

Does regulation substitute or complement governance?[☆]

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February 2008

Abstract

The relation between regulation and corporate governance remains an open debate in the literature. In this paper we implement a novel approach to test whether regulation substitutes for or is a complement to governance. Using data from initial public offerings, we document that regulated firms have greater proportions of monitoring directors and larger boards as well as use similar levels of equity-based compensation as non-regulated firms. Further, regulated and unregulated firms are analogous in terms of observed trade-offs between traditional monitoring mechanisms and inside ownership. Finally, regulated firms do not significantly increase monitoring levels following deregulation. These findings support the hypothesis that regulation and governance are complements. Our results are consistent with regulators pressuring firms to adopt effective monitoring structures.

Keywords: Corporate Governance; Regulation

JEL Classification: G21; G22, G28; G34

[☆]We thank Michelle Lowry, Laura Field, Harold Mulherin, David Reeb, Chad Zutter, and seminar participants at the 2007 Financial Management Association meetings for helpful comments and suggestions. We also thank Kinjal Desai for his research assistance.

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1. Introduction

The literature on corporate governance is somewhat enigmatic on the relation between regulation and governance. Some studies argue that regulation should substitute for governance (substitution hypothesis), since executive decision-making may be more transparent and opportunities to invest in projects severely limited at regulated firms (Demsetz and Lehn, 1985; Smith and Watts, 1992, Joskow, Rose, and Shepard, 1993). Empirical evidence, however, does not fully support this notion (e.g. Hadlock, Lee, and Parrino, 2002; Houston and James, 1995). As an alternative, we propose that regulation and governance serve as complements (regulatory pressure hypothesis). The focus of regulation is not on shareholder wealth maximization; rather, regulators are charged with ensuring safety and soundness. Regulatory pressure may encourage firms to use greater levels of monitoring, similar to a “best practices” approach. Essentially, regulation and governance may work together to ensure an effective governance structure.

In this paper, we provide a novel approach to examine the relation between regulation and governance. Unlike much of the existing governance literature, our analysis is organized around a corporate event (initial public offering or IPO) rather than in calendar time. Baker and Gompers (2003) note that since existing shareholders bear the cost of suboptimal governance, monitoring mechanisms are more likely optimally chosen at the IPO. Brown, Dittmar, and Servaes (2005) demonstrate the importance of having the “proper initial governance structure” for a sample of roll-up IPOs. By contrast, in calendar time, governance structures may be as much a consequence of past performance as a measure of the quality of governance. Analyzing structures at the IPO enables us to examine governance while decreasing the impact of prior performance (calendar versus event time). Using the IPO allows us to partially control for the endogeneity issues associated with prior governance studies.

Governance mechanisms are costly to implement (Shleifer and Vishney, 1997; Baker and Gompers, 2003). If governance mechanisms are essentially unnecessary (substitution hypothesis), regulated firms should have substantially lower levels of monitoring. In addition, Jensen and Meckling (1976) suggest that monitoring can alleviate agency problems when inside ownership is low. If regulation substitutes for governance, the degree of interdependency between traditional monitoring mechanisms and ownership should be less at regulated firms. In contrast, regulatory pressure suggests that firms establish a “system” of governance, where monitoring mechanisms are interchanged for one another (Adams and Mehran, 2003).

We find that regulated firms are different from unregulated firms at the IPO in terms of their governance structure in a univariate setting. Regulated firms adopt governance structures with greater levels of monitoring, especially by the board. In addition, we examine trade-offs between monitoring mechanisms and ownership after controlling for firm characteristics. We document relations between monitoring mechanisms are analogous for unregulated and regulated firms both at the IPO year and two years post-IPO; monitoring mechanisms serve as alternates for ownership at both regulated and unregulated firms. Effectively, we find no evidence regulation substitutes for governance. These results suggest regulation serves as a means of pressuring firms to adopt effective governance structures.

We further test our substitution and pressure hypotheses by examining the effect of deregulation. If regulation substitutes for governance, then removing regulation should lead regulated firms to alter governance structures to more closely mimic those at unregulated firms (Kole and Lehn, 1999). We do not find empirical evidence to support this notion. Governance structures of regulated IPOs following a deregulatory period do not more closely resemble that of unregulated IPOs; post-deregulation regulated firms still have greater levels of monitoring

mechanisms. Further, firms do not significantly increase monitoring levels after a substantial deregulatory period, which would be expected under the substitution hypothesis.

