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THE EVOLVING ENTREPRENEURIAL FINANCE LANDSCAPE

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INTRODUCTION

The entrepreneurial finance landscape is experiencing profound changes. No longer is the focus only on business angels (BAs) and venture capital (VC). Indeed, venture capital only ever applied to a minority of cases and the growth in its research attention probably owed more to the increasing availability of databases than to its applicability to vast swathes of entrepreneurial ventures. The articles presented in this themed issue and summarized in Table 1 address a number of dimensions of this evolving landscape.

Some articles provide new insights into the investment processes of established fund providers. This includes the role of social ties in understanding a more fine-grained view of the early stage in the process of deal screening by venture capital firms (VCs) (Wang), the nature of interorganizational relationships between investors and portfolio companies in the particular context of corporate venture capital (CVC) (Weber, Bauke, and Raibule), and the role of ethnicity in cross-border VC investment (Zhang, Wong, and Ho). Other articles explore some of the emerging forms of entrepreneurial finance, such as venture debt (de Rassenfosse and Fischer) and informal debt (Wu, Si, and Wu). The articles also cover different contexts, from emerging to developed markets.

In what follows, we consider these articles in the wider context of the changing landscape of entrepreneurial finance (as summarized in Figure 1) and suggest areas for extending the research agenda.

FORMS OF FINANCE

Debt has been the focus of attention for much research and policy concerning small businesses. While these firms are typically reluctant to give up equity, their borrowing capacity may be limited by a lack of tangible assets for collateral and irregular cash flows to service interest payments. As such firms are likely to be turned down by banks, they oftentimes become discouraged borrowers, reluctant or unable to access the financing they need to grow (Fraser, Bhaumik, and Wright, 2015).

The 2008-09 financial crash in particular, and its impact on the availability of traditional bank financing, has given impetus to the development of new forms of debt for entrepreneurial ventures. These developments include peer-to-peer lending through crowdfunding platforms as well as venture debt. Venture debt lending lies at the intersection of venture

Keywords: entrepreneurial finance; crowdfunding; venture debt; informal debt; emerging economies
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Table 1. Summary of articles in the themed issue

Authors	Research Question	Theory	Data	Findings
de Rassenfosse and Fischer (2016, this issue)	What criteria do venture debt lenders (VDLs) use to make lending decisions?	Discrete choice	55 senior U.S. venture debt lenders	The provision of patents as collateral is as important as the provision of tangible assets to lenders; VDLs showed a marked preference for start-ups that offered warrants; VC backing substitutes for a start-up's positive cash flows.
Wu, Si, and Wu (2016, this issue)	To what extent is the effect of informal debt on innovation contingent on the accessibility of formal debt and institutional development in an emerging economy?	Entrepreneurial finance	Survey data from 3,235 entrepreneurs in China	There is an inverted U-shaped relationship between the level of informal debt and entrepreneurial ventures' innovation performance; the value of informal debt for promoting innovation is weaker for firms having little or no access to less expensive institutional finance; a better-developed institutional environment strengthens the effects of informal debt.
Weber, Bauke, and Raibule (2016, this issue)	To what extent does existing theory on interorganizational relationships apply in the context of corporate venture capital (CVC) investment?	Dyer and Singh's (1998) relational view on interorganizational relationships	47 CVC- portfolio company dyads	Relation-specific assets and knowledge-sharing routines and complementary resources and capabilities lead to relational rent for both CVC investors and portfolio companies; complementary resources and capabilities are antecedents for knowledge-sharing routines and relation-specific assets, which lead to the desired rent; counterintuitively, informal self-enforcing governance mechanisms (e.g., trust) foster relationship satisfaction, but do not necessarily create relational rent or immediate tangible benefits.
Wang (2016, this issue)	At which stage in the process of accessing VC are social network ties most important?	Social network ties	430 VC-start-up pairs in two university science parks in China	Socially connected start-ups have cumulative advantages in access to venture capital, but this advantage mainly arises in the early stage where information embedded in social ties helps reduce investors' search costs in deal screening; in contrast, social ties are a secondary consideration in the subsequent stage of VC funding decisions.
Zhang et al. (2016b)	Do (Asian) ethnic minority VC investors behave differently from more mainstream VC investors?	Ethnic enclave concept	First-round venture capital fundings in Silicon Valley from 1976 to 2004	Asian VCs were more likely to invest in immigrant Asian entrepreneurs than mainstream VCs; when they invested in mainstream ventures, they paid higher valuations than mainstream VCs; mainstream VCs did not pay higher average valuations compared to Asian VCs when they invested in Asian ventures; the ethnic minority VCs' social network ties and their lower social status could have contributed to such asymmetric behavioral differences.

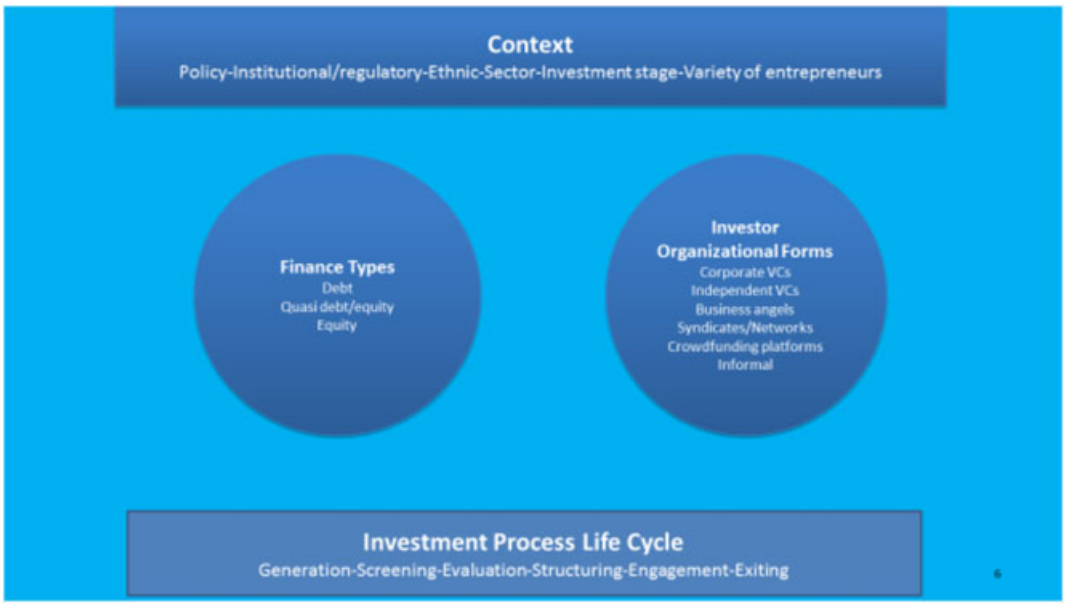

Figure 1. Entrepreneurial finance landscape.

capital and traditional debt, providing a mechanism to raise money that limits equity dilution by allowing entrepreneurs and investors to raise equity at the next funding round at a higher valuation (de Rassenfosse and Fischer, 2016, this issue). These new forms serve to enhance further the heterogeneity of the traditional dichotomy between debt and equity in entrepreneurial finance but also to blur the lines between the two forms by introducing new varieties of quasi debt and equity as well as rewards and donations. There is some limited evidence of the extent to which entrepreneurs seeking crowdfunding have been turned down by other finance providers (Zhang *et al.*, 2016), but we need further studies that explore the drivers behind why entrepreneurs select different forms of crowdfunding, venture debt, and informal funding.

ORGANIZATIONAL FORMS

These new forms of finance are also reshaping the traditional way of looking at entrepreneurial finance as a funding escalator regarding the types of finance providers. It has become too simplistic to view the funding of the stages of new venture growth as a linear progression from the smaller amounts provided at the early stage of development by the 3Fs and grants through progressively larger amounts available from business angels and venture capital to, eventually as ventures mature, IPOs. Rather, new and traditional forms are overlapping and may be both complementary or substitutes. For example, syndication by business angels (BAs) enables larger funding amounts such that business angels can follow ventures from early to late stages that might otherwise be the domain of VCs. Similarly, while rewards and debt-based crowdfunding may provide smaller amounts for early-stage ventures, equity crowdfunding involves larger amounts, providing substitutes for BAs and VCs (Zhang *et al.*, 2016).

However, new forms of entrepreneurial finance may be complementary, including coinvestment between different forms. For example, there is extensive coinvestment between BAs and crowdfunding platforms (Wright, Hart, and Fu, 2015). Further research is needed that explores the rationale for, process of, and outcomes of this coinvestment between different forms. For example, there is some indication that the deals involve investments in less risky but lower return ventures (Wright *et al.*, 2015), but the drivers of this behavior are little understood.

Just as we have come to know more about the variety of VCs and BAs, there is also a need to know more about the variety among these new forms of entrepreneurial finance. For example, with respect to crowdfunding, while the differences between donation, rewards, debt, and equity crowdfunding are recognized, we know little about the nature and impact of different forms within each type and the

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entrepreneurs and their ventures (Ahlers *et al.*, 2015). Equity crowdfunding involves different types of platforms regarding the nature of ownership including nominee (e.g., Seedrs), individual (e.g., Crowdcube), syndicated (e.g., SyndicateRoom) and fund (e.g., OurCrowd) structures. To what extent are these forms targeting different market segments? What are their different business models? How do their success rates differ?

There has been a significant number of new entrants providing new forms of entrepreneurial finance. As with other sectors experiencing extensive diffusion, there will come a point in the sector life cycle where shakeouts are likely. Studies are needed to explore the drivers of such consolidation and whether the pattern will be different from other sectors. For example, with respect to crowdfunding, to what extent has the nature of platforms and available information contributed to a more rapid diffusion and subsequently more rapid consolidation than in other sectors? Which types of crowdfunding providers are likely to become dominant and why?

INVESTMENT PROCESS LIFE CYCLE

The investment process life cycle for traditional VCs and BAs is well known, and there are extensive studies covering most aspects of the process. Nevertheless, there are gaps in our understanding, and the emergence of new providers introduces a new scope for examination of differences in investment behavior compared with traditional players.

Wang (2016, this issue) argues that we need a more fine-grained examination of the early screening and evaluation stages of the investment process. Although the role of ties in VC decision making have been examined (Wuebker, Hampl, and Wüstenhagen, 2015), Wang (2016, this issue) argues that the causal mechanisms are unclear because social ties may influence both a start-up's likelihood of being screened for evaluation and its likelihood of subsequently being funded. It is therefore important to consider the selection effects at each stage. Using evidence from China, Wang finds that socially connected start-ups have cumulative advantages in their access to venture capital. This advantage is primarily at the early stage where information embedded in social ties helps reduce investors' search costs in deal screening. However, social ties are a secondary consideration in the subsequent stage of VC funding decisions. This study was conducted in the particular context of the emerging economy of China, and it would be interesting to conduct further research in other contexts to explore whether the relationships hold.

Although we know a great deal about the investment decision criteria and processes used by VCs, these may not be the same as those used by other types of funds providers. De Rassenfosse and Fischer (2016, this issue) analyze the lending decision criteria of venture debt lenders (VDLs). They find that the chances of obtaining venture debt are significantly increased by the provision of patents as collateral and that this is as important as the provision of tangible assets. They also find that there is a notable preference for start-ups that offer warrants and that VC backing of firms seeking venture debt substitutes for a start-up's positive cash flows.

More generally, there is the issue of the different kinds of information available for decision-making by providers of new forms of entrepreneurial finance. To what extent do these providers have the same access to private information as VCs, and does it matter? For example, with respect to crowdfunding, what are the challenges for investors in accessing private information beyond the public information provided on the platform?

New avenues for the structuring of entrepreneurial ventures are also opened up; these involve combinations of equity, debt, and quasi debt. To what extent are the drivers and impact of these structures different from those in traditional VC and BA deals? Further, it is well known that VC deals in particular involve costly and complex contracting, but how is this different with new forms of entrepreneurial finance? In the specific case of equity crowdfunding, how does the operation of pre-emption and anti-dilution rights vary between different types of platforms, and what are the implications for investors as well as the entrepreneurs involved?

Traditionally, VC and BA funding of entrepreneurial ventures have been associated with the provision of both finance and active involvement by investors, although studies have shown that the extent and effectiveness of this involvement varies among these fund providers (Manigart and Wright, 2013). The new forms of entrepreneurial finance such as venture debt, informal debt, and various forms of crowdfunding raise important issues concerning the extent to which they address venture requirements for investor involvement in developing their business

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alongside providing a solution to financing problems. We need research that explores the different challenges relating to both the willingness and ability of newer forms of entrepreneurial finance to engage as active investors. Weber, Bauke, and Raibulet (2016, this issue) adopt and extend existing theory on interorganizational relationships in the context of corporate venture capital (CVC) (see also Basu, Phelps, and Kotha, 2016), and future studies might usefully apply this approach to new forms of entrepreneurial finance.

In the new environment, the different goals and time horizons of the expanded landscape of organizations providing entrepreneurial finance raises important questions about the implications for the way exiting from investments has been traditionally viewed. Studies are needed to explore the extent and drivers of successful and unsuccessful investments by the different providers.

CONTEXT

The importance of context for understanding the variety of entrepreneurial finance is being increasingly recognized. In particular, different institutional environments within both developed and emerging markets have been identified as playing important roles in the development of VC markets (Li and Zahra, 2012). Although there is growing work relating to the variety of microfinance in different institutional contexts (Bruton *et al.*, 2015), studies of the role of context for other forms of entrepreneurial finance are more limited, and more research is needed.

Wu, Si, and Wu (2016, this issue) note that in emerging economies, informal capital plays an important role, as many formal sources of capital for new entrepreneurs have more constrained access than is the case in mature economies. This can have major implications for the ability of such economies to stimulate much needed innovation. Indeed, they find that for a sample of firms in China, the value of informal debt for promoting innovation was weaker for firms having little or no access to institutional finance, whereas a better-developed institutional environment strengthens the effects of informal debt. We need further research that explores the role of informal debt in other institutional contexts.

While significant research has examined the role of cross-border VC investors, it has tended to focus on the sectors of portfolio firms and links with domestic investors. There has been little research on contextual factors relating to ethnicity in this process. Zhang et al. (2016b) examine the dilemma of ethnic investors in using ethnic network ties to invest. They find a higher likelihood of Asian VCs investing in Asian-led ventures in Silicon Valley than mainstream VCs. The valuation of the investments made by these Asian VCs in mainstream ventures is higher than those by mainstream VCs in such ventures. These findings are asymmetric, as the premium effect is not observed when mainstream VCs invest in Asian ventures.

Finally, recognition of the variety of types of entrepreneurs and their ventures (Zahra and Wright, 2011) presents a further contextual dimension for understanding entrepreneurial finance. VC has traditionally been associated with high growth and innovative ventures, while debt finance has typically been focused upon small businesses. The recent developments in types of entrepreneurial finance and their suppliers we have outlined provide opportunities for entrepreneurs with different goals and ventures at different stages of development to obtain funding that was previously not possible. Additional studies might usefully explore the most effective matches between types of entrepreneur and type of entrepreneurial finance in the new funding landscape.

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VENTURE DEBT FINANCING: DETERMINANTS OF THE LENDING DECISION

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Research summary: *Venture debt lending is a form of start-up financing that lies at the intersection of venture capital and traditional debt. We analyze the lending decision criteria of 55 senior U.S. venture debt lenders (VDLs) using a discrete choice experiment in order to understand how VDLs overcome barriers that traditionally hamper start-ups' access to debt. We find, first, that the provision of patents as collateral is as important as the provision of tangible assets to lenders. Second, VDLs showed a marked preference for start-ups that offered warrants. Third, venture capitalists' backing substitutes for a start-up's positive cash flows.*

Managerial summary: *This article provides insights into the business model of venture debt lenders. Venture debt is an equity efficient way to raise money: it limits equity dilution by prolonging runways and allowing entrepreneurs and investors to raise equity at the next funding round at a higher valuation. The research suggests that venture debt plays an important role in new venture financing, with about one venture debt dollar provided for every seven venture capital dollar invested. It further suggests that backing by venture capitalists (VCs) and the provision of patents as collateral significantly increase the chance of obtaining venture debt. Therefore, it provides additional rationales for having VCs onboard and for applying for patents. More generally, the research illustrates that debt, in the form of venture debt, is available to start-ups with negative cash flows and no tangible assets.*

INTRODUCTION

Venture debt lenders (VDLs) are specialized financial institutions that provide loans to start-ups. Loan recipients usually operate in high-tech industries such as biotechnology or information technology (IT). They have negative cash flows and no tangible assets to secure the loan. Venture debt financing is, thus, not traditional bank financing. This relatively new form of start-up financing lies at the intersection of venture capital and traditional debt.

The U.S. venture debt industry is sizeable despite its young age. A recent estimate by Ibrahim (2010) puts it somewhere between $1 billion and $5 billion per year. According to the estimates presented in this article, the industry provided at least $3 billion in loans to new ventures in 2010, which is about one venture debt dollar for every seven venture capital dollars invested. To be clear, venture debt loans do not encompass supplier credits to start-ups secured by supplied goods or convertible loans that come from venture capitalists (VCs) or business angels. They

Keywords: discrete choice experiment; patent collateral; patent signaling; venture capital; venture debt
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also do not encompass loans to ventures that have stable positive cash flows.[1]

Despite its widespread use in practice, academic studies have overlooked the venture debt phenomenon. Scholarly research on the topic comprises only case studies and field interviews. Some authors have studied a particular lending transaction (Crawford, 2003; Roberts, Sahlman, and Kind, 2008), and others have looked more broadly at the business model of VDLs using qualitative research methods (Mann, 1999; Hardymon and Leamon, 2001; Hardymon, Lerner, and Leamon, 2005; Ibrahim, 2010).

In this article, we empirically analyze the venture lending decision criteria in order to understand how VDLs overcome barriers that traditionally hamper start-ups' access to debt. The analysis relies on a discrete choice experiment conducted with 55 senior venture lenders working for companies that cover at least 60 percent of the U.S. venture debt market. The findings are threefold.

First, we find that the provision of patents as collateral is as important to lenders as the provision of tangible assets; however, it does not substitute for it. This result contributes to the literature on intellectual property and start-up financing (Conti, Thursby, and Thursby, 2013a; Conti, Thursby, and Rothaermel, 2013b; Hsu and Ziedonis, 2013; Hoenig and Henkel, 2015). Previous research has established that patents facilitate access to equity, whereas we show that patents also facilitate access to debt.

Second, VDLs showed a marked preference for start-ups that offered warrants, which helps overcome the agency problems usually associated with loans (Green, 1984; Brennan and Kraus, 1987). Whereas previous research on venture debt described warrants as a 'nice bonus' (Ibrahim, 2010: 1183), our results indicate that lenders actually highly value warrants in the lending decision.

Third, we find that start-ups' VCs backing substitutes for positive cash flows only at early stages, not at later stages, of VC engagement. This result adds another element to the list of benefits associated with having VCs on board (e.g., Sapienza, Manigart, and Vermeir, 1996; Stuart, Hoang, and Hybels, 1999; Hellmann and Puri, 2002; Hsu, 2004). Besides acting as certification agents to less informed investors and providing strategic advice to start-ups, our findings show that VC backing also increases the financing capacity of start-ups by facilitating access to debt.

LITERATURE ON NEW VENTURE FINANCING

Equity versus debt financing of new ventures

Start-ups receive venture debt in the phase *after* initial insider financing provided by the start-up team, family, friends, and angel investors and *before* access to public equity and debt markets. Firms in this phase of the financing cycle have access to intermediated financing in the form of equity provided by VCs and debt provided by banks and specialized finance companies. As pointed out by Berger and Udell (1998), conventional wisdom holds that equity is the primary funding for firms in that phase. However, new ventures *do* rely on debt. Cassar (2004) reports that 90 percent of new ventures in Australia in the late 1990s had some form of debt financing. In addition, bank financing provided a sixth of the financing of new firms. A combination of demand-side and supply-side factors helps explain the debt-equity ratio of new ventures.

The trade-off theory of capital structure captures the demand-side factors. It holds that firms choose their optimal debt-equity ratio by balancing the costs and benefits of these financing modes (Kraus and Litzenberger, 1973). Winton and Yerramilli (2008) and de Bettignies and Brander (2007) model such trade-offs in the specific context of new ventures. On the plus side of venture capital, the entrepreneur benefits from VC involvement in two main ways: it acts as certification agent to outside stakeholders (Stuart *et al*., 1999) and it brings managerial input that increases the venture's chances of success (Sapienza *et al*., 1996; Hellmann and Puri, 2002). On the minus side, the entrepreneur partially loses ownership and control of his/her venture (Hsu, 2004; Ueda, 2004).

Supply-side factors also help us understand the debt-equity ratio. New ventures have peculiarities that

[1] The case of Box.net represents a typical example of a venture debt transaction. Founded in 2005, the company provides cloud content management to business customers. Despite completing a $6 million Series B round of funding in 2008, the company still needed additional funding to continue the development and marketing of its platform. However, money was scarce, and the management team was reluctant to dilute the equity any further. Box.net obtained a $3 million loan in the form of senior debt from Hercules Technology Growth Capital, a specialty finance company. The deal also involved preferred stock warrants, valued at $48,000 at the end of 2008. This extra money allowed the company to bridge a funding gap during a time of difficult macroeconomic conditions, and Box.net eventually raised another $7.1 million from its previous investors at the end of 2009. (Sources: press releases, SEC regulatory filings, and company's Web site.)

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make them poor candidates for receiving traditional loans. First, they have limited-to-no operating cash flow, which is a prime factor of credit worthiness (Carey and Hrycay, 2001). Thus, traditional lenders usually shy away from ventures at the pre-revenue stage. Second, high informational opacity and moral hazard create problems of adverse selection. Both traditional financial institutions and VCs have deployed techniques to deal with these problems.

Financial institutions use a number of methods such as collateral and guarantees, lines of credit, and relationships (Berger and Udell, 1998). The use of collateral is particularly important for traditional lenders: scholars have shown this to be a way of mitigating adverse selection and moral hazard associated with loan contracts (Barro, 1976; Smith and Warner, 1979; Stiglitz and Weiss, 1981; Bester, 1987; Holmstrom and Tirole, 1997). However, new ventures typically lack substantial tangible business assets to pledge as collateral to back the loan. The provision of personal assets as collateral can overcome this problem, but such a solution is costly for the entrepreneur.

By contrast, VCs have deployed techniques that are particularly well suited to the financing of new ventures. They are skilled at reducing informational opacity through the activities of screening (Chan, 1983; Amit, Brander, and Zott, 1998) and monitoring (Gorman and Sahlman, 1989). They also adopt specific contracting practices that further reduce moral hazard such as the staging of venture capital (Sahlman, 1990; Gompers, 1995).

Criteria used by equity investors to assess prospects

The decision criteria used by VCs in funding decisions have been widely studied. The funding decision is a multistage process, and the criteria used by VCs depend on the evaluation stage (Hall and Hofer, 1993; Fried and Hisrich, 1994). The funding decision also depends on factors that are specific to each VC firm (such as fit with VC lending guidelines) and on 'personal chemistry' (Hisrich and Jankowicz, 1990); it is a process that is open to cognitive bias such as overconfidence (Zacharakis and Shepherd, 2001). Notwithstanding these caveats, the decision criteria also exhibit a number of general trends summarized next.

First, VCs consider factors related to the strategic positioning of the firm such as the market in which the new venture operates, the competition it faces, and the capital intensity of its business model. It is widely known in the strategy literature that such factors increase the chance of firm survival (Shepherd, 1999). VCs are naturally looking for ventures with high growth prospects and cash-out potential (Fried and Hisrich, 1994). This criterion is the logical counterpart of the high risk borne by VCs. In that spirit, Elango *et al.* (1995) show that the required hurdle rate is higher for early-stage than for late-stage investors.

Second, VCs attach great importance to the quality of the entrepreneur and the team. As MacMillan, Siegel, and Narasimha (1985: 119) note, 'There is no question that irrespective of the horse (product), horse race (market), or odds (financial criteria), it is the jockey (entrepreneur) who fundamentally determines whether the venture capitalist will place a bet at all.' The importance of the entrepreneur and his/her team is systematically confirmed in the empirical literature (e.g., Tyebjee and Bruno, 1984; Baum and Silverman, 2004).

Third, VCs spend a great amount of time evaluating start-ups' probability of success. Because of the high informational opacity of new ventures, VCs rely on easily observable—but costly to acquire—credentials they believe are correlated with the venture's chance of success (e.g., Baum and Silverman, 2004; Hsu, 2007; Hoenen *et al.*, 2014; Hoenig and Henkel, 2015). For example, Baum and Silverman (2004) argue that VCs use the characteristics of the team as a signal to make judgments about the potential of the start-ups.

Another signal that has received a lot of attention recently is the existence of patents. A patent informs investors about the discipline and expertise of the start-up, as well as the novelty and quality of its technology. The signaling effect of patents appears in recent empirical studies of VC investment decisions, including Häussler, Harhoff, and Mueller (2009); Conti *et al.* (2013a); Conti *et al.* (2013b), and Hsu and Ziedonis (2013).

DETERMINANTS OF THE VENTURE LENDING DECISION

Whereas the VC financing decision criteria have been studied extensively, there is little research on the venture debt decision. We know from scholarly discussions related to traditional debt theory that key criteria are the assessment of repayment capacity, the

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need for collateral, and contractual clauses such as warrants. We explain how these criteria might work in the venture debt context.

Repayment capacity

Traditional lenders place great importance on the operating cash flow to assess repayment capacity (Carey and Hrycay, 2001). However, most of the companies that receive venture debt are at the pre-revenue stage and, consequently, have negative cash flows—they can burn millions of dollars in conducting research and development and in building complementary assets. Thus, lenders have to rely on alternative sources to evaluate the start-up's repayment capacity. A critical factor they look at is whether the start-up has received backing by a VC firm (Mann, 1999; Gompers, 2001). VC backing is beneficial to lenders in two ways: it provides a positive signal about the start-up's future prospects and it increases the start-up repayment capacity.

As we explained, high informational opacity characterizes high-tech start-ups, and VCs are particularly skilled at screening them. Thus, VC backing reduces information asymmetry between entrepreneurs and lenders by signaling the quality of the project. In addition to the quality tag provided by VCs, VDLs and VCs usually know each other well through their frequent interactions. Such social ties may also act as an information transfer mechanism that further reduces the risk of the investment (e.g., Petersen and Rajan, 1994; Shane and Cable, 2002). Thus, we hypothesize:

Hypothesis 1a: VC backing increases the probability of obtaining venture debt.

Lenders may also rely on the VC's capacity to make or attract a follow-on round of financing. VC-backed companies typically go through several rounds of venture financing (Gompers, 1995) that provide cash that can be used to repay the loan (Hochberg, Serrano, and Ziedonis, 2014). While some start-ups may have revenues at the time of the loan application or may be able to obtain revenues in the near future, most are far from receiving positive cash flows. High-tech start-ups generally need three to five years to develop their product; therefore, the most likely source of cash in VC-backed ventures is the next equity round (see Hardymon *et al*., 2005; Roberts *et al*., 2008 for case-study evidence on lenders' reliance on VCs). Ibrahim (2010: 1184) takes it a step further by arguing that VCs and VDLs engage in an implicit contract that VCs repay the loan. These arguments suggest that VC backing may substitute for cash flow (Mann, 1999; Ibrahim, 2010). Note that we do not expect a perfect substitutability. C*eteris paribus*, it is obvious that VDLs would prefer firms that have both positive cash flows and VC backing. However, to the extent that these two sources of cash have the same role for the lender, the marginal utility of having both sources should be lower than the sum of each source individually. We hypothesize:

Hypothesis 1b: VC backing substitutes for cash flow in the venture lending decision.

Collateral

Lenders usually request that their loans be secured by collateral in order to reduce the risk they bear (e.g., Smith and Warner, 1979; Besanko and Thakor, 1987; Inderst and Mueller, 2007). They can seek relief in the collateral by liquidating it should the borrower fail to repay the loan. Collateralization reduces expected foreclosure expenses because secured lenders have priority against unsecured or second-lien creditors over pledged assets. They are, thus, in a preferred position to satisfy their claims in case of bankruptcy.

Besides this traditional function, collateral also serves to discipline borrowers by better aligning their incentives with those of lenders. The borrower is less likely to undertake actions that could damage the lender if the value of the collateral is sufficiently high and the lender is likely to enforce its entitlements (Bester, 1987; Mann, 1997).

We know from qualitative research that, much like traditional commercial loan agreements, collateral is an important aspect of venture debt agreements. It usually takes the form of a first lien on all assets, meaning that the lender can take and sell or hold all property of a debtor to satisfy the company's debt (Hardymon *et al*., 2005).[2] Most high growth potential start-ups, however, do not hold tangible assets. Their

[2] One might wonder why VCs allow VDLs to take a lien on all assets. An interviewee explained that, in practice, there is no tension between VCs and lenders regarding collateralized assets. In the case of bankruptcy, the VC will usually try to liquidate all company assets (in accordance with the lender) to repay the loan. If the VC fails, the lender will try to liquidate the collateralized assets on its own.

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most likely tradable asset is their intellectual property, in particular patents (Mann, 1999; Fischer and Ringler, 2014).

Patents represent assets that are capable of being liquidated and, as such, are used as collateral (e.g., Munari, Odasso, and Toschi, 2011; Crawford, 2003; Hardymon *et al*., 2005). The liquidation value of patents lies in their ability to exclude others from using the underlying invention. On the one hand, in case of default, it is possible to sell the patent along the underlying technology, i.e., facilitating the licensing of the underlying invention to some entity that aims to commercialize the technology (e.g., Arora, Fosfuri, and Gambardella, 2001; de Rassenfosse, Palangkaraya, and Webster, forthcoming). On the other hand, the exclusion right *per se* can be sold to either potential competitors or non-practicing entities. As the risk of inadvertent patent infringement is very high in industries characterized by complex products, nonpracticing entities attempting to acquire exclusion rights in the market for patents give patents a considerable liquidation value (Reitzig, Henkel, and Heath, 2007). We hypothesize:

Hypothesis 2: Offering patents as collateral increases the chance of receiving venture debt.

Equity warrants

Equity warrants convey the right to purchase shares at a stated price within a given time period. Combining this instrument with a loan provides lenders with an upside potential (Green, 1984). Hence, the increase in expected returns can partially reward lenders for the risk they are taking. Warrants should be particularly attractive for VDLs given the expected high growth rates of new ventures. Loans with warrants may look similar to convertible debt, which is used widely by VCs; however, the two instruments are different. Convertible debt converts into equity in a subsequent financing round. By contrast, as with a traditional business loan, repayment of venture debt is mandatory: the warrant comes on top of the loan and generally represents a minor stake.[3]

[3] Venture debt also differs from mezzanine financing in several ways. In particular, venture debt systematically involves collateral, whereas mezzanine financing does not. It is also more senior and has a lower coupon rate than mezzanine financing.

Economic theory suggests that warrants mitigate moral hazard typically associated with loan contracts (Jensen and Meckling, 1976; Green, 1984; Brennan and Kraus, 1987). In short, the provision of warrants rewards lenders for the risky behavior of entrepreneurs, thereby better aligning the objectives of both and reducing agency costs. Entrepreneurs' strong incentives to take on risky behavior and the high risk of failure associated with new ventures exacerbate moral hazard in start-ups. Since VDLs target high growth start-ups characterized by high default risk and pronounced moral hazard problems, warrants should be particularly important to VDLs. We hypothesize:

Hypothesis 3: Equity warrants increase the chances of receiving venture debt.

EMPIRICAL APPROACH

To test our hypotheses, we conducted discrete choice experiments with senior VDLs covering a large share of venture debt lenders in the United States.

Sample

Scoping the population of VDLs in the United States was a major undertaking, as no comprehensive directory exists. As a first step, we identified all major companies active in the industry. We then proceeded to find as many experts as possible within each company.

We deliberately made the list of companies *likely* to offer venture debt broad in order to avoid false negatives (i.e., missing a venture debt firm). We searched the academic literature in detail for the key players (e.g., Hardymon *et al*., 2005; Ibrahim, 2010) and performed a broader search on specialized press, online fora, and directories (including the professional network LinkedIn and the Private Equity and Venture Capital Directory published by PSEPS Ltd) for smaller players. We then either asked company representatives directly or browsed their company Web sites to find whether they actually provide venture debt. Institutions in the sample are of two types: (1) private equity shops (usually specialized) such as Horizon Technology Finance; and (2) banks with an entrepreneurial finance branch such as Silicon Valley Bank. The list comprises 80 U.S. institutions

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likely to provide venture debt financing. This deliberately broad identification strategy implies that the list includes institutions that provide loans to start-ups that may eventually not qualify as venture debt (such as mezzanine financing). To rule out these effectively, we employed control questions at the beginning of the survey.[4]

We then identified experts in each company, restricting the data collection to senior positions, specifically looking for people at the level of CEO, vice president, partner, managing director, and the like. When the company Web site did not provide information on employees, we searched for employee names in public reports, presentations, LinkedIn, and press interviews on venture debt-related topics. We identified 529 *potential* venture lenders with valid e-mail addresses, i.e., approximately 6.6 venture lenders per company. After one invitation e-mail and one reminder e-mail, we obtained data from 66 respondents (a 12.5% response rate).[5] Control questions led to the exclusion of five respondents. A further six respondents left the survey after the first experiment and were excluded.[6] Finally, we obtained choice data from 55 venture lenders across 31 companies, leading to a raw coverage of 10 percent at the individual level and 39 percent at the company level. The Appendix lists companies that took part in the survey conducted in November 2010.

Although industry coverage of 39 percent is a high figure, the response rate obtained is quite conservative in light of the sampling strategy of including false negatives. A comparison of the amount of outstanding loans provided by sampled companies with independent market size estimates allows us to approximate the actual industry coverage more accurately. According to the information participants revealed before conducting the experiments, sampled companies provided $3 billion in loans in 2010. Expert industry guesstimates are in the $1 to $5 billion range (Ibrahim, 2010), suggesting that our sampled companies cover *at least* 60 percent of the U.S. venture debt lending volume. This figure is a first sign that the sample is a fair representation of the industry.

Furthermore, we conducted two statistical tests to assess the representativeness of the sample. The first exploits the fact that individuals who respond after a reminder are similar (or at least, closer) to nonrespondents because they required an additional stimulus to respond (Armstrong and Overton, 1977). Of the 18 control questions asked before the experiment started (e.g., extent to which the company aims to obtain warrant, experience in venture lending, etc.), there are no differences between the 32 first-wave respondents and the 23 second-wave respondents (at the 10% probability threshold). The second test compares observable characteristics of respondents and nonrespondents. There is no bias with respect to institution size and type (private equity shops versus banks and other financial institutions). The p-values associated with the χ^2 cross-table tests for sample independence are 0.121 and 0.854, respectively. Firms we thought were more likely to provide venture debt were also more likely to respond. Had we sent the survey questionnaire to experts from the 46 institutions we thought were extremely likely to, or which are known to, offer venture debt, the firm-level coverage would have been of 60 percent with an individual-level coverage of 16 percent.

Experimental design

The hypothesis test relies on a discrete choice experiment (DCE), also known as choice-based conjoint analysis (see Green and Srinivasan, 1990), performed online. DCE participants receive multiple choice sets, each containing multiple alternatives. A choice set in the context of this study is a lending scenario in which venture lenders must consider providing a loan to three start-ups that differ on five attributes but that are otherwise identical (e.g., same business ideas, comparable characteristics of founders, etc.) so that only the shown attributes matter for the lending decision. Each attribute is associated with different levels. For instance, one attribute is VC engagement with the associated levels: no VC backing; VC backing and early-stage start-up; and

[4] More specifically, the invitation letter clearly defined the venture lending activity and asked participants to confirm that their companies indeed provide venture debt. We included a series of control questions aimed at identifying participants with limited experience with venture debt.

[5] We incentivized participants in two ways: we provided them with a summary of the findings, and we offered them the opportunity to take part in a lottery to win one in 10 $30 Amazon gift cards. The response rate compares well with response rates from 'similar' studies (Graham and Harvey, 2001), especially in light of the facts that respondents hold senior positions and that the experiment was time consuming.

[6] Respondents had to do 12 experiments. We conservatively dropped all the participants who left after the first experiment because we feared they did not have the level of expertise desired.

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VC backing and late-stage start-up. For every choice set, participants have to choose the start-up to which they would like to lend most and the one to which they would like to lend least. Figure 1 shows the choice experiment as presented to participants.

The DCE method is particularly suited to our research question. First, it produces a decision context that is close to the day-to-day lending decision context of venture lenders. Both the experiment and the daily job of participants require a judgment call based on a set of observable start-up characteristics. Second, the DCE approach offers a unique opportunity to assess characteristics of loans *not* chosen by lenders, which is notably difficult to observe. Focusing only on successful transactions may lead to selection bias. Third, it does not confound supply- and demand-side effects, as would transaction-level market data. The material at hand is akin to the frictionless outcome from the supply-side perspective and is, therefore, well suited to assist in the understanding of how lenders operate. Fourth, it relies on utility theory and, therefore, alleviates problems typically encountered in traditional surveys (which exploit stated preferences) such as common method bias. Although the DCE relies on answers from participants, the method is a revealed preference approach. Fifth, it enables controlling for unobserved heterogeneity across start-ups. The design of the experiment is such that all start-up characteristics that do not explicitly vary are equal. Thus, provided the experiment is carefully implemented, omitted variables do not affect the results. This feature is crucial to the study of interaction effects we aim to conduct (see, e.g., Athey and Stern, 1998; Fischer and Henkel, 2013). The DCE approach is common in marketing research and has been successfully used in the entrepreneurial finance literature, notably for the study of VCs' investment decisions (e.g., Shepherd and Zacharakis, 1999; Franke *et al*., 2006).

An important trade-off in designing a DCE is making the experiment as realistic as possible while ensuring that it is manageable for respondents. Hence, we decided to restrict each scenario to three start-ups with a maximum of five attributes (see Lussier and Olshavsky, 1979). We selected the five attributes based on the hypotheses we aimed to test. Eventually, we chose to let the survey participants see 12 choice

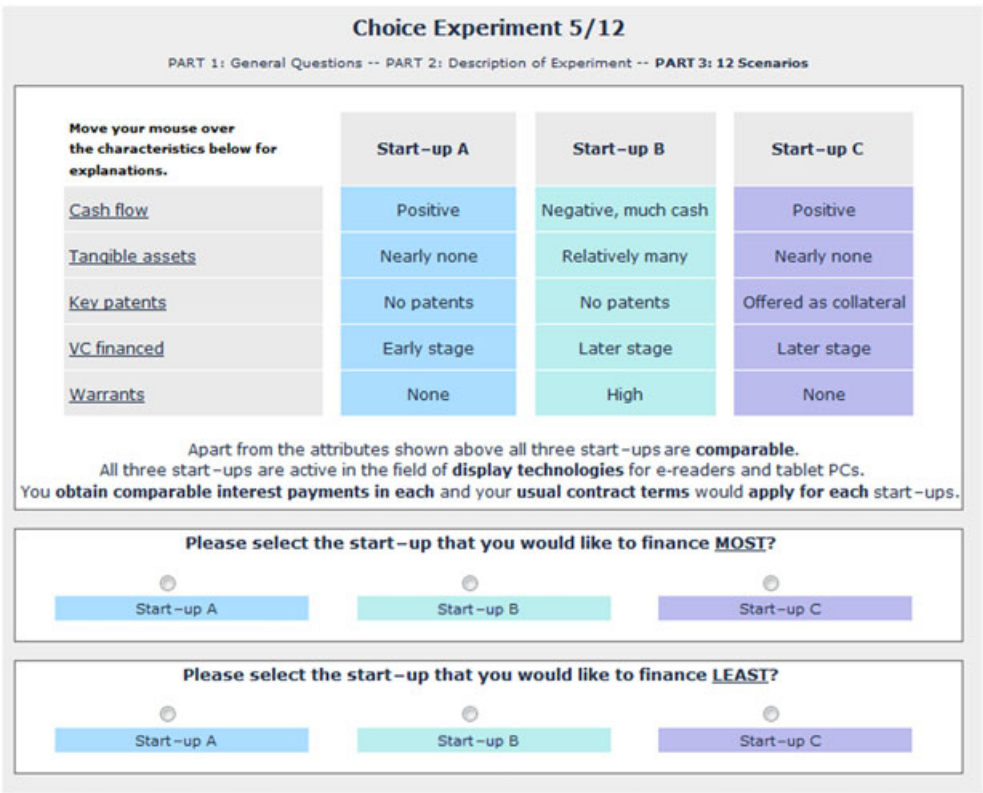

Figure 1. Sample choice experiment

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sets, each containing three start-ups described by five attributes: (1) its operating cash flow; (2) its tangible assets; (3) its patents; (4) the amount of warrants offered; and (5) whether or not it had VC backing. All other potential characteristics are comparable among the three start-ups. All start-ups were engaged in developing display technologies for e-readers and tablet PCs, a field of IT in which venture debt regularly occurs (Ibrahim, 2010). The VDL obtains a comparable interest payment for each start-up, and the usual contractual terms apply.[7] We explained all elements clearly to the participants at the start of the experiment and repeated such explanations in each choice set. We devoted special attention to explaining the attributes of each start-up and their levels so that all participants had a common understanding of them. A participants could also easily retrieve information on attributes and levels by placing his/her mouse over relevant items in the online experiment.

