INDUSTRY EFFECTS ON THE USE OF BOARD AND INSTITUTIONAL INVESTOR MONITORING AND EXECUTIVE INCENTIVE COMPENSATION

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Abstract

This paper develops and empirically tests a theory of the use of board and institutional investor monitoring and the use of executive incentive compensation under different types of uncertainty in the industry. This empirical examination is based on a sample of U.S. firms operating in a wide range of industries. Practical implications derived from this paper direct the attention of both shareholders and governance specialists to critical tradeoffs involved in the use of specific governance mechanisms under demand, competitive, and technological uncertainty.

We thank Vilmos Misangyi, Chamu Sundaramurthy, and Tom Becker for helpful comments on an early version of this article. We are grateful for the research funding for this paper from University of Delaware (General University Research Grant).

Published: 2004

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ABSTRACT

This paper develops and empirically tests a theory of the use of board and institutional investor monitoring and the use of executive incentive compensation under different types of uncertainty in the industry. This empirical examination is based on a sample of U.S. firms operating in a wide range of industries. Practical implications derived from this paper direct the attention of both shareholders and governance specialists to critical tradeoffs involved in the use of specific governance mechanisms under demand, competitive, and technological uncertainty.
In the wake of recent corporate scandals, a healthy skepticism is warranted concerning agency theory assertions about alignment of the economic interests of managers with shareholder wealth interests through the use of corporate governance mechanisms. Monitoring managers’ actions by independent boards and institutional owners and tying managers’ compensation to long-term economic performance of the firm are traditionally viewed as important mechanisms that lead to the adoption of effective strategies and the generation of superior economic performance. However, both large-sample empirical research and recent compelling case-study evidence from firms such as Enron suggest that these governance mechanisms do not always prevent self-serving or illegal activities on the part of some managers (e.g., Dalton, Daily, Certo, & Roengpitya, 2003; Dalton, Daily, Ellstrand, & Johnson, 1998).

The inconsistent economic effect of governance mechanisms may be partly due to the adoption of inappropriate mechanisms under different *industry-specific* conditions that indicate dissimilar levels of uncertainty. In the corporate governance literature, a number of research studies have examined *firm-specific* contingencies that lead to substitution among different governance mechanisms (e.g., Beatty & Zajac, 1994; Bloom & Milkovich, 1998; Demsetz & Lehn, 1985; Miller, Wiseman, & Gomez-Mejia, 2002; Pearce & Zahra, 1992; Zajac & Westphal, 1994). However, the corporate governance research literature has been silent concerning the role of *industry-specific* contingencies on the choice of governance mechanisms. Although Boyd (1990) found the board structure of high performing firms to be more responsive to environmental uncertainty, there has been surprisingly little subsequent research to help us understand the effects of *different types* of *industry-specific* uncertainty on the use of different governance mechanisms.
The concept of uncertainty refers to the phenomenon where, due to limited information about environmental conditions, managers have difficulties in confidently assigning probabilities to how these conditions will influence the effectiveness of strategic decisions (Duncan, 1972). In business environments with high uncertainty, firms’ actions and their economic performance become difficult to predict. Firms become more prone to agency problems because uncertainties about best practices and sources of poor economic performance heighten the information asymmetry between shareholders and managers.

However, increased uncertainty does not necessarily justify an increased use of all corporate governance mechanisms. Specific corporate governance mechanisms function and perform differently under various industry conditions. Different levels of uncertainty may necessitate substitution (Sundaramurthy, 1996) among corporate governance mechanisms, and when firms ignore these industry-specific contingencies, these firms may adopt a less effective set of governance mechanisms. Therefore, the current paper develops and tests a model of the choice of specific corporate governance mechanisms under different types of industry uncertainty. Specifically, by using agency theory-based arguments, this paper investigates why firms differ in their bundle of governance mechanisms by exploring the empirical links between industry uncertainty and the choice of the use of monitoring (by boards and institutional owners) and executive incentive compensation.

Past research studies of governance have limited their examination of executive incentives to CEOs even though strategic decisions are often made with input from other top-level executives (Chandler, 1962; Finkelstein and Hambrick, 1996; Penrose, 1959). Because predictive ability is enhanced when a group of top managers is considered (Hambrick and Mason, 1984), analyzing the compensation structure of key top-level executives as a group can
provide us with a fuller picture about the industry effects on the overall use of managerial incentive compensation. Finkelstein (1988) conducted a series of empirical tests of upper-echelons hypotheses and reported stronger results at the top management team level than at the CEO level of analysis in 81 percent of all regressions. Therefore, this empirical study examines the use of executive compensation at the top management team level.

**THEORY AND HYPOTHESES DEVELOPMENT**

In the business context of public corporations, agency theory (Fama & Jensen, 1983; Jensen & Meckling, 1976) emphasizes the potential conflict of economic interest between owners (the principals) and managers who are placed in charge to act as the principals’ economic agents. In a traditional capitalist firm, increasing the productivity of team production to achieve the highest economic profitability is typically posited to be the main goal of owners (Alchian & Demsetz, 1972). Agents, however, typically have a different utility function and may wish to pursue their own economic interests (Jensen & Meckling, 1976).

With the premise of an efficient capital market for corporate control (i.e., takeovers) (Jensen & Ruback, 1983) and in the absence of market frictions (i.e., zero transaction costs), the economic interests of owners and managers would be aligned, and there would be no agency problem. However, in general, the presence of market frictions (i.e., positive transaction costs) limits the ability of the market for corporate control to achieve this perfect economic alignment by itself (Shleifer & Vishny, 1997). Market frictions include information asymmetry between principals and agents, uncertainty regarding the best management practices, semi-efficient or inefficient markets for managers, and so forth. Given market frictions, additional mechanisms such as outsiders on the board of directors, block and institutional investor ownership, and
performance-based compensation become essential to mitigate the potential agency problem (Eisenhardt, 1989; Mahoney, 1992).

As an important source of market frictions, uncertainty can make it difficult to identify the appropriate firm strategy and to predict economic performance outcomes. Uncertainty often stems from instability and dynamism in specific industry conditions such as demand, competitive actions, and technology (Bourgeois & Eisenhardt, 1988). Studies using agency theory typically view uncertainty or risk as unpredictability that impairs forecasting (Bloom & Milkovich, 1998). Uncertainty refers to changes in the environment that are difficult to predict, similar to Keats and Hitt’s (1988) concept of environmental instability, which was based on Dess and Beard’s (1984) dynamism dimension. Because uncertainty makes it more difficult to identify the best strategy, firms pursue a variety of organizational actions and strategies even within the same industry. An important implication of uncertainty is that it typically creates an environment for agency problems to occur because uncertainty escalates the level of information asymmetry between shareholders and managers. Shareholders can neither clearly assess whether managers are pursuing profit-maximizing strategies, nor clearly determine the marginal effect of managerial strategies and actions on firm-level economic performance. High information asymmetry between shareholders and managers diminishes shareholders’ ability to evaluate managerial actions and gives managers an opportunity to pursue strategies that enhance their own economic interests, at the expense of the shareholders.

