



SORTING THINGS OUT: VALUATION OF NEW FIRMS IN UNCERTAIN MARKETS

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New business models combined with a lack of objective operating data result in significant information asymmetry and uncertainty in the valuation of new firms in emerging markets. Information asymmetry increases the risks of both adverse selection and moral hazard. When traditional differentiators of firm quality are lacking, such as in emerging economic sectors, markets may turn to secondary information sources to filter and sort firms. We investigate the roles played by observable corporate governance characteristics as indirect indicators of new firms' potential qualitative differences. Markets may sort firms based on such characteristics because they are perceived to be correlated with desired but unobservable characteristics and actions and they lower the risks of both adverse selection and moral hazard. Our study of publicly traded U.S. Internet firms found that firm market valuation was strongly associated with corporate governance characteristics (e.g., executive and director stock-based incentives, institutional and blockholder stock ownership, board structure, and venture capital participation). In addition, firm age moderated how markets used some quality proxies to determine firm valuation during the post-IPO period. Copyright © 2003 John Wiley & Sons, Ltd.

Shareholders face many hazards investing in new businesses, but uncertainty is compounded when firms operate in new economic sectors (Aldrich and Fiol, 1994). Many years of data are typically available on established firms and their competitors. Additionally, professional education and training of institutional investors (e.g., mutual and pension fund managers) and investment bankers serve to diffuse knowledge and skills in standard valuation practices (DiMaggio and Powell, 1983). Markets typically rely on this codified knowledge and detailed analysis of financial, economic, and market data to reduce information asymmetry regarding inherent quality and to value firms (Reilly and Brown, 1999) because

such information reduces governance uncertainty (Alchian and Woodward, 1988; Boisot and Child, 1996). However, during the emergence of new industries, investors and analysts lack a codified body of knowledge and industry-specific experience. In these contexts, firms often operate with new and unproven business models and compete against many rival start-ups, all jockeying for early market dominance. Information asymmetry is particularly problematic in new economic sectors because managers have great discretion over scarce financial capital and investors are inexperienced in these domains (Alchian and Woodward, 1988). Two forms of opportunistic behavior that can arise from information asymmetry, adverse selection (i.e., hidden information) and moral hazard (i.e., hidden actions) (Nayyar, 1990; Stiglitz, 1985), are compounded by the uncertainty of new economic sectors. Consequently, when valuing new firms in emerging industries investors are likely to turn

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their attention to secondary sources of information to help identify qualitative differences across firms.

Determining the value of new firms in emerging industries is a vexing problem for investors because of asymmetric information and its associated risks of adverse selection and moral hazard. While these are two distinct forms of risk, both types of risk arise because of the asymmetry of information between a principal and an agent (Hertzel and Smith, 1993; Stiglitz, 1985). In the case of adverse selection, the asymmetry is about qualitative differences in initial conditions, while for moral hazard the asymmetry is about unobserved actions. When information asymmetry is high, prices are typically discounted (Riley, 1989). However, price premiums can still be achieved in such markets if buyers have access to alternative types of data that reduce information asymmetry and which help differentiate new firms of varying quality (Spence, 1974). Thus, in emerging market sectors with high levels of uncertainty investors are likely to shift emphasis from objective financial and operating data, which is lacking or not well understood, to indirect, secondary information sources that are better understood. One type of secondary indicator that may convey valuable information to investors about both hidden information and hidden actions is corporate governance. This paper investigates how indirect but observable indicators of potential value, such as corporate governance mechanisms, may be used to reduce investor uncertainty regarding the risks of adverse selection and moral hazard and thus be used by investors to sort new companies into different valuation strata.

We focus our empirical inquiry on the degree to which corporate governance is associated with both initial public offering (IPO) and post-IPO market valuations of new firms in a new industry context. The following section outlines the development of hypotheses which suggest that corporate governance features provide indirect information to investors in contexts afflicted with significant information asymmetry. We then detail our empirical analyses and discuss results.

CONCEPTUAL DEVELOPMENT

Observable secondary information sources

Corporate governance mechanisms can serve as useful sorting criteria that influence investors'

valuation orderings of firms in new industries when unequivocal indicators of quality are lacking or are unobservable. Signaling theory proposes that firm attributes contain information that reduces investors' uncertainty about intrinsic quality (Spence, 1974). Likewise, screening theory suggests that when buyers cannot access unambiguous information regarding intrinsic quality, they filter alternative offerings based on the presence of other attributes assumed to be correlated with desired, but unobserved, characteristics and actions (Weiss, 1995). Signaling and screening serve to help buyers 'sort' products or services according to desired but unobserved qualities or abilities (Weiss, 1995: 134). In a related manner, according to institutional theory, organizations can positively affect stakeholders' perceptions by adopting organizational structures, designs, and practices that conform to social norms (Meyer and Rowan, 1977). Because normatively appropriate corporate governance mechanisms are widely believed to be associated with efficient organization (Shleifer and Vishny, 1997), investors may use such characteristics as secondary sources of information to help form opinions about the intrinsic value of new firms. Thus, corporate governance mechanisms provide secondary sources of information to investors and thereby affect perceptions of quality and expectations of underlying value. Moreover, consistent with both signaling theory (Spence, 1974) and institutional theory (Stuart, Hoang, and Hybels, 1999), such effects should be strongest when uncertainty is greatest.

Signaling

Signaling theory suggests that activities or attributes can qualify as credible indicators of potential quality that alter the belief of, or convey information to, other individuals in the market (Spence, 1974). Signals allow economic actors to communicate that they are qualitatively different from other actors. Signals are effective at altering perceptions when they cause buyers to believe there are fundamental differences across sellers. Some signals are effective because they imply a certification by other parties, such as the attainment of an academic degree. Alternatively, signals can be effective if they transfer risk from buyers to sellers. Sellers may be able to achieve quality price premiums if they can signal through risk transfer or certification that the cost of doing so is less for them than for

other sellers of lesser quality (Spence, 1974; Riley, 1989). Signaling theory has been used to explain product warranties (Akerlof, 1970), labor markets (Spence, 1974), faculty pay (Gomez-Mejia and Balkin, 1992), insurance markets (Rothschild and Stiglitz, 1976), corporate finance and dividend policy (Ross, 1977), the choice of independent auditors (Titman and Trueman, 1986), and the underpricing of IPOs (Certo, Daily, and Dalton, 2001). Hence, theory suggests that idiosyncratic attributes and characteristics may substitute for unavailable objective financial and operating data by signaling quality and thereby resulting in the market sorting the valuation of new firms.

Screening

Screening theory is the mirror image of signaling theory—it differs from signaling in the assumption of which party moves first. While signaling theory focuses on the informed seller moving first, screening theory assumes that uninformed buyers actively use filtering routines (Weiss, 1995). Like signaling theory, screening theory was developed in the context of labor markets. Employers may actively screen applicants based on some observed characteristic when the truly desired attribute is unobservable. For instance, perseverance (e.g., low quit rates, low absenteeism) is a characteristic known to affect worker productivity (Klein, Spady, and Weiss, 1991). But since perseverance is not directly observable, firms reward high school graduation because it is observable and is associated with perseverance. Importantly, screening theory suggests that it is not necessarily the possession of the surrogate that affects productivity (i.e., the additional learning accomplished between eleventh and twelfth grade has little bearing on productivity). Rather, screening theory suggests that employers have come to perceive that some observable attributes are associated with the desired but unobservable characteristic. Consequently, screening theory also suggests that markets may use surrogate indicators of quality as effective sources of information cues that help to filter and screen new firms in emerging industries.