Two senior venture lenders pretested the experiment. The pretests led us to change the wording of some attribute levels to make them more familiar and understandable to lenders. The pretesters confirmed that the number of choice tasks was manageable and that the attribute levels and setup of the experiment were realistic. With five attributes at three levels each, the full fractional design contains $3^5 = 243$ possible combinations. We produced the 12 choice sets using the efficient fractional-factorial design generated by computerized search (Yu, Goos, and Vandebroek, 2009). Table 1 shows the three levels for all attributes.[8] The use of ordinal attribute values instead of actual figures reduces the risk of framing individuals in an inappropriate way. Importantly, the possibility that individuals may have different frames of reference does not affect the results thanks to the use of mixed logit models, as we will explain later.

Estimation method

Beggs, Cardell, and Hausman (1981) and Chapman and Staelin (1982) propose to decompose the ranking for each choice set into a choice of the best alternative out of all three and a subsequent choice of the second-best alternative out of the remaining two. Thus, each participant makes up to 24 choices: 12 choices from sets of three alternatives each and 12 choices from sets of two alternatives each. The dataset, therefore, comprises a theoretical maximum of 3,300 observations for 12 experiments by 55 lenders: three observations for the first-best option and two observations for the second-best option. In practice, the dataset includes 2,825 observations because of some limited attrition (42 lenders did all 12 experiments).[9] Thus, degrees of freedom are large enough to estimate complex empirical models.

The decomposed data can be fitted with McFadden's (1974) conditional logit estimator, which is commonly used to fit choice data. However, data obtained from choice experiments are likely to violate the assumption of independence of irrelevant alternatives (IIA) underlying this estimator. The IIA assumption implies that the error terms of each respondent's choices are distributed independently and identically. It is quite clear, however, that the preferences of one person should translate into similar choice patterns in different choice sets (Hausman and Wise, 1978).[10] Mixed logit estimators avoid the need for the IIA assumption (Brownstone and Train, 1999; McFadden and Train, 2000) by estimating individual coefficient vectors. They also have the desirable feature of controlling for individual-specific effects. Revelt and Train (1998) proposed a procedure for simulating the necessary resulting function value, which Hole (2007) implemented in the STATA mixlogit command.[11]

[7] Pretesters explained to us that interest rates and contractual terms exhibit little variation in venture debt agreements. Data collected supports this view. For example, the interest rate charged has a mean of 11.5 percent and a standard deviation of 2.6 percent.

[8] We coded each attribute into two dummy variables indicating the deviation from the reference value. To ensure convenient interpretation of coefficient estimates, we used the value with the (presumably) lowest benefit as a reference value for each attribute (the reference level is always the first level of the attribute). Dummy coding is a common practice in the literature to allow for differentiated effects across levels.

[9] To avoid potential attrition biases, we used five versions of the resulting design randomly assigned to survey participants where the order of choice sets and the order of start-up characteristics randomly varied.

[10] Long and Freese (2006) report that there is no reliable way to test for violation of the IIA assumption. They recommend using a conditional logit estimator only if the IIA assumption seems plausible.

[11] For a more detailed description of the estimation method to analyze discrete choice experiments as well as a description of procedures used to calculate average marginal effects of main and interaction effects, see Fischer and Henkel (2013).

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Table 1. Attributes and attribute levels

Attribute	Attribute levels
Cash flow	Negative, little cash available
	Negative, much cash available
	Positive
Tangible assets (usable as collateral)	Nearly none
	Some
	Relatively many
Key patents	No patents
	Patents available, but not offered as collateral
	Patents available, and offered as collateral
VC financed	No VC backing
	Early-stage VC backing
	Later-stage VC backing
Warrants	None
	Medium
	High

RESULTS

Descriptive statistics

The first survey question captures participants' level of experience with the venture lending activity. Respondents were asked to rate their level of experience on a five-point Likert scale ranging from 'not experienced' to 'very experienced.' Eleven of the respondents saw themselves as experienced (score of 4) in venture lending, while 44 saw themselves as very experienced (score of 5). Although there is a well-known tendency for individuals to be overconfident in their abilities, this high score is consistent with the sampling strategy of exclusively targeting individuals holding senior positions. The (self-reported) number of years of experience in financing new ventures, which averages 13.82 years, corroborates the expert status of the respondents. This figure is in line with information retrieved from LinkedIn. The 48 participants we were able to identify on the professional networking database had been working, on average, for 11.73 years in companies that provide loans to small businesses and/or loans to high-tech companies. They had also worked for 2.23 such companies, on average, suggesting significant familiarity with venture lending activity.

A second set of survey questions relates to the characteristics of the loan portfolios. As we asked these questions after the experiments, information is available from only the 42 respondents (from 24 different companies) that completed the last part of the questionnaire. On average, the lending companies in the sample had 87 outstanding loans (standard deviation of 97), with an average maturity of 28 months (standard deviation of six months), an average interest rate of 11.5 percent (standard deviation of 2.6%), and an average default rate of 4 percent (standard deviation of 5.4%). The average loan size was $3.5 million (standard deviation of $2.3 million).

It is possible to derive original market size estimates for the venture debt industry in 2010 by taking these figures together. The outstanding loans by the 24 companies in the dataset are close to $7 billion.[12] As the sample includes the biggest U.S. venture lenders, the population of the market size estimate should be close to the actual industry market size. It will necessarily be below the actual amount of loans because not all lenders participated in the survey and not all participants responded to these final questions. In annual terms, the venture lending firms in the sample provided about $3 billion (7*12/28) in 2010. By comparison, the VC industry invested about $22 billion in the same year.[13] In other words, the venture debt industry provides at least one dollar for every seven dollars invested by VCs.

A third set of survey questions aims at understanding the benefits of venture lending for all stakeholders. Table 2 provides descriptive statistics of the potential benefits of venture debt for lenders, start-ups, and VCs. Lenders mainly aim to obtain interest payments, but also equity warrants. In relation to start-ups, lenders saw the major advantage being that venture debt avoids the dilution of start-ups' equity shares. But, they only somewhat agreed with the proposition that start-ups do not obtain enough money from VCs. Hence, the results point to equity-efficient financing as the major advantage of venture lending for start-ups.[14] Equity efficiency is also the main advantage for VCs: from the lenders'

[12] The estimates of portfolio characteristics seem to be very reliable. We obtained data from 10 venture lending companies with at least two survey participants. For these 10 firms, the within-firm correlation of the number of loans is 0.979, and the within-firm correlation of the average amount of loans is 0.794.

[13] Source: U.S. National Venture Capital Association (http://www.nvca.org).

[14] Venture debt is indeed an equity-efficient way of raising money. The money provided allows the start-up to exceed or hit more milestones and raise equity at the next funding round at a higher valuation, thereby reducing overall dilution to both management and investor teams.

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Table 2. Benefits of venture debt lending from various perspectives

	Strongly disagree	Somewhat disagree	Indifferent	Somewhat agree	Strongly agree
Your company lends to new ventures because it aims to					
…obtain interest payments	0	0	1	4	50
…obtain an equity share via warrants	0	0	2	9	44
Venture debt is important for new ventures because					
…venture debt avoids dilution of the equity shares held by start-ups' owners	0	0	0	11	30
…start-ups do not obtain enough financing from venture capitalists to reach milestones	2	8	6	18	7
Venture debt is important for venture capital firms because					
…venture debt provides the VC more time to evaluate the start-up's worthiness for a follow-on VC round	3	13	5	14	6
…venture debt improves the VC's internal rate of return	0	0	4	19	18
…venture debt reduces the limitation of funds	2	1	5	19	14

perspective, VCs profit most from venture debt through an increase in their internal rate of return (by limiting equity dilution). In relation to other possible benefits to VCs, there is limited agreement on the proposition that venture debt gives VCs more time to evaluate start-ups. Finally, lenders agreed that venture debt reduces the limitation of VCs' funds by providing an additional source of financing.[15]

Econometric results

Table 3 presents our main results. Model 1a reports the results of the traditional rank-ordered logit specification, and Model 1b reports the results of the correct rank-ordered mixed logit, the main specification. As both methods show comparable results, we focus on Model 1b.

[15] Although we based these advantages to the VCs and the entrepreneurial firms on questions asked to VDLs, we are convinced that the answers are relevant. The advantages we asked about were informed by reading the existing literature and online information by VCs and entrepreneurs; thus, they are relevant from the entrepreneurs' and VCs' points of view. More generally, it is reasonable to suspect that VDLs are knowledgeable about entrepreneurs' and VCs' needs (some lenders actually were once VCs or entrepreneurs).

Analysis of main effects

All coefficients associated with the main effects (representing the start-up attributes) in Model 1b in Table 3 are statistically significant. The results support Hypothesis 1a that VC backing increases the probability that a start-up will obtain venture debt, for both early-stage and late-stage backing (i.e., series A and B rounds versus series C round and above). Holding key patents also increases the probability of receiving venture debt, which we interpret as evidence of the signaling effect of patents to venture lenders. In addition, the likelihood that a firm receives the loan significantly increases if offering the patent portfolio as collateral, supporting Hypothesis 2. Finally, the probability that a start-up will obtain venture debt financing increases with the amount of warrants offered, as hypothesized in Hypothesis 3.

Due to the use of nonlinear models, one cannot directly obtain the economic significance of start-up attributes from regression coefficients. They must be gauged by estimating average marginal effects, as explained in Hoetker (2007), for instance. Figure 2 presents average marginal effects obtained using coefficients reported in Model 1b of Table 3. These average marginal effects are the differences in predicted probabilities of switching a dummy variable

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(coding an attribute level as deviation from the respective reference level) from 0 to 1.[16]

Figure 2 underlines the important role of (positive) cash flow. High growth potential start-ups with positive cash flows are real gems, and lenders' preferences for such come as no surprise. The probability that lenders select these start-ups is, on average, 23.9 percentage points higher than the probability of them selecting start-ups with negative cash flows and little cash remaining (the reference level). Receiving warrants is a key parameter for lenders, with a probability increase of 13.5 percentage points for a medium amount of warrants and 21.4 percentage points for a high amount of warrants. VC backing also plays an important role in lenders' decisions, although they are indifferent between early-stage and late-stage start-ups (average marginal effects of 20.7 and 21.3 percentage points, respectively, and the difference is not significantly different from zero). Whereas owning patents but not offering them as collateral increases the chance that venture lenders will select the company by 4.4 percentage points (relative to owning no patent), offering patents as collateral increases the chance by 16.8 percentage points. This result suggests that the pure collateral effect of patents is 12.4 percentage points (16.8 - 4.4), which is similar to the collateral effect of tangible assets. Related to this, the amount of tangible assets seems to not matter to lenders, as witnessed by the nonsignificant difference between 'some' and 'relatively many' assets.

Analysis of interaction effects

Next, we focus on Hypothesis 1b regarding the substitution effect of VC backing and cash flow. We perform the test of substitution effect for both early-stage and late-stage backing in order to evaluate the stability of the effect across the start-up life cycle. We also include an additional interaction effect between offering tangible and intangible assets as collateral because the existing qualitative research does not allow ruling out the possibility of such a substitution effect. The significance of coefficients associated with the interaction variables in Model 1b provides a valid test of the hypotheses (Greene, 2010). However, it is good practice to report the average marginal effects of interaction terms to achieve a picture over the full probability range of outcomes (Huang and Shields, 2000; Norton, Wang, and Ai, 2004). Figure 3 depicts the average marginal effects.

The interaction effect of early-stage VC backing and cash flow is negative and statistically significant at the 1 percent probability threshold for both levels of cash flow. In other words, having early-stage VC backing reduces the impact cash flow has on the lending decision. However, the interaction coefficients associated with late-stage backing are not statistically significant. The results, therefore, support Hypothesis 1b that VC backing substitutes for cash flow, but only in the early stage. The coefficients associated with the interaction variables — patents available as collateral X (few or relatively many) tangible assets—are not significantly different from zero. Thus, there is no evidence of a substitution effect between tangible and intangible assets used as collateral.

Figure 3 shows the average marginal effects for each interaction term in Model 1b. Each plot depicts the predicted probability that a start-up will obtain venture debt financing on the x-axis and the difference in predicted probabilities when an interaction dummy switches from 0 to 1 on the y-axis. The magnitudes of interaction effects vary with the probability that a start-up obtains venture debt financing, which depends on its characteristics and the start-ups with which it is competing. Similar to the calculation of the average marginal effects of the main terms, one must calculate the magnitudes of the interaction effects for every possible combination of start-up characteristics. We then plotted the average interaction effect in each of 10 ranges of predicted probability (0% to 10%, 10% to 20%, etc.) that the start-up obtained venture debt financing. The plots also depict the 90 percent (full lines) and 80 percent (broken lines) confidence intervals.[17] Probability ranges associated with significant effects have upper and lower confidence bands below or above zero.

The first two rows of Figure 3 present the interaction between VC backing and cash flow. The

[16] As this difference in predicted probabilities depends on the choice set, i.e., the start-ups that were competing for venture debt financing, we calculated the difference in predicted probabilities for every single possible combination of start-ups that could compete for financing (see Fischer and Henkel, 2013). Eventually, the results presented are the difference in predicted probabilities averaged over all $3^5*3^5*3^4 = 4.7$ million possible combinations.

[17] We used 100 draws from the distribution of the originally estimated coefficient vector to calculate the confidence intervals. Since the hypotheses on interactions are directed, the confidence intervals indicate significance of one-sided hypotheses tests at the 5 percent and the 10 percent significance levels, respectively.

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Table 3. Coefficient estimates: base model

	Model 1a		Model 1b	
Dependent variable: ranking	Rank-ordered logit		Rank-ordered mixed logit	
Main effects:				
Negative cash flow but still much cash available (base: negative cash flow, little cash available)	0.995**	(0.32)	1.992**	(0.61)
Positive cash flow (base: negative cash flow, little cash available)	2.153***	(0.27)	3.272***	(0.60)
Few tangible assets (base: nearly none)	1.346***	(0.35)	1.981**	(0.69)
Relatively many tangible assets (base: nearly none)	1.183***	(0.27)	1.515**	(0.73)
Patents available but not offered as collateral (base: no patents)	0.480***	(0.14)	0.513**	(0.26)
Patents available and offered as collateral (base: no patents)	1.203***	(0.19)	2.126***	(0.39)
VC financed now in early stage (base: no VC backing)	2.143***	(0.29)	3.567***	(0.53)
VC financed now in later stage (base: no VC backing)	1.389**	(0.46)	2.608**	(0.90)
Medium warrants (base: no warrants)	0.757***	(0.21)	1.581***	(0.47)
High warrants (base: no warrants)	1.348***	(0.24)	2.449***	(0.47)
Interaction effects:				
VC backing early stage X Negative cash flow but still much cash available	-0.768**	(0.41)	-1.887**	(0.73)
VC backing early stage X Positive cash flow	-0.844**	(0.27)	-1.306**	(0.66)
VC backing later stage X Negative cash flow but still much cash available	-0.217	(0.51)	-0.140	(0.79)
VC backing later stage X Positive cash flow	-0.116	(0.26)	-0.171	(0.41)
Patents available and offered as collateral X Few tangible assets	-0.372*	(0.25)	-0.535	(0.59)
Patents available and offered as collateral X Relatively many tangible assets	0.197	(0.30)	-0.229	(0.50)
Respondents / choices	55	2,825	55	2,825
LL / McFadden's pseudo R^2	-726.05	28.3	-641.86	36.6
Wald test / p-value	259.63	0.000	212.43	0.000

Standard errors are shown in parentheses (one-sided tests for hypotheses, two-sided tests for controls). Standard errors clustered on respondents in rank-ordered logit model, robust standard errors in rank-ordered mixed logit model.
* $p < 0.1$,** $p < 0.01$,*** $p < 0.001$.

top-left panel of Figure 3 depicts the interaction effect between early-stage VC backing and negative cash flow. The effect is particularly strong when the start-up already has a high chance of obtaining venture debt financing. We observe a similar pattern in the interaction between early-stage VC backing and positive cash flow (top-right panel). In other words, these patterns suggest that interaction effects matter only when start-up characteristics are particularly promising compared with other potential lending opportunities. Turning now to the interaction between late-stage VC backing and cash flow, the interaction term for late-stage VC backing and positive cash flow (middle-right panel) is particularly interesting. On a low probability that a start-up obtains venture debt financing (i.e., weak start-up characteristics compared with other available lending opportunities), VC backing and cash flow are complementary to each other. However, on a high probability that a start-up receives venture debt financing, both are substitutes for each other, yielding an interaction term that is, on average, not significantly different from zero. The interaction between tangible assets and offering patents as collateral (bottom panel) is not statistically

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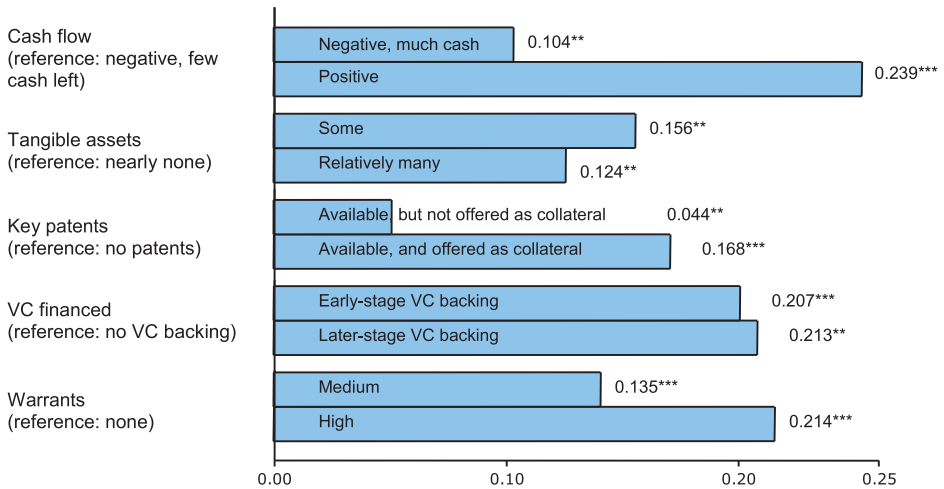

* p < 0.1, ** p < 0.01, *** p < 0.001.

Figure 2. Average marginal effects of the main effects (Model 1b)

significant on average. It is significantly lower than zero only at a very high (approximately 90%) probability that a start-up received venture debt.

Robustness checks

We conducted a series of robustness checks to confirm the validity of the findings and refine some conclusions. Table 4 presents results estimated on lenders with homogeneous lending practices, and Table 5 presents results estimated on lenders with similar industry focus. Figure 4 and Figure 5 depict the respective average marginal effects. Model 2a in Table 4 reports estimation results obtained with a sample of lenders who offer similar interest rates. The average interest rate in the full sample is 11.5 percent with a standard deviation of 2.6 percent. The sample used in Model 2a includes 30 lenders with an interest rate within a range of one standard deviation around the mean. The average marginal effects obtained are very similar to those in Model 1b, suggesting that lenders with relatively low or high interest rates do not drive the results. The test presented in Model 2b focuses on lenders of similar size, as measured by the number of outstanding loans. The sample is restricted to 34 lenders lying within one standard deviation range of 87 outstanding loans (+/- 97 loans)—therefore, the sample excludes the largest players. The results are comparable to those of Model 1b, suggesting that lending practices are similar across firms with portfolios of different sizes. If anything, smaller lenders tend to have a higher preference for tangible assets. The sample used in Model 3b focuses only on the 41 pure VDLs. It excludes institutions that have a commercial banking activity or that also provide venture capital. Two elements are worth noting. First, the interaction effect between patents offered as collateral and having few tangible assets becomes statistically significant. Second, VC backing at an early stage has a statistically significant, stronger effect than VC backing at a later stage. In other words, pure VDLs show a strong preference for early-stage start-ups, for which informational opacity is at its peak.

An additional robustness test aims at ensuring that the results are unaffected by lenders' industry background. To do so, we exploit information on the industry breakdown of the participants' portfolio of loans. The sample used in Model 3a of Table 5 includes lenders with at least 10 to 30 percent of their loans in IT start-ups. Model 3b focuses on lenders with a medium to high share of loans in biotechnology and pharmaceutical start-ups, and Model 3c focuses on lenders with a medium to high share of loans in the medical equipment field. Average marginal effects are qualitatively similar across models. The significance levels of coefficients in Models 3b and 3c are lower than in Model 3a due to the lower number of observations.

Additional robustness tests further confirm the main findings, but we do not report them here for the sake of brevity. We estimated the model on samples that contain lenders with similar default rates, similar loan size, similar loan maturity, and similar expertise in terms of years of engagement in new venture financing. We also estimated the model on a sample that contains only one randomly selected respondent per institution, with qualitatively similar results.

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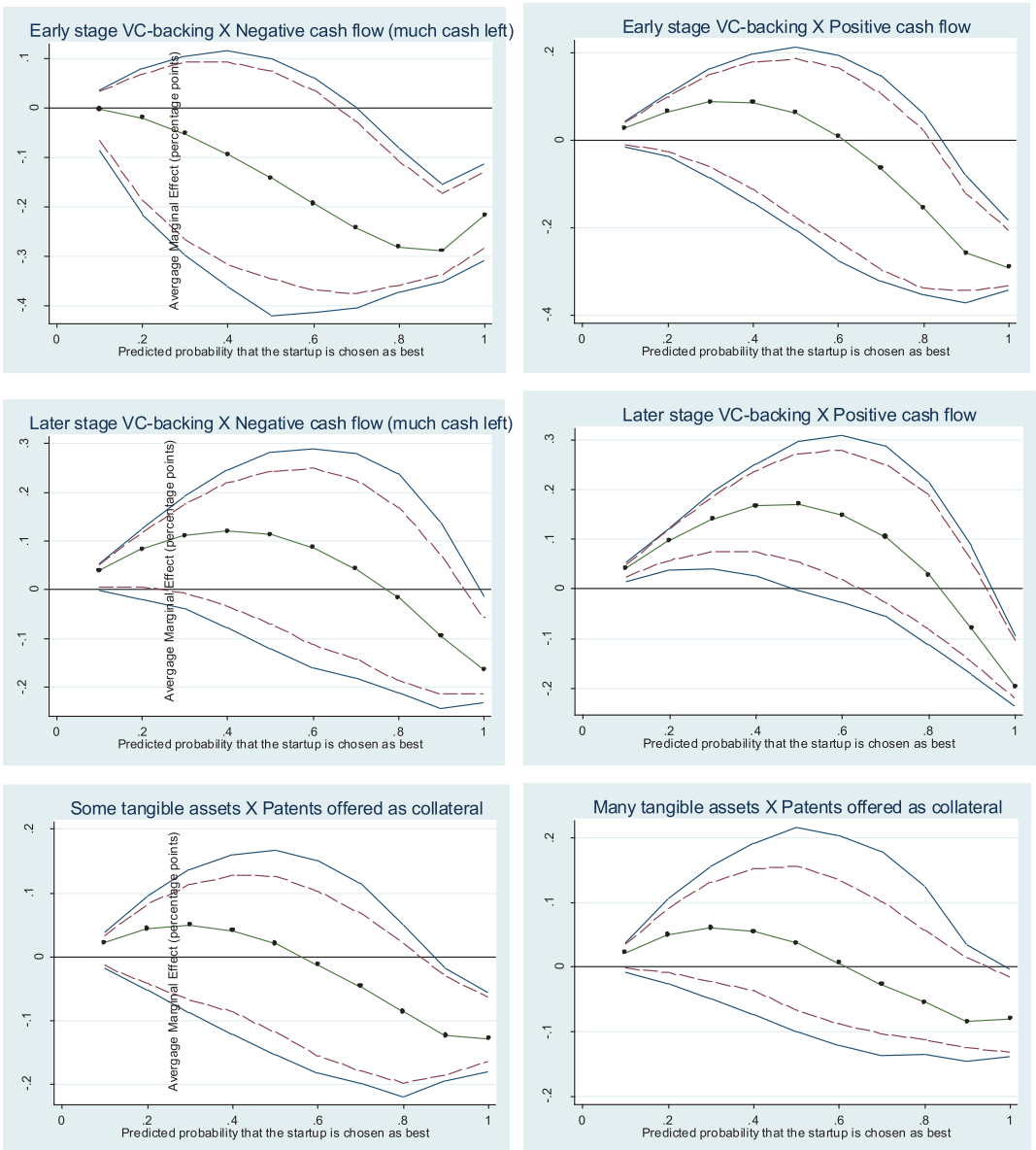

Full lines indicate 90 percent confidence intervals, and broken lines indicate 80 percent confidence intervals. So for one-sided hypotheses tests, they reflect significance on 95 percent and 90 percent significance levels, respectively. For a two-sided test they reflect 90 percent and 80 percent significance levels, respectively.

Figure 3. Average marginal effects of the interaction effects (Model 1b)

DISCUSSION

Contributions to the literature

The area of venture debt has received little scholarly attention to date. To the best of our knowledge, we are the first to offer a quantitative study of the venture lending decision criteria. These criteria help us understand the economic mechanisms that lenders rely on to provide loans to informationally opaque and risky new ventures. Three mechanisms stand out. First, VC engagement is a substitute for positive cash flow, especially for early-stage start-ups. It is possible that the higher probability of cash infusion by the VC in earlier rather than in later stages of VC engagement drives the moderation in the start-up phase. VCs do not want to earn a reputation within the entrepreneurial community of not supporting their

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Table 4. Robustness checks: testing outliers regarding lender characteristics

	Model 2a	Model 2b	Model 2c
Dependent variable: ranking	Without lenders +/- one s.d. in interest rates	Without lenders +/- one s.d. in number of loans	Pure venture debt lenders
Main effects:			
Negative cash flow but still much cash available (base: negative cash flow, little cash available)	3.396*** (0.98)	2.970*** (0.82)	1.741* (0.93)
Positive cash flow (base: negative cash flow, little cash available)	5.453*** (0.991)	4.589*** (0.80)	4.659** (1.70)
Few tangible assets (base: nearly none)	2.976** (1.05)	3.661** (1.44)	3.926* (1.71)
Relatively many tangible assets (base: nearly none)	2.108** (0.74)	2.803*** (0.65)	2.843* (1.42)
Patents available but not offered as collateral (base: no patents)	0.705** (0.38)	0.507* (0.38)	0.492 (0.33)
Patents available and offered as collateral (base: no patents)	2.831*** (0.73)	2.837*** (0.65)	2.481*** (0.78)
VC financed now in early stage (base: no VC backing)	6.026*** (0.92)	3.830*** (0.79)	4.710*** (1.17)
VC financed now in later stage (base: no VC backing)	5.153** (1.67)	3.712** (1.43)	1.373* (1.04)
Medium warrants (base: no warrants)	2.184*** (0.60)	2.408** (0.84)	1.966*** (0.55)
High warrants (base: no warrants)	4.166*** (0.71)	3.462*** (0.66)	3.797** (1.22)
Interaction effects:			
VC backing early stage X Negative cash flow but still much cash available	-2.391* (1.11)	-2.756* (0.24)	-3.057** (0.97)
VC backing early stage X Positive cash flow	-1.878** (0.91)	-1.810** (0.85)	-2.356** (0.97)
VC backing later stage X Negative cash flow but still much cash available	-1.483 (1.32)	-0.861 (1.07)	1.159 (1.18)
VC backing later stage X Positive cash flow	-0.541 (0.82)	-0.446 (0.70)	0.61 (0.58)
Patents available and offered as collateral X Few tangible assets	-0.534 (0.97)	-0.013 (0.65)	-1.064* (0.80)
Patents available and offered as collateral X Relatively many tangible assets	0.557 (0.74)	0.046 (0.61)	-0.600 (0.77)
Respondents	30	34	41
Choices	1,800	2,040	2,045
McFadden's pseudo-R^2	0.28	0.28	0.29

Outliers in this context are defined as lenders showing more or less than one s.d. of the sample mean value.
Standard errors are shown in parentheses (one-sided tests for hypotheses, two-sided tests for controls). Standard errors clustered on respondents in rank-ordered logit model, robust standard errors in rank-ordered mixed logit model.
* $p < 0.1$,** $p < 0.01$,*** $p < 0.001$.

portfolio firms. Their commitment is stronger in early stages and so is the probability of cash infusion (Hardymon *et al*., 2005; Roberts *et al*., 2008; Puri and Zarutskie, 2012). Second, lenders have a strong preference for start-ups that offer patents as collateral. The importance of patents as collateral is on par with the importance of tangible assets as collateral. These two elements—VC backing as a substitute for cash flow and patents as collateral—are the 'belt and suspenders' that lenders typically require (Hardymon and Leamon, 2001). Third, lenders show a marked preference for start-ups that offer warrants. This finding is consistent with the high agency costs that exist between lenders and entrepreneurs in ventures with high growth potential.[18] The existing literature has assumed so far that warrants are a 'nice bonus' (Ibrahim, 2010), but we show that warrants play a central role in the business model of VDLs.

Our findings contribute to research on benefits of venture capital financing. We add a new element to the list of benefits that VCs bring to entrepreneurs—namely the ability to obtain venture debt. Extant

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Table 5. Robustness checks: evaluating differences in specific industry focus of lenders

	Model 3a	Model 3b	Model 3c
Dependent variable: ranking	Loans in IT	Loans in biotech/ pharma	Loans in medical instruments
Main effects:			
Negative cash flow but still much cash available (base: negative cash flow, little cash available)	1.831*** (0.55)	3.168** (1.29)	1.326 (1.88)
Positive cash flow (base: negative cash flow, little cash available)	3.203*** (0.48)	5.053*** (1.42)	5.794** (1.99)
Few tangible assets(base: nearly none)	2.007** (0.70)	2.518* (1.34)	3.773* (1.62)
Relatively many tangible assets(base: nearly none)	1.500** (0.48)	2.230* (1.14)	2.828*** (0.39)
Patents available but not offered as collateral (base: no patents)	0.511* (0.23)	0.801 (0.86)	1.381** (0.56)
Patents available and offered as collateral (base: no patents)	1.898*** (0.33)	3.354*** (0.88)	3.282** (1.13)
VC financed now in early stage(base: no VC backing)	3.256*** (0.52)	4.643s*** (0.84)	4.943** (1.58)
VC financed now in later stage(base: no VC backing)	2.499** (0.39)	4. 952*** (1.54)	2.066 (2.94)
Medium warrants(base: no warrants)	1.521*** (0.43)	2.706*** (0.66)	1.984* (1.08)
High warrants(base: no warrants)	2.494*** (0.39)	2.900*** (0.75)	2.561* (1.20)
Interaction effects:			
VC backing early stage X Negative cash flow but still much cash available	-1.460* (0.73)	-1.897* (1.39)	-1.282 (2.22)
VC backing early stage X Positive cash flow	-1.315** (0.54)	-1.235* (0.90)	-1.278 (1.77)
VC backing later stage X Negative cash flow but still much cash available	-0.277 (0.97)	-0.090 (2.04)	1.672 (3.50)
VC backing later stage X Positive cash flow	-0.171 (0.41)	-1.010 (0.96)	1.310 (1.84)
Patents available and offered as collateral X Few tangible assets	-0.201 (0.52)	0.153 (0.87)	-0.752 (0.93)
Patents available and offered as collateral X Relatively many tangible assets	-0.082 (0.53)	-0.137 (1.23)	-0.394 (1.61)
Respondents	53	32	28
Choices	2,705	1,445	1,205
McFadden's pseudo-R^2	28.0	29.0	26.0

A minimum of 10 to 30 percent (on a scale 0%, 0-10%, 10-30%, 30–70%, 70-100%) of loans of included venture debt lenders go to the respective industry.

Standard errors are shown in parentheses (one-sided tests for hypotheses, two-sided tests for controls). Standard errors clustered on respondents in rank-ordered logit model, robust standard errors in rank-ordered mixed logit model.

* $p < 0.1$,** $p < 0.01$,*** $p < 0.001$.

research has shown that VCs benefit their portfolio companies by acting as certification agents to outside stakeholders (Stuart *et al*., 1999) and by bringing a higher degree of professionalism (Hellmann and Puri, 2002). They also provide activities such as mentoring, strategic advice, and recruitment of senior management (Sapienza *et al*., 1996; Hsu, 2004). This article shows that VC backing also facilitates access to debt. Lenders prefer start-ups backed by VC firms, most likely because the certification signal that VC backing conveys reduces information asymmetry between lenders and entrepreneurs. In fact, one could even argue that VCs, through their certification role, prevent the venture debt lending market from unraveling (Viscusi, 1978).

We also contribute to qualifying the economic importance of venture debt lending. VDLs increase the amount of financing available to start-ups and overcome potential limits of VC funding. These additional funds come at lower costs of dilution for entrepreneurs. Our descriptive statistics suggest a sizeable economic phenomenon. We find that about

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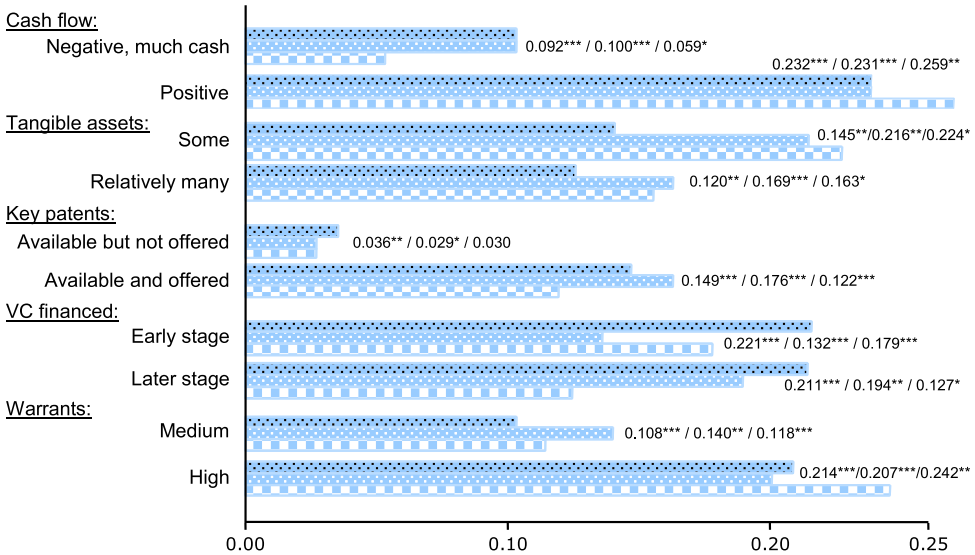
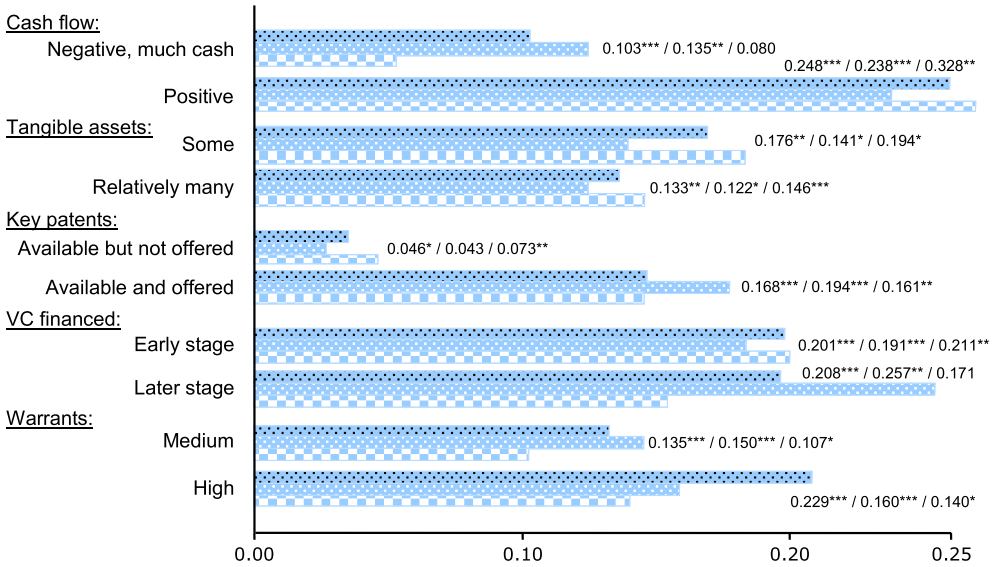


Uppermost bar and first coefficient reflect Model 2a 'Similar interest rates.' Middle bar and second coefficient reflect Model 2b 'Similar number of loans.' Lowermost bar and third coefficient reflect Model 2c 'Only pure venture debt lenders.'
* p < 0.1, ** p < 0.01, *** p < 0.001.

Figure 4. Average marginal effects of the main effects (Models 2a, b, c)



Uppermost bar and first coefficient reflect Model 3a 'IT focus.' Middle bar and second coefficient reflect Model 3b 'Biotech focus.' Lowermost bar and third coefficient reflect Model 3c 'Medical instruments focus.'
* p < 0.1, ** p < 0.01, *** p < 0.001.

Figure 5. Average marginal effects of the main effects (Models 3a, 3b, 3c)

one dollar of venture debt financing comes with every seven dollars invested by VCs.

Our findings also advance knowledge on the effect of intellectual property on start-up financing. Recent research shows that patents increase the chance of obtaining venture capital (Hsu and Ziedonis, 2013; Conti *et al*., 2013a; Conti *et al*., 2013b; Hoenig and Henkel, 2015). The results presented in this article

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extend this finding to the venture debt sphere in two ways. First, the results suggest that lenders prefer start-ups that hold patents (just like VCs), even if patents are not available as collateral. Patents can act as a signal that reduces information asymmetry between entrepreneurs and lenders in high-tech start-ups. Lenders may also value the productive role of patents. In particular, holding patents better insulates a start-up from competition, giving it a higher likelihood of survival (Wagner and Cockburn, 2010). Hence, lenders may simply consider the holding of patents as a factor that reduces perceived lending risk. However, the effect is small: the holding of a patent is associated with an average marginal effect of 4.4 percent, which is the lowest of all effects.

Second, patents further facilitate access to venture debt loans if offered as collateral. Notably, the average marginal effect of offering patents as collateral is as strong as the effect of offering tangible assets as collateral. As far as we can ascertain, we are the first to show that offering patents as collateral facilitates financing and that the effect is comparable to that of tangible assets. This finding adds to the list of roles that patents play in supporting innovative activity.

