evidence from Investments in the Clean Technology Sector

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A Paolo e Rosa,

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Abstract

This thesis proposes three studies that provide novel empirical evidence on how different types of VCs' characteristics signal the quality of an entrepreneurial venture and influence investment strategies of funds subject to self-regulation.

In the first study (in collaboration with Anu Wadhwa) we aim at contributing to the ongoing debate on the different effects of reputation and status on organizational outcomes. We explore the signaling value that these two organizational attributes exert on external parties judging the quality of entrepreneurial ventures under uncertainty. Moreover, we examine whether signaling mechanisms are valuable only if the external parties are affected by high information asymmetry with the valued venture. We test our hypotheses using a sample of 1,339 U.S. clean technology ventures that received the first round of Venture Capital (VC) between the years 1990 and 2012. We look at their ability to gather supplemental financial resources for survival and growth by completing an Initial Public Offering (IPO) or an acquisition by an incumbent firm. The findings indicate that VCs' reputation – an economic attribute based on past performance - can signal a venture's quality externally, while VCs' status - a social-standing attribute – does not have signaling value. The results also show that quality signals are more relevant for public investors at IPOs than for managers of acquiring companies.

The second study looks at how inter-organizational ties with reputable VCs affect valuations received by entrepreneurial ventures that go public. I propose that the signaling effect of reputable VC ties is lower when there is misalignment of strategic interests between the venture and the VCs. I consider the amount of shares sold by insiders in the initial public offering (IPO) and investors' enforcement of demand registration rights as elements indicating misalignment of interests with the venture. The hypotheses are tested on using a sample of 86 IPOs in the main U.S. stock exchanges completed by entrepreneurial ventures operating in the Clean Technology sector. The results suggest that affiliation with reputable VCs elicits a positive response by public investors. However, public markets react less favorably to ties with reputable VCs when they sell large amount of their shares in the IPO or resort to demand registration rights to force the public offering of their shares.

The third study investigates organizations' use of self-regulation as form of symbolic response to normative pressure that does not necessarily entail compliance in practices. I argue that, when self-regulatory initiatives are not supported by an explicit regulatory environment, opportunistic organizations might reduce their efforts to align with the normative ideals through compliant actions and behaviors. The 'walking of the talk', which is the implementation of actions that are aligned with the symbolic response, might also be dis-

couraged by alternative means to obtain organizational legitimacy, such as through an organization's status. The hypotheses are tested on a sample of Venture Capital (VC) funds whose limited or general partners voluntarily decided to join the United Nations' Principles of Responsible Investment (UNPRI, 2006) initiative between 2006 and 2014. The results from a difference-in-differences estimation show that VC funds' likelihood to invest in clean technology companies is lower after funds' stakeholders (i.e. general or limited partners) join the UNPRI initiative. I also find that the likelihood to invest in clean technologies after self-regulation is negatively moderated by the VC fund's status.

Keywords

Venture Capital, Reputation, Status, Initial Public Offerings (IPOs), Clean Technologies, Signaling, Self-regulation

Sommario

La tesi presenta tre studi su come diverse caratteristiche degli investitori in capitale di rischio (venture capitalists) segnalino esternamente la qualità di una startup innovativa ed influenzino le loro strategie tramite fondi d'investimento soggetti ad auto-regolamentazione.

Il primo articolo (in collaborazione con Anu Wadhwa) ha l'obiettivo di contribuire al dibattito in corso sui diversi effetti che reputazione e prestigio di un'organizzazione hanno sui risultati. Consideriamo il valore segnalativo che queste due caratteristiche organizzative hanno per attori esterni interessati a valutare la qualità di una startup innovativa in condizioni d'incertezza. Inoltre, analizziamo se tali meccanismi di segnalazione abbiano valore solo per attori esterni caratterizzati da particolari asimmetrie informative con la startup. Le ipotesi sono testate su un campione di 1,339 startups nel campo delle energie rinnovabili con sede negli Stati Uniti che hanno ricevuto finanziamenti da fondi di venture capital tra il 1990 ed il 2012. L'analisi empirica studia la capacità di queste startups di completare la raccolta di ulteriori risorse finanziarie per la crescita tramite un'offerta pubblica d'acquisto o un'acquisizione da parte di un'altra impresa. I risultati suggeriscono che la reputazione dei venture capitalists, una caratteristica economica derivante dai loro risultati ottenuti in passato, possa segnalare esternamente la qualità di una startup, mentre il loro prestigio, legato alla posizione sociale, sembra non funzionare come segnale. Inoltre, i risultati dimostrano che tali segnali siano più utili per chi compra azioni della startup durante l'offerta pubblica d'acquisto che per i managers di aziende acquirenti.

Nell'articolo studio se i legami con venture capitalists (VCs) dotati di alta reputazione abbiano un effetto sulle valutazioni ricevute da startups innovative durante un'offerta pubblica d'acquisto. L'ipotesi di fondo è che il valore del segnale derivante dal legame con VCs dotati di alta reputazione sia minore in presenza di interessi strategici disallineati tra la startup e tali investitori. L'ammontare di azioni vendute dagli investitori nella startup e l'applicazione di clausole contrattuali che forzino un'offerta pubblica d'acquisto sono i due elementi presi in considerazione come indicatori di disallineamento negli interessi strategici. Utilizzando un campione di 86 offerte pubbliche d'acquisto da parte di "Cleantech" startups nei principali mercati azionari americani, l'analisi empirica dimostra che in media l'essere affiliato con VCs dotati di alta reputazione genera una reazione positiva del mercato. Tuttavia, tale reazione risulta più debole quando parti interne alla startup vendono gran parte delle loro azioni durante l'offerta o quando i VCs ricorrono a speciali clausole contrattuali per forzare la loro uscita tramite offerta pubblica d'acquisto.

Il terzo articolo studia l'uso di forme auto-regolamentative come risposta simbolica delle organizzazioni a pressioni normative esterne. Le ipotesi sono fondate sul fatto che, in assenza di una struttura

regolamentativa chiara che supporti un'auto-regolamentazione, comportamenti opportunistici possano spingere le organizzazioni a ridurre i loro sforzi per cambiare effettivamente le loro azioni e comportamenti in linea con quanto presupposto dall'auto-regolamentazione. Il “passare dalle parole ai fatti”, che implica azioni allineate con la risposta simbolicamente data tramite auto-regolamentazione, potrebbe anche essere disincentivata da mezzi alternativi per ottenere legittimazione, come ad esempio il prestigio di un'organizzazione. Le ipotesi sono testate su un campione di fondi di venture capital i cui accomandanti e soci gestori abbiano volontariamente deciso di sottoscrivere i Principi di Investimento Responsabile delle Nazioni Unite (UNPRI) tra il 2006 ed il 2014. I risultati dell'analisi econometrica dimostrano che la probabilità che un fondo investa in energie rinnovabili è minore per i fondi i cui accomandanti e soci gestori abbiano sottoscritto tale iniziativa. Inoltre, la probabilità d'investimento in energie rinnovabili post auto-regolamentazione è minore per i fondi gestiti da VC prestigiosi.

Parole-chiave

Capitale di rischio, Reputazione, Prestigio, Offerta pubblica d'acquisto, Energie Rinnovabili, Segnali informativi, Auto-regolamentazione

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Chapter 1 Introduction

1.1 Thesis motivation and structure

Venture capital enables the development and commercialization of breakthrough technologies whose feasibility and market-acceptance have great ex-ante uncertainty (Amit, Glosten, & Muller, 1990; Gompers & Lerner, 2004; Hellmann & Puri, 2000). The market success of pioneers commercializing these technologies can impact the evolution of entire sectors, with repercussions on society at large (Florida & Kenney, 1988; Kortum & Lerner, 2000). Venture capital brings to entrepreneurial ventures additional benefits that have been largely documented by extant literature. For instance, the monitoring and coaching services that VC firms provide in addition to providing financial resources improve success rates of portfolio companies (Barry, Muscarella, Peavy, & Vetsuypens, 1990; Hsu, 2006; Shane & Stuart, 2002). VC financing also certifies the value of an entrepreneurial venture to outsiders in situations of idiosyncratic beliefs and information (Megginson & Weiss, 1991). Recent studies have started to pay increasing attention to how different aspects of VC involvement affect the outcomes of entrepreneurial ventures, taking a further step from the traditional view of VC involvement as a dichotomous factor (Ragozzino & Blevins, 2015).

VC firms are heterogeneous in terms of organizational attributes such as experience, sector-specific expertise, social capital and reputation (Gompers, 1996; Hochberg, Ljungqvist, & Lu, 2007; Lee & Wahal, 2004; Pollock, Lee, Jin, & Lashley, 2015; Stuart, Hoang, & Hybels, 1999). On the one hand, we know that entrepreneurs are willing to pay more for affiliation with VCs possessing such extra-financial characteristics (Chen, Hambrick, & Pollock, 2008; Hsu, 2004). On the other hand, a parallel stream of literature has started to distinguish and compare between these organizational attributes, finding evidence of different and contrasting effects on organizational outcomes (Chandler, Haunschild, Rhee, & Beckman, 2013; Dimov, Shepherd, & Sutcliffe, 2007; Ertug & Castellucci, 2012; Jensen & Roy, 2008; Pollock et al., 2015; Stern, Dukerich, & Zajac, 2014; Washington & Zajac, 2005). Therefore, distinguishing the impact of VCs' characteristics on entrepreneurial ventures' outcomes is of primary importance in order to fully uncover the economic benefits deriving from VC-backing. In the following chapters of this thesis I present three studies that aim at contributing theoretically and empirically to these debates. Each study provides new evidence on how different VCs' characteristics might affect both their organizational behaviors and the outcomes of their portfolio ventures.

Signaling theory studies how economic actors convey credible information about themselves to external parties that have limited availability of information (Milgrom & Roberts, 1982; Spence, 1974). This

theoretical lens has been used to investigate how VCs' intangible characteristics such as reputation and status influence entrepreneurial ventures' likelihood of completing an IPO or being acquired by another firm (Barnett & Pollock, 2012; Ragozzino & Blevins, 2015; Stuart et al., 1999). During these "exit events", information asymmetry between external buyers (i.e. managers of acquiring firms or public investors) and a venture's insiders might complicate outsiders' valuations and eventually jeopardize the company's ability to gather the needed financial resources to sustain its survival and growth. A venture's inter-organizational ties with VCs can signal its unobserved quality reducing uncertainty around external valuations (Gulati & Higgins, 2003; Stuart et al., 1999). This is because under uncertain conditions economic actors look to the opinions and choices of others to make up their own minds (Rao, 1994). However, the question of which characteristics of the VCs investing in a venture are the most effective signals to external parties has gone largely unaddressed.

The first study (Chapter 2) distinguishes between the signaling values of two organizational attributes: reputation and status. Although these two characteristics share some similarities that have sometimes caused their mixing and confusion, they are built in different ways and have distinct effects on organizational outcomes (Dimov et al., 2007; Ertug & Castellucci, 2012; Washington & Zajac, 2005). Understanding how they affect the likelihood that an entrepreneurial venture successfully completes an IPO or an acquisition by another firm is important to shed light on the properties that VCs in a syndicate should possess in order to justify the costs of partnership. The study also examines whether signaling mechanisms are in place only when external parties have limited access to information about the valued venture. For young entrepreneurial ventures, understanding which type of outsiders is possible to influence through signaling can provide crucial guidance for assessing the characteristics of their VCs in the lights of the exit goals sought by the entrepreneur.

The level of information asymmetry between parties involved in exit events is not the only contextual factor that can moderate signaling. Most of the extant literature has looked at benefits of reputable ties without considering the context upon which these ties form and develop. Nevertheless, we know that a focal firm's idiosyncratic uncertainty (Stuart et al., 1999), stock markets' conditions (Gulati & Higgins, 2003) and a tie's characteristics such as duration or geographic proximity between parties (Lee, Pollock, & Jin, 2011) are all factors that matter when assessing signaling. The second study (Chapter 3) building on this literature examines whether the signaling value of having reputable ties is contingent upon the alignment of strategic interests between partners in the tie. Looking at initial public offering (IPO) valuations of entrepreneurial ventures, I hypothesize that signaling is attenuated when VCs sell a large portion of their shares or when they resort to demand registration rights to force the public offering of their shares. The results offer guidance to entrepreneurial ventures by highlighting the importance of partnering with VCs that are committed and aligned with a venture's interests in order to exploit the signaling value of these ties.

Institutional scholars indicates isomorphism as common organizational reaction to obtain legitimacy under the increasing pressure of institutional forces (Deephouse, 1996; Suchman, 1995). However, the gain of legitimacy may also depend on organizational attributes like the signals studied in the previous two stud-

ies (Berger, Ridgeway, Fisek, & Norman, 1998; Bitektine, 2011; Podolny, 1994). Therefore, a question that remains unanswered is: do organizations that can rely on such attributes actually need to change their behaviors and practices in response to forms of institutional pressure? In the third study (Chapter 4) I try to answer this question by looking at how organizations react to forms of normative pressure in relation to their status level. Industry self-regulation is defined as voluntary and self-organized attempts to control actions and practices (Olson, 1965). There is evidence showing that organizations adopt such self-regulatory structures in response to normative pressures from stakeholders (Delmas & Toffel, 2008; Edelman, 1992; King & Lenox, 2000). However, it is not clear yet when this type of response remains limited to symbolic action that does not translate into compliant actions and behaviors. The study investigates whether venture capital funds whose limited or general partners joined the UNPRI initiative (a form of industry self-regulation) are more or less likely to act in line with the initiative's ideals than funds not subject to the initiative. Moreover, it examines whether non-compliant behaviors are more diffused among funds managed by high-status VC firms.

1.2 The context

The three studies have in common the context where the empirical analyses are developed: the clean technology (cleantech) sector. I adopt Clean Edge, Inc.'s definition of clean technologies as: “*a diverse range of products, services, and processes that harness renewable materials and energy sources, dramatically reduce the use of natural resources, and significantly cut or eliminate emissions and wastes*¹”. This definition highlights the necessity to encompass in the set of technologies considered all those technological advances that facilitate the transition toward a low-carbon economy, enabling a sustainable use of natural resources. Therefore, I include not only entrepreneurial ventures operating in the classic renewable energy sectors (e.g. solar, wind, geothermal, biomass), but also those commercializing technologies for efficient storage of energy, waste-management, eco-mobility or the diffusion of smart-grid systems. The Cleantech is a sector that has gone through some “boom and bust” periods and the attention of private investors like venture capitalists has been seesawing (Gaddy, Sivaram, Jones, & Wayman, 2016). When in 2012 I started collecting data and information² on VCs' activity in the sector, they had already invested a cumulative estimated amount of 25 billions of dollars in early-stage ventures. Periods of investment euphoria, such as in the years until 2008, were mostly driven by an economic conjuncture pushing VCs to look for novel high-growth sectors where to direct the large amount of funds at their disposal. In fact, low interest rates and increasing asset owners' appetite for risky asset classes had improved fundraising activities on the one side. The consequences of the dot-com bubble and changing dynamics in other high-tech sectors had increased the necessity to find new promising sectors on the other. The Cleantech, with its ethical scope and strong support from governments all over the world appeared as a perfect solution to solve this demand-supply incongruence in the VC industry. However, did not take long before VC firms realized that their capital was immobilized in a sector whose ventures were very different from what they were used to see in the past. Capital intensity, long

¹ Source: <http://cleanedge.com>

² Between 2012 and 2014 I have also conducted several interviews with entrepreneurs, venture capitalists and policy makers participating to three editions of the Cleantech Investment seminar in Lausanne (CH)

time-to-market, difficulty to find follow-up investors, policy uncertainty, unfamiliarity with technologies and their market applications are only few of the most cited problems encountered by VCs active in the sector. Lack of success stories and high media attention to failure cases (e.g. Solyndra) combined with exogenous market factors (i.e. the credit crunch and the “fracking revolution” in the US) contributed to long periods of disillusion about the sector.

To the end of this thesis the Cleantech sector is an appropriate setting to test my theory. On the one hand, signaling mechanisms are central for VCs that want to achieve IPO or M&A-related financial returns through highly uncertain ventures. On the other hand, investing in the Cleantech industry might also have intangible returns to VCs in the form of institutional and social legitimacy. This thesis will try to exploit this duality in VCs’ goals to shed light on factors motivating both the entry and the exit of VCs in the sector.

1.3 Overview and contribution of the thesis

Figure 1.1: Overview and contribution of the thesis

	First Study (2 nd Chapter)	Second Study (3 rd Chapter)	Third Study (4 th Chapter)
Context	Exit events	IPO valuations	VCs’ investment decisions
Unit of analysis	Entrepreneurial venture	Entrepreneurial venture	VC fund
Organizational attributes	Reputation and Status	Reputation	Status
Econometric models	Survival analysis, Marginal structural models (with IPTW)	Heckman 2-stages, OLS	Diff-in-diff (matched control sample), FE Logit
Main findings	Signals are valuable only if directly related to quality and when the receiver’s valuations are influenced by asymmetric information	Signals are less valuable when there is misalignment of strategic interests between parties	Self-regulation might incentivize opportunistic behaviors. Especially for high-status organizations

Chapter 2 The signaling value of reputation and status

(With Anu Wadhwa)

2.1 Introduction

A central issue for young entrepreneurial ventures is overcoming the liability of newness they encounter when seeking new resources for survival and growth (Aldrich & Auster, 1986; Singh, Tucker, & House, 1986). External valuations of their quality and future prospects are fraught with uncertainty due to limited availability of information (Milgrom & Roberts, 1982; Spence, 1974). Information asymmetry between a venture's insiders and public investors in initial public offerings (IPOs) or acquiring companies might compromise the successful accomplishment of an exit. In this context, attributes of a venture's inter-organizational ties, such as corporations or venture capitalists, can act as indirect signals of quality and help external parties to limit uncertainty around their judgments (Barnett & Pollock, 2012; Ginsberg, Hasan, & Tucci, 2011; Gulati & Higgins, 2003; Stuart et al., 1999). This is one of the reasons why entrepreneurs crave affiliation with venture capitalists (VCs) possessing certain characteristics, sometimes at the cost of accepting lower valuations for their startups (Hsu, 2004). However, there are different organizational attributes of an entrepreneurial venture's ties that might be perceived externally as quality signals. It is therefore important to shed light on the heterogeneity of signals exploited by organizations to reduce information asymmetry with third parties. In this paper, we investigate the theoretical tension between the signaling value of two similar and often confounded organizational attributes: reputation and status (Rindova, Williamson, Petkova, & Server, 2005; Washington & Zajac, 2005). We aim at disentangling their effects on external parties' valuations about the quality of entrepreneurial ventures in contexts of high information asymmetry. Particularly we are interested in answering two questions. First, are reputation and status equally effective in signaling an affiliate's unobserved quality to external parties? Second, is their signaling value different for signal receivers affected by different levels of information asymmetry?

Reputation and status are attributes typically exploited by firms to obtain social approval (Berger et al., 1998; Podolny, 1994; Rao, 1994). Extant studies have shown that, even though these two constructs share some similarities, they are substantially different. For instance, they have dissimilar effects on behaviors and strategic decision-making of organizations and their stakeholders (Chandler et al., 2013; Dimov et al., 2007; Ertug & Castellucci, 2012; Jensen & Roy, 2008; Pollock et al., 2015; Stern et al., 2014;

Washington & Zajac, 2005). Reputation is an aspect of organizational identity associated with an economic logic (Rao, 1994; Washington & Zajac, 2005). It refers to outsiders' expectations about future behaviors based on quality of past actions and performance (King & Whetten, 2008; Rindova et al., 2005). Status, instead, is a sociological aspect denoting an organization's relative standing within a social rank. Hence, it is not directly related to observable quality and ability to meet third parties expectations, but it can be earned through behavioral negotiations and contacts with other actors (Berger et al., 1998; Gould, 2002; Washington & Zajac, 2005). Yet, little attention has been paid to differences in how these attributes are perceived by external parties. In this study we resort on signaling theory (Spence, 1974) to argue that, due to its direct link to quality of performance and outputs, reputation is a more effective signal than status, which is only indirectly related to quality. Moreover, we posit that the value of a signal depends upon the level of information asymmetry affecting the external party interested in it (the "signal receiver").

Studying how reputation and status influence third parties' valuations under uncertainty can help us to understand whether social attributes of an organization may bring the same benefits as performance-based attributes. This study, besides providing further support to extant research theorizing the distinctiveness of these two constructs (Chandler et al., 2013; Pollock et al., 2015; Stern et al., 2014), aims at providing empirical evidence on whether it is possible to signal through organizational characteristics that are not directly linked to observable quality, such as status (Barnett & Pollock, 2012). The findings might help entrepreneurs understand and contextualize the benefits they can derive from affiliation with high-reputation or high-status VCs. Moreover, they will also assist VC firms by assessing the impact of their social and reputational capital on external stakeholders' judgements about their portfolio ventures. Finally, the distinction between two different types of signal receivers, public investors at IPOs and managers of acquiring companies, allows a deeper understanding of factors that are important drivers of signaling, such as the extent of information asymmetry.

We test our hypotheses in a novel setting of clean technology (cleantech) entrepreneurial ventures seeking supplemental financial resources through "exit events" (i.e. IPOs or acquisitions). We use both Cox proportional hazard models and marginal structural models with inverse probability treatment weights (IPTW) on a sample of 1,339 U.S. entrepreneurial ventures that received VC investments by 1,268 venture capitalists between 1990 and 2012. The econometric analysis shows that VC reputation positively influences the hazard that entrepreneurial ventures exit by IPO, while VC status seems to negatively impact this hazard. We do not find significant evidence of the effects of VC reputation and status on the hazard that a venture will exit by acquisition.

2.2 Theory and hypotheses

Organizational reputation and status are intangible assets exploited by economic actors to avoid adverse selection problems (Akerlof, 1970; Barnett & Pollock, 2012). When information about uncertain transactions is limited, decision-makers can rely on these characteristics as indirect indicators of a focal firm's quality (Gulati & Higgins, 2003; Stuart et al., 1999). In other words, they are credentials that provide a ra-

tional basis for decision-making in the presence of information asymmetry (Barnett & Pollock, 2012). Organizations can benefit from reputation and status both directly, through their own endowments, and indirectly, through inter-organizational ties with other organizations (Arikan & Capron, 2010; Milgrom & Roberts, 1982; Rindova et al., 2005; Stuart et al., 1999). Affiliation with prominent exchange partners is particularly important for young entrepreneurial ventures suffering of liability of newness and smallness (Singh et al., 1986; Stuart et al., 1999).

Although reputation and status share some similarities and have sometimes been used interchangeably, existing literature has started to emphasize their differences, suggesting that they should be separately incorporated in any model examining performance outcomes (Pollock et al., 2015; Stern et al., 2014; Washington & Zajac, 2005). Reputation is an economic characteristic of organizations that allows to distinguish and compare them (Barnett & Pollock, 2012; Deephouse & Carter, 2005; Washington & Zajac, 2005). It is defined as the broad public recognition about quality of a firm's activities and outputs (Rindova et al., 2005). A crucial element characterizing reputation is the assessment of past actions and performances in order to predict future behaviors (Fombrun, 1996; Podolny, 2005). Status is a sociological concept referring to "an effective claim to social esteem in terms of positive or negative privileges" (Weber, 1978). Specifically, it is an organization's relative standing within a social order that might engender privileges not necessarily based on quality of previous performance (Washington & Zajac, 2005). Status can be acquired via ties with other high-status actors or by displaying symbols that are commonly associated with a certain status (Podolny, 2005; Washington & Zajac, 2005). Its hierarchical nature implies that any gain in status for a focal firm corresponds to a loss of status for other actors in a network (Podolny, 2005). The main differences between reputation and status have been summarized by Pollock et al. (2015). First, only reputation is based on the real "merit" of a firm because status can also be acquired indirectly (Pfarrer, Pollock, & Rindova, 2010; Washington & Zajac, 2005). Second, status judgements need agreement among observers while reputation can be idiosyncratic to different situations or stakeholders groups (Deephouse, 1999; Lange, Lee, & Dai, 2011). Finally, reputation and status are different in the way they influence firms' strategic decision-making processes (Dimov et al., 2007; Ertug & Castellucci, 2012; Lee et al., 2011; Stern et al., 2014). For instance, there is evidence of contrasting effects on the relationship between financing expertise and early-stage investments decisions in the venture capital industry (Dimov et al., 2007), on firms' selection between different potential exchange partners (Jensen & Roy, 2008) and on the likelihood of alliance partnerships formation between incumbent firms and early-stage ventures in technology-driven industries (Stern et al., 2014).

Summing up, prior research has shown that even though the distinction between reputation and status is not always neat, there are important differences between these two attributes. They address different evaluator's questions about the value of an organization (Bitektine, 2011). On the one side, reputation judgements are based on organizations' history of past actions and performances (Deephouse & Carter, 2005; Rindova et al., 2005). On the other side, status judgements are based on differences in organizations' social ranks (Washington & Zajac, 2005). The differences between these two constructs constitute the motivation

for this study, in which we investigate the distinct signaling value of reputation and status of an entrepreneurial venture's VCs for IPO investors and managers of acquiring companies.