Legitimacy

Several streams of research in institutional theory suggest that secondary indicators of quality are used when uncertainty shrouds the observation of

true indicators. At the most basic level, institutional theory holds that organizations can obtain legitimacy by adopting organizational structures, designs, and practices that conform to social norms (Meyer and Rowan, 1977). Branching out from these early arguments, theorists have also proposed that firms' exchange relationships with prestigious parties often affect perceptions of the focal firm's quality. For instance, Stuart *et al.* (1999) reported that affiliations with prominent strategic alliance partners and venture capital firms allow new biotechnology companies to earn greater valuations at IPO. Baum and Oliver (1991) found that ties to important institutions allow young organizations to gain legitimacy and acquire resources. Building on the idea that reputation is socially constructed, Rao (1994) found that victories in certification contests convey legitimacy, generate status orderings, and create favorable reputations. Fombrun and Shanley (1990) found that a broad range of both social and economic cues predict reputational orderings. Consequently, institutional theory suggests that, for a new venture, legitimacy can be gained and perceptions of firm quality enhanced through secondary and potentially symbolic sources of information.

Socio-economic sorting

Taken in concert, the various theoretical perspectives reviewed suggest a socio-economic perspective of market sorting in uncertain contexts. In circumstances characterized by significant uncertainty, markets may sort firms based on observed social and economic structures, which serve as secondary sources of information that may be used to reduce information asymmetry. The secondary sorting characteristics markets use are likely to be observable, have perceived correlations with true, but unobserved, drivers of value, and vary across firms. In the next section, we develop arguments and hypotheses to propose that institutionally legitimate and observable governance characteristics serve as secondary sources of information (i.e., signals) and screening filters. These signals and filters affect investors' valuation sorting and price discrimination among new firms in emerging industries.

In emerging industries, there may be qualitative differences in firms which are not indicated by objective financial and operating data. Thus, firm valuations, which are usually based largely on

such objective data, may bear little resemblance to operating differences across new firms. Brief operating histories may not offer enough data from which to determine qualitative differences across firms. Furthermore, when a new economic sector is propped up by exuberant investor expectations, the likelihood of new firms emerging that lack the fundamental quality necessary to survive and prosper increases significantly. Thus there may be real differences in both the *ex ante* risk (i.e., adverse selection problem) and the likely post-investment behaviors of firms (i.e., the moral hazard problem) that are not easily distinguishable in emerging markets. Consequently, in the context of an emerging economic sector, markets are likely to search for alternative means to sort new firms.

We go beyond the traditional view of agency control mechanisms: we argue that in highly uncertain environments investors attempt to reduce their uncertainty through screening firms and sorting their valuations based on new firms' use of observable agency control mechanisms. Investors are likely to evaluate secondary sources of information, such as firms' corporate governance profiles, and make inferences in attempts to reduce information asymmetry. Corporate governance mechanisms may allow investors in such information-starved contexts to make inferences about both the initial quality of firms (i.e., adverse selection) and variance in post-investment behaviors (i.e., moral hazard problem). Moreover, these inferences and market sorting effects should go beyond efficiency effects. Indeed, sorting effects should be evident even when efficiency effects have yet to materialize. However, as uncertainty is reduced, the importance of these observable proxies should diminish. Thus the presence of normatively appropriate governance mechanisms should result in price premiums (i.e., higher valuations) due to anticipated efficiency effects.

Common agency control mechanisms can be indicative of qualitative differences between new firms because they are observable to outside investors, they are widely believed to be beneficial to shareholders, and their use varies significantly. Because there is evidence that some governance mechanisms may operate as substitutes for others (Beatty and Zajac, 1994; Rediker and Seth, 1995; Zajac and Westphal, 1994), it is important to examine several major corporate governance mechanisms and not focus exclusively on a limited set of mechanisms. We now turn our attention

to how various agency control mechanisms may satisfy the conditions of effective sorting criteria and affect how markets value Internet firms.

Stock-based incentives

Investors may use the presence of stock-based incentives to sort new firms for three reasons: incentives transfer risk; risk transfer is a signal of both managerial and firm quality; and incentives grant legitimacy. Stock-based incentives are observable to outside investors, as firms must disclose the ownership and compensation arrangements of top management. In addition, even among new firms in emerging industries, the use of stock-based incentives varies significantly. We review each of these rationales to suggest that markets favor new firms in emerging industries that use stock-based incentives in the compensation of top executives.

There are two risk-related aspects of stock-based incentives that suggest investors may partially base their sorting of investment opportunities on firm incentive structure. First, incentives like stock ownership and stock option pay require that executives and directors share in the risk of firm failure or success with shareholders (Beatty and Zajac, 1994; Holmstrom, 1987). Executives in high-quality firms should be willing to take on more risk in their remuneration than those in low-quality firms because firm quality reduces their personal risk exposure. Indeed, the risk transferred to executives in high-quality new firms through stock-based incentives is significantly less than in low-quality new firms. Seeing that some risk has been transferred to management, investors may infer that the risk sharing is a signal of firm quality.

Second, the risk transfer properties of stock-based financial incentives also serve as managerial certifications of quality. All else equal (e.g., level of pay), risk-averse executives prefer safe forms of compensation (Finkelstein and Hambrick, 1996)—executives with a total pay package worth one million dollars would prefer that the entire compensation be paid in cash, rather than have large portions of the pay be contingent on future performance. Even if executives desire to invest in the firm, they could purchase stock or options with part of their salaries. Across firms of varying quality, risk-averse executives in high-quality firms will much more likely accept greater stock-based incentives than will risk-averse executives

in low-quality firms because stock options have a high probability of pay-off in high-quality firms. As a result, executives in high-quality firms should more likely have a greater proportion of their wealth tied to stock-based performance. Likewise, outside directors that own significant stakes signal that they have tremendous confidence in the firm because they are willing to invest personal funds in the firm.

In addition to signaling a higher-quality firm, stock-based incentives may also signal higher-quality management. The upper-echelons perspective suggests that executives have material effects on firm outcomes (Finkelstein and Hambrick, 1996). If managerial quality varies, high-quality management will more likely achieve better performance than will low-quality management. While stock-option pay imposes risk on management, executives' risk of not getting the desired return on stock options is partially a function of their personal efforts and talents. Accordingly, the risk associated with stock-based financial incentives is lower for a high-quality manager than it is for a low-quality manager (Wiseman and Gomez-Mejia, 1998). Likewise, this lower risk imposes lower costs on the high-quality manager than on a low-quality manager. Thus, investors may infer that stock-based financial incentives attract high-quality management. Information about managerial quality is critical because executive talent is mobile and managers have more information about quality than do investors, particularly in human-capital, knowledge-based industries (Aboody and Lev, 2000).

Beyond risk transfer, stock-based incentives may be useful as a sorting criterion because such incentives have achieved normative, taken-for-granted status among many financial community constituents—markets expect stock-based incentives to have positive effects on shareholder wealth. Murphy (1999) concludes that this widespread belief in management incentives underlies the thrust toward greater use of stock-based pay by U.S. firms in the past decade. Empirical evidence provides support for the idea that markets expect positive effects from stock-based incentives. Bhagat, Brickley, and Lease (1985) and Yermack (1997) found positive abnormal returns (e.g., returns after accounting for all market effects) for firms adopting stock-based incentives. Hambrick and Jackson (2000) reported that outside director ownership was significantly greater in

high-performing firms than in low performers. These positive associations between incentives and firm performance give credence to Murphy's (1999) contention that there is widespread belief in the positive effects of managerial incentives.