However, we also find that patents do not substitute for tangible assets. This finding is not surprising since markets for tangible collaterals usually exhibit a high degree of liquidity, whereas the market for patents is rather illiquid. Liquid markets facilitate valuation and liquidation (Shleifer and Vishny, 1992). One challenge of using patents as collateral lies in the difficulty of valuing them, as their revenue stream is particularly uncertain (Munari *et al*., 2011). The second challenge lies in liquidating the asset in case of default. Usually one needs a significant amount of tacit knowledge to exploit the invention, such that ownership of the patent does not imply ownership of the invention (i.e., the residual rights of control of intangible assets are difficult to transfer). Discussions with industry experts support that view: the intellectual property is often bundled with the team of engineers when transferred to another party. Even if the lender tries to liquidate the patent's exclusion right and not the underlying technology, the lack of liquid markets makes finding interested buyers challenging.

[18] Lenders' preference for start-ups that offer warrants is in line with a series of theoretical works that explain that warrants reduce agency cost. However, as one venture debt expert told us, 'Warrants are great. If I have the chance to get a piece of the next Google, why should I refuse?' The experiment is unable to single out the most important reason behind lenders' preferences for warrants.

Limitations

Our study presents some limitations that offer opportunities for further research. First, the choice experiment approach brings unique advantages for studying decision criteria, but it comes with caveats. One cannot rule out the possibility that lenders would have acted differently if they had had to use their own money. Furthermore, one cannot be sure that participants were mentally able to keep all other start-up attributes equal. These limitations are true for all choice experiments, and we have paid particular attention to designing the experiment as realistically as possible in order to alleviate these concerns. Nevertheless, an analysis of transaction-level data would be an interesting extension to the present work. The key empirical challenges such an approach would need to overcome are the selection bias that arises from the fact that we observe only successful outcomes, the confounding of both supply- and demand-side effects, and the estimation of interaction terms in the face of unobserved heterogeneity.

Second, one can question the generalizability of the findings. Data descriptives confirm that most venture debt loans do occur in the IT industry, emphasizing the relevance of the setup. However, lenders may rely on different economic mechanisms across industries. For example, the findings regarding the collateral effect of patents are likely to be stronger in biotechnology or pharmaceutical industries and weaker in industries where patents are not essential. This intuition finds some resonance in Graham *et al*. (2009), who report that entrepreneurs in biotechnology and medical instrument industries rely more on patents to secure investment than do those in the IT industry. With respect to the results related to cash flow, warrants, tangible assets, and VC backing, we are confident they are general enough to occur in other industries. However, there is a need for further research to highlight specific industry effects.

Third, although we selected the most important characteristics identified by qualitative research, the choice experiment approach implies that we can study only a limited set of start-up characteristics. Importantly enough, this feature does not affect the results. The mixed logit regression model estimates individual coefficient vectors and, therefore, controls

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for the possibility that respondents may have different perceptions of characteristics not shown. However, start-up characteristics not tested in this research could provide additional insights into the lending decision criteria. Future research could investigate the effect of characteristics found to play an important role in venture capital investment decisions, such as growth opportunities, market size, or the quality of the management team. Similarly, we suspect that VC reputation and the strength of ties between VCs and VDLs play a role in the venture lending decision.

Finally, we have studied venture debt taking a lender's perspective. An obvious extension to the present work is to analyze the demand side. It would be particularly interesting to understand the circumstances under which it is optimal for entrepreneurs to take on venture debt, thus allowing for normative guidance to start-up owners on financing decisions. Open questions include the extent to which the separation between ownership and control affects the attractiveness of venture debt, the effect of venture debt on subsequent share issues, and the very reason for the existence of venture debt as a capital market intermediary. One can also study venture debt from the policy makers' viewpoint, in particular whether we should encourage the practice of venture debt. For that purpose, it would be particularly interesting to study the causal effect of venture debt on innovation and start-up growth.

Practical implications

This study's focus on lenders is particularly valuable to entrepreneurs, as it provides insights into lenders' preferences. We provide additional rationales for having VCs onboard and for applying for patents. More generally, entrepreneurs must bear in mind that venture debt does not substitute for venture capital. VDLs have a much shorter time horizon than VCs, and they require a monthly repayment. In addition, they do not provide management advice. In that respect, venture debt is a temporary source of finance that complements venture capital. Its main advantage is to limit equity dilution by prolonging runways and allowing entrepreneurs (and investors) to raise equity at the next funding round at a higher valuation. The results also suggest another rationale for applying for patents. Many start-ups do not file patents because they are expensive (Graham *et al*., 2009), especially for start-ups at the pre-revenue stage. The findings further emphasize that the signaling and collateral effects are additional factors entrepreneurs should take into account when considering patent applications.

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APPENDIX

Venture Debt Lenders
Aegis Capital Group LLC
Agility Capital LLC
BFI Business Finance
BlueCrest Capital Finance, LP
Comerica
Culver Capital Group
Eastward Capital Partners LLC
Escalate Capital Partners
Gold Hill Capital Management LLC
Harris & Harris Group Inc
Hercules Technology Growth Capital Inc
Horizon Technology Finance
InnoVentures Capital Partners
Leader Ventures
Leasing Technologies International Inc
Lighthouse Capital Partners Inc
Madison Development Corporation
MCG Capital Corp
MMV Financial
Noble Venture Finance
ORIX Venture Finance
Oxford Finance Corporation
Pearl Street Capital Group
Pinnacle Ventures
RCC Ventures LLC
Sand Hill Capital
Square 1 Bank
SVB Capital (Silicon Valley Bank)
US Capital Partners
Velocity Financial Group
Wellington Financial LP

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ENTREPRENEURIAL FINANCE AND INNOVATION: INFORMAL DEBT AS AN EMPIRICAL CASE

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Research Summary: *Drawing on entrepreneurial finance theory, we examine the trade-offs among different sources of capital for entrepreneurial firms in emerging economies and their impact on innovation. In emerging economies, one of the unique aspects of firm financing is the presence of informal capital, as many formal sources of capital for new entrepreneurs have more constrained access than is the case in mature economies. We suspect that informal debt has an important effect on innovation, and this effect is contingent on the accessibility of formal debt and institutional development. The hypotheses are tested using survey data from 3,235 entrepreneurs in an emerging economy, China.*

Managerial Summary: *This study demonstrates an inverted U-shaped relationship between the level of informal debt and entrepreneurial ventures' innovation performance. The value of informal debt for promoting innovation was found to be weaker for firms having little or no access to often less expensive institutional finance, whereas a better-developed institutional environment strengthens the effects of informal debt.*

INTRODUCTION

New businesses and small ventures have increasingly become an important and indispensable element of emerging economic systems, given their roles in employment growth, competition, and innovation. However, entrepreneurs usually have insufficient resources to fund their new ventures from internal sources and must seek finance from external sources. Furthermore, how entrepreneurial firms receive external funding is one of the most fundamental questions for research on entrepreneurship in emerging economies (Cassar, 2004). The literature on entrepreneurial finance has recognized that capital decisions about which financing sources to use can have important implication for the operations of a business, including risk of failure, firm performance, and sustainable development (Denis, 2004; Hall, Daneke, and Lenox, 2010; Sirmon, Hitt, and Ireland, 2007).

Although the literature on entrepreneurial finance has grown substantially over the past decade (e.g., De Bettignies and Brander, 2007; Chemmanur and Fulghieri, 2014; Denis, 2004; Zhang, 2014), two important deficiencies remain. Previous research on entrepreneurial finance has centered on the question of the trade-offs among different sources of capital for entrepreneurial firms; but, this question has been examined, so far, primarily as the trade-offs associated with outright formal debt versus equity funding. Very little has been published on the trade-offs associated with formal versus informal funding. Formal sources include capital from institutions, such

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as banks and credit unions, or from government or nongovernmental (NGOs) organizations, such as the post office, whereas informal sources include capital from supplier credit, customer prepayments, personal savings, or gifts from family or friends. Informal finance has emerged as a popular source of finance in many emerging economies (Bruton, Khavul, and Chavez, 2011). There is a need, however, for greater examination of informal finance (Webb *et al*., 2013).

The second deficiency related to studies on entrepreneurship and entrepreneurial finance is the topic of innovation. Van de Ven (1986) defined innovation as the development and implementation of new ideas by people who over time engage in transactions with others within an institutional order. Innovation factors are largely related to key entrepreneurial issues, such as the generation or adoption of new ideas, entrepreneurial behaviors, transactions, and refinements of the institutional context. Recent studies (e.g., Christensen and Raynor 2003; Li and Si, 2007; Wright *et al*., 2005; Bruton *et al*., 2013; Si, 2015) have also reported that there are a variety of interactive relationships between innovation and entrepreneurship in both mature and emerging economies. Entrepreneurs commonly recognize opportunities that can be discovered or created (e.g., Suddaby, Bruton and Si, 2015). Such entrepreneurial opportunities are often found or created in markets where only innovation, or innovative products and services have the potential to address unsatisfied customer needs (e.g., Suddaby, Bruton, and Si, 2015; Burgelman and Hitt, 2007; Christensen and Raynor, 2003). To capture the value from opportunities newly recognized, entrepreneurs identify or create inventions and commercialize them as parts of new products and services, thereby creating innovations in the marketplace (Burgelman and Hitt, 2007). Often, innovations need to be put in place as soon as possible, so speed becomes an important factor in bringing an innovation to market. In this manner, innovation is in the context of entrepreneurship and is a primary way for entrepreneurs to create value and exploit entrepreneurial opportunities (Li and Si, 2007; Suddaby, Bruton, and Si, 2015).

This study will address these issues. Specifically, we bring informal debt into the discussion of entrepreneurial finance and examine how the various financial options can impact the success of entrepreneurs in emerging economies. As noted earlier, to take advantage of an opportunity discovered or created, entrepreneurs need to engage in innovations—creating new products and services in the marketplace and appropriating value from them (Suddaby, Bruton, and Si, 2015). Innovation typically requires enormous investments, so entrepreneurs must acquire the requisite financial resources to exploit them. However, entrepreneurs often face financial constraints and experience difficulty in quickly obtaining working capital from formal financing channels (Ebben and Johnson, 2006). Such conditions are particularly critical for entrepreneurs in emerging markets where financial markets are underdeveloped and alternatives for capital are limited. For these reasons, entrepreneurs often are forced to rely on informal debt to deal with the financial needs of innovation. In this study, we suspect that informal debt has an important effect on innovation, and this effect is contingent on the accessibility of formal debt and the context provided by a country's institutional development. We test our hypotheses by using the data garnered from a large sample of 3,235 entrepreneurs in China, examining their sources of financing and the role of innovation in their ventures.

This study makes several contributions to the literature. First, we contribute to the understanding of the theory of entrepreneurial finance by exploring the trade-offs among various sources of capital for entrepreneurial firms and their implications for the key variable of innovation, which has not yet adequately served as the focus of serious studies. We emphasize innovation-based entrepreneurial activities in emerging economies that center on product/service innovation with the considerable uncertainties of risk balanced against the potential for high growth. We focus our discussion on the trade-offs of formal and informal funding on innovation performance in entrepreneurial ventures. Second, we deepen the understanding of entrepreneurial finance by examining informal debt, a topic that largely has been ignored. Third, we advance scholarly understanding of entrepreneurship in its relationship to the use of informal capital in emerging economies.

THEORY AND HYPOTHESES

Sources of capital

There are numerous trade-offs to consider as entrepreneurs choose the means by which to build up the capital structure of each venture. Scholars have typically focused on issues of entrepreneurial trade-

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offs between debt and equity funding (e.g., Chua *et al*., 2011; Zhang, 2014). Prior studies (e.g., Chemmanur and Fulghieri, 2014; De Bettignies and Brander, 2007) have identified several striking differences between debt and equity funding such as: (1) bank finance provides high incentives for entrepreneurs by leaving an entrepreneur with full ownership of the firm, whereas equity funding dilutes the entrepreneur's incentives to provide the necessary effort; (2) banks are relatively passive investors, whereas equity funding providers such as VCs (venture capitalists) normally provide managerial input to entrepreneurial firms; (3) equity funding tends to take a longer time to accumulate than does debt funding; (4) outright bank loans need to reach a certain scale to finance plans and cover administrative costs, whereas equity funding tends to be more flexible (e.g., angel investors). Thus, it has been recognized in the literature that there are trade-offs over matters such as control and ownership that depend on the types of financing an entrepreneur may pursue. We have reviewed the literature on advantages and disadvantages of different sources of capital for entrepreneurial firms and present them in Appendix (see Appendix).

Informal debt for entrepreneurs in emerging economies

In emerging/developing economies, outright bank loans are not common (Zhang, 2014). Entrepreneurs, especially novices, typically do not have access to bank financing, as the banks are targeted on businesses running lower risks, especially when the overall context of extreme economic and institutional instability can make new ventures seem far too risky to serve as acceptable prospects for standard loans (Li, 2006). Under such conditions, informal debt financing from friends, family, or others in the community (such as suppliers) becomes the dominant means of accumulating capital (Conning, 1999). In a survey of 136 small firms in Tanzania, Satta (2003) found that 63 percent of them faced difficulties in accessing finance from financial institutions, and this was a major constraint on their development. Similarly, in his study of major sources of enterprise start-up funds, Buckley (1997) found that 96 percent of the entrepreneurs in Kenya had never applied for a loan from a bank because of such barriers.

Similarly, in a 2008 survey conducted by China's Industrial and Commercial Association, the data showed that 90 percent of small and microenterprises had never applied for a loan from a formal financial institution (including commercial banks, the post office, credit unions, government and non-governmental organizations, and 35 percent of their financial needs were met by informal forms of finance. Li (2006) estimated that the total amount of capital provided by informal debt in China in 2005 was about 800 billion RMB, although the real figure is likely to have been larger (Li, 2006). In the face of the importance of the role played by informal debt on new and small entrepreneurial activities on the national scale, it is truly unfortunate that the effects of informal debt on innovation in emerging/developing economies have so far received so little scholarly consideration. Furthermore, the more innovative such ventures are, the greater the perceived risk they must run in the eyes of the standard lender.

Informal funding and formal funding differ in the provisions of their financing contracts, which will ultimately affect the acceptable amount of risk the firms can afford to run in product or service innovations. Almost by definition, the outcome of any innovative project depends on contingencies that are hard to predict and can be said to involve a high degree of uncertainty and a concomitant probability of failure (Chemmanur and Fulghieri, 2014).

Informal debt can be attractive to entrepreneurs because of its speed, initial transaction fees, and freedom from collateral requirements. Informal debt can often involve much lower transaction costs than formal debt (Armendáriz and Morduch, 2007). Informal debt can be established in one or two face-to-face meetings, among parties whose personal familiarity allows them to negotiate the amount and the interest rate quickly, leading to an oral or written agreement specifying the repayment schedule (Buckley, 1997). In an interview, a group of Chinese entrepreneurs who said they used informal debt reported that the average time taken between first approaching the lender and getting the cash was three or four days; such entrepreneurs were under the impression that the clearance time for standard bank loans would have extended over weeks or even months. The individuals making the loans were known to the borrowers, but the relationships were not necessarily close. Instead, these were loans that occurred between individuals with capital and entrepreneurs who urgently needed it. The entrepreneurs might have preferred to have access to formal bank lending because of generally lower rates of interest, but they judged that it would not be available within the desired time frame.

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Once a loan has been paid back and a credit record has been established, the procedure for getting further informal loans becomes even quicker. Thus, the process of getting a series of informal loans from the same source can become exponentially quicker than fulfilling the paperwork and review requirements involved in obtaining loans through formal financial channels (Chen, 2010; Hu, 2010), which can be an important consideration for entrepreneurs with urgent financial needs.

How do novice entrepreneurs in emerging/developing countries overcome financial constraints and launch new products when faced with formal financial constraints? A novice entrepreneur characteristically has limited financial resources to apply to innovations: a short business history and a lack of several crucial things—a proven performance record, resources for collateral, general legitimacy, and status (which can only be acquired over time)—all tend to place a novice entrepreneur under a substantial handicap in the quest for formal financing (Stinchcombe, 2000; Zott and Huy, 2007). The limitations we have detailed are perhaps common to many pioneering souls, and entrepreneurs whose innovations are later copied and become pivotal factors in their sectors wind up having performed a service for the general economic climate of their nations and sometimes the world.

Informal debt and innovation

Entrepreneurs are often constrained by their limited financial resources and encounter difficulty in obtaining loans from formal financing (Ebben and Johnson, 2006). This is especially true for entrepreneurs in emerging markets where financial markets are underdeveloped. Given that there are limited alternatives to formal financing, entrepreneurs sometimes must have access to informal debt to resolve their financial needs for innovation. In this study, we argue that informal debt, especially over the long term, offers a kind of double-edged sword—there is an inverted U-shaped relationship between informal debt and innovation.

Still, informal debt can prompt innovation in two different ways. One effect is that its relative accessibility can greatly increase the chance of acquiring capital to finance innovation activities, and another effect is that the rapidity with which it can be granted can greatly shorten the time lapse involved in capital acquisition. The relative accessibility of the innovative process and the quality of a new product and market performance are hard to verify. This difficulty generates severe information asymmetry between innovative entrepreneurial ventures and finance providers, so that the former may possess superior information about the intrinsic quality of their new products (Amit, Brander, and Zott, 1998; Zott and Huy, 2007).

Through its flexibly, informal debt provides entrepreneurs with loans without collateral or a guarantor. But, it charges high interest rates to cover the high risk of lending without collateral (Buckley, 1997). The rapidity with which an informal loan can be granted contrasts with the long processes involved in obtaining capital through formal financing: time-consuming and complicated procedures—including rigid application procedures, feasibility analyses, field investigations, the frequently impossible necessity of providing collateral, and further formalities—often serve to discourage entrepreneurs involved in competitive marketplaces where time is almost literally money. In contrast, informal microfinance can involve much lower transaction costs (Armendáriz and Morduch, 2007). It usually involves one or two face-to-face meetings to negotiate the amount and the interest rate, leading to an oral or written agreement specifying the repayment schedule (Buckley, 1997).

While the initial effects of both greater accessibility and rapidity of informal debt might be seen as encouraging its continued use, such advantages tend to decrease with repeated use over the long term. The granters of informal debt tend to favor short maturities, as such short-term loans reduce business uncertainty. For an entrepreneur, having to repay a loan so quickly involves a disruptive effect; furthermore, the granters (possibly excluding family and friends) of informal debt tend to charge higher interest rates to reward themselves for the risks involved in providing in such loans; such interest rates can lead to serious overstretching on the part of an entrepreneur (Hu, 2010).

Thus, heavy or repeated use of informal debt can bring a substantial financial burden to innovative entrepreneurial ventures already handicapped by limited financial resources (Buckley, 1997). In China, some informal capital providers routinely charge more than 40 percent interest on an annualized basis (Wu, 2011). With such high rates of interest, it is not just a question of the financial resources of borrowers easily being overstretched; entrepreneurs involved in

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what are essentially relationship-based transactions find they may also have to devote substantial time and resources to building strong social ties and trust. Failure to do so can result in all sorts of quarrels and disputes. Too much reliance on informal debt can expose entrepreneurs to numerous conflicts and entanglements. Much of an entrepreneur's effort and energy must be devoted to dealing with personal, group, or community relationships, and the resulting difficulties can wind up leaving less time and resources for new product development. When entrepreneurs pursue large amounts of informal debt, they may overburden their ventures with financial pressures and stretch their managerial resources excessively and, hence, lower innovative outcomes.

Therefore, at low levels of informal debt, increases in the level of informal debt serve primarily to enhance the twin effects of accessibility and rapidity of capital acquisition. At high levels of informal debt, however, increases in the level of debt strengthen the twin disadvantages of disruption and overstretching far more than can be compensated by the twin advantages of accessibility and rapidity of acquisition of funds. When used habitually, the disadvantages of informal debt outweigh its advantages. Based on these arguments, we expect to observe an inverted U-shaped effect of the level of informal debt on innovation performance.

Hypothesis 1 (H1): A venture's level of informal debt has an inverted U-shaped relationship with its innovation performance.

The moderating effect of formal finance

While informal debt affects entrepreneurial ventures' innovation performance, this effect is ultimately contingent on the suitable availability of alternative sources of financing (Kyriakopoulos and Moorman, 2004; Armendáriz and Morduch, 2007). The current study proposes that a venture's accessibility to formal finance will weaken the relationship between informal debt and its innovation performance. To realize quick profits and reduce risk, the providers of informal loans tended to charge high interest rates with short maturities (Armendáriz and Morduch, 2007; Hu, 2010). This imposed strong financial pressures on the entrepreneurs to focus on short-term returns, so they could quickly pay back loans carried with high interest rates. As a result, many entrepreneurs had little interest in making investments in developing long-term innovation capability (Armendáriz and Morduch, 2007; Si, 2015).

In contrast, institutional finance providers usually offered medium-term (1 to 2 years) or long-term (more than two years) maturities on their loans (Chen, 2010). Relatively longer periods of repayment allowed an innovative entrepreneur to implement a new product development project (planning, conceptual design, testing, process development, and production start-up) within a reasonable time period (Eisenhardt and Tabrizi, 1995). Moreover, financial institutions, because of their significant size and influential impact on the whole financial system, are usually closely supervised and monitored by regulators and policy makers (Satta, 2004). To promote and maintain a healthy financial system, a series of regulations and requirements (including prudential regulatory requirements and non-prudential regulatory requirements[1]) are issued to regulate their provision of financial services. An entrepreneur able to access capital controlled by formal institutional providers will enjoy a low interest rate and sometimes even a zero interest rate. There is always a legal ceiling on the highest interest rates that can be charged by an institutional finance provider; this is not applied in the case of an entrepreneur who borrows money from informal finance providers in China (Wu, 2011). Such conditions placed on formal financial channels can rescue an innovative entrepreneurial venture from the heavy financial burdens brought on by high interest rates associated with informal lending and, in turn, can increase the entrepreneur's tolerance of risk and uncertainty associated with innovation activities.

Moreover, an informal capital provider relies heavily on his/her own lending experience and personal relationship with the borrower, rather than professional skills and expertise in making a money-lending decision. Group lending emphasizing the importance of a networking strategy is also often adopted for monitoring and enforcement of loan payback (North, 1990; Webb *et al*., 2009). Such

[1] Prudential regulations involve the definition of detailed standards for financial structure, accounting policies, and management practices, where non-prudential requirements refer to legal responsibilities and duties, such as the registration of licensed entities, disclosure of ownership and control structures, reporting or publication of financial statements, external audits, and the transparent disclosure of interest rates to customers.

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exchange tends to diminish and overlook the importance of systematic evaluation of an innovation project in decision making. Largely due to the convenience provided by informal debt, many entrepreneurs seldom have thought through their innovation projects: matters such as whether the purchase of new technology and equipment or the increased investment in research and development can really give their ventures an advantage; how the market will respond to the launch of a new product; and other considerations often do not seem to warrant detailed examination in the absence of outside scrutiny.

It turns out that quite often such needs are derived more from entrepreneurs' overconfidence and imagination, rather than based on field study and market testing. In contrast, an application for institutional finance usually involves a rigorous process involving conducting feasibility analysis, assessing the relative advancement of a technology, and evaluating possible market responses (Anthony, 2005; Wu, 2011). Institutional providers rely on their knowledge and expertise in a decision-making process. Their decisions tend to depend on a rule-based impersonal exchange (often termed 'arm's-length transaction'), rather than a relationship-based personalized transaction structure (Anthony, 2005). Such a decision-making process saves substantial time and resources which, in turn, can be reallocated to invest in the multiple stages of innovation activities.

Overall, maintaining a well-run enterprise with adequate records and accounting can greatly increase the potential for success of an innovative project. Moreover, the professional knowledge and expertise involved in formal finance provide an impartial assessment on an innovation project (e.g., market response, product rivals). Such impersonal assessment raises an entrepreneur's awareness of potential risks and failures and effectively can serve to tame overconfidence and excessive optimism. Therefore, when an entrepreneurial venture accesses formal finance to make use of its various benefits for innovation, it relies less on informal finance to boost its innovation activities. Thus, there exists a supplementary relationship between the two types of entrepreneurial finance that can each serve to govern the innovation outcome of an entrepreneurial venture.

Hypothesis 2 (H2): The accessibility of formal finance negatively moderates the relationship between informal debt and entrepreneurial ventures' innovation performance.

The moderating effect of the institutional environment

Institutional environments are characterized by the elaboration of rules and requirements to which individual organizations must conform in order to receive legitimacy and support (Scott, 2008). The development of the overall institutional environment is one important factor that will shape the effects of informal debt (Satta, 2003, 2004; Chen, 2010). A developed institutional environment tends to have strict regulatory and supervisory policies with respect to minimum capital requirements, capital adequacy ratio for core capital, ceiling on unsecured loans, single borrower limit, ceiling on interest rate, the way of resolving unpaid loans, and the qualification of a debt provider (Satta, 2004). Such a clear and stringent regulatory framework pushes informal debt to operate in a transparent way so as to establish its legitimacy (Rahman and Luo, 2011). These well-developed regulations are exemplified by non-prudential and prudential regulatory requirements that are modified to regulate informal debt and monitor for unsafe and unsound practices in their provision of credit, saving and other financial services. These requirements expressly stipulate what type of informal finance providers (very likely those who have instituted strict internal governances and high levels of financial transparency) are allowed to access external financing to complement their own resources in order to reach as many prospective borrowers as possible (Satta, 2003; Chen, 2010). These requirements strengthen institutions' financial sustainability. More importantly, it effectively reduces potential negative effects (e.g., the overstretching effect, the disruptive effect).

As noted earlier, the overstretching effect is mainly related to numerous conflicts and entanglements possible in informal debt. A well-developed institution can reduce such conflicts. Prior studies have suggested that in markets with strong institutions, business exchanges rely more on market-based rules, rather than on personal relationships (Peng, 2003; Rahman and Luo, 2011). Developed institutions offer entrepreneurs more opportunities to gain access to advanced technologies, join innovation networks of incumbent innovators,

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and take advantage of innovation intermediaries (Satta, 2004). As such, entrepreneurs can capitalize on institutional advantages to develop their technological advantages (Makino, Lau, and Yeh, 2002; Wu, 2013) and reduce the necessity of expending greater time and cost to build personal relationships in acquiring important knowledge, human capital, and other resources necessary for innovation. Furthermore, while the disruptive effect in informal debt is rooted in short maturities, well-developed institutions can effectively stimulate entrepreneurial ventures' incentives to invest in innovation by encouraging debt with appropriate maturities. Therefore, better-developed institutional environments can be expected to suppress the negative effects and allow for the positive effects of informal debt on entrepreneurial ventures' innovation. Therefore,

Hypothesis 3 (H3): A better-developed institutional environment strengthens the relationship between a venture's level of informal debt and its innovation performance.

METHODS

Data and sample

The current study collected data from a large survey on entrepreneurial ventures conducted by the All-China Federation of Industry and Commerce in collaboration with the United Front Work Department of the Central Committee of the Communist Party of China and the State Administration for Industry and Commerce of the P.R.C (People's Republic of China) under a project entitled the Chinese Private-Owned Entrepreneurs Survey. The survey selected a random sample of 4,315 firms from a list of Chinese private-owned ventures across 31 provinces/municipalities registered in the State Administration for Industry and Commerce of the P.R.C.

Before the formal survey, the questionnaire was pilot tested to determine whether the questions were properly worded and well understood in the context of Chinese business. Trained interviewers were then recruited to conduct onsite interviews. This survey method ensured access to the correct respondents, confirmed the correct use and understanding of the terms, and provided high response rates (Si and Cullen, 1998; Chen and Wu, 2011). A letter of introduction explaining the purpose of the study and inviting participation was then hand delivered to each venture's entrepreneur. After getting a positive response, the interviewers presented the questionnaires to the entrepreneurs and collected the surveys after their completion. Each completed questionnaire was immediately checked by the interviewer to determine whether it had been filled out in accordance with the instructions. All questionnaires were verified by supervisors before data entry (Si and Cullen, 1998). The survey successfully obtained 3,837 responses.

The survey was comprised of two separate questionnaires answered by two different groups of respondents. One respondent provided basic profile information on matters such as a venture's ownership, R&D expenditures, and labor force size as well as demographic characteristics of the entrepreneur; the other respondent provided information on innovation outcomes. The sample covered various sectors, including manufacturing, agricultural, transportation, service, etc. After excluding items with missing values, the final sample included 3,235 ventures. Of the 3,235 entrepreneurial ventures, about 51 percent were of medium size, with 11 to 100 employees, and more than 35 percent were smaller, with fewer than 10 employees. About 42 percent had been in business less than five years, with another 36 percent aged from five to seven years. The sectors involved were as follows: about 43 percent in manufacturing; 22 percent in wholesale and retail; 14 percent in information and technology; 6 percent in agriculture; 6 percent in construction; 4 percent in restaurant; 2 percent in transportation; and 2% in civil service. About 64 percent of the ventures were from eastern China, 22 percent from middle China, and 14 percent from western China.

To assess the risk of heteroskedasticity (i.e., whether or not pooling data across industries and cities would be appropriate), the panel data were analyzed using White's generalized test (Si and Cullen, 1998; Bowen and Wiersema, 1999). The Breusch-Pagan test statistics revealed no heteroskedasticity concerns ($\chi^2 = 16.71$, $p = 0.84$). The estimated residuals were also plotted against the independent variables; no systematic patterns of heteroskedasticity were found (Wooldridge, 2009). Industry and city dummy variables were also created. This further alleviated any concerns about possible heteroskedasticity associated with pooling the data (Greene, 1994).

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To overcome the common method bias, the study employed the information provided by two different sets of respondents answering at different times. Specifically, the information on the dependent and independent variables was provided by different respondents from the same firm. This research design substantially minimized the risk of common method variance (Eisenhardt and Tabrizi, 1995; Si and Cullen, 1998). In addition, a Harmon one-factor test for common method bias showed that the first factor explained less than 39 percent of the variance, indicating that common method bias was not a serious concern in this study.

Measures

Product innovation performance was measured by the sales value realized in 2005 derived from new products a venture had successfully introduced over the previous three years. Compared with other measures, such as the number of new products or patents granted, revenue from new products is a better indicator of successful product innovation because it reflects the commercial significance of a firm's innovation activities related to a specific market. Previous studies have shown that introducing new products tends to increase market share and market value (Chaney and Devinney, 1992), improve firm performance (Roberts, 1999), and enhance a firm's survival chances (Banbury and Mitchell, 1995; Katila, 2002).

Informal debt

This study measured the extent of a venture's informal debt by calculating the total amount of loans given by informal debt providers. The higher the amount of informal debts the venture obtained, the higher the level of its use of this kind of financial service. Following the lead of Bruton *et al.* (2011), this study focused on those unregistered financial providers (e.g., individual moneylenders) and informal financial lending associations (e.g., rotating savings and credit associations).

Formal finance

This study measured the degree of a venture's accessibility to formal finance by calculating the total amount of loans it obtained from institutional finance. To identify the scope of formal institutions, this study followed Rahman and Luo (2011)'s theoretical framework and divided formal finance in China into the following classifications of financial institutions: four state-owned banks (Industrial and Commercial Bank of China, Agricultural Bank of China, China Construction Bank, and Bank of China); shared holding banks (e.g., China Merchants Bank, Shanghai PuDong Development Bank); nonbanking financial institutes (e.g., trust and investment companies); rural credit cooperatives (RCCs); and urban credit cooperatives (UCCs). The aggregated number of loans a venture obtained from these formal institutions was used to measure the degree of accessibility the venture had to formal finance. Formal finance was proposed as a moderating variable, but its direct effect was also included in the regression models. This allowed for an assessment of the moderating effect of formal finance above and beyond any direct effect it might have in the venture's relationship with informal financing (Rothaermel and Alexandre, 2009).

Level of institutional development

On the basis of previous work by Wu (2013), this study developed a measure that assesses the level of institutional development in which entrepreneurial ventures are operating. The level of institutional environment was quantified as a compound factor combining two components: (1) the level of the development of the financing environment; and (2) the level of the development of the legal system. The responses were coded as values from 1 to 4, with 1 representing 'very poor' and 4 representing 'significantly improved.' The reliability of this multiple-item construct was assessed by computing a Cronbach's alpha, and the alpha ($\alpha = 0.78$) was greater than the recommended 0.70, indicating acceptable reliability. An exploratory principal component factor analysis with varimax rotation was conducted to subtract the common factor, explaining 79.5 percent of the variance. This value was then saved to reflect the level of institutional environment.

Previous studies have suggested that an entrepreneur's gender can have an important effect on aversion to risk (Coleman and Cohn, 2000; Elston and Audretsch, 2010). To control for the effect of entrepreneur gender, a dummy variable was created, coded as '1' when an entrepreneur was male and '0' when the entrepreneur was female. When the entrepreneur is also the venture's general manager (or CEO), he/she has more managerial discretion in driving the venture in risky directions (Li and Tang,

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2010). This study controlled for this effect by creating a dummy variable entrepreneur-CEO duality, coded as '1' when duality was presented and '0' for others.

Prior studies have shown that R&D expenditures can have a positive effect on innovation performance (Wu, 2013), so a venture's R&D expenditures was another control. To account for different resources possessed by a firm, each venture's R&D expenditures were divided by its total sales to obtain a firm-size adjusted measure of R&D expenditures (Laursen and Salter, 2006; Wu, 2012). The study also controlled for firm age. Prior studies have provided different predictions about the effect of firm age on innovation performance (e.g., Sorensen and Stuart, 2000), so firm age was included without predicting a specific influence. Larger firms may have more resources to devote to innovative activities (Eisenhardt and Tabrizi, 1995), so firm size, measured by the logarithm of the number of employees, was included as a control variable. In addition, because the sample included firms from five different manufacturing industries, four industry dummy variables were created. In addition, the study included four location dummy variables.

Statistical modeling

To test the hypotheses, a stepwise hierarchical regression approach was employed to assess the explanatory power of each set of variables (Aiken and West, 1991). The models (M1 to M6) were of the form:

Baseline (M1): $Y = \alpha_1 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5$

H1 (M2): $+\beta_6 X_6 + \beta_7 X_7$

(M3): $+\beta_8 X_8 + \beta_9 X_9$

H2 (M4): $+\beta_{10} X_{10}$

H3 (M5): $+\beta_{11} X_{11}$ (*excluding* $\beta_{10} X_{10}$)

(M6): full model including all the variables

Where Y represents a venture's sale values derived from its new products introduced over the last three years; X_1 represents entrepreneur gender; X_2 represents entrepreneur-CEO duality; X_3 represents firm age; X_4 represents firm size; X_5 represents firm-size adjusted R&D expenditure; X_6 represents the level of informal debt; X_7 represents its square term; X_8 represents formal finance; X_9 represents the level of institutional environment; X_{10} represents the interplay between informal debt and formal finance; and X_{11} represents the interplay between informal debt and institutional environment. To reduce any potential multicollinearity problem, the predictor and moderator variables were mean centered before creating interaction terms (Aiken and West, 1991). All the analyses were conducted with the help of version 12 of the STATA statistical software package.

RESULTS

Table 1 reports descriptive statistics for the variables used in the analyses. A review of the correlations among the independent variables indicates that multicollinearity is not a major concern. This was confirmed with the analysis of variance of inflation (VIF). The VIF values ranged from 1.14 to 4.31,

Table 1. Means, standard deviations, and correlations

	Mean	SD	1	2	3	4	5	6	7	8	9
1 New product sales	700.071	3395.260	1.000								
2 CEO gender	1.136	0.343	−0.035*	1.000							
3 CEO duality	0.909	0.288	−0.037*	−0.046*	1.000						
4 Firm age	7.126	4.444	0.076*	−0.043*	0.047*	1.000					
5 Firm size	173.288	499.243	0.293*	−0.046*	0.002	0.102*	1.000				
6 R&D expenditure	37.560	215.037	0.500*	−0.031	−0.035*	0.065*	0.331*	1.000			
7 Informal debt	4.582	35.387	0.053*	−0.019	−0.025	0.013	0.089*	0.055*	1.000		
8 Formal financing	51.440	278.197	0.243*	−0.038*	−0.049*	0.086*	0.502*	0.301*	0.035*	1.000	
9 Institutional environment	0.001	1.103	0.054*	−0.013	−0.018	−0.038*	0.042*	0.034*	−0.005	0.024	1.000

* indicates significance at the $p \leq 0.05$ level of confidence.

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well below the cutoff threshold of 10, which indicates that there were no serious multicollinearity problems in the models (Si and Cullen, 1998; Hair *et al.*, 1998).

Table 2 provides the estimation results testing Hypotheses 1, 2, and 3. The adjusted R^2 values in M2 to M6 indicate significant explanatory power, and the changes in R^2 in M2, M3, M4, M5, and M6 indicate significant increases in explanatory power in those restricted models compared with M1, M2, M3, M4, and M5, respectively.

Hypothesis 1 predicts an inverted U-shaped relationship between the level of informal debt and product innovation performance. As shown in M2 and M6, the influence of informal debt on product innovation is positive at a moderate level of informal debt, but diminishes when the use of informal debt reaches a high level (the coefficients of informal debt in M2 and M6 are positive and significant: $\beta = 10.881$, $p \leq 0.001$ and $\beta = 11.984$, $p \leq 0.001$, respectively; whereas the coefficients of its square term are negative and significant: $\beta = -0.008$, $p \leq 0.001$ and $\beta = -0.009$, $p \leq 0.001$, respectively). Thus, Hypotheses 1 was supported; a moderate level of informal debt has a stronger influence on the venture's innovation performance than does either a low or a high level of informal debt.

Hypothesis 2 predicts that the accessibility of formal finance negatively moderates the relationship between informal debt and entrepreneurial ventures' innovation performance. In M4 and M6, the coefficients of the interaction term Informal × Formal

Table 2. Hypothesis testing

	M1	M2	M3	M4	M5	M6
Constant	503.077*	483.266*	424.759	407.252	446.144*	430.851
	(265.447)	(265.213)	(265.214)	(265.305)	(265.076)	(265.281)
Entrepreneur gender	−233.609	−224.681	−209.320	−205.833	−223.042	−219.187
	(153.096)	(152.823)	(152.578)	(152.539)	(152.515)	(152.522)
Entrepreneur-CEO duality	−161.690	−178.523	−137.461	−133.481	−138.629	−135.468
	(181.942)	(181.870)	(182.054)	(182.006)	(181.878)	(181.870)
Firm age	28.209**	26.887*	26.720*	27.135*	26.296*	26.651*
	(11.874)	(11.858)	(11.858)	(11.856)	(11.847)	(11.849)
Firm size	0.897***	0.883***	0.778***	0.791***	0.779***	0.789***
	(0.108)	(0.109)	(0.114)	(0.114)	(0.114)	(0.114)
R&D expenditure	6.735***	6.666***	6.585***	6.592***	6.591***	6.596***
	(0.251)	(0.251)	(0.252)	(0.252)	(0.252)	(0.252)
Location dummy	(included)	(included)	(included)	(included)	(included)	(included)
Industry dummy	(included)	(included)	(included)	(included)	(included)	(included)
Informal debt (Informal)		10.881***	10.608***	12.724***	10.333***	11.984***
		(2.869)	(2.868)	(3.102)	(2.867)	(3.115)
(Informal debt)^2		−0.008***	−0.008***	−0.010***	−0.008***	−0.009***
		(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Formal finance (Formal)			0.522**	0.542**	0.525**	0.540**
			(0.202)	(0.202)	(0.202)	(0.202)
Institutional environment			133.580**	133.284**	135.000**	134.651**
			(47.394)	(47.378)	(47.351)	(47.346)
Informal × Formal				−0.009*		−0.009*
				(0.005)		(0.005)
Informal × Institutional environment					5.973**	5.463**
					(2.217)	(2.248)
Adjusted R^2	0.156	0.236	0.286	0.346	0.396*	0.466*
R^2 change		0.08*	0.05*	0.06*	0.05*	0.07*
Model F	195.664	142.358	112.798	101.907	102.442	93.320
DF	5	7	9	10	10	11
N (sample size)	3235	3235	3235	3235	3235	3235

Notes: The values reported are regression coefficients, with robust standard errors given in parentheses.
* indicates significance at the $p \leq 0.05$ (** $p \leq 0.01$; *** $p \leq 0.001$) level of confidence (one-tailed tests).

