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ARTICLES

Standing out from the crowd: the visibility-enhancing effects of IPO-related signals on alliance formation by entrepreneurial firms

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Abstract

In this study, we explore how multiple signals related to entrepreneurial companies at the time of their initial public offering (IPO) influence the firms' ability to acquire non-financial resources over time. Specifically, the study looks at how signals based on investors' initial reactions to the IPO, analyst coverage and affiliations with experienced venture capitalists and prominent underwriters combine to enhance the IPO firm's visibility and reduce uncertainty, thereby influencing its ability to form post-IPO alliances. We also consider the extent to which the effects of each of the signals are sustained or diminish over time. Their analysis of 404 IPOs conducted by technology companies between 1995 and 2000 shows that these signals are positively related to alliance formation patterns, and that the effects of these signals deteriorate at different rates over time.

Key words • alliances • cognition • entrepreneurship • initial public offerings • prestige • signaling

The ability to attract attention in order to garner resources is of critical importance to entrepreneurial firms (Certo, 2003; Deeds et al., 2004; Higgins and Gulati, 2003, 2006; Lounsbury and Glynn, 2001; Rindova et al., 2005, 2006, 2007; Sanders and Boivie, 2004). Extensive research has focused on how specific signals can reduce uncertainty about firms' quality and future prospects in the eyes of key stakeholders. Such studies have examined how mechanisms such as placement in certification contests (Rao, 1994), certification from credentialing agencies (e.g. Baum and Oliver, 1991), media rankings (Rindova et al., 2005; Wade et al., 2006), relationships with high-status actors (e.g. Haunschild, 1994; Higgins and Gulati, 2003, 2006; Podolny, 1994; Stuart et al., 1999) and announcements of

corporate actions – including adopting long-term incentive plans (Westphal and Zajac, 1994, 1998), stock repurchase plans (Westphal and Zajac, 2001; Zajac and Westphal, 2004) and corporate name changes (Lee, 2001) – can enhance organizational legitimacy and reduce stakeholder uncertainty about the firm.

However, in order to serve as uncertainty-reducing signals, these characteristics must first attract the attention of those who use them. This process has generally been assumed: if a signal is provided, the appropriate actor will naturally attend to it and use it. Thus, the role signals play in attracting attention has not been considered in any great detail. In addition, while research has also begun to explore how the cognitive 'availability' (Kuran and Sunstein, 1999; Pollock et al., forthcoming) of firms – or the ease with which they can be recalled by stakeholders and thus become the focus of attention – can facilitate their gaining intangible assets such as reputation and celebrity status (Rindova et al., 2006, 2007), less consideration has been given to the influence of availability on entrepreneurial firms' abilities to garner other forms of more tangible assets. Further, while research on the role of signaling as related to entrepreneurial firms has contributed to our understanding of the social construction of markets, such work has typically focused on the effects signals have on financial outcomes at the time the signal appears, or concurrent with a significant event, such as a firm's initial public offering (IPO) (e.g. Gulati and Higgins, 2003; Megginson and Weiss, 1991; Sanders and Boivie, 2004; Stuart et al., 1999). Less attention has been paid to how these signals increase a firm's likelihood of inclusion in the 'consideration sets' (Roberts and Lattin, 1997; Zuckerman, 1999) of organizations that could, for instance, become valuable partners. In this study, we attempt to address some of these gaps in prior research by developing a more refined understanding of signal characteristics and the ways in which distinct signals from different sources may enhance an entrepreneurial firm's visibility and ability to form post-IPO strategic alliances.

We explore these issues in the context of start-up firms in the information technology (IT) sector during the mid- to late 1990s. New organizations, especially those in developing industries, are associated with tremendous uncertainty and thus face significant challenges gaining the attention of key potential partners as they seek legitimacy (Aldrich and Baker, 2001; Aldrich and Fiol, 1994; Amit and Zott, 2001; Deeds et al., 2004; Rao, 1994; Stinchcombe, 1965) and the resources necessary for survival and growth (Fischer and Pollock, 2004; Khurshed, 2000; Martens, 2004). In this study, we examine how IT companies that went public during the internet boom of the mid- to late 1990s benefited from different signals that enhanced their recognition among potential alliance partners and helped them gain access to post-IPO strategic alliance opportunities. In particular, we focus on the signals provided by (1) the market's initial reaction to the company as reflected by the change in stock price during its first day of trading (Demers and Lewellen, 2003; Pollock et al., forthcoming; Welch, 1992); (2) the attention given to the firm by stock analysts (Rao et al., 2001; Zuckerman, 1999); and (3) the signals emerging from the firm's association with

experienced and prominent actors (i.e. venture capitalists and underwriters) prior to and during the IPO process (Carter and Manaster, 1990; Gulati and Higgins, 2003; Megginson and Weiss, 1991; Stuart et al., 1999). We argue that these signals combine to enhance the newly public firm's access to alliance partners in this highly uncertain and volatile industry context. Further, we consider the rate at which the efficacy of each of these signals deteriorates over time, a topic with scant existing research.

Theory development

Formation of strategic alliances

In developing and sustaining sources of competitive advantage, newly public firms must gain access to valuable knowledge, resources and technology. Companies may acquire such resources by developing strategic alliances with other firms that may offer complementary or supplementary sources of synergy (Ahuja, 2000a, 2000b; Dyer and Hatch, 2006; Gulati, 1995, 1998, 2007; Powell et al., 1996; Zaheer and Venkatraman, 1995). A strategic alliance is commonly defined as any voluntarily initiated cooperative agreement between firms that involves exchange, sharing or co-development, and can include contributions by partners of capital, technology or firm-specific assets. Prior work has shown that a firm's entry into exchange relationships such as alliances with other companies can in turn affect myriad firm outcomes including market share (Podolny et al., 1996), the spread between costs and prices (Podolny, 1993) and reactions of the financial community (Anand and Khanna, 2000; Gulati and Wang, 2003; Lavie, forthcoming; Stuart et al., 1999).

By some accounts, the cumulative growth rate of strategic alliance formation across all sectors between 1995 and 2000 was approximately 40 percent (Halevy, 2000). The growth rate in the IT sector was even more significant (Hagedoorn, 2002; Halevy, 2000; Lavie, forthcoming). Indeed, alliances were vital to the survival and success of many newly public, resource-constrained IT companies seeking to grow their market by pooling resources with other firms. Factors that propelled alliance formation in the late 1990s included rapid technological innovation, shrinking product cycles, blurred competitive boundaries and the drive for compatibility and interoperability with others' products. During this period, firms entering new alliances sought to expand their opportunity space by seeking complementary or supplementary resources from their partners.[1] It is safe to say that start-ups in this sector were very active and formed significant numbers of strategic alliances.

Prior research has suggested that a firm's proclivity to form strategic alliances is dependent in part on its visibility within the industry, the perception that it has something useful to offer partners and the expectation that the firm will be able to deliver on its commitments in the future (Ahuja, 2000b; Chung et al., 2000; Gulati, 1999, 2007; Rosenkopf et al., 2001; Stuart, 1998). Thus, potential

alliance partners must first become aware of a given firm's existence and availability in order to form an alliance with it. Further, they will consider not only the firm's willingness to enter a strategic alliance, but also its ability to contribute value to the relationship. Prior research has also suggested that alliances form through a matching process such that, in the face of asymmetric information, both partners simultaneously assess the viability of the other as reflected in the network of prior ties in which it may be embedded (Gulati, 1995, 2007; Gulati and Gargiulo, 1999).

While there is a fair amount of research on the entry of established firms into alliances, less work has explored the variety of ways in which companies, especially newer ones with less developed networks of prior ties that might give them exposure to future partners, are able to move into potential allies' consideration sets (Mitra, 1995; Roberts and Lattin, 1997; Zuckerman, 1999). Given the cognitive limitations of firms making strategic decisions (March and Simon, 1958; Ocasio, 1997), we suggest that companies seeking to partner with entrepreneurial firms will rely on a variety of signals in identifying alliance partners. In particular, we argue that firms considering entering into an alliance with a start-up are likely to attend to signals that increase the young firm's visibility and reduce perceptions of uncertainty about its credibility as a partner.