The heightened information asymmetry problem can become particularly salient in industries with uncertainty in demand, competition, and technology (Bourgeois & Eisenhardt, 1988; Williamson, 1985). Demand uncertainty involves instability in overall industry sales and the sales generated by firms individually. This instability makes it difficult to decide on the level
of investments that firms should make. Without the ability to forecast future sales with confidence, firms may easily end up in situations of under- or over-investment (Finkelstein & Boyd, 1998). Thus, shareholders cannot easily assess whether poor economic performance results from instability in industry-wide sales or from managerial incompetence and/or opportunism.

**Competitive uncertainty** involves unpredictability in rival firms’ strategies and competitive actions. Without a good sense of rival firms’ capabilities for retaliatory actions or imitation, managers experience difficulties in choosing appropriate firm-level strategies. Even when managers opt for strategies that fit well with their own firm’s resources and capabilities, unexpected competitive actions (e.g., aggressive pricing and advertising strategies, and rival firms’ influences on distribution channels) can undermine a firm’s economic performance. Competitive uncertainty refers to the degree to which firms in a given industry have difficulty anticipating or predicting rivals’ actions because of the underlying industry structure. The IO economics literature argues that increased industry consolidation presents more opportunity for competitive signaling. Ghosh (2004) points out that industry concentration is one factor that makes an industry more attractive, citing Schumpeter’s (1942) argument that an increase in industry concentration makes rival behavior more predictable. It has been argued that higher industry concentration leads to more market power in the hands of firms, or less industry competition (Eckbo, 1992), because it facilitates intra-industry collusion or dominant firm pricing.

**Technological uncertainty** can further heighten the information asymmetry between shareholders and managers. With technological uncertainty, it becomes difficult to predict when and how frequently new product and/or process technologies will emerge in the industry.
Therefore, firms struggle in opting for specific technology paths and solutions among a number of possible alternatives. Even when a firm makes outstanding advances in its product/process technologies, unexpected shifts in technology platforms in the industry can lead to loss of competitive advantage. In such environments, it can be difficult to evaluate managerial performance and to judge if managers could and should have foreseen the changes in the industry and reformulated the firm’s technology strategy accordingly. All three types of uncertainty constitute market frictions because they typically create incomplete contracts (Williamson, 1985). Essentially, these three types of uncertainty impede shareholders’ ability to judge the quality of strategic decisions and managerial performance due to bounded rationality and/or information asymmetry (Williamson, 1985).

The heightened information asymmetry between shareholders and managers and the greater potential for agency problems create an increased need for closer monitoring of managerial decisions and actions. Agency theory advocates the monitoring of managerial actions by independent boards and influential institutional shareholders when conditions within the firm and its environments suggest that there is high risk of managerial opportunism (Fama & Jensen, 1983). The board of directors can be a powerful monitoring mechanism that encourages economic value-maximizing decisions when its members are not under the CEO’s influence (Morck, Shleifer, & Vishny, 1989). Board independence can be greatly improved by including outside directors on the board because these outside directors are more likely to question the decisions made by the CEO and other executives.

Outside directors observe and question managerial actions on behalf of shareholders who usually have only publicly available information about the firm’s strategy and prospects. The board’s ability to question managers does not reduce the uncertainties in the business
environment. What is reduced is the information asymmetry between managers and outside directors who monitor managers on behalf of shareholders. Information asymmetry is reduced because outside directors build *firm-specific* and *industry-specific* knowledge as a result of frequent conversations with managers and due to their access to non-public company documents. Being a board member gives directors the rights and privileges to ask managers questions about the reasoning behind important managerial decisions. This ongoing discourse involves discussions about managers’ goals and planned directions for the firm, and why and how formulated strategies fit with the conditions in the environment. As a result, outside directors build meaningful knowledge about why a firm should or should not pursue certain strategies under specific demand, competitive, and technological conditions in the environment. Communication with managers helps outside directors develop a practical understanding of what a particular firm’s strategies should look like when specific knowledge about the firm is synthesized with the specific knowledge of the industry. With an enhanced understanding of the firm and its environment, outside directors can assess the quality of managerial actions much more accurately than ordinary shareholders. Also, they can assess more accurately the extent to which economic performance outcomes are driven by instability in the environment as opposed to managerial incompetence/opportunism.

Compared to inside directors who are less independent of the CEO’s influence, outside directors are much more likely to use such information to reduce the likelihood of selfish and/or illegal acts of managers. While inside directors usually have significant knowledge of the firm and the industry, questioning the CEO’s and their own actions will not be in their best interest in most cases. That’s precisely why more outside director involvement becomes necessary as the level of uncertainty in the environment increases. Thus, we predict that the use of board
monitoring via outside directors will be more prevalent in industries with higher uncertainty, where there is need for closer monitoring of managerial actions.

*Hypothesis 1a:* The higher the *demand uncertainty* in the industry, the higher the percentage of outsiders on the board.

*Hypothesis 1b:* The higher the *competitive uncertainty* in the industry, the higher the percentage of outsiders on the board.

*Hypothesis 1c:* The higher the *technological uncertainty* in the industry, the higher the percentage of outsiders on the board.

Besides monitoring by the board of directors, monitoring by institutional ownership has been a common form of corporate governance in the United States (Ryan & Schneider, 2002). Agency theory explains that institutional investors can provide effective monitoring and governance because their block ownership and large voting power make it easier and more economically rewarding to influence a firm’s strategic decisions (Sundaramurthy, 1996). The large size of the investments frequently makes it difficult for institutional investors to sell off their investments even when companies have poor economic performance and/or poor governance practices because these sell offs may result in a substantive decline in price. Because of the illiquidity of institutional funds, institutional investors often become activists, attempting to influence firms through private negotiations and/or proxy fights (Carleton, Nelson, & Weisbach, 1998).

Monitoring and governance by institutional ownership can be particularly meaningful in business environments with high uncertainty in demand, competitive, and technological conditions that invite managerial opportunism and agency problems. When the business environment is less predictable and the information asymmetry between managers and shareholders is high, the need for monitoring of managerial decisions regarding proper
deployment of firm-level resources increases significantly (Demsetz & Lehn, 1985). Because institutional investors have more to gain in uncertain environments through the mitigation of heightened agency problems via their own monitoring and governance, concentration of institutional ownership is likely to be greater as the levels of demand, competitive, and technological uncertainty increase in the industry. In more uncertain environments, institutional owners can create more shareholder wealth through exerting their influence to obtain tighter management control.