Quality Signals: Reputation and Status

According to Spence's (1974) signaling theory, an organizational activity or attribute can be considered a quality signal when possesses two properties. First, it is directly related to the valued characteristic (i.e. quality). Second, its cost is inversely related to quality, which means that is more costly to send the signal for poor-quality actors. Signals are valuable when the characteristic of interest is not directly observable and it is difficult or expensive to gather information limiting uncertainty around an evaluation (Spence, 1974). Firms' inter-organizational ties, such as relationships with VCs, alliance partners or investment banks, are observable characteristics that can be externally perceived as signals of quality (Gulati & Higgins, 2003; Uzzi, 1997). We follow previous studies arguing that patterns of affiliation (i.e. inter-organizational ties) shape external parties' perceptions about quality (Gulati & Higgins, 2003; Stuart et al., 1999). This is particularly critical for young entrepreneurial ventures, suffering of liability of newness and lack of legitimacy (Singh et al., 1986), as well as for firms operating in mediated markets characterized by ambiguity about companies' valuations (Brealey, Leland, & Pyle, 1977; Gulati & Higgins, 2003).

Even though scholars have started to acknowledge that signals are not always equally effective or useful (Stern et al., 2014), little attention has been paid to how entrepreneurial ventures exploit reputation and status of their VCs as signal of their quality. We argue that the value of a signal depends on two elements. First, it depends on the existence of a direct link with past-performance and quality of output. Second, it depends on the idiosyncratic level of information asymmetry affecting the external party interested in receiving the signal (the "signal receiver").

The Venture Capital Context

The venture capital industry offers a particularly suitable setting for studying the signaling value of ties with high-reputation and high-status organizations. First, entrepreneurial exit events are typically characterized by high information asymmetry between a venture's insiders and external parties (Gulati & Higgins, 2003; Stuart et al., 1999). In these situations, signaling through inter-organizational ties is critical to reduce a venture's uncertainty and convince external investors to buy its shares, giving VCs and other insiders the possibility to liquidate their stakes in the venture (Bygrave & Timmons, 1992; Ginsberg et al., 2011). Furthermore, the fact that entrepreneurial ventures typically have two potential ways to achieve a successful exit permits to differentiate between two types of signal receivers with different idiosyncratic levels of information asymmetry: public investors and acquiring companies. The choice to consider acquisitions and IPOs as successful exit outcomes deserves some further explanation. The focus of this study is on the benefits that VCs' organizational attributes bring to private entrepreneurial ventures. Although a measure of returns generated with an exit event would have been a more precise proxy of entrepreneurial performance, lack of information regarding VCs' equity shares and exact amount invested at each round impedes us to say anything

about exits' profitability. Instead, we followed prior studies facing similar data limitations and considered the achievement of an IPO or a trade sale as measures of a venture's success (Hochberg et al., 2007; Nahata, 2008; Ragozzino & Blevins, 2015; Ter Wal, Alexy, Block, & Sandner, forthcoming). The ability to complete one of these two events in a timely manner is, indeed, essential for entrepreneurial ventures that want to survive and grow after exiting the VC-cycle. Moreover, a venture's benefits of undergoing an IPO or an acquisition go beyond the mere access to fresh finance and include, among others: the possibility to scale-up the commercialization processes (Aldrich, 1999) and exploit synergies and economies of scale (Larsson & Finkelstein, 1999). Nevertheless, there might be cases of exits that cannot be considered successful for the entrepreneurs, such as "fire-sales" acquisitions pushed by VCs to liquidate bad investments. Among the few studies raising attention about these situations, Puri and Zarutskie (2012) do not find evidence of VCs propensity to disguise failures as acquisitions. To limit concerns related to fire-sales we restrict our attention to full acquisitions of entrepreneurial ventures only, where the 100% of a venture's equity is sold by VCs and entrepreneurs (Ragozzino & Blevins, 2015). Second, venture capitalists (VCs) are typically embedded in a network of strong relationships as consequence of co-investment practices commonly adopted to spread financial risks (Bygrave & Timmons, 1992). In the majority of cases, investments in high-growth and innovative ventures are done by groups of investors (organized in syndicates) rather than by single investors. Multi-party collaborations in this context present unique status dynamics that are different from the case of dyadic collaborations (Zhang, Gupta, & Hallen, 2016). Social status is an important characteristic to improve VCs' ability to attract co-investors in a syndicate (Hochberg et al., 2007; Sorenson & Stuart, 2001) and increase chances of portfolio ventures' success (Gulati & Higgins, 2003; Stuart et al., 1999). Finally, reputation is a crucial asset to nurture in order to remain competitive in the VC industry (Gompers, 1996; Lee & Wahal, 2004; Petkova, Wadhwa, Yao, & Jain, 2014). Extant research has shown that reputation increases a VC fund's deal flow (Hsu, 2004), enhances the probability of exiting via IPOs or acquisitions (Nahata, 2008; Sorensen, 2007) and improves both exit and post-exit valuations of portfolio companies (Arikan & Capron, 2010; Krishnan, Ivanov, Masulis, & Singh, 2011; Lee & Wahal, 2004; Pollock, Chen, Jackson, & Hambrick, 2010). Moreover, it also generates some affiliation-related costs (Chen et al., 2008; Hsu, 2004).

This paper differs from existing studies in the venture capital and signaling literature in several dimensions. First, prior works in this or similar contexts have either examined only one of the two focal constructs at time, without paying specific attention to their theoretical distinctiveness (see Nahata (2008) for an exception), or have ignored differences between characteristics of signal receivers (see Ragozzino and Blevins (2015) for an exception). To our knowledge this is the first study to disentangle the effects of reputation and status of an entrepreneurial venture's ties in the distinct cases of acquisition and IPO exits. Second, extant literature has sometimes neglected the importance of organizational dynamics in the context where signaling take place (Ma, Rhee, & Yang, 2013). In a group of co-investors (typically organized as an investment syndicate) there might be disagreement over collective decisions like the managing of time-to-exit (Chahine, Arthurs, Filatotchev, & Hoskisson, 2012). Therefore, measuring reputation and status for a single investor only (e.g. the lead investors in the syndicate) would not account for situations where the simultaneous presence of multiple prominent affiliates might either reinforce or hinder the effect of signaling (Ma et

al., 2013). We take a step beyond existing studies, which measure these signaling attributes either at the beginning of the exchange relationship between the venture and its VCs or at a specific point in time (e.g. at the exit event), and try to assess the evolvement over time of reputation and status at the VC syndicate level. We take into account variations in both the composition of the syndicates and reputation and status endowments of their members. We argue that reputation and status' levels in a VC syndicate represent two different signals for external parties trying to estimate the value of an entrepreneurial venture under uncertainty. The effectiveness of signaling also depends on the amount of information asymmetry between the entrepreneurial venture's insiders and the signal receiver.

Initial Public Offerings (IPOs)

An initial public offering is a process undertaken by a private company to obtain finance from the public markets and give existing shareholders the possibility to liquidate their ownership positions (Daily, Certo, Dalton, & Roengpitya, 2003). When IPOs involve high-tech entrepreneurial ventures, public buyers' valuations about the worthiness of an investment are challenged by unproven scalability of the business models and uncertain technology trajectories (Sanders & Boivie, 2004). Moreover, although the set of public buyers might also encompass some more informed investors (e.g. large institutional investors), they usually have limited expertise about the operational complexities of the offering companies (Poulsen & Stegemoller, 2008). The evaluation process is further complicated by asymmetric information with parties inside the issuing company. For these reasons, public investors tend to limit the uncertainty surrounding a single purchase of IPO shares by diversifying their investment portfolios. Quality signals from a venture's equity investors may be important to support the public investors' evaluation processes and help them avoid adverse selection. However, not all characteristics of an entrepreneurial venture's VCs are equally relevant or visible to public investors.

On the one hand, reputation is an organizational attribute that fully complies with Spence's (1974) signal definition. Indeed, it is both directly related to quality (see definition in Rindova et al., 2005; and Fombrun, 1996) and costly to build when quality is poor (Barnett & Pollock, 2012). Reputation might help external evaluators by emphasizing differences on the basis of an objective comparisons between organizational behaviors and track records (Barnett & Pollock, 2012; Deephouse & Carter, 2005; Fombrun & Shanley, 1990; Whetten & Mackey, 2002). Furthermore, ties with reputable VCs, besides having a certifying function, might indicate that the venture absorbed important substantial resources functional to guarantee its long-term success (Gompers & Lerner, 2004; Megginson & Weiss, 1991; Pollock et al., 2010). Potential transfer of these resources from a venture's ties (e.g. human capital, know-how, market experience, etc.) can reinforce public investors' judgements about the perceived quality. Therefore, we argue that public buyers at IPOs will perceive the level of reputation of an entrepreneurial venture's VCs as a positive signal of its quality. This theorized effect is in line with prior research showing that affiliation with reputable firms enhances entrepreneurial ventures' performance (Carter & Manaster, 1990) and acts as positive signal of quality to external parties (Stuart et al., 1999). We therefore hypothesize that.

Hypothesis 1a: *The higher a VC syndicate's reputation, the greater the entrepreneurial venture's hazard of going public*

On the other hand, status, which is the result of an organization's positioning within its network of social relations, does not necessarily reflect actual quality and merit. Status might, in fact, be earned by affiliations with other actors – regardless of an organization's real performance (Bergh, Ketchen, Boyd, & Bergh, 2010; Dimov et al., 2007; Gould, 2002; Washington & Zajac, 2005). Thus, it does not fully satisfy Spence's requirements to be considered a signal (Spence, 1974). Nevertheless, some scholars have argued that status might still be seen as quality signal due to certain “conferred privileges”, not directly associated to quality *per se*, that make its signaling cost inversely related to true quality (Berger et al., 1998; Bergh et al., 2010; Dimov & Milanov, 2010; Gould, 2002; Podolny, 2005). This is at the origin of the systematically distortion of the perceived relationship between status and quality.

In the context of entrepreneurial exits, where quality signals come from ventures' inter-organizational ties, it is also important to consider a signal “visibility” in the eyes of the external receivers. In this sense, reputation is a signal easier to appreciate because built on a track of observable performance and behaviors. This is not the case for status, where public investors are called to evaluate the structural positioning of a series of organizations (i.e. the VC firms investing in the company) within a sector-specific network of relations they have scarce familiarity with. Finally, the signaling power of reputation, which is more context-specific and less resilient than status, might be stronger during specific events such as exits (Barnett & Pollock, 2012; Podolny, 2005). Reputation may function as a more specific signal of quality than status in driving selection choices because of different levels of importance that these two judgment mechanisms have at different stages of a decision-making process (Jensen & Roy, 2008). The lack of a direct link with past performance together with the scarce visibility of the signal to external investors unfamiliar with the network structure of an entrepreneurial venture's ties (i.e. the network of co-investments among VCs in our case) lead us to argue that status' signaling value is positive but lower than reputation's.

Hypothesis 1b: *The higher a VC syndicate's status, the greater the entrepreneurial venture's hazard of going public*

Hypothesis 1c: *The effect of a VC syndicate's reputation on the entrepreneurial venture's hazard of going public is greater than the effect of the syndicate's status*

Acquisitions

Trade sales of entrepreneurial ventures to established companies in the same or closely related sectors are an alternative way of financing a company's activities while offering a path to liquidity to existing shareholders. This exit option has become more and more diffused as evidenced by the fact that, in recent years, acquisition deals involving VC-backed companies have outnumbered VC-backed IPOs. Two of the main reasons for the gaining of momentum of acquisitions over IPOs as preferential exit ways are: (i) the possibility to avoid a series of costs and challenges related to the process of going public (Brau, Francis, &

Kohers, 2003) and (ii) the potential access to complementary assets of the acquirer company (Poulsen & Stegemoller, 2008). Bayar and Chemmanur (2012), in their effort to model a private firm's choice of which exit mechanism to pursue, have identified the difference in the amount of information asymmetry between an entrepreneurial venture's insiders and potential buyers as a key driver in the exit decision. Single investors in the IPO market are in an informational disadvantage position when compared to potential acquirers because of lower industry expertise to value the firm. We build on their assumption arguing that acquiring companies are generally affected by lower information asymmetry than public investors at IPO. We offer several reasons in support of our argument. First, managers of acquiring companies might have more information available to value a target entrepreneurial venture's specific assets by virtue of their sector-specific expertise (Bayar & Chemmanur, 2012). IPO investors base their valuations on financial analysis of documents that are often misleading and difficult to read (Kothari, Shu, & Wysocki, 2009; Kravet & Muslu, 2013; Lehavy, Li, & Merkley, 2011; Loughran & McDonald, 2014). Similarly, acquirers might have a superior understanding about novel technologies and viability of innovative business models. Finally, they typically show interest in an entrepreneurial venture only if strategically relevant to them and if they have a rather clear vision on future developments of the venture within the parent company. Moreover, the formation of early-stage relationships in the form of equity investments or alliances is a precaution that acquirer companies typically take to further limit information asymmetry and uncertainty around their valuations. Therefore, we expect the signaling value of reputation and status to be generally weaker in the case of acquisitions when compared to IPOs because of lower information asymmetry between the entrepreneurial venture's insiders and the signal receiver.

Albeit uncertainty is curbed by a greater and deeper knowledge of market and technology, acquirer companies might still need to rely on quality signals to inform their assessments of the value and worthiness of a target venture. The mechanisms in place to influence judgments of this category of external evaluators are similar to those explained before for the case of initial public offerings. On one side, reputation of a venture's VC ties signals its quality given the fact that prominent investors have put their reputation at stake to endorse the company (Lee & Wahal, 2004; Stuart et al., 1999) and may have provided substantial resources functional to its success (Bygrave & Timmons, 1992; Pollock et al., 2010). On the other, also a VC's social rank may send a signal to prospective acquirers of a venture and alleviate the problem of asymmetric information they face. Status of a venture's VCs, although detached from previous performance and behaviors, is based on social capital that is put at risk by association with the venture. Therefore, high-status VCs might not be able to provide the venture with substantive benefits and resources but can still have a certification function in the eyes of potential acquirers (Pollock et al., 2010). However, because reputation is directly related to observable performances, which are more visible and easier to assess than social status for managers of acquiring companies, we expect its relevance as quality signal to be higher than status' one. Moreover, status is a form of judgment more indicated to screen potential transaction partners, by categorizing them according to social ranks, while reputation is typically used to choose a specific organization within a status category (Bitektine, 2011; Jensen & Roy, 2008). A specific event as an acquisition requires a specific judgment about how the venture will behave in the future relative to other organizations (reputation judgment),

instead of an evaluation about the organization's ranked order relative to similar organizations (status judgment) (Bitektine, 2011). We therefore hypothesize that.

***Hypothesis 2a:** The higher a VC syndicate's reputation, the greater the entrepreneurial venture's hazard of being acquired*

***Hypothesis 2b:** The higher a VC syndicate's status, the greater the entrepreneurial venture's hazard of being acquired*

***Hypothesis 2c:** The effect of a VC syndicate's reputation on the entrepreneurial venture's hazard of being acquired is greater than the effect of the syndicate's status*

2.3 Method

Research Setting: The U.S. Clean Technology Sector

We test our hypotheses on a sample of VC-backed clean technology entrepreneurial ventures. Clean technologies ("cleantech") encompass all products, processes or services that reduce waste and require as few non-renewable resources as possible (Pernick & Wilder, 2008). There are several reasons why the choice of the cleantech sector, in addition to reducing heterogeneity among ventures, provides an appropriate context for studying the signaling value of reputation and status. First, the high capital intensity of investments supporting development and commercialization of clean technologies makes the availability of private and public funding a key factor driving cleantech ventures' success. Venture capital in this sector has flourished with the intent to improve market diffusion of technologies that could lead the transition toward a low-carbon economy while generating returns. Nevertheless, VC-funded ventures have met higher than anticipated barriers in going through the stages of their innovation cycle (Wüstenhagen & Menichetti, 2012). The term "valley of death" has been used to indicate a common phase characterizing companies in this sector, when a successful prototype of a technology has been developed but supplemental financial resources are needed to move towards commercialization and scaling-up phases (Bürer & Wüstenhagen, 2009; Ghosh & Nanda, 2010). Exits via trade sales of portfolio ventures to incumbent firms or public listing are necessary outcomes to both guarantee the survival and diffusion of the technologies and avoid the negative impact that a too long investment cycle has on annualized returns of VC funds (Wüstenhagen & Teppo, 2006). Thus, VCs' use of social approval assets to increase the likelihood that their portfolio ventures in this sector will reach an exit becomes fundamental to help them surviving the "valley of death" and avoid negative repercussions on funds' performance. Second, strategic decisions in technology-intensive industries are generally fraught with uncertainty (Eisenhardt, 1989). In the cleantech sector, uncertainty is particularly accentuated due to capital intensity, policy instability and technology novelty (Bürer & Wüstenhagen, 2009; Ghosh & Nanda, 2010; Marcus, Malen, & Ellis, 2013; Petkova et al., 2014; Wüstenhagen & Teppo, 2006). Under these conditions and given the difficulty in gathering supplemental information to lower uncertainty, economic actors like IPO investors or acquiring firms would need to draw more on signals of quality, or attributes that are thought to be related with the venture's ability to deliver certain standard of performances in the

future, to support their investment processes (Podolny, 2005; Stuart et al., 1999). The reason is because under high uncertainty people look for signals, such as ties with high-reputation or high-status affiliates, which would legitimate the decision and alleviate the risk of incurring in adverse selections. Overall, we expect signaling to have a crucial role in enhancing successful exits in a sector where VCs have invested significant amounts in their portfolio ventures without experiencing many liquidation events and external parties are particularly affected by uncertainty during evaluations of VC-backed ventures.

Sample and Data

Following prior works on venture capital (Gompers, Kovner, Lerner, & Scharfstein, 2008; Guler, 2007), we collected data on VC financing rounds from the Securities Data Corporation’s *VentureXpert* database owned by Thomson Financial. Additional data on VC-backed ventures were combined using the Cleantech Group’s proprietary *i3 platform* as well as *Compustat* and *CRSP* for market-level variables. Data on relevant characteristics of initial public offerings and acquisitions were drawn from Jay Ritter’s IPO database³ and Securities Data Corporation’s (SDC) *Global New Issues*. The final sample included information on all cleantech ventures headquartered in the U.S. that received their first round of investment between 1990 and 2012. We focused only on investments made at the venture capital stage and excluded other types of private equity investments in relatively mature companies, buyouts and angel investments. Because our sample is composed only by companies sufficiently good to attract at least one round of financing, we limit extreme variation in ventures’ quality by removing the lowest quality private ventures (Ozmel, Robinson, & Stuart, 2013). Purging the sample from excessive variation in quality should minimize concerns that the estimates are driven by heterogeneity in firms’ quality. If information about every VC investing in a venture was not available, the venture was excluded from the study. We used the “Company Technology Application” classification provided by *VentureXpert* to pick ventures associated with clean technologies. Additionally, we verified each venture’s sector categorization into the cleantech sector by cross-checking with information from cleantech-specific databases and business reports⁴. Clean technology ventures in our sample are distributed across a range of different sub-sectors (e.g. Photovoltaic, Biofuels, Energy Efficiency, e-mobility, Wind Power, etc.). Distribution of companies across the nine main industries is provided in Table 2.1.

Table 2.1: Ventures distribution across industries

Biotechnology	64	4.65	4.65
Communications and Media	3	0.22	4.87
Computer Hardware	6	0.44	5.31
Computer Software and Services	16	1.16	6.47
Consumer Related	25	1.82	8.28
Industrial/Energy	957	69.55	77.83
Medical/Health	2	0.15	77.98
Other Products	167	12.14	90.12
Semiconductors/Other Elect.	136	9.88	100
Total	1,376	100	

³ Source: <http://bear.warrington.ufl.edu/ritter/ipodata.htm>

⁴ We verified consistency of each entrepreneurial venture’s categorization with information from Bloomberg New Energy Finance and Cleantech Group’s *i3* database

The final dataset used for the analysis consisted of 1,376 entrepreneurial ventures that received a total of 2,880 investment rounds from 1,268 VCs. Each venture was tracked from the first investment date until: (a) the IPO or acquisition date, (b) the official bankruptcy date or the end of the tenth year after the initial investment⁵ when the venture appeared defunct but bankruptcy official date was missing or (c) the end of 2012. Companies that received their first funding round before 1990 were excluded from the study. Among entrepreneurial ventures in the sample, 19.8% exited successfully by the end of 2012 for a total of 71 IPOs and 201 acquisitions.

Dependent Variable

Hazard of IPO and acquisition. We want to examine the hazard that a VC-backed entrepreneurial venture completes an IPO or is acquired in a given year. We consider the hazard that one of these two exit events happen as a proxy of a private cleantech venture's ability to successfully attract further capital for development and growth (Guler, 2007; Stuart et al., 1999). Each venture in the sample is considered "at risk" of undergoing an IPO or an acquisition at any time since the year it receives its first VC investment round. We use two distinct dependent variables to differentiate between these two types of exit. The dichotomous variables equal one if a particular venture goes public (or is acquired) during year t , 0 otherwise. Entrepreneurial ventures that did not fail or achieve a successful exit by December 31st, 2012 were treated as right censored.

Independent Variables

VCs' Reputation. VCs' reputation is measured adopting an extended version of the multi-item index developed and validated by Lee et al. (2011) which has been utilized in previous studies as comprehensive measure of reputation (Petkova et al., 2014; Pollock et al., 2015). We re-computed the original index extending it to 2012. The index is based on six indicators of VCs' past actions and performance aiming at capturing the two relevant dimensions of reputation identified by Rindova et al. (2005): quality and prominence. Prominence of a VC firm is related to its visibility and, thus, to the intensity of its investment activity (Rindova, Petkova, & Kotha, 2007). It is measured by the number of ventures and total amount of dollars invested by a VC firm in the five years prior to a given year. Quality and distinctiveness of a VC firm's activity is gauged by its age, the average of the total amount of dollars under management, the number of funds raised and the number of portfolio ventures taken to IPO over the prior five years⁶. Each index's item is measured with a rolling 5-years window prior to the focal year⁷ and the final index has been re-scaled on a 100-point scale for each year in the sample to ensure comparability across years. VCs' Reputation is the average value of the reputation score for all VCs affiliated with a venture at time t ⁸. The final reputation measure is standardized,

⁵ Following Hochberg et al. (2007), a company that has not exited by the fund's 10th year of life is assumed to have been liquidated

⁶ Results remained unchanged when taking the total amounts of each item (except VC Age) over the 5 years prior to the focal year instead of the averages.

⁷ For robustness check we also computed a version of the index in which the 5-years rolling window include the focal year. This version of the index did not alter any result.

⁸ Results remained unchanged when measuring VC Reputation as the count of VCs in the top 1% or 5% of the yearly reputation ranking or when considering the reputation of the lead VC only (Nahata, 2008).

to allow comparability of effects with status, and updated over time to take into account both changes in the composition of the syndicate after each investment round and variations in the yearly reputation scores of VCs. Prior literature has often measured reputation either for a single lead VC in a syndicate or for VCs participating in the first investment round only (Krishnan et al., 2011; Nahata, 2008). However, these approaches do not account for the possibility that a venture could benefit from the reputation of VCs joining at later stages. Moreover, there are VCs which might have significant decisional power within a syndicate even without covering the role of lead VC.

VCS' Status. VCs' status has been assessed exploiting the relationships that exist among VC investors in the network of co-investments. We measured social influence of each VC firm by looking at its centrality in the overall syndication network (Guler, 2007; Podolny, 2001). Following prior research (Hochberg et al., 2007), we operationalized status as eigenvector centrality (Bonacich, 1987) which considers every VC's co-investment tie in a given time period and then recursively weighs each connection by the centrality of the connected actor. We followed Lee et al. (2011) and for each year in our sample, we constructed undirected adjacency matrices in which two VCs had a direct tie if they co-invested over the 5-year window that ended in the year prior to the focal year. We assigned a score based on the eigenvector values to each of the VC investors active between 1985 and 2012. Each eigenvector value was normalized by the maximum possible eigenvector measure given the number of investors active in a given year and re-scaled on a 100-point scale to assure comparability with the reputation index. Finally, VC Status has been computed as the average value of the score for all VCs affiliated with a venture at time t . As for reputation, also the status measure has been standardized to allow comparability of the two constructs (Pollock et al., 2015)⁹. We used the software GEPHI to compute the status measure.

Control Variables

Entrepreneurial ventures' attributes. Exit events can be driven by quality and characteristics of portfolio ventures. We controlled for several characteristics that may denote a venture's quality and therefore impact exit hazards. We measured the *Cumulated Investment* (in USD Million) received by each portfolio venture across all investment rounds. Because VCs stage their investments, and follow-on funding is given to a venture only if specific milestones in terms of performance have been reached (Gompers, 1995), the amount of VC funding may be considered a reasonable measure to capture ventures quality (Nahata, 2008). We included the dichotomous variable *Early/Seed-Stage Venture*, which equals one if the venture was at a seed or early stage (according to Venture Economics' classification) at the last financing round, and 0 otherwise. Ventures at early stages are characterized by higher uncertainty about the viability of their business model and might encounter more difficulties in reaching an exit (Sorenson & Stuart, 2001). The *VC Syndicate Size* is also considered as measure of deal attractiveness. Syndication helps VCs to select better deals by reducing uncertainty through the comparison of reciprocal expectations (Hochberg et al., 2007). Thus, syndicated investments are often a sign of highly innovative (Bygrave & Timmons, 1992) and less traditional

⁹ The results remain unchanged when using unstandardized measures

deals (Lockett, Murray, & Wright, 2002), which may influence occurrence of successful exits. Furthermore, previous studies suggest that VCs are more keen to invest and support companies that are geographically close (Li & Mahoney, 2011; Sorenson & Stuart, 2001). Hence, the dichotomous variable *VCs Geographically Close* was included to specify if at least one VC is located in the same metropolitan location of the focal venture in year t . Likewise, the variable *non-US VCs* signals the presence of investors headquartered outside the US. Finally, *year* and *Cleantech sub-sectors* indicators were included to control for unobservable industry and temporal effects.