Sources of uncertainty-reducing signals

Research on signaling suggests that under uncertain conditions actors are likely to attend to available signals that can reduce their perceived uncertainty about a course of action (Spence, 1973, 1974). Spence (1973: 357) defines signals as 'those observable characteristics attached to the individual that are subject to manipulation by him'. He notes that signals are the result of conscious and voluntary actions resulting in uncertainty-reducing characteristics that are costly to obtain (Spence, 1974). Subsequent research on signaling at the organization level has considered a wide variety of characteristics that can serve as signals about firms in markets laden with uncertainty: warranties associated with new product introductions (Akerlof, 1970), advertising expenses (Nelson, 1974), corporate name changes (Lee, 2001), insider buying and selling of stocks (Fried, 2000; Sanders and Boivie, 2004), corporate governance characteristics (Certo, 2003; Certo et al., 2003; Sanders and Boivie, 2004), founder presence (Nelson, 2003), software preannouncements (Hoxmeier, 2000), celebrity endorsements (Dean and Biswas, 2001), winning certification contests (Rao, 1994; Wade et al., 2006) and affiliations with prominent and legitimate actors (Baum and Oliver, 1991; Carter and Manaster, 1990; Gulati and Higgins, 2003; Haunschild, 1994; Higgins and Gulati, 2003, 2006; Podolny, 1994).

Explicit in Spence's definition of a signal, and hence implicit in much of the research on signaling, is the assumption that the focal actor exerts a significant amount of control over the signal's nature. However, as a variety of studies demonstrate, a number of characteristics over which the focal actor has only

partial control are frequently used as signals. For example, scholars have treated indicators such as third-party endorsements (e.g. Carter and Manaster, 1990; Gulati and Higgins, 2003; Higgins and Gulati, 2003, 2006; Stuart et al., 1999), winning certification contests (e.g. Rao, 1994; Rindova et al., 2005; Wade et al., 2006) and market reactions (e.g. Rao et al., 2001) as signals. Although they may result from actions initiated by the focal actor, these signals are provided by third parties who make their own determinations and decisions, and thus are only partially under the focal actor's control, at best (Podolny, 1993). Further, it is important to remember that a particular characteristic only functions as a signal if it is perceived as such by *the receiver of the information who uses it to make an evaluation*. In other words, for actor characteristics to serve as signals, those who are making evaluative decisions must first focus on them (Fiske and Taylor, 1991; Ocasio, 1997; Starbuck and Milliken, 1988). Thus, the utility of a signal is also a function of its ability to enhance a firm's visibility in the eyes of the signal's recipient (Higgins and Gulati, 2003; Pollock et al., forthcoming; Sunstein, 2004; Tversky and Kahneman, 1973). While several studies have shown the positive consequences of signals in shaping firm behavior and outcomes, few have considered how different types of signals can differentially increase a firm's visibility and availability and thus increase its ability to garner resources (for exceptions, see Gulati and Higgins, 2003; Stuart et al., 1999).

A major milestone in the development of an entrepreneurial firm's life is the initial public offering (Fischer and Pollock, 2004; Husick and Arrington, 1998; Martens, 2004). While the IPO provides substantial financial resources and enhances the young firm's legitimacy, significant uncertainties remain about the firm's capabilities, and hence its future prospects, including its ability to survive (Fischer and Pollock, 2004; Jain and Kini, 2000; Pollock and Rindova, 2003; Ritter, 1991). Here we consider three potential sources of signals available at the time of and subsequent to the IPO that can both reduce uncertainty and enhance a firm's visibility and availability, thereby increasing its ability to attract post-IPO alliance partners: (1) the market's initial response to the company's stock offering on the day of its IPO, (2) the firm's affiliation with prominent and experienced underwriters and venture capitalists (VCs) at the time of IPO and (3) the number of analysts that follow the company subsequent to its IPO. We consider the implications of each of these possible signals on the newly public firm's prospects to attract alliance partners. We also assess the rate at which each of those signals deteriorates over time.

Initial market response

One visibility-enhancing characteristic of a firm going through an IPO is the first-day 'pop' in its stock price (Demers and Lewellen, 2003; Loughran and Ritter, 2004; Pollock et al., forthcoming). The vast majority of firms undertaking IPOs experience a significant increase in stock price on the day they go public (Loughan and Ritter, 2004). Indeed, if a company does not experience such an increase, the offering is generally considered a failure (Pollock and Rindova, 2003), largely

because the stock price change on the first day of public trading reflects the market's initial response to and evaluation of the firm. Research has shown that the more enthusiastic the market's initial response to the IPO, the more attention the firm tends to receive from the media, investors, analysts and the general public (Aggarwal et al., 2002; Cliff and Denis, 2004; Demers and Lewellen, 2003; Pollock et al., forthcoming; Rajan and Servaes, 1997). Underwriters, along with executives of IPO firms and their venture capitalist backers, have generally viewed the 'cost' of this signal as an acceptable part of the IPO process (Demers and Lewellen, 2003; Loughran and Ritter, 2002, 2004), based on the expectation that it can reduce stakeholders' perceived uncertainty about the firm and/or create 'buzz' (Dye, 2000) that can yield a number of benefits. Indeed, one technology company CEO told us that, given a start-up firm's limited ability to acquire often scarce resources (including employees, marketing, distribution, etc.) and the relentless pressure to be the first to capture a dominant position in a particular market space, its first-day pop in stock price was an integral mechanism for 'attracting eyeballs' and identifying the likely 'winners' in the market. He noted that firms explicitly tried to replicate the formula that led to Netscape's success (and ignited the internet boom), which included a dramatic run-up in stock price on the day of the IPO. He also noted that because they were playing in a new market, firms had to 'create their own self-fulfilling prophecy', and that a large jump in stock price on the day of the IPO was a big part of that process.[2]

Recent studies support these claims. Research has shown that abnormally large first-day run-ups in stock price have generated increased levels of traffic to companies' websites following the IPO (Demers and Lewellen, 2003), greater levels of general media attention (Demers and Lewellen, 2003; Pollock et al., forthcoming) and positive media coverage (Pollock et al., forthcoming), higher levels of market analyst interest in the company's stock (Aggarwal et al., 2002; Cliff and Denis, 2004; Loughran and Ritter, 2004; Rajan and Servaes, 1997), a greater probability of conducting a secondary offering (Jegadeesh et al., 1993) and a lower probability of failure in the five years following an IPO (Fischer and Pollock, 2004). While the average run-up in stock price has changed over time on a percentage basis, thereby making comparisons of absolute changes across time periods difficult, in all time periods covered by the aforementioned studies, run-ups that substantially exceed the norms for the period are considered noteworthy and attract attention.[3]

In our context, we expect that in order to serve as a useful signal that attracts the attention of potential alliance partners who face asymmetric information about each other, the initial market response must be perceived as a credible, salient and interpretable signal. The initial market response is a credible signal because, at least in the short term, it can be perceived as costly to the firm going public as well as to the investors buying the stock (Loughran and Ritter, 2002; Megginson and Weiss, 1991). Further, it is likely to be salient because it is figural; that is, it stands out against the background of most stock price movements because of its extremity (Fiske and Taylor, 1991; Tversky and Kahneman, 1973). It is also a useful metric because it allows for easy comparison of companies,

regardless of age, size or industry. Finally, the vast amount of research and popular press coverage about the market's initial responses to IPOs at the time of our study validated it in the minds of many observers as perhaps one of the most important indicators of an IPO's success (Ritter and Welch, 2002), thus making it widely available and easily recalled (Kuran and Sunstein, 1999; Sunstein, 2004).

Research in social psychology describes a decision-making heuristic frequently employed under conditions of uncertainty, the availability heuristic, which is likely to shape the process by which the first-day bump in stock price influences potential alliance partners' subsequent decision-making. Recent research on availability cascades suggests that opinions and beliefs can become widely held and persistent – even if they are based on little or no substantive information – to the extent that they become available, or salient and easy to recall, and are socially reinforced via others' expressed choices and actions (Kuran and Sunstein, 1999; Pollock et al., forthcoming; Sunstein, 2003, 2004). As all firms are not equally likely to receive the same level of stakeholder attention (Hoffman and Ocasio, 2001; Ocasio, 1997; Rindova et al., 2007; Zuckerman, 1999), the presence of a positive signal that is salient and easy to recall is likely to influence decision-making related to partner selection. Such general signals may be especially influential in uncertain conditions, where actors lack clear notions of what specific partner characteristics are most desirable. Thus, given cognitive limitations in evaluating and assessing all possible information and choices, characteristics that make a signal more available (Kuran and Sunstein, 1999; Rindova et al., 2005; Tversky and Kahneman, 1973) and increase the likelihood that a firm falls within a potential alliance partner's consideration set (Mitra, 1995; Roberts and Lattin, 1997; Zuckerman, 1999) for further evaluation may also increase the firm's probability of forming more strategic alliances.