Regarding the heightened information asymmetry problem under uncertainty, institutional investors typically have lower information asymmetry problems than small investors. Block institutional investors’ ownership-driven power and economic incentives both motivate and allow these investors to communicate with managers and to monitor closely strategic decisions (Carleton et al., 1998; Shleifer & Vishny, 1997). Institutional investors may possess more information about the firm’s policies and consequently may influence managerial actions more frequently than small investors. Small (individual) investors are likely to be more risk averse in investing in firms operating under uncertainty because they lack the resources and information that institutional investors have to reduce uncertainty. Institutional investors receive information from their own expert analysts, who specialize in certain industries and specific firms or groups of firms, and utilize other information databases about critical industry trends. In addition, block institutional owners have a better chance of communicating with managers and inquiring about their rationale for strategic actions and future projections. A small investor will have little chance, if any, of communicating with top-level executives, of receiving non-public information about the firm, and of influencing a firm’s strategy. Therefore, concentration of
institutional ownership will be higher in industries with higher levels of uncertainty, where there is greater shareholder wealth creation potential from institutional investor monitoring.

_Hypothesis 2a:_ The higher the demand uncertainty in the industry, the higher the percentage of institutional ownership.

_Hypothesis 2b:_ The higher the competitive uncertainty in the industry, the higher the percentage of institutional ownership.

_Hypothesis 2c:_ The higher the technological uncertainty in the industry, the higher the percentage of institutional ownership.

Further, agency theory advocates the use of incentive mechanisms to align the economic interests of managers with those of shareholders (Jensen, 1983; Jensen & Murphy, 1990). It is argued that incentive systems that reward superior economic performance may motivate managers to take the appropriate strategic actions because superior economic performance is rewarded with generous compensation. Indeed, this agency theory argument has been influential in the promotion of increased executive pay for higher firm-level performance. Some performance-based incentives reward short-term firm-level performance, such as bonuses, whereas other types of economic incentives reward long-term firm-level performance, such as managerial stock ownership.

However, executive incentives may not be equally effective under different levels of uncertainty. Particularly, executive incentives may not be as useful as board or institutional investor monitoring under high levels of uncertainty because the inherent uncertainty in particular industries makes it riskier to operate and make decisions and reduces managers’ control over performance outcomes. Even the most intuitive and reasonable decisions (ex ante) may result in modest or poor economic returns as demand conditions fluctuate, unpredicted rivalry takes place, unexpected technological shifts occur in the industry, and so forth.
Shareholders may be tempted to shift the risk borne by uncertainty to managers via performance-based incentives. However, managers may not be willing to bear this business risk when their own influence on economic performance consequences is constrained by uncertainties in the industry. When managers are less willing to accept risk-bearing incentive contracts, the costs of using pay-for-performance incentives increase (Beatty & Zajac, 1994; Eisenhardt, 1989; Zajac & Westphal, 1994).

In a world where all managers were risk neutral and indifferent between variable and fixed income, shareholders would always shift the (business) risk to the managers via incentive-based contracts. By doing that shareholders can have the so-called first-best contract where they pay managers only when results are delivered (Holmstrom, 1982). However, in actual business practice --- and according to the principal-agent mathematical model --- managers are frequently not risk neutral. Thus, there are significant costs of using performance-based incentives. Specifically, risk-averse managers may react to these incentives negatively and try to reduce their risk exposure in many ways such as by distorting performance measures, which can negatively impact firm-level economic performance (Bloom & Milkovich, 1998; Walsh & Seward, 1990). Further, risk-averse managers may demand a higher amount of total compensation to bear individual financial risk that they cannot diversify away in legitimate ways (Eisenhardt, 1989; Scholes, 1992). When they are not granted higher total compensation, risk-averse managers with outside employment alternatives may exit from uncertain business environments (Eisenhardt, 1988; Gray & Cannella, 1997), and consequently firms in these industries may suffer from a shortage of competent managers. In this business situation, firms may have to work exclusively with risk-seeking managers although such managers may make decisions too fearlessly without a balanced view of the future prospects. Given these increased
costs of managerial incentives, firms will use performance-based incentives more sparingly under high levels of demand, competitive, and technological uncertainty in the industry.

Hypothesis 3a. The higher the demand uncertainty in the industry, the lower the use of performance-based bonuses for executives.

Hypothesis 3b. The higher the competitive uncertainty in the industry, the lower the use of performance-based bonuses for executives.

Hypothesis 3c. The higher the technological uncertainty in the industry, the lower the use of performance-based bonuses for executives.

Hypothesis 4a. The higher the demand uncertainty in the industry, the lower the stock ownership percentage for executives.

Hypothesis 4b. The higher the competitive uncertainty in the industry, the lower the stock ownership percentage for executives.

Hypothesis 4c. The higher the technological uncertainty in the industry, the lower the stock ownership percentage for executives.

These hypotheses do not suggest that firm-specific risk factors are irrelevant in substitutions among different governance mechanisms. The extant research indicates that the choice of specific governance mechanisms is linked to firm’s lack of resources, exposure to various business risk factors, and poor firm-level financial performance (e.g., Beatty & Zajac, 1994; Bloom & Milkovich, 1998; Pearce & Zahra, 1992; Zajac & Westphal, 1994). Even though industry uncertainty and firm-level risk factors may be correlated, firm-specific factors do not necessarily mirror uncertainty conditions at the industry level. Just as it would be inappropriate to capture firm-specific risk factors with indicators of industry-level uncertainty, it is also incorrect to assume that firm-level risk indicators will reflect industry uncertainty conditions. Therefore, our hypotheses predict that there will be an empirical link between industry uncertainty and the choice of corporate governance mechanisms after controlling for firm-specific risk and profitability factors.
METHODS

Sample

We empirically tested our theory in a multi-industry sample of United States firms that went public in 1995. We chose the initial public offering setting for our sample for both theoretical and empirical reasons. First, it was important to test the theory in a sample of firms that experience various levels of uncertainty of different types. Firms undergoing an IPO often operate in dynamic, high-growth industries that involve different forms and levels of environmental uncertainty (Mosakowski, 1993), making these firms a suitable empirical context.

