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Quality signals? The role of patents, alliances, and team experience in venture capital financing

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ABSTRACT

Observable resources, particularly patents, alliances, and team experience, are known to affect a start-up's ability to attract venture capital financing. In this context they potentially fulfill a twofold function: as productive assets and, likely, as signals of characteristics of a venture that are not observable at the time of assessment. In particular, patents, alliances, and team experience may serve as signals of the unobservable quality of a venture's technology. Most existing studies based on firm-level transaction data cannot disentangle signaling from productive effects. Using a conjoint-based survey among 187 European and U.S. venture capitalists, we find they rely on research alliances and, partly, on team experience as signals of technological quality. While patents affect the venture capitalists' decision making in their property rights function, we find no indication that they serve as technology quality signals.

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1. Introduction

Venture capitalists (VCs) specialize in financing young firms with a high growth potential. Such investments bear a high risk due to a lack of securities and a high level of uncertainty. In particular the start-up itself is subject to uncertainty, since for lack of a track record its quality is only imperfectly observable. Thus, in evaluating a young firm, external parties have to rely on attributes that are observable at the time of assessment and presumably correlated with further, unobserved determinants of the start-up's quality (Stuart et al., 1999).

For high technology start-ups, patents, alliances, and team experience are important instances of observable resources. In line with Spence's (1973) definition, all of them can potentially serve as signals as they are differentially costly to obtain for ventures of different quality.¹ Indeed, patents and research alliances have been argued to serve, in particular, as signals of the quality of the venture's technology (Audretsch et al., 2012; Baum and Silverman, 2004; Cao and Hsu, 2011; Conti et al., 2013; Häussler et al., 2012; Hoenen et al., 2014; Hsu and Ziedonis, 2013; Long, 2002; Mann and

Sager, 2007; Stuart, 2000). Also team experience might provide a signal in this regard as a high-quality technology is more likely to attract a good team.

However, while patents, alliances, and team experience have long been recognized as relevant selection criteria for venture capital investors, actually identifying a signaling effect above and beyond the productive value of the respective resource is challenging. Most existing studies are based on firm-level transaction data and relate observable resources to venture capital funding figures. This approach provides meaningful results, however it does not allow the disentanglement of the signaling effect of these resources from their productive effect. As Mann and Sager (2007, p. 200) put it regarding patents, "we cannot untangle whether the patent or the technology that it covers best explains the results that we report." Similarly, we are not aware of any study that disentangles the signaling and productive effects of alliances and team experience. As notable exceptions, Hsu and Ziedonis (2013) and Hoenen et al. (2014) show that the effect of patents on venture capital financing is stronger in situations where signals are more urgently needed—in early funding rounds, when the venture team has no IPO experience, and when, at the IPO, the venture is not backed by a prominent VC. The authors interpret these findings as evidence of a signaling effect of patents. Yet, a clear separation of signaling and productive effects is beyond the scope of their studies since the data preclude actual ceteris paribus comparisons. Also, which quality of the start-up its patent stock actually signals—e.g., technology quality or commercial orientation—is not clear.

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¹ In Section 2.1 we explain why we emphasize signaling in the sense of Spence (1973) over decision-theoretic signaling in the interpretation of our study.

Given the importance of high-tech start-ups for the economy, and the apparent relevance of patents, alliances, and team experience in this context, a better understanding of the role of these resources in venture capital financing is desirable from a theoretical as well as from a practical perspective. The importance of a resource as a signal has various strategic implications, in particular related to differential skills of start-ups to generate the signal and even to deliberate manipulation (e.g., [Prabhu and Stewart, 2001](#)). We thus ask: to what extent, if at all, do patents, research alliances, and team experience signal information to potential investors about the quality of a new venture's technology? And related, which of these three resource types—intellectual capital, alliances, human capital—are more important in this role?

Drawing on value appropriation and signaling theory, we develop a conjoint approach. Our research setting is the screening of business plans, the first stage of the venture capital decision making process, in which information asymmetries between entrepreneurs and VCs are high and thus signaling particularly important. We conducted a survey among 102 European VCs with an investment focus on Germany and 85 U.S. VCs, all of whom invested in high technology start-ups.² Participants completed a conjoint experiment in which the importance of observable start-up characteristics—patents, alliances, and the team's experience—for securing venture capital funding was tested. To isolate the signaling effect of these resources, we conducted the experiment under two scenarios. In one scenario, participants were told that the technological quality of the start-ups under consideration was unknown to them. In the other scenario, they were briefed that the firms' technologies were known to them and equally good. With the collected choice data we estimate mixed-logit models. Since no signaling regarding the start-ups' technologies is required in the scenario featuring equally good technologies, differences between the two scenarios indicate signaling effects of the respective characteristic.

Our results are surprising. Although we find a comparatively high importance of patents for securing venture capital funding, we cannot identify a signaling effect of patents. In other words, VCs value patents highly, but not as signals of the venture's technology quality. Instead, VCs seem to rely on research alliances and, partly, on team experience as signals in this regard. These findings are rather unexpected in the light of conceptual studies on a patent's signaling value (e.g., [Graham et al., 2009](#); [Long, 2002](#)) and question received wisdom.