VC firms' attributes. The presence of corporate venture capitalists (*Corporate VCs*) or investment banks (*Bank VCs*) in the VC syndicate of an investment may influence the choice and timing of a venture's exit. These categories of investors are generally more risk-averse and more oriented towards late-stage investments than traditional VCs. General partners of corporate VCs have different compensation mechanisms compared to traditional VC firms' managers (Gompers & Lerner, 2004; Nahata, 2008). Moreover, having an investment bank in the pool of investors may facilitate operations at the moment of exiting due to an enhanced network of connections with public market stakeholders. We controlled for presence of corporate and bank VCs at each financing round by inclusion of dichotomous variables. We included the age of the oldest fund among all those composing a venture's syndicate in a given year (*Oldest Fund Age*), as measure of funds' maturity which might affect exit timing decisions. Similarly, we checked if any VC firm in the syndicate had at least one fund under management that is considered *Late-Stage Funds* according to VentureXpert classification.

Exit Market Conditions. We proxy exit market conditions with *Exit Volume* that is the yearly number of exits by IPO¹⁰ (Gompers et al., 2008). We used other two indicators to control for market conditions besides exit volume. First, *Stock Market Returns* were measured as yearly returns on the U.S. stock markets (Brau et al., 2003; Lowry & Schwert, 2002). The computation has been done using both the CRSP's value-weighted and equal-weighted indexes for the three major U.S. stock exchanges¹¹ (Baker & Wurgler, 2000). Second, *Stock Market Volatility* has been measured at a yearly level using the Chicago Board Options Exchange Market Volatility Index¹², a popular measure of the volatility of stock markets. These are all considered measures of perceived investment opportunities strongly related to market valuations (Pagano & Panetta, 1998; Ritter & Welch, 2002).

Model Specifications

Cox Proportional Hazard Models. We use Cox proportional hazard models (Cox, 1972; Wooldridge, 2006) to estimate the hazard that an entrepreneurial completes an exit event. We track each entrepreneurial venture from the first investment round until one of the following events: an IPO, the acquisition by another

¹⁰ Results remain the same if we consider exits by acquisition, IPOs in the cleantech sector only or VC-backed exits only

¹¹ NYSE, AMEX, NASDAQ stock indexes are used

¹² Source: <http://www.bloomberg.com/quote/VIX:IND>

company, the official failure¹³ or the end of the study period. To differentiate between the two possible exit outcomes we provide separate results for Cox models referring to IPO and acquisition events. Cox models allow the estimation of the effects of our explanatory variables on the baseline hazard of exit $\lambda_0(t)$, taking into account right-censoring of observations. The outcome of these type of survival models is the hazard rate of exit $\lambda(t)$, which is the instantaneous probability that an entrepreneurial venture goes public or is acquired in a given period t assuming that it is still at “risk” of experiencing one of these events. The rate of occurrence of an exit event at time t equals the density of events at t , divided by the probability of surviving to duration t without experiencing the event. The hazard rate at time t for an entrepreneurial venture with covariates X_i is assumed to be:

$$\lambda(t|X_i) = \lambda_0(t)\exp\{X_i'\beta\} \quad (1)$$

The choice of a semi-parametric model allows avoiding the parameterization of the baseline hazard rate distribution $\lambda_0(t)$ ¹⁴, which describes the risk for ventures with $X_i = 0$. The term $\exp\{X_i'\beta\}$ is the relative risk associated with the set of characteristics X_i . One of the main assumptions of Cox proportional hazards models is that of proportional hazards. This implies that the survival curves for different strata corresponding to particular choices of values for X_i , must have hazard functions proportional over time. To test for proportionality we created interactions of the predictors in our model and a function of survival time. By including these interactions in the model we verified that none of the predictors was significant, thus, violating the proportionality assumption. We obtained a further confirmation that proportionality assumption is generally not violated by graphically plotting the scaled Schoenfeld residuals for each predictor to observe the flatness of the projected line. Data was configured into yearly spells for each venture¹⁵. To account for possible time-invariant unobserved factors that might generate correlations across error terms we clustered the errors at the entrepreneurial venture level.

Inverse Probability Treatment Weights (IPTW). Endogeneity might bias the results if unobserved factors affecting exit hazards also determine whether a portfolio company receives investment by high-reputation or high-status VCs. In such cases, a wrong model specification that does not consider that levels of status and reputation in an investment syndicate are not randomly assigned can lead to biased estimates. In our specific case, if prominent VCs systematically invest in high-quality ventures, the latter’s exits may be due to the matching process instead of the hypothesized mechanisms (Hsu, 2004; Lee & Wahal, 2004). To overcome these issues, we decided to resort on Marginal Structural Models (MSMs) with Inverse Probability Treatment Weights (IPTWs), a novel approach derived from biostatistics to model selection into time-varying treatments (Azoulay, Ding, & Stuart, 2009; Robins, Hernan, & Brumback, 2000; Wu, 2012). Marginal structural proportional hazards models are causal models used to estimate the effect of non-randomized time-

¹³ We manually checked web archives and news releases to ascertain the effective bankruptcy of companies that 482 days after an investment round had not reached an exit event or a follow-on round (Guler, 2007)

¹⁴ We verified in separate analyses that results are very similar when using parametric models where different assumptions about the distribution are made (i.e. exponential and Weibull)

¹⁵ Results do not change organizing the data in entrepreneurial venture-quarter (Ma et al., 2013) or VC firm – entrepreneurial venture – investment round spells (Guler, 2007)

dependent treatments on survival outcomes by appropriately controlling for time-dependent confounders (Fewell et al., 2004; Robins, 1999). A time-dependent confounder is a covariate that predicts both selection into treatment and future outcome, while being influenced by past treatment history. In our case, the treatments are the reputation and status levels in a venture’s syndicate. The model consists of two stages. First, each entrepreneurial venture’s probability of having their own history in terms of reputation and status levels in the syndicate is estimated and used to obtain inverse probability of treatment weights (IPTW). After reviewing several studies investigating the possible issues that differentiate the “traditional” binary treatment case from situations where the treatment is continuous (like in our setting), we decided to dichotomize the treatment in order to avoid making too many assumptions about the underlying distributional form and possible heteroscedasticity of the treatment (Naimi, Moodie, Auger, & Kaufman, 2014). Second, the obtained weights are used to create a pseudo-population in which treatments are statistically exogenous, allowing a causal interpretation of the treatment-outcome relationship (Fewell et al., 2004; Robins et al., 2000). The main assumption at the base of the IPTW estimator is, akin to propensity-score matching techniques, that all relevant time-dependent confounders must be observed (Robins et al., 2000). Because the assumption of no unobserved determinants of selection into treatment cannot be tested, we relied on the inclusion of determinants of high-reputation or high-status syndicates drawn from past literature in finance and organizational sociology. The stabilized inverse probability treatment weights were computed similarly for the two treatments (VC reputation and status) by estimating the likelihood that a venture has at least one VC in the top 10% reputation or status rankings in year t ¹⁶. In the case of VC reputation, the stabilized weight $SWreputation_{it}$ for an entrepreneurial venture i at time t was defined as:

$$SWreputation_{it} = \prod_{\tau=0}^t \frac{Pr(VCs \text{ in Top10\% Rep}_{it}=1|X_{it})}{Pr(VCs \text{ in Top10\% Rep}_{it}=1|X_{it}, Z_{i,\tau-1})} \quad (2)$$

The denominator is the probability that an entrepreneurial venture received funding by at least one high-reputation VC at time τ , conditional on past history of 'prognosis factors' for attracting high-reputation VCs in the syndicate, whether time-varying or fixed overtime. Where $Z_{i,\tau-1}$ represent past values of time-varying confounders, and X_{it} is the history of the vector of variables X (including both time-varying and constant characteristics of entrepreneurial venture i) until time τ (Azoulay et al., 2009; Wu, 2012). We resorted on existing literature on organizational network and status to identify relevant confounders that influence an entrepreneurial venture’s ability to attract high-reputation and high-status VCs in the investment syndicate (Nahata, 2008; Podolny, 2001; Sorenson & Stuart, 2001; Stuart et al., 1999) The list of covariates used to compute the weights included: venture’s age, the number of years between a venture’s founding date and the first investment round, the cumulative number of VC rounds received, the average density of the co-investment networks of VCs in the syndicate (lagged one year), and a series of industry sub-sector, geographic state and year dummies. We present the results for both the Cox proportional hazards models with no weights and for the marginal structural models (MSM) using inverse probability of treatment weights (IPTWs). For the latter category of models, because traditional Cox models do not allow for time-varying

¹⁶ Results remain the same when estimating the likelihood of presence in a venture’ syndicate of VCs in the top 5% or top 1% of the yearly rankings

weights we fit pooled logistic regressions with robust variance estimators (Fewell et al., 2004; Robins et al., 2000). In order to account for entrepreneurial ventures that drop out before an exit event occurs or the study period ends we derive new weights ($SWcensored_{it}$) for the probability of remaining uncensored up to time t using the same set of confounders that we used for reputation and status stabilized weights. The final weights used to estimate the effect of VC reputation and status on the occurrence of entrepreneurial exit events are computed as $SWreputation_{it} * SWstatus_{it} * SWcensored_{it}$ (Hernán, Brumback, & Robins, 2001).

2.4 Results

Table 2.2 reports descriptive statistics (for time-varying covariates the means and standard deviations at the first investment round are reported) and correlations between the main variables at the venture-year level. The measures of status and reputation are positively and significantly correlated. However, VIF tests (mean VIF = 1.35, maximum VIF = 1.98) suggest that multicollinearity is not a problem (Pollock et al., 2015). Nonetheless, we also controlled the robustness of results by checking consistency in signs and statistical significance of coefficients when the two key constructs are alternatively excluded from the regressions.

Figure 2.2: Descriptive statistics and correlations between variables at the date of first investment

No.	Variables	Obs.	Mean	Std. Dev.	Min	Max	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	VCs Reputation	1236	1.20	1.20	-2.46	4.61	1													
2	VCs Status	1081	1.08	2.07	-4.91	4.61	0.634	1												
3	Exit Volume	1376	167.15	93.99	45	510	0.170	0.039	1											
4	Stock Market Returns	1376	9.57	30.30	-43.7	72.60	0.007	0.005	-0.135	1										
5	Stock Market Volatility	1376	20.14	7.37	11.1	39.19	-0.035	0.003	-0.362	0.531	1									
6	Early/Seed-Stage Venture	1376	0.41	0.49	0	1	-0.049	0.135	-0.031	-0.003	0.027	1								
7	Bank VCs	1376	0.09	0.29	0	1	0.049	-0.002	0.004	0.010	0.013	-0.073	1							
8	Corporate VCs	1376	0.10	0.31	0	1	-0.062	0.057	-0.049	-0.021	0.014	-0.003	0.017	1						
9	non-US VCs	1376	0.27	0.44	0	1	-0.023	0.071	-0.013	-0.004	-0.013	0.044	-0.006	0.179	1					
10	VCs Geographically Close	1376	0.33	0.47	0	1	-0.093	-0.016	-0.011	-0.001	0.010	0.108	-0.030	0.013	0.006	1				
11	Cumulated Investment Amount (mln)	1376	20.80	173.10	0	5401	0.083	0.030	-0.014	-0.003	0.003	-0.077	0.024	0.048	0.039	-0.044	1			
12	VC Syndicate Size	1376	1.78	1.09	1	8	-0.011	0.198	-0.026	-0.007	0.001	-0.083	0.049	0.333	0.340	0.093	0.096	1		
13	Oldest Fund Age	1376	26.83	23.10	0	141	-0.006	0.211	-0.059	-0.005	0.014	0.021	0.024	0.214	0.272	0.008	0.053	0.537	1	
14	Late-Stage Funds	1376	0.06	0.23	0	1	0.035	0.031	0.045	0.005	-0.008	-0.062	0.016	0.088	0.050	-0.034	-0.002	0.207	0.074	1

Determinants of reputation and status levels in the syndicate

Table 2.3 presents the results for the four pooled cross-sectional logit models estimated to calculate numerators and denominators for the IPTWs of reputation and status treatments.

Table 2.3: Probability of receiving funds by high-reputation and high-status VC firms

VARIABLES	Model 1a		Model 1b		Model 2a		Model 2b	
	DV: Top 10% Reputation = 1		DV: Top 10% Status = 1		DV: Top 10% Status = 1		DV: Top 10% Status = 1	
	Denominator	Numerator	Denominator	Numerator	Denominator	Numerator	Denominator	Numerator
Years from venture founding to first financing round	-0.001 (0.020)	-0.012** (0.004)	-0.008 (0.041)	-0.036*** (0.007)				
Cumulative VC number of rounds	0.390*** (0.091)		0.845*** (0.135)					
Average density of the co-investment network (lagged)	0.056*** (0.011)		0.281*** (0.015)					
Venture Age	0.011 (0.020)		-0.005 (0.040)					
Industry dummies	Yes	Yes	Yes	Yes				
State dummies	Yes	Yes	Yes	Yes				
Year dummies	Yes	Yes	Yes	Yes				
Constant	12.247*** (1.177)	-0.280 (1.073)	-8.833*** (1.293)	-1.648 (1.165)				
Observations	5866	6527	5825	6486				
Entrepreneurial Ventures	991	1090	983	1082				
Log-likelihood	-2125	-3839	-611.8	-5732				

Standard errors in parentheses
 *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Models 1a and 1b look at the determinants of a focal venture’s conditional probability of receiving its own observed reputation treatment history (in terms of presence of high-reputation VCs in the syndicate) up to the year t. The analysis confirms the importance of the selected time-varying and fixed confounders as determinants of reputation at the investment syndicate level. In model 1a, the positive and statistically significant coefficient estimates on syndicate’s average density of the co-investment network and cumulative number of VC rounds received by the venture, suggest that connectedness of VCs and the venture’s ability to meet financial milestones are important elements influencing the likelihood of attracting reputable investors in the syndicate. Models 2a and 2b estimate the determinants of VC status level in a syndicate. The results show that the same factors explaining the likelihood of receiving funding by reputable VCs are also determinants of the probability that high-status VCs join the investment syndicate.

Using the numerator and denominator estimations we derived the predicted probability for each entrepreneurial venture’s syndicate of showing the observed reputation and status levels. We, then, used such values to create stabilized inverse probability treatment weights to remove the selection bias in the marginal structural models. Table 2.4 presents the regression results of both the un-weighted Cox proportional hazards and the marginal structural models using IPTWs to estimate the effect of VC reputation and status on the hazard that an entrepreneurial venture experiences an IPO event. Because Cox models do not allow for time-varying, subject-specific weights, we fit a pooled logistic regression to weight subjects by the inverse probability of treatment received. Table 2.5 presents the same models for acquisition exits to test the second set of hypotheses.

IPOs

Table 2.4: Cox proportional hazard models and marginal structural models using IPTWs for the hazard of IPO exits

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
VARIABLES	Cox Model - Controls Only	Cox Model - with Reputation	Cox Model - with Status	Cox Model - with Reputation and Status	Pooled Logistic regression - Unweighted	Marginal structural Model with IPTWs
VCs Reputation		0.573** (0.181)		0.866*** (0.214)	0.883*** (0.216)	1.002*** (0.286)
VCs Status			0.045 (0.096)	-0.230** (0.082)	-0.214* (0.088)	-0.381*** (0.111)
Exit Volume	0.134*** (0.003)	0.143*** (0.003)	0.134*** (0.003)	0.141*** (0.003)	0.118 (0.001)	0.093*** (0.011)
Stock Market Returns	0.102*** (0.024)	0.109*** (0.024)	0.102*** (0.024)	0.109*** (0.024)	0.094*** (0.017)	0.115*** (0.025)
Stock Market Volatility	0.081 (0.141)	0.086 (0.140)	0.078 (0.139)	0.062 (0.141)	0.033 (0.145)	-0.099 (0.188)
Early/Seed-Stage Venture	-1.730** (0.579)	-1.693** (0.584)	-1.698** (0.593)	-1.590** (0.588)	-1.727** (0.602)	-2.094** (0.659)
Bank VCs	0.396 (0.281)	0.290 (0.289)	0.474+ (0.279)	0.291 (0.296)	0.397 (0.307)	-0.250 (0.463)
Corporate VCs	-0.364 (0.425)	-0.266 (0.419)	-0.482 (0.414)	-0.368 (0.423)	-0.179 (0.386)	-0.522 (0.572)
non-US VCs	0.060 (0.257)	0.082 (0.252)	0.042 (0.254)	0.129 (0.256)	0.184 (0.277)	1.465** (0.465)
VCs Geographically Close	-0.313 (0.291)	-0.190 (0.293)	-0.291 (0.286)	-0.146 (0.296)	-0.072 (0.309)	1.032* (0.444)
Cumulated Investment Amount (mln)	0.002 (0.002)	0.001 (0.001)	0.002 (0.002)	0.001 (0.001)	0.001 (0.001)	0.002 (0.001)
VC Syndicate Size	0.192*** (0.054)	0.205*** (0.053)	0.175** (0.054)	0.233*** (0.054)	0.223*** (0.053)	0.259*** (0.063)
Oldest Fund Age	-0.008 (0.008)	-0.008 (0.007)	-0.008 (0.008)	-0.006 (0.007)	-0.006 (0.008)	-0.008 (0.008)
Late-Stage Funds	0.454 (0.326)	0.405 (0.317)	0.425 (0.327)	0.457 (0.322)	0.509 (0.351)	-0.578 (0.464)
Constant					-41.303*** (1.448)	-33.939*** (3.812)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Cleantech sub-sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8739	8022	7299	7227	5821	4443
Entrepreneurial Ventures	1376	1280	1218	1209	1121	887
Log-likelihood	-381.7	-364.9	-362.0	-353.3	-292.8	-225.4

Robust standard errors in parentheses
 *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Results from the Cox proportional hazards models (models 1 to 4) in Table 2.4 confirm that market conditions have a relevant impact on timing of venture capital exits (Ball, Chiu, & Smith, 2011; Gompers et al., 2008). Specifically, the number of yearly IPOs and the level of stock market returns increase the hazard that an entrepreneurial venture exits via IPO¹⁷. These results indicate a general preference of VCs to liquidate investments during periods of “exit waves”. Hot market periods allow the selling shareholders to take advantage of both lower adverse selection costs (Lowry & Schwert, 2002) and widespread investors’ optimism (Pagano & Panetta, 1998). Stock market volatility, another factor depending on external market conditions, does not seem to impact the probability of IPO. Other two factors meaningfully affecting the hazard of experiencing a successful IPO are: the size of the VC syndicate at year t and the operational stage of the venture

¹⁷ We also tried to test different measures of yearly stock market returns such as the returns on the S&P 500 Index or the total returns of all Cleantech listed stocks from Compustat. All these measures showed the same effect on IPO timing

at the latest investment round. The higher the number of VCs showing interest and actively supporting an entrepreneurial venture, the higher is the likelihood that this venture will reach an IPO. Such hazard decreases if the venture is at seed or early stage at time t .

The results in model 4 support our hypothesis that reputation of an entrepreneurial venture's VCs is a positive signal of quality influencing public investors (Hypothesis 1a). The average level of reputation among VCs investing in a company significantly increases ($p < 0.01$) the venture's hazard of going public (model 2). The coefficient remains positive and significant ($p < 0.01$) when simultaneously including VC status (model 4). Hypothesis 1b is not supported as, contrary to our expectations, when controlling for average reputation level in the syndicate, VC status has a negative and significant effect on the IPO hazard (model 4). This result indicates that ties with high-status investors, not only do not have a positive signaling value to external parties, but might even deter ventures' chances of going public. We discuss possible explanations to this unexpected result in the next session of the paper. Finally, the Wald test has confirmed that the coefficient of VC Reputation is significantly larger ($p < 0.001$) than the coefficient of VC Status, confirming that reputations is a more effective quality signal than status to public investors (Hypothesis 1c). Results for the relationship between the two attributes of interest and IPO hazards hold also under the IPTW estimation (model 6). VC reputation remains positive and statistically significant ($p < .001$) while VC status has a negative and significant effect ($p < .001$) on the IPO hazard.

Acquisitions

Regression results do not provide support to our second set of hypotheses, proposing a positive signaling value of VC reputation and status on acquirer companies (Hypotheses 2a and 2b), with the effect of reputation greater than that of status (Hypothesis 2c). The effects of VC reputation and status are not significant in any of the models estimating the hazard of exiting via acquisition (models 2 to 6 in Table 2.5). Overall, this result might indicate a lower necessity of external parties involved in this type of deals (i.e. acquiring companies) to rely on secondary signals to assess the quality of an entrepreneurial venture. The result is in line with our theory on the importance of the signal receiver and her idiosyncratic level of information asymmetry. Inter-organizational ties with high-status or high-reputation VCs, which are costly and difficult to acquire, do not improve external perceptions about quality of entrepreneurial ventures if the evaluators possess enough information to limit uncertainty and risk of adverse selection. All the control variables affecting the probability of going public as shown in Table 2.4 (i.e. VC Syndicate Size, Exit Volume and Stock Market Returns) remain statistically significant for all the models in Table 2.5. Moreover, the presence of non-US VCs in the investment syndicate decreases the likelihood of exit via acquisition ($p < 0.01$).

Table 2.5: Cox proportional hazard models and marginal structural models using IPTWs for the hazard of acquisition exits

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
VARIABLES	Cox Model - Controls Only	Cox Model with Reputation	Cox Model - with Status	Cox Model with Reputation and Status	Pooled Logistic regression - Unweighted	Marginal structural Model with IPTWs
VCs Reputation		-0.028 (0.080)		0.011 (0.110)	0.035 (0.113)	0.050 (0.142)
VCs Status			-0.056 (0.039)	-0.052 (0.052)	-0.051 (0.052)	-0.069 (0.073)
Exit Volume	0.143*** (0.002)	0.139*** (0.002)	0.139*** (0.002)	0.139*** (0.002)	0.124 (0.001)	0.129*** (0.006)
Stock Market Returns	0.110*** (0.010)	0.104*** (0.011)	0.102*** (0.011)	0.102*** (0.011)	0.091*** (0.007)	0.100*** (0.012)
Stock Market Volatility	0.084 (0.062)	0.106+ (0.062)	0.095 (0.065)	0.096 (0.066)	0.080 (0.069)	0.070 (0.084)
Early/Seed-Stage Venture	-0.707** (0.223)	-0.700** (0.229)	-0.773** (0.244)	-0.775** (0.245)	-0.975*** (0.247)	-0.588 (0.364)
Bank VCs	0.093 (0.217)	0.150 (0.222)	0.105 (0.231)	0.162 (0.237)	0.157 (0.244)	0.383 (0.285)
Corporate VCs	-0.340 (0.257)	-0.314 (0.251)	-0.224 (0.255)	-0.229 (0.255)	-0.215 (0.266)	-0.493 (0.328)
non-US VCs	-0.593** (0.191)	-0.577** (0.194)	-0.558** (0.197)	-0.566** (0.200)	-0.590** (0.208)	-0.610* (0.271)
VCs Geographically Close	-0.285+ (0.164)	-0.291+ (0.164)	-0.303+ (0.168)	-0.300+ (0.167)	-0.319+ (0.173)	-0.253 (0.230)
Cumulated Investment Amount (mln)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.001 (0.001)
VC Syndicate Size	0.128*** (0.032)	0.125*** (0.033)	0.121*** (0.033)	0.119*** (0.034)	0.152*** (0.033)	0.171*** (0.045)
Oldest Fund Age	-0.006 (0.004)	-0.007 (0.004)	-0.006 (0.004)	-0.006 (0.004)	-0.006 (0.004)	-0.009 (0.007)
Late-Stage Funds	-0.537+ (0.323)	-0.482 (0.307)	-0.480 (0.309)	-0.488 (0.308)	-0.580+ (0.318)	-0.988* (0.385)
Constant					-41.014*** (0.265)	-42.495*** (2.970)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Cleantech sub-sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8739	8022	7299	7227	6949	5201
Entrepreneurial Ventures	1376	1280	1218	1209	1178	929
Log-likelihood	-1252	-1173	-1094	-1092	-788.6	-385.3

Robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Robustness Tests

Alternative measures for Reputation and Status. We specified several models where alternative measures for the two focal constructs have been included. First, for each year t following the first investment round we measured reputation and status of the VC with the highest scores among all investors in a venture. This measure changes over time due to VCs' gains or losses of reputation and status as well as variations in the syndicate composition after new investment rounds. Table 2.6 shows that, using these new measures, results remain unchanged from those discussed before for both IPO (model 1) and acquisitions hazards (model 4).