While this paper focuses on regulated versus unregulated firms, our findings have implications for research on corporate governance more broadly. A debate exists as to whether corporate governance affects market values (Gompers, Ishii, and Metrick, 2003; Core, Guay, Rusticus, 2006). Corporate governance can reduce agency problems and lead to more effective monitoring of managers. However, adopting these mechanisms is costly. If governance were unimportant, then, in an environment where information asymmetry and managerial discretion are limited, monitoring systems would be essentially unnecessary (i.e., regulation would substitute for governance). Our results are not consistent with this, and thus provide additional support on the importance of corporate governance in protecting shareholders.

The remainder of this paper is organized as follows. Section 2 details the motivation and hypotheses. In section 3, we describe our samples, data collection, and summary statistics. Section 4 presents empirical results and differences between regulated and unregulated firms at the IPO. In section 5, we provide robustness specifications, while section 6 concludes.

2. Motivation

2.1 Regulation as a substitute or a complement for governance?

Adams and Ferreira (2006) note that the issue of whether regulation substitutes for governance remains an open question. Empirical research provides some evidence that regulation substitutes for traditional monitoring mechanisms. Joskow, Rose, and Shepard (1993) find lower pay for regulated CEOs, while Kole and Lehn (1999) note that the governance structures at regulated firms move toward structures of unregulated firms post-deregulation. Hubbard and Palia (1995) and Crawford, Ezzell and Miles (1995) document a stronger link between compensation and performance post-deregulation. Becher, Campbell and Frye (2005)

find bank directors receive less incentive compensation than non-bank directors, while Booth, Cornett, and Tehranian (2002) show internal monitoring of managers at regulated firms is less important. Thus, the presence of regulators may substitute for traditional shareholder monitoring mechanisms by reducing the effect of managerial decisions on shareholder wealth.

However, other results are inconsistent with the substitution hypothesis. Hadlock et al. (2002) determine regulated CEOs are held at least as accountable for performance as non-regulated CEOs. Houston and James (1995) indicate CEO stock holdings and use of option-based compensation are lower in banking due to differences in investment opportunities and other firm characteristics rather than regulation. Adams and Mehran (2003), Booth et al. (2002), and others show boards of regulated firms have greater independence than those of non-regulated firms. If regulated firms require less monitoring, boards should be comprised of a smaller proportion of independent outside directors relative to non-regulated firms. These findings cast doubt on the substitution hypothesis.

Furthermore, Skeel (1999) and Joskow et al. (1993) note that regulators do not have the same financial interests as shareholders and focus on safety and soundness rather than wealth maximization. Regulators do not regulate monitoring levels that firms are required to maintain¹ and do not specify board size or the number of independent directors.² However, the presence of regulators may pressure firms to adopt effective corporate governance structures. Booth et al. (2002) point to the threat of corrective actions by regulators. Joskow et al. (1993) note that

¹ Savings institutions do face limitations on stock ownership. Federal regulations prohibit a person, firm, or group from acquiring over 10% of any class of voting stock without prior approval. However, this approval appears non-binding. To illustrate, ownership levels exceed 10% for every savings bank in our sample with any monitoring holdings. Similar to Adams and Mehran (2003), we do not include individuals as monitoring blockholders. Also, banks face restrictions regarding acquisitions, which may have some effect on ownership structures.

² Banks are required to have an audit committee that is independent of management. However, there has been recent pressure toward independence for all firms. For example, in 1999 Nasdaq required its members to have audit committees comprised only of independent directors. The NYSE rules require a majority of independent directors on the audit committee. The Sarbanes-Oxley Act of 2002 requires all audit committee members to be independent. Thus, all companies, regulated or unregulated, would be required to meet these requirements.

regulation increases the visibility of corporate governance through enhanced public scrutiny and provides a set of instruments (price and allowable cost decisions) to penalize firms perceived to have poor governance structures. For banks, Baxter (2003) highlights the importance that they are perceived by regulators as “well managed”. If their management rating becomes less than satisfactory, financial holding company status could be jeopardized under the Graham-Leach-Bliley Act. Adams and Ferreira (2006) contend regulators view board oversight as an important complement to supervision rather than a substitute. They point to studies by the Comptroller of the Currency and General Accounting Office, which linked bank failures and inadequate board monitoring. Thus, regulatory pressure may be strongest with respect to board structures.