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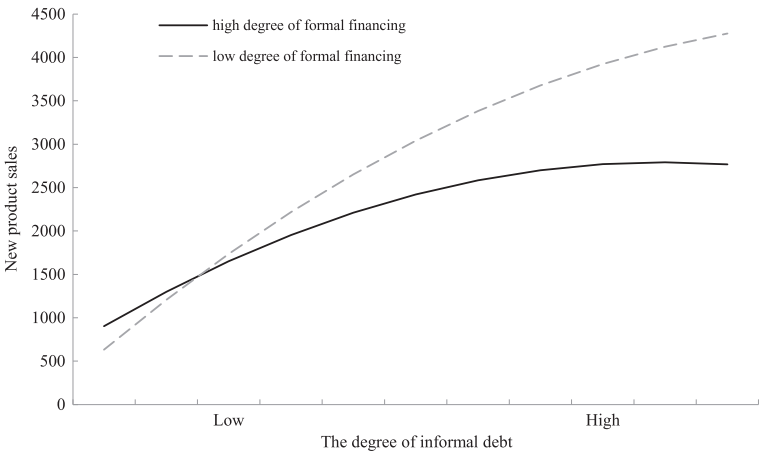

Figure 1. Informal debt, formal finance, and innovation performance

are negative and significant ($\beta = -0.009$, $p \leq 0.001$ and $\beta = -0.009$, $p \leq 0.001$, respectively), indicating that the accessibility of formal finance weakens the relationship between informal debt and product innovation performance. To gain more insight into the interaction effect of Hypothesis 2, the significant interaction effect was plotted in Figure 1, following the procedure suggested by Aiken and West (1991). The horizontal axis represents the extent of a venture's use of informal debt, and the vertical axis represents the venture's product innovation performance. The firms were split into two groups based on the degree of accessibility to formal finance—high degree (one standard deviation above the mean) and low degree (one standard deviation below the mean). The figure shows that informal debt has a curvilinear relationship with product innovation performance. More importantly, informal debt at a high degree of accessibility of formal finance has a weaker positive effect on product innovation performance than that at a low degree of accessibility of formal finance, as Hypothesis 2 predicts.

Hypothesis 3 suggests a positive moderating effect of institutional development on the relationship between informal debt and product innovation performance. In M5 and M6, the coefficients of the interaction term, Informal × Institutional environment, are positive and significant ($\beta = 5.973$, $p \leq 0.01$ and $\beta = 5.463$, $p \leq 0.01$, respectively), indicating that a better-developed institutional environment strengthens the observed relationship between informal debt and product innovation success. To facilitate interpretation, the interaction is plotted in Figure 2 following the same procedure. The firms were split into two groups based on the level of institutional development set at a high level (one standard deviation above the mean) and a low level (one standard deviation below the mean). The figure again shows an inverted U-shaped

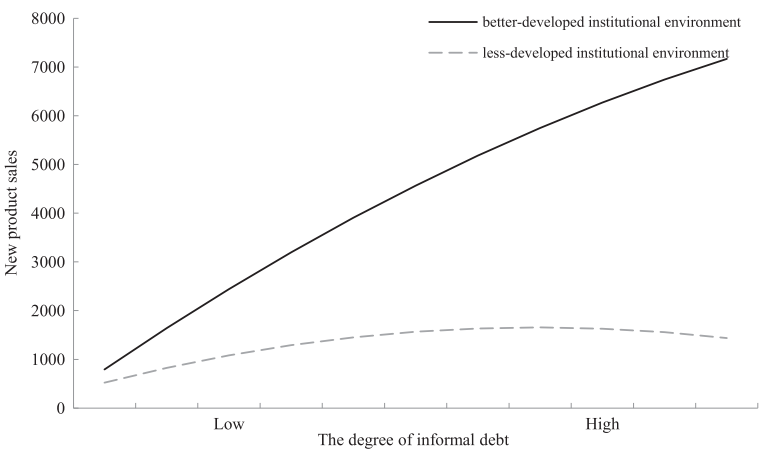

Figure 2. Informal debt, institutional environment, and innovation performance

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relationship between informal debt and the venture's product innovation. More importantly, the effect of informal debt on product innovation performance at a high level of institutional development is stronger than that at a low level of institutional development, as Hypothesis 3 predicts.

The robustness of these results was tested in several ways. First, to reduce any concerns that might arise from the fact that the sample contained observations from firms without any new products, all the models were reestimated with a subsample of 2,275 firms, all of which had introduced at least one new product during the period studied. The results did not change in any substantial way. Second, one could argue that the pattern of venture financing in regulated industries (the transportation industry) may be different from patterns in unregulated industries, such as electronic equipment. The Chinese government exerts more policy constraints on the former, creating more hurdles for external financing. To eliminate this concern, reference to the *Catalogue of Industries for Guiding Foreign Investment in 2000*, an official guideline issued jointly by China's Ministry of Commerce and its National Development and Reform Commission, was used to exclude the transportation sector from the sample analyses. The results remained consistent with the earlier findings, providing additional evidence of their robustness.

DISCUSSION AND CONCLUSION

One of the most important issues facing entrepreneurial firms is how to obtain external sources of finance for their new ventures, given that these are typically not yet profitable and lack tangible assets. To address this difficult question in the field of entrepreneurial finance research, we discuss the theoretical trade-offs among different sources of capital for entrepreneurial firms and their implications for the key outcome variable—innovation. To deepen our theoretical understanding, we used informal debt as an important case in point, examined its positive and negative effects on innovation, and explored the boundary conditions behind the entrepreneurial finance-innovation relationship. Using a large dataset of Chinese entrepreneurs and their sources of finance for product innovation, the results revealed that the effect of informal debt on entrepreneurial ventures' innovation performance was more complex than what current literature recognizes. It seems that informal debt has both positive and negative financial aspects that need to be carefully balanced. The results also support the idea that the relationship between entrepreneurial finance and innovation performance is contingent upon the accessibility of formal finance and the levels of institutional development. These results have important implications for our existing knowledge as well as for practice and public policy.

Implications for theory and research

First, this study makes an important contribution to entrepreneurial finance theory. Previous research on entrepreneurial finance has been focused primarily on the trade-offs associated with debt versus equity funding. We have extended this discussion by exploring the trade-offs associated with informal and formal funding and have examined how informal debt operates within this broader theoretical context. We have made great efforts to document the direct effects of informal debt on successful product innovation for the focal venture. Moreover, we have provided evidence that informal debt interacts with other financing channels to influence a venture's product innovation.

Recent works have called for the identification of multiple financial intermediaries that entrepreneurs can reconfigure to develop an appropriate portfolio of financing for their ventures' growth, a field that suffers from a lack of empirical evidence (Cassar, 2004). This study surmised that multiple financial channels may not only directly affect entrepreneurial ventures' product innovation, but also interact with each other to affect product innovation. Consistent with this proposition, the result showed that the extent of accessibility of formal finance weakens the positive effect of informal debt on a venture' product innovation. These findings not only suggest that those unidimensional approaches of postulating informal debt as far-reaching panaceas may well be too optimistically driven, but also open up opportunities for future research exploring in greater detail the different types of capital providers and which type has the greatest positive impact on entrepreneurial ventures' performance and long-term success.

Second, this study advances the research on the performance implications and consequences of entrepreneurial finance. Prior research in this area has focused primarily on entrepreneurial ventures'

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profitability rather than on their sustainable growth, in part because of the difficulty of collecting growth data from entrepreneurs in field studies. As a response to calls for the examination of the long-term performance implications of informal debt, this study helps advance research on entrepreneurial finance by exploring the role of entrepreneurial finance in shaping a venture's innovation performance and by providing empirical evidence, thus greatly enriching the growing literature on entrepreneurial finance-performance linkage (Bruton *et al*., 2011; Khavul, Chavez, and Bruton, 2013).

Third, this study complements the theory that describes the advantages and disadvantages of various sources of finance. This theory aims to explain why firms choose among different alternatives of finance. To date, however, scholars have been enthusiastic about the benefits of various sources of finance and, thus, have placed scant focus on specific potential negative consequences of one source or another (Buckley, 1997; Morduch, 2000). This research suggested that high levels of informal debt under certain conditions can harbor specific negative effects for entrepreneurs using this particular kind of financial service and can inhibit successful product innovation. The results strongly support such arguments by showing an inverted U-shaped relationship between informal debt and entrepreneurial ventures' innovation performance: a moderate level of informal debt relates to the highest degree of product innovation, whereas a high level of informal debt appears to have a negative influence on innovation performance. These findings enrich our extant theory by demonstrating the advantages and disadvantages of two kinds of entrepreneurial finance.

Additionally, this research deepens the existing knowledge of the entrepreneurial finance-innovation linkage by highlighting its boundary conditions. Building upon and extending the institutional theory, this study argues that a better-developed institutional environment pushes informal debt to operate in a more transparent way, to adopt safe practices, and to effectively discipline its services so as to mitigate its negative effects. The results show that a better-developed institutional environment can strengthen the positive effect of informal debt on product innovation in entrepreneurial ventures. Thus, this finding pinpoints the importance of a better-developed institutional environment and suggests the need to look not just at entrepreneurs' multiple finance channels, but also at the particular national institutional context in which these financial services are embedded.

Managerial implications

The arguments and findings of this study offer some important implications for entrepreneurs and policy makers. First, entrepreneurs need to recognize the positive effects of informal debt in promoting innovation performance. Being constrained by self-generated limited financial resources or denied by institutional finance, they can consider informal debt as an important source of financing that can help overcome urgent capital demands in new product development. The findings, however, also draw entrepreneurs' attention to the costs it may generate and strongly suggest the necessity of striking a balance between the positive and negative effects of such financing. In other words, the use of informal debt needs to be considered carefully and executed judiciously because an overreliance on high levels of informal debt may be just as harmful as underusing such a financial service. Excessive use may lead to high financial pressure as well as entanglement in a web of complicated social relationships. To overcome the dark side of informal debt, entrepreneurs should ensure that they can tap multiple sources of financing that complement each other. To gain more innovation benefits from external sources of financing, an entrepreneur should strive to broaden her/his social network, as it will help identify alternative financial channels and enable her/his venture to access critical capital and other resources that are useful for innovation success and long-term growth.

These findings also have valuable implications for policy makers. The governments of many emerging market countries (e.g., China and India) have developed preferential policies to encourage the emergence of debt and allow their various institutions to participate in providing credit, savings, and other financial services. The results of this study support such policies by showing that a better-developed institutional environment can promote a healthy development of debt, which can significantly facilitate product innovation among ventures. In the longer run, such an institutional environment in conjunction with certain enhanced firm-level technological capabilities may well help many emerging market ventures develop new technologies and achieve sustainable

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competitive advantages. Thus, policy makers should endeavor to strengthen market-supporting institutions and improve the efficiency of important financial markets.

Limitations and future research

Future research could improve and build on this study in several directions. First, the measurement of innovation performance used here relied on successful new product introductions. Clearly, some forms of innovation are related to the quality of new products and to process innovation, but these were ignored in this research. Future studies might examine the role of informal debt for other forms of innovation performance. Another direction for future research would be to develop further the basic model. This study attached great importance to the national institutional environment, but researchers might profitably explore in greater depth the relationship between informal debt and innovation performance by examining how other types of environmental factors (e.g., economic development, norms, values, or cultural differences) moderate the relationship. Examining cultural differences might be particularly enlightening.

In addition, firm-level analyses using data garnered from large surveys might fruitfully be supplemented by studies using a longitudinal design to track the dynamics of the processes in question. Also, generalizing the findings from a Chinese sample warrants caution. Although the processes observed in China appear to be similar to those in other emerging market contexts, there may be some peculiarity of organizational structure, government actions or the institutional setting associated with China or the time period. To establish their generalizability, the models need to be replicated using data of firms from other emerging markets. This is especially important given the heterogeneous institutions of emerging markets, as their different levels of institutional development should affect how emerging market firms obtain innovation benefits from different aspects of the institutional environment.

In short, the discussions and results of this study suggest that researchers need to consider/compare the benefits and costs across various sources of capital when examining the influences of entrepreneurial finance on key outcomes such as innovation performance. The analyses demonstrate that the impacts of informal debt as a specific empirical case on product innovation of entrepreneurial ventures depend on whether the ventures have the ability to access alternative sources of financing and the development of the national institutional environment.

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APPENDIX

Source of of entrepreneurial finances: advantages and disadvantages

Sources of entrepreneurial finance	Specific types	Advantages	Disadvantages	Sources
Formal equity	Venture capitalists	1. Provide monitoring services; 2. Provide a variety of support services; 3. Certification	1. Surrender partial ownership of the venture; 2. Dilute the entrepreneur's incentive to provide effort	De Bettignies and Brander (2007); Denis (2004)
	Angel investors	1. Serve important networking role; 2. Shorter time until venture financing; 3. The unique role in fund equity	1. Equity stage relatively small, provide few post-investment support services; B. Lack a clearly stated mission; C. Inherent conflicts of interests between corporation and entrepreneurial venture—little incentive to provide value-added support service	Chemmanur and Fulghieri (2014); Denis (2004)
	Corporate venturing	1. Have longer investments horizons than traditional VC firms	1. Lack a clearly stated mission; 2. Lack a sufficient commitment; c. conflicts over the strategic direction of the startup	Chemmanur and Fulghieri (2014); Denis (2004)
Informal equity	Informal crowdfunding	1. Raise funds from a large number of investors	1. Increase the chance that investors will lose money; 2. Crowdfunding may not be beneficial for the long-term success of entrepreneurial firms	Chemmanur and Fulghieri (2014)

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APPENDIX: Continued

Sources of entrepreneurial finance	Specific types	Advantages	Disadvantages	Sources
Formal debt	bank loans	1. Leave entrepreneur with full ownership, avoiding dilution of entrepreneurial effort and loss of entrepreneur control	1. Deprive the firm of VC's managerial input; 2. Need collateral acceptable to banks; 3. The loan amount needs to reach a certain scale	Talavera, Xiong, and Xiong (2012); De Bettignies and Brander (2007); Zhang (2014)
Informal debt	debts from friends, family, money lenders	1. Detailed personal knowledge of the client is available	1. The costs and interest rate can be affected by the relationship between the lender and the borrower; 2. Loans are small and short term to reduce default risk; 3. The nominal rate is sometimes higher than that of formal sector loans, especially in rural areas; 4. Incur reciprocal financial obligations	Chua et al. (2011); Zhang (2014)

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AN EMPIRICAL TEST OF THE RELATIONAL VIEW IN THE CONTEXT OF CORPORATE VENTURE CAPITAL

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Research summary: *This study focuses on Dyer and Singh's (1998) relational view in the context of corporate venture capital (CVC) investors and their portfolio companies, who mutually strive for interorganizational rent generation. Aiming to better understand this relational rent-generation process, our article entirely operationalizes and refines Dyer and Singh's (1998) model. While our findings attest strong explanatory power to the original model in the context of CVC investment relationships, they suggest the existence of additional relationships between the constructs of the relational view. Specifically, we identified relation-specific assets as well as knowledge-sharing routines as mediators between complementary resources and capabilities and relational rent.*

Managerial summary: *In this article, the relational view as an existing theory on interorganizational relationships is applied and tested using quantitative data in the context of corporate venture capital (CVC) investments. Our analysis confirms that relation-specific assets and knowledge-sharing routines, as well as complementary resources and capabilities, lead to relational rent. This is supernormal profit creation for both CVC investors and portfolio companies. The relationships are, however, not as straightforward as the original theory suggests, with complementary resources and capabilities being antecedents for knowledge-sharing routines and relation-specific assets which, subsequently, lead to the desired rent. Counterintuitively, informal self-enforcing governance mechanisms (trust) appear to foster relationship satisfaction, but not necessarily create relational rent or immediate tangible benefits.*

INTRODUCTION

The relational view (RV), introduced by Dyer and Singh in 1998, is an eminent and highly cited interorganizational theory attempting to explain competitive advantage by specifically focusing on dyadic relationships as the unit of analysis. By making the dyad the focal unit of analysis, the RV suggests that there are elements within this dyad, i.e., specific to the relationship and not to the individual parties, that result in jointly generated supernormal returns, or relational rents. A citation analysis of previous literature dealing with the RV in the last two decades reveals a large gap between the overall number of citations on the one hand and the number of articles actually applying the RV as a theoretical foundation on the other hand. While there has been a discussion on whether the RV really has a right to exist or whether it is simply old wine in new skins (Dyer, 1999; Molina, 1999), first empirical research indicates that the RV has, indeed, additional explanatory power over and above existing theories (Mesquita, Anand, and Brush, 2008). Notwithstanding, a comprehensive

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analysis of the entire RV is, to the best of our knowledge, still missing, as the RV has mainly been used to back up single arguments. Very few notable exceptions aim at furthering our understanding of the RV through empirical evidence (Dyer and Hatch, 2006; Maula, Autio, and Murray, 2003; Mesquita *et al*., 2008), and little research that deals with the overall framework exists.

This article is, thus, inspired by the idea of fully empirically testing the RV. Corporate venture capital (CVC) investing serves as a particularly suitable empirical context for this endeavor, as CVC investments are direct equity investments made by established companies in privately held entrepreneurial ventures (Maula, 2007) with the purpose of combining and complementing competencies and resources in a dyadic relationship to eventually mutually generate value, that is relational rent. These investments are best understood as boundary-spanning activities or interfirm relationships (Weber and Weber, 2011) involving, on the one side, the incumbent with its CVC unit and its business units and, on the other side, a young innovative venture that becomes a portfolio company (PC) of the CVC unit through an investment made by the latter.

Beyond the mere testing of the original RV model, our article particularly aims at refining it. Based on the RV and integrating additional research that has emerged since 1998, we attempt to deepen our understanding of relational rent generation and enhance the application feasibility of the RV. Building specifically upon earlier qualitative research on the RV in the field of CVC (Weber *et al*., 2016), we examine the role of complementarities by testing if and how far this determinant's effect on relational rent is mediated through the other three determinants. To do so, we present three models following Baron and Kenny's (1986) instructions on how to identify mediation effects. Model 1, the direct model, mirrors the RV as originally proposed by Dyer and Singh (1998). Model 2, the full model, shows the direct and indirect effects of complementary resources and capabilities on relational rent generation in a single model. Model 3, the mediated model, shows only the indirect effects of complementary resources and capabilities on relational rent generation. With these findings, we provide evidence for additional relationships between the RV's conceptual elements that have not been investigated empirically before. Thereby, our work advances the literature on the RV, and, therewith, also contributes to our understanding of rent generation within CVC investment relationships.

THEORY AND HYPOTHESES

The relational view and corporate venture capital investments

The RV developed by Dyer and Singh (1998) is an interorganizational theory attempting to explain competitive advantage by specifically focusing on dyadic relationships—as opposed to individual firms (Mesquita *et al*., 2008)—as the unit of analysis. The RV posits that four determinants lead to relational rent, which is defined as 'supernormal profit jointly generated in an exchange relationship that cannot be generated by either firm in isolation' (Dyer and Singh, 1998: 662). The four determinants of relational rent are 'relation-specific assets,' 'knowledge-sharing routines,' 'complementary resources and capabilities,' and 'effective governance mechanisms'(Dyer and Singh, 1998) (see Figure 1).

Extensive research from strategic management involving the RV has, directly or indirectly, focused primarily on the rent-generating effects of usually *only one* of the determinants listed earlier (e.g., Dyer and Nobeoka, 2000), with few researchers taking more than one determinant into account (e.g., Liu *et al*., 2010). In the context of CVC investing, research has identified that some of these individual determinants represent the reason as to why CVC firms exist and how they operate (e.g., Dushnitsky and Shaver, 2009; Gompers and Lerner, 1998; Maula *et al*., 2003). Nevertheless, the RV's entire framework has not been applied in the context of CVC, far from being further investigated and developed. This situation persists despite the existence of selected notable empirical findings explicitly documenting interrelatedness between some of the four determinants of relational rent. One of these exceptions stems from Mesquita *et al*. (2008). By utilizing the possibilities of structural equation modeling (SEM) to treat multiple equations simultaneously and the introduction of interaction effects, the authors show that the determinants of relational rent do not operate without affecting each other. Other notable exceptions come from Maula *et al*. (2003) and Maula *et al*. (2006, 2009), contributing to RV and CVC research alike. The authors also apply structural equation modeling (SEM) to CVC-portfolio firm dyads and find that one determinant of relational rent—complementary resources and capabilities—appears to be a precondition for another, relation-specific assets. This then, ultimately, results in increased relational rents in the form of knowledge transfer. To the best of our

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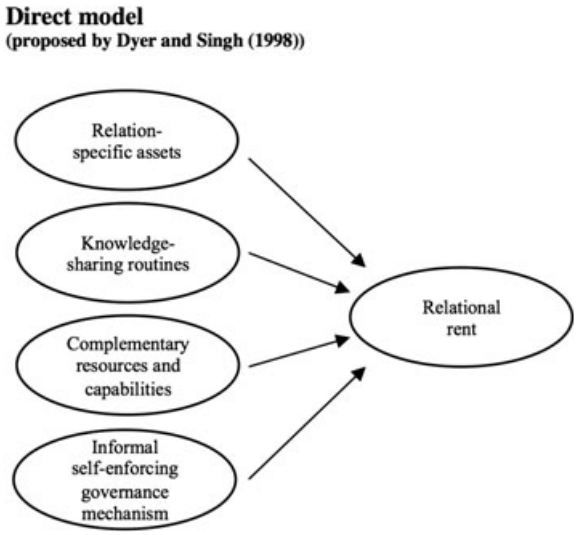

Figure 1. Direct model (originally proposed by Dyer and Singh (1998))

knowledge, no study looks at the combined impact of all four determinants of the RV as originally conceptualized. Furthermore, the data collection and analysis of Maula *et al.* (2003) was done from the PC's perspective, while we focus primarily on the CVC investor's perspective. We believe an investigation at the intersection of CVC and RV research to be a promising avenue to pursue because complex frameworks, such as the RV, are advisable to understand the complexity of interorganizational relationships in general (Gulati, 1998; Osborn, 1997; Park *et al*., 2002) and CVC investor-PC dyads in particular (Maula *et al*., 2006).

In order to concentrate on the core of our research, we follow Maula *et al*.'s (2003) approach and make a simplifying assumption. Although we are aware of the fact that many (corporate) VC investments are characterized by syndicate partnerships and although there is a probability that this network configuration has an impact on every single dyadic relationship between the PC and the respective investors in that network, our focus is on the very dyadic relationship that the PC maintains with a single corporate investor. PCs choose every additional (corporate) investor in a syndicate for very good, and often complementary, reasons (Maula *et al*., 2006). In typical (corporate) VC investment constellations, the relationship between investment manager and the PC has been identified as a central value driver (Fried and Hisrich, 1995; Weber and Weber, 2007). This is especially true for CVC investments, in which investment managers, having a bird's-eye view, act as a gatekeeper for the resources flowing between the two separate entities (the corporation with its business units and the new venture). The CVC manager helps the PC navigate through the large corporation, while identifying and motivating relevant business partners. This constellation fits the theoretical perspective of the RV. The two parties involved may achieve relational competitive advantage by being able to leverage assets (such as knowledge) to varying extents throughout their relationships (Mesquita *et al*., 2008).

Dyer and Singh's relational view in the context of corporate venture capital investments (direct effects model)

Dyer and Singh (1998) proposed relation-specific assets, i.e., assets that are tailored toward the needs of a specific partnership (Klein *et al*., 1978; Teece, 1986), as a determinant of relational rent. Williamson (1985) differentiates three types of asset specificity: (1) site specificity; (2) physical asset specificity; and (3) human asset specificity. In the context of CVC investing, the latter—human asset specificity—is the most relevant. As CVC investments are typically minority investments, making substantial investments in either physical or site specificity does not—at least from the perspective of the CVC investor—offer an appropriate strategic choice due to the high risk relative to the low capital committed. Furthermore, when investing (corporate) VC in young, fast-growing companies, it is the relationship between the investing entity and the target company that has

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been shown to be of tremendous importance (Fried and Hisrich, 1995; Weber and Weber, 2011). Higashide and Birley (2000), for instance, summarize from their research on this 'socially complex relationship' that 'the impact of the emotional commitment on the venture performance is significant and positive' (Higashide and Birley, 2000: 7). Thus, besides the unique technology or the innovative product/service that the investor is interested in when investing in a new venture, for the ultimate investment decision, the management team is key (Elango *et al*., 1995; Hisrich and Jankowicz, 1990; Siegel *et al*., 1988; Weber and Weber, 2005).[1] In addition, in their study on investors' decision criteria, Hall and Hofer (1993: 40) summarize that 'one of the factors carefully considered in the final stages of project evaluation is…whether or not the 'chemistry' between entrepreneur and the venture capitalist is right.' Hence, besides the business model itself, it is mainly the people running the new business that are the investment target. This is due to the fact that the investors know they will be working more or less closely with the entrepreneurial team over the coming years. Referring to Argyris (1962); Higashide and Birley (2002) point out that interpersonal problems between group members or personality clashes lead to less effective or suboptimal outcomes. In their study on the consequences of conflicts between the two parties of an investment relationship, Higashide and Birley (2002: 59) demonstrate that affective conflicts, or emotional conflicts, in such relationships are 'negatively associated with performance.' Furthermore, with their knowledge, creativity, and ability to attract additional highly qualified people as well as other resources, the entrepreneurs will determine the early success of such high-risk investments (Elango *et al*., 1995).

Human asset specificity is accumulated through social interactions between the parties of an exchange relationship, capturing 'the time spent in activities which do not necessarily lead to personal short-term benefits, but rather activities that signal a long-term commitment to the relationship' (De Clercq and Sapienza, 2001: 111; Dyer and Singh, 1998). An example of such relation-specific investments in the CVC context would be a CVC unit devoting considerable time and effort to better understand the potential of a new venture, allowing relational capital to develop between the CVC investor and PC management. The new venture, in turn, may develop or change reporting procedures specifically fitting the CVC investor's reporting requirements or it may adopt its newly developed technology to the specific requirements of business units within the parent corporation. For instance, 'We also have a business unit dealing with the same topic. They actively work together with them [the PC], provide them with engineering resources, and have made a strategic account manager responsible for that relationship' (Weber *et al*., 2016: 72). Through the devotion of time and the buildup of personal ties as a result of strategically oriented social interactions, which can occur *ex ante* as well as *ex post* investment, both investor and investee make a relation-specific investment, demonstrating their intentions and willingness to invest in a lasting relationship (Bensaou and Anderson, 1999; Nyaga and Whipple, 2011). Relation-specific investments made *ex post*, that is after signing the contract, can—in the worst case—lead to unintended lock in effects (Bensaou and Anderson, 1999; De Clercq and Sapienza, 2001; Nyaga and Whipple, 2011). In such cases the relationship is usually discontinued and the time invested, as well as the transactional efficiency gains attached, lose their value (Weber and Weber, 2011). Thus, they represent a non-recoverable investment in the sense of a relation-specific asset for both partners (Parkhe, 1993).

Research in related fields shows that relation-specific assets in the form of intense social interactions and relational rent are related (Tsai and Ghoshal, 1998). For instance, Yli-Renko *et al*. (2001) found that relation-specific assets have a positive effect on knowledge acquisition for entrepreneurial high-tech ventures and that knowledge acquisition ultimately leads to competitive advantage by means of innovation and cost efficiency. In the context of CVC investments, too, the investors' relation-specific investment is believed to have a positive impact on relational rent. De Clercq and Sapienza (2001) theorize that through the idiosyncratic contributions of the two partners, a synergistic bundle is generated

[1] It is important to differentiate between the reasons/original motivation parent organizations pursue when setting up a CVC unit and the eventual investment criteria when investing into certain new ventures. While in the first case, for many or even most parent organizations, the deal flow as well as the subsequent 'window on technology' is key (see review by Dushnitsky (2012)), in the second case, the eventual investment criteria regarding the importance of the management team are very similar to those applied by independent VCs (Weber and Weber, 2005; Siegel *et al*., 1988).

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'that the partners are unable to attain in the absence of collaboration' (De Clercq and Sapienza, 2001: 111). For instance, Wadhwa and Kotha (2006) showed in their study on knowledge outcomes for CVC investments in the telecommunication industry how investments specific to the relationship between the corporate investor and the PC can boost corporate innovation. Another example for relation-specific investments could be that the CVC unit spends time with introducing the PC to various potential suppliers, clients, and partners in order to help the new venture grow and find markets. By doing so, the CVC investor shares its own knowledge and contacts, and the PC is enabled to get access to and make use of these valuable experiential knowledge and resources. This, in turn, increases not only the PC's but, subsequently, also the CVC investor's financial performance. De Clercq and Sapienza (2001: 119) summarize that building 'commitment through the creation of relation specific time investments is particularly important for the transfer of intangible factors such as managerial skills or technical know-how.' Therefore, we propose the following hypothesis in line with Dyer and Singh's (1998) original model of the RV:

Hypothesis 1a: (H1a), The investment in relation-specific assets in the relationship between corporate investor and portfolio company positively impacts the extent of relational rent generated.

Knowledge-sharing routines are another determinant of relational rent. They are defined as 'a regular pattern of interfirm interactions that permit the transfer, recombination, or creation of specialized knowledge' (Dyer and Singh, 1998: 665). Knowledge-sharing routines are special purpose interactions, in which information and knowledge are exchanged strategically with the goal of learning. As a result, these routines have a positive impact on relational rent in the form of productivity advantages (Dyer and Nobeoka, 2000), faster knowledge acquisition (Dyer and Hatch, 2006), or increased innovation. Specifically in the context of CVC investing, the acquisition of new knowledge from innovative technology ventures or its combination with already existing knowledge is a major goal of corporate investors (Maula, 2007; Weber and Weber, 2005). Knowledge-sharing routines between the partners are, for instance, formal quarterly supervisory board meetings or more informal but regular/routinized meetings to discuss the PC's technology development.

Dyer and Singh (1998) name two subprocesses of knowledge-sharing routines: 'partner-specific absorptive capacity' and 'incentives to encourage transparency and discourage free riding.' Partner-specific absorptive capacity represents the ability of a firm to recognize the value of and assimilate information from a specific co-operation partner (Dyer and Singh, 1998; Lane and Lubatkin, 1998). It is a development of the more abstract concept of absorptive capacity, that refers to the 'ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends' (Cohen and Levinthal, 1990: 128). Taking into account partner specificity, this dyadic construct reflects the ability of the CVC investor and the PC to recognize each other's potentially valuable knowledge, learn from each other, and leverage their partially overlapping and partially complementary knowledge pools (Hughes *et al*., 2014; Makri *et al*., 2010) to achieve supernormal returns, i.e., to generate relational rents. In the context of customer-supplier relationships, partner-specific absorptive capacity was found to have a strong positive effect on performance (Selnes and Sallis, 2003).

In addition to partner-specific absorptive capacity, the right incentive structure can support knowledge sharing, as it encourages transparency and discourages free riding (Eisenhardt, 1989), that is actors' free exchange of information and knowledge for the common good, ultimately leading to relational rent generation (Hamel, 1991). Chen *et al*. (2010), for instance, show in their study on interorganizational R&D cooperation that transparency between partners is a crucial determinant for interorganizational learning. First support for these findings in the field of CVC research comes from Yang (2012), who demonstrates that transparency has positive effects in CVC investor-PC relationships. In particular, knowledge outflows from corporate investors to PCs enhance the new ventures' performance. In addition, knowledge inflows from PCs to corporate investors are facilitated by incentive structures that encourage the PCs' transparency and discourage free riding (Yang, 2012). Dushnitsky and Lenox (2005) provide empirical evidence that sufficient absorptive capacity and the right incentive structures can lead to CVC investors' learning. They show that the PC's firm value increases if the CVC operation's focus is on strategic objectives, such as the acquisition of

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knowledge, rather than on financial objectives. We, therefore, propose, in line with Dyer and Singh's (1998) original model of the RV, the following hypothesis:

> *Hypothesis 1b: (H1b), There is a significant positive relationship between knowledge-sharing routines in the relationship between corporate investor and portfolio company and the extent of relational rent generated.*

Dyer and Singh (1998) further suggest that (1) self-enforcement rather than third-party enforcement and (2) informal rather than formal self-enforcement governance mechanisms have a positive impact on relational rent generation. Thus, they ultimately consider informal self-enforcing governance to be most effective for relational rent generation. Trust is one of the most investigated informal self-enforcing governance mechanisms in research on inter-organizational relationships (Bachmann and Zaheer, 2013; Lane and Bachmann, 1996) and is also used as a prime example by Dyer and Singh (1998). They argue that self-enforcing governance does not only lower transaction costs, but is also highly suited to lead to greater value-creation initiatives. Value-creation initiatives are difficult to govern by formal governance mechanisms, such as written contractual agreements, as they are typically not pre-definable, but evolve during commencement of the exchange relationship over time. Informal self-enforcing governance devices, such as trust, support the sharing of fine-grained tacit knowledge and resources that are difficult to price and that offer innovations or responsiveness not explicitly definable *ex ante*. Because informal self-enforcing governance mechanisms are socially complex and idiosyncratic to the relationship, they are difficult to imitate and, thus, offer the potential for sustainable rent generation (Dyer and Singh, 1998). Existing research also delivers empirical support for the positive impact of informal self-enforcing governance on performance outcomes (Fulmer and Gelfand, 2012). Palmatier *et al.* (2007), for instance, show the importance of trust, particularly in their comparison of dominant theoretical perspectives to explain the performance of interorganizational relationships. Furthermore, extensive empirical research indicates that trust in exchange relationships has a positive effect on knowledge acquisition in alliances (Kale and Singh, 2007), on lowering transaction costs, and improving information sharing (Dyer and Chu, 2003), and on perceived relationship performance (Şengün and Nazli Wasti, 2009). For the VC-PC relationship, De Clercq and Sapienza (2001: 119) argue that 'the presence of trust increases the cost efficiency of relation-specific investments and also enhances each partner's knowledge processing capability' (for similar arguments see Shepherd and Zacharakis (2001)). Weber and Weber (2011) demonstrate for the CVC context the tremendous importance of trust as an antecedent for successful knowledge transfer and knowledge creation between the partners—a measure for relational rent generation. In line with these findings and with Dyer and Singh's (1998) suggestions on the relationship between informal self-enforcing governance and relational rent in their original RV model, we propose that:

> *Hypothesis 1c: (H1c), There is a significant positive relationship between informal self-enforcing governance in the relationship between the corporate investor and the portfolio company and the extent of relational rent generated.*

Finally, Dyer and Singh (1998) propose complementary resources and capabilities as a determinant of relational rent. Building upon prior work by Barney (1988); Harrison *et al*. (2001) assert that greater value may be created when dissimilar yet related resources are combined. Ideally such complementarities are based on idiosyncratic synergies between two firms that are not easy to imitate (Barney, 1988). Accordingly, Dyer and Singh (1998: 666) define complementary resource endowments 'as distinctive resources of alliance partners that collectively generate greater rents than the sum of those obtained from the individual endowments of each partner.' They argue that exchange partners leverage the other party's resources and capabilities in conjunction with their own to generate supernormal profits by accessing scarce resources that would otherwise be difficult to obtain on secondary markets on favorable terms. Along this line of reasoning, complementarities between a corporate investor and a new venture are also thought to determine the rent-generating potential of this specific relationship (Ketchen *et al*., 2007). Ivanov and Xie (2010), for instance, demonstrate that asset or operation complementarities between start-ups and corporate investors lead to higher IPO valuations

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and takeover premiums, mirroring earlier findings from Gompers and Lerner (1998). Hence, it seems as if Dyer and Singh's (1998) proposed leverage effect between one's own and the other party's resources and capabilities is specifically relevant to the relationship between the established corporation and the innovative PC. This holds because complementarities between the corporate investor and the new venture typically build a major part of the investment rationale that motivates the investment in the first place. Weber and Weber (2011: 261-262), for instance, give voice to portfolio companies that particularly highlight the complementary resources of their corporate investors: 'We appreciate in the case of [business unit] that they have [specific] marketing machines, knowledge, and contacts in financing issues and that the BUs basically have the [specific] technology machine. We get access to all that' and 'They had an extremely interesting network, the distribution network alone was invaluable.' In line with these illustrations and Dyer and Singh's (1998) original RV model, we hypothesize that:

Hypothesis 1d: (H1d), There is a significant positive relationship between the complementary resources and capabilities of the corporate investor and the portfolio company and the extent of relational rent generated.

Partial mediation between the determinants of relational rent: the role of complementary resources and capabilities (mediation model)

In addition to the direct positive effect of complementarities on relational rent proposed by Dyer and Singh (1998) and hypothesized earlier, there is some evidence that there are additional indirect effects of complementary resources and capabilities, which are partially mediated through the three other determinants of relational rent (see Figure 2 for the proposed relationships).

First, we expect relation-specific assets within the CVC investor-PC relationship to partially mediate the relationship between complementarities and relational rent generation. The underlying reasoning is as follows: when complementarities between a PC and the corporate parent are in place, the respective business units are more able and likely to provide product and market support, as they are better incentivized to promote the entrepreneurial firm (Hellmann, 2002). These incentives mainly arise due to the immediate tangible benefits for the business performance of the

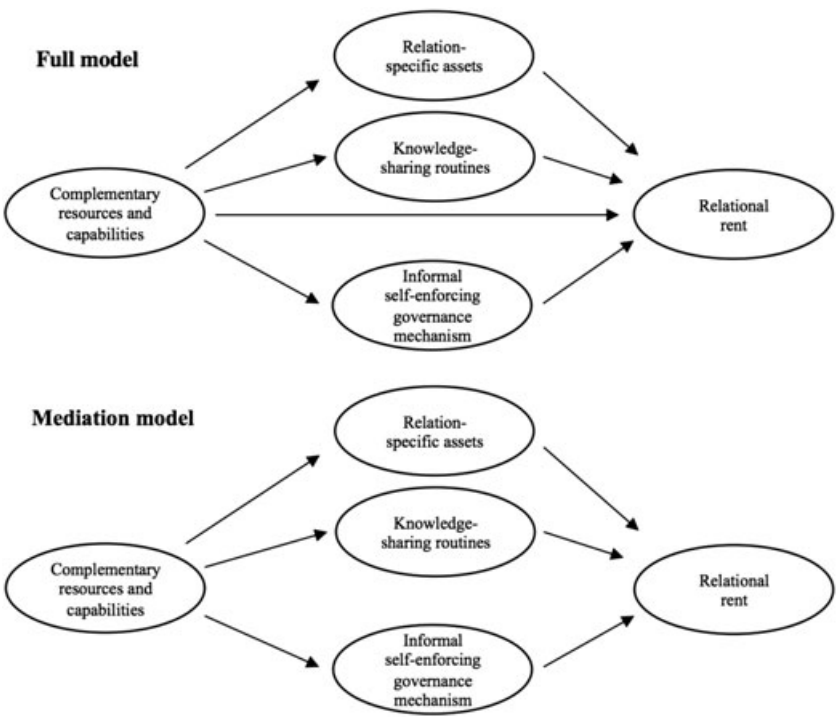

Figure 2. Full model and mediation model

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corporate unit which, in turn, serves as the basis for evaluation of the latter's employees. Weber and Weber (2011: 263), for instance, cite a CVC investor explaining this mechanism: 'The BUs contribute only if they have a personal motivation. If they are evaluated in terms of revenue or output and they see a company that promises to be a multiplier, then they suddenly get highly motivated. All they have eyes for at that point is the cash in their pockets.' When complementary resources and capabilities are in place, additional incentives for the business units often arise due to the reduced effort that is necessary in case the support expected by the PC lies within the business unit's area of core expertise. This more pronounced support by the corporate business units, in turn, enhances the value generated for both the entrepreneurial firm and the corporate investor by leading to higher exit valuations (Santhanakrishnan, 2002). This higher involvement from the corporate side, however, demands higher coordination efforts of the investment manager in his/her role as a broker, setting up contacts at multiple levels between the two organizations, helping the entrepreneurial firm navigate within the complex organization of the corporate parent and ensuring the latter's collaboration in critical situations. Such intense interaction is likely to result in relational capital and, thus, buildup of human asset specificity. A good example of such an intense relationship is illustrated by a CVC manager, who we interviewed in the course of our pre-study:

> 'We are permanently acting as a matchmaker between the portfolio company and [corporation]. [Corporation] is simply a huge organization, and we permanently try to bring them [the PC] into contact with different departments on our side. This means they [the PC] may want to expand to Asia, and we have the contacts for that. They want to get in touch with a customer in Asia, and we know the sales manager [and] the account manager for the customer or we have another portfolio company there. The question is always: can we find synergies?'