Table 2.6: Robustness checks – alternative measures of VC Reputation and Status

VARIABLES	IPO			ACQUISITION		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Cox Model	Cox Model	Cox Model	Cox Model	Cox Model	Cox Model
Highest VCs Reputation	0.470*			-0.073		
	(0.194)			(0.106)		
Highest VCs Status	-0.127			0.003		
	(0.090)			(0.052)		
VCs Reputation		1.024***	0.897***		0.073	-0.042
		(0.232)	(0.236)		(0.121)	(0.111)
VCs Status (Degree Centrality)		-0.443***			-0.131	
		(0.132)			(0.083)	
VCs Status (Betweenness Centrality)			-0.182*			-0.000
			(0.076)			(0.044)
Exit Volume	0.138***	0.142***	0.145***	0.149***	0.139***	0.149***
	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)	(0.003)
Stock Market Returns	0.106***	0.112***	0.110***	0.109***	0.103***	0.108***
	(0.024)	(0.024)	(0.024)	(0.011)	(0.011)	(0.011)
Stock Market Volatility	0.065	0.044	0.092	0.103	0.090	0.110
	(0.141)	(0.142)	(0.142)	(0.066)	(0.066)	(0.068)
Early/Seed-Stage Venture	-1.668**	-1.543**	-1.561**	-0.820***	-0.751**	-0.724**
	(0.592)	(0.588)	(0.586)	(0.244)	(0.245)	(0.246)
Bank VCs	0.327	0.283	0.411	0.201	0.129	0.167
	(0.296)	(0.292)	(0.308)	(0.233)	(0.242)	(0.244)
Corporate VCs	-0.471	-0.361	-0.387	-0.243	-0.224	-0.210
	(0.414)	(0.426)	(0.422)	(0.255)	(0.255)	(0.261)
non-US VCs	0.129	0.142	0.198	-0.590**	-0.555**	-0.649**
	(0.258)	(0.258)	(0.256)	(0.200)	(0.200)	(0.202)
VCs Geographically Close	-0.199	-0.126	-0.183	-0.305+	-0.297+	-0.268
	(0.288)	(0.300)	(0.304)	(0.167)	(0.167)	(0.173)
Cumulated Investment Amount (mln)	0.001	0.001	0.001	-0.000	-0.000	-0.000
	(0.002)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
VC Syndicate Size	0.144*	0.242***	0.221***	0.122***	0.126***	0.113***
	(0.057)	(0.055)	(0.053)	(0.036)	(0.034)	(0.034)
Oldest Fund Age	-0.007	-0.005	-0.007	-0.007	-0.006	-0.007
	(0.008)	(0.007)	(0.007)	(0.004)	(0.004)	(0.005)
Late-Stage Funds	0.428	0.450	0.465	-0.500	-0.482	-0.558+
	(0.325)	(0.320)	(0.339)	(0.308)	(0.309)	(0.320)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Cleantech sub-sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7227	7227	6738	7227	7227	6738
Entrepreneurial Ventures	1209	1209	1146	1209	1209	1146
Log-likelihood	-358.7	-351.5	-332.7	-1092	-1091	-993.1

Robust standard errors in parentheses
 *** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Second, we used two alternative measures for VC status that, still relying on the analysis of the investors' network, aim at capturing diverse facets of social connectedness. We computed *Degree Centrality* which is the count of ties that an investor has based on co-investments in the previous 5 years. Because degree centrality is a function of network size, each degree measure has been normalized by the maximum possible degree given the number of investors active in a given year and re-scaled on a 0 to 100 points scale. Degree centrality could be considered as a good proxy for information flow. The higher the number of ties of a given VC the easier the access to information, contacts and resources (Hochberg et al., 2007). We also computed *Betweenness Centrality* looking at key actors in the network that act as "hubs" bridging VCs without previous ties. Betweenness centrality is operationally given by the number of shortest-distance paths between other VCs in the network upon which the VC sits (Hochberg et al., 2007). A VC with high value of betweenness centrality is considered a key actor on whom the others should rely to improve their own status in the network. Models 2 and 3 (for the IPO case) as well as 5 and 6 (for the acquisition case) in Table 2.5

confirm results previously discussed, with the effect of VCs' Reputation on IPO hazard that remains always positive and significant. It is interesting to notice that the negative effect of status on the likelihood of entrepreneurial ventures' IPO is negative and significant also with these alternative measures of status. Particularly strong is the negative effect of Degree Centrality ($p < 0.001$), pointing out how ties with busy investors that are very active in terms of recent co-investment activity might not bring the expected benefits to the venture.

Competing risks events. Competing risks are events that occur instead of the failure event of interest and cannot be treated as censored (Fine & Gray, 1999). For instance, when estimating the hazard of an entrepreneurial venture going public, it would be reasonable to consider an acquisition as a competing event. Treating entrepreneurial ventures that are acquired as being right-censored in the estimation of the IPO hazard could lead to biased estimates. In other words, the probability of going public not only is a function of the hazard of IPOs but it is also a function of the hazard of acquisitions, because an acquisition might impede an IPO to occur. To further test for robustness of our results we also estimated competing risks models as suggested by other studies (Fine & Gray, 1999; Lee & Wang, 2003). The results (in Table 2.7) do not show any important difference with the Cox and marginal structural models previously discussed (Tables 2.4 and 2.5).

Table 2.7: Robustness checks – Competing Risks Models

VARIABLES	IPO			ACQUISITION		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
	Competing Risks Model - with Reputation	Competing Risks Model - with Status	Competing Risks Model - with Reputation and Status	Competing Risks Model - with Reputation	Competing Risks Model - with Status	Competing Risks Model - with Reputation and Status
VCs Reputation	0.547*** (0.136)		0.692*** (0.184)	-0.103 (0.079)		-0.034 (0.107)
VCs Status		0.105 (0.080)	-0.136 (0.083)		-0.088* (0.038)	-0.074 (0.048)
Exit Volume	0.004*** (0.001)	0.006*** (0.001)	0.004*** (0.001)	-0.002+ (0.001)	-0.002+ (0.001)	-0.001 (0.001)
Stock Market Returns	0.007 (0.005)	0.011+ (0.006)	0.007 (0.006)	-0.003 (0.003)	-0.003 (0.003)	-0.003 (0.003)
Stock Market Volatility	-0.088*** (0.020)	-0.095*** (0.021)	-0.089*** (0.021)	-0.005 (0.012)	-0.007 (0.012)	-0.007 (0.012)
Early/Seed-Stage Venture	-1.706** (0.593)	-1.788** (0.602)	-1.606** (0.601)	-0.713** (0.227)	-0.757** (0.241)	-0.767** (0.242)
Bank VCs	0.310 (0.275)	0.477+ (0.277)	0.359 (0.277)	0.087 (0.213)	0.046 (0.217)	0.110 (0.222)
Corporate VCs	-0.325 (0.405)	-0.625 (0.384)	-0.449 (0.409)	-0.305 (0.255)	-0.180 (0.261)	-0.193 (0.262)
non-US VCs	0.221 (0.255)	0.252 (0.253)	0.245 (0.254)	-0.583** (0.198)	-0.557** (0.202)	-0.567** (0.203)
VCs Geographically Close	-0.272 (0.282)	-0.359 (0.275)	-0.250 (0.284)	-0.340* (0.166)	-0.341* (0.170)	-0.344* (0.170)
Cumulated Investment Amount (mln)	0.001*** (0.000)	0.001*** (0.000)	0.001** (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
VC Syndicate Size	0.231*** (0.053)	0.198*** (0.054)	0.249*** (0.054)	0.125*** (0.032)	0.126*** (0.033)	0.122*** (0.033)
Oldest Fund Age	-0.008 (0.008)	-0.008 (0.008)	-0.007 (0.008)	-0.005 (0.004)	-0.004 (0.004)	-0.004 (0.004)
Late-Stage Funds	0.355 (0.304)	0.401 (0.304)	0.373 (0.307)	-0.674* (0.302)	-0.640* (0.304)	-0.650* (0.304)
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Cleantech sub-sector dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8022	7299	7227	8022	7299	7227
Entrepreneurial Ventures	1280	1218	1209	1280	1218	1209
Log-likelihood	-400.7	-396.7	-389.6	-1204	-1124	-1122

Robust standard errors in parentheses
*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$

Multi-clustering. We followed previous studies adopting similar settings and clustered the error terms at the venture level to take into account possible correlations across errors resulting from time-

invariant unobserved factors (Guler, 2007; Ozmel & Guler, 2014). However, if the same VCs are involved in different observed ventures then the estimated standard errors might still be biased. To solve this problem a multi-way clustering technique would be recommended (Cameron & Miller, 2010). Yet, the choice of venture-year spells for the survival analysis does not allow us to perform a multi-way clustering. To check for robustness of results to this possible issue we re-run the analyses on a sub-sample of 485 entrepreneurial ventures invested by only one investor. We also tried to set the study sample such that the triad venture-investor-year would represent a spell. Results were unchanged in both cases.

Underwriters' reputation. Since the hazard rate of going public might depend in large part on the perception of quality that is possessed by the investment banks underwriting an offer (Ginsberg et al., 2011), we decided to run an additional analysis to find evidence supporting this alternative explanation. Because entrepreneurial ventures that stay private do not have the necessity to be affiliated with an underwriter, we limit such analysis to the 71 entrepreneurial ventures that experienced an IPO between 1990 and 2012. Table 2.8 below displays a first-stage regression where the likelihood of going public is predicted from the all sample and then used in a second-stage regression to take into account possible sample selection bias. We measured the average reputation of a venture's underwriters using the Carter-Manaster's underwriters ranking (Carter & Manaster, 1990) and *IPO valuation* as the market capitalization of a firm at the end of the first trading day. We find that investment banks' reputation is a significant predictor of the valuation that an entrepreneurial venture receives at IPO. This result on the one hand highlights how entrepreneurial ventures' outcomes might be influenced by external affiliates different from VCs, suggesting that more studies on the diversity of inter-organizational relationships are needed. On the other hand it is reinforced the idea at the base of this paper that acquisitions and IPOs are sold through different processes, involving different intermediaries.

Table 2.8: Robustness checks – Heckman 2-stages model

VARIABLES	Model 1	Model 2
	IPO Valuation	IPO
SECOND STAGE		
Underwriters Reputation	6.553*** (1.346)	
No. of Funds in Total	-4.263*** (1.274)	
Silicon Valley	20.162 (18.286)	
FIRST STAGE		
VCS Reputation		0.006*** (0.001)
VCS Status		0.002 (0.001)
Funds age		-0.004+ (0.002)
Energy Funds		0.067 (0.046)
Cumulated Number of Rounds		0.076*** (0.007)
Cumulated Investment Amount (mln)		0.000*** (0.000)
VC Syndicate Size		0.039** (0.015)
VCS Geographically close		-0.247*** (0.036)
non-US VCS		0.094** (0.032)
Corporate VCS		-0.068 (0.048)
Bank VCS		0.158*** (0.045)
Stock Market Returns		0.002* (0.001)
Stock Market Volatility		-0.016*** (0.004)
Exit Volume		-0.000*** (0.000)
Correction for selection		-166.880*** (23.454)
Constant	352.171*** (55.707)	-1.210*** (0.139)
Observations	11,469	11,469
Year dummies	Yes	Yes
Wald Chi-square	710.1	710.1
Standard errors in parentheses		
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1		

2.5 Discussion

In this paper we explored the difference between the signaling value of reputation and status. We looked at VC syndicates' characteristics and their effect on external perceptions about entrepreneurial ventures. The hypotheses were tested on a sample of cleantech entrepreneurial ventures that received VC funding between the years 1990 and 2012. The results show that ties with high-reputation VCs increase an entrepreneurial venture's likelihood of going public, while ties with high-status VCs seem to reduce this likelihood. We also found that inter-organizational ties with high reputation or high status VCs do not affect the probability that a venture is acquired. We argue that the effectiveness of signaling only in the case of IPO exits might be related to the different levels of information asymmetry affecting external parties receiving the signal in the two exit situations: public investors and acquirer companies.

Reputation and Status

Previous research has highlighted the benefits of organizational reputation and status (Fombrun, 1996; Granovetter, 1985; Podolny, 2005). In this study, we provide empirical evidence to demonstrate that reputation is more valuable than status as quality signal in situations of high information asymmetry between

parties. This finding adds to existing research exploring distinctiveness and independence of these two organizational attributes (Bastedo & Bowman, 2010; Dimov & Milanov, 2010; Milanov & Shepherd, 2013; Pollock et al., 2015; Stern et al., 2014; Washington & Zajac, 2005). It suggests that status is a less effective signal than reputation because not necessarily linked to quality and merit, which is one of the two Spence's requirements to consider an organizational attribute a signal of quality. The results remark that the signaling value of an organizational attribute depends on the existence of a direct and visible link with quality of past actions and behaviors (Spence, 1974). Public investors, faced with the decision to buy IPO shares in an entrepreneurial venture, seek information about its ability to deliver good results and increase its long-term value. In this context, inter-organizational ties with reputable VCs, which have been successful with regard to past actions and performances, are valued as reliable indicator of quality. On the contrary, organizational characteristics based on social esteem and only indirectly tied to actual merit of a venture's ties do not seem to matter. This result, which goes against our initial predictions, leaves open to further investigation the possible reasons that lead venture capitalists endowed with high status to retard their entrepreneurial ventures' IPOs. One reason might be the overflow of information that characterizes this type of VCs due to their social centrality and high number of connections. Being in the center of the VC network might be inefficient and generate an attention deficit towards portfolio ventures that obstruct their path to the public markets. The lack of attention does not favor the completion of a long and structured process like an IPO. Another reason might be that high-status VCs are more prone to wait for particularly favorable exit market conditions that would allow them to exit at exceptionally high valuations. Their social status may tempt them to look for remarkable exits that would be up to their rank. The testing of this hypothesis might be object of future studies in this area. Moreover, the presence of high-status VCs might generate contrasts in the syndicate's decision-making process that negatively reverberate on the timing of an IPO (Ma et al., 2013). Status disparity and coexistence of multiple high-status actors are research topics left to exploration in future research. Finally, external parties are expected to resort more on characteristics that are task-relevant and salient to inform their evaluations (Berger, Cohen, & Zelditch Jr, 1972). As a consequence, the higher specificity of reputation compared to status increases its efficacy as signal of quality (Barnett & Pollock, 2012; Lange et al., 2011; Podolny, 2005).

The results of this study suggest that entrepreneurs choosing between multiple VC investors from whom to accept VC funding in exchange of equity stakes, should be careful to separately assess potential benefits deriving from their reputation, based on track records, and their status, based on associations with other actors in their network. An entrepreneurial venture's success, measured as likelihood of reaching an IPO, will be positively affected only by the former intangible asset. If an entrepreneurial venture foresee an acquisition exit as way to attract supplemental resources for fueling growth, then neither reputation or status of the VCs in the syndicate appear to matter.

The signal receiver

The current study also suggests that characteristics of the external evaluators have a crucial role in determining a signal's effectiveness. Different signal receivers can have different availability of information

that makes a signal more or less useful regardless of its nature and direct link with proven quality. The empirical setting allowed us to distinguish between two types of receivers with different levels of information asymmetry: public investors in IPOs and acquiring companies. We find that signals of quality are relevant only for IPO buyers. On the one hand, public investors risk their capital on IPO issues in spite of limited knowledge and availability of information about the true quality of the ventures' activities, technologies and strategies. For this type of investors, IPO ventures' ties with reputable VCs represent a valuable quality signal to support their investment decisions. On the other hand, managers of acquiring companies might not need to rely on quality signals because subject to significantly lower information asymmetry with the issuing ventures. First, they tend to have greater familiarity with the market and technology of the valued venture. Acquisitions completed to grow or expand are usually carried on in sectors and technological areas close to those of the acquiring company. For this reason, the technical uncertainty around the valuations is limited compared to the case of IPO investments. Second, predictions about future performance of a venture or technology cannot disregard the impact of changes in the regulatory environment. For instance, in a sector like cleantech, long-term sustainability of business models and ventures' profitability are heavily conditioned by regulatory policies. Acquirer companies might be affected by lower regulatory uncertainty than public investors due to higher experience with operations in regulated sectors and the possibility to influence policy makers and their regulatory directives through lobbying activities. Finally, the future success of an entrepreneurial venture depends also on the operational strategies that will follow up an exit event. In the case of IPOs, issues concerning how the venture management would cope with the new ownership and with pressures from the stock market might increase its perceived uncertainty. This might not be the case for acquisitions deals, where usually there is a clear vision about future strategies of the venture within the parent company. Moreover, acquirer companies have the possibility to actively influence the target venture's strategies and its decision-making process, further limiting uncertainty and concerns about future outcomes.

Overall, this study draws attention to the limited value that quality signals have in situations where external parties evaluating an entrepreneurial venture possess enough information to support their investment decisions. Acquisition of VC-backed entrepreneurial ventures are managed by informed decision-makers that, subject to lower technical, regulatory and operational uncertainty than IPO investors, do not necessarily need to rely on quality signals like reputation or status of the target venture's inter-organizational ties.

We add to prior literature underlining the diversity of acquisitions and IPOs as ways to provide an exit opportunity to shareholders of entrepreneurial ventures (Bayar & Chemmanur, 2012; Ragozzino & Blevins, 2015). Existing literature evaluating ventures' performance has often treated these two events in the same way (Nahata, 2008; Stuart et al., 1999). We show that it is important to analyze them separately in order to capture differences between parties involved in the transactions. Entrepreneurs pondering the possible benefits of affiliation with reputable VCs must consider the most likely exit way as an important element that could undermine any beneficial effect of the tie. Ties with high-reputation VCs will not provide much benefit in terms of positive influence to external parties if the entrepreneurial venture's prospect is to be acquired by a strategic buyer with limited information asymmetry.

Limitations and Future Research

This study does not come without limitations. Although we have tried to be as rigorous as possible in the data collection and analysis, we acknowledge some issues that could undermine the internal validity as well as the generalizability of the findings. First, as pointed out by Petkova et al. (2014), the reputation measure adopted is constructed at the firm level and does not consider possible effects of individual reputations within organizations. Besides, this measure, despite its proven reliability in capturing the quality and performance dimensions of reputation, considers only the intensity of a VC's investment activity (namely the total number of ventures and the total amount of dollars invested during a five years horizon) as proxy for visibility. This last aspect of a VC's reputation may be influenced by other factors such as efforts to improve one's own image (e.g. through the use of social networks, participation to networking events or informal word of mouth, etc.) that are not captured by the adopted measure. Future studies may move away from using past data and rely on more qualitative methods to measure the prominence-side of reputation. Another potential source of limitation for the current study comes from generalizability of results. The sample is meant to be representative of ventures operating in a context of high novelty and ambiguity that receive early-stage financing from venture capitalists. However, the market dynamics in the cleantech sector and the consequent need to rely on signaling as way to overcome uncertainty might be different than in other more mature and closer to end-consumers sectors. The VC sector in general may not be fully representative of the universe of firms relying on signaling (Petkova et al., 2014). Moreover, due to known differences between the U.S. venture capital market and other geographic areas like Europe or China we cannot be sure that these organizational mechanisms would apply to other geographic contexts. Lastly, validity of results is conditional on the attempt to account for the dynamics of self-selection of ventures into investment rounds from high-reputation and high-status VCs by estimating structural models using inverse probability of treatment weights. However, these types of models make the untestable assumption that all the variables associated with both probability of receiving funds by prominent VCs and the completion of a successful exit are measured. Although we included a comprehensive set of covariates in line with findings from previous empirical studies, future research might take a step forward and measure a richer set of characteristics of the entrepreneurial ventures that are proxies of their quality (e.g., founders' background and experience, product/service development stage, customer base, etc.).

A series of research opportunities rise from this study. Future research should continue investigating the differences between reputation and status as quality signals using multi-industry and multi-geography samples. Although focusing on a single industry allowed us to control for a variety of factors, it limited the generalizability of our results. Moreover, other types of inter-organizational ties with different reputation and status endowments might be considered. Existing literature in similar settings have mentioned among others: alliance partners (Stuart et al., 1999), underwriters of IPOs (Carter & Manaster, 1990), executives and directors (Gulati & Higgins, 2003).

Chapter 3 Clashing interests in the IPO process: contingencies of signaling with reputable VC ties

3.1 Introduction

Scholars have shown growing interest in understanding how connections with reputable organizations affect firms' behaviors and performances (Fischer & Pollock, 2004; Gulati & Higgins, 2003; Stuart et al., 1999). The context of firms undergoing initial public offerings (IPOs) offers a setting where it is possible to observe how reputable ties can influence valuations by external investors that are subject to asymmetric information (Chen et al., 2008; Gulati & Higgins, 2003). It has been shown that young entrepreneurial ventures associated with reputable venture capitalists (VCs) and underwriters, which are both considered the most influential financial intermediaries in IPO events, obtain higher IPO valuations (Carter & Manaster, 1990; Krishnan et al., 2011; Lee et al., 2011; Lee & Wahal, 2004; Nahata, 2008; Pollock et al., 2010; Stuart et al., 1999). However, most of the extant literature has looked at benefits of relationships with reputable parties without considering the context upon which these ties form and develop. The few empirical studies examining the specific circumstances under which a focal firm may derive greater advantages from reputable ties have highlighted that effectiveness of signaling is contingent upon: a focal firm's uncertainty (Stuart et al., 1999), exit market conditions (Gulati & Higgins, 2003) and characteristics of the tie such as duration, industry-specific experience and geographic proximity between parties (Lee et al., 2011).

To date, little attention has been paid to whether possible conflicts in the relationship with reputable organizations might hinder a firm's outcomes. In this study, I examine whether the signaling value generated by inter-organizational ties with reputable organizations is contingent upon the alignment of strategic interests between parties. The hypotheses are developed in the context of IPOs completed by VC-backed entrepreneurial ventures operating in a novel and highly uncertain sector. Following previous research on signaling via inter-organizational ties, I study the effect of reputable VC ties on the valuations that entrepreneurial ventures receive by public investors in an IPO (Barnett & Pollock, 2012; Spence, 1974; Stuart et al., 1999). I suggest that the game that VCs play when exiting from their portfolio ventures poses a strategic dilemma that may influence the effectiveness of signaling. Unfriendly exits may hinder both VCs' interest in helping an IPO venture to receive higher valuations and the reliability of such ties as signal of quality for public investors. The hypothesized relationships are tested on a sample of 86 entrepreneurial ventures in the U.S. Clean

Technology sector that went public on U.S. stock exchanges before 2015. The sample has been selected from the analysis of 1,603 U.S. Cleantech ventures that received a first round of venture capital between 1985 and 2012.

The findings add evidence to the signaling effect of inter-organizational ties with reputable VCs. Specifically, the results indicate that public market's reaction to reputable inter-organizational ties is less positive when the IPO firm shows high levels of insider selling or VCs enforce hostile contractual clauses forcing the public offering of their shares. Overall, this study sheds light on important contingencies that might affect the signaling value of affiliation with reputable partners. By looking at specific characteristics of the relationship, it addresses the call in strategic management literature for more research on the contingent value of signaling via inter-organizational ties (Arikan & Capron, 2010; Gulati & Higgins, 2003; Reuer, Tong, & Wu, 2012). Under conditions of diverging strategic interests, entrepreneurial ventures should reconsider the prospect of obtaining higher IPO valuations thanks to expensive ties with reputable VCs (Hsu, 2004). Ultimately, the ability of such affiliates to positively influence external perceptions is conditional on how committed and aligned they are with a venture's interests.

3.2 Theory and hypotheses

Signaling via ties with reputable VCs

Organizational reputation is the broad public recognition of a firm's quality based on its past performance and outputs (Rindova et al., 2005). It is an important economic characteristic that allows to distinguish and compare between organizations (Barnett & Pollock, 2012; Washington & Zajac, 2005). Firms can benefit from this intangible attribute both directly, as source of competitive advantage to obtain legitimacy and acquire resources, and indirectly, by leveraging their inter-organizational ties with reputable partners (Milgrom & Roberts, 1982; Rindova et al., 2005; Stuart et al., 1999). The reputation of a firm, or that of its inter-organizational ties, is particularly valuable for external parties interested in assessing its value despite information asymmetry. For these external parties, relying on signals of quality that are costly and difficult to imitate, such as a firm's inter-organizational ties with reputable organizations, helps lowering the risks of adverse selection (Hsu, 2004; Shane & Cable, 2002; Spence, 1974; Stuart et al., 1999). Young entrepreneurial ventures are a category of firms particularly concerned by uncertainty and information asymmetry surrounding their valuations by external parties (Baum & Silverman, 2004; Singh et al., 1986). Attributes of an entrepreneurial venture's ties are one of the main sources of information for an external evaluator trying to esteem its value and future potential (Gulati & Higgins, 2003; Stuart et al., 1999). Following Arikan and Capron (2010), I consider inter-organizational ties (or affiliations) those social or business relationships that are formally established by a venture during its life. Extant literature has given two explanations of why a venture's relationships with reputable organizations are a valid signal of its quality. First, reputable ties provide certification because of their accepted ability to discern quality under uncertain conditions (Baum & Oliver, 1992; Carter & Manaster, 1990; Fombrun, 1996; Stuart, 1998). Organizations with high reputation endowments are believed to be cautious in the selection of their exchange partners because of the risk to

dissipate their good reputation (Podolny, 1994; Stuart et al., 1999). For instance, Podolny and Stuart (1995) revealed that inventions in uncertain technological areas were more likely to be spread when they had been previously adopted by prominent organizations. Second, prestigious affiliates may also bring with them substantive resources (e.g. experience, social and human capital, etc.) that can increase a venture's chances of long-term survival and growth (Bygrave & Timmons, 1992; Fischer & Pollock, 2004; Pollock et al., 2010).