This study makes three contributions. First, we add to a recent stream of research on the role of observable resources in venture capital financing ([Audretsch et al., 2012](#); [Baum and Silverman, 2004](#); [Cao and Hsu, 2011](#); [Conti et al., 2013](#); [Greenberg, 2013](#); [Hoenen et al., 2014](#); [Hsu and Ziedonis, 2013](#); [Häussler et al., 2012](#); [Mann and Sager, 2007](#)). To the best of our knowledge, this study is the first to clearly separate the signaling effect of three important start-up resources from their function as productive assets, and to assess their relative importance as signals. Second, we contribute to the literature on venture capital selection criteria (e.g., [Franke et al., 2008](#); [Hall and Hofer, 1993](#); [MacMillan et al., 1985](#)). Third, we extend the range of applications of conjoint analysis for managerial research (e.g., [Fischer and Henkel, 2013](#); [Shepherd and Zacharakis, 1999](#)) by combining it with a scenario approach.

2. Venture capitalists' decision making

Faced with high uncertainty and limited information in assessing new high-tech ventures, VCs need to rely on those

² A part of this data set has also been used by [Hoenig and Henkel \(2012\)](#) in a study of industry differences in the use of patents and alliances as VC screening criteria.

characteristics of the start-up that are observable. They will assess the inherent value of these observable characteristics, and in addition will likely take them as a basis for drawing conclusions about unobservable characteristics of the firm. In other words, they may use observable resources as signals of unobservable quality dimensions. In the following, we first review the literature on signaling in venture capital decision making. We then turn to three specific observable resources—patents, alliances, and team experience—and discuss their functions as productive assets and as signals of the unobservable quality of a start-up's technology. [Table 1](#) provides an overview of the pertaining studies, which are discussed in the following subsections.

2.1. Signals

Investing in young technology-based ventures is a high risk undertaking. New organizations are confronted with numerous challenges and therefore highly vulnerable, a phenomenon that [Stinchcombe \(1965\)](#) termed liability of newness. With their product offering still in the development phase, start-ups, especially high technology start-ups, face a high technical and commercial failure rate ([Aldrich and Fiol, 1994](#); [Tushman and Rosenkopf, 1992](#)). In addition, start-ups are difficult for investors to evaluate since they lack a performance track record or even revenues ([Penrose, 1959](#); [Shane and Stuart, 2002](#)).

A particular challenge for investors is to assess the quality of the new firm's technology. Information asymmetries are severe—naturally, the entrepreneurial team possesses more information about the quality of the technology than any outside investor ([Shane and Stuart, 2002](#)). “[I]nformation asymmetry”, as [Arthurs and Busenitz \(2003, p. 147\)](#) note, “may allow an entrepreneur to engage in opportunistic behavior, more specifically, adverse selection or moral hazard [...] For example, the entrepreneur may attempt to ‘oversell’ the merits and viability of the venture [...] in order to secure more favorable financing terms [...]” Such overselling happens indeed and affects the relationship between VC and founders; as [Pollack and Bosse \(2014\)](#) phrase it, “[t]his information asymmetry as well as the potential for moral hazard [...] plagues entrepreneurs and limits the ability of potential investors to gauge the legitimacy of ventures [...]” Eventually, information asymmetry may hinder the establishment of an investor/start-up relationship ([Leland and Pyle, 1977](#)). In this situation, [Spence's \(1973\)](#) signaling theory applies.

A second reason why entrepreneurs will often overstate the merits of their venture is that they tend to be overly optimistic (e.g., [Cooper et al., 1988](#); [De Meza and Southey, 1996](#)). This implies that some of the information needed for an objective valuation of the venture is unknown to both VC and entrepreneurs, or at least not correctly interpreted by the latter. In this case, a signal has a decision-theoretic function, providing information to both parties.

Our own interviews with VCs confirm the above effects—overselling due to asymmetric information and overstating due to over-optimism.³ Both make external signals valuable to the VC. In the interpretation of our study we emphasize

³ We addressed this issue with seven of our interviewees (see [Section 3.1](#)). Five of them clearly saw deliberate overselling on the part of the venture team (all quotes translated by the authors): “I think it is a principal-agent model with certain information asymmetries. Also the investors do not openly address all pitfalls in the contracts” (Interviewee 1); “Honesty: SW(OT) is often consciously omitted in selling mode” (Interviewee 2); “They regularly omit weaknesses, they always present it simpler than it is” (Interviewee 3); “The entrepreneur is in a sales pitch. Thus, positive aspects are emphasized and weaknesses are mentioned as little as possible” (Interviewee 4); “Both [conscious overselling and over-optimism] happens. In the end, the investor wants a team that can present the venture in a favorable light” (Interviewee 5). Asked about the relative importance of deliberate overselling and over-optimism, specifically with respect to the quality of the venture's

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