Second, managers play a particularly central role in IPO firms, which are relatively smaller and younger and have limited access to resources. Thus, these firms may be particularly susceptible to managers’ willingness to bear risks and accept performance-based incentives (Beatty & Zajac, 1994). Due to a higher likelihood of bankruptcy among these firms compared to larger/older firms, managers face a greater risk to their employment. This increased risk of unemployment makes it difficult to attract and retain talented managers to these business ventures. Combined with the increased employment risk, heavy reliance on performance-based incentives may significantly discourage managers from joining and/or staying with these business ventures because a significant portion of their personal wealth and their future career are tied to the economic success of the risky venture. So, getting the managerial incentives right in conjunction with industry uncertainty can be quite essential in the IPO context.

Third, the business relationships between venture firms and their investors can be very close, where investors communicate and ask for information regularly, provide advice and contacts, and closely monitor venture firms’ strategic actions and financial consequences (Amit, Brander & Zott, 1998; Barry, Muscarella, Peavy & Vetsuypens, 1990; Kozmetsky, Gill &
Smilor, 1985; Megginson & Weiss, 1991). These very close business relationships enable investors to do their monitoring jobs more effectively. Without using complex techniques such as proxy fights, block investors can influence managerial actions through board membership, frequent communication with managers, and more access to firm-specific information. Also, because these ventures are in continuous need for financing for further growth, managers work diligently to get along with the block investors. Thus, for IPO firms, board monitoring can be a critical governance mechanism to mitigate the problem of information asymmetry between shareholders and managers, which is typically elevated under high levels of industry uncertainty.

Fourth, unlike firms that have received public scrutiny and legitimacy pressures for a long time, IPO firms vary greatly in their choices of different forms of governance. Firms that have been public for some time tend to have highly similar corporate governance practices because of years of mimicking each other. Under pressure to achieve legitimacy, these firms are inclined to adopt institutionalized corporate practices including those related to corporate governance (Davis, 1991; Leblebici, Salancik, Copay, & King, 1991; Zucker, 1983). This pressure to conform to institutionalized practices can significantly reduce inter-firm variability and can make it more difficult to detect the industry or firm-specific effects on the use of specific governance mechanisms. While IPO firms also face pressures to adopt institutionalized governance mechanisms (Certo, 2003), their exposure to this public pressure tends to be considerably shorter than the public firms that have been under the scrutiny of financial markets for a long time. For all of these reasons, we submit that the IPO context is appropriate to test empirically our theory.

An overview of the sample statistics indicates that managerial ownership concentration is comparable to those found in more mature firms. Wright, Ferris, Sarin, & Awasthi (1996) report
a management ownership of 12.7 percent in a sample of large public firms listed in the Value Line Investment Survey. The 14 percent management stock ownership in our sample is comparable to the levels reported in empirical studies of large/mature public firms. Management ownership is common in IPO firms although managers of IPO firms can be far from being owner-managers. Starting a new company and bringing it to the IPO stage normally requires significant amounts of investments via multiple rounds of financing. In our sample, it took firms an average of 13.15 years (after their founding) to go public. Only a small fraction of these multiple rounds of financing comes from the founders. Founders often provide the human and management capital, but the financial capital often comes from outside sources such as the venture capital industry, which receives ownership in return for investment. Even though founders may have a significant ownership stake in the company at the time of the inception, after several rounds of financing, founders’ stock ownership gets diluted to a point where founders become minority owners in the company. In support of this argument, we observe that, in our sample, managers collectively own only 14% of the company stock. In a group of five managers, that figure corresponds to less than an average of 3% ownership per manager, which is far from making a manager a manager-owner. Further, in our sample of 60 IPO firms, in only 29 firms were founder(s) still active in company management. In these 29 firms, collective stock ownership by founders is 18.5 percent, which is still less than one fifth of the company. These numbers suggest that, in our sample, stock ownership is not concentrated in the hands of a few managers or founders, certainly not to the point that the phenomenon of separation of ownership and management is eliminated.

Furthermore, in our sample, institutional investors own 37 percent of the company stock. In a study of 400 of the largest U.S. corporations, Zajac and Westphal (1994) report that
ownership by blockholders is 37 percent in these firms. Here again, we see that, with regard to
ownership, newly public firms do not have to be very different from larger and older public
firms. Given the fact that the firms in our sample have similar levels of uses of specific
governance mechanisms, we think that this empirical context is appropriate to test a general
theory of industry uncertainty effects on the use of governance mechanisms. Nevertheless, as we
emphasize in our discussion of future research, testing this theory in mature public firms would
be highly useful.

We also note the increasing number of IPO studies published in top management journals
in the past few years (e.g., Beatty & Zajac, 1994; Carpenter, Pollock & Leary, 2003; Certo,
2003; Certo, Covin, Daily & Dalton, 2001; Filatotchev & Bishop, 2002; Gulati & Higgins, 2003;
Stuart, Hoang, & Hybels, 1999; Welbourne & Andrews, 1996). There is a growing curiosity and
fascination about how IPO firms behave and perform because these firms are a great source of
cutting-edge new technologies and economic growth. Not long after the IPO event, many IPO
firms end up joining the ranks of Fortune 500 firms. IPO firms can also fail and result in
substantial loss of shareholder wealth, which also makes it important to develop an
understanding about management and governance of these firms. Our paper contributes to our
knowledge of newly public firms. However, this contribution is only secondary to our main
contribution of developing a theory of industry effects on the use of corporate governance
mechanisms. Our sampling design of using IPO firms resulted in a sample of firms that are
nearly all single-industry firms, which is particularly appropriate for our research question.

In forming our sample, we identified common stock initial public offerings (IPO) in 1995
from 24 manufacturing industries (SIC codes 2800-3800) including chemicals, primary metals,
industrial machinery, computers, electrical equipment, transportation equipment, and measuring
instruments. The year 1995 was chosen for sampling due to the large number of public offerings that occurred during this year. There were 84 firms that filed with the Securities and Exchange Commission in 1995 to sell common stock via an initial public offering. After accounting for missing data on different variables, we arrived at our final sample that consists of 60 firms.\footnote{Given our relatively small sample size, we conducted a series of power analyses (Cohen, 1988). These analyses indicate that our sample has significant power to detect both large and medium size effects. The effect size refers to the degree to which the phenomenon (that is argued in a hypothesis) is present in the population, and the rule of thumb in power analysis is that 0.80 indicates acceptable power (Cohen, 1988). We found that there is a 99% chance that we would detect a large effect size in our sample of 60 observations. We also found that there is a 97% chance that we would detect a medium effect size in our sample. The only size effect our sample may not be able to detect is a small size effect (i.e., there is only a 56% chance that we would detect a small effect size in our sample). We are also confident about the presence of those effects that we detected in our regression analyses as the t- significance tests for regression coefficient estimates already take into account our sample size to calculate the critical t values that we need to exceed to reject the null hypothesis while minimizing the type 1 error.}