Initial public offerings (IPOs) are highly important and non-repeatable events during one organization's life where forms of market failure might happen due to information asymmetry between the IPO firm's insiders and external parties (Pollock, Porac, & Wade, 2004). The two parties might have different information sets on the actual value of the firm leading to imperfections concerning timing, pricing or future consequences of the IPO process (Habib & Ljungqvist, 2001). Moreover, entrepreneurial ventures undergoing the IPO process are typically characterized by limited track-records, financial resources shortly coming to an end and high uncertainty around their future strategic plans (Fischer & Pollock, 2004). When the transformation from private to publicly traded firm happens to quickly in a venture's life then its management may not be ready for the systematic change in strategy needed. For instance, changes with respect to goals, time horizons, managerial flexibility, financial resources deployment and tolerance to performance volatility may be possible sources of risk for a venture's long-term survival (Fischer & Pollock, 2004). Relationships with reputable financial intermediaries are a key aspect to signal quality under these highly uncertain conditions (Grinblatt & Hwang, 1989).

Inter-organizational ties with investment banks underwriting the offer and VCs have a significant impact on public investors' valuations (Barry et al., 1990; Carter & Manaster, 1990; Gompers, 1996; Lee et al., 2011; Lee & Wahal, 2004; Megginson & Weiss, 1991). The mere presence of VC investors in a firm's equity structure has been shown to positively affect the likelihood of going public (Hsu, 2006; Shane & Stuart, 2002) as well as IPO costs and valuations (Barry et al., 1990; Megginson & Weiss, 1991). However, VCs are heterogeneous in terms of reputational capital (Fitza, Matusik, & Mosakowski, 2009; Gompers & Lerner, 2004; Hsu, 2004); in fact they need to continuously enhance their reputations in order to remain competitive in the venture capital sector (Petkova et al., 2014; Sahlman, 1990). Existing studies show that high-reputation VCs have higher chances of bringing their portfolio firms public (Krishnan et al., 2011; Nahata, 2008; Sorensen, 2007) and obtain better valuations at IPO (Krishnan et al., 2011; Lee et al., 2011; Lee & Wahal, 2004; Nahata, 2008; Pollock et al., 2010; Stuart et al., 1999). Furthermore, firms backed by reputable VCs have better long-term performance in terms of post-IPO valuations (Arikan & Capron, 2010; Reuer et al., 2012) and operating results (Lee et al., 2011). I follow extant literature arguing that high-reputation VCs investing in an entrepreneurial venture signal his potential by virtue of their willingness to be associated with the venture (certifying value) and the substantive enhancement in terms of resources that they might bring (substantive value) (Bygrave & Timmons, 1992; Gompers, 1996; Megginson & Weiss, 1991; Pollock et al., 2010). This leads to the baseline hypothesis of this study.

Hypothesis 1: Inter-organizational ties with reputable VCs increase the valuation of entrepreneurial ventures at IPO

However, as in most of the previously listed studies, Hypothesis 1 assumes that the signaling effect of inter-organizational ties with reputable VCs is uniform at all times. It is not clear yet under which specific circumstances an entrepreneurial venture undergoing an IPO may derive greater or reduced benefits from affiliation with reputable VCs. For instance, we already know that public investors may place greater attention to this type of signals in situations of higher market and firm-related uncertainty (Arikan & Capron, 2010; Gulati & Higgins, 2003; Reuer et al., 2012; Stuart et al., 1999). Furthermore, reputable affiliates matter more in the valuation process when the valued firm has less experience (Sanders & Boivie, 2004; Stuart et al., 1999) or completes the offer during a “cold market” period, when pricing of the issues is more complicated (Gulati & Higgins, 2003). Finally, contingencies of ties’ reputation upon factors like timing of VC involvement in a venture, VCs’ industry-specific experience and geographic distance between the venture and its investors have been also explored (Lee et al., 2011). Some empirical studies have, therefore, started to shed light on the various types of contingencies that affect signaling via inter-organizational relationships. I argue in what follows that the nature of the relationship between the venture and its VC ties deserves greater attention in order to clarify under which specific circumstances reputable ties can be considered an effective signal of quality.

Alignment of strategic interests

The decision to list a VC-backed venture on the public market is a setting that might give rise to conflicting views between the parties involved (Amit et al., 1990; Gompers, 1995). On the one side, VCs are known for not being “patient and brave” (Bygrave & Timmons, 1992). Their strategies as equity owners are ultimately driven by the necessity to generate quick returns for the investors in their funds. They see in the IPO a unique and natural opportunity to liquidate their equity investments (Bygrave & Timmons, 1992; Lerner, 1994). Moreover, the ability to regularly bring portfolio ventures public is a sign of grandstanding in the eyes of limited partners that influences VC firms’ future performances and fundraising activity (Gompers & Lerner, 2004). For this reason, VCs are incentivized to maintain good relationships with market participants (e.g. underwriters, accountants, etc.) (Fund, Pollock, Baker, & Wowak, 2008; Gompers, 1996; Lee et al., 2011; Lee & Wahal, 2004). On the other side, entrepreneurs are typically characterized by long-term views in their strategies regarding their ventures. They might be reluctant to the idea of a premature IPO if they believe that the firm needs more time to mature and prove its viability before being exposed to the public markets (Hellmann, 2000). Indeed, the change from private to publicly traded firm necessitates a systemic change in strategies and organizational practices as new types of shareholders bring in different objectives and time-horizon constraints (Fischer & Pollock, 2004). The decision of when to take an entrepreneurial venture public is not always taken by mutual agreement of these two parties. Indeed, there is anecdotal evidence showing that venture capitalists might force their portfolio ventures to publicly list their shares when the entrepreneurs are reluctant to take their companies public. Venture capitalists tend to protect themselves from such inconvenient situations through the stipulation of legal clauses (Cable & Shane, 1997; Gompers & Lerner, 2004). The typical contractual solutions adopted include the use of convertible securities and the implementation of demand registration rights (Hellmann, 2000). The second type of contractual provisions

refers to liquidity agreements that are stipulated at the moment of an equity investment round to facilitate shareholders' conversion of their stock into cash. Particularly, demand registration rights enable, under certain conditions, VCs to force a company to register their shares for sale to the public (Allison, Hall, McShea, VanYe, & LLP., 2008). Because they might influence a firm's cost of raising future equity, they are carefully negotiated between parties in the contracting phase. Specifically, the venture's management usually tries to limit the number of such rights, asks for the possibility to delay their enforcement (usually until 12 months after the IPO) and demands guarantees on the number of shares offered and amount of proceeds generated under these terms.

I posit that the enforcement of demand registration rights during an IPO, which enables VCs to force the liquidation of their shares, is a sign of misalignment of strategic interests between the entrepreneurial venture and its VCs. The effectiveness of inter-organizational ties with reputable VCs as signals of quality will be attenuated if the affiliation relationship is conflictual in the eyes of public investors. Moreover, if a venture is forced, through the enforcement of demand registration rights, to register VCs' securities with the Security and Exchange Commission (SEC), these shares will be issued along with the new IPO shares at the offer price. Consequently, VCs' incentive to signal a venture's quality and increase its perceived value will be lower because of the risk of 'leaving money on the table' due to an underpriced offer (i.e. a situation where the final share price is higher than offer price). Thus, I suggest.

***Hypothesis 2:** The positive relationship between inter-organizational ties with reputable VCs and the IPO valuation is attenuated for entrepreneurial ventures forced to register VCs' shares via demand registration rights*

There is evidence showing that, in their quest for different types of information to reduce asymmetries and quantify differences across firms, public investors do not only look at organizational attributes (e.g. reputation of partners) but they also resort on other signals such as corporate governance characteristics or patents (Heeley, Matusik, & Jain, 2007; Hsu & Ziedonis, 2013; Sanders & Boivie, 2004). The continued commitment of a firm's insiders after the IPO is an example of alternative indicator which is directly observable by public investors and presumably related to a firm's quality (Sanders & Boivie, 2004). A large proportion of shares sold by existing shareholders might be externally perceived as a negative signal as it indicates a general lack of confidence in a venture long-term value. All other conditions being equal (e.g. regulatory duties due to lock-up period, etc.), if VCs or other insiders decide to sell a large portion of their equity stock in the IPO this might imply that a firm's value has reached its expected peak and that they are not committed to the firm anymore. The negative signal sent to public investors might compromise the IPO process to such an extent that insiders tend to conceal and confound this practice by adopting parallel strategies (Ang & Brau, 2003). In the first place, they initially underreport the number of shares sold in the offer in the first versions of the prospectus to then report the actual numbers in less visible amendments just before the offer. In the second place, when these types of concealing strategies occur, they disproportionately increase the ratio of secondary to primary shares offered and commit to longer lock-up periods to confound external judgments (Ang & Brau, 2003).

Thus, insider selling is another sign of misalignment in strategic interests between the venture entrepreneur and its equity investors. When it occurs, the latter will be less incentivized to use their own reputation as signal of quality to influence external investors. On the contrary, since the Rule 144 of the Securities Act limits the amount of shares that insiders can sell at IPO in order to not undermine the new issuance of stock, the only way they have to liquidate their stock ownerships is often through the offer of their secondary shares, along with the new shares issued, at the IPO offer price. These secondary shares, conditional upon registration rights agreed in the contracting phase (discussed in the previous section of the paper), need to be registered before the offer. The SEC does not put any limit on the amount of shares insiders can offer in this way. When this is the case (i.e. Rule 144 limitations binding), insiders do not have any incentive to positively influence the IPO firm's first-day valuation because this would only increase the level of underpricing, indicating a wealth loss for them.

In summary, different signals combine in helping public investors reduce their uncertainty about valuations of IPO firms. In order to assess the true benefits that entrepreneurial ventures can derive from inter-organizational ties with reputable organizations it is important to look at the long-term alignment of strategic interests between a venture's management and its main shareholders. Insider selling is an example of a visible sign of misalignment of strategic interests between the two parties. I therefore posit that.

***Hypothesis 3:** The positive relationship between inter-organizational ties with reputable VCs and the IPO valuation is attenuated for entrepreneurial ventures with high proportion of equity sold by executive officers and directors*

***Hypothesis 4:** The positive relationship between inter-organizational ties with reputable VCs and the IPO valuation is attenuated for entrepreneurial ventures with high proportion of equity sold by venture capitalists*

3.3 Method

Research Setting: The U.S. Clean Technology Sector

The hypotheses are tested on a sample of VC-backed clean technology entrepreneurial ventures. Clean technologies ("Cleantech") encompass all products, processes or services that reduce waste and require as few non-renewable resources as possible (Pernick & Wilder, 2008). The choice of this specific sector was justified by different reasons. First, it is a sector where VC activity during the study period has been intense due to policy and market approval for long-term plans to change global energy consumption habits. The successful private and public market financing of cleantech entrepreneurial ventures is vital in order to increase future access to capital for renewable energy generation assets. This has motivated policy makers to devote particular attention in attracting high investment amounts in this capital-intensive sector (Inderst, Kaminker, & Stewart, 2012). Nevertheless, the intense VC activity in the sector has not corresponded to a likewise level of successful exits via IPOs (Ghosh & Nanda, 2010). The difficulties that VC-backed ventures in this sector encounter when trying to bridge the funding gap between venture capital and subsequent forms of late-stage

financing (Moore & Wüstenhagen, 2004; Wüstenhagen & Teppo, 2006), make the use of signals to influence market acceptance particularly valuable for VCs that want to remain competitive in this sector. Most entrepreneurial ventures in the sector have asked VCs to fund their research and development for a market that was frequently non-existent yet. Among those that have reached a pre-commercial testing phase, with a working prototype of the technology ready for commercialization, most have failed for the drying up of venture capital and the inability to finance the large-scale development phase (Ghosh & Nanda, 2010). Some of these ventures have tried to file for an IPO with very little or no revenues. A prominent example is the electric vehicle company Tesla that reported quarter losses of \$38.5 million at the moment of its IPO. In such context, considering also the high competition from the big oil and energy companies, public investors have to take even more care when deciding where to invest and signals of quality might support their decisions. Second, the use of signals like affiliation with reputable partners is especially important in this field given that venture's success is hard to predict because strictly related to controvert and ambiguous technologies (Petkova et al., 2014). Given the high uncertainty and novelty of the sector it is also imaginable to observe with reasonable frequency VCs' protection strategies like the contractual stipulation of demand registration rights. Finally, venture-specific uncertainty is particularly high for public investors compared to other sectors where judgements about the viability of business models are not heavily influenced by unpredictable future policies and regulations. This makes the endorsement effect from inter-organizational relationships particularly valuable to observers in this realm.

Sample and Data

The initial sample was drawn from Securities Data Corporation's *VentureXpert* database owned by Thomson Financial. It included all VC-backed entrepreneurial ventures in the U.S. Clean Technology sector that received the first round of venture capital between 1985 and 2012. To restrict the attention on entrepreneurial ventures, only those receiving at least one VC financing round in the first 10 years of life were selected. Of the 1,603 ventures, 86 went public on U.S. stock exchanges between 1990 and 2015. Focusing on U.S. IPOs only, enables the exclusion of some heterogeneity concerns tied to idiosyncratic financial conditions in international markets. The "Company Technology Application" classification provided by Thomson Reuters was used to select entrepreneurial ventures associated with the development and commercialization of clean technologies. I verified ventures' categorizations in the cleantech sector by checking their presence in the *Cleantech Group's i3* and *Bloomberg New Energy Finance* (BNEF) platforms, which are specific database containing information on cleantech VC and private equity deals. About the 50 percent of companies in the sample were active in the production and distribution of energy generated from renewable sources or in services related to pollution control and recycling. The rest of the sample was divided among diverse sub-sectors such as energy storage and efficiency, e-mobility or sustainable chemistry. IPO listings were drawn from the Securities Data Corporation's *Global New Issues* and the *Cleantech Group's i3* databases, information on VC funding rounds were obtained from Securities Data Corporation's *VentureXpert* and integrated with data from *CrunchBase* database when missing. Accounting and market valuations data were collected from *Compustat* and *CRSP* databases. All the other relevant variables were hand-collected from firm's IPO

prospectuses. Following previous research (Chen et al., 2008; Pollock et al., 2010), all IPOs that were spin-offs or carve-outs from corporations were excluded to ensure that I was examining only independent entrepreneurial ventures. From the total of 86 U.S. IPOs of cleantech VC-backed ventures, complete information from prospectuses, financial performance and composition of the investment syndicate over time was available for 69 VC-backed IPOs¹⁸.

Dependent Variable

IPO Valuation. Consistent with previous research (Megginson & Weiss, 1991; Pollock et al., 2010), IPO success was measured as the natural logarithm of a firm's market capitalization at the end of the first day of trading. Market capitalization was defined as the share price at the end of first trading day multiplied by the number of shares outstanding after the IPO¹⁹.

Independent Variables

VCs Reputation. VC reputation was measured using the composite index developed and validated by Lee et al. (2011). This index captures both the perceived quality and prominence dimensions of reputation indicated by Rindova et al. (2005) and has been considered one of the most comprehensive measure of VC reputation (Petkova et al., 2014). The index is based on six indicators of VCs' past actions and performance aiming at capturing the two dimensions of reputation identified by Rindova et al. (2005): quality and prominence. Prominence of a VC firm is related to its visibility and, thus, to the intensity of its investment activity (Rindova et al., 2007). It is measured by the number of ventures and total amount of dollars invested by a VC firm in the five years prior to a given year. Quality and distinctiveness of a VC firm's activity is gauged by its age, the average of the total amount of dollars under management, the number of funds raised and the number of portfolio ventures taken to IPO over the prior five years²⁰. Each index's item is measured with a rolling 5-years window prior to the focal year and the final index has been re-scaled on a 100-point scale for each year in the sample to ensure comparability of the index across years. Since a portfolio venture is typically invested in by more than one VC in each funding round and the composition of the VC syndicate changes over time, I computed for each IPO firm the average of the reputation score for all the VCs still mentioned in the IPO prospectus as part of the ownership structure of the firm²¹. This measure allows accounting for the effect that multiple high-reputation VCs can have on a venture's exit. Simply examining the prestige of the lead VC in the syndicate, an approach used in prior literature (Nahata, 2008), does not account for the possibility that a venture could benefit from the reputation of VCs that do not have a lead role but might still have significant decision making power within a syndicate.

¹⁸ Information on the exact number of shares offered by VCs – necessary to test Hypothesis 4 – was available for only 62 of the 69 IPO firms. For 7 firms it was not possible to infer the equity stock owned by VCs before and after the offer

¹⁹ To ensure reliability of measures, share prices and number of shares outstanding after the offer were cross-checked between SDC Global new issues and CRSP database

²⁰ Results remained unchanged when taking the total amounts of each item (except VC Age) over the 5 years prior to the focal year instead of the averages.

²¹ Results were generally consistent when measuring reputation of VCs investing in the first or last round before the IPO.

Demand Registration Rights. A dichotomous variable taking the value of one if enforcement of “demand registration rights” was mentioned in the prospectus section related to the description of the capital stock, and 0 otherwise, was created. Demand registration rights enable investors to force a venture to register their shares for sale to the public and can affect the future cost of raising capital of a company.

Insider selling. I followed Ang and Brau (2003) and defined “insiders” as the owners of secondary shares, whose sales go directly to the selling shareholders; as opposed to net proceed from sales of primary shares that go to the company. Specifically, I counted the percentage of shares for which sale the company did not receive any of the net proceeds and divided between shares owned by executive officers and directors and shares owned by VCs. Equity sold by executive officers and directors was measured as the percentage of company stock sold by executives and directors owning more than 5% of the company total stock at the IPO. If an executive was affiliated with a venture capital firm, his or her stock ownership was included in the computation of the equity sold by VCs, which was measured as the percentage of company stock sold by VCs during the IPO process (Sanders & Boivie, 2004).

Control Variables

To account for other factors that might systematically affect IPO firms’ market valuation, I included several control variables²². *Underwriters reputation* was measured using the well-known Carter and Manaster (C-M) ranking system (Carter, Dark, & Singh, 1998; Carter & Manaster, 1990; Pollock et al., 2010). The measures are based on analyses of investment banks’ positions in the “tombstone” announcements for IPOs. I used the IPO prospectuses to identify the lead and co-managing underwriters for each IPO. Reputation scores were available for all the underwriters involved in the IPOs of the sample. Consistent with the computation of the VC Reputation measure, for each IPO firm the average reputation score of involved underwriters was computed. The effect of the overall *IPO market activity*, which might influence IPO valuations and public investors’ need to rely on signals of quality, was computed as the natural logarithm of the monthly number of IPOs²³. To control for restrictions on VCs’ ability to sell their shares at IPO, the natural logarithm of the number of days between the IPO and the lock-up expiration date was included (*Lock-up period*). Furthermore, I followed prior research and included several measures to control for firm’s quality, scale and intangibility of resources (Arikan & Capron, 2010; Gulati & Higgins, 2003; Sanders & Boivie, 2004). To this end, I included the *Number of employees at IPO, pre-IPO sales* (annual net revenues in thousands of dollars in the year prior to the IPO), *pre-IPO profitability* (EBITDA in thousands of dollars in the year prior to the IPO) and *Tobin’s Q* (the market value of all financial claims against the firm divided by the book value of total assets). Exploiting fine-grinded information from prospectuses I also included alternative measures that might help ruling out possible concerns related to the effect of underlying venture quality (Chen et al., 2008; Fischer & Pollock, 2004; Pollock et al., 2010; Pollock & Rindova, 2003). For this reason, I included: *Average TMT tenure*, as the mean number of years that top management team’s members listed in the IPO

²² Given the small size of the final sample, the number of variables included as controls was limited, compared to those available from data collection, to avoid limiting degrees of freedom in the regression analysis

²³ Data on number of initial public offerings were drawn from Jay Ritter’s IPO database. Source: <http://bear.warrington.ufl.edu/ritter/ipodata.htm>

prospectus had been with the company at the IPO date; *Average TMT age*, as the mean age of top management team's members listed in the IPO prospectus at the IPO date; *Founder survived* as a dichotomous variable, coded one if at least one of the founders survived until the IPO and 0 otherwise; *Founder-CEO* as a dichotomous variable coded one if one of the founders was the CEO at the IPO and 0 otherwise; *CEO seats in other boards* as a dichotomous variable coded one if the CEO seats also in other organizations' boards at the time of the IPO and 0 otherwise; and *Directors and executives hired in the IPO year* as the count of the number of directors and executives hired in the year leading to the IPO. Finally, it is also important to control for the use that the IPO venture propose to do of the proceeds. Because using the IPO proceeds to repay existing debt might be seen as a negative signal of a company future innovation and growth prospects, I included the dichotomous variable *Proceeds used to re-pay debt* that signals when the repayment of existing debt lines is the only motivation mentioned in the IPO prospectus section dedicated to the use of proceeds. *Year dummies* were included to control for unobservable time effects related to the year the venture goes public.

Model Specifications

In general, sample selection might cause biased estimates due to unobserved factors if the criteria chosen to select the sample are not independent of the outcome variable. In the case of this paper, since entrepreneurial ventures going public are not randomly selected from the population of VC-backed ventures, the results that we would obtain using an OLS regression would suffer from selection bias. I used the Heckman two-stage approach to correct for such potential selection bias (Heckman, 1979). In the first-stage (Gulati & Higgins, 2003; Lee et al., 2011), the likelihood of IPO was modeled using the all sample of VC-Backed entrepreneurial ventures that were active in the US clean technology sector between 1985 and 2012. The following variables were used to predict the likelihood that a venture would go public: the total number of VC firms investing in the venture, the total number of VC rounds received, the average number of deals made by VC firms investing in the venture, the average number of funds raised by VC firms investing in the venture and four founding year dummies reflecting whether the venture was founded before 1990 (the excluded category), between 1990 and 1999, between 2000 and 2008, or after 2008. Estimates from the parameters of the first-stage model were then incorporated into a second-stage regression to predict IPO valuation.

3.4 Results

The summary statistics and correlations between the main variables are provided in Table 3.1 and 3.2. The correlation matrix presented in Table 3.2 indicates that the level of pre-IPO sales is positively correlated with the number of employees at IPO, as they can both be considered proxies of a firm's size. Moreover, the hiring of executives in the year preceding an IPO seems to be a practice positively correlated with the first-day valuation.

Table 3.1: Descriptive statistics of main variables

Variable	Obs	Mean	Std. Dev.	Min	Max
IPO Valuation	86	19.69	1.32	16.52	22.21
VC Reputation	83	17.90	15.71	0.65	69.67
Underwriters reputation	86	7.40	2.05	0.00	9.00
Number of employees at IPO	86	2.05	8.01	0.00	71.60
IPO market activity	86	3.05	0.87	0.69	4.33
Lock-up period	86	5.22	0.20	4.50	6.59
TobinQ	82	2.32	1.59	0.44	9.12
pre-IPO sales	82	656.22	1591.04	0.00	8264.90
pre-IPO profitability	82	119.01	362.39	-78.57	2630.60
Founder survived	75	0.49	0.50	0.00	1.00
Founder-CEO	75	0.29	0.46	0.00	1.00
CEO seats in other boards	75	0.39	0.49	0.00	1.00
Average TMT age	75	50.44	3.96	36.73	59.14
Average TMT tenure	75	3.97	2.37	0.65	11.77
Directors and executives hired in the IPO year	75	3.89	3.06	0.00	14.00
Proceeds used to re-pay debt	86	0.45	0.50	0.00	1.00
Demand Registration Rights	75	0.48	0.50	0.00	1.00
Equity sold by executive officers and directors	86	4.22	14.45	0.00	100.00
Equity sold by venture capitalists	67	28.42	14.24	0.00	67.92
Total number of VCs	1603	3.32	3.23	1.00	25.00
Total number of investment rounds	1603	2.96	2.76	1.00	19.00
Average number of deals made by VCs	1603	1848.92	3341.06	1.00	22757.00
Average number of funds raised by VCs	1602	8.80	13.28	1.00	137.00

Table 3.2: Correlations between main variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1 IPO Valuation	1																						
2 VC Reputation	0.1675	1																					
3 Underwriters reputation	0.2576	0.3694	1																				
4 Number of employees at IPO	0.0346	0.1211	-0.0545	0.148	1																		
5 IPO market activity	-0.2631	0.0425	-0.1201	-0.0928	0.2337	1																	
6 Lock-up period	0.109	0.034	0.0665	0.012	-0.0003	-0.0899	1																
7 TobinQ	-0.0058	-0.1383	-0.1229	0.6523	0.0049	0.015	-0.2788	1															
8 pre-IPO sales	0.3043	0.2906	0.1486	0.5604	0.0261	0.0138	-0.2308	0.696	1														
9 Founders survived	0.3059	0.2987	-0.3448	0.0602	0.6824	-0.066	0.2532	-0.1062	-0.0081	1													
10 Founder-CEO	-0.1044	-0.0779	-0.1532	-0.144	-0.152	-0.2155	0.1027	-0.2478	-0.2124	0.5777	1												
11 CEO seats in other boards	0.1636	-0.0299	0.0906	-0.0739	-0.307	0.0642	-0.0236	-0.0193	0.081	-0.0343	0.0658	1											
12 Average TMT age	-0.1432	-0.1803	-0.2009	-0.2405	-0.1541	0.0367	-0.1831	-0.1147	-0.001	-0.0566	0.0637	0.0508	1										
13 Average TMT tenure	0.4172	0.2018	0.1491	-0.0986	0.1151	0.0131	-0.0715	0.0566	0.1296	-0.0288	-0.0735	-0.0372	-0.1013	1									
14 Directors and executives hired in the IPO year	-0.057	0.0078	0.007	-0.1409	-0.134	0.023	0.0235	-0.0567	0.0753	-0.2535	-0.1409	0.1721	-0.1912	-0.459	1								
15 Proceeds used to repay debt	0.2972	0.0156	-0.0697	0.1614	0.0886	0.1471	-0.1515	0.0858	0.0214	-0.0673	-0.0735	0.1721	0.0146	-0.2364	0.0248	1							
16 Demand Registration Rights	0.2972	0.0078	0.007	-0.1409	-0.134	0.023	0.0235	-0.0567	0.0753	-0.2535	-0.1409	0.1721	0.0146	-0.2364	0.0248	0.2218	1						
17 Equity sold by venture capitalists	-0.2462	-0.0058	-0.1003	-0.0344	0.0384	0.0073	-0.1709	0.5577	0.6785	-0.0379	-0.0688	-0.1314	-0.0389	0.0578	0.0259	0.0259	0.0259	1					
18 Equity sold by executive officers and directors	0.0339	-0.2069	0.0337	-0.1589	-0.0234	-0.1785	0.3904	-0.2012	0.0075	0.0757	0.018	-0.1373	-0.0652	0.0248	-0.1731	-0.0207	-0.1791	0.1018	1				
19 Total number of VCs	0.0533	-0.0881	-0.1258	-0.1736	-0.083	-0.166	0.4881	-0.2161	0.1792	0.1548	0.0778	0.1566	0.0451	0.005	-0.0563	-0.2512	0.143	-0.0842	-0.2367	1			
20 Total number of investment rounds	0.0604	0.0024	0.0923	-0.0987	-0.0545	0.1607	0.0213	-0.7248	-0.0937	0.2346	0.0691	0.1943	0.0451	-0.1636	0.0177	-0.2512	0.143	-0.0842	-0.3146	0.6486	1		
21 Average number of deals made by VCs	0.2384	0.4946	0.3401	0.086	0.0348	0.0094	-0.1906	0.308	0.3116	-0.0477	0.0857	0.1943	-0.1461	-0.2988	0.186	-0.0453	0.0676	-0.0335	-0.1203	-0.0696	0.0334	1	
22 Average number of funds raised by VCs	0.1675	0.3694	0.151	0.0545	0.148	-0.0003	-0.0899	0.696	0.3116	-0.2706	-0.2243	0.0692	-0.1488	0.272	-0.0874	0.1187	-0.1433	0.0298	0.0014	-0.1761	-0.2484	-0.182	1
23																							

Table 3.3 presents the results from the two-stage Heckman selection models in which the first-stage regression (model 1) predicts the likelihood that a venture goes public and the second-stage (models 2-5) predict the valuation received at IPO. Model 2 includes the main effects of the controls and explanatory variable to test the first hypothesis. In models 3 to 5 the interaction terms are included to test the remaining hypotheses.