In summary, stock-based incentives are observable corporate governance mechanisms that vary across firms, even in emerging industries. They may act as secondary indicators of potential value and thus be used by investors to sort new companies into different valuation strata because they provide information to investors suggesting that they are associated with unobserved quality. Investors in new firms in new industries are likely to use information about stock-based incentives as an observable characteristic that may substitute for more unobservable indicators of firm quality. Consequently, information about stock-based incentives should affect investors' valuation and share pricing among new firms in emerging industries. This logic leads to the following hypothesis:

Hypothesis 1: The intensity of stock-based financial incentives (e.g., executive stock option pay, executive stock ownership, and outside director stock ownership) will be positively associated with market valuations of new firms in new industries.

Ownership structure may also act as an effective market-sorting criterion. Some forms of ownership structure are less expensive for high-quality firms than for firms of low quality. Prior research has found that ownership structure reduces agency costs (Bethel and Liebeskind, 1993; Shleifer and Vishny, 1997; Thomsen and Pedersen, 2000). For instance, large shareholders can pressure management to avoid value-destroying strategies (e.g., diversification) and thereby increase firm performance (Amihud and Lev, 1981). Large shareholders should also be able to monitor executives in the nascent industries to a greater extent than less powerful and more dispersed shareholders can. We extend prior work on ownership structure by arguing that when valuing new firms markets will prefer some ownership profiles to others. We examine three distinct forms of ownership—blockholder ownership, institutional ownership, and venture capital ownership—and explain how markets may evaluate ownership structure when valuing new firms in emerging industries.

Blockholder and institutional ownership

When a select number of investors own significant portions of the firms' outstanding shares (*blockholders*), much of the economic risk of failure is vested in the hands of a few. To the extent that firms can attract large blockholders, risk for dispersed owners may be somewhat reduced. Attracting blockholders should be more costly for low-quality firms than for high-quality firms. Substantial ownership in one firm implies that the blockholder has a less well-diversified portfolio with an inferior risk–return trade-off (Alchian and Woodward, 1988). Blockholders will only accept this risk if they can expect compensating returns, such as those offered by high-quality firms. Also, because blockholders have so much invested in the firm, the benefits of monitoring and disciplining managers outweigh the costs (Demsetz, 1983). Research on private equity placements has shown that the announcement of sales to blockholders through discounted private equity placements is associated with positive abnormal returns (Wruck, 1989; Hertzel and Smith, 1993). Blockholders, with their superior access to information and voting power, have the ability and incentives to vigilantly monitor top executives and assure firms make wealth-maximizing decisions (Bethel and Liebeskind, 1993). However, in addition to the benefits of increased monitoring, blockholder ownership may also serve as a signal of unobservable quality. Hertzel and Smith (1993) showed that the abnormal returns from private equity placements were a result of the resolution of asymmetric information about firm value and not just the result of increased monitoring benefits. Although the effects of monitoring may take several periods to manifest, markets may take the presence of blockholders as a signal that the firm is appropriately governed. Consequently, investors in emerging industries are likely to prefer firms that have attracted blockholder ownership over those which have not.

Institutional investors also have both the incentives and the ability to monitor (Bethel and Liebeskind, 1993). Institutional owners employ professional analysts who are experts at screening and monitoring firm performance. Because of institutional investors' collective level of ownership they possess power to influence corporate decisions (Pound, 1992). For instance, Useem (1996) reported that institutional ownership approaches 60

percent in the 1000 largest U.S. firms. Hence, as with blockholders, the mere presence of institutional ownership signals to other shareholders that diligent monitoring is available.

In contrast to more developed industries, institutional ownership in emerging industries is more limited. This lower level of ownership by institutional investors is likely a reflection of the investors' more cautious approach to investment. With the exception of specialized funds created for the express purpose of seeking out new firms, institutional investors are likely to be particularly averse to investing in new firms, particularly firms using new business models. Indeed, it is more difficult to attract institutional investors to new firms. To the extent that institutional money represents 'smart money,' market investors may view institutional ownership as an important endorsement of quality (Stuart *et al.*, 1999). Fombrun and Shanley (1990) reported that institutional ownership helped build the reputations of large established firms. Consequently, markets should prefer firms in emerging industries which have attracted institutional investment to those which have not.

In summary, investors are likely to use ownership structure as a valuation-sorting criterion. Ownership structure both signals that other parties have certified the firm's quality and such ownership transfers some risk from dispersed investors to large blockholders and institutional owners. New firms which possess endorsements from knowledgeable and powerful owners are likely perceived to be of higher quality and, consequently, attract price premiums. This logic leads to the following hypotheses:

Hypothesis 2: Blockholder ownership will be positively associated with market valuations of new firms in new industries.

Hypothesis 3: Institutional ownership will be positively associated with market valuations of new firms in new industries.

Venture capital backing

Exchange relationships between organizations can serve as endorsements that alter the perceptions of external parties—particularly with emerging firms that are subject to ambiguous measures of quality (Stuart *et al.*, 1999). Such relationships can serve as signals that reduce uncertainty for outside

investors. One exchange relationship of firms completing IPOs that is likely to be interpreted as an uncertainty-reducing signal is the venture capital (VC) backing the firm has received.

Because newly founded firms may not expect positive cash flow until several years after founding, they often require the backing of venture capitalists. Most new business ventures begin without the backing of venture capitalists (Bhide, 1990); however, among high-risk ventures, VC backing may be critical (Sapienza and Gupta, 1994). VC backing does not just provide access to resources during the early stages of development; its presence may cause outside investors to interpret funding from venture capitalists as a signal that other knowledgeable investors endorse the firm. In support of this logic, Stuart *et al.* (1999) reported that total cash raised from venture capitalists reduced the time to IPO and increased the valuation achieved at time of IPO for new biotechnology firms.

We argue that markets may sort new firms based on the level of VC funding firms were able to attract. Success at raising capital from venture capitalists will alleviate some of the concerns over uncertainty otherwise faced by investors in firms in emerging industries. Thus, venture capitalist funding should be positively associated with market capitalization. This logic leads to the following hypothesis:

Hypothesis 4: The proportion of equity owned by venture capitalists prior to the IPO will be positively associated with market valuations of new firms in new industries.

Just as markets may sort firms based on the level of VC ownership achieved, the continued commitment of those venture capitalists after the IPO should also be informative to outside investors. When venture capitalists sell significant portions of their prior investment, it may be interpreted negatively by outside investors. Venture capitalists selling their stakes in firms may indirectly communicate information about the VC firm's confidence in the new firm's long-term value. For instance, selling large stakes in the firm may signal that the firm's value has peaked. Alternatively, when venture capitalists continue to hold a great deal of their prior investment, they signal that they are still committed to the firm and expect continued increases in market capitalization. Consequently,

we expect that the percentage of VC ownership liquidated at the time of IPO to be interpreted as a negative signal. Markets are likely to use this information when valuing and sorting new firms. This logic leads to the following hypothesis:

Hypothesis 5: The proportion of equity sold by venture capitalists at the time of the IPO will be negatively associated with market valuations of new firms in new industries.

Board structure

Boards of directors can reduce agency costs through vigilant oversight and can also add value by giving advice to top management (Fama and Jensen, 1983; Mizruchi, 1983). Both monitoring and advice giving are positively associated with subsequent firm performance (Westphal, 1999). However, boards can be sources of inefficiency when they are passive and are removed from strategic decision-making (Mace, 1986), or when they lack independence (Walsh and Seward, 1990). Lack of board independence can be particularly problematic in new, small firms (Gompers, 1995), and some institutional investors have recently expressed concern that independence is lacking in many Internet firms (Newbury, 2000).