We argue that in the IPO market context, the market response the firm experiences on its first day of trading creates a highly visible and salient signal that makes the firm cognitively available to potential alliance partners and creates enduring positive perceptions that are easily recalled (even if the specific size of the run-up itself is forgotten). The ability of the initial run-up to generate social proof via positive availability cascades, or buzz (Dye, 2000), about the firm among customers, suppliers, investors and the media suggests that the first-day run-up in stock price may increase a firm's opportunities to form strategic alliances following its IPO and thus increase the number of post-IPO alliances. Based on these arguments we hypothesize:

HYPOTHESIS 1 The first-day run-up in stock price will be positively associated with the number of post-IPO strategic alliances formed by a focal firm.

Prominent affiliations

In the context of an entrepreneurial firm's undertaking an IPO, there can also be significant benefits to affiliations with key endorsers, which enhance the firm's

visibility and reduce uncertainty in the face of asymmetric information by providing strong signals of its legitimacy (Rindova et al., 2005). In particular, firms approaching IPOs can benefit from endorsements by underwriters (Carter and Manaster, 1990; Higgins and Gulati, 2003, 2006; Pollock, 2004; Stuart et al., 1999) and venture capitalists (VCs) (Barry et al., 1990; Gompers, 1996; Gulati and Higgins, 2003; Lee and Wahal, 2004; Megginson and Weiss, 1991). Prominent, experienced VCs who specialize in a limited number of industries and participate in the IPO market frequently are expected to use their expertise to identify and develop the most promising young companies (Baum and Silverman, 2004; Jain and Kini, 1995; Lee and Wahal, 2004). These VCs are also likely to possess large numbers of relationships with past and current firms in their portfolios, and thus be best positioned to serve as 'matchmakers' facilitating alliance formations (Hsu, 2006; Lindsey, 2004). Indeed, one technology company CEO we spoke to noted that access to a prominent and experienced VC's *keiretsu* – that is, the network of firms that it has funded and developed over the years – was a critical component of a firm's ability to become successful, and was thus viewed as the sign of a 'winner'.

Affiliations with prestigious underwriters can also attract attention and enhance an IPO firm's visibility. The willingness of prestigious underwriters to risk their reputational capital by serving as the lead underwriter of an initial public offering is generally recognized as a powerful signal of the focal firm's promise (Carter and Manaster, 1990; Hayes, 1970; Higgins and Gulati, 2003; Pollock et al., 2004). Much has been written about the financial benefits accruing to firms at the time of their IPO from their ties to prominent underwriters and VCs. Generally, prior research has focused on linking these affiliations to the success of the offering itself (e.g. Carter and Manaster, 1990; Gulati and Higgins, 2003; Megginson and Weiss, 1991; Stuart et al., 1999). However, little work has examined the effects of these ties beyond the IPO – for example, how they may help a firm acquire non-financial resources subsequent to the offering by enhancing its visibility.

The processes underlying the availability of information about a firm at the time of its IPO, as described earlier, are also likely to shape the signals provided by prominent endorsers and their impact on outcomes subsequent to a firm's IPO. For instance, in a recent study of the antecedents of business school reputation, Rindova et al. (2005) found that certification by renowned institutional intermediaries and affiliation with high-status actors (prominent journals and PhD-granting institutions) had the strongest effect on organizational prominence, which in turn influenced the wage premiums received by the programs' MBAs. The researchers argued that 'the formation of public opinion follows a "social influence" logic, leading some organizations to gain disproportionate amounts of public attention and support on the basis of rather general and non-specific impressions and beliefs' (Rindova et al., 2005: 1037), and that these opinions and beliefs are formed and sustained via the firms' prominent affiliations. The implication of these findings for our study is that the positive signals arising from the

involvement of a firm with prominent VCs and underwriters, two affiliations widely held to serve as valuable signals, may exert a similar form of generalized social influence and help to increase the young firm's visibility, thereby enhancing its ability to form post-IPO alliances. We therefore hypothesize:

HYPOTHESIS 2 Endorsement by prestigious underwriters and experienced VCs will be positively associated with the number of post-IPO strategic alliances formed by a focal firm.

Analyst coverage

Receiving analyst coverage is critical for public companies (Rao et al., 2001; Zuckerman, 1999), particularly for newly public firms (Cliff and Denis, 2004; Krigman et al., 2001). Analysts are market experts who issue reports on and ratings of the quality and investment potential of firms in the industries they cover. Thus, analysts play a crucial role in reducing uncertainty and enhancing the visibility and cognitive availability of firms to stakeholders because they mediate information flows between companies and other market participants who may invest in or do business with these firms. The failure to obtain analyst coverage, then, is significant in part because analysts, though not barred from issuing negative ratings of companies, do not like to initiate coverage on companies they expect to perform poorly (Rao et al., 2001); thus, the vast majority of analyst ratings issued are positive. For this reason, firms falling outside analysts' consideration sets will not only be perceived as of lower quality, they will also be less visible because they are not part of discussions among highly influential information intermediaries (Pollock and Rindova, 2003; Zuckerman, 1999). Prior research has confirmed that companies failing to gain analyst coverage suffer an 'illegitimacy discount' in their stock pricing (Zuckerman, 1999). Thus, we argue that because of the important role analysts play in information dissemination they are likely to enhance the visibility of firms they cover through a variety of direct and indirect mechanisms. For example, potential alliance partners may read analyst reports,[4] speak directly to analysts or attend the large annual industry conferences investment banks host (Reingold, 2006). Analysts can also have a more indirect effect via their influence on the media, who report on and thus highlight the attention given firms by analysts (Zuckerman, 1999), along with frequently using analysts as expert sources. We therefore hypothesize:

HYPOTHESIS 3 The number of analysts covering a focal firm subsequent to its IPO will be positively associated with the number of post-IPO strategic alliances it forms.

Signal durability over time

While there is a growing literature on signals in markets, there have been few attempts to assess the influence of these signals over time (for an exception, see

Gulati and Higgins, 2003). Theoretical perspectives based on assumptions of economic rationality and continuous updating suggest that signals are only substitutes for direct experience in the face of asymmetric information (Akerlof, 1970) and that the effects of signals will be temporary, quickly deteriorating once more direct experience has been acquired or when new, disconfirming information is obtained (Rao et al., 2001; Welch, 2000). In our context, this line of reasoning would suggest that the effects of signals provided at the time of the IPO can be expected to attenuate, or deteriorate, very quickly after the IPO as additional information about the firm – including information related to its performance and potential as an alliance partner – becomes available.

However, this may not necessarily be the case. First, it is not clear to what extent new post-IPO information that may be relevant to evaluating a firm's capability and desirability as an alliance partner is publicly available, or the extent to which it circulates among potential alliance partners. Further, the signals provided at IPO may continue to exert some influence on alliance partner decisions for some time if the signals sustain cognitive availability and ease of recall. Information that is dramatic and therefore stands out relative to other information is more likely to become cognitively available, as is that which is experienced repeatedly and thus becomes more familiar (Hawkins and Hoch, 1992; Kahneman et al., 1982). Here we expect some variability in the ongoing availability of the signals in question, and thus variations in the expected durability of their post-IPO effects.

In the context of our study, we expect the effects of endorsements by prestigious underwriters and experienced VCs on alliance formation patterns to decline more quickly than the effects of the initial market response and analyst coverage. While the endorsements of prestigious underwriters and VCs are especially important at the time of the IPO, the relationships they represent tend to end soon after the IPO. Underwriters may provide some aftermarket trading support in the days following the offering (Ellis et al., 2000) but their involvement with the company generally ends quickly after that. The direct involvement of VCs may last a bit longer following the IPO, and the effects of their network-building capabilities may be even longer term, but VCs nonetheless tend to reduce their active engagement with newly public firms once the offering has been completed, lock-up periods have expired and their positions in the firms are liquidated or the shares are turned over to the limited partners who invested in the fund (Sahlman, 1990).