Table 3.3: Results of Heckman regressions on the effects of VC reputation on IPO valuation

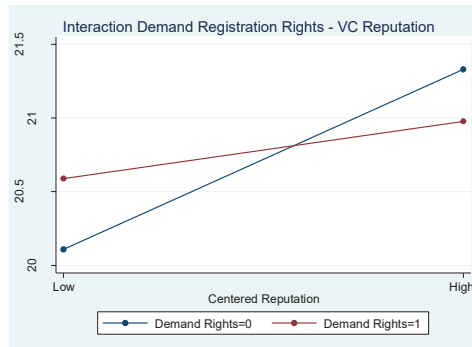
VARIABLES	Model 1	Model 2	Model 3	Model 4	Model 5
SECOND STAGE					
Underwriters reputation		0.225*** (0.065)	0.242*** (0.062)	0.206*** (0.060)	0.218** (0.070)
Number of employees at IPO		0.008 (0.016)	0.006 (0.016)	-0.039+ (0.021)	-0.026 (0.017)
IPO market activity		0.573** (0.190)	0.599*** (0.182)	0.501** (0.177)	0.690*** (0.191)
Lock-up period		0.758 (0.638)	0.851 (0.611)	0.734 (0.591)	1.633+ (0.966)
Tobin's Q		0.059 (0.060)	0.056 (0.057)	0.075 (0.056)	0.135+ (0.074)
pre-IPO sales		0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000** (0.000)
pre-IPO profitability		-0.000 (0.001)	-0.001 (0.001)	0.002* (0.001)	-0.001 (0.001)
Founder survived		-0.176 (0.272)	-0.269 (0.262)	0.003 (0.258)	-0.524+ (0.286)
Founder-CEO		0.160 (0.253)	0.069 (0.247)	0.056 (0.237)	0.327 (0.259)
CEO seats in other boards		0.108 (0.179)	0.177 (0.174)	0.233 (0.171)	0.131 (0.174)
Average TMT age		-0.046+ (0.026)	-0.057* (0.025)	-0.064** (0.024)	-0.038 (0.027)
Average TMT tenure		-0.051 (0.044)	-0.043 (0.042)	-0.044 (0.041)	-0.080+ (0.047)
Directors and executives hired in the IPO year		0.102*** (0.030)	0.095** (0.029)	0.080** (0.028)	0.106*** (0.029)
Proceeds used to pay debt		-0.569** (0.192)	-0.639*** (0.187)	-0.639*** (0.179)	-0.778*** (0.204)
Equity sold by executive officers and directors		0.010 (0.009)	0.011 (0.009)	0.012 (0.009)	-0.001 (0.010)
Demand Registration Rights		0.014 (0.208)	0.552+ (0.308)	0.278 (0.210)	0.208 (0.241)
Equity sold by venture capitalists					0.009 (0.009)
VC Reputation		0.028*** (0.007)	0.040*** (0.009)	0.021** (0.007)	0.062*** (0.015)
VC Reputation X Demand Registration Rights			-0.027* (0.012)		
VC Reputation X Equity sold by executive officers and directors				-0.001*** (0.000)	
VC Reputation X Equity sold by venture capitalists					-0.001** (0.000)
FIRST STAGE					
Total number of VCs		0.074*** (0.021)			
Total number of investment rounds		0.005 (0.026)			
Average number of deals made by VCs		0.000* (0.000)			
Average number of funds raised by VCs		0.011*** (0.003)			
FoundedYearRange (1990-1999)		-0.119 (0.166)			
FoundedYearRange (2000-2008)		-0.420** (0.149)			
FoundedYearRange (After 2008)		-0.504* (0.217)			
Year dummies		No	Yes	Yes	Yes
Correction for Selection Bias (λ)			-0.712* (0.315)	-0.526+ (0.307)	-0.686* (0.293)
Constant		-1.950*** (0.148)	14.772*** (3.906)	14.048*** (3.739)	15.954*** (3.638)
Observations		1,586	1,586	1,586	1,579
IPO Firms		69	69	69	62
Wald Chi-square		302.2***	302.2***	338.4***	366.5***
Standard errors in parentheses					

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

The first-stage model was highly predictive. *Total number of investment rounds* was the only not significant variable among the selected predictors of the IPO likelihood. With regard to the second-stage models, results show that having reputable investment banks among those underwriting the offer significantly increases the likelihood of receiving a higher IPO valuation ($p < 0.001$). IPO market conditions ($p < 0.001$) and “window-dressing” activities (i.e. the hiring of new executives in the year before the offer) ($p < 0.001$) are two important factors positively influencing public investors’ valuations (Ball et al., 2011; Chen et al., 2008; Derrien, 2005; Fischer & Pollock, 2004; Gulati & Higgins, 2003). Moreover, ventures using the IPO proceeds to repay existing debt are penalized by public markets in their valuations ($p < 0.001$). In some of the models the results show also a significant negative effect of management teams’ age on IPO valuations. Contrary to the theorized effects of negative signals such as insider selling, I do not find evidence of a negative effect of the moderator variables (i.e. *Demand Registration Rights*, *Equity sold by executive officers and directors* and *Equity sold by venture capitalists*) on the valuation that a venture receives at IPO. From a careful analysis of extant literature it emerged that the only paper explicitly testing for the main effect of VC sell-off at IPOs found a weak effect on firms’ valuations (Sanders & Boivie, 2004). The paper also shows that the negative signaling effect of insider selling becomes stronger when looking longitudinally at valuations in the years after an IPO.

Hypothesis 1 predicted that ties with highly reputable VCs increase valuations that entrepreneurial ventures receive at IPO. Model 2 in Table 3.3 tests this hypothesis. The findings reveal a positive and strongly significant effect of VC Reputation on the IPO valuation ($\beta = 0.028$, $p\text{-value} < 0.001$), providing support for the baseline hypothesis of this study. The sign and significance level of the coefficient of VC Reputation remains unaffected also after adding the interaction terms (models 3-5). The results support also Hypothesis 2, suggesting that the positive effect of affiliation with highly reputable VCs on IPO valuations will be attenuated when demand registration rights are enforced. Model 3 in Table 3.3 shows that the interaction effect between VC Reputation and Demand Registration Rights is negative and statistically significant ($\beta = -0.027$, $p\text{-value} < 0.05$). The test of equality of coefficients confirmed, at the 5% significance level, the difference of VC Reputation coefficients when demand registration rights are enforced or not. To illustrate the magnitude of the decline in the signaling effect of reputation when these contractual clauses are enforced, Figure 3.4 plots the relationships between VC reputation and IPO valuation for entrepreneurial ventures going public with and without these clauses. As the figure shows, an increase in the level of reputation of a VC syndicate has a greater impact on IPO valuations if there is no enforcement of demand registration rights as per contractual agreement (blue line).

Figure 3.4: Interaction Demand Registration Rights – VC Reputation



Hypothesis 3 and 4 predicted that insider selling from VCs and executives, as sign of misalignment of interests between parties in an IPO firm, is a negative signal that negatively moderates the positive effect of VC Reputation on IPO valuation. The negative and significant interactions of VC Reputation with the percentages of equity sold by executive officers and directors ($\beta=-0.001$, $p\text{-value}<0.001$) and VCs ($\beta=-0.001$, $p\text{-value}<0.01$) in models 4 and 5 support to the two hypotheses. The tests of difference of coefficients confirmed the significance of these results at the 1% level of confidence. Representations of these results are plotted in Figures 3.5 and 3.6. Variables have been mean-centered to facilitate the visual interpretation of the graphs.

Figure 3.5: Interaction Equity Sold by Executives and Directors – VC Reputation

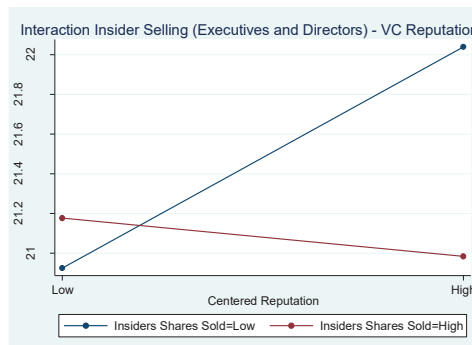
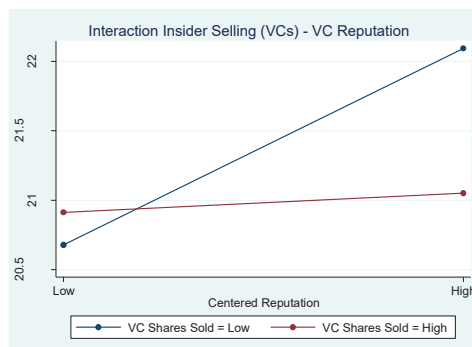


Figure 3.6: Interaction Equity Sold by VCs – VC Reputation



Entrepreneurial ventures characterized by large sales of insider shares in an IPO (red lines in both graphs) convey a negative signal to the public market that offsets any benefit from inter-organizational ties with reputable organizations. These findings would confirm that connections with highly reputable affiliates impact IPO success especially when strategic interests of the two parts are aligned.

3.5 Discussion

This study examines under which circumstances inter-organizational ties with reputable organizations influence the external valuations that entrepreneurial ventures receive by public investors at IPO events. The analysis of a sample of cleantech VC-backed IPOs provides support to extant research showing that venture capitalists are important financial intermediaries whose reputational capital positively affects IPO firms' success (Gulati & Higgins, 2003; Lee et al., 2011; Nahata, 2008; Stuart et al., 1999). I find that entrepreneurial ventures affiliated with reputable VCs receive better valuations at IPO when there is alignment of strategic interests between the entrepreneurs and the VC investors. This finding is supported by the negative moderation that practices like insider selling and enforcement of hostile contractual clauses have on the benefits of signaling via reputable inter-organizational ties. I do not find evidence of a direct effect of these negative signals on IPO valuations. On the one hand, public markets may need time to negatively discount insider selling signals as pointed out by the results of Sanders and Boivie (2004), showing that the negative effect of VC selling on firms' valuations become stronger in the years after an IPO. On the other hand, the lack of direct effects of the moderators might indicate that discordant views between VCs and entrepreneurs are difficult to assess for external investors. Conflictual relationships might nevertheless influence VCs' willingness to use their reputation to signal a firm's quality and increase its valuation at IPO.

This paper advances recent research on the contingent value of inter-organizational relationships by showing that external parties that estimate an entrepreneurial venture's quality in situations of asymmetric information, do not only look at the existence of ties with reputable partners, but also at the nature of these ties. Taken together, the findings of this study indicate that the beneficial effects from reputable affiliations are not uniform at all time but are rather contingent upon characteristics of the relationship. In circumstances characterized by long-term misalignment of interests between an entrepreneurial venture and its reputable affiliates, the emergence of conflicting situations might undermine the transfer of reputational capital as well as the inclination to get it across to external parties. This also suggests that positive signals might sometimes be concealed by signals that the market perceives as negative (e.g. insider selling). Other studies have proposed alternative signals to solve possible adverse selection problems (Dewally & Ederington, 2006; Sanders & Boivie, 2004). Future studies might further examine the substitution or complementary effect between different categories of signals that IPO firms might exploit. This paper also extends prior research on strategic interests and incentives of parties involved in entrepreneurial finance transactions (Arthurs, Hoskisson, Busenitz, & Johnson, 2008; Hsu, 2004; Stuart et al., 1999). The findings show that alignment of strategic interests between an entrepreneurial venture's management and its VC investors is a necessary condition to enhance the venture's performances (Milgrom & Roberts, 1982; Spence, 1974). The results suggest that being

affiliated with reputable VCs at IPO events is particularly valuable for entrepreneurial ventures when these VCs are committed in keeping their shares after the IPO and if they did not negotiated stringent liquidity agreements with the venture. On the contrary, when VCs or other executives take advantage of the IPO event to exit from a venture by offering large amount of their secondary shares and when these offers are enforced through demand registration rights, the effect of VC reputation on the firm valuation is attenuated. The study has also some managerial implications. It suggests that investors infer the quality of IPO firms not only by looking at prominence of their ties but also weighing their decisions based on idiosyncratic characteristics of these ties. Private entrepreneurial ventures receiving early-stage financing by reputable VCs and often accepting lower valuations in exchange, should be cautious when contracting demand registration rights and clauses that facilitate insider selling strategies at IPO because they might severely affect their performances.

Limitations and Future Research

There are several limitations to this study that may represent an opportunity for future research avenues. First, although I control for the bias associated with the fact that quality of ventures reaching an IPO is on average higher than other VC-backed ventures, other endogeneity issues may affect the results of this paper. When the explanatory variables are not exogenous they might correlate with the error term of the dependent variable, leading to inconsistent estimates. Specifically, the main concern is related to omitted common causes that influence the dependent variable and are not orthogonal to the regressors. In this specific case, the intrinsic quality of a venture might both influence VC Reputation, because when faced with multiple offers entrepreneurial ventures are more likely to sell their equity stakes to reputable VCs (Hsu, 2004), and engender higher exit valuations. There is no evidence demonstrating that reputable VCs have informational advantages that make them better at “picking winners” (Sorensen, 2007). This is confirmed by the fact that the percentage of ventures that turn out to be “home-run” successes, generating returns that make a whole fund’s portfolio successful, is very limited for all categories of VCs (Lee et al., 2011). Nevertheless, extant research has shown that experienced VCs besides adding value through their interaction with a venture over time, are also better at “sorting”, that is the ability to attract higher quality ventures (Hsu, 2004; Sorensen, 2007). Therefore, the explanatory variable VC Reputation becomes endogenous when sorting drives investment decisions based on venture’s dimensions that are unobserved in the data. In this case, the error term becomes positively correlated with VC Reputation leading to inconsistent estimates that are biased upward. Moreover, unobservable factors related to a venture quality might cause similar endogeneity concerns for the other regressors in the model such as insiders selling or investors’ enforcement of demand registration rights. Although I have tried to control for variables that may be considered proxies of a venture's intrinsic quality (e.g. sales turnover, profitability, number of employees, etc.), the ability to purge the estimates from possible biases is complicated by the lack of information on intangible ventures’ qualities that influence investors decisions (e.g. business model uncertainty, perceptions about the founding teams, perceived competition treats, etc.) (Kaplan & Strömberg, 2004). One of the recommended solutions to this type of endogeneity problems is to estimate the model using instrumental variables that are independent of the error term but related to the endogenous variables. 2SLS models allow to use the portion of variance that an

instrument predicts in the endogenous regressor to predict the dependent variable of interest. Unfortunately, finding an appropriate exogenous source of variance in this study setting is difficult. Previous studies facing similar issues have used characteristics such as a venture's industry attractiveness or the geographic distance between the investor and the company (Gompers & Lerner, 2004; Lee et al., 2011). However, because it is also easier to obtain higher valuations for ventures in highly attractive industries and geographic distance also facilitates monitoring intensity and the VC's preference to invest in geographically close ventures, these instruments might not be entirely orthogonal to the error term. Second, future studies might examine the generalizability of the findings on the contingent value of signaling via organizational reputation in other countries or economic sectors. For instance, intangible signals of quality may be less relevant in sectors more stable and mature than cleantech. In such situations, more tangible and easier to observe signals (e.g. corporate governance signals) may have a greater impact on external parties subject to information asymmetry. Third, this study focuses only on one category of ties among all those that an entrepreneurial venture can have and use to draw reputational benefit and influence investors at IPO: those with venture capital investors. Although I control for the reputational gain coming from the hiring of prominent underwriters, future research could expand the present study by looking at benefits from reputations of other affiliates (i.e. alliance partners, external executives and directors in the board, accountants, etc.). Finally, future studies may consider new contingencies when analyzing benefits from inter-organizational ties with reputable organizations. Particularly, venture-specific uncertainty has been demonstrated to play a crucial role in shaping signaling (Arikan & Capron, 2010; Sanders & Boivie, 2004; Stuart et al., 1999). Scholars might test new measures of venture-specific uncertainty that go beyond the lack of information resulting from quick exits or intangible assets level of a firm.

The paper extends previous literature on the contingent value of inter-organizational ties with reputable organizations (Gulati & Higgins, 2003; Lee et al., 2011; Stuart et al., 1999) by investigating how specific characteristics of a relationship may alter signaling. Studying the valuations that entrepreneurial ventures receive at IPO, I show that the positive signal of having inter-organizational ties with reputable organizations has a greater impact on external parties when there is alignment of interests between the parties involved (i.e. the venture and the VCs). I hope that this study will encourage more research on circumstances influencing organizations' ability to derive advantages from affiliations with reputable organizations that are sometimes costly to acquire and maintain.

Chapter 4 Who walks the talk? Venture capital funds' actions after symbolic self-regulation of limited and general partners

4.1 Introduction

Social movements and other actors exerting normative pressure can play a central role in motivating organizations' adoption of sustainable practices that are more aligned with societal values and needs. For instance, the last decade has seen a strong emergence of movements aimed at encouraging institutional investors' (i.e. asset owners and asset managers) adoption of environmental, social and governance (ESG) practices in their portfolio strategies. Under the pressure of normative forces investors are switching from the traditional "quick-returns"-driven approach to investments more patient evaluations that consider the impact of nonfinancial factors on long-term performances and benefits for society at large.

Existing studies have started to explore the effects of normative forces on organizational responses (Berrone, Fosfuri, Gelabert, & Gomez-Mejia, 2013; Eesley & Lenox, 2006; King, 2008; Marquis, Toffel, & Zhou, 2015; Pacheco & Dean, 2015; Reid & Toffel, 2009). It has been shown that self-regulation is a common form of organizational action in response to institutional pressure (Delmas & Toffel, 2008; Edelman, 1992; King & Lenox, 2000). However, it is not clear yet whether and under which circumstances self-regulation leads to real commitment with the normative goals as opposed to actions that have only a symbolic value. This latter outcome refers to situations where the organizational answer to institutional pressure does not translate into actual compliance in practices (Marquis et al., 2015). In other words, organizations do not always "walk the talk" after self-regulating but might act opportunistically, as proven by the widespread diffusion of "greenwashing" behaviors (Berrone, Fosfuri, & Gelabert, 2015; Delmas & Cuerel Burbano, 2011; Lyon & Maxwell, 2011). Following previous studies (King & Lenox, 2000; Short & Toffel, 2010) investigating how opportunistic behaviors may hinder compliance with the normative ideals when self-regulation is not supported by an explicit regulatory structure, this article theorizes and tests the impact of self-regulation on organizational actions in a novel context: venture capital funds' investment decisions.

Social movement and institutional scholars have also argued that organizational responses to normative forces are heterogeneous and dependent upon several regulatory, normative, strategic and saliency-related factors (Eesley & Lenox, 2006; King, 2008; Pacheco & Dean, 2015; Reid & Toffel, 2009; Short & Toffel, 2010). In this paper I also explore whether an organization's choice of complying with normative ideals through aligned actions is dependent upon its social status. According to the institutional perspective, in fact, organizations conform to normative practices to obtain legitimacy within their organizational field (DiMaggio & Powell, 1983; Scott, 1995). I posit that the possibility to obtain legitimacy by resorting on alternative means, such as organizational attributes, might foster opportunistic behaviors that are misaligned with the symbolic commitment to self-regulate.

Answering these questions can have important implications for strategic management research as well as in practice. Although self-regulatory institutions have a critical role in encouraging organizations' appropriate behaviors and actions, it is also important to understand under which conditions their pressure might lead to symbolic responses that hide divergent behaviors. The hypothesized relationships are tested using a conditional difference-in-differences estimation on a matched sample of 1,482 venture capital funds active between 2004 and 2014. By comparing the likelihood to invest in clean technology companies of funds subject to the UNPRI initiative with that of a control sample of matched funds, I examine how organizations act in response to symbolic commitments to self-regulate when explicit sanctions are not enforced and alternative means to legitimacy are possible.

4.2 Theory and hypotheses

Self-regulation as response to normative pressure

Organizational behaviors are shaped by the institutional characteristics of the environment in which organizations operate (Scott, 1987). Compliance with normative and regulatory pressure coming from the institutional environment allows organizations to align with societal values and gain legitimacy, which is a necessary condition to improve access to resources, increase survival chances and enhance long-term stability (Meyer & Rowan, 1977; Scott, 1995; Suchman, 1995). As a result, organizational structures in an institutional environment tend to homogenize (DiMaggio & Powell, 1983). The adoption of structural forms that are legitimized by the institutional environment can sometimes occur in spite of efficiency losses. To limit possible inefficiency that might negatively influence their competitive positions, organizations tend to decouple the symbolic adoption of structural forms from the actual implementation.

Although normative pressure is based on norms that are by their nature less explicit and structured than regulations, extant studies have shown that it might affect organizations' quest for legitimacy by disrupting existing norms, behaviors and practices (Lounsbury, Ventresca, & Hirsch, 2003; Reid & Toffel, 2009; Weber, Rao, & Thomas, 2009; Zald, Morrill, & Rao, 2005). For instance, the environmental "consciousness" of firms is influenced by the activity of associations and NGOs helping stakeholders to assess and monitor their environmental footprint, which is a challenging task due to the technical knowledge re-

quired and the existence of asymmetric information between parties (King, Lenox, & Terlaak, 2005; Lyon & Maxwell, 2011). The typical actors exerting normative pressure on firms are social entities such as NGOs, professional organizations or advocacy groups (Bartley, 2007; Berrone et al., 2013; Davis, Morrill, Rao, & Soule, 2008; Den Hond & De Bakker, 2007; King & Soule, 2007; Pacheco & Dean, 2015; Reid & Toffel, 2009). They are sometimes referred as secondary stakeholders because they lack a formal link with the targeted organizations (Eesley & Lenox, 2006). Social movements create support to reach the aimed normative goals by mobilizing resources and building an efficient infrastructure for collective action, where information can flow between members (McAdam, McCarthy, & Zald, 1996). The clear articulation of problems and theorization of solutions is another relevant aspect of the potential impact that they have on organizations' institutional rules (McAdam et al., 1996; Sine & Lee, 2009; Suchman, 1995). They have traditionally operated as source of pressure for public politics, in a sort of lobbying activity, with the aim of indirectly changing organizational behaviors of private firms (Della Porta & Diani, 2009). More recently, they have started to re-direct their normative pressure to openly and directly target private organizations (Davis et al., 2008; Eesley, Decelles, & Lenox, 2015; Reid & Toffel, 2009).