It becomes evident that the complementary competencies and resources can be 'transformed' into relational rents only if the two parties highly invest into the relationship in the form of relation-specific assets. In line with Maula *et al.* (2003), who argue that the expected return from collaborating is determined by complementary resources and markets, and in line with the qualitative findings by Weber *et al.* (2016) indicating that complementary resources act as an antecedent for other determinants of relational rent, we propose:

> *Hypothesis 2a: (H2a), Relation-specific assets mediate the positive effect of complementary resources and capabilities between the CVC investor's corporate parent and the portfolio company on relational rents.*

Second, we also expect knowledge-sharing routines between the CVC investor and the PC to partially mediate the relationship between complementary resources/capabilities and relational rent generation. Complementarities provide incentives for the parties to engage in knowledge-sharing routines (Steensma *et al.*, 2012). However, for knowledge-sharing routines to be successful, a certain degree of overlapping knowledge is needed (van Wijk *et al.*, 2008). Put differently, the motivation of corporate business units to support the PC and the motivation of the PC to seek advice from the corporate business units depend on the degree to which complementarities are in place, as they provide the necessary precondition or incentive for actors to pursue knowledge transfer (Maula *et al.*, 2003). Still, the ability and willingness of the two parties to receive and give advice depends on their partner-specific absorptive capacities (Carmeli and Azeroual, 2009; Minbaeva *et al.*, 2003) and on a certain degree of overlapping knowledge bases and similarity (Mowery *et al.*, 1996; Szulanski, 1996; van Wijk *et al.*, 2008).

Consequently, assuming that a certain degree of overlapping basic knowledge is given, a high degree of complementarity between corporate investor and PC will translate into a challenging knowledge-sharing process, as a large knowledge gap has to be bridged. To bridge this gap, it is likely that more intense knowledge-sharing routines, such as weekly meetings with the business unit, will be necessary or helpful in order to leverage the full potential of the investment relationship. To illustrate this effect, we provide a quote from a CVC manager describing such diverse routines set up to ensure the knowledge transfer and mutual knowledge creation that, subsequently, lead to relational rents:

> 'We have these board meetings on a quarterly basis. Then, we have monthly fiscal reports. In addition, the colleague from sales is surely talking several times a week with them; so

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several times. I speak at least once a week with the coinvestors, if not even every three days, and I also speak frequently with the management team…Additionally we have an account update every quarter. They [the PC] were here a short while back talking to us and the business unit. The two [the PC and the BU] spoke with each other and generally we were always in sync… This is very important for us because we can identify that the relationship is adding value.'

Based on this reasoning as well as the illustrating citation, we propose:

Hypothesis 2b: (H2b), Knowledge-sharing routines mediate the positive effect of complementary resources and capabilities between the CVC investor's corporate parent and the portfolio company on relational rents.

Third, we eventually expect informal self-enforcing governance between the CVC investor and the PC to partially mediate the relationship between complementary resources and capabilities and relational rent. Dyer and Singh (1998) name trust as a prime example of an informal governance mechanism based on self-enforcement. A key dimension of trust is the belief in the exchange partners' ability to fulfill their duties (ability-based trust) (Mayer *et al*., 1995). Complementary resources and capabilities, as a main motivation for interfirm cooperation (Teece, 1992) are, in turn, considered by the exchange parties as a sign to believe in the value-generation potential of a specific relationship as well as the other party's general ability to deliver on this promise. Hence, the greater the (assumed) synergetic potential between the two partners based on their complementary resources and capabilities, the greater the incentive for the parties to find a trustful exchange basis to be able to economize substantially on governance costs (Dyer and Singh, 1998; McEvily *et al*., 2003; Park and Steensma, 2013). Thus, the stronger the exchange party's belief that substantial value may be created through the interaction with the other party, the more likely it is to make the leap of faith and develop trust in this party. In addition to this ability-based trust, the mutual trust in the partners' positive intentions and motives describes benevolence-based trust (Mayer *et al*., 1995); this is also important (Weber and Göbel, 2006; Weber and Weber, 2007, 2011). In a relationship based on benevolence-based trust, both partners believe that the respective other will take common interests into account rather than use the received resources for its own benefit or even against its exchange partner (Nooteboom, 1996; Shepherd and Zacharakis, 2001). Together, we argue, the elements of trust function as leverage for relational rents being mutually generated out of the complementary resources and capabilities. In this context, Weber and Weber (2011: 262) cite the founder of a portfolio company explaining, 'I'm convinced that the mutual trust and the chemistry between each other were key factors. Trust is a very powerful element for a CVC investor. I assume that if they don't have the impression that they can unequivocally trust this individual, then they don't continue.'

Our reasoning is in line with Makri *et al*.'s (2010) finding from their empirical study of 95 high-tech M&A transactions that if partner selection takes scientific and technological complementarities into account, governance costs may be reduced. Under such circumstances, coordination is facilitated and hierarchical governance becomes less necessary (Gulati and Singh, 1998). Hence, if partners are selected with respect to their complementarities and if informal self-enforcing governance is simultaneously used instead of hierarchical governance, coordination effort and transaction costs can be reduced (Makri *et al*., 2010). Given the findings by Makri *et al*. (2010) from the M&A setting, our argument of trust being a mediator in the relationship between complementarities and relational rent generation in the CVC context gains further weight. Strategic benefits, which are typically a primary goal for CVC investors (Wang and Wan, 2013), are by the very nature of this setting regularly based on economic and/or technological complementarities (Kann, 2000; Keil, 2002; Maula *et al*., 2003). Thus, we propose that:

Hypothesis 2c: (H2c), Informal self-enforcing governance mechanisms mediate the positive effect of complementary resources and capabilities between the CVC investor's corporate parent and the portfolio company, impacting relational rents.

RESEARCH DESIGN

Sample and procedure

The study consists of data from an online survey and interviews with investment managers conducted by

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the researchers on-site at each CVC unit. The CVC units were identified with the help of databases from VC associations, such as the EVCA and BVK (an European and a German (C)VC Association, respectively), and by scanning reported investment activities from 2010 to 2012 in the trade press. We sampled CVC programs structured in separate organizational units in Austria, Germany, and Switzerland that were operating for at least two years. By doing so, we ensured homogeneity in relevant contextual aspects that were not under investigation (King *et al*., 1994). From the 29 CVC programs that fell into the categories we've outlined, only six declined the request to participate in our study. This leads to a response rate of 79 percent, which lies well above the response rate for surveys in general (Baruch and Holtom, 2008) and also for the domain of CVC research in particular (Dushnitsky and Shapira, 2010), substantially increasing the representativeness of our sample. Twenty-eight investment managers from 23 different CVC units operating within this study's scope were personally interviewed regarding their high and/or low performing investments, and they also completed an additional online survey regarding these particular investments.

The unit of analysis in this study is the individual investment relationship, that is the CVC investor-PC dyad. In the process of interviewing CVC managers, we collected detailed data from 47 of these CVC investor-PC dyads from the 28 investment managers, who answered either on their best or their worst performing investment or both. We made sure that the investment managers directly responsible for the specific investment were questioned. This ensured maximum intimacy of the respondent with the specific relationship. To increase data validity, additional data from 25 corresponding PCs was collected that formed respective counterparts in those CVC investor-PC relationships.

Analytical approach

The analytical approach we chose, partial least squares (PLS), is well suited to generate insights on small- to mid-sized samples (Henseler *et al*., 2009; Hulland *et al*., 2010). The sample size required for PLS is 10 times the highest number of exogenous constructs loading on an endogenous construct (Barclay *et al*., 1995; Chin, 1998; Chin, *et al*. 2003). Some authors even stipulate a requirement of only five times this number (Gopal *et al*., 1992). More recently, Reinartz *et al*. (2009) have shown that in comparison to covariance-based approaches, PLS-SEM achieves high levels of statistical power even with comparatively small samples. PLS-SEM is, therefore, the appropriate approach for our research due to it being a soft modeling approach that does not require strong assumptions with respect to distribution, sample size, and measurement scale (Vinzi *et al*., 2010). Moreover, PLS is able to handle a high number of correlated variables even with a very limited number of cases (Garthwaite, 1994). In our case, we are confronted with a rather small sample size due to the limited size of the population in combination with the difficulty of obtaining data from CVC managers—typically senior managers that are hard to access. Shamir *et al*. (1998) described a similar phenomenon for leadership studies. In a nutshell, PLS seems to be well suited for our research goals to: (1) derive a new approach toward investigating relational rent generation in interorganizational relationships; and (2) predict the relevance of different relational elements for the success of CVC investments (cf. Meznar and Nigh, 1995; Wold, 1985). We used the SmartPLS 2.0 software package to estimate the measurement and the structural models (Ringle *et al*., 2005). To evaluate the precision of the model's estimates, we needed to obtain standardized and recognized standard error coefficients. For this, we used bootstrapping, a nonparametric resampling technique. Bootstrapping is considered more effective than the alternative jackknife estimation (Efron and Tibshirani, 1993). N sample sets are created, obtaining N estimates of the PLS model parameters. This is done by a process of random sampling with replacement from the existing dataset. In their methodological evaluation using a Monte Carlo simulation, Sharma and Kim (2013) conclude that research with small sample sizes will especially benefit from using PLS with bootstrapping. We used a bootstrap approach with 500 resamples, following Chin (1998). Each sample drawn consists of the same number of cases as the original sample, so we can calculate the significance of the parameters (Efron and Tibshirani, 1993).

We predict three models to test our mediation hypotheses: (1) a direct model without mediation, which is the original RV model (H1a-H1d); (2) a full model including all hypothesized direct and indirect paths; and (3) a mediation model (H2a-H2c). Furthermore, to additionally qualify our findings, we applied a Sobel test (Sobel, 1982, 1986), which is a

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method for testing the significance of a mediation effect in structural equation models. It works as a specialized t-test, which determines whether the reduction of the direct effect after including the mediator in the model is significant. To compare and contrast the results from both sides of the CVC investment relationships, we used multiple comparison with a Bonferroni correction (Abdi, 2007) to compare our two datasets (CVC and PC datasets) and to establish how similar they are to one another with respect to their means and their variances.

Our data collection was done by means of a key informant methodology (Phillips and Bagozzi, 1986), and we chose the key informants based on their position as investment managers with active investments. Information was collected from the key informants only about their own investments, ensuring that investment managers have a 'bird's-eye view' (Weber, 2009) and should be most knowledgeable about their investment and its relationship with the corporate parent (Kumar *et al*., 1993). Furthermore, to minimize key informant bias, surveys were thoroughly checked with regard to the use of structured and already pretested questions from the literature. Additionally, a pilot was done as a pretest, which led to a review of some questions to ensure a better understanding of our questionnaire by respondents, and complex questions were followed up on in personal interviews (Huber and Power, 1985).

Measures

We measured all theoretical concepts using a multiple indicator approach, where each multi-indicator construct was modeled as a reflective latent variable, because each block of indicators measured the same underlying phenomenon (Chin, 1998). The items used were taken mainly from the existing literature and measured on seven-point Likert scales anchored with '1 = strongly disagree' to '7 = strongly agree.' For an overview of all measures and all items please see Appendix.

Capturing the construct of relational rent is challenging, particularly in the context of VC investments, where there is often a complete lack of profit during the high growth phase of start-ups. Measuring the success of CVC investments is even more challenging due to the additional (indirect) strategic and investment-specific value-adding objectives (Hill and Birkinshaw, 2008) that inherently lead to individual investors evaluating the value generated by a portfolio company differently. While a financial investment's attractiveness could typically be described by its internal rate of return (IRR), there are theoretical as well as practical reasons why this is not the best measure in the CVC context.

From a theoretical perspective, IRR does not capture the breadth of the primary strategic implications of CVC. Not only do CVC investors have strong strategic goals (besides financial gain) attached to their investments, but also the structure of goals may differ substantially between different CVC investors, leading to a metric not suitable for the overall sample. Furthermore, as opposed to a financially oriented VC, a CVC unit has to address more diverse stakeholders' needs. Consequently, a valid metric does not just capture the pure financial performance of an individual investment, but the main stakeholders' overall perception of the dyad. In addition, portfolio companies may not only come from different sectors with different growth potential, but may also be in different development stages. A simple single-metric IRR would not capture these differences. Moreover, from a practical perspective, valid IRR data is difficult to collect. Many CVC investors are reluctant to publish or even disclose their IRRs. This may be due to their awareness of the earlier-mentioned theoretical shortcomings of IRR as a success metric for CVC investors or simply because of their reluctance to share private data, which could have a negative impact on future business, be it for the CVC investor, the corporate parent, or the portfolio company.

Previous research has attempted to capture CVC performance by diverse measures ranging from the increase in the corporate parents' patent output (Dushnitsky and Lenox, 2005) to the non-liquidation of investments (Gompers and Lerner, 1998; Maula and Murray, 2002). These studies take an indirect approach toward CVC performance. Subjective measures are, in this context, a much more direct approach and are also commonly used in alliance research to assess alliance outcomes (Shenkar and Reuer, 2006). Previous findings indicate that these subjective measures are well suited to map objective outcomes (Geringer and Herbert, 1991). In CVC literature, Hill and Birkinshaw (2008) have already used subjective measures to evaluate the performance of the whole corporate venturing unit. Analogous to their approach, we focus on the level of individual

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investment relationships. As a result, in our study, *relational rent (RR)* was measured by three items from Selnes and Sallis (2003) (which were also used by Cheung *et al*. (2011)) capturing how a relationship has resulted in improved product quality, the development of new markets, and the reduction of costs.

Relation-specific assets (RELAS) were operationalized as investments in human relation-specific assets (see Hypotheses 1a for further explanation) and measured through the quality of the relationship between the corporate investor and the portfolio company by three items asking, for instance, about the level of reciprocity residing in the relationship and the level of personal friendship at multiple levels in the relationship. The items are based on Kale *et al*. (2000).

Knowledge-sharing routines (KSR) were modeled as a second-order construct (Wetzels *et al*., 2009) with two dimensions, which reflect the two subprocesses proposed by Dyer and Singh (1998): (1) partner-specific absorptive capacity; and (2) incentives to encourage transparency and discourage free riding, which are themselves latent variables being measured by reflective items. This ensures the conceptual multidimensionality of the construct while simultaneously allowing for theoretical parsimony and reduced model complexity (Edwards, 2001; Law *et al*., 1998; MacKenzie *et al*., 2005; Wetzels *et al*., 2009). *Partner-specific absorptive capacity (ABSCA)* was measured as the degree to which the CVC unit and the PC had developed overlapping knowledge bases with respect to (1) market knowledge, (2) technological knowledge, and (3) business knowledge by three items based on a scale from Weber and Weber (2010). Prior related knowledge and a certain history in the relevant areas of expertise largely determine absorptive capacity (Cohen and Levinthal, 1990; Keil, 2004). *Incentives to encourage transparency and discourage free riding (TRANS)* was measured by three items based on Gorman and Sahlman (1989) that capture the investment manager's level of involvement with his/her PC's business. Being highly involved in the business provides the manager with deep insights into the activities of the start-up and makes it more difficult for the entrepreneurs to conceal important information. This ultimately reduces free riding, as it would be more easily detected and fined accordingly. We asked the investment managers how much time and effort they spend on supporting the PC in (1) strategic matters, (2) operational matters, and (3) acquiring new funding.[2]

Informal self-enforcing governance (ISGOV) was operationalized as trust (Dyer and Singh, 1998), one of the most researched informal self-enforcing governance mechanisms in interorganizational research (Bachmann, 2002; Dyer and Singh, 1998; Parmigiani and Rivera-Santos, 2011). To capture a broad spectrum of the complex construct of *trust,* it was measured by a scale of five items based on Tsai and Ghoshal (1998) and Moran (2005), focusing on general trust and, specifically, ability-based trust in exchange relationships.

Complementary resources and capabilities (COMP) was measured by three items adapted from Sapienza *et al*. (2004) asking for the similarities in the customer group served, the demand correlation between the products offered by the PC and the corporate parent, and the complementarities of the technological competencies of those two parties. Each item in this scale reflects a potential touching point between corporate investor and start-up. A start-up's technology, which is complementary to the corporate parent's technology, for instance, may be sold to existing and new customers in the parent's existing value chain, which should ultimately generate value for the corporate parent and the start-up. If there is a complementarity in the customer group, distribution and sales infrastructures of the corporate parent may be leveraged, which also should ultimately generate value for the corporate parent and the start-up. The same applies to correlated demand for the respective offerings, as the corporate investor supporting the start-up would automatically lead to increased sales for its own business units.

RESULTS

Measurement model evaluation

Having already discussed the measures, we now evaluate the structural model and consider the amount of variance in the endogenous constructs that the model explains. We start by inspecting the

[2] A widely used measure for knowledge-sharing routines as well as for governance is board seats. Consequently, we included it in our questionnaire. However, 42 out of 47 investment relationships had board mandates, leading to an overrepresentation issue (Bottazzi *et al*., 2004), rendering the metric less useful to our research.

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measurement model and, specifically, the outer factor loadings of each individual item in order to assess their reliability. Any loading below 0.5 indicates either a poorly measured item, an inappropriate item, or an improper contextual use of the item and should, therefore, be eliminated from the structural model (Hulland, 1999). All outer factor loadings within our models lie comfortably above this threshold and above the level of 0.7 that has more recently been suggested as a rule of thumb for reflective measurement models (Hair *et al.*, 2011). Outer factor loadings within our model range from 0.71 to 0.93.

In order to measure the amount of variance a latent variable captures from its indicators and, thus, how well the latent variable contributes to its indicators relative to measurement error, we need to analyze the average variance extracted (AVE) (Fornell and Larcker, 1981), which is an indicator of the reliability of the latent variable item score and of convergent validity for each of the latent variables. Our AVE values range from 0.55 to 0.80 for all constructs and are, therefore, above the desirable 0.5 threshold (Chin, 2010); this demonstrates adequate convergent validity for the structural equation model. Furthermore, we calculated the composite reliability (Werts *et al.*, 1974), which indicates how robustly a construct is measured by its items. We prefer this measure of internal consistency to the commonly used Cronbach's alpha (Cronbach, 1951), as it does not assume tau equivalency, which 'is seldom if ever achieved' (Cortina, 1993: 101). For composite reliability, values greater than 0.6 are desirable (Bagozzi and Yi, 1988; Chin, 2010). Our results are all greater than the desired 0.6 threshold (Chin, 2010), a quality level that was achieved through the adaptation of existing, tested measurement scales. Table 1 provides detailed information on the composite reliability and AVE of our model.

Discriminant validity enables us to identify whether each construct within our model is more strongly correlated with its own indicators than with those of any other construct. This ensures that no two constructs share the same indicators and that these constructs can, thus, be considered as theoretically distinct from one another. In order to confirm discriminant validity, the square root of the AVE needs to exceed the intercorrelation of each construct with the other constructs in the structural equation model (Chin, 1998; Chin, 2010). Detailed analysis can be seen for our structural models in Table 2; the analysis confirms a high degree of discriminant validity. An analysis of the measurement item's cross-loadings, whose magnitude is well below indicator loadings, also confirms the discriminant validity of our models (Chin, 1998).

Structural model evaluation

Next we evaluate our structural model and consider the properties of the overall models. The model statistics for all three models—the direct (i.e., Dyer and Singh's (1998) original model), the full, and the mediation models—offer support for the suitability of Dyer and Singh's (1998) RV to explain the success of corporate VC investment relationships. First, we calculated the Stone-Geisser cross-validated redundancy Q^2 (Geisser, 1975; Stone, 1974), which indicates whether a model has predictive power. Q^2 values for all constructs are above the desired threshold of zero (Chin, 1998; Fornell and Larcker, 1981; Hair *et al.*, 2011), ranging from 0.04 to 0.61, with values from 0.27 to 0.29 for the dependent variable in all three models. More recently, a global criterion of goodness of fit (GoF) for PLS modeling has been suggested and applied by Tenenhaus *et al.* (2005); this is represented by the geometric mean of the average communality and average R^2 (for

Table 1. Composite reliability (CR) and average variance extracted (AVE)

	Direct model		Full model		Mediation model	
Construct	CR	AVE	CR	AVE	CR	AVE
RR	0.9238	0.8019	0.9238	0.8019	0.9238	0.8019
COMP	0.8540	0.6638	0.8552	0.6644	0.8548	0.6633
RELAS	0.9084	0.7679	0.9068	0.7645	0.9068	0.7645
KSR	0.8771	0.5450	0.8771	0.5449	0.8771	0.5449
ISGOV	0.9297	0.7266	0.9295	0.7262	0.9294	0.7261
ABSCA	0.8845	0.7187	0.8845	0.7187	0.8845	0.7187
TRANS	0.8640	0.6802	0.8641	0.6803	0.8641	0.6803

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Table 2. Square root of AVE ($AVE^{0.5}$) and Pearson's correlations

Correlations among constructs—direct model							
$AVE^{0.5}$		RR	COMP	RELAS	ISGOV	ABSCA	TRANS
0.90	RR	1.000					
0.81	COMP	0.511	1.000				
0.88	RELAS	0.501	0.292	1.000			
0.85	ISGOV	0.452	0.476	0.576	1.000		
0.85	ABSCA	0.356	0.395	0.040	0.370	1.000	
0.82	TRANS	0.314	0.264	0.123	0.085	0.560	1.000
Correlations among constructs—full model							
$AVE^{0.5}$		RR	COMP	RELAS	ISGOV	ABSCA	TRANS
0.90	RR	1.000					
0.82	COMP	0.507	1.000				
0.87	RELAS	0.506	0.303	1.000			
0.85	ISGOV	0.450	0.499	0.587	1.000		
			0.				
0.85	ABSCA	0.356	0.394	0.046	0.369	1.000	
0.82	TRANS	0.314	0.280	0.119	0.088	0.560	1.000
Correlations among constructs—mediation model							
$AVE^{0.5}$		RR	COMP	RELAS	ISGOV	ABSCA	TRANS
0.90	RR	1.000					
0.81	COMP	0.505	1.000				
0.87	RELAS	0.456	0.313	1.000			
0.85	ISGOV	0.450	0.499	0.628	1.000		
0.85	ABSCA	0.356	0.393	0.048	0.369	1.000	
0.82	TRANS	0.560	0.280	0.051	0.088	0.560	1.000

endogenous constructs). Our model provides an excellent fit to the data, as the models score 0.55, 0.55, and 0.52, respectively, on this metric, lying well above the reference point for a large fit of 0.36 (Wetzels *et al*., 2009). An overview of the metrics can be found in Table 3. Second, all three models have strong to moderate explanatory power for relational rent generation in CVC investment relationships with $R^2 = 0.44$, $R^2 = 0.44$, and $R^2 = 0.38$, respectively (Amoroso and Cheney, 1991; Chin, 1998; Cohen, 1988); they seem to be well suited to the context of CVC investing.

Table 3. Model statistics (for dependent variable—relational rent)

Model	Q^2	*GoF*	R^2
Direct effects model	0.58	0.55	0.44
Full model	0.58	0.55	0.44
Mediation model	0.58	0.52	0.38

Examining the relationships in the original model, three of the four determinants have significant positive influence on relational rent: complementary resources and capabilities ($\beta = 0.30, p < 0.05$), relation-specific assets ($\beta = 0.37, p < 0.05$), and knowledge-sharing routines ($\beta = 0.22, p < 0.10$) (cf. Table 4). Consequently, Hypotheses 1a, 1b, and 1d are supported. The relationship between informal self-enforcing governance and relational rent is, however, not significant. Consequently, we have to reject Hypothesis 1c. We examined the path coefficients for the three models to more closely assess the role of mediating effects. The conditions for partial mediation are: (1) there is a significant relationship between the independent variable and the mediator; (2) there is a significant relationship between the mediator and the dependent variable; and (3) the direct effect between the independent and the dependent variable in the full model (i.e., the direct model after adding the mediators) is significantly reduced compared to the effect in the direct model (Baron

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Table 4. Path coefficients

Description of paths	Direct model (Dyer and Singh, 1998)	Full model	Mediation model
COMP → RR	0.30*	0.29	
COMP → RELAS		0.30*	0.30**
COMP → KSR		0.39*	0.39*
COMP → ISGOV		0.49***	0.50***
RELAS → RR	0.37*	0.39*	0.40**
KSR → RR	0.22^{+}	0.23	0.31*
ISGOV → RR	n.s.	n.s.	n.s.
KSR → ABSCA	0.90***	0.90***	0.90***
KSR → TRANS	0.87***	0.87***	0.87***

*** $p < 0.001$
** $p < 0.01$
* $p < 0.05$
$^{+}$ $p < 0.10$; n.s.: not significant.

and Kenny, 1986; Semrau and Sigmund, 2012). Table 4 indicates that these conditions are met for relation-specific assets (H2a) and knowledge-sharing routines (H2b), but not for informal self-enforcing governance (H2c).

We conducted an additional Sobel test (Sobel, 1982, 1986) for the mediators that meet the conditions for mediation. The test indicated a significant partial mediation *($p = 0.05$)* for relation-specific assets. Consequently, Hypothesis 2b cannot be falsified, and the partially mediating role of relation-specific assets for the relationship between complementary resources and capabilities and relational rent is demonstrated. The Sobel test for the mediating role of knowledge-sharing routines is also significant *($p = 0.08$)*. Consequently, Hypothesis 3b cannot be falsified, and partial mediation is demonstrated for knowledge-sharing routines, too.

As we have outlined, the sample size of our additional 25 paired PCs does not allow for a statistically meaningful separate reevaluation of our structural path model. It is, however, possible to evaluate how alike the two datasets are using multiple comparisons. As both CVC managers and PC managers were asked the same questions, we performed a t-test to compare the means of the corresponding items from the responses of the CVC investors and the PCs. We examined whether there is evidence in our data to reject the null hypothesis for any of the individual item pairs (H_0: $\mu_1 = \mu_2$ and H_1: $\mu_1 \neq \mu_2$). In order to counter the issue of α level inflation in multiple comparison, we used the Bonferroni correction (Abdi, 2007; Glantz and Slinker, 1990) to calculate a corrected value for the desired α of 0.05. Given that we have 25 paired items, the Bonferroni corrected α is $\alpha_F = 0.002$. The results of our multiple comparisons indicate that we can reject the null hypothesis in only three distinct cases, where the means can be considered to be significantly different from one another. Additionally, we performed F-tests to evaluate the similarity of the variance on the individual indicators for the two samples. There is no evidence that the variances differ significantly. These findings suggest that the datasets from CVC investors and PCs are very similar despite coming from two different populations. It would be reasonable to expect similar results if the same PLS path model was calculated with the PC dataset. Thus, the result from the multiple comparisons provides additional support for the validity of our model outside the narrow scope of CVC investors.

Finally, Harman's (1967) single-factor method with varimax rotation was used to determine post-hoc if there is any common method bias within our data. If substantial common method bias is present either: (1) a single factor will emerge from the factor analysis; or (2) one factor will account for the majority of the covariance (Podsakoff *et al.*, 2003). Six factors emerged, accounting for 77.6 percent of the variance, with the first factor accounting for 21.5 percent of the variance. These results suggest that common method bias is not of significant concern, while the varimax rotation indicates that all variables fit on factors.

DISCUSSION

In this article, we set out to deepen our understanding of the relational rent-generation process in the relationship between CVC investors and their portfolio companies by applying Dyer and Singh's (1998) model of the relational view. The purpose of this study was twofold: (1) to empirically test Dyer and Singh's complete RV model in the context of CVC investing; and (2) to investigate the role of complementary resources and capabilities and potentially partially mediating effects between this determinant and the other three determinants of relational rent. To do so, we integrated new empirical and conceptual developments from management research to comprehensively operationalize the entire model of the RV. Furthermore, building on existing literature and on first qualitative evidence from the field of CVC research, we not only tested all the direct effects proposed by Dyer and Singh (1998), but also hypothesized and tested additional partially mediating

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effects of relation-specific assets, knowledge-sharing routines, and informal self-enforcing governance on the relationship between complementary resources and capabilities and relational rent in the CVC context. In doing so, our study contributes to two fields of existing theory. First, we complement literature on interorganizational relationships, in particular the relational view, by operationalizing the model's elements and by presenting an empirical investigation of the entire model of the RV as proposed by Dyer and Singh (1998). Moreover, we provide a first indication that there are partially mediating effects between the determinants of relational rent in addition to the direct effects proposed by the authors of this highly cited but rarely applied theoretical approach. In addition, we show the approach's explanatory power for CVC research. Second, by applying the RV to the CVC context, we also complement literature on CVC. Our results help shed light on the complex process of relational rent generation between the corporation with its CVC unit and business units as well as the portfolio company.

Dyer and Singh's relational view in the context of corporate venture capital investments (direct effects model)

Our article's most significant contribution is to the literature on interorganizational relationships. We operationalize all of the RV's determinants, which has not been done in CVC or in other fields of research. We know of no research that has tested the entire relational view in its complexity. By doing so, our study closes an open research gap in strategic management literature, where the relational view plays an important role.

Our findings confirm most of the relationships proposed by the RV. The direct model indicates that three out of the four determinants have a significant positive impact on relational rent generation. However, the fourth determinant, informal self-enforcing governance, did not exhibit a significant relationship to relational rent generation. Our contradiction of the effect originally proposed by Dyer and Singh (1998) for informal self-enforcing governance is also mirrored in previous research. Dirks and Ferrin (2001) conclude in their meta-analysis of 43 studies on informal self-enforcing governance in the form of trust in organizational settings that while attitudes and perceptions are consistent and well researched, the effects of trust on 'behavior and performance outcomes are weaker and less consistent' (Dirks and Ferrin, 2001: 455). Some researchers, for instance, could not detect significant effects of intragroup trust on team performance (Dirks, 1999; Kegan and Rubenstein, 1973). By contrast, Langfred (2004) found that trust does lead to team performance. However, this effect was found only when actors were in an environment with little autonomy. In an environment with a high level of autonomy, by contrast, a high level of trust led to lower performance. The authors explained this finding by noting that the more team members trusted one another, the less they monitored one another. PCs of CVC investors have, of course, varying degrees of autonomy depending upon their strategic setup. On a continuum of autonomy, however, they can all be placed nearer to a high autonomy extreme due to the inherent setup of CVC investments, which typically come in the form of minority investments offering limited authority to the CVC investor over the PC. De Clercq and Sapienza (2005) deliver first empirical evidence on the role of informal self-enforcing governance for relational rent generation in the field of VC investing. The authors find evidence contradicting the positive effects of trust for relational rent in their study on 298 U.S.-based VC companies. In particular, they uncover a negative relationship between the VC investor's trust in its PC and VC learning. The authors offer two explanations, both of which are plausible in the context of CVC: (1) if too much trust exists, actors may not question each other's decisions to a proper extent, leading to group think and limiting the cognitive conflict in such relationships, which ultimately decreases the quality of information exchanged or of decisions (cf. Janis, 1982; Yli-Renko *et al*., 2001; Zahra *et al*., 2006); and (2) high trust relationships between an investor and a new venture may lead to an investment selection bias, letting investors invest in trusted ventures to minimize cognitive distance rather than maximizing the opportunities for learning (Harrison *et al*., 1997). Notwithstanding, Weber and Weber (2011) demonstrate that a low level of trust in the CVC investor-PC relationship does negatively impact PCs' and, subsequently, CVC investors' performance. Concluding from these findings, the relationship of trust on performance seems to be characterized by an inverted u-shape curve. While trust is important, relational rent is ultimately generated based on the complementary resources and capabilities that both partners bring to the table. Hence, a balanced level of trust might be the appropriate way of maintaining

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those relationships and might be the answer to our mixed findings.

To shed further light on this result contradicting Dyer and Singh's (1998) projections for informal self-enforcing governance's influence on relational rent, we ran an additional analysis with an alternative dependent variable. This dependent variable, *relationship satisfaction*, captures how satisfied the exchange partners are with the relationship and whether they believe it is worthwhile. In contrast to relational rent, which captures the tangible benefits that have already been, or are currently being, realized through a relationship (Selnes and Sallis, 2003), relationship satisfaction adds an element of intangible future expectations about the relationship to the equation. We detect a strong positive and highly significant effect of informal self-enforcing governance on relationship satisfaction *($\beta = 0.56$, $p < 0.001$),* while all other determinants lose their significance. This finding is in line with past research that has indicated the link between expectations of future benefits and informal self-enforcing governance (e.g., Sako, 1998). In a business environment, a party classifying a relationship as worthwhile typically assumes future benefits from it. Thus, relationship satisfaction might serve as an early indicator of potential future relational rent, and the impact of informal self-enforcing governance might, consequently, unfold only over time. Furthermore, Dyer and Singh (1998: 671) themselves caution the reader that informal self-enforcing governance, while being the superior relational governance device, is prone to the 'paradox of trust,' referring to the increased risk of opportunism. Our research might also be interpreted as first empirical support for this thesis.

Partial mediation between the determinants of relational rent: the role of complementary resources and capabilities (mediation model)

Except for Mesquita *et al.*'s (2008) implicit findings, we know of no research that systematically investigated potential mediating effects between the determinants of relational rent. By doing so, our study closes another open research gap in the literature.

Another important insight of our study is that complementary resources and capabilities are found to significantly positively influence the other three determinants of relational rent (cf. Table 4). This insight not only supports the finding of Maula *et al.* (2003) that complementary resources and capabilities have a significantly positive impact on relation-specific assets in CVC investment relationships but also extends Maula *et al.* (2003) by providing empirical evidence of a significantly positive relationship between complementarities and the other two determinants, i.e., knowledge-sharing routines *($\beta = 0.39$, $p < 0.05$)* and informal self-enforcing governance *($\beta = 0.50$, $p < 0.001$)*. Furthermore, by providing first quantitative evidence of partially mediated relationships between complementarities and relation-specific assets and, potentially, knowledge-sharing routines, we deliver first quantitative qualification for the postulation made by qualitative research (Weber *et al.*, 2016) that the RV's determinants of relational rent may be interrelated, with complementary resources and capabilities acting as an antecedent.

Relational rent generation from the perspective of the portfolio company

With our study, we also shed light on relational rent generation from the PC's point of view. Our multiple comparisons of the data from the CVC investors and the PCs indicate that PCs have a similar perspective upon rent generation and recognize the same relevant drivers of relational rent as the CVC investors, despite their different role in the investment relationship. Moreover, the three instances in which the null hypothesis was rejected during the multiple comparisons provide additional insights into our data. One of the items for which the null hypothesis had to be rejected relates to the market knowledge of actors. Our data revealed that this is caused by the different perceptions that PCs and CVC investors have with regard to the similarity of their market knowledge. CVC investors believe their knowledge is very similar to that of their respective PCs, while the PCs believe the discrepancies to be very large. The other two item pairs measure each individual party's perception of the time and effort that the CVC manager has invested in operative and strategic support. Here the investment managers perceive their personal effort as being much greater than is perceived by the receiving portfolio firms. This finding indicates that the CVC investors evaluate their contribution higher than the receiving party does—that is, potentially indicating the presence of an overconfidence bias (Camerer and Malmendier, 2007).

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The complexity of relational rent generation in CVC investments

We further complement CVC literature by shedding light on the complexity of relational rent generation between the corporation with its CVC unit and business units as well as the portfolio company. The interrelationships between the determinants of the relational rent we have outlines help explain how CVC performance is eventually created. Supported by previous research that complementary resources and capabilities are clearly the precondition for CVC success, we can implicitly make a statement on the characteristics of promising investment targets. It might not be sufficient for a CVC investor to invest in financially promising new ventures unless they are somewhat strategically related to the corporation's businesses. Only then can they profit from the valuable leverage effect the business units are theoretically able to provide. Methodologically, we showcase PLS-SEM as an appropriate method to investigate empirically complex phenomena in the field of entrepreneurship and strategic management research (which are characterized by a high number of correlated variables and simultaneously are subject to sample size constraints).

IMPLICATIONS, LIMITATIONS, AND FUTURE RESEARCH

Grasping Dyer and Singh's (1998) complex theoretical approach in one comprehensive empirical investigation and in a new research field and operationalizing the model's various components brought up a range of challenges. We largely overcame those challenges in this study and, therewith, complement the literature on interorganizational relationships as well as CVC by testing, challenging, and advancing the relational view. We believe our work has various theoretical and practical implications.

Theoretical implications

First, our finding that Dyer and Singh's (1998) RV serves as an appropriate lens for investigating the CVC investor-PC dyad and that it offers explanatory power for relational rent generation in CVC investment relationships has implications for future research in the field of interorganizational relationships. Our demonstration that three out of four determinants of the relational view positively impact relational rent generation may encourage scholars to intensify their empirical investigations of interorganizational relationships based on Dyer and Singh's (1998) entire approach. By highlighting the potential of this approach for further research on interorganizational relationships in the CVC context, we seek to encourage scholars to increase the number of studies that apply Dyer and Singh's (1998) framework to this area in order to deepen the understanding of its generalizability and potential.

While we conducted our analysis in the context of CVC investments, we believe this research setting to be somewhat comparable, or at least related to, other interorganizational settings (Dushnitsky and Lavie, 2010), such as M&A, strategic alliances, or buyer-supplier relationships. Our findings on the interrelatedness of the determinants of relational rent, thus, offer potential for future research not only in the field of CVC but also for those comparable settings. It would, hence, be desirable to choose additional contexts in future research.

We hope that those future studies will go into even more detail than the present one has. More complex research could also serve to better understand our particularly interesting finding that informal self-enforcing governance, which does not impact relational rent generation, has a strong positive effect on relationship satisfaction. This second dependent variable, which we tentatively included in our model, seems to offer—at least in the context of CVC investing—additional insights into what might be the role of informal self-enforcing governance for relational rent generation.

Second, our insights into additional links between the original theory's independent constructs, with the identified partially mediated relationships, opens up various future research avenues in the field of interorganizational relationships and the relational view. Our findings suggest that Dyer and Singh's (1998) original model should be carefully refined and expanded by integrating those additional partially mediating relationships. Moreover, some of the subdimensions of the four determinants should be reassessed and redefined in order to avoid issues of partially overlapping constructs and to achieve mutual exclusiveness in the subdimensions. We encourage future scholars to test our suggested partial mediating effects using larger datasets and in various contexts, as well as elaborate on our findings. Moreover, future researchers might even want to investigate additional interrelationships on the level of the eight subdimensions for further indirect effects unfolding

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via the other determinants of relational rent, expanding the first attempts of Weber *et al.* (2016). Doing so may help explain the complex dependent construct, relational rent.

Third, by comparing the dyadic data from CVC and PC managers that we collected simultaneously, we open up a path for potentially promising research on the implications of the overconfidence of CVC investment managers. This behavior of overconfidence is indicated in our study by the assessment discrepancy about the contribution that CVC managers deliver for PCs' performance. Specifically, in terms of their impact, investment managers tend to overestimate their contributions relative to the assessment of the PCs' CEOs. In previous research not stemming from the field of CVC research, overconfidence has been found to cloud CEOs' decisions regarding corporate investments (Malmendier and Tate, 2005) and to influence VC investment decisions (Zacharakis and Shepherd, 2001). So far, research on the implications of overconfidence for CVC operations has received very limited attention (for a notable exception, see Benson and Ziedonis (2010)). Therefore, we encourage further investigations to clarify the role of investment managers' attitudes and perceptions on performance, as well as how the staffing within CVC units influences these perceptions.