High-quality new firms should have an advantage over low-quality firms in attracting qualified outside talent to serve on the board of directors. Outside directors must be concerned about their reputation (Fama and Jensen, 1983). Aligning oneself with a potentially failing firm could have disastrous effects on the reputation and career of an outside board member. Gilson (1989) found that board members of failed firms had significantly reduced chances of landing future board seats. Good talent will therefore migrate toward the less-risky, high-quality new firms. High-quality firms should also find it easier to attract outside talent to serve on the board. Consequently, investors are likely to demonstrate a preference for and assign higher valuations to those new firms that have attracted outsiders to fill board positions.

In summary, board structure is likely to be used as a market-sorting criterion for firms in emerging markets. As a result, new firms with outsider-dominated boards are more likely to be priced at a premium than those that are dominated by insiders. This logic leads to the following hypothesis:

Hypothesis 6: The proportion of board members who are outsiders (board structure) will be positively associated with market valuations of new firms in new industries.

Uncertainty reduction

We have argued that in emerging industries where uncertainty makes external valuation problematic, markets will increasingly turn to other, nontraditional information cues to help sort new firms. However, not all firms in emerging industries suffer from the same degree of informational uncertainty and uncertainty can be reduced over time. Indeed, we would expect that the effects hypothesized above should be strongest when uncertainty is greatest (Stuart *et al.*, 1999).

The greater the understanding the market has of a particular firm, the more investors can rely on traditional models and standards when valuing that firm. One factor that affects the uncertainty of IPO firms is their age. Research in organizational ecology finds that firms suffer from significant risks of death during early and adolescent periods (Henderson, 1999). The uncertainty and risk of new firms even induces high-risk investors like venture capitalists to exercise precautionary investment strategies, such as investing in timed stages rather than all at once. Sequenced investments reduce the risk to the venture capitalists and buy them time to receive and evaluate objective operating data.

Firms produce more objective data about their operations the longer they have been in operation. New firms have very little objective data to disclose to prospective investors. Alternatively, firms that have been in operation for several years can accumulate volumes of objective information concerning their operations. Consequently, firm age affects the amount of information available to investors at the time of IPO. Due to SEC disclosure regulations, the length of period a firm has been in operation significantly increases data availability of post-IPO firms. As a result of the positive association between time since founding and data disclosure, we argue that firm age will significantly affect the level of uncertainty confronting investors in new firms. Thus, firm age should be a strong moderating factor in how indirect indicators of quality are used in the firm valuation process. Consistent with this idea, Stuart *et al.* (1999) found that firm age moderated the effects of endorsements from prominent exchange

partners among biotechnology firms. Because corporate governance mechanisms are secondary indicators of unobservable quality, their use for market sorting should diminish with firm age, as more objective data accumulate about a firm and its operations. Accordingly, we expect that the association between corporate governance attributes and firm valuation outlined in the first six hypotheses will be moderated by firm age. This logic leads to our concluding hypothesis:

Hypothesis 7: The association between corporate governance mechanisms (Hypotheses 1–6) and firm market capitalization will be moderated by firm age.

The context

Our study examines how markets sort new firms in new industries by partitioning economic resources through market valuations. The specific industry context we examine is the commercialization of the Internet. The Internet's economic promise led to a rapid entry of firms specializing in the new economy. Investors pumped billions of dollars into hundreds of new firms. The early success of companies such as America Online and Yahoo! vividly demonstrated the new economy's potential. Many new entrants attempted to exploit the market frenzy for Internet IPOs, but most new entrants never made it to the point of an initial public offering (Sine, Mitsuhashi, and Kirsch, 2002). Our focus is on that subset of Internet firms that completed an IPO. These firms received the initial underwriter and investor certification that is inherent in the IPO process. Moreover, it is these Internet firms that exposed public investors to significant risk. Publicly traded Internet firms achieved exorbitant valuations even when their business models were not well understood. Indeed, research documents that simply changing a firm's name to include a '.com' suffix was associated with positive, abnormal returns (Lee, 2001).

History has proven that many of these business start-ups lacked fundamental soundness necessary to survive and prosper. Economic casualties in the new economy now litter the competitive landscape and remind investors of the risks associated with new economic sectors. However, notwithstanding the significant declines and failures in the Internet sector, many Internet firms remain capitalized

at multiples far exceeding those of firms in traditional industries.¹ Similar conditions have existed in many arenas, including biotechnology, wireless technology, cable television, and personal computers. While we will focus here specifically on Internet firms, our theory is generalizable to these and other contexts where new business models and lack of codified knowledge result in quality uncertainty.

RESEARCH METHOD

Sample

Our sample frame included Internet firms that completed an initial public offering. We identified a comprehensive list of publicly traded Internet firms by consulting numerous sources that track Internet firms (e.g., *Fortune*, Motley Fool, Hoovers). We were initially inclusive rather than exclusive; if a firm was listed on one list but not another, we included it in our preliminary sample. Then, based on company self-descriptions, we retained all firms that described themselves as doing business that was primarily related to the Internet. We also used the Hoover database of IPOs to search for all IPOs since 1993, the year before the commercialization of the World Wide Web. We looked at the description of each equity offering and used the same criteria listed above. If a firm described its business as primarily related to or occurring through the use of the Internet we included it in our sample. Our goal was to create a list of all publicly traded Internet firms that completed an IPO before July 1, 1999. At the time of our data collection no publicly traded Internet firms had died. Therefore, to the best of our knowledge, our initial sample included all public Internet firms. Consequently, our sample is best described as 'intratypical' (Kimberly, 1976). By using intratypical sampling, we implicitly control for firm type. This process yielded a total of 193 publicly traded Internet firms that met the criterion. We were able to collect complete data for 184 of these firms. A means test indicated that firms that were dropped due to missing data were not significantly different from the firms in the final sample on any of the theoretical variables.

Data regarding market capitalization and other financial data were collected from Compustat.

Executive and director stock-based incentives, blockholder ownership, and board structure were collected from firm Proxy statements. Institutional ownership data were collected from Marketguide, an online investment data service, and from *Value Line*. We collected data on venture capital ownership from forms S-1, S-2, and S-3 from the Edgar database of the SEC. These forms, the registration forms for new offerings of securities, list the beneficial shareholders both before and after the proposed offering.

Analyses

We tested the hypotheses in two ways. First, we estimated models that predicted the level of capitalization achieved in the firms' IPO. In these regressions, all independent variables were measured at the time of the IPO. These IPO models estimate the effects of the independent and control variables on the market's initial public valuation of the firms. In addition, we estimated our models longitudinally by predicting the market capitalization of each firm on a year-by-year basis. In the longitudinal models, we used a lagged dependent variable design. The longitudinal models estimate the effects of the independent variables over time. In the longitudinal analysis, all independent variables were measured at the end of the prior year.