Data on these IPO firms come from initial registration statements. The Securities and Exchange Act of 1934 requires corporations in interstate commerce (1) whose stock is listed on national exchanges or (2) that have over 500 shareholders and over $3 million in assets to file an initial registration statement, i.e., prospectus, with the Securities and Exchange Commission (Peterson, 1994). Past IPO studies heavily relied on prospectus data to conduct empirical analysis because the prospectus provides considerably richer data than conventional financial statements such as annual reports and proxy statements (Filatotchev & Bishop, 2002). Prospectus document includes detailed information on the conditions of their business (e.g., risk factors), ownership structure, top management team, financial statements, articles of the incorporation and bylaws. We had access to the prospectus data through Primark’s (formerly known as Disclosure) New Issues Database.
Measures

**Dependent variables.** To test our hypotheses regarding the choice or presence of specific governance mechanisms, we calculated four dependent variables. *Board outsider percentage* was calculated as the ratio of outsider directors to the total number of directors (Beatty & Zajac, 1994). *Institutional ownership percentage* was calculated as the percentage of company stock owned by institutions including pension funds, venture capital firms, mutual funds, and insurance companies (Mahoney, Sundaramurthy and Mahoney, 1997). Two indicators of performance-based management compensation were used. The first one, *performance-based bonuses*, indicates the firm’s use of short-term performance-based managerial incentives. This construct was calculated as the percentage of cash compensation managers received in the form of bonus rather than salary. The second construct, *managers’ stock ownership* as a percentage of total stock, reflects the firm’s use of long-term performance-based managerial incentive. The firm-level data on corporate governance were compiled from prospectus documents. The ownership data for both managers and institutions reflect the ownership percentage immediately after the IPO.

**Independent variables.** Uncertainty in the industry was measured at three levels: demand, competitive, and technological uncertainty. To measure *demand uncertainty* for each industry based on its 4-digit SIC code, the industry-level total sales for years 1986-1995 were regressed on the year variable, and the standard error of the regression slope coefficient was divided by the mean total industry sales (Dess & Beard, 1984). Previous research suggests that the number and size distribution of firms within the industry are linked to the rigor and dynamics of competition (Bain, 1968; Wiersema & Bantel, 1993). Thus, we measure *competitive uncertainty* with the most common measure of industry concentration (i.e., four-firm
concentration ratio) (Scherer, 1980), where the industry’s total market share percentage accounted for by the four largest firms was subtracted from 100 to indicate competitive uncertainty. Lower values of this variable indicate lower competitive uncertainty because concentration in the industry enables firms to signal each other about firm-level strategies (e.g., pricing strategy) and makes competitive actions and reactions more predictable (Ghosh, 2004, Oster, 1999, Scherer, 1980). The data for demand and competitive uncertainty variables were compiled from U.S. Bureau of the Census, Census of Manufacturers. Data for the competitive uncertainty variable are available only during Census years; thus, we used data from 1992 Census as a proxy for 1995. Further, to calculate the measure of technological uncertainty, we used the number of patents issued in each industry (Sharfman & Dean, 1991). The number of patents issued annually for the years 1985 through 1994 was regressed on the year variable, and the standard error of the regression slope coefficient was divided by the mean number of patents for the specific industry. High levels of variation in the number of patents issued suggests that it is difficult to predict when and how frequently new product and/or process technologies will emerge in the industry, making decisions about committing to specific technological paths rather risky. The data for this variable were available at the two-digit SIC code level from the U.S. Patent and Trademark Office’s publication, *Patenting Trends in the United States*.

**Control variables.** Further, in the light of past corporate governance research, we used several control variables in our regression analyses. We controlled average age in the management team as an overall indicator of the general experience and knowledge managers possessed. Also, the level of firm-based risk that IPO firms face may influence the choice of corporate governance mechanisms (Beatty & Zajac, 1994). Thus, we controlled firm-level risk with two variables. The first variable is the number of risk factors companies listed in their
prospectuses to inform potential investors about the conditions that may endanger the future of their company. Risk factors indicate current and potential risks specific to firms such as the need for expanded product line, loss of patents, dependence on a single product family, and fluctuations in results of operations. Past research has used this indicator as an effective measure of firm-specific risks in the context of IPO firms (Beatty & Zajac, 1994). We also controlled firm-level risk with an indicator of profitability. We used a dummy variable that indicates whether the firm was profitable or not during the year before it went public (Beatty & Zajac, 1994). Finally, we controlled for market capitalization as it may affect a firm’s attractiveness to block or institutional investors. Market capitalization also shows a firm’s ability to seek funding through capital markets.

Ordinary least squares regression was used in all models. Anticipating heteroskedastic error terms, we employed a robust regression technique that uses White-corrected estimator of variance (White, 1980). Multicollinearity was not a problem in any of our models (i.e., all variance inflation factors are smaller than 2). Also, we standardized the variables because of the large unit differences among them. Firm size and firm age were normalized via logarithmic transformation. Table 1 summarizes the descriptive statistics and correlations for all variables.

--------------------------------------
Insert Table 1 about here
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EMPIRICAL RESULTS

Table 2 shows the empirical results of hypothesis testing for board and institutional ownership monitoring. We performed our analyses hierarchically. We first entered control variables and then the independent variables. Due to strong substitution effects between
management bonus percentage and stock ownership percentage, we use these control variables alternatively when we estimate the levels of board outsider ratio and institutional investor ownership (Beatty & Zajac, 1994; Zajac & Westphal, 1994). In all models, we see the R-square go up as the independent variables (i.e., industry uncertainty indicators) are added to the regression.

We argued in hypothesis 1a that, the higher the demand uncertainty in the industry, the higher the percentage of outsiders on the board. In support of this hypothesis, we found that the ratio of outsiders on the board increases as demand uncertainty increases in the industry. In support of hypothesis 1b, we also found that as the competitive uncertainty increases in the industry, the ratio of outsiders on the board increases. In hypothesis 1c, we argued that the higher the technological uncertainty in the industry, the higher the percentage of outsiders on the board; however, we did not find support for this hypothesis. The empirical results are similar for the second set of hypotheses that test the presence of institutional investor ownership under three types of uncertainty in the industry. In support of hypothesis 2a, we found that institutional ownership percentage increases with the level of demand uncertainty. There was partial support for hypothesis 2b. The second model for institutional ownership indicates that, institutional ownership percentage increases with the level of competitive uncertainty. Hypothesis 2c, however, was not supported.