Firms and institutional investors are under constant pressure from their stakeholders to be more responsible and embrace governance practices that are more aligned with societal values (Reid & Toffel, 2009; Short & Toffel, 2010). This pressure puts them at risk of tangible losses in terms of legal expenses and indirect reputational damages (Eesley & Lenox, 2006). Actions from activist groups might drag firms "through the mud" and influence external risk perceptions (Eesley et al., 2015). Extant literature has found that there is heterogeneity in organizational responses to institutional pressure and in the ability of subsequently obtaining legitimacy from these actions (Berrone et al., 2015; Briscoe & Safford, 2008; Davis, McAdam, Scott, & Zald, 2005). The gain of legitimacy ultimately depends upon the signaling strength of the undertaken action as well as the intensity of the normative force (Berrone et al., 2015). One diffused form of organizational response to institutional pressure is the adoption of self-regulatory structures (Delmas & Montes-Sancho, 2010; King & Lenox, 2000; Short & Toffel, 2010), which refer to voluntary and self-organized attempts to control actions and practices (Olson, 1965).

Different streams of literature have shown discordant views on the outcomes of adopting self-regulation as organizational response to normative pressure (Bromley & Powell, 2012; King & Lenox, 2000; Marquis et al., 2015; Short & Toffel, 2010). On the one hand, some studies argue that adoption of self-regulatory structures enables the institutionalization of values and norms that eventually bring to real commitment and incorporation of aligned practices into the decision-making processes of organizations (King & Lenox, 2000; Short & Toffel, 2010). Collectively valued behaviors can be established in an organization through the three main institutional mechanisms explained by King and Lenox (2000). First, informal coercive forces might pressure organizations to comply in order to avoid social sanctions and public shaming. Second, self-regulation facilitates the codifications of aligned values and norms and their integration in the organizational structures. Third, the creation of a social network of organizations subject to the same normative forces allows the diffusion of information and knowledge that may encourage companies to homogenize

their behaviors (DiMaggio & Powell, 1983; King & Lenox, 2000; Meyer & Rowan, 1977). On the other hand, another strand of the literature argues that self-regulatory structure might have a mere symbolic value (Marquis et al., 2015; Meyer & Rowan, 1977). There is in fact some evidence suggesting that self-regulation does not always turn into actual compliance but might be launched by firms as symbolic sign of action (King & Lenox, 2000; Short & Toffel, 2010). Symbolic actions are typical of situations where actual implementation is difficult due to efficiency and task-related concerns (Meyer & Rowan, 1977). This type of response can be used by companies subject to normative forces as an immediate and easy protection mechanism to deflect external negative attention without the necessity to effectively change organizational practices (Krawiec, 2003; McKendall, DeMarr, & Jones-Rikkens, 2002). For example, existing studies have shown that firms self-adopt employment equal opportunity policies as substitutes for actual compliance (Edelman, 1992). Similarly, participation to initiatives like the United Nations Global Compact is sometimes considered a way to divert media attention from actual management practices (Williams, 2004). Another emerging phenomenon related to symbolism in the environmental sustainability domain is the “greenwashing”, which is the misleading communication of a firm’s bad environmental performances (Delmas & Cuerel Burbano, 2011). Firms might seek to gain or maintain legitimacy by strategically varying the type and amount of information disclosed about their sustainability performance (Marquis et al., 2015).

This paper builds on the latter perspective. It examines how self-regulation without sanctions may affect organizations’ actions taking into account possible opportunistic behaviors and alternative ways to obtain legitimacy. Despite existing literature has explored the main factors explaining organizations’ adoption of self-regulatory structures (King & Lenox, 2000; Marquis et al., 2015; Reid & Toffel, 2009), we still know little about the real impact of self-regulation on organizational outcomes (see, King & Lenox, 2000; Short & Toffel, 2010, for exceptions). Whether and under which circumstances self-regulation will facilitate the adoption of organizational practices and behaviors that are in line with the underlying normative goals is still an open question. This study intends to shed further light on this question by looking at investment decisions of venture capital (VC) funds conditional on participation of any of the main stakeholders (i.e. limited and general partners) to self-regulatory initiatives aimed at encouraging responsible investment. Moreover, the paper investigates how organizational attributes can influence the likelihood of following through on the commitment to self-regulate with compliance in actions.

Organizational outcomes after self-regulation

The term self-regulation refers to an organization’s self-organized attempt to control actions and practices in absence of explicit regulation (Olson, 1965). In the context of this paper, I denote the voluntary decision of VC funds’ limited or general partners to join the UNPRI initiative for responsible investment. Such initiative builds on an extensive network of investors working together to publicly demonstrate their commitment to responsible investment issues and to actively incorporate sustainable factors in their decision-making processes (UNPRI, 2006). Other scholars have already mentioned this and similar initiatives as forms of normative action to encourage organizations’ adoption of more transparent practices (Reid & Toffel, 2009). However, the fact that the environmental and social responsibility principles encouraged by

the initiative are “voluntary and aspirational”²⁴, meaning that the pressure received by signatory members is based on a set of norms and guidelines rather than explicit rules, leaves space to possible opportunistic behaviors that go against the initiative’s ideals (King & Lenox, 2000). In fact, without the presence of a regulatory environment based on control mechanisms, coercive actions and explicit sanctions, self-regulation might be opportunistically used by organizations as signal of conformity irrespective of their actual compliance in practices (Deephouse, 1996). Furthermore, by homogenizing member organizations in front of external stakeholders, industry self-regulation might have the counter-effect of allowing bad-performers to obtain legitimacy without necessarily changing their behaviors (King & Lenox, 2000).

Therefore, drawing from empirical findings highlighting the risks of undesired behaviors of organizations self-regulating in absence of an defined regulatory environment (King & Lenox, 2000; Short & Toffel, 2010), I argue that investors voluntarily exposing to self-regulation will be less likely to exhibit compliant actions because of opportunistic behaviors incentivized by the absence of formal sanctions. Specifically, as any of a VC fund’s partner (i.e. limited or general partner) joins a self-regulatory structure as answer to increasing environmental pressure (e.g. UNPRI initiative), the VC fund’s necessity to respond to this pressure with real actions might decrease because the signaling effect of joining the initiative will already guarantee the aimed gain in legitimacy. Therefore, I propose.

***Hypothesis 1:** VC funds whose limited or general partners participate in the UNPRI initiative will be less likely to invest in cleantech deals than those that do not participate*

Hypothesis 1 is the baseline hypothesis of this paper. The strength of the relationship posited should, however, depend upon several attributes of the organizations adopting the self-regulatory structure. Specifically, I suggest that fund-level attributes such as the social status will influence the fund’s likelihood to pursue actions aligned with the normative guidelines.

Status as alternative source of legitimacy

Extant literature has pointed out that the effect of normative pressure on organizational responses is moderated by a series of factors, including characteristics of both the institutional force and the targeted organizations (Burstein & Linton, 2002; Soule & Olzak, 2004). In general, target organizations tend to change their policies and practices in the direction of the normative pressure received when they are simultaneously exposed to regulatory threats (Reid & Toffel, 2009). Pacheco and Dean (2015) found that firms’ actions in response to social activism are also moderated by firm- and competitive-level forces, such as competitors’ responses to the same stimuli and firm’s dependence on the targeted market. Another important factor altering the conditions wherein social movements are effective in influencing organizational practices is the past history of reputation and performance of the target organization (King, 2008). Specifically, a negative track record interacts with media attention in amplifying the likelihood of positive corporate responses to norma-

²⁴ <http://www.unpri.org/about-pri/about-pri/>

tive forces. Stakeholder salience, in terms of power, urgency and legitimacy of its normative goals, has also been found to be an important determinant of organizational response to institutional pressure (Eesley & Lenox, 2006; Mitchell, Agle, & Wood, 1997). This paper adds to this research stream by investigating the contingent effects of the target organization's status on its response to normative pressure.

One of the main motivations for adoption of self-regulatory structures is the focal organization's need to gain or maintain legitimacy (Berrone et al., 2015; Meyer & Rowan, 1977). The way in which an organization can obtain legitimacy, however, may depend on other aspects influencing the way an organization is evaluated by outsiders (Bitektine, 2011). Organizational attributes – such an organization's status – might provide alternative access to legitimacy by signaling an organization's social rank. Status may, therefore, deter an organization's likelihood to “walk the talk”, which is the display of outcomes and practices that are aligned with the self-regulation principles. Organizational status is an attribute typically exploited by firms to obtain social approval (Berger et al., 1998; Podolny, 1994; Rao, 1994). It is a sociological aspect denoting the organization's relative standing within a social rank. Hence, it is not directly related to observable quality and ability to meet third parties expectations but it can be earned through behavioral negotiations and contacts with other actors (Berger et al., 1998; Gould, 2002; Washington & Zajac, 2005). Extant studies have started to show that, even though similar, it is substantially different from reputation, which is based on a more economic logic and directly linked to quality of past performance (King & Whetten, 2008; Rao, 1994; Rindova et al., 2005; Washington & Zajac, 2005). I argue that, although the absence of a supportive regulatory environment might encourage organizational behaviors and practices that diverge from the symbolic commitment of self-regulation, the direction of these outcomes will also be dependent upon existence of other means that organizations have to obtain legitimacy. For instance through their perceived status (Bitektine, 2011; Deephouse & Carter, 2005; Pahnke, Katila, & Eisenhardt, 2015; Rao, 1994). Furthermore, the three institutional mechanisms facilitating compliance in practices even when explicit sanctions might be less effective in the case of highly reputable and socially respected organizations. First, informal coercion based on the possibility that names of not conforming members could be made publicly available, may negatively reverberate on the ultimate success of the initiative when exerted on high-status participants. The threat of shaming well-connected members might, in fact, cause their departure from the initiative. This might, in turn, affect participation decisions of other organizations imitating them because of their status (Haveman, 1993; Kraatz, 1998). Second, not all the organizations targeted by institutional pressure are equally keen to calls for change (King, 2008; Soule & Olzak, 2004). The transition from symbolic action to actual compliance is a passage that requires predisposition for major internal changes in organizational practices and norms (Meyer & Rowan, 1977). Institutionalization of new norms and values, which is the second mechanism that potentially brings to conformity with the normative ideals, may be more difficult for organizations fearing more the risk of failure. High-status organizations might be more reluctant to structural changes that might jeopardize their social ranks. Third, mimetic forces, referring to the creation of a network where actors can benefit from the dissemination of information on best-practices, are unlikely to affect organizations that are already well-positioned in their networks. Therefore, the value of the flowing information may result redundant to members already characterized by high-status.

Overall, these arguments suggest that high-status funds targeted by normative pressure may be more likely to limit their responses to the symbolic action of self-regulation. The organizational efforts and the risks related to changes in investment behaviors might discourage the implementation of practices that are conform to the normative ideals. I therefore hypothesize that:

***Hypothesis 2:** Participation of a VC fund's limited or general partners in the UNPRI initiative will decrease the likelihood that a fund will invest in cleantech deals to a greater extent for high-status funds*

4.3 Method

The United Nations' Principle of Responsible Investments (UNPRI, 2006) initiative

Over the last decade, the inclusion of environmental, sustainability and corporate governance (ESG) considerations and best practices into institutional investors' decisions has been actively encouraged by several organizations and social movements. For instance, the United Nations-supported Principles of Responsible Investment (UNPRI, 2006) provide to its signatories a supporting framework to encourage sustainable actions. Similarly, other initiatives such as the Investors Network on Climate Risk organized by the coalition for environmentally responsible economies (CERES) or the Global Sustainable Investment Alliance have the explicit missions to advance investment decisions that consider ESG criteria and mobilize investors to address climate and other key sustainability risks, while highlighting low-carbon investment opportunities. In general, all these initiatives aim to stimulate investors' actions through normative pressure.

The initiative object of this study is UNPRI: "the leading global network for investors to publicly demonstrate their commitment to responsible investment, to collaborate and learn with their peers about the financial and investment implications of ESG issues, and to incorporate these factors into their investment decision making and ownership practices"²⁵ (UNPRI, 2006). It is based on a set of six principles (listed in Table 4.1) developed since the year 2006, when the UN General Secretary invited a group of the world's largest institutional investors supported by external experts from various fields to discuss about the alignment of institutional investors' behaviors with objectives of society. The framework provided by the UNPRI scheme offers to both asset owners (e.g. pension funds, corporations, government funds, etc.) and asset managers (e.g. private equity firms, venture capital firms, etc.) the possibility to incorporate on a voluntary base these principles in their daily practices (UNPRI, 2006). In the year 2016 the program counted 1,380 signatories (divided in asset owners, investment managers and service providers) for a total of US\$ 59 trillion assets under management represented.

²⁵ <http://www.unpri.org/about-pri/about-pri/>

Table 4.1: Guiding Principles of Responsible Investments

1	We will incorporate ESG issues into investment analysis and decision-making processes.
2	We will be active owners and incorporate ESG issues into our ownership policies and practices.
3	We will seek appropriate disclosure on ESG issues by the entities in which we invest.
4	We will promote acceptance and implementation of the Principles within the investment industry.
5	We will work together to enhance our effectiveness in implementing the Principles.
6	We will each report on our activities and progress towards implementing the Principles.

Source: <http://www.unpri.org/about-pri/the-six-principles/>

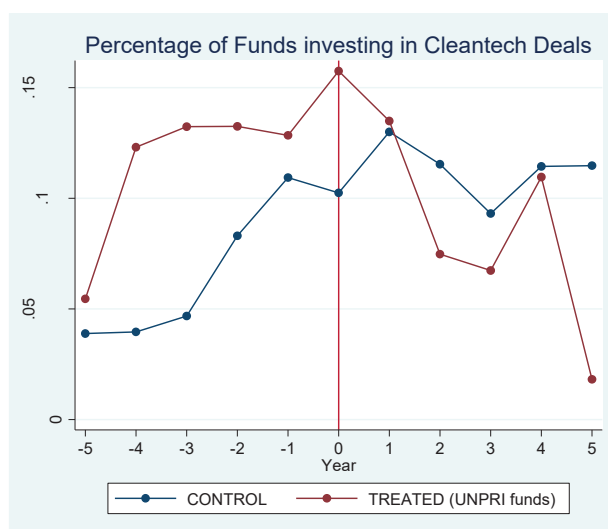
Sample and Data

The construction of the sample used for the empirical analysis started by including all venture capital funds active worldwide between the years 2004, two years before the UNPRI initiative was officially launched, and 2014. Information on the characteristics of a fund's general partner (i.e. the investment firm managing the fund), limited partners (i.e. investors participating in the fundraising) and equity investments made over its life were collected from the Thomson Reuters' *VentureXpert* database. The initial sample included 1,482 funds for which complete information on 693 limited partners and 899 general partners were available. Funds whose life were shorter than 3 years or had not made at least one investment deal by the end of the study period were excluded from the sample. Information on whether and when a funds' partner joined UNPRI was obtained from the organization managing the same initiative. Among the 1,482 funds composing the starting sample, 343 had at least one stakeholder (limited or general partner) joining the UNPRI initiative between 2006 and 2014 while the fund was still active.

The main hypothesis of this article is that VC funds subject to UNPRI, thus exposed to self-regulation on a voluntary base, will be less likely to invest in sustainable companies operating in the clean technology (cleantech) sector with respect to the counterfactual situation of funds not targeted by the initiative. Because the focus is on the effects of the treatment (fund partners' participation in the UNPRI initiative) on investment outcomes, it is important to show that differences in the likelihood to invest in cleantech companies can be attributed to the treatment and not to other factors which also explain the decision to join the initiative. Other studies facing similar issues have suggested the development of a matched sample composed by all the treated funds and a number of control funds that were otherwise similar but did not receive the treatment (Pahnke et al., 2015; Short & Toffel, 2010). This approach is based on the assumption that had treated funds not been affected by self-regulation, the trend in investment decisions during the post-signatory period would have been the same as that of non-treated funds. The use of a difference-in-differences estimation on a matched control sample (conditional difference-in-differences) has been a widely used technique to estimate treatment effects in similar settings affected by selection bias (Abadie, 2005; Shadish, Cook, & Campbell, 2002; Short & Toffel, 2010). This approach entails, as a first step, to find a group of non-treated funds that are similar to the treated ones in all the relevant pre-treatment characteristics, and then use this group as a close substitute for the unobservable counterfactual situation in which the treated group is not

receiving the treatment. The matching of treated funds with a suitable control group was done implementing a Coarsened Exact Matching (CEM), a method for reducing imbalance in covariates between treated and control groups (Blackwell, Iacus, King, & Porro, 2009)²⁶. The following UNPRI fund's characteristics have been included to develop the matched sample: *Fund Age* (based on the fund's founding year), *Fund Size* (in US millions dollars range)²⁷, *Firm Type* (e.g. Corporate VC, Bank VC, Venture Capital, Government Fund, etc.), *Firm Nation* and *Self-regulation Year* (i.e. the year a fund starts to be influenced by UNPRI principles). Control funds matched exactly on these characteristics and the treated funds' *Self-regulation Year* was used as the "match year" for the control group of funds. Each matched fund's observation was included in the analysis starting two years before the match year until five years after (Short & Toffel, 2010). The final matched sample included 146 treated (1,155 fund-year observations) and 566 control funds (4,611 fund-year observations)²⁸. To check if the matching procedure generated a matched sample of treated and non-treated funds that looked similar in the years prior to joining the UNPRI initiative, I visually assessed the validity of the parallel trend assumption. This key assumption in difference-in differences estimations requires that the trend in the outcome variable for both treatment and control groups during the pre-treatment period are similar. To this end, Figure 4.2 plots the yearly percentage of funds investing in at least one cleantech deal for both treated and control funds. Similarly, Figure 4.3 shows the yearly percentage of cleantech deals per fund. Both graphs show that the trends in terms of cleantech investments of the two groups are parallel during the pre-treatment period.

Figure 4.2: Yearly percentage of funds investing in at least one cleantech deal for both treated and control funds

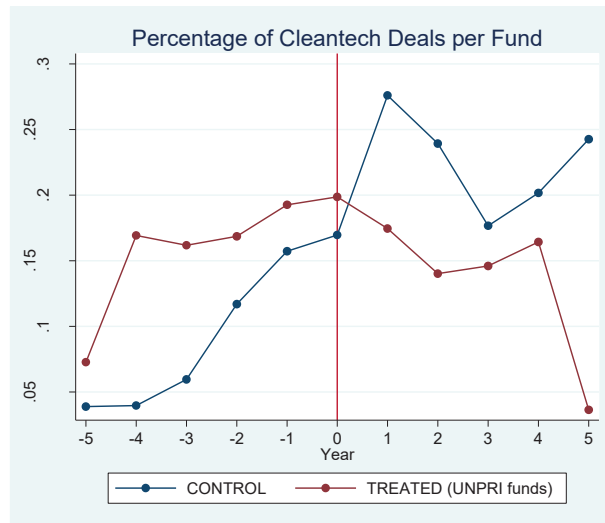


²⁶ Results are robust to the use of alternative matching methods such as propensity score matching using one-to-one nearest neighbor matching with replacement

²⁷ The coarsening for the continuous variable *Fund Size* has been set to classify funds in the following size ranges: 0-500\$m, 500\$m-5\$m, 5\$m-10\$m, >10\$m

²⁸ The fact that the number of treated funds is higher than the corresponding matched controls is due to the fact that some UNPRI funds had multiple matches based on the selected dimensions. Results remained the same when adopting a k-to-k solution to avoid that the CEM procedure resulted in strata with unbalanced numbers of treated and control observations.

Figure 4.3: Yearly percentage of cleantech deals per fund for both treated and control funds



Dependent Variable

Cleantech investment. Stakeholders that self-expose themselves to normative principles from a movement like UNPRI can either pursue a complying behavior by aligning their actions and practices to the movement’s normative goals or diverge from them by limiting their responses to symbolism (Marquis et al., 2015; Short & Toffel, 2010). One of the expected outcomes from joining UNPRI is an increased and more conscious engagement of signatories with sustainable investments. This study aims at estimating the likelihood of investing in companies that commercialize products or services based on clean technologies that reduce waste and require as few non-renewable resources as possible (Pernick & Wilder, 2008; Pernick, Wilder, & Winnie, 2013). The assumption made is that an increase in the probability to invest in cleantech would be an organizational response in line with the normative goals promoted by the initiative, while a decrease would be a symptom of divergence from the symbolic commitment. Therefore, the dependent variable, *Cleantech investment*, is a dichotomous variable that equals 1 if the focal fund invests in at least one cleantech company in a given year and 0 otherwise. The “Company Technology Application” classification provided by *VentureXpert* was used to pick companies associated with clean technologies. Furthermore, each company’s sector categorization into the cleantech sector was verified by cross-checking with information from cleantech-specific databases (i.e. *Cleantech.org* and *Bloomberg New Energy Finance*) and business reports. Because measuring cleantech investment with a dichotomous variable might not capture the intensity of the investment activity the hypothesis have also been tested using the yearly number of cleantech investment as dependent variable²⁹, the results remained the same.

Independent Variable

²⁹ Because of the underlying distribution, negative binomial models in the difference-in-differences configuration have been used for estimation of results when the dependent variable was the number of yearly cleantech investments

UNPRI. The main explanatory variable in the difference-in-differences analysis is *UNPRI*, a dummy variable set to 1 in the years after any of a fund's stakeholders joined the UNPRI initiative, and 0 in the years before. *UNPRI* was always 0 for funds in the control group as they never joined the initiative. To test the moderating effect of status proposed in Hypotheses 2 a variable measuring this organizational attribute for the firm managing a fund has been created. *VC status* has been assessed exploiting the relationships that exist among VC investors in the network of co-investments. Social influence of each VC firm has been measured by looking at its centrality in the overall syndication network (Guler, 2007; Podolny, 2001). Following prior research (Hochberg et al., 2007), status is operationalized with the eigenvector centrality (Bonacich, 1987) which considers every VC's co-investment tie in a given time period and then recursively weighs each tie by the centrality of the connected actor. For each year in the sample, I constructed undirected adjacency matrices in which two VCs had a direct tie if they co-invested over the 5-year window that ended in the year prior to the focal year. Each eigenvector value was normalized by the maximum possible eigenvector measure given the number of investors active in a given year. The software GEPHI has been used to compute the status measure.

Control Variables

A set of controls have been included to account for other factors influencing funds' decisions to invest in cleantech companies. Because the volume of a fund's investment activity might influence its likelihood to diversify into more sectors and, therefore, invest also in cleantech, the variables *Fund's number of deals*, counting the yearly number of investment made by a fund, and *Average equity per deal*, measuring the average deal size in USD millions, have been included. Being entrenched in an extended network may also influence the ability to learn about promising deals in the cleantech sector. For this reason, I also controlled for a *Fund's average number of co-investors*, *Number of deals as single investor* and *Average size of joined rounds* (in USD millions) in a year. Because investment decisions might be driven by factors related to geographic proximity, the dichotomous variable *Same country* has been included to signal if the fund and at least one invested companies were in the same country at the moment of the first investment. Another important characteristic possibly influencing a fund's investment strategies is a company's maturity and operational stage. For this reason, dichotomous controls for presence in a fund's portfolio of companies at *Early/Seed stage* in a given year were included and the *Average age of portfolio companies* has been computed annually. Finally, to control for year-by-year variations, a full set of year indicators have been included.

Model Specifications

In line with extant literature in similar settings (King & Lenox, 2000; Short & Toffel, 2010), I used conditional fixed effects logistic regression models to estimate a fund's likelihood of investing in cleantech after joining the UNPRI initiative. Because this type of models are only identified for funds that displayed a variation in the dependent variable during the study period, the matched sample used for the analysis was restricted to 177 funds (1,350 fund-year observations) that have invested in cleantech at least once between 2004 and 2014. However, to make sure that the sample reduction would not bias the results, as robustness

test, I re-estimated all models using Ordinary Least Squares (OLS) models with fund and year fixed effects. The standard errors have been clustered at the fund level. These models, although not particularly suited for estimations when the dependent variable is dichotomous, allow the use of the entire matched sample, including funds that never invested in cleantech deals during the study period.

4.4 Results

Tables 4.4 and 4.5 report the summary statistics for both the entire sample (1,482 funds) and the matched sample (712 funds). Table 4.6 provides correlations between the main variables.