Several methodological issues deserve mention: potential reverse causality, survivor bias, repeated observations of firms, and alternative explanations. First, it is possible that highly valued firms find it easier to implement governance structures consistent with our independent variables. If this is the case, it may be possible to detect associations consistent with our hypotheses and erroneously assume support for the hypotheses. To rule out possible reverse causality, we use a panel data design with a lagged dependent variable. We control for prior year market value and use a panel of multiple years of observations. Consequently, our analysis estimates the effects of the independent variables on the dependent variables, given the prior level of market valuation. However, because we have panel data, two other issues are also important. We have multiple observations per firm and some firms may not survive the entire period. If some firms fail before the end of 2000, it is possible that processes related to our independent variables are associated with the likelihood of survival, and such effects could result in survivor bias. To address

¹ For instance, as of June 30, 2003, the market value of Amazon.com was 9.7 times greater than that of Barnes & Noble (B&N), even though Amazon's sales and assets were only 78 percent and 59 percent, respectively of those of B&N.

these issues, we used a panel, autoregressive least-squares regression model to estimate models that tested the hypotheses, and we employed the Heckman procedure to handle possible survivor bias. Because some firms do not survive the entire window of observation, we used the Heckman two-stage estimation procedure (Heckman, 1979). The Heckman model includes two equations. The first model (the selection model, not reported) is an event-history model for the full sample. It estimates the likelihood of death as a function of all control and independent variables. The hazard rate from that model is then included in a second-stage regression model of market valuation (i.e., among the reduced sample of firms that survive each year).

We tested for multicollinearity and found no indications of such problems (e.g., no variable inflation factor was greater than 1.4, well below the level indicating potential problems). The exception to this was in the tests for Hypothesis 7 (the moderating effect of firm age). In these models, multiple interactions with firm age created multicollinearity problems. Consequently, we estimated each interaction in separate models. We examined Cook's Distance (Cook's *D*) to examine whether any outliers strongly influenced the results. We discovered that one firm (Ameritrade) had a Cook's *D* value of 2.9 (values over 1.0 are potentially problematic), indicating that it may have had undue influence on the results. Accordingly, we repeated our analysis and dropped this observation to see how sensitive the results were to its inclusion. This sensitivity analysis revealed that the exclusion of Ameritrade actually increased the variance explained in our models, and that all independent variables significant in the full dataset were still significant. Because this outlier worked against finding support for our hypotheses, we decided to keep the observation in the dataset, resulting in slightly lower explained variance. Finally, in the regression tables we multiplied some of the coefficients by a constant in order to ease the reading of the table. These transformations are noted on the table (they have no influence on reported significance levels).

Measures

Dependent variables

We measured *market valuation* as the firm's market capitalization, calculated as follows: $V = p * s$,

where V is the value of market capitalization, p is the price of the firm's shares on the last day of the year, and s is the total number of shares outstanding at that time. For market capitalization at the time of IPO, we used the end of the first trading day (results were virtually identical if we used the capital raised at the offering price—no change in sign or significance levels). We log-transformed these values. Several other scholars have recently used the same measure of Internet firm performance (Kotha, Rajgopal, and Rindova, 2001). The measure has also been used in the study of other new firms in emerging economic sectors, such as biotechnology (DeCarolis and Deeds, 1999; Stuart *et al.*, 1999) and in the study of a diversified sample of IPO firms (Welbourne and Andrews, 1996; Welbourne and Cyr, 1999).

Independent variables

There are two ways in which executives can have stock-based incentives: through their pay and through stock ownership. For that reason, we measured *top management team (TMT) stock-based incentives* in two ways. First, we included a measure of *TMT stock-based pay*, which was measured as the proportion of total executive compensation granted in long-term forms (e.g., stock options) (Zajac and Westphal, 1994). We used the average stock-based compensation of the TMT; and we used the estimated value of these awards on the date of grant, not the eventual pay-off received. For stock options, we used the Black–Scholes valuation method (Zajac and Westphal, 1994). Consequently, our measure avoids any confound between stock-option pay-off and our dependent variables. Second, we measured *TMT stock ownership* as the percentage of company stock owned by executive officers of the firm (Zajac and Westphal, 1994). We also included a separate measure of *outside director stock ownership* (Hambrick and Jackson, 2000), calculated the same as executive stock ownership but for outside directors only.

Blockholder ownership was measured as the percentage of firm stock owned by parties with at least a 5 percent stake in the company, who were not officers or directors and who had no business ties to the firm. *Institutional ownership* was measured as the total percentage of company stock owned by institutional investors (e.g., pension funds, mutual funds). Both measures of ownership structure have been used widely in prior research (Bethel and

Liebeskind, 1993). *Venture capital ownership* was measured as the percentage of firm equity owned by VC firms on the date of the IPO. Likewise, *venture capital equity sold* was measured as the percentage of company stock sold by VCs during the IPO process. Finally, *board structure* was assessed by a traditional measure of board outsiders and insiders, the percentage of board members who were outsiders not otherwise employed by the firm (Beatty and Zajac, 1994).

Control variables

To account for other systematic determinants of a new firm's market valuation, we included several control variables. First, we accounted for the possible effects of *firm size* by including a control for firm sales (log transformed). Anecdotal evidence suggests that firm growth may also affect the market's valuation of an Internet firm. As a result, we included a measure of *sales growth*, measured as the percentage gain in sales from the prior year. Notwithstanding criticisms in the business press that the market seems to disregard profitability when valuing Internet firms, it seems reasonable that profitable Internet firms may be valued more highly, *ceteris paribus*, than the firms that are losing money. To account for this, we included a measure of firm profitability, the level of *net income* for the previous year.

We controlled for *firm age*, measured as the number of years since the firm was founded, because firms that have been in business longer have had more time to create value. We also created a control for time elapsed since the IPO. However, since firm age and time IPO were highly correlated and had similar effects in models, we report only models with firm age. The market may not value all segments of the Internet equally. Therefore, we included controls for the specific segment of the Internet sector in which the firm competes. We used dummy variables to indicate which of four broad categories best described the firm's business: *software and services*, *content*, *Internet service providers (ISP)*, or *electronic commerce*. For purposes of our analysis, electronic commerce was the omitted category. We also controlled for year of observation. The Internet bubble peaked shortly after year-end 1999, and began a precipitous drop during 2000.

Because market capitalization may be affected by a number of exogenous factors, in the longitudinal models we controlled for *prior year market capitalization*. For instance, it is feasible that firms valued highly initially maintain their lead over those valued less highly at their IPO. This control variable allows us to account for otherwise unobserved heterogeneity among these firms. For instance, there may be factors otherwise unrelated to any of our control variables (e.g., which venture capital firm backed the company, the market's receptiveness to new issues at the time of public offering) that influence the market's valuation of the firm. Including this control results in a lagged dependent variable, which can result in a specification error. As a result, we use the instrumental variable estimation technique outlined by Johnston and DiNardo (1997: 154–158) to produce a consistent estimator.

RESULTS

Descriptive findings

The descriptive statistics and correlations of variables used in this study are reported in Table 1. The Internet firms in this sample had an average market valuation of \$5.5 billion. However, valuation ranged from \$1.5 million to \$343 billion. Compared to large, traditional U.S. firms, stock-based incentives are somewhat greater in Internet firms (cf. Bethel and Liebeskind, 1993; Sanders and Carpenter, 1998; Zajac and Westphal, 1994). It is notable that there was tremendous variance in the use of stock-based compensation, with values ranging from zero to 99 percent of pay in stock-based firms. Board structure (58% outsiders) was less than the structure typically found in large firms (Zajac and Westphal, 1994), but greater than that reported in Beatty and Zajac's (1994) study of IPO firms. Blockholder ownership (16%) was greater in the Internet firms we studied than in typical studies of large U.S. firms, but much less than blockholder ownership reported in other studies of IPO firms (Beatty and Zajac, 1994). As would be expected of highly uncertain markets, institutional ownership (24%) was significantly lower in our sample of Internet firms than in large U.S. firms (Bethel and Liebeskind, 1993; David, Kochhar, and Levittas, 1998; Useem, 1996). VC ownership prior to IPO averaged 13 percent; the average VC reduction in ownership was just over 3 percent.