While the market's initial response to the public offering is also contemporaneous with the IPO event, we expect its effects to be more enduring. This is in part because extreme market responses are likely to be highly salient to a variety of stakeholders, and thus easier to recall (Fiske and Taylor, 1991). However, it is also due to the prospective nature of the signal. In some ways, the market's initial response is more 'forward looking', to the extent it is viewed as an indicator of who the likely winners in the market will be. Similarly, the ability of the firm to attract and retain significant amounts of analyst coverage, especially in the

face of the large number of companies going public during the unique period of our study, may also be perceived as a signal of the firm's ongoing potential. In addition, a firm's ability to obtain coverage may help to maintain the company's visibility and cognitive availability because repeated exposure via analysts' quarterly earnings estimates, ratings and periodic reports and updates makes the company more familiar and easier to recall. Based on the preceding we therefore hypothesize:

HYPOTHESIS 4 The effects of the initial market response and analyst coverage will remain more persistent over time than the effects of underwriter and VC endorsement on the number of post-IPO strategic alliances a firm enters.

Data and research methods

Research context

We tested our ideas in a research context where the potential for substantial variation in organizational uncertainty exists, and where uncertainty-reducing and visibility-enhancing signals have been of considerable importance and can be readily observed: the initial public offerings of internet-based IT companies. While all IPOs are by their nature highly uncertain, the level of uncertainty surrounding an offering was magnified for internet-related firms, especially during the mid- to late 1990s when firms were going public at an unprecedented rate and at a younger age than had been typical. As a result, many firms were going public with relatively unproven business models and severely limited revenue streams (Amit and Zott, 2001). In addition, although the internet has existed since 1969, the technologies underlying the development of commercializable internet-related business applications were still in their infancy in the mid- to late 1990s, and the level of current and future demand for the products and services offered was unclear. As a consequence, the purpose and nature of the firms themselves often shifted rapidly (Rindova and Kotha, 2001), and the metrics used to evaluate the performance and quality of internet-related businesses had not been clearly established. Taken together, these factors created considerable uncertainty about the firms and increased the need for the establishment of strategic alliances. We acknowledge that this is a unique period, in which there was greater than usual uncertainty surrounding the young firms going public. Yet this quality allows us to explore the efficacy of varying signals in the face of asymmetric information that could affect post-IPO firm outcomes.

Sample

Our sample consisted of internet-based IT firms that conducted IPOs between 1 January 1995 and 30 September 2000. We defined an internet firm as a company founded with the intention of using the internet as the core of its primary

line of business and the basis for the majority of its revenues. Firms that generated a substantial proportion of their revenues from the internet but that were not founded with the intention of being primarily internet-focused (e.g. Cisco, AOL) were not included in our sample. Consistent with prior research (e.g. Ritter, 1991; Welbourne and Andrews, 1996), we also excluded spin-offs of publicly held companies (e.g. BN.com). These companies were excluded because this study focuses solely on firms that have never participated in the public market before. Potential alliance partners have more information about and experience with spin-offs and their parent firms (who often retained majority ownership of the spin-offs' stock), which can influence the potential alliance partners' perceived uncertainty and willingness to partner with the firm.

We used several sources to identify firms that met our definition. We began with the online resource IPO.com.[5] Among their IPO classifications were 'internet Services' and 'internet Software'. Using these classifications, we searched IPO.com's online database for firms that had conducted (priced and traded) IPOs. Because there were likely some internet firms that met our definition but were not listed under the above classifications, we also conducted searches under the category headings 'Brokerage Services', 'Computer Software', 'Financial Services', 'Telecommunications Services', 'Media', 'Telecommunications' and 'Business Services', and read the business descriptions of the companies to determine if any of them met our criteria for classification as an internet firm. Once these searches had been completed, we compared our list to other lists of internet companies in order to determine whether there were any other firms to add to our sample. These other sources included the *USA Today* e-business 100, internet.com's internet company index, internetstocks.com's 'etaildex' and Morgan Stanley Dean Witter's B2B report. Our search yielded a sample of 404 internet firms that met our definition and for which complete data were available six months after IPO. The sample was reduced to 368 at 12 months and 318 after two years, primarily due to acquisitions and firm failures during these periods.

Dependent variable

Number of post-IPO strategic alliances

In this study we are concerned with the volume or number of alliances formed over a given period of time. Thus, we measured the cumulative number of post-IPO strategic alliances entered by a firm. In order to explore the extent to which predicted effects changed over time, we measured the cumulative number of post-IPO strategic alliances over three increasingly longer time periods: six months after the IPO, 12 months after the IPO and two years after the IPO. These time periods were chosen because a common time frame was needed in order to make valid comparisons across IPOs (because companies went public over a six-year time period). Also, a sufficient amount of time needed to elapse for firms and their management teams to recover from the IPO process, refocus on strategic and operational activities and position themselves to negotiate new alliances.

Finally, we wanted to use time periods long enough to allow valid tests of the durability of the signals. In order to determine the number of post-IPO strategic alliances a firm participated in, we compiled strategic alliance data on each of the companies in the sample. These data were obtained from the Securities Data Corporation Joint Ventures database and include all forms of strategic alliances (i.e. marketing agreements, R&D alliances, product licensing agreements, equity joint ventures, etc.).

Independent variables

Underwriter prestige

Underwriter prominence was operationalized using an index developed by Carter and Manaster (1990) and then updated by Carter et al. (1998). The Carter–Manaster scores have been widely adopted as a reasonable and reliable proxy for underwriter prestige. Scores range from 0, indicating low prestige, to 9, indicating high prestige. If a sample company had a lead investment bank that resulted from a merger of two investment banks in the period following the creation of the Carter–Manaster scores, the merged entity was assigned the higher of the banks' prestige measures. The lead underwriter for each IPO was identified using the SDC New Issues database.

Venture capitalist experience

A measure analogous to the Carter–Manaster score does not exist for VCs, so we had to identify another proxy for VC prominence and experience. Prior research suggests that VC age can be used as a reasonable proxy, because older firms tend to be the most pre-eminent and successful VCs, as indicated by their ability to attract the most capital from investors and participate in more IPOs (Gompers, 1996; Lee and Wahal, 2004). Indeed, our sample's most senior VC firms include venerable firms such as Greylock, Oak Investment Partners, Venrock Associates, Hambrecht and Quist Venture Associates, Menlo Ventures, Mayfield and Kleiner Perkins Caufield and Byers. Although several VCs often provide financing to a firm simultaneously, the VC with the largest ownership stake is generally considered its 'lead' VC (Gompers, 1996; Lee and Wahal, 2004). Using data obtained from the offering prospectuses, we identified the VC with the largest percentage ownership of the company prior to the IPO. Then, using data from VentureXpert, another Securities Data Corporation database, we identified the year when the VC established its first investment fund, and subtracted that year from the focal firm's IPO year to establish VC age at IPO. Firms that did not receive venture backing were assigned a VC age of 0.[6] This approach is appropriate because we are exploring the signaling value of the VC's age, and firms that receive no VC backing obviously cannot benefit from VC-related signals. In addition, because the ages of the VCs ranged from 1 to 40 years, it is unlikely that age differences among younger VC firms mean the same thing as equivalent differences among older VC firms (i.e. differences are more meaningful for

the younger firms). In order to account for this potential non-linear relationship, VC age was transformed into its natural logarithm. Because VC age is 0 for non-VC backed firms, a 1 was added to all VC ages before they were transformed.

Although VentureXpert was the best source available for determining VC ages, we were missing data for some of the lead VCs in our sample. In order to preserve the maximum number of observations, we employed the mean substitution method recommended by Cohen et al. (2003) and substituted the mean value of VC age for our entire sample in those cases where a firm received VC backing but the VC's age was missing. As Cohen et al. (2003) suggest, we also included a dummy variable (VC age missing) in the regressions to indicate whether the age of the VC was missing for the observation.

Initial market response

Consistent with prior research (Ritter and Welch, 2002), the initial market response is defined as the percentage change in stock price between the initial price set for the stock by the underwriters and the company and the closing price on the first day of trading. Like VC age, we do not expect the effects of the initial market response to be linear, with equivalent differences of more significance at the lower end of the range than at the higher end. Further, initial market responses in our sample ranged from −43 percent to 605 percent, with an average of 76 percent, and analysis of the descriptive statistics revealed that this variable's distribution had a skewness of 1.94 and a kurtosis of 8 (the theoretical values for normally distributed data are 0 and 3, respectively). Because we were concerned that the skewness and kurtosis of this measure might affect our findings, we log-transformed the variable. Because some of the values are zero or negative, the absolute value of the minimum observation in our sample plus 1 was added to transform the range of the observed distribution to positive values prior to transforming the measure.[7] Adding a constant to all observations does not change the distribution of the observations, but by making all values positive it allows us to transform this measure into its natural logarithm. The transformation significantly improved the distributional properties of the data, as the skewness and kurtosis for the transformed measure were −.31 and 5.4, respectively.