Methodologically, we present an exemplary case on how a so far underinvestigated research question —i.e., the variables' interrelatedness in a complex theoretical framework—may be examined by a methodological alternative to covariance-based SEM approaches. PLS-SEM and covariance-based SEM are complementary methods in the sense that the advantages of the former are the disadvantages of the latter and vice versa (Hair *et al*., 2012). PLS unfolds its strength particularly in the analysis of a large number of interrelated variables under sample size constraints and/or non-normal data, when covariance-based approaches would lead to no, or questionable, results (Hair *et al*., 2011; Tenenhaus *et al*., 2005). While we acknowledge the limitations of PLS, we believe it is a valuable tool to spur interest in underinvestigated areas of entrepreneurship and strategic management that suffer from various empirical limitations.

Practical implications

This article also provides valuable input for CVC practitioners by drawing attention to the different mechanisms in place that lead to relational rent generation within a CVC investment relationship. It is important for practitioners to know that informal self-enforcing governance will primarily build relationship satisfaction, which might play out in the long run, but will not necessarily lead to short-term relational rent generation. By contrast, investments in relation-specific assets and effective knowledge-sharing routines are more likely to result in short-term relational rent generation. It is here that the predictive property of PLS (Meznar and Nigh, 1995; Wold, 1985) and the situational interpretation of R^2 values (Backhaus *et al*., 2003) should be considered. Given the variety of different factors influencing CVC performance, such as the organizational setup of the CVC unit, qualification of the staff, or investment focus (Maula, 2007), the relatively high R^2 values indicate the importance of the variables in our model to predict CVC performance.

Limitations

While our chosen methodology, PLS, as a soft-modeling approach, requires no strong assumption with respect to sample size or measurement, it simultaneously implies 'a lack of the classical parametric inferential framework that is replaced by empirical confidence intervals and hypothesis testing procedures based on resampling methods' (Vinzi *et al*., 2010: 48). In addition, PLS is not able to deal with recursive, reciprocal relationships (Chin, 1998; Fornell, 1982). To overcome these limitations, we encourage longitudinal studies and studies with larger sample sizes and possibly a (non-recursive) covariance-based SEM approaches to test our suggested model (Henseler *et al*., 2009). Furthermore, we acknowledge that our data exhibits a nested structure with specific characteristics on the level of the CVC unit, the investment manager, and the individual investment relationship, which should be accounted for. This was not possible in this study due to our sample size limitations, and we encourage future research using larger samples to employ multilevel analysis. Another limitation may be the generalizability of our findings. Our findings apply to the context of CVC investments. While this context shows certain similarities to other forms of co-operation, such as strategic alliances or buyer-supplier relationships, it remains distinct. We, therefore, call for the testing of our model for different boundary-spanning activities of corporations to further increase

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its robustness. In addition, our CVC context is a purely commercial one. It would be of high interest to increase our knowledge regarding the RV's applicability for interorganizational relationships in other contexts, such as the social context or even for cross-sector partnerships. Furthermore, our analysis is based on data that has been collected at a certain point in time. Hence, we are unable to observe the effect that time brings into CVC investor-PC relationships. It may be legitimate, for instance, to postulate that there is a relationship between relational rent and the potentially chronologically preceding outcome variable of relationship satisfaction, which we tested exemplarily as an additional outcome variable. Through adding this time dimension, all the determinants proposed by Dyer and Singh's (1998) RV might work on generating relational rent in the context of CVC investing. The importance of informal self-enforcing governance for relational rent generation, while not detected by our research, might come into play over time. We, consequently, call for further (potentially qualitative) longitudinal process research to shed more light on the interplay of other relational outcomes and relational rent over time. A final limitation of our research lies in our simplifying assumption of the CVC investor-PC relationship as a pure dyad. With this assumption, we ignore potential additional syndicate actors who might have an impact on the dyadic relational rent-generating process under investigation. This simplifying assumption enables us, however, to focus on our main research interest —that is, the full empirical investigation of the RV despite the inherent complexity of the theory and the research context. To deepen our knowledge of whether, if, and how the potential impact of a syndicate setting affects the relational rent-generating dyad, further research would be desirable. For instance, a qualitative approach could focus on uncovering potential power asymmetries and/or micro political power games between syndicate members potentially impacting the single dyadic rent-generating process such as the processes unfolding in the course of the board meetings. Moreover, additional research on pure dyads not 'suffering' from potential additional network effects in other industry settings would be desirable. By doing so, our arguments could either be supported or qualified by new insights. Alternatively, a social network analysis could be an appropriate way to tackle the syndicate configuration.

Despite these limitations, we believe this study makes five important contributions. First, it enriches interorganizational research on the RV by providing the first comprehensive test of Dyer and Singh's (1998) highly cited but rarely applied theoretical approach involving all four determinants of relational rent. Second, by establishing the idea of partially mediated relationships between the determinants of relational rent, we provide the first empirical support that there are additional indirect effects at work in the process of relational rent generation. Third, this article contributes to CVC research by delivering empirical evidence for the explanatory power of the RV in CVC investment relationships as well as by allowing insights into the complexity of relational rent generation in this relationship. Our results indicate that this approach yields promising predictions and warrants more attention in the context of CVC investments. Fourth, this article provides valuable input for CVC practitioners aiming to steer CVC performance. Our work draws attention to relational factors and the different mechanisms in which value can be generated. Finally, we can show by using multiple comparisons that the structural model developed is likely to be very similar for PCs receiving CVC funding.

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APPENDIX

Variables, items, and corresponding sources

Variable	Item	Source
Dependent variable: relational rent		
(1) The relationship with this PC has helped improve our parent firm's product quality.		Selnes and Sallis (2003); also used by Cheung *et al*. (2011)
(2) The relationship with this PC has a positive effect on our parent corporation's ability to develop successful new products.		
(3) The relationship with this PC has helped us reduce costs.		
Independent variables:		
Relation-specific assets		
(1) There is close, personal interaction with our portfolio company at multiple levels.		Kale *et al*. (2000)
(2) The relationship between the CVC unit and this portfolio company is characterized by personal friendship at multiple levels.		
(3) The investment relationship is characterized by high reciprocity among the CVC unit and the portfolio company.		
Complementary resources and capabilities		
(1) This portfolio company primarily serves the same customer group as the respective business unit of our parent corporation.		Yli-Renko *et al*. (2001)
(2) The demand for this portfolio company's products/services and the demand for our parent corporations' products/services are positively correlated.		
(3) This portfolio company's technological competencies are based upon key technologies of our parent corporation.		
Knowledge-sharing routines		
a) Absorptive capacity		
How similar would you judge the knowledge base of the CVC unit and this portfolio company to be today with respect to:		Weber and Weber (2010)
(1) markets		
(2) technology used		
(3) business competence		
b) Incentives to encourage transparency and discourage free riding		
How much time and energy have you spent during the last financial year on the following tasks?		Gorman and Sahlman (1989)
(1) Supporting PC management with strategic issues		
(2) Supporting PC management with operative issues		
(3) Helping obtain additional financing		
Informal self-enforced governance mechanisms		Tsai and Ghoshal (1998) and Moran (2005)
(1) We believe that in our relationship with this PC, no party will take advantage of the other, even if the opportunity arises.		
(2) This PC always keeps the promises they make to us.		
(3) We can trust this PC to always behave professionally and make competent decisions.		
(4) We can trust that the founder/CEO will always make decisions to the PC's best interest, even if he needs to accept personal disadvantages for this purpose.		
(5) We can rely on the PC's personnel to not create additional unnecessary work for us.		

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BRINGING THE STAGES BACK IN: SOCIAL NETWORK TIES AND START-UP FIRMS' ACCESS TO VENTURE CAPITAL IN CHINA

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Research summary: *Social networks are believed to help start-ups access venture capital (VC). However, the causal mechanisms remain unclear because social ties probably influence both a start-up's likelihood of being screened for evaluation and its likelihood of being funded. Whereas prior studies conceptualize venture financing as a single-moment event, in this article, it is theorized as a dynamic multistage process in which a screening decision precedes a funding decision. Failure to address the selection effects at each stage could lead to biased findings regarding how social ties confer advantage in venture financing. This study uses a hand-collected dataset from China to empirically examine these arguments.*

Managerial summary: *Social networks are believed to help start-ups access venture capital. However, it is unclear whether this is because social ties help venture capitalists (VCs) and start-ups overcome the problems of information asymmetry and behavioral opportunism in early-stage financing or whether VCs are more likely to become aware of investment opportunities embedded within social networks. This study divides VC decision making into two stages: awareness generation and venture evaluation. This study finds that socially connected start-ups have cumulative advantages in the access to venture capital, but this advantage mainly arises in the early stage where information embedded in social ties helps reduce investors' search costs in deal screening. In contrast, social ties are a secondary consideration in the subsequent stage of VC funding decisions* Copyright © 2016 Strategic Management Society.

INTRODUCTION

Social ties matter in venture finance (Stuart and Sorenson, 2005). Entrepreneurs, endowed with little legitimacy and few resources for survival and growth, often use their social capital to access financial capital. In a study of 134 U.S. high-tech firms, Shane and Stuart (2002) find that new ventures are most likely to be funded when their founders are socially connected with the venture capital (VC) community. Similar results have been replicated in many settings (e.g., Shane and Cable, 2002; Hallen, 2008), including transition economies (e.g., Bruton and Ahlstrom, 2003). Batjargal and Liu (2004) find that Chinese venture capitalists not only prefer to invest in firms owned by their friends, but also approve more funding for them. The prevalence of social ties in the quest for financial capital seems to confirm the old saying—'It's not what you know; it's who you know.'

Why do VCs favor socially connected entrepreneurs? The existent literature focuses on venture evaluation and examines the role of social ties in overcoming the problems of information asymmetry and behavioral opportunism in early-stage financing. On the one hand, social ties could serve as a pipeline to transfer trustworthy information between investor and entrepreneur (Podolny, 2001). Such collaborative communication creates opportunities for the two parties to combine their resources to create

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new value (Uzzi and Lancaster, 2003). On the other hand, social ties could serve as a stick to help mobilize the collective force of the community connecting the two parties to sanction either one should it conduct malfeasance against the other (Coleman, 1988; DiMaggio and Louch, 1998). When social embeddedness breeds the pros of value creation while weeding the cons of opportunism, a given entrepreneur would be evaluated more positively by exchange partners with whom she has prior ties than by those with whom she does not. The entrepreneur's start-up will, in turn, be more likely to secure funding from the former than from the latter.

While these arguments seem compelling, the causal mechanisms by which social ties affect venture financing are unclear (Stuart and Sorenson, 2007). A key shortcoming in the literature is that it has ignored the dynamic nature of venture financing. Given the large number of funding requests VCs receive and the complexity of evaluating them, VC firms generally divide the funding decision into relatively simple, yet structured, stages (Newell and Simon, 1972; Eckhardt, Shane, and Delmar, 2006). Although it is common for VCs to reject up to 90 percent of the business plans they receive before reviewing the rest for funding decisions (Tyebjee and Bruno, 1984), past studies have focused on the final outcome of start-up-VC interactions while ignoring the intermediary steps leading to the VC's final decision. When decision making takes place in a sequence of actions and deliberations, we are obliged to take a process-oriented view if we want to reveal the causal mechanisms hidden in the black box (e.g., Coleman, Katz, and Menzel, 1966; Fernandez, Castilla, and Moore, 2000). As Eckhardt *et al.* (2006: 221) have warned concerning venture financing research, '[F]ailure to appropriately address the potential effects of selection at each stage fails to capture key relationship and leads to biased findings.'

To better understand the role of social ties in venture financing, I build on the long tradition established by Simon (1955) and Coleman *et al.* (1966) and argue that VC firms, like most organizations, are constrained by limited cognitive capability and that the best way to conceptualize venture financing is with a dynamic, multistage model of decision making. In particular, I distinguish between two stages in the VC decision process: the stage of awareness generation, in which funding applicants are sorted into groups to be further considered for evaluation, and a subsequent stage of venture evaluation in which the firms in the consideration set are evaluated and those with the highest expected return on investment are chosen for funding. This distinction is analytically useful for disentangling the role of social contacts: given that VC firms have qualitatively different needs at different stages, it becomes possible to develop predictions about which specific aspects of the fund-seeking entrepreneurs' social contacts will be more helpful at each stage.

To explain the varying roles of social ties across these two stages, I look at the VC decision environment and the content and structural features of networks connecting VCs and entrepreneurs. I argue that social ties have a powerful effect on venture financing: information embedded in social ties helps reduce investors' search costs in deal screening, but it is a secondary consideration in the subsequent stage of funding decision. Since a start-up cannot get to the second stage without succeeding in the first, those with social ties to investors could have a cumulative advantage over their unconnected peers in accessing capital even if social ties do not help in the final decision to fund. Without conceptualizing venture financing as a multistage process, one could mistakenly attribute the effect of social ties at the earlier stage to the later stage and, thus, exaggerate their role in venture evaluation.

The current study uses a hand-collected dataset to illustrate how venture financing could be modeled as a two-stage selection process. The data come from 85 technology-based start-up firms in two Chinese university science parks (USPs). Even though USP-based start-ups are not representative of firms seeking venture capital, this dataset offers a number of empirical advantages. First, I have details on start-ups' fund-raising outcomes at each stage in the process of raising capital, including the contacts through which they approached VC firms and whether they received interviews and offers from each VC firm they approached. This allows for a clean assessment of success at different stages in the capital-raising process. Second, because the dataset contains multiple start-up-VC pairs for each start-up, I can address important empirical concerns that have been levied against studies of social contacts in venture financing—namely, endogeneity and individual heterogeneity (Stuart and Sorenson, 2007). Third, this dataset was collected in China, an emerging economy with the world's third-largest VC market. While much research has been done on VCs in developed economies, much less is known about VC practices

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in the increasingly important emerging markets (Cumming and Johan, 2013).

The rest of the article is organized as follows: first, I develop a multistage model of social network effects to predict how social ties generate economic advantage in the context of venture capital. Second, I use the dataset from two Chinese university science parks to empirically test some of the theoretical predictions. Third, I discuss the limitations of the empirical setting and econometrics strategy and use my fieldwork to shed further light on the potential mechanisms by which social ties do or do not play a key role in venture evaluation. Fourth, I link this study with the broad network literature to explore potential ways to further investigate how social ties generate economic advantage in different settings.

Multistage model of social network effects in venture financing

Over the past three decades, the study of economic exchanges has moved beyond its earlier focus on formal institutions and individual actions toward an emphasis on the structure of social relations (Granovetter, 1985). As the notion that social ties create privileged access to key resources gained increasing acceptance, the focus of research shifted toward the mechanisms by which they do so. An emerging theme in several literatures is that decision making is a sequence of actions and deliberations and that the influence of social networks is contingent on the stage of the decision-making process (e.g., Mizruchi and Stearns, 2001; Fernandez and Sosa, 2005). This line of argument can be traced back to Coleman *et al*.'s (1966: 58) classic *Medical Innovation* study, which argued that factors 'enter into the making of a decision' with a 'characteristic time-order' that 'correspond[s] to a sequence of stages in the cognitive process of decision making itself'. The authors further suggest that relatively formal sources of influence may bring word of a medical innovation, but this is followed, 'prior to actual adoption of the innovation, by rather extensive checking with other sources, and particularly with the informal-personal sources of information' (Coleman *et al*., 1966: 58).

Van den Bulte and Lilien (2001, 2009) picked up the idea and showed that distinguishing between the attention and evaluation stages has important implications. Reanalyzing the *Medical Innovation* data, they find that a one-stage model would show no evidence that social ties matter among doctors in new drug diffusion, but a two-stage model would show that network ties do influence the evaluation and, thus, the eventual adoption of a new drug. In a similar fashion, Fernandez and Sosa's (2005) study of labor market segregation shows that while the gender homophily of networks affects job application, that effect would be concealed if a study focused solely on the employer's final choice.

The two-stage model of decision making can apply to many contexts, including venture financing. Faced with many funding requests, VCs have to trade off time and effort with information accuracy (Fried and Hisrich, 1994). Given their cognitive limitations, VCs tend to divide their decision into relatively simple, yet structured, stages. VCs may be influenced by certain characteristics of an entrepreneur and his/her start-up in an early stage and later by different characteristics as they select the final candidates. Like doctors and employers, VCs rarely evaluate all the available options or even all that they are aware of (see Figure 1). A VC firm may well screen out 90 percent of the business plans it receives before reviewing the rest (Tyebjee and Bruno, 1984). With such a drastic filtering effect at the deal screening stage, the best way to conceptualize venture financing is with a multistage model of decision making to allow for the possibility that key relationships enter at different stages (Eckhardt *et al*., 2006). Since VCs do not finance ventures that do not make it into their consideration sets to be evaluated, ignoring the sequential nature of the process could lead to biased findings regarding how social capital (such as social ties) helps early-stage ventures secure VC funding.

Social ties and awareness generation

Theory and research on decision making have long pointed out that actors rarely evaluate all the options that are available or even all that they are aware of (e.g., Simon, 1955). As the set of alternatives actually considered can be much smaller than the set available, the filtering can be substantial (March and Simon, 1958; Van den Bulte and Lilien, 2009). Even though Stuart and Sorenson's (2005: 238) literature review on entrepreneurship and social networks explicitly points out that start-ups connected with the VC community are more likely to 'reach the attention of investors looking for options,' the theme has generally been ignored.

An important insight regarding consideration sets is that they are also the result of satisficing rather than

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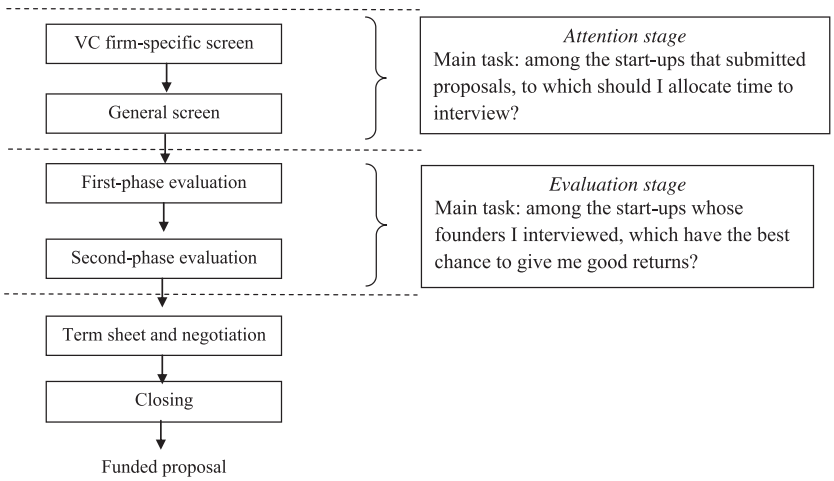

Figure 1. Venture capital investment process

optimizing, particularly in complex situations in which the search for the best candidates requires efforts beyond an actor's cognitive capability (Simon, 1955; March and Simon, 1958). Given the number of funding requests they receive and the limited time they can spend screening them (Fried and Hisrich, 1994), venture capitalists are likely to take the shortcut of relying on information conveyed through social ties to infer a proposal's quality (Shane and Cable, 2002; Stuart and Sorenson, 2005). When search is conducted through social networks, information acquisition tends to be cheap and expeditious, as social relationships are preexisting and 'are maintained for other purposes' (Coleman, 1988: 104). Intergroup bias may even lead investors to interpret the information channeled through networks more positively and give entrepreneurs with whom they have social ties the benefit of the doubt (Sorenson and Waguespack, 2006).

The importance of network ties in seeking VC attention was repeatedly emphasized by both investors and entrepreneurs in my fieldwork. As one entrepreneur-turned-investor put it:

> 'I cannot emphasize enough how important personal relationships are in this business. Guanxi [the Chinese word for social ties] opens doors. The more people you know in a meaningful way, among people who are involved in company building, the more likely you will get the opportunity to talk about your venture.'

A second investor was more explicit about the informational role of social ties:

> 'You can pick up the phone and make some calls…You know each other well and [the referrer] has to answer your questions. This is a quick way for you to get information about the firm, particularly on the management team. It often takes time for you to dig out the information independently. Our firm receives around 30 to 70 business proposals each week. Both the most and least promising ones are easy calls. However, the majority fall in a gray area. Extra information that is trustworthy definitely makes a difference in our decision regarding whom to invite [for a presentation].'

In seeking a VC's attention, entrepreneurs with social ties to that VC may have further advantages unrelated to the information that social ties convey. The investor may feel that he or she has no choice but to treat the entrepreneur favorably (Zuckerman, 2008). When an investor's friend recommends a deal, taking action—for example, scheduling an interview—would be interpreted as reciprocity for the friend's goodwill and would help bolster his reputation among other investors and entrepreneurs. In contrast, inaction would be interpreted as a lack of respect for the friend, which would damage his reputation and rupture that social tie. Since it is relatively inexpensive for VCs to expand their consideration sets on the margin, they might include proposals when the referral conveys little information but carries a high social cost for inaction. I heard this argument from both investors and entrepreneurs in my fieldwork. For example, one well-respected investor told me about an entrepreneur he had interviewed:

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> 'I made my fortune in this industry back in California and know it inside out. His firm had no chance to deliver the type of return I would expect [as an investor]. Do not get me wrong: it is a solid business and he can make good money. I have no doubt about it…[I met the entrepreneur because] Director M [of one of the most renowned science parks in China] made the introduction. For me, that made it a 'political task,' and there was no choice [but to interview the entrepreneur]…You give people credit for their good intentions [in referring deals].'

Similarly, another investor explained:

> 'We live in a *guanxi* society. Whether in business dealings or in daily life, it's better to give people some *mianzi* [that is, preserve each other's face and show respect]…Conducting business only on business terms does not work. When you only put up the business face, people think you are coldhearted and calculating. It would create distance, and not many people would speak their hearts to you. You have to walk a fine line, and this is not a trivial issue.'

Perhaps the strongest evidence for the network effect at the screening stage comes from an entrepreneur who initially approached a VC firm without a referral:

> 'I waited for quite some days and then received a phone call from one associate in the firm. He asked me a few questions about my technology and business model and seemed to be genuinely interested. However, I heard nothing from him for the next two weeks. Then one day I ran into my former boss at a tech expo…It turned out one of his buddies was a partner in the VC firm. I asked him to make an introduction, and he agreed. The next day, I received a phone call from the partner…We met at a coffee house. He was very intrigued by my technology and thought highly of my business model. So he invited my team to make a formal pitch at his firm.'[1]

[1] In the end, that VC firm did not invest in his start-up, as one of the four general partners refused to endorse the deal.

Combining theoretical arguments with the field research regarding the effects of social ties on VC deal screening suggests the following hypothesis:

> *Hypothesis 1 (H1): Start-up firms are more likely to receive interview offers from VCs with which they have social ties than from VCs with which they do not have social ties.*

Social ties and venture evaluation

While the role of social ties in awareness generation has been generally ignored, the literature has repeatedly emphasized their role in venture evaluation, particularly in reducing the concerns with information asymmetry and moral hazard that make it hard for VCs to distinguish good deals from bad.

Information asymmetry is an issue because start-up firms do not have performance track records, and the entrepreneurs, therefore, know more about their own capabilities and intentions than the investors do (e.g., Sahlman, 1990). But entrepreneurs may also be overconfident and tempted to overstate the attractiveness of their proposals, so VCs must guard against being sold a 'lemon' (Amit, Glosten, and Muller, 1990).

Embedding economic exchanges in social relations can be an important mechanism by which to overcome information asymmetry and opportunism (Granovetter, 1985). First, network ties bring the 'shadow of the past' into current transactions; when two parties have frequent contacts in a variety of contexts, they can develop tacit knowledge about each other's capabilities, integrity, and reliability (Batjargal and Liu, 2004). Preexisting ties can also help overcome information asymmetry through referrals (Fernandez *et al*., 2000). A contact who knows both the entrepreneur and the investor can make references based on the parties' preferences and compatibilities. The more the mutual contact cares how he is perceived by the other parties, the more he will take care to filter out deals that may go badly (Smith, 2005). Furthermore, network ties bring expectations of trust and obligation into economic exchanges (Portes and Sensenbrenner, 1993). Such expectations, in turn, may activate a cooperative logic of exchange between investors and entrepreneurs, motivating them to pool their efforts and resources to create new value and mutual benefit (Uzzi, 1999). In contrast, when the two parties are socially unconnected, resources and attention are likely to be diverted from productive

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use because, even when both parties are actually behaving in good faith, they cannot be sure of that, and there will be an element of distrust and defensiveness (Cable and Shane, 1997).

In securing funding, social ties help not just as a 'good faith conformity' norm, but also as a collective sanction mechanism that raises the cost of opportunistic behavior (Coleman, 1988). As the relationship connecting an entrepreneur and an investor could be multiplex and span across time and space, doing wrong to one party would not only ruin one's ties with that party, but would also damage one's social standing within the common circle and affect one's treatment by many different actors across a wide range of interactions (including noncommercial ones) well into the future (Granovetter, 1985). In a venture finance setting, the more an entrepreneur values membership in the network shared with the investor, the less she will be tempted to treat that investor opportunistically. Because an entrepreneur's opportunistic behavior reduces the expected payoff from the investment, *ceteris paribus*, investors will be more willing to invest in entrepreneurs with whom they are socially connected (Shane and Stuart, 2002).

To summarize these arguments, when social ties can serve both as a pipeline for trustworthy information and as a stick to sanction against opportunistic behavior, we expect that a start-up's evaluation by a VC firm should vary with the degree to which its economic transactions with that firm are embedded in social attachments.

> *Hypothesis 2 (H2): In the evaluation stage, an entrepreneur's chance of receiving financing from a venture capital firm increases with the existence of social ties between the two parties.*

Although the existent literature predicts that social ties help ventures earn positive evaluations during the second stage of start-up-VC interaction, there are, in fact, good reasons to doubt the effect of social ties on venture evaluation (Sorenson and Waguespack, 2006). Although investors are expected to favor start-ups to which they are connected when social ties are the only source of reliable information (Rangan, 2000), it is unclear why they should favor connected start-ups when the ties connecting them are 'clunky' (Obukhova, 2012) but reliable information is available elsewhere (Van den Bulte and Lilien, 2001). The VC industry has developed measures such as due diligence, vesting, and board membership with which to assess the quality of entrepreneurs and to align their own and the entrepreneurs' interests (Sahlman, 1990; Gompers and Lerner, 1999). While these mechanisms are not perfect, neither is reliance on prior ties (Fernandez *et al*., 2000). The important issue is that as long as the alternative mechanisms function reasonably well, the role of social ties in evaluation should be limited (Zuckerman, 2008).[2] Granovetter (1985: 491) is very explicit in recognizing the limitation of social ties in economic exchange, arguing that 'networks of social relations penetrate irregularly and in differing degrees in different sectors of economic life, thus allowing for what we already know: distrust, opportunism, and disorder are by no means absent.' Granovetter (1985: 491) also noted that 'social relations may indeed often be a necessary condition for trust and trustworthy behavior; they are not sufficient to guarantee these and may even provide occasion and means for malfeasance and conflict on a scale larger than in their absence.' His message, however, has been lost in the literature.

Although there are good reasons to doubt the positive role of social ties in venture evaluation, the sequential nature of VC decision making and the significant filtering at the awareness generation stage suggest the following hypothesis about the cumulative advantage of social ties in venture financing:

> *Hypothesis 3 (H3): Combining the awareness stage and the evaluation stage, an entrepreneur's overall chance of receiving financing from a venture capital firm is positively influenced by the existence of social ties between the two parties.*

EMPIRICAL SETTING AND DATA

I use data from two Chinese university science parks (USPs) to empirically examine how social relationships enter into VCs' decision making. USPs were established in China to promote the development

[2] Indeed, if the alternative mechanisms do not function well, social ties must be the only channel by which VCs can collect information and evaluate deals, which would contradict the idea that the competitive advantage of VCs lies in having industrial, technological, and managerial expertise that can be brought to bear in evaluating deals, managing portfolio firms, and nurturing them for successful exit.

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of high-tech ventures through technology commercialization, knowledge agglomeration, and resource sharing. China built its first USP in 1991 and now has about 100. The parks where I interviewed are in Beijing and Guangzhou. Due to their sponsoring institutions' technological capacity and success in promoting high-tech firms, these two parks are classified as 'national university science parks' and have attracted enormous attention from VCs seeking high-tech opportunities. Among firms located in the parks, I chose to study internet- and telecom-related ventures, as these areas have attracted most of the VC investment in China during the past decade (Li, 2005).[3]

This USP setting in China helps advance our understanding of venture financing in multiple ways. First, the VC literature has mainly focused on the developed world. Even though China has become the third-largest VC market in the world, we know very little about VC practices there. Second, China shares key institutional features with other emerging economies in which the VC industry has taken off over the past decade (Cumming and Johan, 2013). My findings may, therefore, be generalizable to other developing economies.[4] Third, Chinese USPs keep comprehensive information on the firms they host, enabling researchers to define the boundary of the target population in order to sample relevant firms.

My data are the result of seven months of fieldwork in 2008 and 2009, during which I conducted more than 170 interviews, including meetings with 129 entrepreneurs, 17 venture capitalists, eight governmental officials, and 10 science park managers.[5] The interviews lasted 45 minutes to three hours, with most being about 90 minutes. The interview questions focused on the founder's background and the start-up's path of development. The founder also completed a questionnaire that solicited detailed information about his/her education, career history, start-up experience, relationships with VCs, and the outcome of each of the start-up's VC funding requests.

One unique feature of the dataset is that it distinguishes between the various stages of start-up-VC interaction. Although prior studies have found a positive association between entrepreneurs' ties with investors and their start-ups' access to VC funding, they have had information only on the outcome of funding decisions and, thus, implicitly assumed that networks influence VCs' evaluation of every firm, whether or not it has passed the deal screening stage and entered the consideration set for deal funding. As a result, this line of research cannot distinguish between three types of social tie effects: those that take place at: (1) the first stage—deal screening; (2) the second stage—deal funding; or (3) both stages (see Figure 2). A dataset that makes an explicit distinction between the two stages should help us unpack the causal mechanism to explain where the advantages of social ties to VCs arise for entrepreneurs.

By approaching the sampled firms through referrals by university administrators, USP managers, venture capitalists, entrepreneurs, and journalists who report on high-tech ventures, I got most of the interviews I sought. Excluding firms that had never pursued VC investment or that refused to provide information necessary for this study, I had detailed information on 85 internet and telecom firms from the two parks. These firms were relatively young, averaging around four years old at the time of my interviews. The unit of analysis in this article is the start-up-VC pair. For each of the VC firms that a start-up approached, I created a start-up-VC pair to capture the process of their interaction. In total, there are 430 start-up-VC pairs.

[3] By the end of 2009, there were about 500 firms in the Beijing USP, more than 200 of which were relevant to my research. Based on the Chinese alphabetic order of their names, I tried to approach every third firm for interviews. As the Guangzhou park had fewer than 150 firms, I interviewed representatives at all 36 internet and telecom firms there.

[4] Some readers may disagree. Indeed, there are two schools of thought regarding whether China-based findings on social ties apply to other contexts. On the one hand, scholars from the cultural anthropology tradition tend to perceive China as a unique society whose *guanxi*-based relationships are very different from social ties elsewhere (e.g., Hwang, 1987). On the other hand, economic sociologists find that *guanxi* and social ties in other cultures have much in common, especially in channeling information, defining appropriate behaviors, and discouraging malfeasance (e.g., Gold, Guthrie, and Wank, 2002). In recent years, the latter camp has examined how social ties in the developing world can help fill the void left by underdeveloped market-supporting institutions, particularly in business partner identification, contract enforcement, and dispute resolution (e.g., Zhou *et al.*, 2003). Similar results have also been found in other transitional economies such as Vietnam (e.g., Malesky and Taussig, 2008), Russia (e.g., McMillan and Woodruff, 2002), and India (Nanda and Khanna, 2010). Furthermore, scholars have found evidence suggesting that when market institutions improve, Chinese entrepreneurs rely less on social relationships for economic transactions (e.g., Zhang, Tan, and Tan, 2015).

[5] I also interviewed two corporate investors, four VC attorneys, and seven journalists reporting on high-tech ventures.

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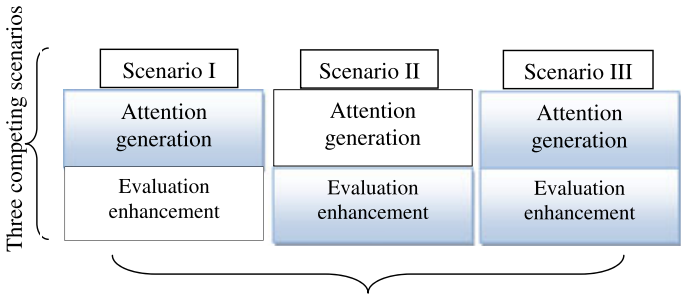

Note: Shaded box indicates the stage at which social ties play a role in decision making.

Figure 2. Competing mechanisms for network advantage

While referrals gave me a high response rate, they may create a problem of recall bias, a fundamental challenge in survey-based research. As individuals may systematically differ in the accuracy or completeness of their recollections, one may worry that an entrepreneur will try harder to remember a positive outcome, such as an interview offer, than a negative outcome in order to avoid losing face with the interviewer. Given that we examine the staged nature of VC decision making, to some extent this concern is reduced, as there is no good reason to believe that entrepreneurs are more likely to recall positive outcomes at one stage than at another. But because I cannot directly test how bias enters entrepreneurs' recall of their interactions with VCs across the stages, I interpret my empirical results with caution.

Variables and their measurements

My survey gathered detailed information about the following variables:

Funding offer

In order to test my hypotheses, I created a dummy variable to capture whether an entrepreneur received a term sheet from a particular VC that she approached during the first major round of fund-raising.[6] A term sheet is a document outlining the material terms and conditions of an investment agreement between an entrepreneur and a VC firm. Although not binding on the parties in its entirety, a term sheet guides the negotiation of the final terms of the agreement. Receiving a term sheet is generally perceived as a significant milestone for the venture, and it takes serious commitment on the investor's side to offer one (Hoffman and Blakey, 1991). My sample includes 58 VC term sheet offers to 22 firms. The proportion of start-ups receiving VC term sheets is high due to the concentration of high-quality firms in these particular USPs and to the VCs' particular interest in the internet and telecom sectors.

Interview offer

Funding offers measure only the final outcome of start-up-VC interactions. To capture the dynamic nature of this process, I create a dummy variable at the start-up-VC-pair level to indicate if an entrepreneur receives an invitation from a VC to give a PowerPoint presentation, which is generally taken to be a serious interview offer. This is typically the first formal meeting between the two parties; it gives the start-up the opportunity to demonstrate its business model, its market opportunity, and the founding team's capacity to potential investors. Therefore, it can be seen as a watershed event showing a VC's interest in the firm. Out of the 430 start-up-VC pairs, 231 interview offers were extended to 69 start-ups.

Social tie

This study's key explanatory variable is a start-up's primary method of soliciting VC financing. For each of the VCs that a start-up approached, the start-up's founder was asked: 'What is the primary method

[6] Of all the possible rounds of venture financing, I focus on the first round because: (1) an entrepreneur's ties to the VC community often change dramatically after the first round; and (2) the funding dynamics of subsequent rounds are largely determined by the first round.

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through which you got to contact the VC firm?' The response options were: (1) we were friends; (2) we were introduced by mutual friends; (3) we were acquaintances; (4) we were introduced by mutual acquaintances; (5) we met at a conference/other business occasion; (6) I submitted a business plan; and (7) other. These seven responses were categorized as either social ties (responses 1-4) or no ties (responses 5-7). I explicitly instructed the entrepreneurs to answer this question regarding the relationship with the VC at the time the contact was initiated, rather than at the time of the interview. Of the 430 cases of deal origination in the sample, around 55 percent were initiated through social ties.[7]

Other entrepreneur and firm characteristics

To provide more accurate estimates of the hypothesized relationships, I control for other factors that previous research has found to be important in explaining venture financing. First, I collected information on the amount of capital the founding team invested during the start-up's first year. Given the information asymmetry between VCs and entrepreneurs, outside investors consider the founders' investment as a sign of their confidence in the venture's promise. In addition, firms with larger resource endowments are more likely to progress quickly through the development process (Shane and Stuart, 2002; Eckhardt *et al.*, 2006).

Second, I collected information on the entrepreneurs' work histories. Past studies have suggested that individuals' network opportunities are greatly shaped by their career paths (Burton, Sørensen, and Beckman, 2002) and that start-ups inherit organizational routines and cultures from the founders' previous work experience (Phillips, 2002). Investors may, therefore, use an entrepreneur's career to project his/her venture's future performance. I construct a dummy variable, *high-profile career*, to measure whether the entrepreneur had worked as a middle or top manager in any of a group of the most famous Chinese start-ups listed on the New York Stock Exchange or the NASDAQ.[8]

Third, to capture an entrepreneur's human capital, I collected information on educational background (whether the entrepreneur had received a doctoral degree and which college cohort she had belonged to) and leadership skills (whether the entrepreneur had been a student leader in college). [9]

Prior research has shown that firms that have overcome the 'liability of newness' are more likely to attract investors' attention (Hallen, 2008). Studies also suggest that VCs favor certain industries for early-stage investment (Shane and Cable, 2002). Therefore, I created a variable, *firm age*, to document a firm's years of establishment at the time of the interview and two dummy variables, *telecom sector* and *e-commerce sector*, to capture its industry.

I collected the names of the VCs approached by start-ups in my sample. Given that VCs vary in their expertise and industrial focus, the same start-up can be evaluated differently by different investors. To capture this dimension, I created an ordinal variable to rank a VC firm's prestige, based on information from the firm Zero2IPO.[10] Research has shown that start-ups are particularly interested in investments from high-status VCs (Hsu, 2004).

Methods

I use several methods to examine the relationship between social ties and venture financing at the start-up-VC-pair level. I begin with a descriptive analysis of the proportion of interview and funding offers that were obtained through social ties. I then use logit regressions to estimate the effect of social ties on venture financing. In doing so, I examine the conclusions to be drawn from alternative conceptual models: one that distinguishes between the awareness and the evaluation stages and another that collapses the two stages to estimate the cumulative effect of social ties in venture financing.

[7] Although the percentage of deal originations through social ties seems high in China, it is comparable to the percentage in the U.S. (Tyebjee and Bruno, 1984).

[8] These firms are 51Job, AsiaInfo, Baidu, China.com, Ctrip, Focus Media, KongZhong, Linktone, Netease, Shenda Interactive Entertainment, Sina, Sohu, The9 Ltd, Tom Online, and UTstarcom. Some entrepreneurs worked at more than one of these.

[9] I created a four-category variable to capture college cohort: 1 indicates that one started college before 1980; 2 in the 1980s; 3 from 1990 to 1995; and 4 after 1995.

[10] Zero2IPO is arguably China's most authoritative consulting firm on VCs. Each year, it ranks the 'Top 50 Best VC/PE Firms in China.' Although the exact ranking order can be controversial, experts generally agree that the ranked firms are among the best in China. Based on Zero2IPO rankings from 2006 and 2007, VCs in my sample are assigned one of four values: 0 for VCs unranked in either year; 3 for VCs ranked among the Top 25 in both years; 2 for VCs ranked in both years but not consecutively among the Top 25; and 1 for the rest.

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The two-stage model of the effect of social ties on awareness generation and venture evaluation is expressed as:

$$Pr\left(interview\ offers_{ij} = 1\right) = F\left(\alpha_1 + \beta_1 social\ ties_{ij} + \sum B_1 Z + \mu_{i,j}\right); \quad (1)$$

$$Pr\left(funding\ offers_{ij} \middle|\ interview\ offers_{ij} = 1\right) = F\left(\alpha_2 + \beta_2 ties_{ij} + \sum B_2 Z + \mu_{i,j}\right). \quad (2)$$

The one-stage model of social ties' cumulative effect is expressed:

$$Pr\left(funding\ offers_{ij} = 1\right) = F\left(\alpha_3 + \beta_3 ties_{ij} + \sum B_3 Z + \mu_{i,j}\right). \quad (3)$$

In these equations, ij represents the start-up$_i$-VC$_j$ pair; social ties$_{ij}$ measures the social ties between start-up$_i$ and VC$_j$; Z is a vector of control variables that captures VC-level and entrepreneur/start-up-level characteristics; α, β, and B are the constant term and the coefficients for social ties and control variables; and μ is the error term.[11]

This article makes three main predictions: (1) social ties matter most during the deal screening stage (that is, β_1 is positive and statistically significant); (2) the role of social ties diminishes during the deal funding stage (that is, β_2 is positive but much smaller than β_1); and (3) a connected start-up has a cumulative advantage in access to venture capital (that is, β_3 is positive and statistically significant). Jointly, these results suggest that a one-stage model would misallocate the social tie effect in the awareness generation stage to the later venture evaluation stage.