Table 1. Descriptive statistics and correlations^a

Variable	Mean	S.D.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1 Market valuation at IPO (log transformed)	3.81	1.17																	
2 Market valuation (log transformed)	5.78	2.22	0.56																
3 TMT stock-based compensation	0.37	0.26	0.39	0.32															
4 TMT stock ownership	0.16	0.15	0.01	-0.02	-0.05														
5 Outside director stock ownership	0.09	0.19	0.03	0.03	0.02	-0.33													
6 Blockholder ownership	0.16	0.18	0.08	0.08	0.08	-0.18	-0.02												
7 Institutional ownership	0.24	0.22	0.29	0.54	0.24	-0.32	-0.12	0.14											
8 Board structure	0.58	0.23	-0.09	-0.23	0.06	0.02	0.12	0.06	-0.16										
9 VC ownership prior to IPO (%)	13.20	19.10	0.23	0.14	0.18	0.22	0.30	0.07	-0.02	0.15									
10 VC sell-off (%)	3.19	5.99	0.05	-0.06	0.07	0.15	0.22	-0.01	-0.06	0.12	0.75								
11 Firm size (log of sales)	3.24	2.14	0.34	0.55	0.17	-0.09	-0.08	0.01	0.52	-0.25	-0.05	-0.13							
12 Sales growth (%)	7.00	78.20	0.12	0.06	0.03	-0.06	-0.03	0.10	0.13	-0.12	-0.02	-0.02	0.10						
13 Net income (000,000)	-63.65	467.32	0.01	0.19	-0.11	0.06	0.02	-0.15	0.23	-0.19	-0.08	-0.04	0.14	0.01					
14 Firm age	8.00	6.10	0.02	0.21	-0.06	-0.22	-0.23	0.09	0.48	-0.32	-0.21	-0.12	0.44	0.20	0.23				
15 Software/service	0.57	0.49	0.06	0.07	-0.08	-0.05	-0.05	0.01	0.12	0.01	0.07	0.04	0.09	0.03	0.11	0.16			
16 Content	0.19	0.39	-0.13	-0.05	0.05	0.06	0.04	-0.05	0.01	-0.08	-0.07	-0.03	-0.02	-0.03	-0.06	-0.57			
17 ISP	0.11	0.31	0.12	0.11	-0.01	-0.12	0.00	0.02	0.07	-0.08	0.05	0.03	0.04	-0.13	-0.10	-0.06	-0.17		
18 E-commerce	0.13	0.32	-0.24	-0.30	-0.26	0.09	0.02	-0.13	-0.04	-0.07	0.05	-0.02	-0.03	-0.06	-0.05	-0.39	-0.19	-0.14	

^a Correlations greater than 0.13 are significant at $p < 0.05$, and those greater than 0.18 are significant at $p < 0.01$. $n = 184$

IPO results

The results of our IPO regression analyses are reported in Table 2. Model 1 of Table 2 reports the control variables for the IPO valuation estimates. Firm size and sales growth were both positively associated with market valuation, while net income and firm age were both negatively associated with valuation. The independent variables were added in Model 2. The change in adjusted R^2 was statistically significant, and the magnitude of the change suggests practical significance of the findings as well—the addition of the independent variables more than doubled the explained variance. All three measures of stock-based incentives (executive stock-based pay, executive stock ownership, and director ownership) were positive and significant, supporting the first hypothesis. In support of Hypotheses 2 and 3, both blockholder ownership and institutional ownership were positive and significant. Likewise, in support of Hypotheses 4 and 5, VC ownership and sell-off were significant (ownership was positive and sell off was negative). Hypothesis 6 was not supported in the IPO model, as board structure was positive but not significant.

Post-IPO results

The post-IPO results are reported in Table 3. The results for the post-IPO longitudinal analysis were largely consistent with the results from the IPO model. As noted in Model 2 in Table 3, the full model explained 64 percent of the variance in market valuation. As with the IPO model, executive stock-based pay and executive stock ownership (Hypothesis 1), institutional ownership (Hypothesis 3) and VC ownership (Hypothesis 4) were positive and significant. In addition, as predicted by Hypothesis 5, the proportion of VC equity sold off was negative and significant. Contradicting Hypothesis 6, board structure (i.e., proportion of outsiders) was negative and significant. Both blockholder ownership and outside director ownership had the predicted positive signs, but neither was significant in the post-IPO model.

Contingency effects

Our final hypothesis (Hypothesis 7) predicted that the effects of corporate governance on firm value would be moderated by firm age. We tested this hypothesis in both the IPO and post-IPO models. In order to test this hypothesis, we created

Table 2. Firm market valuation at IPO

	Model 1 Controls	Model 2 Theoretical model
Intercept	3.38*** (0.28)	2.20*** (0.39)
Firm size (log of sales)	0.19*** (0.05)	0.11* (0.05)
Sales growth	0.003*** (0.001)	0.002** (0.001)
Net income ($\times 100$)	-0.01** (0.004)	-0.01* (0.003)
Firm age	-0.05** (0.02)	-0.03 (0.02)
Software/services	0.35* (0.26)	0.18 (0.23)
Content	0.46 (0.29)	0.26† (0.26)
ISP	0.80* (0.32)	0.61* (0.30)
Year dummies	Incl. ^a	Incl. ^a
TMT Stock-based pay		1.27*** (0.28)
TMT stock ownership		1.13* (0.52)
Director stock ownership		0.85** (0.37)
Blockholder ownership		0.75* (0.41)
Institutional ownership		1.19** (0.48)
Board structure (% outsiders)		0.25 (0.36)
VC ownership pre-IPO		0.01* (0.005)
Venture capitalist sell-off		-0.02† (0.01)
Adjusted R^2	0.19	0.39
Change in adjusted R^2		0.20***
<i>n</i> =	184	184

† $p < 0.10$; * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

^a Dummy variables for year are included in the analysis but not shown to preserve space.

interaction terms comprised of firm age and each of the eight market sorting indicators. Diagnostic tests indicated that including all eight interactions simultaneously created problems of multicollinearity. Consequently, we ran separate models for each interaction term. To conserve space, the tables only include the models with significant interactions. In the IPO model, none of the interactions was significant. Thus, at the time of IPO, firm age did not moderate the effects of market sorting. This may be because the great majority of firms were quite young at the time of IPO and insufficient objective