Analyst coverage

This measure is represented by the number of analysts following an IPO firm six months (for the six-month period) and 12 months (for the 12- and 24-month periods) after the initial public offering. Analysts are important information intermediaries (Rao et al., 2001; Zuckerman, 1999), and as such their coverage of a newly public firm can be helpful in legitimating the organization and allowing it to attract resources (Krigman et al., 2001). Preliminary analyses showed that the analyst coverage measure was highly correlated with our other predictor variables, which is consistent with prior research that has found relationships between these measures (e.g. Krigman et al., 2001; Rajan and Servaes, 1997). In order to avoid collinearity problems, we regressed each analyst coverage measure

on the other independent variables and used the residuals from this regression as an instrumental variable in our analysis (Cohen et al., 2003). To ease interpretation, the untransformed measure was used to calculate the descriptive statistics. The number of analysts covering a firm was obtained from the Compact Disclosure SEC database.

Control variables

Annual sales

Our analyses included a firm's total revenues in the year prior to the focal year to control for factors associated with firm size. Thus, for the six- and 12-month periods we used sales in the year prior to IPO, and for the two-year models we used sales in the year a company went public. We chose to use sales as our indicator of size because it was the most relevant indicator for this industry at this time. Firms involved in the internet boom were exhorted by the press and their financiers to 'get big fast' by growing their revenues as quickly as possible.

Market returns

This measure was the change in a firm's stock price from the end of the first day of trading to the end of the relevant period (i.e. six months, 12 months or two years following the IPO). The change in the first day's stock price was excluded because this measure was included as a separate independent variable. This measure was included to control for the visibility accorded a firm due to the market's subsequent evaluations, separate from its initial valuation.

Year dummies

Dummy variables were included to control for a variety of factors that could be associated with the year in which the company went public. The omitted year was 1995.

Sub-industry dummies

Although all of the companies in our sample are focused on the internet, within this broad category there are a number of distinct sub-industry classifications. Variations may exist in a firm's ability or need to form post-IPO strategic alliances based upon its sub-industry classification at the time of the offering. In order to control for factors associated with sub-industry type, we created a set of dummy variables based on the classification system used in *USA Today*'s internet 100 index. The adapted classification system yielded the following business types:

1. e-Infrastructure: data, voice and video carriers, web hosts, hardware suppliers;
2. e-Services/solutions: consultants, software/applications, back office services;
3. e-Advertising/marketing/media: internet advertising and research;
4. e-Retail: consumer products and services;
5. e-Finance: banks, brokers and credit companies;

6. e-New media: advertising/subscription-supported communities;
7. Internet service providers: toll-supported access providers;
8. Infomediaries: firms that act as liaisons between buyers and sellers and do not carry a significant amount of inventory; we further restrict the definition to include only firms that have a consumer on at least one side of the deal (i.e. business-to-consumer and consumer-to-consumer intermediaries);
9. Business-to-business: firms involved in business-to-business e-commerce.

E-Infrastructure was used as the omitted category.

Venture capitalist backing

Because not all firms in our sample received VC backing prior to going public, we include a dummy variable indicating whether a firm has received VC funding. VC involvement was determined using the firms' offering prospectuses.

Firm age

Firm age at IPO was calculated as the months since the firm's incorporation date. Younger firms are subject to a greater likelihood of failure for a variety of reasons (Hannan and Freeman, 1989; Stinchcombe, 1965). Older firms typically have greater levels of slack resources and have gone through more rounds of pre-IPO financing, and may be perceived as less risky by potential alliance partners. This variable was log-transformed to reduce the effect of extreme values on the analysis.

Number of pre-IPO alliances

The frequency with which firms form alliances prior to their IPOs can also provide valuable information to stakeholders about the offering firm (Stuart et al., 1999), as well as indicate a firm's propensity to form alliances post-IPO (Gulati, 1999). We therefore controlled for the number of pre-IPO alliances when predicting post-IPO alliances. This measure was calculated using the same data sources for the calculation of post-IPO alliances.

Total value of the IPO

This measure was the total number of shares offered during the IPO, multiplied by the offering price. The size of the offering can send signals to the market about the relative quality and stability of the offering, and is frequently used as a control by finance scholars conducting IPO-related research (Ibbotson and Ritter, 1995). This variable was log-transformed to reduce the effect of extreme values.

California dummy

This location variable was included to account for the fact that internet firms located in areas rich in technology-related activity have greater access to strategic alliance partners, and may be subject to more hype surrounding their IPOs. In our sample, 40 percent of the companies had their headquarters in California.

Method of analysis

Our dependent variable is a count of the number of post-IPO alliances. Count data are seldom normally distributed, thus violating a key assumption of OLS regression (Greene, 1993). In such cases, a Poisson distribution provides a more reasonable approximation. One limitation of the Poisson model is that it assumes that the variance of the expected event counts is equal to its mean, even though count data are often overdispersed, with the variance of the event counts exceeding their mean (Cameron and Travendi, 1986). This problem can be solved by using the negative binomial distribution, which estimates an additional parameter that corrects for overdispersion. In testing our models, we found that the negative binomial distribution was required for predicting post-IPO alliances.

Results

Table 1 presents the descriptive statistics and correlations for all the variables used in our analysis. Table 2 presents the results of the analyses predicting post-IPO alliances for the six-month, 12-month and two-year time periods. Hypothesis 1 suggested that the first-day run-up in a firm's stock price would be positively associated with the number of post-IPO strategic alliances. The results in Table 2 show that the market's initial response is not significantly related to the number of alliances after six months. However, it has significant effects in the 12-month and two-year models. Given that lag time may be necessary before the effects of this signal can be observed, this pattern of results is not surprising. Thus, the overall results provide general support for hypothesis 1.

Hypothesis 2 suggested that affiliation with prestigious underwriters and experienced VCs would be positively related to the number of post-IPO strategic alliances. The results presented in Table 2 show that underwriter prestige is only significant in the 12-month model, and the significance level is marginal ($p < .10$), providing limited support for hypothesis 2. VC age does not have a significant effect on the number of post-IPO alliances during the first six months; however, it becomes significant in the 12-month and two-year models, providing support for hypothesis 2. Thus, hypothesis 2 is partially supported overall, and more strongly supported for VC age than for underwriter prestige.

Hypothesis 3 predicted that the number of analysts following a company would be positively associated with the number of post-IPO alliances. Analyst coverage is positive and significant in the models for all three time periods. Thus, hypothesis 3 is strongly supported.

Finally, hypothesis 4 predicted that the effects of the endorsement signals on alliance formation would weaken more quickly over time than the effects of the initial market response and analyst coverage signals. The pattern of results observed in Table 2 provides partial support for this hypothesis. While only analyst coverage has a significant effect at six months, all of the variables show significant effects at