To alleviate the concern with capability-based rival hypotheses, I also run entrepreneur-level fixed effects conditional logit regressions. If ties to VCs help a start-up get financed, one has to wonder why all entrepreneurs do not develop such ties. It could well be that variables such as unobservable firm capability hold back both the development of ties and access to capital. In an entrepreneur-level fixed effects model, the entrepreneur's observed and unobserved characteristics, such as gender and capability, are constant for all start-up-VC pairs involving that entrepreneur's start-up; the only independent variable that varies is the method by which the entrepreneur approaches a given investor. In this way, it is possible to estimate within-entrepreneur variation in VC funding as a function of the existence or absence of social ties with each VC the entrepreneur approaches. Similar approaches have been used in a variety of contexts, such as research scientists' career choices (Stern, 2004) and entrepreneurs' selection of VC affiliation (Hsu, 2004).

RESULTS

Figure 3 suggests that start-ups are more likely to receive interviews from VCs with which they have ties (66%) than from VCs with which they have no ties (38%). However, the advantage of social ties—as reflected in funding offers—becomes much weaker in the evaluation stage. Conditional on being interviewed, 27 percent of the cases with ties and 21 percent of the cases without ties end in funding offers.

Table 1 shows the descriptive statistics and correlation matrix. Both interview offers and funding offers are positively correlated with start-up-VC social network ties. However, the correlation is stronger for interview offers (0.28) than for funding offers (0.14), tentatively suggesting that social ties play a larger role at this early stage of venture financing. Table 2 shows that the correlation between funding offers and network ties becomes even weaker (0.06) when we look only at cases in which the start-ups have actually entered the evaluation stage. Collectively, these descriptive statistics suggest that a two-stage conceptual model is appropriate for understanding how social ties enter into VCs' investment decisions.

Table 3 provides the results of two-way clustering logit regressions predicting the likelihood that a start-up receives interview and funding offers. Three steps are taken. First, following the previous literature, Model 1 ignores the multistage nature of venture financing and focuses only on its final outcome. Models 2 and 3 look at the awareness and evaluation stages separately, examining when and how social ties really matter in venture financing.

Across the three models, the control variables provide important insights into VC financing. First, VCs are more likely to interview and fund start-ups

[11] To reduce the risk of nonindependent errors, given that there can be multiple observations for the same start-up or the same VC, I adopt a two-way clustering logit model to calculate the variance estimators, as proposed by Petersen (2009).

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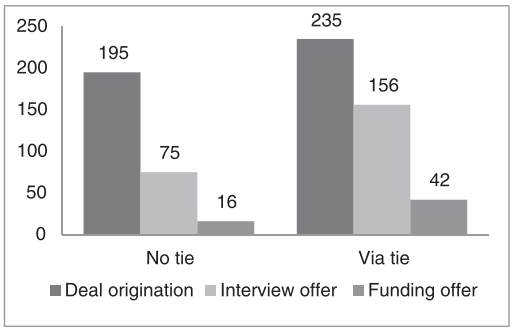

Note: The data include 430 funding requests made by 85 start-ups. Among the 235 funding requests made through start-up VC social network ties, 17.95 percent (42 requests) resulted in funding offers, while among the 195 requests made through non-network means, only 7.69 percent (16 requests) resulted in funding offers.

Figure 3. Venture financing for start-up firms in two Chinese university science parks

Table 1. Descriptive statistics and correlation matrix (N = 430)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1 Interview offer	1.00															
2 Funding offer	0.37	1.00														
3 Social tie	0.28	0.14	1.00													
4 Male	-0.02	0.04	0.08	1.00												
5 College cohort	-0.01	-0.09	0.01	0.06	1.00											
6 Foreign education	0.31	0.22	0.10	-0.09	-0.06	1.00										
7 PhD degree	0.02	0.03	-0.01	0.03	0.05	0.10	1.00									
8 Student leader	0.25	0.28	0.07	-0.04	0.06	0.16	0.10	1.00								
9 Party membership	0.01	0.04	-0.01	0.08	-0.09	-0.22	-0.05	0.09	1.00							
10 High-profile career	0.27	0.29	0.06	-0.06	-0.06	0.20	-0.06	0.12	-0.09	1.00						
11 Located in Beijing	0.29	0.22	0.07	-0.18	0.20	0.31	-0.07	0.27	-0.05	0.16	1.00					
12 Firm age	-0.05	-0.11	0.07	0.09	0.38	-0.14	-0.11	-0.06	-0.11	-0.02	0.05	1.00				
13 Founder investment	0.33	0.29	0.07	0.13	-0.17	0.19	-0.05	0.23	0.13	0.21	0.11	-0.19	1.00			
14 Telecom sector	0.18	0.19	0.05	-0.08	-0.07	0.00	-0.05	-0.01	0.04	0.19	0.12	0.21	0.11	1.00		
15 e-commerce sector	-0.06	-0.03	0.04	0.04	0.14	-0.01	-0.10	0.08	-0.21	-0.15	0.05	0.28	-0.06	-0.14	1.00	
16 VC ranking	-0.27	-0.22	-0.12	0.07	0.08	-0.07	-0.13	-0.08	-0.04	-0.07	-0.01	0.04	0.03	-0.08	0.04	1.00
Mean	0.54	0.13	0.55	0.90	2.87	0.27	0.15	0.10	0.36	0.09	0.61	3.70	3.78	0.08	0.19	1.50
Std. deviation	0.50	0.34	0.50	0.30	0.85	0.45	0.35	0.30	0.48	0.28	0.49	1.93	1.15	0.27	0.39	1.06
Minimum	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.10	0.00	0.00	0.00
Maximum	1.00	1.00	1.00	1.00	4.00	1.00	1.00	1.00	1.00	1.00	1.00	8.00	7.60	1.00	1.00	3.00

whose founders have established successful career paths in high-profile start-ups (Hallen, 2008), as this type of work experience both familiarizes an entrepreneur with the start-up process and helps him/her build social connections with key resource holders such as VCs (Burton *et al.*, 2002). Second, an entrepreneur's initial investment also matters, serving as an important signal to potential investors of her confidence in and commitment to the business opportunity (Eckhardt *et al.*, 2006). It may also be a surrogate for prior success or for wealthy family background, both of which may suggest other influences on VCs' screening and funding decisions. Third, industrial sector and gender matter, but only in the funding stage (Model 3: B = 1.27, SE = 0.52

Table 2. Correlation coefficients between funding offers and social ties

	Two stages collapsed	Evaluation stage only
Coefficient	0.14	0.06
Significance level	0.00	0.36

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Table 3. Logit models predicting start-up-VC interaction in two Chinese USPs

	Two stages collapsed		Interview offer stage		Funding offer stage	
	Model 1		Model 2		Model 3	
	B	S.E.	B	S.E.	B	S.E.
Social tie	0.67*	0.36	1.10***	0.30	0.46	0.36
Male	1.25**	0.56	0.22	0.68	1.27***	0.52
College cohort	-0.30	0.33	0.22	0.18	-0.35	0.34
Foreign education	0.63	0.50	1.03***	0.37	0.41	0.49
PhD degree	0.04	0.64	0.15	0.33	0.08	0.62
Student leader	1.17*	0.60	1.29***	0.39	0.92	0.57
Party membership	0.29	0.55	0.13	0.41	0.29	0.58
High-profile career	1.44***	0.58	2.45**	1.11	1.18**	0.54
Located in Beijing	1.20**	0.60	0.73*	0.38	1.02*	0.58
Firm age	-0.18	0.14	-0.07	0.09	-0.16	0.14
Founder investment	0.52***	0.18	0.57***	0.15	0.35**	0.16
Telecom sector	1.81***	0.64	1.36	0.96	1.59***	0.59
e-commerce sector	0.72	0.74	-0.14	0.40	0.79	0.78
VC ranking	-0.74***	0.20	-0.60***	0.11	-0.52***	0.21
Constant	-5.23***	1.29	-3.23***	1.00	-3.88***	1.33
N	430		430		231	
Wald χ^2 (d.f.)	94.88 (14)***		112.49(14)***		52.14(14)***	
Pseudo R^2	0.342		0.315		0.221	

* $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$ for two-tailed tests.

for male; B = 1.59, SE = 0.59 for telecom), suggesting that investors search broadly for new opportunities but invest in firms with a narrower range of characteristics.

Coming back to the main focus, Model 1 confirms the prior literature, showing that social ties are positively correlated with funding offers in a one-stage model. This finding is of substantive significance; after controlling for a long list of entrepreneurial attributes and firm characteristics, the existence of social ties almost doubles the odds of receiving funding (B = 0.67; Exp(B) = 1.95; $p < 0.10$). I next decompose the advantage of social ties, running separate models on attention generation and funding evaluation. Model 2 relates to the attention stage, finding a positive and statistically significant association between social ties and the likelihood of an interview offer (B = 1.10; Exp (B) = 3.00; $p < 0.01$). When the values for all the control variables are arbitrarily set at the mean, switching a start-up-VC pair from being unconnected to being socially connected increases the chance of an interview offer by 19.6 percent. Model 3 focuses on the evaluation stage, finding a positive but statistically insignificant association between social ties and funding offers (B = 0.46; $p > 0.10$). Together, these models suggest that social ties provide firms with a cumulative advantage in receiving VC investment; however, the advantage arises mainly at the early stage of deal screening and not at the later stage of deal funding.

Table 4 presents the results for the fixed effects models. Model 4, for interview offers, shows that start-ups are significantly more likely to receive attention from VCs with which they are connected (B = 0.96; $p < 0.01$). The VC funding equation, Model 5, provides no support for the argument that social ties have a strong effect on venture financing at the evaluation stage (B = 0.05; $p > 0.10$). These results are similar to those reported in Models 2 and 3 in Table 3. Since I estimate within-start-up fixed effects with start-up-VC pairs as the unit of analysis, the effects of social contacts are independent of any observable and time-invariant unobservable attributes of the entrepreneur. This shows that the observed relationship between social ties and interview offers is not simply attributable to unobserved capability measures that may bring about both tie formation and interview offers.

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Table 4. Start-up-level fixed effects logit models for USP firms

	Interview offer stage		Funding offer stage	
	Model 4		Model 5	
	B	S.E.	B	S.E.
Social tie	0.96***	0.31	0.05	0.49
VC ranking	-0.77***	0.16	-0.70***	0.26
N	244		106	
LR χ^2 (d.f.)	44.8(2)***		9.22(2)***	
Pseudo R^2	0.222		0.100	

* $p < 0.10$;
** $p < 0.05$;
*** $p < 0.01$ for two-tailed tests.
Note: Model 4 predicts an entrepreneur's likelihood of receiving an interview offer. The analysis dropped 38 groups (186 observations) with either all positive or all negative outcomes. Model 5 predicts an entrepreneur's likelihood of being selected for funding by a VC that has interviewed him/her. The analysis dropped 48 groups (125 observations) with either all positive or all negative outcomes.

While Tables 3 and 4 show consistent patterns of the impact of social ties on start-up-VC interactions, one might worry that the secondary role of social ties in venture evaluation is an artifact of the shrinkage of observation size across the two stages. While this is a legitimate concern, my conclusion that social ties play a larger role at the awareness stage is based not only on the lack of statistical significance of the social tie variables at the evaluation stage (Models 3 and 5), but also on the change of magnitude in their coefficients from the attention stage (Models 2 and 4) to the evaluation stage (Models 3 and 5). Thus, my findings cannot be explained solely by the shrinking of sample size due to the filtering effect at the first stage, whereby many entrepreneurs who made funding requests were nevertheless not interviewed.[12]

[12] To further reduce the concern that the difference in statistical significance for the coefficient of social ties was due to sample sizes, I randomly draw a sample of 231 observations in the first stage, run the regressions in Model 2 of Table 3, and perform 500 bootstrap replications. Even with the same smaller sample size in both stages, we still observe a positive and significant effect of social ties in the first stage. While this result does not rule out the possibility that a larger sample size in the second stage might produce a statistically significant coefficient for social ties in venture evaluation, it does provide direct evidence for the article's key argument that the role of social ties varies across the two stages and that connected firms have an advantage in the first-stage sorting process. Results are reported in the Appendix.

Discussion

This article provides the first effort to develop a multistage view of the role of social ties in the dynamic process of decision making in the context of venture financing. The evidence comes from a Chinese dataset that breaks the VC funding decision into awareness and evaluation stages in order to investigate possible mechanisms. I find that social ties provide firms with a cumulative advantage in receiving VC investment; however, when decomposed, this advantage mainly operates on the selection of the consideration set, rather than on the decision to grant funding. In a context in which decision making takes place in stages and social ties play an important role in determining which options enter the consideration set, collapsing the multiple stages into one will apply the explanatory power of the effect of the ties at the early stage to the final stage instead, thereby mistaking the cumulative effect for an effect on venture evaluation.

While this study shows consistent patterns of how social ties generate economic advantages in venture financing, I feel obliged to interpret these results with caution, as the article has several limitations. First, the dataset is not representative of early-stage start-up firms. The firms in my sample are among the best high-tech start-ups in China and are in science parks affiliated with top Chinese universities. A number of their founders obtained advanced degrees overseas and worked in *Fortune* 500 companies. One may worry that both the high quality of these start-ups and their endorsement by top science parks attenuate

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the effects of social ties; these particular entrepreneurs might have done just as well independent of costly investment in tie formation. Therefore, my findings might not be generalizable to the general population of high-tech firms in China.[13] Future studies may use a more representative sample to test whether the empirical patterns observed in this article hold across firms of different caliber and in different institutional settings (that is, outside university science parks).

Second, this article fails to investigate herding behavior—an important dynamic in venture financing that could bias the results. When one venture firm offers a term sheet to a start-up, other investors may take this as a critical quality signal and short-circuit their own due diligence. If social ties lead to the first offer and unconnected investors follow suit, we would fail to observe a social tie effect in aggregation even though there had been one. Testing this hypothesis would require fine-grained information about the chronological sequence of funding offers; unfortunately, I did not have such data.

Third, recall bias can be a fundamental challenge in survey-based research. An entrepreneur who cares how the interviewer perceives her might consciously or unconsciously try harder to recall positive rather than negative outcomes. To reduce this concern, I conduct robustness tests by rerunning the analyses in Tables 3 and 4 with the subsample of 'high-credential' entrepreneurs, as they are more likely to feel secure about their social positions and to share their funding experiences honestly.[14] Although the coefficients differ in magnitude from those of the original models, the main results regarding how social ties affect VCs' decision-making processes and generate a cumulative advantage in funding access hold.[15]

While I find no statistically significant association between social ties and venture evaluation among firms that have entered a VC's consideration set, this result should be interpreted with caution. Lack of evidence supporting a positive social effect is not evidence that there is no social effect. Indeed, in the significance testing tradition of Fisher (1935), a null hypothesis can only be rejected on the basis of data, but can never be accepted or proved. With all these statistical caveats in mind, my fieldwork does suggest possible mechanisms that prevent social ties from playing a role in venture evaluation in China. Even though these suggested mechanisms cannot be empirically tested in this article, they have the potential to shed new light on the limits of social ties in economic exchanges and, thus, are worth an in-depth discussion.

First, information conveyed through social ties may not be fine-grained enough for venture evaluation. VCs receive referrals not only from other investors and seasoned entrepreneurs, but also from laypersons such as neighbors and friends. Although the trained eyes of professional ties could help an investor judge a start-up's general quality and potential match with his portfolio, nonprofessional ties would not be able to do so. Shane and Cable (2002: 371) surveyed 566 venture capitalists listed on *Pratt's Guide to Venture Capital Sources*. The 136 individuals who responded had an average of 17 years of investment experience and had previously made an average of 12 seed-stage investments.[16] This raises the interesting possibility that professional ties might play a role in both the deal sorting and deal funding stages while nonprofessional ties might have an effect only during the deal sorting stage.[17] Although mutual friends are motivated to bring entrepreneurs and investors together, this may result in 'blind dates' that do not match the parties' skills, assets, and objectives. Thus, social referrals help entrepreneurs and investors search at the 'extensive'

[13] Scholars of VC financing often have to make a trade-off between the most representative sample and the most relevant sample. While using a dataset that is representative of firms seeking VC investments helps one generalize the study results, most of the firms in the sample are not relevant to VC activities, given that VCs seek only the most promising firms. For this reason, many studies have traded off representativeness for relevance. The strategy of sampling on high-potential firms was also adopted by Burton *et al.* (2002), Shane and Stuart (2002), and Hsu (2004).

[14] I define an entrepreneur as 'high credential' if he/she: (1) held a high-profile position earlier in his/her career; (2) was a student leader in college; (3) studied overseas; (4) earned a doctoral degree; or (5) made an initial investment in the upper half of those of all the firms sampled.

[15] These results are available upon request.

[16] One survey conducted by Smart, Payne, and Yuzaki (2000) of 145 American venture capitalists showed that more than 67 percent of them had MBAs and 56 percent had graduated from Stanford and Harvard. A majority had more than 10 years' business experience; of these, 34 percent of respondents was in corporate management, while 30 percent were former entrepreneurs.

[17] This study explores only the deal sorting and deal funding stages. Future studies could explore how social ties influence an entrepreneur's choice among VC offers. If professional ties do a better job of matching a start-up with a VC firm, then we should expect that when a VC and an entrepreneur are connected professionally, funding offers are more likely to be accepted.

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margin, but not necessarily at the 'intensive' margin (Fernandez *et al*., 2000).[18]

Second, even when referrers have both private information on the quality of the investment opportunity and the expertise to distinguish sound projects from bad ones, VCs may still have reservations about how much to rely on such information. Chinese investors are well aware that the referrer may be a personal friend of the entrepreneur or may have been promised a commission fee and, therefore, may give the investor a biased picture of the opportunity. In a different context, Fernandez *et al*. (2000: 1333) find that human resource managers are highly skeptical about the motivation of employee referrers. As one HR manager said, 'You would think that people would not refer just anybody since it would reflect on them if the person were not any good. But the other side of this is that I know people who would refer their dog if they can get a $250 bonus.' The stakes in venture financing are much higher, and we have no reason to expect that people are more scrupulous about VC referrals than about job referrals. One investor was particularly explicit on this point: 'Often people get a commission fee of one to three percent [of the investment the VC makes in a firm]. That's *a lot* of money! As the old saying goes, 'with money, you can get the ghost to turn the millstone!"

While the investors are not hypercritical, the high financial stakes push them to rely on more than personal trust to protect their interests. As one entrepreneur-turned-investor said, 'When stakes are high, temptations are also high…You want to trust people, but you also need proof of their trustworthiness and the tools to protect yourself…I have seen enough cases where good personal relationships turned sour due to the conflict of interests…Business is about people. However, you cannot take it too personally.'

This echoes scholars' concerns about the dark side of embedded economic exchanges. As Nee and Ingram (1998: 22) point out, it is difficult to know 'from *ex ante* whether and to what extent personal ties can cement trust between economic actors.' Granovetter (1992: 43) goes even further, raising the concern that 'the trust engendered by personal relations presents, by its very existence, enhanced opportunity for malfeasance…Certain business crimes, such as embezzling, are simply impossible for those who have not built up relationships of trust that permit the opportunity to manipulate accounts. The greater the trust, the more the potential gain from malfeasance.'[19]

Both the statistical results and the field interviews raise an interesting question regarding the balance of two obligations in economic transactions. 'Universal' obligations for VCs—such as being professional, maximizing organizational efficiency, and selecting the most promising start-ups for investment—can coexist with obligations to behave responsibly in one's relations to particular network partners—obligations such as being 'humane,' fulfilling friendship duties, and treating connected ventures favorably. While the results at the attention stage correspond well with the argument that 'the mere fact of attachment to others may modify economic action' (Granovetter, 1992), the results at the evaluation stage suggest that investors also seek to minimize the

[18] Chinese investors are often candid about the pitfalls of overreliance on social ties for venture evaluation. As one general partner from a Beijing VC firm cautioned: 'You have to be careful [about the reliability of information sources]. You pay close attention to recommendations of people who you know mean business. Unfortunately, that's not always the case. When it is your Aunt No. 7 or Uncle No. 8, you listen but have to make your own judgment. You will be surprised to see how far off the mark some referred business plans are! In certain cases, if they [the referrers] have some business sense or know a bit of the technology, they might feel embarrassed.' I repeatedly heard similar messages during my fieldwork. Here is another example: 'One cannot take people's opinions for granted…VC is a very complex business, and many folks have no clue about how we operate…Sure, we manage others' money. But we are not bank officers and we do not just allocate money to any venture that is sound [to a loan officer].' Some investors put it more subtly: 'There are cases in which one person's opinion may influence our decision. However, that's extremely rare. When we are interested in a firm but hesitate to invest, usually we would wait for it to reach a certain milestone. We may also call upon other VCs to seek their opinions. It is much less risky to go along with a partner…For sure, we trust some people's judgment more than others', particularly if they have collaborated with us in the past and their recommended ventures were successful. As professional investors, we still need to go through the [due diligence] process…For deals [in which] I can make an investment based on recommendations, they are usually [so] good that we have to compete [with other VCs that can also see how good they are].'

[19] Even when social ties provide reliable information about an entrepreneur, the information may not give that entrepreneur an advantage in receiving VC funding. When ties convey complete information about an entrepreneur, investors will learn about weaknesses as well as strengths. Thus, unless referred start-ups are, on average, of higher quality than other start-ups, more information will not make investors more likely to fund them. However, if referred firms are, on average, of higher quality than those without referrals, one has to ask to what extent social connections have independent effects on funding decisions.

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impact of social obligations and have no hesitation in turning down funding requests from connected yet unqualified start-ups. Future studies may explore how this balance of obligations shapes the evolution of social networks. When doing favors becomes so time-consuming that it gets in the way of professional tasks, investors have to calculate what favors to do for whom at what time.[20]

Broader implications

One of the key distinctions between this article and prior research is its explicit modeling of decision making as a multistage process composed of: (1) awareness generation; and (2) evaluation for selection. Similar multistage models have been developed in the labor market and innovation diffusion literatures. However, each literature draws different conclusions regarding the role of social ties. For instance, the innovation-diffusion literature finds that social ties matter mainly in the evaluation stage (Coleman *et al*., 1966), while my study finds them more prominent in the awareness generation stage. The labor market literature falls in the middle; scholars find that network ties matter in both stages but play a larger role in the awareness generation stage (Fernandez *et al*., 2000). Comparing the three literatures lets us: (1) better understand how social ties enter the decision-making process; and (2) draw some general conclusions regarding what types of ties matter, when, and how. I propose two factors at work.

The first factor is the number of options available to decision makers. When many options compete for attention, limitations on decision makers' cognitive abilities often constrain them from engaging in optimal search behaviors. Rather than ranking all options and selecting the best ones, they often construct mental criteria and rely on heuristics or social ties as informational shortcuts to constructing a consideration set (March and Simon, 1958). This holds for both venture financing and labor markets, where the sheer number of candidates makes it far too costly for decision makers to investigate every option, forcing them to rely on social ties as an informational cue in the first stage (selection). As long as the observable quality of connected options satisfies the screening criteria, those options will be given priority and become part of the construction set for final evaluation. In contrast, new drug adoption has a different dynamic, as only a few new drugs are introduced each year for a given illness and these often receive enormous publicity through the drug makers' commercial campaigns. As a result, doctors often become aware of what's new and available on the market through public channels such as mass media or professional magazines rather than through network ties (Coleman *et al*., 1966).

The second factor is the nature of the social ties themselves. When ties are formed endogenously through professional means, they are more likely to convey information based on professional knowledge that can help a decision maker judge among referred candidates. However, when ties are heterogeneous and many are nonprofessional, such as friends and relatives who are not in the business, the information they convey will be less valuable. In the case of VC investments in China, many of the referrals are made through social ties who are not professional investors or seasoned entrepreneurs. It is understandable that VCs are reluctant to rely on such sources, particularly since they can collect information independently through due diligence and other means. The labor market context presents similar yet lower-level heterogeneity. Employees have knowledge of the features and requirements of jobs available in their own firms, but they are not professional human resource managers and, thus, have limited knowledge of what type of individual can best fill a given position (Fernandez *et al*., 2000). By contrast, the ties that doctors consult on new drugs tend to be other doctors, who have the professional knowledge to help judge the new drug's quality.

In summary, the number of options faced by decision makers and the heterogeneity of their social ties jointly influence when and to what extent social ties matter in the decision-making process. When the number of options is large and alternative information mechanisms are not cost effective, decision makers are more likely to rely on social ties. However, if the consideration set is small and alternative information mechanisms are practical, decision makers depend less on social ties, particularly those outside the professional domain. Together, these two

[20] We see this in the previously noted relationship between Director M and the returnee investor. Even though the investor interviewed the entrepreneur to show his appreciation of the director's referral, he took a mental note that this entrepreneur was not investment worthy. During our conversation, the investor half-jokingly claimed that he assigned himself a quota of social favors: 'For Director M, I can receive up to three firms per season. If all these firms are good, I am willing to increase the quota. However, if all are bad, I have to decrease it.'

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mechanisms generate the limited yet powerful effects of social ties in venture financing.

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APPENDIX

Logit models predicting interview offers

	Coefficient	S.E.	Bootstrap S.E.
Social ties	1.10***	0.30	0.42
All other controls		Yes	Yes
Sample size		430	231

*p < 0.10; **p < 0.05; ***p < 0.01 for two-tailed tests.

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ETHNIC ENCLAVE AND ENTREPRENEURIAL FINANCING: ASIAN VENTURE CAPITALISTS IN SILICON VALLEY

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Research summary: *We examine the dilemma of ethnic investors in using ethnic network ties to invest by extending the 'ethnic enclave' concept to incorporate two dimensions: social network and social status. Our analysis of the first round of venture capital funding in Silicon Valley from 1976 to 2004 shows a higher likelihood of Asian venture capitalists (VCs) investing in Asian-led ventures than mainstream VCs. In addition, the valuation of their investments in mainstream ventures is higher than those by mainstream VCs in such ventures. In contrast, this premium effect is not observed when mainstream VCs invest in Asian ventures. These asymmetrical findings suggest the premium Asian VCs pay to compete in the mainstream venture market is due to their lower social status rather than their social network disadvantages.*

Managerial summary: *Do ethnic minority investors behave differently from more mainstream investors? We examine this question by studying the venture capital industry in Silicon Valley over the period 1976 to 2004. We found that Asian venture capitalists (VCs) were more likely to invest in immigrant Asian entrepreneurs than mainstream VCs, and when they did invest in mainstream ventures, they paid higher valuations than mainstream VCs. In contrast, mainstream VCs did not pay higher average valuations compared to Asian VCs when they invested in Asian ventures. We show that two social factors—the ethnic minority VCs' social network ties and their lower social status—could have contributed to such behavioral differences.*

INTRODUCTION

Ethnic minority entrepreneurs are over-represented among innovation-based founders in the United States (Saxenian, 2006). Compared to a foreign–born population of 12 percent in 2000, 25 percent of founders of venture capital (VC)-backed U.S. companies from 1990 to 2005 were immigrants (Anderson and Platzer, 2006), as were founders of 25 percent of technology and engineering ventures with more than $1 million in sales in 2006 (Wadhwa *et al.,* 2007). The largest U.S. VC-backed public companies started by immigrants include Intel, Sanmina-SCI, Sun Microsystems, eBay, Yahoo!, and Google, to name a few (Ndofor and Priem, 2011).

While immigrant entrepreneurs contribute significantly to job creation and innovation in the United States, they generally face greater challenges in acquiring financial capital than do their mainstream peers (Kushnirovich and Heilbrunn, 2008). The literature on sociology (Aldrich and Waldinger, 1990; Fisman, 2003; Nielsen, 1985) and entrepreneurship (Bates, 1997; Brüderl and Preisendörfer, 1998; Masurel *et al.,* 2002) have long recognized the

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importance of the social network of co-ethnics in funding new businesses. For instance, Light (1972) argues that a cultural proclivity toward business partnerships and the institution of rotating credit unions enabled Chinese and Japanese immigrants to start small businesses. Very recent studies find that co-ethnicity between innovation-based entrepreneurs and their VC investors facilitates the funding process through increased trust (Bengtsson and Hsu, 2015; Hegde and Tumlinson, 2014).

Although intriguing and important, the existing literature on ethnic entrepreneurship has not fully examined the ethnicity-driven behavior of *investors*. Theoretically, while these prior studies have recognized the roles of ethnic solidarity (Nielsen, 1985) and social homophily in ethnic social networks (Hegde and Tumlinson, 2014), they have not fully explored the complex impacts of one fundamental feature of ethnicity—the social status of minority groups (Wang and Altinay, 2012). In the particular context of VC investment, minority ethnic investors may suffer from lower social status and, hence, face barriers to investing in the mainstream venture market. Thus, while co-ethnic social network ties may facilitate investment by ethnic investors in ethnic ventures, they may at the same time also reinforce the lower social status of the ethnic investors, causing them to have to pay a premium compared to mainstream investors when they invest in the mainstream market. This social status effect can be distinguished from the social network effect, as it is asymmetrical, i.e., while the investors with lower social status need to pay a premium to invest outside their social networks, the mainstream investors do not similarly pay a premium when they invest outside their mainstream networks.

In this article, we exploit these insights on both the advantages and disadvantages of using co-ethnic ties to study co-ethnic VC investment in Silicon Valley. In particular, we propose to disentangle the traditional construct of the 'ethnic enclave' (Portes, 1981) into two distinct dimensions: the social network ties among co-ethnics and the social status of an ethnic minority group in a host society. While the original ethnic enclave concept focuses only on entrepreneurs and employment (Sanders and Nee, 1987), we extend it to study the behavior of venture investors. In essence, we hypothesize that ethnic investors are driven by two competing forces when funding co-ethnic entrepreneurs. On the one hand, an ethnic social network reduces information asymmetry and increases trust and solidarity between entrepreneurs and investors; ethnic investors would then have a higher ability and, hence, likelihood to invest in co-ethnic entrepreneurs compared to non-ethnic investors. On the other hand, according to social status logic, a high reliance on ethnic ties may lead to a vicious circle, whereby ethnic investors' lower social status as an immigrant community will be reinforced, thus constraining their ability to compete on equal footing in the mainstream business world (Rudman, Feinberg, and Fairchild, 2002; Tajfel, 1978). To break out of this social status constraint, ethnic investors would have to pay a premium when they do invest outside their ethnic networks. In contrast, mainstream investors do not pay a premium above what is paid by Asian investors when they invest in Asian ventures. These hypotheses are tested and supported by the data on the first round of VC investment in innovation-based ventures in Silicon Valley over the period 1976 to 2004.

This study makes an important theoretical contribution to the ethnic entrepreneurship literature by developing the 'ethnic enclave' concept to incorporate both the social network and social status dimensions and showing the need for ethnic investors to trade-off between investing within their ethnic networks and in mainstream ventures. By combining the logics of social network and social status, this study also contributes to the entrepreneurial financing literature that is traditionally grounded only on network-based entrepreneurship studies. The combination offers more insights than either network-based entrepreneurship studies (Hoang and Antoncic, 2003) or social status studies (Hsu, 2004) could offer on their own. In particular, by highlighting how an ethnic network can reinforce entrapment in lower social status, this study answers the call for more research on the drawbacks of using social networks in the entrepreneurial process (Hoang and Antoncic, 2003; Zhang, 2010).

RESEARCH CONTEXT

In this study, we investigate the behavior of minority ethnic VCs versus their 'mainstream' counterparts in Silicon Valley. We chose Silicon Valley because it is the dominant center in the world in terms of the size of VC investment made (Kenney, 2000). Despite a sharp meltdown of VC investing after the dot-com crash in 2000, Silicon Valley has rebounded and continues to garner the largest share of VC investments. According to the latest PwC/NVCA survey (PwC/NVCA, 2016), Silicon Valley accounted

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for 47 percent of total U.S. VC investment in 2015, up from around 33 percent at the height of the dot-com boom (1999 to 2000). Figure 1 shows the quarterly data on VC investment in the region from 1995 to 2015.

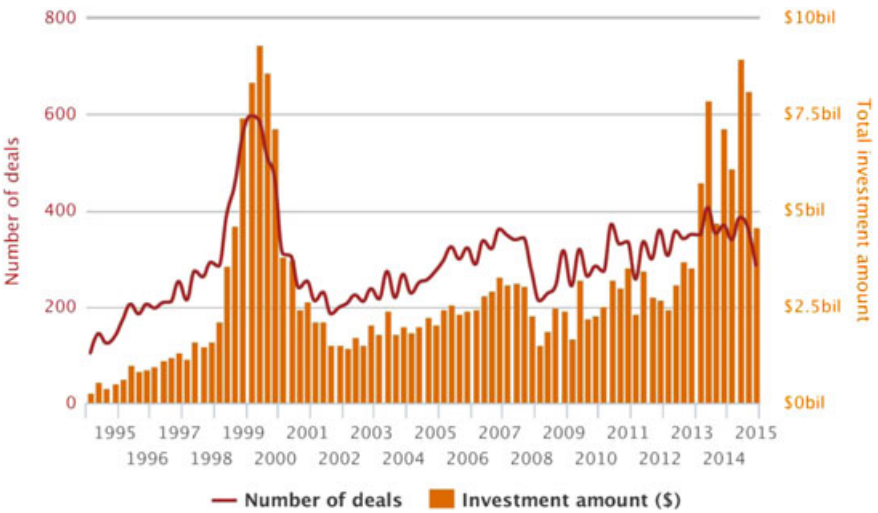
We also chose Silicon Valley because a large number of ethnic entrepreneurs and VCs co-locate there, which makes it an ideal location to study the effect of the ethnic enclave on venture investing. As reported by Saxenian (2006), there are more than 30 professional and networking associations targeting immigrants in Silicon Valley, composed of more than 33,000 members. We focus on the ethnic ties in Asian groups. Asian entrepreneurs featured prominently among foreign-born entrepreneurs who started ventures in Silicon Valley, with close to 21 percent of all entrepreneurial founders being immigrant Asians (Fairlie and Chatterji, 2013; Saxenian, 2000a). Since Chinese and Indians comprise the largest and fastest-growing Asian ethnic groups in Silicon Valley, we confine our classification of Asians to these two groups following prior studies (Choi, Lee, and Gleason, 2005; Dossani, 2002; Saxenian, 2000b).

The development of ethnic professional networking organizations in the 1990s (e.g., Monte Jade for the Taiwanese, TiE for Indians, and Hua Yuan for Mainland Chinese) and the emergence of new successful role models were likely to have accelerated the entrepreneurial pursuits of immigrant Asians in Silicon Valley. Another contributing factor is the growing presence of 'Asian VC' firms that are run by general partners who are Asians and receive significant amounts of funding from limited partners who are of Asian origins. Indeed, many of the well-known Chinese and Indian entrepreneurs who succeeded in starting and growing the first Asian-led high-tech ventures in Silicon Valley in the 1980s later became VCs in the valley. Acorn Campus and Venglobal are good examples of such Asian VC firms. In addition, globally minded innovative high-tech firms started to emerge in Asia in the 1990s; they were most prevalent in Taiwan, and some of them began setting up VC arms in Silicon Valley to seek either strategic diversification into new technology areas or strategic acquisition of new technologies synergistic with their current businesses. Prominent examples include Acer Ventures and UMC Capital. A third group of Asian VCs consists of independent funds set up to tap emerging Asia-Silicon Valley connections.

THEORETICAL DEVELOPMENT AND HYPOTHESES

Ethnic enclave and ethnic entrepreneurship

The original concept of the ethnic enclave is based on co-ethnic employment in the same location—that is, ethnic entrepreneurs hire co-ethnic employees in their businesses. Portes (1981: 291) defines the ethnic enclave as consisting of 'immigrant groups which concentrate in a distinct spatial location and organize a variety of enterprises serving their own ethnic market and/or the general population.' Portes and his



Source: PwC/NVCA MoneyTreeTM Report; Data: Thomson Reuters

Figure 1. VC investment in Silicon Valley (1995 to 2015)

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colleagues (Portes and Bach, 1985; Portes and Jensen, 1989; Wilson and Portes, 1980) showed that the minority enclave provides mechanisms and resources for minority groups to take an alternative route to advance their socioeconomic position despite discrimination and limited resources (Bates, 1994). Both entrepreneurs and their employees in the enclave are found to gain economic returns compatible with those of their counterparts working outside the enclave (Sanders and Nee, 1987).

We base our study on a conceptualization of the ethnic enclave that embraces two distinctive dimensions we believe are needed to understand ethnic entrepreneurship. First, the social network dimension reflects the culturalist perspective (Wang and Altinay, 2012), which stresses the roles of co-ethnic network ties in which individual behavior, social relations, and economic transactions are intertwined and shaped by cultural heritage (Aldrich and Waldinger, 1990; Levie, 2007). The second dimension is largely represented by the structuralist perspective, which argues that it is a structural (mainly class-based) disadvantage that influences entrepreneurial activities (Mulholland, 1997; Ram and Jones, 1998; Virdee, 2006). This view is amplified by the embeddedness approach, which calls for understanding of the wider socioeconomic structure in which ethnic entrepreneurs are embedded (Kloosterman and Rath, 2001; Jack and Anderson, 2002). Since ethnic groups are embedded in the social structures of a host society, social status may impact group opportunity structure, group characteristics, and, thus, investment strategies (Aldrich and Waldinger, 1990).

While the original ethnic enclave concept focuses only on ethnic employers and their co-ethnic employees (Sanders and Nee, 1987), this study extends the concept to the study of entrepreneurial financing. By integrating the effects of co-ethnic networks and the social status of the ethnic group in the host society, we hope to develop a more complete picture of the benefits and constraints of relying on ethnic ties by ethnic investors which, in turn, enhances our understanding of ethnicity-driven behavior of investors. Next we will articulate these dimensions and their impact on ethnic entrepreneurial financing.

Social network and co-ethnic investment

A social network of co-ethnics facilitates entrepreneurial financing through two mechanisms. First, a social network helps reduce information asymmetry and enforce trust. In most cases, VCs have less knowledge about the highly risky and unproven markets and technologies of specific innovation-based new ventures than do entrepreneurs (Shane, 2000). Information asymmetry creates a huge hurdle for VCs to invest in new ventures because VCs will find it difficult to judge the viability of the ventures, and they also have a high concern about the likelihood of opportunistic behavior by the entrepreneurs (Gompers, 1995; Shepherd, Douglas, and Shanley, 2000). Social networks work as information conduits between VCs and entrepreneurs; they provide an efficient means to transfer private information about the quality of the ventures and the entrepreneurs and, thus, reduce the problem of information asymmetry (Venkataraman, 1997; Zhang *et al.,* 2008). Moreover, in a social network, information about opportunistic behavior by an entrepreneur is spread more quickly and comprehensively than would otherwise be the case, leading to swift punitive responses. The knowledge that sanctions are in place to penalize in-group misconduct serves as assurance for investors, leading to enforced trust between entrepreneurs and investors (Alexy *et al.,* 2012). *Ceteris paribus*, ethnic VCs find themselves at a relative disadvantage when investing outside of their co-ethnic networks, as they generally do not have access to the same level of information from the mainstream business world as do mainstream VCs (Choi *et al.,* 2005).