Table 3. Firm market valuation post-IPO

	Model 1 Controls	Model 2 Theoretical model	Model 3 Firm age × Director ownership	Model 4 Firm age × Institutional ownership	Model 5 Firm age × Board structure	Model 6 Firm age × VC ownership	Model 7 Firm age × VC sell-off
Intercept	-0.66 (1.45)	1.28 (1.44)	0.32 (1.45)	0.24 (1.51)	0.62 (1.53)	1.13 (1.42)	1.35 (1.43)
Firm size (log of sales)	0.36*** (0.07)	0.23*** (0.06)	0.23*** (0.06)	0.22*** (0.06)	0.22*** (0.06)	0.24*** (0.06)	0.24*** (0.06)
Sales growth (× 100)	0.05 (0.08)	-0.04 (0.07)	-0.006 (0.06)	-0.02 (0.06)	-0.02 (0.07)	-0.01 (0.07)	-0.01 (0.06)
Net income (× 100)	0.02 (0.02)	0.02 (0.01)	0.02 (0.01)	0.01 (0.01)	0.02 (0.01)	0.02 (0.01)	0.02 (0.01)
Firm age	-0.04* (0.02)	-0.06** (0.02)	-0.06*** (0.02)	-0.11*** (0.03)	-0.03 (0.03)	-0.05* (0.02)	-0.05** (0.02)
Prior year market valuation	0.42*** (0.08)	0.24*** (0.06)	0.26*** (0.06)	0.25*** (0.06)	0.25*** (0.06)	0.25*** (0.06)	0.25*** (0.06)
Software/services	0.82* (0.34)	0.51† (0.29)	0.53† (0.29)	0.43 (0.29)	0.50† (0.29)	0.56* (0.29)	0.59* (0.29)
Content	0.75* (0.37)	0.58† (0.31)	0.54† (0.31)	0.48 (0.32)	0.57† (0.32)	0.63* (0.31)	0.66* (0.32)
ISP	1.42*** (0.42)	0.93** (0.37)	1.00*** (0.37)	1.02** (0.37)	0.95* (0.37)	0.89* (0.36)	0.91** (0.37)
Year dummies	Incl. ^a	Incl. ^a	Incl. ^a	Incl. ^a	Incl. ^a	Incl. ^a	Incl. ^a
TMT stock-based pay	1.01*** (0.29)	0.98*** (0.29)	0.98*** (0.29)	0.99*** (0.29)	0.94*** (0.29)	0.94*** (0.29)	0.95*** (0.29)
TMT stock ownership	1.02* (0.61)	1.09* (0.61)	1.16 (0.62)	1.14* (0.62)	1.08* (0.61)	1.05* (0.61)	1.05* (0.61)
Director stock ownership	0.59 (0.35)	1.98** (0.69)	0.61† (0.46)	0.58 (0.46)	0.60† (0.45)	0.58 (0.46)	0.58 (0.46)
Blockholder ownership	0.62 (0.49)	0.71† (0.48)	0.32 (0.51)	0.52 (0.49)	0.68† (0.48)	0.69† (0.49)	0.69† (0.49)
Institutional ownership	3.57*** (0.46)	3.49 (0.46)	2.62*** (0.62)	3.52*** (0.48)	3.51*** (0.46)	3.50*** (0.47)	3.50*** (0.47)
Board structure (% outsiders)	-1.04** (0.35)	-1.02** (0.35)	-0.93** (0.36)	-0.53 (0.54)	-0.97** (0.35)	-0.98** (0.36)	-0.98** (0.36)
VC ownership pre-IPO	0.03*** (0.01)	0.03*** (0.01)	0.03*** (0.01)	0.03*** (0.01)	0.04*** (0.01)	0.04*** (0.01)	0.03*** (0.01)
VC sell-off	-0.08*** (0.02)	-0.08*** (0.02)	-0.09** (0.05)	-0.08*** (0.02)	-0.07** (0.02)	-0.07** (0.02)	-0.04† (0.03)
Interactions with firm age		-0.27** (0.10)	0.12** (0.05)	-0.09† (0.06)	-0.03** (0.001)	-0.03** (0.001)	-0.01* (0.003)
Adjusted R^2	0.50	0.64	0.65	0.65	0.65	0.65	0.65
Change in adjusted R^2		0.14***	0.01*	0.01*	0.01*	0.01*	0.01*
N =	452	452	452	452	452	452	452

† $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ ^a Dummy variables for year are included in the analysis but not shown to preserve space.

data were available to help reduce investor uncertainty.

In the post-IPO models, the coefficients for all interactions except one were negative, and five were significant. Specifically, the interaction of firm age with director ownership, VC ownership, VC ownership sell-off, and board structure were negative and significant. Contrary to our predictions, the interaction of institutional

ownership and firm age was positive and significant. Consequently, in the post-IPO period, a number of factors instrumental in market sorting were moderated by firm age.

Possible alternative explanations

It is possible that the governance mechanisms we study may have positive efficiency effects on firm

performance beyond the market sorting effects we examine. If these mechanisms have positive efficiency effects, they would lead to higher levels of operating performance directly, and perhaps secondarily to higher market valuations (Murphy, 1999). For this reason, as noted above, we both controlled for efficiency effects directly (i.e., controls for net income and sales levels) and used a longitudinal panel design with a lagged dependent variable. One of the benefits of longitudinal analysis is that it allows us to implicitly control for all other unobserved stable firm effects (Xiao, 1986). Thus, firm efficiency, while it may not be directly observed, is controlled for in the models. Nevertheless, we conducted sensitivity tests to further rule out that efficiency effects drove the reported results.

We estimated sensitivity models in which both firm size and net income took on the role of the dependent variable (and, as with the theoretical models, with an instrumental variable for the prior value of the dependent variable). If efficiency is the operating mechanism, these models should display good fit, and the addition of the governance mechanisms to the models should significantly increase the variance explained over the control models. However, the models *did not* display good fit characteristics. For instance, in comparison to the full model reported in the Table 2, only two of the eight independent variables were significant in the model predicting firm size, and none of the independent variables were significant in the net income model. In addition, neither model showed a significant increase in variance explained. Thus the theoretical model we report displays much greater fit than the alternative efficiency models.

DISCUSSION

Uncertainties regarding new business models, lack of codified operating and industry data, and investor inexperience with similar firms all present market participants with the potential of investing in virtual lemons. In new and uncertain economic markets, corporate governance serves as a secondary indicator of potential quality and thereby facilitates market evaluation and sorting. Markets may examine normative governance structures for information cues regarding the quality of new firms. Such secondary indicators

of quality appear to reduce investor uncertainty regarding adverse selection and moral hazard. The confluence of quality uncertainty and hyper-valuation prompts markets to place more emphasis on indirect indicators of potential qualitative differences in order to sort industry participants. The findings of this study demonstrate that within one highly uncertain context market sorting was positively associated with normative corporate governance characteristics.

Secondary indicators of qualitative differences, like the governance attributes we studied, are particularly important in new economic segments like the Internet. Governance mechanisms are both visible to outsiders and widely believed to be in shareholders' best interests, yet they still vary significantly across firms. Some governance attributes suggest the firm has received an endorsement from a knowledgeable party. Others provide a form of certification through risk sharing. Markets appear to reward those firms that possess such endorsements and certifications even when primary objective indications of quality are lacking. The pattern of results reported here provides support for the view that markets turn to such secondary indicators of quality to sort the economic values of new firms. The findings were robust across both the IPO (when the market first has an opportunity to sort) and post-IPO models.

The finding for board outsiders deserves special attention. We hypothesized that the market would place a premium on firms which had outsider-dominated boards. Board structure was not significant in the IPO model, but it was negative and significant in the post-IPO model. Over time, it appears that the market came to prefer insider-dominated boards. In retrospect, it appears that Internet firms may be a special context in which insiders help form a more effective board. Insiders have greater access to subjective information regarding top-management performance and may be especially useful when information processing at the board level is critical. For instance, Baysinger and Hoskisson (1990) argued that outsiders would be more effective in contexts characterized by high levels of diversification and low levels of research and development, and that small, R&D-intensive firms may be better governed by insider-dominated boards. Our results are consistent with their argument that insiders are valuable in some contexts where information is scarce.