Table 4.4: Summary statistics of the main variables for the matched sample (N=712 funds)

Variable	Obs	Mean	Std. Dev.	Min	Max
Cleantech investment	4,875	0.11	0.31	0	1
UNPRI	4,875	0.11	0.31	0	1
Fund's number of deals	4,875	4.16	5.59	0	51
Fund's average number of co-investor	4,875	0.25	0.64	0	8
Number of deals as single investor	4,875	4.80	4.31	0	31
Average size of joined rounds	4,875	25.59	171.23	0	6200
Same country	4,875	0.79	0.41	0	1
Early/Seed stage	4,875	0.27	0.45	0	1
Average equity per deal	4,875	3.61	3.92	0	46.16
Average age of portfolio companies	3,926	16.15	147.92	0	6200
VC Status	4,582	1.58	2.07	-4.59	4.61

Table 4.5: Summary statistics of the main variables for the two groups in the matched sample

Variable	UNPRI funds (N=146)					Matched control funds (N=566)				
	Obs	Mean	Std. Dev.	Min	Max	Obs	Mean	Std. Dev.	Min	Max
Cleantech investment	1,019	0.107	0.31	0	1	3,856	0.107	0.31	0	1
UNPRI	1,019	0.527	0.50	0	1	3,856	0	0.00	0	0
Fund's number of deals	1,019	3.343	5.14	0	51	3,856	4.375	5.68	0	43
Fund's average number of co-investors	1,019	0.34	0.80	0	8	3,856	0.231	0.58	0	6
Number of deals as single investor	1,019	3.841	3.98	0	24	3,856	5.057	4.36	0	31
Average size of joined rounds	1,019	44.37	300.37	0	6200	3,856	20.62	114.58	0	5401
Same country	1,019	0.698	0.46	0	1	3,856	0.813	0.39	0	1
Early/Seed stage	1,019	0.2	0.40	0	1	3,856	0.291	0.45	0	1
Average equity per deal	1,019	3.377	4.45	0	42.49	3,856	3.671	3.77	0	46.16
Average age of portfolio companies	743	30.36	246.34	0	6200	3,183	12.84	113.06	0	5400
VC Status	948	1.048	2.10	-4.5	4.61	3,634	1.725	2.04	-4.6	4.61

Table 4.6: Correlations between the main variables (n=3,731 funds-years)

Variable	1	2	3	4	5	6	7	8	9	10	11
1 Cleantech investment	1										
2 UNPRI	-0.045	1									
3 Fund's number of deals	0.301	-0.076	1								
4 Fund's average number of co-investors	0.104	-0.003	0.266	1							
5 Number of deals as single investor	0.089	-0.068	0.268	-0.177	1						
6 Average size of joined rounds	0.008	0.040	-0.026	0.092	-0.016	1					
7 Same country	0.175	-0.104	0.398	0.143	0.575	0.041	1				
8 Early/Seed stage	0.208	-0.068	0.541	0.139	0.183	-0.074	0.359	1			
9 Average equity per deal	-0.017	0.024	0.053	-0.138	0.641	0.034	0.458	-0.131	1		
10 Average age of portfolio companies	0.018	0.017	-0.023	0.106	-0.050	0.872	0.029	-0.061	-0.003	1	
11 VC Status	0.107	-0.082	0.372	-0.098	0.498	-0.037	0.325	0.291	0.329	-0.039	1

Table 4.7 presents the results of the Conditional Fixed Effects Logistic Regression with errors clustered at the fund level to test the effect of self-regulation on VC funds' cleantech investments (Hypothesis 1). Odds ratios are reported to facilitate interpretation of the coefficients.

Table 4.7: Conditional Fixed Effects Logistic Regression Analysis on the matched sample (UNPRI vs. control funds)

VARIABLES	DV: Cleantech Investment		DV: Cleantech Investment		DV: Cleantech Investment		DV: Cleantech Investment	
	Model 1	Odds Ratios	Model 2	Odds Ratios	Model 3	Odds Ratios	Model 4	Odds Ratios
UNPRI	-0.822*	0.439*	-1.249**	0.287**	-0.753*	0.471*	-0.881	0.414
	(0.329)	(0.144)	(0.472)	(0.135)	(0.376)	(0.177)	(0.582)	(0.241)
UNPRI X VC Status					-0.490**	0.612**	-0.500+	0.606+
					(0.173)	(0.106)	(0.262)	(0.159)
VC Status					0.136	1.146	0.316	1.372
					(0.131)	(0.150)	(0.203)	(0.279)
Fund's number of deals			0.151***	1.163***			0.154***	1.166***
			(0.023)	(0.026)			(0.023)	(0.027)
Number of deals as single investor			0.023	1.023			-0.005	0.995
			(0.164)	(0.167)			(0.176)	(0.175)
Fund's average number of co-investors			0.049	1.050			0.056	1.057
			(0.042)	(0.044)			(0.043)	(0.045)
Average size of joined rounds			-0.003	0.997			-0.003	0.997
			(0.002)	(0.002)			(0.002)	(0.002)
Same country			3.019***	20.462***			2.841***	17.125***
			(0.612)	(12.519)			(0.623)	(10.665)
Early/Seed stage			0.363	1.438			0.397	1.487
			(0.268)	(0.385)			(0.278)	(0.413)
Average age of portfolio companies			-0.052	0.949			-0.052	0.949
			(0.047)	(0.045)			(0.053)	(0.051)
Average equity per deal			0.003	1.003			0.003	1.003
			(0.002)	(0.002)			(0.003)	(0.003)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations (Fund-year)	1350	1350	1041	1041	1282	1282	999	999
Number of Funds	177	177	149	149	169	169	143	143
chi2	60.75	60.75	231.4	231.4	74.20	74.20	227.5	227.5

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Model 1 tests Hypothesis 1. The negative and significant coefficient on UNPRI ($\beta=-0.822$, $p<0.05$) indicates that funds whose partners joined the UNPRI initiatives, therefore subject to self-regulation, decreased the likelihood of investing in cleantech companies by a factor of 0.44 compared with their matched controls. This result, which is robust also to the inclusion of controls (model 2), provides support to Hypothesis 1 stating that participation to self-regulatory initiatives without direct regulatory threat incentivizes non-compliant behaviors. To test the second hypothesis, models 3 and 4 assess the coefficient for the interaction term *UNPRI X VC Status*. The coefficient is negative and significant ($\beta=-0.490$, $p<0.01$) supporting the argument in Hypothesis 2 that the negative effect of UNPRI membership on funds' likelihood of investing in cleantech is greater for high-status funds. Among the controls, it is worth noting that the coefficients for the variables *Fund's number of deals* and *Same country* are positive and significant in all model specifications. These results provide evidence that the higher is the number of deals in which a fund is involved on a yearly base the higher will be the likelihood that at least one of these deals involves a cleantech company. Moreover, funds investing in portfolio companies based in the same country are especially likely to invest in cleantech related deals.

Table 4.8: OLS Regression Analysis with fund fixed-effects on the matched sample (UNPRI vs. control funds)

VARIABLES	DV: Cleantech=1 Model 1	DV: Cleantech=1 Model 2	DV: Cleantech=1 Model 3	DV: Cleantech=1 Model 4	DV: Num. of Cleantech startups Model 5
UNPRI	-0.057* (0.027)	-0.079* (0.032)	-0.046 (0.029)	-0.072+ (0.040)	-0.099* (0.046)
UNPRI X VC Status			-0.021* (0.010)	-0.008 (0.013)	
VC Status			0.001 (0.006)	0.001 (0.007)	
Fund's number of deals		0.010*** (0.002)		0.011*** (0.002)	0.024*** (0.005)
Number of deals as single investor		0.004 (0.013)		0.000 (0.013)	0.005 (0.030)
Fund's average number of co-investors		0.002 (0.002)		0.002 (0.002)	-0.005 (0.008)
Average size of joined rounds		-0.000 (0.000)		-0.000 (0.000)	-0.000 (0.000)
Same country		0.080*** (0.019)		0.081*** (0.020)	0.099*** (0.028)
Early/Seed stage		0.032* (0.016)		0.029+ (0.016)	0.049* (0.025)
Average age of portfolio companies		-0.003+ (0.002)		-0.004* (0.002)	-0.001 (0.005)
Average equity per deal		0.000 (0.000)		0.000 (0.000)	0.000 (0.000)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Observations (Fund-year)	4875	3926	4582	3731	3926
Number of Funds	712	691	682	662	691

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

As a robustness test, all model specifications have been estimated using OLS models with funds fixed effects. The use of this model allows estimations based on the entire matched sample without discarding funds with no variation in the dependent variables. Results in Table 4.8 confirm that *UNPRI* has a negative and significant ($\beta=-0.057$, $p<0.05$) effect on the likelihood to invest in cleantech in a given year. Moreover, OLS models yielded consistent results when using a continuous measure of the yearly number of cleantech investment as outcome variable (Model 5).

Overall, the results from the analysis support the idea that funds subject to the *UNPRI* principles become less likely to invest in cleantech after joining the initiative than their matched controls. The negative likelihood to invest in cleantech is greater for funds managed by high-status VC firms.

Robustness Tests

A series of robustness analyses to confirm the findings regarding the main hypothesis have been performed.

Table 4.9: Conditional Fixed Effects Logistic Regression Analysis on the entire sample

VARIABLES	DV: Cleantech=1		DV: Cleantech=1		DV: Cleantech=1	
	Model 1	Odds Ratios	Model 2	Odds Ratios	Model 3	Odds Ratios
UNPRI	-0.798** (0.275)	0.450** (0.124)	-1.284** (0.409)	0.277** (0.113)	-0.996* (0.480)	0.370* (0.177)
UNPRI X VC Status					-0.458* (0.210)	0.633* (0.133)
VC Status					0.320* (0.151)	1.377* (0.208)
Fund's number of deals			0.134*** (0.019)	1.143*** (0.021)	0.132*** (0.019)	1.141*** (0.021)
Number of deals as single investor			0.286* (0.119)	1.331* (0.158)	0.242+ (0.124)	1.274+ (0.158)
Fund's average number of co-investors			0.083* (0.032)	1.087* (0.035)	0.083* (0.033)	1.086* (0.036)
Average size of joined rounds			-0.001 (0.002)	0.999 (0.002)	-0.002 (0.002)	0.998 (0.002)
Same country			2.325*** (0.370)	10.225*** (3.782)	2.201*** (0.373)	9.036*** (3.372)
Early/Seed stage			0.456* (0.218)	1.577* (0.344)	0.493* (0.226)	1.637* (0.369)
Average age of portfolio companies			-0.029 (0.036)	0.971 (0.035)	-0.024 (0.039)	0.977 (0.038)
Average equity per deal			0.002 (0.002)	1.002 (0.002)	0.003 (0.002)	1.003 (0.002)
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations (Fund-year)	2193	2193	1596	1596	1523	1523
Number of Funds	318	318	246	246	236	236
chi2	98.35	98.35	351.5	351.5	343.5	343.5

Standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Table 4.9 displays the results of the conditional fixed-effects logistic regression models from the all sample (before the implementation of the matching procedure). The negative and significant coefficients of *UNPRI* (in models 1 and 2) and the interaction term *UNPRI X VC Status* (in model 3) confirm that the results are not artifacts of the matching process. Finally, I checked if results were changing when measuring self-regulatory response with an investor initiative different from UNPRI. I obtained data on limited and general partners' memberships with the Investor Network on Climate Risk (INCR), an over 10 years old network of institutional investors with social purposes similar to those of UNPRI. The matched sample using the INCR initiative as treatment resulted smaller: 111 treated funds and 111 matched controls. However, results were highly consistent regarding both the likelihood to comply in practices with the normative principles and high-status organizations' lower tendency to conform to the normative ideals.

4.5 Discussion

This paper explores investment funds' actions after shareholders' adoption of self-regulatory structures. Building on existing literature on practices and behaviors following symbolic responses to normative pressure (King & Lenox, 2000; Short & Toffel, 2010), I test whether, in the absence of a structured regulatory environment, self-regulating organizations "walk the talk" by acting in conformity with their symbolic

responses. I study the investment decisions of a sample of venture capital funds structured as limited partnerships between asset owners and asset managers. The findings show that a fund's shareholders voluntary affiliation with initiatives aimed at encouraging inclusion of ESG considerations into the investment decisions, negatively influence the fund's likelihood to invest in clean technology companies. This result should be interpreted in the light of previous research advocating the distinction between symbolic response to normative pressure (i.e. self-regulation) and effective compliance in outcomes (Marquis et al., 2015; Short & Toffel, 2010). "Greenwashing" behaviors, for instance, highlight organizations' tendency to discern symbolic from real actions as answers to external *stimuli*. This study confirms that self-regulation might bring to opportunistic behaviors when not assisted by an adequate regulatory framework (King & Lenox, 2000). A second important finding is that the likelihood of investing in cleantech deals is more negative if the fund is managed by a prestigious VC firm. This result provides support for the hypothesis that organizational status is an alternative mean to legitimacy that makes compliance in actions with the normative goals unnecessary. When organizations can rely on intangible attributes to obtain legitimacy then their responses to normative pressure may be limited to symbolic actions. In this way, it is possible to avoid structural changes in norms and practices that might lead to inefficiencies and jeopardize an organization social ranking.

In addition to theorizing about and testing the conditions that affect investors' responses to normative pressure for sustainability, this paper makes several contributions to existing literature. First, it contributes to institutional studies by sustaining the importance of the regulatory environment to deter opportunistic behaviors covered by symbolic responses to normative forces (Berrone et al., 2013; King & Lenox, 2000; Short & Toffel, 2010). Extant research has already raised concerns on the effectiveness of organizations self-regulations as answer to normative pressure (Short & Toffel, 2010). The empirical analysis of this study provides additional evidence that self-exposure to institutional norms should be disentangled from actual organizational actions. This result reinforces the necessity to separate the two stages of organizational responses: symbolic and real actions. The passage from symbolic response to actual compliance might not always occur (Short & Toffel, 2010) and involves predisposition for organizational change as well as availability to bear the risk of inefficiencies. This paper expands on this theoretical distinction in organizational types of responses by studying a context where symbolism might hinder the "walk of the talk". Second, novel contingencies of the impact of normative pressure on organizational actions are investigated. Prior research has shown that the effect of normative pressure on firms' actions is moderated by the regulatory environment (King & Lenox, 2000; Reid & Toffel, 2009), saliency of the institutional force (Eesley & Lenox, 2006), strategic factors (Pacheco & Dean, 2015), media coverage and organizational characteristics (King, 2008). By looking at the social status of targeted organizations as an alternative mean to obtain legitimacy, I extend institutional literature on the conditions under which normative forces have tangible impact on organizational practices. The analysis suggests that status is an aspect of organizational identity that substitutes the real need to change organizational behaviors in line with the pressure received from self-regulation in order to seek legitimacy.

A third contribution of this paper is to the emerging environmental management literature on the phenomenon of greenwashing (Berrone et al., 2015; Delmas & Cuerel Burbano, 2011). Participation to voluntary programs, movements and networks is seen as one of the ways in which organizations respond to increasing concerns about environmentally responsible conducts (Delmas & Montes-Sancho, 2010; King & Lenox, 2002). My findings hint to the fact that the positive visibility deriving from self-exposure to institutional norms combined with an organization's social rank, might hide dissonant practices that are hidden to the eyes of external observers.

Limitations and Future Research

There are some main limitations in this empirical study, which could open promising avenues for future research. First, interpretation of the results is based on the main assumption that compliance in practices following self-exposure to the UNPRI movement is gauged by the likelihood of investing in clean technology companies. Although the analyzed social movement has the active incorporation of ESG issues in signatories' portfolio strategies listed among its stated principles, this might not necessarily result in an increase or decrease of investments in the cleantech sector. As pointed out by different institutional investors and financial actors that have been interviewed to validate the results of this study, a decrease in the likelihood to invest in green VC deals might correspond to an increase in compliant investments through other financing vehicles such as listed equities or corporate bonds. However, I believe that looking at the specific asset class object of this paper (Clercq, Fried, Lehtonen, & Sapienza, 2006), although representative of only a small share of an investment firm's global strategy, it is still relevant to assess the real impact that movements like UNPRI have on the transition to a low-carbon economy. Venture capital funds are a common investment vehicle for financing new and innovative ventures, which constitute the fly-wheel for the so claimed green revolution in the current economic system (Knight, 2010; Sine, Haveman, & Tolbert, 2005). Moreover, the amount of financial resources invested in VC funds by large institutional investors such as pension funds or insurance companies have increased in recent years, making this financial vehicle more and more diffused among investors (Della Croce, Kaminker, & Stewart, 2011). However, future studies might explore the effect of self-regulation on investment practices that include a broader set of financing vehicles such as listed equities. Similarly, the responsible investment principles stated by the UNPRI and similar initiatives promoting ESG considerations, might see the realization of concrete actions in sectors different than cleantech. Examples are investments in companies with missions and goals that have a social impact without necessarily touching on environmental issues, or companies operating in more traditional sectors with a particular attention to the implementation of ESG principles (e.g. by limiting emissions or applying triple bottom-line principles in their management strategies). Although it might become debatable what to eventually consider as ESG-compliant investments (Inderst et al., 2012), I encourage future studies to evaluate compliance in practices adopting alternative outcome measures based on different sector. Another limitation derives from the methodology used to test the theorized relationships. As pointed out by researchers using the conditional difference-in-differences method (Short & Toffel, 2010), although it is a robust approach to test program evaluations in empirical studies, it does not correct for selection on unobservables. In other words, robust-

ness of results relies on the assumption that no factor correlated with both the decision to join the UNPRI initiative and the investment decisions remains unmeasured. Specifically, results would be biased if any of these unobserved factors has a disproportionate representation among the treated and matched controls samples. To this end, I have tried to exploit data at hand in order to be as rigorous as possible in the construction of the matched sample.

I began by asking whether self-regulation without sanctions negatively influences VC funds' compliant behaviors and if the response depends on status endowments. I found that, when formal control mechanisms are absent, organizations do not act in line with the normative principles but tend to limit their responses to symbolism. These purely symbolic responses are particularly likely for high-status organizations. Many questions remain opened for future investigations. For instance, regulatory pressure might interact with the normative pressure exerted by external organizations and be effective in penalizing symbolic behaviors. There is also the need for a better understanding of how symbolic and real actions bring companies to enhance their legitimacy and which factors moderate this relationship.

Chapter 5 Conclusion

The venture capital sector has often offered scholars in various management fields an ideal setting to test their theories. This dissertation resorts to properties of this context to study signaling and self-regulation. The first two studies provide novel empirical evidence on how different types of VC's organizational attributes can signal the quality of entrepreneurial ventures affecting their performance. The third study examines VCs' behaviors following the adoption of self-regulatory structures in response to normative pressure. The findings aim at contributing to a broader discussion on organizational factors such as reputation, social status and legitimacy.

Previous research has used signaling theory to explain the link between VC involvement and entrepreneurial outcomes. Inter-organizational ties with VCs possessing certain characteristics help entrepreneurial ventures to convince third parties about their quality. The first study of this thesis suggests that it is important to isolate and individually assess the signaling benefits of different VCs' characteristics. Results show that two similar and interdependent attributes like reputation and status represent different signals for external parties evaluating ventures under uncertainty. Reputation, which is directly linked to quality of past actions and performance, has a positive effect on entrepreneurial outcomes linked to external judgements. On the contrary, the same effect is negative for status, which is socially constructed and not necessarily based on observable quality. However, signals of an entrepreneurial venture's quality can also be superfluous if external parties already possess enough information to inform their valuations. The necessity of information asymmetry between parties in order to justify the need for resorting on quality signals is confirmed by the fact that VCs' reputation affects an entrepreneurial venture's hazard of completing an IPO but does not seem to influence the likelihood of acquisition by another firm. In the latter exit event, indeed, the acquiring firm has access to sufficient information to assess the value of a venture due to industry experience, familiarity with technologies and the possibility to actively influence the future strategic planning of the venture. Furthermore, results from the second study show that signaling benefits of affiliation with reputable VCs are moderated by possible contrasts in the relationship between the venture and the VCs. Specifically, when the strategic interests of the two parties are not aligned then the positive effects of VC reputation on external valuations becomes negative. This suggests that the ability to exploit inter-organizational ties to signal quality is conditional upon the nature of the relationship with the reputable partner. From a practical standpoint, the first two studies indicate that entrepreneurs should privilege affiliation with VCs that have a track record of previous successes rather than VCs that are socially well connected in their networks. However, advantages from such partnerships are greater for entrepreneurial ventures foreseeing an IPO exit than for ventures that are possible targets of acquisition by incumbent firms. Moreover, the benefits of affiliation with

reputable VCs are weaker if the investors do not show long-term commitment with the entrepreneurial venture's strategic plans.

The second phenomenon analyzed is organizations' self-regulation in response to forms of normative pressure. The third study provides empirical evidence to the hypothesis that the absence of a defined regulatory structure based on explicit norms and penalties incentivizes opportunistic behaviors in the form of symbolic responses. I find that VC funds whose general or limited partners voluntarily join self-regulatory initiatives are less likely to change their strategic behaviors in line with the normative ideals. Furthermore, the occurrence of opportunistic behaviors following self-regulation is higher for VC funds managed by high-status firms. This indicates that organizational attributes such as status might provide alternative ways to legitimacy that make the risk of changing actions and behaviors in response to stakeholders' pressure unnecessary. This finding has implications for both investment funds' managers and policy makers. Fund managers should be aware that participation to initiatives aimed at encouraging greater attention to sustainability issues can result in fewer investments in clean technologies. Policy makers could feel encouraged to consider sustaining voluntary initiatives of self-regulation with adequate control systems that would assure compliance in practices and behaviors of participants. Moreover, specific attention should be paid to control the behaviors of high-status firms joining this type of initiatives.

To conclude, the thesis offers new insights on the signaling value that VC ties have for entrepreneurial ventures and the real impact of investors' self-regulation without control. The three studies discussed few selected aspects of these phenomena which are likely to open new important areas of investigation for future research.

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Curriculum Vitae

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AREAS OF INTERESTS

Entrepreneurial finance, Strategic Management, Technology and Innovation Strategy

EDUCATION

- September 2012 - present* **École Polytechnique Fédérale de Lausanne (EPFL)**
Corporate Strategy & Innovation Unit
Ph.D. in Management of Technology
Dissertation: Signaling and self-regulation in venture capital: evidence from investments in the clean technology sector
Expected date of completion: September 2016
- September 2006 - March 2012* **Politecnico di Milano, Italy**
B.A and *MSc* degree in Management and Production Engineering
- Master thesis on the financing of open source software startups (in collaboration with EPFL)
 - Exchange program at Wageningen Universiteit (The Netherlands)

TEACHING EXPERIENCE

- *2015-present:* “Technology and Innovation Strategy” (master course at EPFL) - Teaching Assistant
- *2012-2015:* “Corporate Strategy” (master course at EPFL) - Teaching Assistant

PROFESSIONAL EXPERIENCE

- March 2012 - September 2012* **EQUUS, LLC (boutique consulting and advisory services firm)**
Project Consultant in Supply Chain Management
- Main Project(s): Demand planning and forecasting
 - Main Industry: Consumer goods

OTHER ONGOING PROJECTS

- With Kenneth Younge, *Risk assessment in the IPO filing process.*
- With Giovanni Colavizza, *The impact of Social Media on Corporate Reputation: the case of Venture Capitalists using Twitter*
- With Philipp Bubenzer (in collaboration with the European Commission). *Organizational life-cycle and Innovation: Evidence from European SMEs*
- *Unmeasured latent method construct: Does it really solve common-method variance biases? Evidence from a Montecarlo simulation.* Working Paper

SELECTED PRESENTATIONS

- “The Signaling Value of Reputation and Status: Evidence from VC-Backed Entrepreneurial Ventures in the Cleantech Sector” invited paper, *Academy of Management annual meeting*, Anaheim (USA), August 2016.

- “Clashing Interests in the IPO Process: Contingencies of Signaling with Reputable VC Ties” invited paper, *Academy of Management annual meeting*, Anaheim (USA), August 2016.
- “Who Walks the Talk? Venture Capital Funds’ Actions after Symbolic Self-Regulation of Limited and General Partners” invited paper, *Academy of Management annual meeting*, Anaheim (USA), August 2016.
- “The Signaling Value of Reputation and Status: Evidence from VC-Backed Entrepreneurial Ventures in the Cleantech Sector” invited paper, *Babson College Entrepreneurship Research Conference*, Bodø (Norway), June 2016
- “Signaling through Affiliates: How do Reputation and Status affect External Parties evaluating Entrepreneurial Ventures?” invited paper, *Academy of Management annual meeting*, Vancouver (Canada), August 2015.
- “When does Reputation from others really help? Assessing Contingency of Reputation on Venture-specific Uncertainty and Affiliates-specific Strategic Intent” invited paper, *DRUID annual conference*, Rome (Italy), June 2015.
- “Rush or Wait? How Venture Capitalists’ Reputation and Status influence Exit Decisions” invited paper, *Western Academy of Management annual meeting*, Kauai (United States), March 2015.
- “The dark side of VC reputation: evidence from the Clean Technology sector” invited paper, *Strategic Management Society special conference*, Tel Aviv (Israel), March 2014.
- “Financing entrepreneurial firms under weak IP regime” invited paper, *Strategic Management Society annual conference*, Prague (Czech Republic), October 2012.

HONORS AND GRANTS

2012 - 2016	Recipient of Full Time Doctoral Fellowship, École Polytechnique Fédérale de Lausanne, Switzerland
2013 - 2015	Best Teaching Assistant Award, École Polytechnique Fédérale de Lausanne, Switzerland
March 2015	Best Doctoral Student Paper Award Nominee at Western Academy of Management annual meeting, Kauai, United States
October 2014	Best Poster Award at College du Management research day, EPFL, Switzerland

PROFESSIONAL ACTIVITIES

- Member of the Academy of Management (BPS and TIM divisions) and of the Strategic Management Society
- *Ad-Hoc Reviewer*: Academy of Management meeting (TIM and ENT divisions), Strategic Management Society conference, DRUID conference, Western Academy of Management
- Organization of the European Strategy, Entrepreneurship and Innovation (SEI) Workshop 2013, May 3rd, EPFL Lausanne

SUMMER SCHOOLS

- Summer School in Econometrics - organized by GSE (Barcelona Graduate School of Economics), Universitat Pompeu Fabra, Barcelona, Spain, June 30th - July 4th 2014.
- Summer School in Entrepreneurship – organized by KAIST, Seoul, Korea, August 17th - 22nd 2015

PERSONAL INFORMATION

Date of birth: February 26th, 1987

Citizenship: Italian

Languages: Italian (native), English (fluent), French (proficient)