The second mechanism for ethnic social networks to facilitate entrepreneurial financing is through ethnic solidarity (Portes and Sensenbrenner, 1993), which stems from homophily and highlights the role of personal similarity in breeding connection. It is a basic organizing principle that is prevalent across a wide range of social interaction contexts (e.g., McPherson, Smith-Lovin, and Cook, 2001), such as entrepreneurial team formation (Ruef, Aldrich, and Carter, 2003). Because of the reduced information asymmetry, enhanced trust, and ethnic solidarity, ethnic VCs would be more likely than mainstream VCs to invest in ventures led by co-ethnic entrepreneurs (Shane and Cable, 2002). The well-documented phenomenon of ethnically based rotating credit associations (e.g., Geertz, 1962) is a good example of an ethnic social network-based institution. Of course, by the same token, ethnic VCs would be less likely than mainstream VCs to invest in ventures led by mainstream entrepreneurs.

This perspective of the ethnic social network is consistent with actual experiences of Asian entrepreneurs and VCs in Silicon Valley. Historically,

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Asian immigrants in Silicon Valley perceived themselves as outsiders to the mainstream entrepreneurial ecosystem. Among other factors, Asian entrepreneurs found it difficult to obtain funds from U.S. VC firms (Leng, 2002; Saxenian, 2000b). In response, Asian immigrants, including entrepreneurs, VCs, and others, created social and professional networks among themselves on the basis of common languages, culture, or educational and professional experiences. These networks, both formal and informal, support their entrepreneurial activities, and the most successful entrepreneurs leverage heavily on these resources as sources of information, know-how, skill, and capital while integrating into the mainstream technology community (Saxenian, 2002). Examples of such social networks include the Indus Entrepreneur (TiE), the Monte Jade Science and Technology Association, and the Silicon Valley Chinese Engineers Association. These networks explain why Taiwanese VC firms have played a vital role as a funding source for U.S. start-ups of ethnic Chinese (Leng, 2002). Grounded on the theoretical argument and anecdotal evidence, we predict:

Hypothesis 1: Ceteris paribus, Asian VCs have a higher likelihood to invest in Asian-led ventures than do mainstream VCs.

Social status and co-ethnic investment

While the 'social network' dimension highlights benefits to ethnic investors, the other dimension, 'social status,' manifests constraints of relying on co-ethnics in an ethnic enclave, that is, the problem of entrapment in low social status associated with immigrant communities. The social status logic is developed from social identity theory. Social identity is defined as the 'cognition of membership of a group and the value and emotional significance attached to this membership' (Tajfel, 1978: 63). Strong social identity stems from trust and supports within the same ethnic group, and reciprocal paybacks are expected after the focal actor receives favors from ethnic members, which strengthens existing social identity (Kalnins and Chung, 2006).

The major theme of social identity theory is that in-group identification is causally related to intergroup bias and intergroup discrimination (Brown, 2000). People strive to achieve and maintain a positive social identity in order to boost their self-esteem, and the positive identity derives primarily from favorable comparison between the in-group and out-groups (Sidanius *et al.,* 2004). Distinct social groups are associated with different levels of social status; immigrant communities are often perceived as having lower social status compared with their indigenous counterparts, i.e., mainstreams (Ndofor and Priem, 2011). The mainstreams tend to keep the bias and discrimination against the immigrant groups in order to keep their perceived higher social status (Tajfel, 1978). As a result, if the exchange takes place only within co-ethnics, the lower social status will be reinforced, making it even harder for the ethnic actor to move into mainstream society and obtain higher status.

A number of social network effects are likely to reinforce the entrapment of the minority investors in lower status by reducing their performance compared to mainstream investors. First, as networks composed of ethnic ties are usually small and very dense, the information flow in the network is limited and redundant (Granovetter, 1995). This would imply that Asian VCs that work mainly with Asian-led ventures will be less likely to get to know the larger investment opportunities in mainstream ventures. Second, strong solidarity and restrictive obligation in ethnic networks may force VCs to take actions that are not in their best economic interests (Portes, 1998; Portes and Sensenbrenner, 1993). In particular, in Confucian culture, actors are bonded with strong social obligation once a strong tie is built (Xiao and Tsui, 2007). Hence, Asian VCs may have to continue to invest in or support a co-ethnic venture, even if the venture does not meet the milestone performance requirements; they fear losing their reputation in the ethnic network if they fail to do so.

We believe that the negative ethnic network effects are likely to perpetuate the lower social status of the minority group members unless they make conscious efforts to jump out of their ethnic enclave. Ndofor and Priem (2011) found that immigrant entrepreneurs with higher prior managerial experience tend to pursue dominant market strategies (where they serve both mainstream and co-ethnics markets) instead of the ethnic enclave strategy (where their product/market scope involves a value chain dominated by co-ethnics). Their study implies that to reduce the potential negative impacts of the ethnic enclave, ethnic players need to deliberately get out of their comfort zone and do business in the mainstream business world.

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In our research context, in order to succeed in Silicon Valley, Asian VCs need to establish a significant presence within the mainstream technology community. To achieve this objective, Asian VCs need to invest actively, particularly in mainstream ventures; as the number of their investments rises, so too will their ties with mainstream investors (Hsu, 2004, 2006). This is especially true since VCs tend to syndicate (undertake investments jointly) with other VC partners, resulting in a widening of their social networks (Alexy *et al.,* 2012). Syndication with mainstream VCs in mainstream ventures will help Asian VCs expand their networks into the mainstream VC networks. Furthermore, as Asian VCs undertake more investments, they develop greater expertise in working with mainstream venture entrepreneurs. Both of these factors—more extensive networks in mainstream VC networks and greater expertise—allow the VCs to be more effective in helping their investee ventures acquire needed resources which, in turn, will serve to increase their social status in Silicon Valley (Hsu, 2004, 2006). Because of these benefits, Asian VCs have very strong motivations to invest in mainstream ventures.

Entrepreneurs of mainstream ventures, however, may have relatively lower incentives to accept VC funds from ethnic investors if they had similar offers from mainstream VCs. The social identity theory suggests that with relatively lower social status, Asian VCs may not be able to confer as much credibility to the new ventures as mainstream VCs do, which limits the benefits of reputation transfer from the VCs to the ventures (Hsu, 2004; Nahata, 2008; Stuart, Hoang, and Hybels, 1999). Indeed, Hsu (2004) found that new ventures accept lower pre-money valuations to get funds from more prestigious VC investors. In our context, with a weaker demand from mainstream ventures and a stronger motivation to do mainstream deals, Asian VCs may offer relatively higher pre-money valuation when investing in mainstream ventures as compared to mainstream VCs. Therefore, we predict:

> *Hypothesis 2: Ceteris paribus, Asian VCs will offer higher pre-money valuation to mainstream ventures than do mainstream VCs.*

It is important to recognize that for this prediction to arise from the social status logic and not the social network logic, we need to check that the converse is not true when mainstream investors invest in Asian-led ventures. In other words, this effect is asymmetrical and arises solely from the *lower* social status of the ethnic investors, so we should not observe a similar premium-paying effect when mainstream investors, who do not suffer lower social status, invest outside their mainstream networks into Asian-led ventures.

METHODOLOGY

Data sources and sample frame

We extracted data from Dow Jones VentureSource, a VC market research firm, on all ventures with headquarters in the Bay Area and Silicon Valley that were funded by VC firms based in Silicon Valley from 1976 to 2004. Information on the ventures' top management as well as valuation data were obtained from VentureSource, as previously done by Gompers and Lerner (2004) and Gompers, Kovner, and Lerner (2009). We also used the VentureXpert database to extract salient information about the VCs that invested in these ventures. This was supplemented with information from VentureSource, VCs' websites, and direct contact with select VCs to confirm the identity of limited partners (LPs).

We focus our analysis on the first funding rounds received by the ventures for two reasons. First, it controls for the impacts of venture growth stage and capital demands in different funding rounds, as a later funding round will usually imply a higher pre-money valuation and higher capital demand (Gompers and Lerner, 2001). Second, the first round of funding is likely to be the stage when the effect of social networks is most significant. This follows from Choi *et al.*'s (2005) finding that social capital plays a more important role at the earlier stage of companies' development, and from the fact that in the initial funding round, potential VCs have fewer signals of the likelihood of success of the investee company, thus making social networks more influential in making investment choices.

To identify the ethnic group of each venture, we checked the background of its CEO, chairman, or president. We first checked their names to identify those of Chinese or Indian ethnicity, then the country from which they obtained their bachelor's degree. If both indicated that they were originally from an Asian country, we labeled them 'Asian' ('Chinese' or 'Indian' specifically). We considered only first-generation immigrants as ethnic entrepreneurs

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because the literature suggests that America-born Asians, compared with immigrants, have significant advantages in language and social and political skills and may not be tightly associated with their ethnic groups any more (Huang, Frideger, and Pearce, 2013; Rusinovic, 2008). We labeled a venture as an 'Asian-led venture' if the CEO, chairman, or president at the time of the venture's first funding round was 'Asian.' We then checked the non-'Asian-led' ventures to filter out those with a CEO, chairman, or president whose surname was not Anglo-Celtic, European, or Jewish, following the approaches of Kerr (2008) and Bengtsson and Hsu (2015). The remaining ventures are labeled 'mainstream' and would exclude American-born Asians and other ethnic minorities such as South Americans and Middle Easterners. It must be highlighted that the label 'mainstream' refers to the majority group ('white Caucasian') to which the investors and entrepreneurs belong (versus those who are ethnic Asian immigrants), and it does not imply that there is any difference in the nature of industries and markets being started/funded by the two groups. A total of 2,670 ventures were identified in this process. Among them, 15.8 percent of ventures were Asian led, with the incidence of Chinese (10.2%) being higher than that of Indians (5.7%).

In robustness tests, we adopted a broader definition of an Asian-led venture that includes an Asian holding any CXO (CEO, CTO, or COO and equivalent) position and a more restrictive definition that includes only CXOs with executive roles and excludes non-executives. An additional robustness test included 38 ventures with American-born Asian leaders among the mainstream ventures. In all cases, we obtained similar results.

Next, we classified the VC firms that funded the ventures as Asian or mainstream in three steps. First, following prior studies (e.g., Kalnins and Chung, 2006; Masurel *et al.,* 2002; Saxenian, 2000a; Zaheer, Lamin, and Subramani, 2009), we checked the name of each general partner in the VC firm as well as the country where he/she obtained his/her bachelor's degree. If both indicate that the partner was originally from an Asian country, we labeled the partner 'Asian' ('Chinese' or 'Indian' specifically). Again, we considered only first-generation immigrants as ethnic investors. In the second step, we identified all the VC firms where more than half of the general partners were 'Asian.' Finally, we checked the identity of the limited partners (LP) in these VC firms to confirm if those that represent Asian institutions or sources accounted for more than half of the fund. We labeled a VC firm as an 'Asian VC' ('Chinese VC' or 'Indian VC' specifically) if it fulfilled both criteria of majority Asian general partner and majority Asian LP. For VC firms not classified as Asian VCs, we checked that the majority of their general partners were of Anglo-Celtic, European, or Jewish background, and we classified these as 'mainstream' VCs. In total, we identified 362 VCs, of which 20 were Asian VCs.

In many cases, syndication was used, i.e., multiple VCs invest in the same venture. Following prior studies (Hsu, 2004), we used the lead VC as the representative investor in the particular deal, since lead VCs negotiate prices and make final decisions in closing deals. When the information about who was the lead VC was unavailable (53% cases), we chose the largest VC, measured by the size of the funds under management. The information about lead VCs was extracted from VentureSource and funds size was extracted from VentureXpert.

Measures

Hypothesis 1

The dependent variable is a dichotomous variable identifying whether the venture was *Asian led* at the time of the first funding round. The reference group is mainstream ventures. The predictor variable is also a dichotomous variable indicating whether the lead investor of the funds came from an *Asian VC* firm. The reference group is mainstream VC firms.

Control variables included VC size, VC experience, funding environment, time period of funding, and industrial sector. *VC size* is measured by the amount of total funds under management of the VC firm. Since a number of small VCs did not disclose the exact amount of funds under management, but only in the range below $100 million, we constructed an ordinal scale to measure firm size (1 = ≤$100 million; 2 = $100 million ~ $1 billion; 3 = $1 billion ~ $2.5 billion; and 4 = ≥$2.5 billion). Following prior studies (Abell and Nisar, 2007; Lee and Wahal, 2004; Hochberg, Ljungqvist, and Lu, 2007; Nahata, 2008; Wang and Wang, 2011), *VC experience* is measured by the age of the VC firm when the investment was made, using an ordinal scale (1 = less than 1 year old; 2 = 1 to <2 years; 3 = 2 to <5 years; up to 8 = more than 30 years). To control for the influence of funding environment, we included the variable *VC market munificence*, measured by the total amount of VC

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investment in Silicon Valley in the particular year. Moreover, since VC funding also varies according to *time period*, dummy variables for the period of the first funding round were also included in our analysis. The reference category is the internet bubble years of 1997 to 1999. Finally, since VC funding varies systematically according to industry sector, we included *sectoral dummy* variables as controls: health care/pharmaceuticals, software, semiconductors, retail/consumer/business products and services, and other sectors. The reference category is 'other IT (including communications).' Finally, to control for the potential influence of *syndication,* we included a variable measuring the size of the syndicate.

Hypothesis 2

The dependent variable *pre-money valuation* is the pre-money valuation received by the venture before its first funding round. This is operationalized as the difference between the amount of money received by the venture in its first funding round and the post-money valuation of the venture after the injection of investment from VCs during the first funding round. The data were extracted from the VentureSource database.

The main predictor variable is *Asian VC,* which indicates whether the lead investor was an Asian VC firm, and the reference group is mainstream VC firms.

Again, we controlled for *VC size, VC experience, VC market munificence, industry sector,* and *the time period of funding*. However, more fine-grained sectoral classifications were used in order to avoid masking the differences in funding received among the various subsectors. In addition, we included *venture age* to control for the quality of ventures. Finally, we included variables relevant to syndication, including *the size of the syndicate* and *whether mainstream* + **C:***VCs were part of the syndicate*.

We used logit regression to test Hypothesis 1 and OLS regression to test Hypothesis 2. The unit of analysis is investment deal. Since we focus only on the first funding round, a particular venture appears only once in our observations. However, a particular VC firm may invest in multiple deals. To take into account the dependence of the deals invested by the same VC firm, we included 'cluster' in the regression command when using Stata to analyze the data.

FINDINGS

Table 1 shows the descriptive and correlation statistics of the variables used in testing Hypotheses 1 and 2. Overall, the low correlation coefficients suggest that multicollinearity is not a concern. It is also noted that the sample of valid cases for testing Hypothesis 2 is reduced to 1,201 ventures after accounting for missing values. This reduction is due to valuation data being unavailable in many cases. We address potential bias by conducting robustness tests, and the results will be reported later.

In Table 2, we present an overview of the data categorized into four cells according to the source of funding and the type of venture: Group A (Asian-led ventures funded by Asian VCs), Group B (Asian-led ventures funded by mainstream VCs), Group C (mainstream ventures funded by Asian VCs), and Group D (mainstream ventures funded by mainstream VCs).

In Table 2, comparing Groups A and C, we observe that 54 percent (=42/(42 + 36)) of the Asian VCs' funds went to Asian-led ventures. Meanwhile only 12 percent (=139/(139 + 984)) of the investments by mainstream VCs went to Asian-led ventures, as seen in Groups B and D. This observed pattern is consistent with the prediction of Hypothesis 1.

We calculate the mean and standard deviation of the pre-money valuation values for each of the four groups and present them in Table 2. The table shows that the mean pre-money valuation by Asian VCs in mainstream ventures (Group C) seems higher than that in any of the other three groups, which appear to have similar levels. The t-tests show that pre-money valuations by Asian VCs are significantly higher than by mainstream VCs when investing in mainstream ventures (i.e., Group C is larger than Group D), but mainstream VCs do not offer higher valuations than Asian VCs when investing in Asian-led ventures (i.e., Group B is not larger than Group A). These observed patterns are consistent with Hypothesis 2. To confirm both hypotheses, we need to test if the observed patterns remain valid after controlling for various relevant factors, and this is done through the regression models we present later.

Regression test results

Table 3 shows the logistic regression results for the likelihood of a VC-backed venture being Asian led at the time of its first funding round. Compared with

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Table 1. Descriptive analysis and correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)-(22)
1. Pre-money	1									
2. Age of venture	0.145**	1								
3. Funding before '97	-0.13**	0.011	1							
4. Funding after '00	0.103**	-0.041	-0.49**	1						
5. VC experience	0.103	0.016	0.019	0.071	1					
6. VC fund size	0.091**	0.015	-0.049	-0.007	-0.663**	1				
7. Asian VC	0.062*	-0.038	-0.18**	0.225**	-0.044	-0.04	1			
8. Mainstream venture	-0.004	0.012	0.16**	-0.182**	0.010	0.05†	-0.286**	1		
9. Syndication size	0.158**	0.020	0.068*	0.025	0.219**	0.295**	0.089**	-0.023	1	
10. Biopharm	-0.035	-0.043	0.050†	0	-0.030	-0.059*	-0.071*	0.076**	-0.001	Correlations
11. Med. devices	-0.08**	-0.057*	0.047	-0.009	-0.009	0.003	-0.066*	0.082**	-0.026	between
12. Medical IS	-0.013	0.040	0.003	-0.026	-0.005	0	-0.038	0.010	-0.022	industry
13. Other health care	0.016	0.053†	-0.015	-0.025	0.039	0.026	-0.013	0.021	-0.019	dummies
14. Communications	0.076**	-0.060*	-0.054†	0.067*	0.090**	0.071*	0.029	-0.079**	0.028	omitted for
15. Electronics	-0.009	0.017	0.119**	-0.060*	-0.013	0.036	-0.018	0.031	0.081**	parsimony
16. Inform. service	0.032	-0.033	-0.069*	-0.043	0.001	-0.01	-0.027	0.052†	-0.044	
17. Semiconductor	-0.03	-0.040	0.016	0.026	0.041	0.084**	0.204**	-0.143**	0.146**	
18. Consumer product	0.034	0.035	0.073*	-0.035	-0.036	-0.041	-0.019	-0.003	-0.011	
19. Consumer service	0.042	0.023	-0.19**	-0.009	-0.018	-0.058*	0.025	0.037	-0.036	
20. Retailer	0.061*	0.116**	0.038	-0.074*	-0.042	0.016	-0.016	0.063*	0.023	
21. Materials and chem.	0.026	0.043	0.018	-0.025	-0.032	-0.011	0.055†	0.021	0.019	
22. Energy	-0.01	-0.012	0.001	0.031	0.035	0.026	-0.011	0.017	0.035	
Min	0.01	0	0	0	1	1	0	0	1	
Max	500	62.25	1	1	8	4	1	1	26	
Mean	9.42	1.82	0.49	0.2	3.51	2.62	0.06	0.84	2.17	
S.D.	21.99	3.58	0.5	0.4	2.33	1.35	0.24	0.36	2.17	

N = 1,201 listwise (N is less than 2,670 due to missing data).
† $p < 10\%$, * $p < 5\%$, ** $p < 1\%$.

Table 2. Number of deals, mean, and standard deviation of pre-money valuation for first-round investment

		Source of VC funding			t-test for difference between Asian VC and Mainstream VC
		Asian VC	Mainstream VC	All	
Leadership of venture	Asian-led venture	(Group A) 8.1 (7.8) N = 42	(Group B) 10.0 (13.7) N = 139	9.6 (12.5)	t = 0.897 *(p = 0.371)*
	Mainstream venture	**(Group C) 22.1 (38.0)** N = 36	(Group D) 8.9 (22.4) N = 984	9.4 (23.2)	t = 2.070 * *(p = 0.046)*
	All	14.5 (27.0)	9.1 (21.5)	9.4 (21.9)	t = 1.750 † *(p = 0.084)*

† $p < 10\%$, * $p < 5\%$.
Note: Standard deviation in parentheses, N = 1,201.

Table 3. Logistic regression on likelihood of VC-backed ventures being Asian led at time of the first funding round (Hypothesis 1)

	Model 1			Model 2			Model 3		
	Std. beta		Sig.	Std. beta		Sig.	Std. beta		Sig.
Controls									
Constant	-2.471	***	0.000	-2.3	***	0.000	-2.325	***	0.000
VC fund size	-0.122	*	0.037	-0.097		0.108	-0.099		0.102
VC experience	-0.012		0.702	-0.010		0.755	-0.011		0.748
Year of funding before 1997	0.576	***	0.000	0.534	**	0.001	0.539	**	0.001
Year of funding from 2000	1.021	***	0.000	0.990	***	0.000	0.986	***	0.000
VC market munificence	0.000		0.793	0.000		0.709	0.000		0.683
Health care and pharmaceuticals	-0.951	***	0.000	-0.949	***	0.000	-0.941	***	0.000
Software	0.028		0.833	0.018		0.892	0.021		0.879
Semiconductors	0.929	***	0.000	0.945	***	0.000	0.953	***	0.000
Retail, consumer, and business	-0.551	**	0.005	-0.551	**	0.005	-0.536	**	0.006
Other sectors	-0.350		0.582	-0.328		0.607	-0.315		0.620
Predictor									
Asian VC	1.461	***	0.000	1.511	***	0.000	1.738	***	0.000
Additional tests									
Syndicate size				-0.057	†	0.059	-0.046		0.148
Syndicate size * Asian VC							-0.092		0.308
Nagelke R^2	0.157			0.159			0.159		

† $p < 10\%$, * $p < 5\%$, ** $p < 1\%$, *** $p < 0.1\%$. Note: N = 2,670.

mainstream VCs, Asian VCs are found to have a significantly higher likelihood to invest in Asian-led ventures, after controlling for other influential factors ($b = 1.461$, $p < 0.001$). When syndication and the presence of Asian VCs in syndicates are included for robustness checks, similar results are found ($b = 1.511$, $p < 0.000$; $b = 1.738$, $p < 0.000$, respectively). Taking these findings together with the distribution of ventures reported in Table 2, we conclude that Hypothesis 1 is supported.

Table 4 shows the OLS regression results. Hypothesis 2 compared the pre-money valuation in the four groups in Table 2 and predicted that the value in Group C will be higher than that in Group D, but that there is no significant difference between Groups A and B.

Models 1 and 2 test Hypothesis 2 using the subsample composed of the deals of Asian-led ventures (Groups A and B) and mainstream ventures (Group C and D), respectively. As can be seen in

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Table 4. Regression on the pre-money valuation for the first funding round (Hypothesis 2)

	Model 1 Sample of Asian-led firms (N = 181)			Model 2 Sample of mainstream firms (N = 1,020)			Model 3 Sample of mainstream firms (N = 1,020)			Model 4 Sample of mainstream firms (N = 1,020)		
	Std. beta		Sig.	Std. beta		Sig.	Std. beta		Sig.	Std. beta		Sig.
Controls												
(Constant)			0.227			0.159			0.905			0.731
Age of venture	0.264	***	0.001	0.126	***	0.000	0.124	***	0.000	0.125	***	0.000
VC fund size	0.140		0.171	0.070	†	0.087	-0.037		0.365	-0.044		0.286
VC experience	0.028		0.781	0.039		0.345	0.029		0.477	0.030		0.452
Year of funding before 1997	0.001		0.994	0.015		0.710	0.029		0.456	0.026		0.501
Year of funding from 2000	0.057		0.577	0.035		0.462	0.040		0.399	0.035		0.456
VC market munificence	0.141		0.107	0.131	**	0.006	0.125	**	0.008	0.128	**	0.007
Communications	0.020		0.799	0.086	*	0.012	0.079	*	0.021	0.077	*	0.023
Retailer	na			0.063	*	0.046	0.057	†	0.068	0.056	†	0.072
Electronics	0.184	**	0.009	0.012		0.721	-0.004		0.909	-0.003		0.926
Consumer/business product	0.332	***	0.000	0.015		0.633	0.015		0.621	0.019		0.587
(Insignificant industry dummies not reported)												
Predictors												
Asian VC				0.090	**	0.005	0.075	**	0.018	0.004		0.919
Mainstream VC	0.057		0.430									
Additional tests												
Syndicate size							0.145	***	0.000	0.127	***	0.000
Syndicate size * Asian VC (pure)										0.112	**	0.006
F	4.778***			4.436***			5.262***			5.401***		
Adjusted R^2	0.251			0.063			0.081			0.087		

† $p < 10\%$, * $p < 5\%$, ** $p < 1\%$, *** $p < 0.1\%$.

Note: N = 1,201, among which the number of Asian-led ventures is 181 and the number of ventures with Asian VCs is 78. N is less than 2,670 due to missing data.

Model 1, the coefficient of *mainstream VC* is positive but insignificant ($b = 0.057$, $p = 0.430$). It suggests that mainstream investors did not offer significantly higher valuation to Asian-led ventures than Asian VCs did (i.e., Group B is not larger than Group A). In Model 2, the coefficient of *Asian VC* is positive and significant ($b = 0.090$, $p = 0.005$). It suggests that Asian investors did offer significantly higher valuations to mainstream ventures than mainstream VCs did (i.e., Group C is larger than Group D). Therefore, Hypothesis 2 is supported.

Additional analyses

Because much prior research has suggested syndication is a critical factor that influences investment activities and performance (cf., Jääskeläinen, 2012), we ran additional regressions to check the effect of syndication in the subsample of mainstream ventures (Groups C and D). We included two new variables as predictors. First, because prior studies found that it is common for a relatively larger number of VC firms to use syndicates to pool their capital and distribute financial risks in the case of a large size investment, we added in the variable *syndicate size,* measured by the number of VCs in the investment (for solo investment, it takes a value '1'). To test the interaction effects of syndication and ethnic ties, we included the second variable, *Asian VC (pure)*, which takes a value of '1' if the syndicate was comprised solely of Asian VCs and '0' otherwise, and we calculated the product terms *syndicate size * Asian VC (pure).*

Models 3 and 4 in Table 4 examine the subsample composed of deals in mainstream ventures. The main effect of *syndicate size* is positive and significant at the 0.000 level, and the coefficient of the product term *syndicate size * Asian VC (pure)* is positive and significant in Model 4. The results suggest that a larger syndicate tends to offer larger pre-money valuation; more importantly, syndication with only

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other Asian VCs would not help an Asian VC avoid paying premiums in its investment. We also ran a robustness test to check the effect of alternative specifications of syndication. We substituted *syndicate size* with a dummy variable *syndication*, which takes a value of '1' if the funding team was a syndicate and '0' for a solo investor. The results were largely similar, but using *syndication* yielded lower R^2 and higher significant levels. Overall, the additional tests support Hypothesis 2.

We conducted additional analyses to rule out alternative explanations to our finding regarding the higher valuation in Group C. One may attribute the relatively high valuation in Group C (Asian VCs in mainstream ventures) to the overall higher quality of those ventures. We compared the investment performance measured by the percentage of IPO/acquired ventures by year 2010 in each of the four groups and reported the result in Table 5. Table 5 and the ANOVA test result of insignificant interaction suggest that Group C did not outperform the other groups. Instead, Groups B and D seemed to outperform Groups A and C, as supported by the significant main effect for *source of VC funding*. This indicates that mainstream VCs' investment performance was better than Asian VCs in both Asian-led and mainstream ventures. Although it is hard to judge whether VCs picked winners or built them (Baum and Silverman, 2004), the data in Table 5, at least to some extent, rule out the alternative explanation that Group C was composed of better quality ventures worthy of higher valuation.

To further test that the higher valuation for deals in Group C is not due to their higher quality than deals in other groups, we tested another measure of the quality of deals in terms of the likelihood of receiving follow-on investment by mainstream VCs. In this test, the binary dependent variable is investment by mainstream VCs in the second round, and the predictor is investment by Asian VCs in the first round. We found that after the first-round investment by Asian VCs, there is no significantly higher or lower likelihood of mainstream VCs subsequently investing in the venture, regardless of the ethnicity of venture leadership ($b = 0.804$, $p = 0.276$).

Another alternative explanation of our finding is the Winner's Curse argument. Here, due to information asymmetry, a series of Asian VCs all generate noisy estimations of the value of any given mainstream venture, then the one that offers the highest valuation will be chosen by the venture—and it almost certainly pays too much (Thaler, 1988). Moreover, this overpayment may not be as severe when Asian VCs invest in Asian-led ventures due to their use of network ties to reduce information asymmetry. We believe, however, the Winner's Curse

Table 5. Proportion of IPO or acquired ventures in each group

		Source of VC funding		
		Asian VC	Mainstream VC	All
Leadership of venture	Asian-led venture	(Group A) 36%	(Group B) 55%	43%
	Mainstream venture	**(Group C) 46%**	(Group D) 57%	57%
	All	43%	57%	

Two-way ANOVA

2 by 2 factorial design	**F**	**Sig**
Tests of between-subject effects		
Corrected model	5.978***	0.000
Intercept	55.015***	0.000
Interaction term: Leadership of venture * Source of VC funding	0.021	0.884
Main effects		
Leadership of venture	2.383	0.123
Source of VC funding	8.031**	0.005

** $p < 1\%$, *** $p < 0.1\%$.
Note: N = 2,670.

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would not explain the higher value of Group C than Group D very well. This is because the same argument would also imply a higher value in Group B than Group A, because in Group B the mainstream VCs may also face a high level of information asymmetry in evaluating Asian-led ventures. Since, in fact, we did not see differences in the two groups, the Winner's Curse may not be causing our result.

A third alternative explanation of our finding is that because of the 'liability of foreignness,' Asian VCs simply lack sufficient local knowledge in evaluating mainstream ventures; hence, they tend to overpay due to lower competence (Zaheer, 1995; Zaheer and Mosakowski, 1997). To rule out this explanation, we scrutinized the Asian VCs' learning activity in Group C and analyzed the relationship between the accumulated number of mainstream ventures that a particular VC invested in during the last five years and the average valuation in mainstream ventures. The data analysis showed a negative but insignificant relationship ($b = 0.044$, $p = 0.80$). It suggests that previous investment in mainstream ventures did not reduce the valuation of the Asian VCs, i.e., there is no learning effect. Although not conclusive, the persistence of the high premium over time suggests that lack of knowledge is unlikely to be the main driver of our finding regarding Hypothesis 2.

Robustness tests

We conducted a number of robustness tests. First, to address the major drop in observations due to missing valuation data, we compare the full dataset of 2,670 cases with the subsample of 1,201 cases used in testing Hypothesis 2. We observe some differences: 18 percent of the full sample have attained IPO compared to 29 percent of the subsample; 58 percent of ventures in the full sample are syndicated deals, compared to 66 percent of the subsample; 5.6 percent of ventures in the full sample were funded by Asian VCs, compared to 6.5 percent of the subsample. Given the potential bias in the subsample, we conducted robustness testing by running the regression analysis using a different dependent variable, *investment size*. This is measured as the amount of money received by the venture in its first funding round. Theoretically, these two alternative dependent variables are related concepts. Empirically, they are highly correlated, with a Pearson coefficient of 0.79 calculated from the data in our study. Using investment size, the sample increased to 2,465 valid cases, with less than 10 percent missing data. The regression analysis with investment size as the dependent variable returns similar results as using pre-money valuation, suggesting that our results are robust.

Second, to check the sensitivity of our results to the way we defined a venture as Asian led, we rerun our analysis using a broader definition of 'Asian-led ventures' to include any venture where an ethnic Asian has, at any point, held one of the positions of CEO, CTO, or COO. We also used a narrower definition that excludes non-executive leadership roles such as chairman. All our results remain the same.

Third, we checked the deals in Group A—namely Asian VCs investing in Asian-led ventures. We confirmed that the majority of deals were made within the specific ethnic group: all investments by Indian VCs were in Indian-led ventures, while 89 percent of investments by Chinese VCs were in Chinese-led ventures. Within the Chinese cohort, we also scrutinized the subgroups of Taiwanese versus mainland Chinese, as one may suspect that the two groups may not cross over due to political or historical reasons. Our results confirmed the suspicion, with all deals by mainland Chinese VCs going to ventures led by mainland Chinese (seven deals), while the majority of Taiwanese VC investments were in Taiwanese-led ventures (26 out of 31 deals, with the others going to ventures led by Indians and Singaporean Chinese). The matching behavior observed within the Indian, mainland Chinese, and Taiwanese Chinese groups suggests that a social network could be formed based on a refined ethnic definition, and the network boundary is clear. We then tested our hypotheses using a subsample composed of only Chinese or Indian VCs and their co-ethnic ventures. All hypotheses were still supported; though the results were weaker (the terms were significant at 10%).

DISCUSSION

Our findings on the investment behaviors of Asian VCs in Silicon Valley highlight a number of novel and interesting features of VC funding involving Asian ethnic groups. First, although Asian VCs are more likely to invest in Asian-led ventures than mainstream VCs, they do not enjoy a discount (lower pre-money valuation) compared to mainstream VCs. In contrast, Asian VCs offer significantly higher pre-money valuation to mainstream ventures than

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mainstream VCs do. The high valuation of Asian VCs is not likely due to their lack of ties in the mainstream network, because mainstream VCs, in fact, did not offer higher valuation to Asian-led ventures than to mainstream ventures, despite their lack of ties in the Asian network. Moreover, our additional tests showed that the higher valuation of Asian VC in mainstream ventures did not lead to a higher likelihood of IPO or receiving follow-on investment from mainstream VCs. It further confirms that the higher premiums for these deals may not be due to their higher quality, but are a 'discriminatory' price paid to overcome their lower social status.

Theoretical contributions

This study makes an important theoretical contribution to the ethnic entrepreneurship literature by developing and extending the concept of 'ethnic enclave,' which has traditionally been used to examine employment (employers and their co-ethnic workers) in existing research (Portes, 1981). As highlighted by Fong and Shen (2011: 1608), 'Later studies showed that there are only a few cases of minority enclaves, such as Cubans in Miami (Logan, Alba, and McNulty, 1994). In other words, there are only a few industries where both minority employers and minority employees are concentrated. These findings suggested the limitation of employing the concept of the minority enclave.' We rejuvenate the concept by disentangling it into two dimensions —'social network' and 'social status'—and show that it can be extended to study other forms of co-ethnic relationships besides the employer-employee relationship and to other industry contexts besides the traditional ones—the investor-entrepreneur relationship in the venture capital industry in Silicon Valley, in our case.

Our study also contributes to the entrepreneurial financing literature, a major strand of which is traditionally grounded on network-based entrepreneurship studies (Batjargal and Liu, 2004; Hoang and Antoncic, 2003; Shane and Cable, 2002; Stuart and Sorenson, 2007). This study suggests that both network-based and social status perspectives should be integrated to understand entrepreneurial financing involving ethnic minority investors. Although our study context is confined to venture capitalists in Silicon Valley, we believe that our conceptual framing may be generalizable to other contexts where minority investor groups have significant presence, which is the case for financial hubs like London, New York, and Singapore.

By highlighting how ethnic networks can reinforce entrapment in low social status, this study also answers the call for more research on the dark side of using social networks in the entrepreneurial process (Hoang and Antoncic, 2003). The limited prior studies on the drawbacks of using social network ties have all taken the entrepreneurs' perspective and focused on the constraints that the entrepreneurs face (Gomez-Mejia, Nunez-Nickel, and Gutierrez, 2001; Jack, 2005; Portes, 1998; Portes and Sensenbrenner, 1993; Sharma, 2004; Schulze *et al.,* 2001). They argued that because their social networks are much more accessible compared to the general market place, the entrepreneurs may become 'locked in' within their networks, which hinders their long-term growth (Zhang, 2010). Our study offers a fresh perspective by showing that ethnic minority *investors* may also suffer from this 'locked in' effect of using social networks, i.e., the dark side of using social networks in the entrepreneurial process may apply to the resource owners as well as the resource seekers. We also offer preliminary evidence that the premium Asian VCs paid in entering the mainstream world did not pay off in the short run—their investments in mainstream ventures neither led to a higher likelihood of IPO nor increased the chance of receiving follow-on investment from mainstream VCs. Further research on effective strategies for investors to move up the ladder of social status will be interesting.

Empirical contributions

Our findings bear important implications for the strategic behavior of venture investment practitioners. First, ethnic VCs that have lower social status need to balance the short-term benefits of using their social networks versus the long-term cost of lower social status entrapment. While investing outside their social networks is initially costly, they may need to do so to break out of their lower social status enclave. One effective means appears to be syndication with investors that have higher social status. Second, mainstream investors that enjoy higher social status may want to exploit their social status advantages to offset their social network disadvantages vis-à-vis the ethnic investors to invest more in ethnic entrepreneurs. Indeed, with the rapid growth of the Asian market in general and the

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Chinese and Indian market in particular in recent years, more mainstream VCs in Silicon Valley have started to pay attention to investing in Asian-led ventures that may enjoy social network advantages in entering the Asian markets.

Limitations and future research directions

Our study is subject to a number of limitations. First, as in most VC studies, we obtained data only on transacted investment deals, and we did not have information about investment deals that did not materialize; as such, we do not know whether a particular VC did not invest in a particular venture because they could not access each other (i.e., limited information flow between and within ethnic ties and mainstream world) or because the VC decided not to invest after studying the venture (i.e., information asymmetry between entrepreneurs and investors). Future studies may use experiment and survey (e.g., Hsu, 2004) to verify the results of this study.

Second, due to data accessibility limitations, we could not differentiate investors with Anglo-Celtic, European, or Jewish names who are American born from those who are immigrants, so we lumped both as belonging to the 'mainstream.' Future research can examine possible differences in investment behaviors between the two groups. Compared to their American-born counterparts, these immigrants may lack social networks in America, but may still share the same level of social status. Thus, it would be interesting to see if their social status can alleviate their social network disadvantages.

Third, our study is confined to a minority enclave that has lower social status. Future studies may consider using the same dual dimensional social enclave framework to study minority enclaves that enjoy a *higher* social status in the society within which it is embedded. For instance, it would be interesting to apply the framework to study the behavior of U.S. VC investors in the Chinese venture market, where their higher social status (at least initially) may confer benefits that can more than offset their social network disadvantages.

Fourth, we recognize that the perceived social status of any social enclave is not permanent, but can evolve over time. In particular, in response to the growing connections between California and Asia, and more particularly the rapid rise of China and India in recent years, VC firms in Silicon Valley are increasingly shifting their investment activities toward new ventures that are able to exploit both the advanced technological innovation of Silicon Valley and the emergent market opportunities and talent base of Asia in general, and China and India in particular. In exploiting this new trend of investing in transborder ventures, the Asian VCs in Silicon Valley are likely to enjoy greater social network advantages versus the established U.S. VC firms which, at least until the early 2000s, may not have paid sufficient attention to Asian entrepreneurs. Indeed, we have deliberately confined our study up to only the early 2000s to avoid the possible confounding effect of a potential shift in the perceived social status of Asian VCs and entrepreneurs in recent years. In the future, researchers may want to examine if the evolving role of Asian VCs in Silicon Valley has indeed led to a change in their social status, which should be reflected in declining valuation premium vis-à-vis mainstream VCs.

Our study findings suggest that future research should test whether our ethnic enclave construct can be extended to other social contexts. Theoretically, ethnicity is not the only factor that could create a 'social enclave' where social network and social status intertwine; other social enclave-inducing factors include geographic location (e.g., VC networks in a less developed venture market may have lower social status than their counterparts in leading hubs like Silicon Valley or Boston), education (e.g., membership in an Ivy League alumni network may carry higher social status than one in a lesser known university), and membership in elite professional/occupational associations. In any social enclave that involves a group with lower social status, the social network that underlies it can be expected to facilitate within-network investment by its members through geographic proximity (Sorenson and Stuart, 2001) or social proximity (Bengtsson and Hsu, 2015), while its lower social status can be hypothesized to create barriers for its members to invest outside its network (Hochberg *et al.,* 2007). In other words, investing using social networks may be expedient for investors in the short run due to their information and homophily benefits, but may be suboptimal in the long run if the social networks entrap them into a lower social status enclave that entails the payment of a high premium to move out of it. This need for investors to trade off the effect of a social network and social status in making investment decisions is a prediction that neither network-based entrepreneurship studies (Hoang and Antoncic, 2003) nor social status studies (Hsu, 2004) could offer by themselves. Thus, it would be interesting for future research to test whether such a social enclave effect exists in social contexts other than an ethnic enclave.

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