Uncertainty reduction

The results for our test of Hypothesis 7 lend additional credence to the idea that the level of uncertainty facing investors affects the use of quality proxies in market sorting. However, these findings also suggest that some sorting and screening criteria have relatively constant information value while others are contingent in nature. Signals should be most important when the uncertainty is greatest (Stuart *et al.*, 1999). Uncertainty in the Internet context is generally high; however, it should be greatest during the early years of firms' operations, prior to the accumulation of objective data that can be systematically analyzed by outside investors. The findings suggest that in this context some secondary indicators of potential qualitative differences are dependent on firm age. Closer examination of a few of these contingency effects suggests that some mechanisms may be primarily used to reduce the risk of adverse selection, while others may be used primarily to reduce the risk of moral hazard.²

The amount of VC equity sold at the time of IPO is a good example of an information source that reduces adverse selection but not moral hazard. Theoretically, the influence of this construct—this variable measures how much of the firm's stock the VC sold at the time of IPO—cannot be attributed to a monitoring effect which lowers moral hazard. So, the main effect cannot be interpreted as a moral hazard effect, but is entirely consistent with an adverse selection effect. In addition, the interaction of VC sell-off with time (firm age) is also consistent with the adverse selection story; this information about what the VC sold off is less valuable later when there is more direct information about the firm available.

Alternatively, the financial incentives associated with stock ownership and stock-based pay are clearly direct mechanisms to control moral hazard (Murphy, 1999). Moral hazard risks deal with actions an agent may take that are unobservable to investors. These risks are not confined to adolescent firms. Increased firm age does not give investors a greater ability to observe otherwise currently hidden executive actions. The fact that the effects for the interactions with age and our executive incentive variables are not significant is

consistent with the idea that moral hazard risk is less affected by firm age. While these interactions do not conclusively disentangle the effects relative to moral hazard and adverse selection, the pattern of effects is consistent with this intuition.

The effects for the interaction of institutional ownership and firm age are also noteworthy. Institutional ownership actually showed an increased effect over time. It is unlikely that this is due to increased monitoring ability. Studies on institutional ownership have suggested that the evidence of monitoring benefits by institutional ownership is very weak at best (Black, 1998). The results seem to imply that some secondary sources of information help build momentum in external evaluations of the firm and assist in building firms' reputations over time.

Implications

The findings of this study have several implications for theory and practice. As the sources of competitive advantage move further away from tangible resources and towards intangible and knowledge-based resources, investors will find significant difficulty in valuing potential downstream economic benefits. Because uncertainty causes buyers to discount valuations (Akerlof, 1970), high-potential firms may leave significant capital on the table until information asymmetry is reduced and true value is known. The findings suggest that high-quality firms can benefit significantly *ex ante* by adopting attributes and activities that reduce quality uncertainty. Even when such attributes impose significant cost on firms (e.g., imposition of greater monitoring), the reduction of investor uncertainty may more than offset the marginal cost of monitoring. While our study focused directly on Internet firms, the issue of quality uncertainty also has broad applicability to other contexts where resources are largely intangible and where quality uncertainty is high.

The study uses a very uncertain and nontrivial context to demonstrate how agency control mechanisms are interpreted as signals and screening criteria to assist in the market sorting of new firms. The agency theory and corporate governance literatures have generally focused on issues of moral hazard related to the separation of ownership and control. For instance, the roles of incentives and monitoring are largely considered because of their ability to constrain undesired behaviors (Shleifer

² We thank an anonymous referee for motivating this possible explanation.

and Vishny, 1997). Enterprises that are large, traditional, and publicly held are subject to many potential agency problems. However, monitoring these larger firms is facilitated by readily available codified information. With Internet firms, and firms in other emerging industries, investors face greater problems of information asymmetry than in traditional industries. As a result, the problems of adverse selection are also accentuated. The findings of this study contribute to the agency and corporate governance literatures by showing how governance takes on an increased role in highly uncertain environments through its *ex ante* signaling and screening, which affects market sorting and valuation. These indirect proxies of quality have significant effects on firm valuation before any objective efficiency effects have materialized.

Boards of directors and executives may find it easier to manipulate some governance attributes than others, introducing the possibility of false signaling. However, firms that implement agency control mechanisms for the purpose of sending false signals should find the cost of such mechanisms greater than firms that use signals as true indications of quality. Some mechanisms are difficult to implement in short order. For instance, increasing the proportion of compensation given in stock-based forms of pay can change more rapidly than can the percentage of stock owned by executives and directors or attracting institutional ownership.

Our research builds on previous research of signaling and screening. Finance scholars have studied such issues as dividend policy and choice of auditors (Ross, 1977; Titman and Trueman, 1986). These types of signals reflect managerial intent to reduce information asymmetry. More recently, scholars of organizations have examined such attributes as interorganizational networks (Stuart *et al.*, 1999) and prior affiliations of key managers (Higgins and Gulati, 2000). These latter studies suggest that because the social structures of network affiliations aid in resource accumulation, they also serve as third party endorsements of quality. Together with prior research, our findings suggest that organizational characteristics that are otherwise opaque indicators of firm quality can serve as credible market signals and screening criteria, thereby affecting firm valuation.

Limitations, future research, and conclusions

We examined market sorting only during the

IPO and early post-IPO period of new Internet firms. Our results may not be generalizable to all contexts, and perhaps not even to all IPO contexts. Further research is needed to determine whether market sorting based on secondary indicators of qualitative differences is equally efficacious across industries. We expect corporate governance attributes will be valuable signals in IPO firms, and that they are even more valuable when underlying technology is poorly understood. This is consistent with the idea that uncertainty moderates the value of signals (Spence, 1974). The Internet firms in this study are in their infancy, and the signaling effects of governance mechanisms may change over time as more information about successful firm strategies and business models diffuses; this should reduce the objective quality uncertainty regarding firms in this industry and further reduce the effects of market sorting based on secondary indicators of quality.

Another limitation of this study is that despite suggestive empirical evidence we cannot definitively differentiate between the effects relating to adverse selection and those relating to moral hazard. Markets will reward reductions in either form of risk (Hertzel and Smith, 1993). However, this problem is not unique to our study. The relatedness and potentially interdependent nature of these two risks have been noted by prior research (Chiappori and Salanié, 2000; Hertzel and Smith, 1993). And, while not perfect, the results of the interactions do provide some suggestive evidence that helps tease out these two effects. More importantly, the theory that markets sort based on the presence of secondary indicators of quality that reduce investor uncertainty is robust to both types of risk.

The literatures on signaling and reputation building are closely related. Indeed, Fombrun and Shanley note, 'Reputations [are] the outcomes of a competitive process in which firms signal their key characteristics to constituents to maximize their social status' (Fombrun and Shanley, 1990: 234). Firms also form beliefs about how their competition operates by evaluating signals (Weigelt and Camerer, 1988). And, reputations themselves are types of signals (Fombrun and Shanley, 1990). Some research suggests that new firms enhance their reputations by actively sending positive signals (Kotha *et al.*, 2001). Future research should examine more closely how firm governance structures may form the building blocks of long-term reputations (Fombrun and Shanley, 1990).

Emerging industries provide significant opportunity to create wealth, but they are inherently uncertain. Investors in these industry contexts not only face the moral hazard that engages shareholders of all publicly held firms; they also face the considerable risks associated with adverse selection. During the early periods of emerging industries, investors face significant quality uncertainty. In these contexts, it is difficult to distinguish *ex ante* between firms that will likely create value and firms that are likely to succumb to the liability of newness. In such contexts, markets can use signals and develop screening criteria based on observable but secondary indicators of perceived quality. Thus markets sort firms and endow significant price premiums to those that possess opaque indicators of quality.

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