Table 1 Descriptive statistics and correlations

Variable	ID	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12
Alliances 6 mo.	1	1.11	1.89												
Alliances 12 mo.	2	2.34	4.44	.81											
Alliances 2 yr	3	3.57	7.50	.72	.93										
Sales year before IPO	4	14.58	38.43	−.07	−.06	−.05									
Sales year of IPO	5	39.42	75.22	−.04	.00	.02	.75								
Market return 6 mo.	6	1.06	2.25	.31	.36	.33	−.07	.00							
Market return 12 mo.	7	.38	1.84	.23	.26	.29	−.01	.07	.56						
Market return 2 yr	8	.05	1.55	−.07	−.07	−.04	−.01	−.02	−.13	−.04					
Pre-IPO alliances	9	4.93	6.83	.23	.23	.19	−.06	−.07	.07	.11	−.12				
ln firm age	10	3.69	.76	−.09	−.07	−.09	.09	.05	.06	−.03	−.13	.13			
ln offer value	11	4.02	.69	.13	.15	.15	.15	.22	.02	−.04	−.21	.14	−.04		
1996	12	.06	.23	−.03	.00	.04	−.07	−.09	−.11	−.06	.22	−.10	−.05	−.24	
1997	13	.05	.22	−.05	−.02	.04	−.04	−.03	−.03	.10	.37	−.11	.00	−.22	−.06
1998	14	.08	.27	.04	.02	.05	−.02	−.04	.07	.25	−.14	.04	−.06	−.13	−.07
1999	15	.57	.50	.15	.11	.03	−.07	−.06	.28	.09	−.09	−.03	−.03	.18	−.28
2000	16	.23	.42	−.21	−.20	−.19	.15	.17	−.31	−.30	−.14	.14	.09	.14	−.13
CA dummy	17	.40	.49	.10	.13	.13	−.04	−.04	.17	.07	−.01	.23	.08	.10	.03
Sub-ind. type 2	18	.40	.49	.04	.04	.04	.04	.06	.13	.08	−.05	.05	.16	−.08	.05
Sub-ind. type 3	19	.08	.27	−.06	−.05	−.05	−.06	−.07	−.03	−.04	.03	−.04	.04	−.10	.04
Sub-ind. type 4	20	.11	.32	−.03	−.08	−.07	.11	.12	−.10	−.11	.07	−.02	−.07	.05	−.09
Sub-ind. type 5	21	.02	.14	.00	−.02	−.03	−.01	−.03	−.06	−.05	.00	−.07	−.08	−.04	−.03
Sub-ind. type 6	22	.10	.30	.03	.06	.05	−.09	−.10	.00	−.02	.18	.10	−.15	−.02	.06
Sub-ind. type 7	23	.06	.23	−.07	−.04	−.02	−.01	−.04	−.11	−.04	−.01	−.01	−.04	.01	.03
Sub-ind. type 8	24	.04	.19	.00	−.01	−.01	.07	.06	−.04	−.03	.05	−.02	.05	.03	−.05
Sub-ind. type 9	25	.06	.24	.01	.06	.06	−.01	.02	.07	.08	−.08	−.03	−.05	.05	−.02
VC backed	26	.77	.42	.15	.14	.14	−.03	.05	.10	.05	−.17	.22	.13	.29	.02
VC age missing	27	.10	.30	−.02	−.04	−.05	−.03	−.02	−.01	−.06	.05	−.01	−.04	.04	−.01
Analysts 6 mo.	28	3.79	2.49	.21	.21	.23	.03	.12	.18	.09	−.06	.08	.00	.20	−.16
Analysts 12 mo.	29	4.67	4.13	.30	.37	.39	.01	.11	.37	.34	−.11	.06	−.04	.14	−.08
First-day run-up	30	76.59	95.38	.18	.21	.20	.01	.13	.31	.24	−.12	.14	.02	.34	−.11
Underwriter prestige	31	7.34	3.13	.17	.17	.15	.08	.04	.20	.13	−.10	.21	.05	.41	.00
VC experience	32	2.04	1.28	.13	.13	.12	−.01	.08	.09	.03	−.16	.17	.13	.28	.03

13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
−.07																		
−.26	−.33																	
−.13	−.16	−.62																
.01	−.03	−.02	.03															
−.01	−.03	−.12	.12	.08														
−.07	.05	.03	−.07	.02	−.24													
.06	.01	.05	−.03	−.03	−.29	−.10												
.05	−.04	.09	−.08	−.08	−.11	−.04	−.05											
.04	.06	.02	−.10	.00	−.27	−.09	−.12	−.05										
.04	.08	−.03	−.06	−.10	−.20	−.07	−.09	−.03	−.08									
−.04	−.01	.06	−.01	.00	−.16	−.06	−.07	−.03	−.06	−.05								
−.06	−.07	−.02	.12	−.03	−.21	−.07	−.09	−.04	−.08	−.06	−.05							
−.05	−.03	.01	.04	.23	.04	−.05	.04	−.05	−.05	−.01	−.08	.05						
.00	−.07	.13	−.09	.04	−.08	.08	−.02	.01	−.03	.09	−.02	.01	.19					
.02	−.09	.17	−.06	−.02	.01	−.08	.12	.00	−.05	.00	.07	.07	.06	.02				
.07	−.01	.09	−.10	.00	.07	−.14	.04	−.04	−.07	−.03	−.01	.11	.04	−.01	.71			
−.16	.03	.13	−.04	.14	.10	−.08	−.10	−.08	−.06	−.09	.01	.08	.16	.03	.00	.00		
−.07	.01	.09	−.08	.23	.07	.00	−.02	−.02	−.03	−.03	.04	−.08	.37	−.02	.00.	.00	.19	
−.04	−.04	−.03	.07	.23	.07	−.07	.05	−.02	−.06	−.05	−.09	.02	.87	.22	.00	.00	.17	.32

Table 2 Negative binomial regressions predicting number of post-IPO alliances

	6 months		12 months		1 year	
Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Sales[a]	−0.00	−0.00	−0.00	−0.00	0.00	−0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Market return[b]	0.12**	0.10**	0.12**	0.06	−0.04	−0.01
	(0.03)	(0.03)	(0.04)	(0.04)	(0.05)	(0.05)
No. of pre-IPO alliances	0.04**	0.04**	0.04**	0.04**	0.05**	0.03**
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Ln firm age	−0.34**	−0.40**	−0.23*	−0.21*	−0.30**	−0.25**
	(0.10)	(0.10)	(0.09)	(0.09)	(0.10)	(0.09)
Ln offer value	0.30*	0.10	0.42**	0.18	0.47**	0.19
	(0.13)	(0.15)	(0.11)	(0.13)	(0.12)	(0.12)
1996 dummy	−0.66	−0.72	−1.05*	−0.63	−1.08*	−0.55
	(0.51)	(0.53)	(0.48)	(0.47)	(0.49)	(0.46)
1997 dummy	−0.91†	−0.86	−1.18*	−0.81†	−0.49	−0.27
	(0.53)	(0.53)	(0.50)	(0.48)	(0.51)	(0.47)
1998 dummy	−0.81†	−0.55	−1.50**	−1.06*	−1.23**	−0.90*
	(0.47)	(0.48)	(0.48)	(0.47)	(0.48)	(0.44)
1999 dummy	−0.87*	−0.64	−1.33**	−0.91*	−1.55**	−1.17**
	(0.42)	(0.42)	(0.42)	(0.40)	(0.42)	(0.39)
2000 dummy	−1.94**	−1.68**	−2.61**	−2.02**	−3.02**	−2.32**
	(0.46)	(0.47)	(0.45)	(0.44)	(0.45)	(0.42)
CA dummy	−0.02	−0.06	0.15	0.01	0.21	0.04
	(0.15)	(0.15)	(0.14)	(0.14)	(0.14)	(0.14)
Sub-ind. type 2	0.14	0.16	0.52*	0.44*	0.35†	0.31
	(0.22)	(0.23)	(0.21)	(0.21)	(0.21)	(0.20)
Sub-ind. type 3	−0.13	−0.13	0.41	0.48	0.22	0.34
	(0.35)	(0.35)	(0.32)	(0.32)	(0.32)	(0.31)
Sub-ind. type 4	−0.04	−0.09	0.05	0.03	−0.21	−0.18
	(0.29)	(0.30)	(0.28)	(0.28)	(0.28)	(0.26)

Sub-ind. type 5	(0.32)	(0.28)	(0.23)	(0.20)	−1.43*	−1.32†
	(0.52)	(0.52)	(0.54)	(0.52)	(0.70)	(0.68)
Sub-ind. type 6	−0.12	−0.04	0.59*	0.73**	0.44	0.56*
	(0.29)	(0.29)	(0.27)	(0.27)	(0.28)	(0.26)
Sub-ind. type 7	−0.51	−0.47	−0.08	0.11	0.04	0.31
	(0.39)	(0.40)	(0.33)	(0.33)	(0.36)	(0.34)
Sub-ind. type 8	0.35	0.30	0.52	0.55	0.68†	0.77*
	(0.42)	(0.42)	(0.40)	(0.38)	(0.41)	(0.38)
Sub-ind. type 9	−0.01	0.03	0.54†	0.63*	0.68*	0.64*
	(0.35)	(0.36)	(0.31)	(0.31)	(0.30)	(0.29)
VC backed	0.50*	0.16	0.50**	−0.26	0.75**	−0.14
	(0.21)	(0.36)	(0.19)	(0.34)	(0.20)	(0.33)
VC missing	−0.15	−0.19	−0.24	−0.23	−0.45*	−0.36†
	(0.24)	(0.24)	(0.22)	(0.22)	(0.23)	(0.22)
No. of analysts[c]		0.09*		0.07**		0.09**
		(0.03)		(0.02)		(0.02)
First-day run-up		0.07		0.19†		0.30**
		(0.11)		(0.10)		(0.10)
Underwriter prestige		0.03		0.05†		0.04
		(0.03)		(0.03)		(0.03)
VC experience		0.12		0.27*		0.31**
		(0.12)		(0.11)		(0.11)
Constant	0.25	0.48	0.21	−0.44	0.80	−0.23
	(0.76)	(0.87)	(0.73)	(0.80)	(0.76)	(0.81)
Log-likelihood	−536.36	−523.63	−704.60	−671.89	−698.52	−658.92
Observations	409	404	388	368	318	304

Notes:
† significant at 10%; * significant at 5%; ** significant at 1%.
[a] Sales for six and 12 months year before IPO; sales for 24 months are in year of IPO.
[b] Market returns in each model are for the respective period (six months, 12 months and 24 months).
[c] Number of analysts at the end of six months for models 1–2 and 12 months for models 3–6.