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2 We also ran our regressions with both management compensation variables entered in the same equation and found two changes. First, the effect of demand uncertainty on board outsider ratio was significant at the 10% level instead of 5% level. Second, the p-value for the effect of demand uncertainty on institutional ownership has increased to 10.9%, which is slightly above the critical value of 10%.
Table 3 shows the empirical results of hypothesis testing for management compensation. In hypothesis 3a, we predicted a negative relationship between the level of demand uncertainty and the use of performance-based bonuses for executives. On the contrary, the empirical results indicate that the bonus proportion of managers’ total cash compensation increases with demand uncertainty. For competitive uncertainty, however, the empirical results are consistent with our prediction for bonus compensation. In support of hypothesis 3b, the bonus proportion of managers’ total cash compensation decreases with competitive uncertainty. Hypothesis 3c was not supported.

The empirical results corroborate hypothesis 4a. Managers’ stock ownership percentage decreases with the level of demand uncertainty in the industry. On the other hand, managers’ stock ownership percentage does not seem to vary significantly with competitive and technological uncertainty. Overall, with higher demand uncertainty in the industry, firms adopt higher use of short-term performance-based managerial incentives (i.e., bonus), but they opt for lower use of long-term performance-based incentives (i.e., stock ownership). Also, as predicted, firms use short-term performance based incentives (i.e., bonus) to a lower degree as the level of competitive uncertainty increases in the industry.³

³ We also ran a multivariate analysis where we jointly estimated the models for institutional ownership percentage and management stock ownership percentage. The empirical results were very similar to the individual regression results. The only notable change was that, in the institutional ownership model, the significance for industry demand uncertainty decreased from 0.01-level to 0.05-level although this change did not affect the conclusion of our hypothesis testing. Multivariate analysis indicated that two equations are jointly significant (F=3.82; p<0.0001), and that the industry demand uncertainty variable is jointly significant in both models (F=5.11, p<0.0097).
DISCUSSION AND CONCLUSIONS

The research literature on corporate governance offers little theoretical insight and empirical evidence about whether industry-specific conditions may account for some of the inter-firm heterogeneity in the choice of specific governance mechanisms. In this research paper, we developed theoretically and tested empirically how the use of monitoring by board outsiders and institutional investors and the use of managerial incentives differ on the basis of different types of uncertainty in the industry (e.g., demand, competitive and technological uncertainty). We empirically tested our theory with a sample of high-growth and entrepreneurial IPO firms, which typically operate in dynamic environments and experience various levels and types of uncertainty (Kor, 2003; Mosakowski, 1993). Compared to large firms that have been public for a long time, these newly public firms exhibit a richer variety in the level and combination of specific governance mechanisms that they possess. The empirical results of this research study indicate that industry uncertainty does, indeed, significantly influence the choice of governance mechanisms. Specifically, we found that industry effects on the choice of governance mechanisms are strongest and most consistent for demand uncertainty and competitive uncertainty.

Effects of Demand Uncertainty on the Choice of Governance Mechanisms

Greater demand uncertainty, which reflects higher instability in sales generation in the industry from year to year, is associated with higher levels of monitoring by the board of directors and institutional investors. These empirical findings suggest that increased information asymmetry caused by demand uncertainty is an invitation to both forms of monitoring through which shareholders try to mitigate potential agency problems. Outside directors, who are likely
to be less intimidated by the CEO, can communicate directly to all top-level executives and inquire about their reasoning for strategic decisions and projections for industry trends. With insight and knowledge about managers’ mindsets and key industry-specific factors, outside directors can partially overcome the problem of information asymmetry and assess more accurately the likely marginal effect of managerial actions on financial performance. Similarly, institutional investors can effectively evaluate managerial actions and influence strategic decisions in directions of economic value creation because of ownership-driven control rights and their access to valuable information about the firm and the industry (through executives and their own experts). Under greater uncertainty there are higher economic payoffs from monitoring to mitigate agency problems that can otherwise cause significant wealth loss. Thus, the levels of monitoring both by outside directors and through a concentration of institutional investor ownership increase under demand uncertainty.

In highly uncertain industries, monitoring can be a powerful governance mechanism especially in IPO firms. In these firms, institutional investors such as venture capitalist firms can be influential in deciding when there is need for more outside directors and who these directors should be. Given the highly risky nature of these investments, membership on the board gives these investors convenient access to useful non-public company information and the ability to communicate easily and frequently with these top-level managers. With these communication and information advantages, outside directors and institutional owners can more accurately assess how well the firm is managed and what actions may need to be taken to improve performance of the firm (Fried, Bruton & Hisrich, 1998).

Our empirical results are consistent with those of Pearce & Zahra (1992) and Pfeffer (1972) who also found a higher presence of outside directors on boards when firms operate in
environments with high uncertainty. These studies, however, provide a different theoretical explanation. Using insights from resource-dependence theory (Pfeffer & Salancik, 1978), these and other studies identify the lack of information and the unpredictability of changes as major problems for managerial decision-making, and they view the board and inclusion of more outside directors on the board as co-optation mechanisms to cope with uncertainty in the external environment (Hillman & Dalziel, 2003). According to this view, for example, uncertainties in supplier relationships may lead to appointment of a director from a major supplier to secure critical resources and relationships.

While this explanation is quite plausible, we hasten to emphasize that the lack of information and the unpredictability of changes have important implications not only for managerial decision making but also for the emergence of new agency problems because of the elevated information asymmetry between shareholders and managers. To better understand the reasons behind an increase in the board outsider ratio, we need to take a closer look at the affiliations of outsiders and whom they represent. In our sample of IPO firms, we find that a significant portion of the outside directors represent major investors (e.g., institutional investors including venture capitalists) in these firms. Through board membership, it is convenient for the institutional investors to monitor closely managerial actions and influence firm-level strategy and governance practices. This significant positive correlation between the board outsiders and institutional investor ownership supports the agency theory argument that investors heavily use the board of directors as a monitoring mechanism to oversee managerial actions to ensure superior economics returns from their IPO investments. Thus, monitoring and governance are among the most important reasons for the higher presence of outside directors on the board under high uncertainty.
The resource-dependence theory explanation for investor-linked board membership would be that firms with capital requirements would be willing to provide board seats to investors in return for the external funding they receive (Pfeffer, 1972). So, agency theory highlights that investors prefer having this board seat because it allows these investors to monitor managerial actions more closely while the resource-dependence perspective emphasizes that co-optation by boards allows the firm to have access to financial resources. The major difference between the two is that agency theory explains and highlights the reasons for the use of board monitoring from the shareholders’ perspective whereas resource-dependence theory explains and stresses the reasons for the use of outsiders on the board from the firm’s perspective.

However, another difference is that, in our research paper, we argue and demonstrate that industry-specific uncertainty is an important reason for the higher use of board monitoring whereas Pfeffer (1972) shows that the firm-specific resource needs influence the number of outside directors on boards. In our sample of IPO firms, all firms are in need of capital, yet we still observe significant differences in the use of board monitoring in conjunction with industry-specific uncertainty, and these differences can be explained by the agency theoretical arguments presented in the current paper. Our empirical results indicate that the links between industry uncertainty and the use of board monitoring exist even after controlling for firm-level business risk, financial performance, and firm’s ability to raise funds in the capital markets. This empirical finding confirms the use of boards as a monitoring mechanism. Also, unlike resource dependence theory, the agency perspective offers theoretical insights not only for the use of board monitoring but also for the concentration of institutional ownership and the use of managerial incentives.
Further, we find that, with greater demand uncertainty, firms rely less on long-term performance-based managerial incentives (i.e., executive stock ownership). This empirical finding is consistent with our argument that the firm’s ability to shift business risk to managers diminishes because, with increasing demand uncertainty, managers’ control over a firm’s economic performance becomes constrained. However, under demand uncertainty, firms rely more on short-term performance-based incentives (i.e., executives’ bonus percentage). Instability in market demand seems to affect the use of long-term incentives (stock ownership) in a negative manner, as expected, but it has a positive impact on short-term incentives. Perhaps firms shift their emphasis from long-term incentives to short-term incentives because, under high levels of demand uncertainty, managers’ ability to influence firm-level economic performance is somewhat limited to the short-term rather than the long term.

In the current sample, managers received an average of twenty-two percent of their cash compensation through bonus payments. It may be that in the IPO setting short-term performance-based incentives are used heavily with increased demand uncertainty in order to influence managers to focus on the volatility of the market and to make decisions that will reduce the negative effects of such fluctuations on firm-level economic performance. Put differently, under demand uncertainty in the industry, firms substitute managerial stock ownership by performance-based bonus compensation, which may be more effective in inducing the desired managerial behavior (e.g., closer managerial attention to strategic actions that reduce negative effects of instability in industry sales on short-term firm-level economic performance).

**Effects of Competitive Uncertainty on the Choice of Governance Mechanisms**

Our empirical results also largely corroborate our theory concerning the links between competitive uncertainty and the choice of corporate governance mechanisms. Unpredictability
of competitors’ actions and reactions adds to the information asymmetry between managers and shareholders and makes it more difficult to assess the correctness of managerial actions. In this kind of environment, closer monitoring of managerial actions by the board and institutional investors are prevalent forms of corporate governance. Because of their information gathering advantages (e.g., dialogue with the executives), outside directors and institutional owners can build useful knowledge about the firm’s competitive strategy and key rivals’ intentions and capabilities. This knowledge is crucial in the evaluation of the roles played by unpredictable competitive conditions and managerial incompetence/opportunism in shaping a firm’s economic performance. Also, this knowledge helps the board and institutional investors point the management team in the right direction.

Additionally, in support of our theory, we find that the use of bonus compensation decreases with competitive uncertainty. Firms avoid emphasis on short-term performance-based incentives when managers’ ability to predict and influence competitors’ strategy is limited. In industries with high competitive uncertainty, managers receive a higher percentage of their cash compensation in the form of salary rather than performance-based bonuses. By emphasizing salary cash compensation as fixed income, firms provide managers with the economic incentive to work in highly uncertain competitive environments.

**Effects of Technological Uncertainty on the Choice of Governance Mechanisms**

Unlike demand and competitive uncertainty, we do not find any effects of technological uncertainty on monitoring by boards or institutional investors. Initially we found this empirical result puzzling, especially in the presence of our strong empirical results for demand and competitive uncertainty. However, upon reflection, it seems highly warranted to believe that monitoring mechanisms have different implications under technological uncertainty.
One highly plausible conjecture is that the knowledge of specific product and process technologies in an industry may be highly complex and may take a long time to develop. Even though outside directors and institutional investors have access to valuable information about the firm and industry trends, it still may be extremely difficult to predict which product/process technologies will be dominant in the future. Most likely, managers will always have a knowledge advantage because of their day-to-day involvement with firm-specific investments in technology. In fact, as argued before, even managers may have difficulties envisioning future technology trends when new technologies frequently emerge in the industry in unexpected fashions. Ultimately, if outside directors and institutional investors cannot reduce this technology-driven information asymmetry and effectively mitigate the potential agency problems, then there is not much to be gained by intense monitoring through either mechanism. This line of reasoning, which can be derived from Ouchi (1979), can plausibly explain why we do not see a higher proportion of outside directors on boards or a higher concentration of institutional ownership as the level of technological uncertainty escalates.

Also, we were curious to see whether the empirical results would change if we substituted a measure of technology intensity (i.e., the number of patents issued in the industry) for our measure of technological uncertainty (i.e., variability in the number of patents). There were two differences regarding the effects of technology intensity on the choice of managerial incentive compensation. At higher levels of industry technology intensity, (1) there was higher use of bonus compensation and, (2) lower use of management stock ownership. While firms were willing to use bonus compensation with increasing technology intensity, they were hesitant to use bonus compensation with increasing technological uncertainty in the industry. However,
firms were unwilling to use stock ownership heavily as a managerial incentive at higher levels of either technology intensity or technological uncertainty.

**Limitations and Future Research**

We acknowledge here that this empirical research study has a number of limitations. First, despite including all firms undergoing a common stock IPO during the selected timeframe, our sample size is modest due to missing data on certain variables. However, in some sense, it makes it all the more suggestive that we do find a number of statistically significant relationships in our sample indicating that industry uncertainty is highly likely to be an important factor to consider in governance research. Also, the cross-sectional nature of our data does not allow us to demonstrate causality in the relationships discussed in the paper. The data do corroborate our interpretation of the findings, which are consistent with the theory: *Uncertainties in the industry influence the use of specific governance mechanisms.*

Additionally, further empirical research using other sampling designs is needed before the empirical findings of the current paper can be generalized to large public firms where corporate governance decisions may be shaped by institutional and legitimacy-related forces as well as economic forces (Leblebici, Salancik, Copay and King, 1991; Zucker, 1983). Finally, because we rely on secondary data sources, it was not possible to measure directly managers’ perceptions of the risk associated with various types of industry uncertainty. Alternative data gathering techniques could be helpful for future research studies that examine managers’ perceptions of risk and the processes that influence managers’ responses to specific governance mechanisms. However, it has been argued that perceptual measures of environmental uncertainty are more appropriate for studying managerial behavior, whereas objective measures are more
valuable for understanding the external constraints imposed on a firm, as in this study (Boyd, Dess & Rasheed, 1993; Boyd & Fulk, 1996).