12 months, and three of the four continue to have significant effects at two years, with prestigious underwriter endorsement as the non-significant variable.

Because the alliance formation measures are cumulative, in that the measure for all alliances formed during the two years following the IPO subsumes the measures we use for all alliances formed six months and one year after IPO, it is possible that the effects observed over the longer time periods are being driven largely by the early influence of the signals. In order to explore this issue further, we conducted an additional analysis and used our current model specifications to predict the number of alliances formed between six months and one year, and the number of alliances formed between one year and two years, controlling for the number of alliances formed in the prior period. The results of this analysis are presented in Table 3. Model 2 in Table 2 effectively measures the influence of the signals on alliance formations from zero to six months. The pattern of results observed in Table 3 show that the signaling effects of the first-day run-up in stock price become stronger over time and the signaling effects of analyst coverage are strongest in the earlier periods, have no significant effect during the six- to 12-month period, but then once again have a positive and significant effect on the number of post-IPO alliances during the second year, although the effects are somewhat weaker during the latter period. In contrast, the signaling effects of VC age are strongest during the period between six and 12 months but weaken thereafter, and are not significant in the later period. Underwriter prestige does not have significant effects in any of the models. This pattern of results is generally consistent with our hypotheses, in that neither endorsement signal has an effect on alliance formations during the second year after the IPO, while both the initial market response and analyst coverage continue to have significant effects on the number of alliances formed during the later period.

Discussion

Our goal has been to explore how different signals in contexts of asymmetric information influence an organization's ability to acquire resources from its external environment by enhancing its visibility and reducing uncertainty. We also examined the extent to which the effects of these signals endure or decay over time. We focused on the effects of signals resulting from the initial run-up in stock price on the day of a firm's IPO, analyst coverage and a focal firm's affiliations with prominent and experienced institutional intermediaries, and explored the effect of each of these signals on firms' abilities to form post-IPO strategic alliances. The results of our analysis generally suggest that these signals increased a young firm's ability to form strategic alliances subsequent to its IPO. Further, our results also suggest that the effects of the different signals vary in longevity.

An important contribution of our study is our assessment of the role of multiple signals in simultaneously shaping entrepreneurial firms' post-IPO actions. Our results indicate that signals originating from prominent affiliations

Table 3 Negative binomial regressions predicting change in post-IPO alliances

Variables	6–12 months Model 1	12–24 months Model 2
Sales[a]	−0.00	0.00
	(0.00)	(0.00)
Market return[b]	0.10*	−0.00
	(0.05)	(0.06)
No. of alliances 0–6 mo.	0.21**	0.08**
	(0.04)	(0.02)
No. of pre-IPO alliances	0.02	0.02
	(0.01)	(0.01)
Ln firm age	0.01	−0.13
	(0.12)	(0.12)
Ln offer value	0.38*	0.47**
	(0.16)	(0.17)
1996 dummy	0.79	0.85
	(0.61)	(0.65)
1997 dummy	0.67	1.43*
	(0.61)	(0.66)
1998 dummy	0.39	0.51
	(0.62)	(0.65)
1999 dummy	0.17	−0.59
	(0.54)	(0.60)
2000 dummy	−0.65	−1.44*
	(0.61)	(0.68)
CA dummy	0.16	0.03
	(0.17)	(0.18)
Sub-ind. type 2	0.64*	0.21
	(0.26)	(0.26)
Sub-ind. type 3	0.93*	0.30
	(0.39)	(0.40)
Sub-ind. type 4	−0.03	−0.45
	(0.37)	(0.35)
Sub-ind. type 5	0.27	−0.20
	(0.68)	(1.17)
Sub-ind. type 6	1.20**	0.36
	(0.32)	(0.34)
Sub-ind. type 7	0.65	0.04
	(0.41)	(0.45)
Sub-ind. type 8	0.42	0.65
	(0.48)	(0.48)
Sub-ind. type 9	1.12**	0.29
	(0.36)	(0.37)
VC backed	−0.59	0.36
	(0.43)	(0.43)
VC missing	−0.27	−0.48
	(0.28)	(0.30)
No. of analysts 12 mo.	0.03	0.04†
	(0.02)	(0.02)
First-day run-up	0.18	0.37**
	(0.13)	(0.14)

(*Continued*)

Table 3 (Continued)

Variables	6–12 months Model 1	12–24 months Model 2
Underwriter prestige	0.05	0.00
	(0.04)	(0.04)
VC experience	0.28*	0.07
	(0.14)	(0.13)
Constant	−4.21**	−3.79**
	(1.07)	(1.12)
Log-likelihood	−468.25	−392.17
Observations	368	304

Notes:
† significant at 10%; * significant at 5%; ** significant at 1%.
[a] Sales for six and 12 months year before IPO; sales for 24 months are in year of IPO.
[b] Market returns in each model are for the respective period (six months, 12 months and 24 months).

and through salient and visible events over which the firm may have limited control can shape firm actions in subsequent periods. We find that a substantial run-up in stock price on the day of a focal firm's IPO increases its propensity to enter into new alliances following the IPO. Analyst coverage also appears to play a significant role in enhancing a newly public firm's proclivity to form alliances, suggesting that the well-covered company is able to attract alliance partners more easily. In highly uncertain environments where resources can be scarce and firms have limited time to achieve success, signals that help young companies stand out from the crowd and put them on a positive trajectory can turn early predictions of success into self-fulfilling prophecies, especially in winner-take-all markets (Frank and Cook, 1995).

It is important to recognize that we have explored these dynamics in a highly uncertain and rapidly changing new market environment, and that we cannot differentiate the relative benefits of each signal in terms of visibility enhancement and uncertainty reduction. Future research should continue to explore these issues, endeavoring not only to tease apart the relative benefits of visibility enhancement and uncertainty reduction provided by the myriad signals a firm can provide to potential partners, but also to examine the extent to which such signals have the same effect in less dynamic markets.

Another important contribution of this study is our consideration of the longevity of signal-related effects. While our results are preliminary and thus should be interpreted with caution, they do suggest that signals differ in the extent to which their effects decline over time. The influence of the initial run-up in stock price on the number of alliances formed appeared to grow over our period of study. This finding is consistent with the prediction that this signal's effects are likely to persist (Kuran and Sunstein, 1999; Tversky and Kahneman, 1974). Similarly, the signaling effects of analyst coverage also endured, although they did appear to diminish somewhat over time. VC experience failed to have a significant effect during the first six months, but had a significant influence thereafter on the number of alliances formed, at least during the year following the IPO. This may be because experienced VCs, rather than serving merely as symbolic certifiers, also actively

help their portfolio firms establish strategic alliances (Hsu, 2006). For example, Kleiner Perkins Caufield and Byers, one of the most prominent VC firms in Silicon Valley, is very proud of the *keiretsu* of firms that it has helped fund (Warner, 1998), which are linked via a combination of strategic alliances and interlocking board directorates. Kleiner Perkins even features its *keiretsu* firms and the relationships among them prominently on its website. Recent research has also found evidence of the VC *keiretsu* effect in shaping patterns of alliance formations (Lindsey, 2004). Thus, an experienced VC's longer-term value may arise largely from significant access to its network of portfolio companies – access that may endure even after a firm in which it has invested goes public. Future research should give greater consideration to which relationships provide not only signals but also such substantive resources, and continue to explore and delineate the substantive and symbolic benefits of third-party endorsements.

In contrast to the influence of VC experience, underwriter prestige had a different pattern of influence on the number of post-IPO alliances formed by firms. Underwriter prestige only had a significant relationship with the number of alliances formed in one of our models in Table 2, and did not demonstrate a significant influence in our supplemental analyses presented in Table 3. Our results are consistent with prior research that has established the power of underwriter prestige as a signal in the short term when conditions are most uncertain (Carter and Manaster, 1990; Pollock and Rindova, 2003), but not for longer-term outcomes. It may be the case that this signaling effect is not particularly durable because, unlike VCs, an underwriter's substantive influence on the operations of the company is not likely to be great, and because unlike investors, underwriters generally bear little real financial risk in handling the offering (Chen and Ritter, 2000). Future research should continue to consider this issue by exploring the durability of different types of signals on a wider variety of outcomes, over varying periods of time, and with inclusion of the actual costs of the different signals.

Finally, our study also contributes to the growing literature on the antecedents of alliance formation (e.g. Gulati, 1998, 2007; Powell et al., 1996; Rosenkopf et al., 2001; Stuart, 1998). While much research in this area has focused on structural features of networks, such as actor centrality or relationships with common partners, as factors influencing alliance formations (e.g. Gulati, 1999; Gulati and Gargiulo, 1999), our study illustrates how signals provided by highly visible and salient firm experiences can also act as catalysts for alliance formation. Future research should continue to explore factors that influence the search-related and decision-making activities of firms engaging in alliances.

Additional future research directions

In this study, we have focused on signals that were especially important in our research context. However, there are other ways that firms can attempt to influence resource providers – such as impression management (Elsbach, 1994; Elsbach and Kramer, 1996) or manipulation of the media (Pollock and Rindova, 2003) – that were not considered in our analysis. We also did not focus on how

other characteristics of firms undertaking IPOs, such as their centrality in alliance networks and degree of innovativeness, could serve as signals and influence alliance formation. Alternative research contexts that allow scholars to consider a wider variety of signals, or that focus on reducing types of uncertainty other than those that exist in the IPO market, could lead to different patterns of relations and longevity. Our consideration of the simultaneous effects of multiple signals and how these shift over time will hopefully encourage others to follow suit and continue to broaden the sets of signals considered and their patterns of deterioration (e.g. Hsu and Ziedonis, 2007).

A related limitation of our study, which is shared with many studies that try to identify the effects of signals on firm behavior and outcomes, is that it is possible that the pattern of results observed is not due to relationships between our predictor variables and alliance formations, but instead emerges from correlations between these measures and unmeasured features of firm quality. While this is a possibility, we control for a number of firm-quality characteristics, including firm sales, post-IPO market performance, offer value, industry membership, geographic location, firm age and the year in which the firm went public. Further, we chose the context of our study specifically because the qualities a firm needed to possess in order to be successful were not well understood during this early period of industry development, thereby increasing the levels of asymmetric information and concomitant uncertainty. Nonetheless, future research should develop more complex sets of firm-quality controls when exploring these issues in this and other contexts.

Although we have tried to control for multiple potential sources of endogeneity, as in most studies of signaling we cannot account for all possible sources. Future research may therefore continue to explore possible endogenous relationships among the constructs we have identified. For example, scholars may want to continue to explore the factors that lead to both high levels of underpricing and post-IPO alliance formations. Although we attempt to control for some of the factors identified in the growing body of research on the rationale for and antecedents of underpricing (e.g. start-up quality and underwriter reputation), it would be worthwhile to consider the possibly endogenous nature of underpricing, post-IPO alliance formation and other factors.

Another set of future research directions relates to the dependent variable used in this study. Our analysis focused on the number of alliances formed following the IPO. Given that the importance of alliances for resource acquisition was especially significant in this industry context (Hagedoorn, 2002; Halevy, 2000; Lavie, forthcoming), and that our interest lay in how the visibility-enhancing and uncertainty-reducing capabilities of signals influenced firms' abilities to acquire resources following their IPOs, focusing on the number of alliances formed was appropriate. Future research could elaborate on other factors that may drive the rate at which alliances are formed by newly public companies, while also extending the post-IPO time period in question. Another related issue arises from the fact that we were unable to determine if and when alliances were terminated, and thus considered only the number of alliances formed, rather

than the number of active alliances a firm was involved in at any given time. The significant challenges of collecting data on alliance terminations have inhibited the pursuit of such questions in most studies of alliances. While we did not explore this issue directly, in our supplementary analysis in Table 3 we did explore the effects of the signals on alliance formation within each time period, controlling for the number of alliances formed in the prior period, which does take the 'carrying capacity' of the IPO firm into account, to some extent. Nonetheless, future research should continue to explore these important issues.

Further, we did not differentiate among distinct types of alliances (e.g. marketing, technology licensing, R&D), or explore whether particular types of signals are more or less effective at facilitating the formation of specific kinds of relationships. In addition, substantial time lags exist between when the signals are provided and when their effects on alliances are likely to be observed. However, because this time lag should make it more difficult to observe signaling effects, our analysis is a conservative test of our hypotheses. Finally, the effects of the signals considered in this study could differ in their ability to promote the acquisition of other types of resources. Future research should continue to explore and extend our findings by taking a finer-grained look at whether different types of alliances, or different types of alliance partners, are influenced to a greater or lesser degree by different types of signals. Future research should also consider the effects of signals in other time periods and other empirical contexts where the relationship between the signals provided and the outcomes observed are more temporally proximal.

A further exploration of alliance formation patterns would be to consider ways to separate out the effects of antecedent signals in increasing the propensity of a firm to enter into alliances and in their ability to attract partners that want to enter into alliances with a focal firm. In this study, we consider the association between the signals and the firm's proclivity to enter into future alliances, but are not able to unpack this relationship: that is, whether the proclivity is driven by the firm's willingness to enter into new alliances as opposed to the interest of prospective partners in allying with the focal firm. Clearly, for a firm to successfully enter into an alliance, both the firm and a potential partner must wish to ally simultaneously. Future research can seek creative ways to unpack these effects and consider the role of various signals in shaping each of these factors that influence alliance formations.

Another future research direction is the consideration of how signals may combine in additive or substitutive ways to influence the number of alliances formed (e.g. Gulati and Higgins, 2003; Lee, 2001). To address this issue, in analyses not reported here we interacted our signal measures and included these interaction terms in all of our models. None of the interactions were significant, suggesting that the potential for moderated relationships was not high in our particular context. However, future research should continue to explore the potential for non-linear relationships among multiple signals and may find results of varying form and significance across different contexts.

Finally, it is also important to recognize that our study explored the effects of signals related to young organizations in an emerging industry, and coincided with a 'market bubble' (Abolafia and Kilduff, 1988) in which investors became overly – some would even say irrationally (e.g. Aggarwal and Rivoli, 1990) – exuberant about the prospects for internet firms. While this context offered a number of advantages for testing our arguments, it may limit the generalizability of our results. It is possible that a different pattern of results might emerge in other contexts, where additional signals are available, and/or where the need for signals that reduce uncertainty and enhance visibility may be less pronounced. We hope that this study will encourage future research into such dynamics in varying market contexts.

Conclusion

This study extends research on the role of signaling in market activities by taking a more integrative approach to evaluating the influence of alternative signals and exploring how these signals combine to influence a firm's access to strategic alliances following its IPO. This study also opens up new avenues for research on signaling by recognizing that signals have visibility-enhancing properties that can influence the behavior of firms and their partners in subsequent time periods, and that these influences decay to varying degrees as time unfolds, taking us a step forward in our understanding of how economic markets are socially constructed.

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Notes

1 There is a rich body of research on the antecedents of alliance formation (e.g., Gulati, 1999, 2007; Gulati and Gargiulo, 1999), a topic beyond this article's scope.

2 It is possible that the extremity of first-day run-ups during this period made this signal particularly relevant. However, as we discuss later, a variety of studies using samples predating the internet boom have found significant effects of greater than average run-ups on a variety of outcomes.

3 There is a rich body of research by finance scholars on the market inefficiencies and information asymmetries leading to the 'underpricing' of stock (see Loughran and Ritter (2004) and Ritter and Welch (2002) for reviews). However, our focus here is not on why these run-ups

in stock price occur, nor whether they are perceived as rational, and we make no claims about why a particular level of first-day run-up in price occurs. Instead of studying their antecedents, our focus is on the consequences of run-ups for visibility enhancement and reduction of perceived uncertainty. We discuss possible endogenous effects that future research can explore in this context later in the article.

4 Analysts' reports during this period, especially those issued by star internet analysts such as Mary Meeker and Henry Blodgett, were widely disseminated and discussed (Reingold, 2006).

5 IPO.com itself was a victim of the bursting internet bubble and ceased operations in 2003. However, prior to ceasing operations, it represented a comprehensive source of information on the IPO market.

6 As noted later, we also control separately for whether a firm has received venture financing, allowing us to further control for differences between firms that received financing from young VC firms and those that received no VC financing.

7 All percentages were first multiplied by 100 to avoid issues with values less than 1. Thus, if a firm's run-up in stock price on the first day was 75 percent, the value to which the constant was added would be 75.

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