In addition, future empirical studies could further examine the relationship between technological uncertainty and governance. While we have not found increased monitoring by outside directors with this type of uncertainty, there may be other factors that affect this relationship. For example, specific backgrounds of the outside directors may be relevant to the effectiveness of board monitoring under technological uncertainty. Also, recent empirical research suggests that different types of institutional investors may have different effects on important organizational outcomes such as innovation (Hoskisson, Hitt, Johnson, & Grossman, 2002). Therefore, future research may explore whether specific types of institutional investors are more effective in mitigating potential agency problems under technological and other forms of uncertainty. Finally, recent research (e.g. Hoskisson, et al, 2002) has indicated that different types of institutional investors impact firm strategy in different ways. Thus, future research would benefit from examining whether different types of institutional investors are equally attracted to investing in risky ventures under different levels of industry uncertainty.

Conclusions

This theoretically grounded empirical paper contributes to the management research literature concerning why firms differ in their bundle of governance mechanisms. The empirical results of this study highlight the differences in the effects of industry-specific uncertainties on the choice of different governance mechanisms. A major conclusion of this empirical study is that the use of monitoring by boards and institutional investors and the use of executive performance-based incentives increase significantly with demand uncertainty and with
competitive uncertainty in the industry. Also, firms emphasize bonus incentives and de-emphasize stock ownership under demand uncertainty.

Moreover, this research paper highlights the practical implications for shareholders and governance experts by directing their attention to the trade-offs in substitution among specific governance mechanisms under different types of industry uncertainty. The empirical results suggest that specific corporate governance mechanisms may not be universally effective. This implication is important economically because unnecessary or excessive use of a particular governance mechanism can be costly for the firm, just as the absence of essential mechanisms could be under certain industry conditions. To achieve greater benefit from governance mechanisms, shareholders and corporate governance specialists should (1) consider the effects of industry-specific contingencies on the use and effectiveness of specific mechanisms, and (2) make the necessary substitutions among mechanisms under different types of industry-specific uncertainty. Future empirical research on the cost-benefit trade-offs among these mechanisms will be useful because, without an examination of the contingencies that influence the choice of mechanisms, firms are likely to continue to suffer from agency problems and/or bear significant economic costs due to the inappropriate use of governance mechanisms.
REFERENCES


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<td>0.00</td>
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<tr>
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<td>0.23</td>
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<td>0.07</td>
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<td>0.17</td>
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<td>9. Management age</td>
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<td>0.17</td>
<td>0.14</td>
<td>0.01</td>
<td>0.02</td>
<td>0.24</td>
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<td>*</td>
<td>0.26</td>
<td>*</td>
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<td>17.04</td>
<td>0.02</td>
<td>-0.40</td>
<td>**</td>
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<td>-0.11</td>
<td>-0.20</td>
<td>0.26</td>
<td>*</td>
<td>0.00</td>
<td>0.18</td>
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<td>*</td>
<td>0.09</td>
<td>-0.18</td>
<td>-0.17</td>
<td>0.05</td>
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<td>-0.10</td>
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<td>0.37</td>
<td>**</td>
<td>-0.21</td>
<td>0.46</td>
<td>**</td>
<td>0.26</td>
<td>-0.17</td>
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a Firm size and market capitalization are in million U.S. dollars.

b * p< .05

** p< .01
### TABLE 2
Results of Ordinary Least Squares Regression Analysis: Board and Ownership Monitoring

<table>
<thead>
<tr>
<th></th>
<th>Board outsiders ratio</th>
<th>Institutional ownership %</th>
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<td>Demand uncertainty</td>
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<td>0.32 **</td>
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<td></td>
<td>(0.12)</td>
<td>(0.11)</td>
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<td>Competitive uncertainty</td>
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<td>(0.14)</td>
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<td>(0.16)</td>
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<td>Management bonus %</td>
<td>-0.33 *</td>
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**a** Standard errors are provided in parantheses below the standardized coefficient estimates.

**b** + p< .10  * p< .05 ** p< .01 *** p< .001
### TABLE 3
Results of OLS Regression Analysis: Management Incentive Compensation $^{a,b}$

<table>
<thead>
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<td>(0.09)</td>
<td>(0.11)</td>
</tr>
<tr>
<td>Competitive uncertainty</td>
<td>-0.20 +</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>(0.10)</td>
<td>(0.12)</td>
</tr>
<tr>
<td>Technological uncertainty</td>
<td>-0.16</td>
<td>0.14</td>
</tr>
<tr>
<td></td>
<td>(0.11)</td>
<td>(0.12)</td>
</tr>
<tr>
<td>Management bonus %</td>
<td></td>
<td>0.46 *</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.64 ***</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(0.18) (0.17)</td>
</tr>
<tr>
<td>Management stock ownership %</td>
<td>0.35 *</td>
<td>0.47 ***</td>
</tr>
<tr>
<td></td>
<td>(0.13)</td>
<td>(0.12)</td>
</tr>
<tr>
<td>Log firm size</td>
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<td>0.13</td>
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<tr>
<td></td>
<td>(0.14)</td>
<td>(0.13)</td>
</tr>
<tr>
<td>Management age</td>
<td>0.17</td>
<td>0.29 *</td>
</tr>
<tr>
<td></td>
<td>(0.15)</td>
<td>(0.14)</td>
</tr>
<tr>
<td>Log firm age</td>
<td>0.25 *</td>
<td>0.34 **</td>
</tr>
<tr>
<td></td>
<td>(0.10)</td>
<td>(0.11)</td>
</tr>
<tr>
<td>Number of risk factors</td>
<td>0.08</td>
<td>0.00</td>
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<tr>
<td></td>
<td>(0.10)</td>
<td>(0.11)</td>
</tr>
<tr>
<td>Profitability</td>
<td>0.16</td>
<td>0.16 +</td>
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<tr>
<td></td>
<td>(0.10)</td>
<td>(0.09)</td>
</tr>
<tr>
<td>Market capitalization</td>
<td>0.37 ***</td>
<td>0.42 ***</td>
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<tr>
<td></td>
<td>(0.09)</td>
<td>(0.08)</td>
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<tr>
<td>R-square</td>
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<td>F-value</td>
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<td>17.38 ***</td>
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$^a$ Standard errors are provided in parantheses below the standardized coefficient estimates.

$^b$ $+p<.10$ $*p<.05$ $**p<.01$ $***p<.001$