Perhaps the area most influenced by regulation is executive compensation. Houston and James (1995) note the FDIC Improvement Act of 1991 (FDICIA) provides regulators with oversight of senior management and requires undercapitalized institutions to receive approval prior to paying bonuses or increasing compensation. In addition, John et al. (2000) argue for a more prominent role for management compensation structures in bank regulation. However, regulators have been reluctant to adopt strict guidelines limiting compensation policies for healthy banks. Joskow et al. (1993) attribute differences in executive compensation at regulated firms to political pressures. They site the weaker link between pay and performance at regulated firms to an effort to reflect interests of both consumers and the firm. While regulators do not implicitly influence governance structures, there may be a more direct link with compensation.

2.2. Hypotheses

The extant literature has focused largely on the idea that regulation substitutes for governance, but has failed to address empirical findings inconsistent with this hypothesis. In addition to examining the substitution hypothesis in a new setting, we also propose an alternative

hypothesis: regulatory pressure. Regulators focus on safety and soundness rather than shareholder interests, which weakens the substitution argument. Essentially, the substitution hypothesis implies these goals are interchangeable or paired. Rather than substitute, regulators may pressure firms to adopt effective governance structures; regulation and governance may work together and serve as complements rather than substitutes.

To explore if regulation substitutes or complements governance, we test three hypotheses.

H1A Substitution: If regulation substitutes for governance, monitoring levels should be lower at regulated firms.

H1B Pressure: If regulation pressures firms to adopt effective monitoring structures, monitoring levels should be the same or higher at regulated firms.

The substitution hypothesis clearly predicts that regulated firms should have lower levels of monitoring directors, smaller boards, less monitoring (external) shareholdings, and implement less equity-based compensation.³ In contrast, greater use of each of these mechanisms would be consistent with the regulatory pressure hypothesis where firms feel pressure to adopt effective governance structures. However, governance mechanisms are costly to implement and firms tend to establish monitoring systems where one measure may be increased when another decreases, suggesting the firm's overall system of governance is also important to examine.

H2A Substitution: If regulation substitutes for governance, trade-offs between monitoring mechanisms and inside ownership will not exist.

H2B Pressure: If regulation pressures firms to adopt effective monitoring structures, trade-offs between monitoring mechanisms and inside ownership will exist.

³ While smaller boards may be more efficient, John and Senbet (1998) suggest that larger board have more monitoring potential.

As agency problems can arise from the separation of ownership and control, effective monitoring should include providing alternate monitors for low levels of inside ownership. However, the substitution hypothesis contends that regulators take the place of a more traditional system of governance. Booth et al. (2002) find the need for traditional monitoring mechanisms is less critical to regulated firms, since regulators are an alternative monitor. Regulated firms may be less likely to establish systems of governance where traditional governance mechanisms are exchanged for one another. In contrast, if regulators pressure firms to establish controls, monitoring mechanisms should still be an alternative to inside ownership. While our first two hypotheses rely on governance characteristics and structures, our third hypotheses considers governance dynamics by considering how these structures change in a deregulatory period.

H3A Substitution: If regulation substitutes for governance, monitoring levels of regulated firms should increase following deregulation and more closely match those of non-regulated firms.

H3B Pressure: If regulation pressures firms to adopt effective monitoring structures, monitoring levels utilized by regulated firms post-deregulation should remain unchanged or decrease.

When regulation is at least partially removed, the substitution hypothesis predicts firms will increase traditional monitoring mechanisms as regulators provide less monitoring (Kole and Lehn, 1999). Deregulation serves as a shock to firms which must then adapt their governance structures. However, if regulation pressures firms to adopt effective monitoring structures, a partial removal of regulation may not cause firms to alter governance structures significantly. Alternatively, without regulatory pressure, some firms may decide to reduce levels of monitoring if these levels were too high under regulation or if agency problems lead firms to choose less monitoring post-deregulation. In its essence, the regulatory pressure hypothesis does not support an increase in monitoring levels following deregulation.

3. Data and Summary Statistics

We collect data for IPOs in 1993, 1996, and 1998. Analyzing a sample during the 1990s allows us to examine how deregulation affected governance and provides a powerful test for the pressure and substitution hypotheses. Also, Gompers et al. (2003) note legislation in the 1980s resulted in wide variation in governance structures for established firms; however, these structures were more stable in the 1990s. Further, the 1990s may be more representative of current governance structures rather than reactions to legal provisions. Using a more recent year (post-internet bubble) would decrease our sample of regulated firms substantially.⁴ For the 1993 sample, we start with 453 IPOs on the IPO Prospectus database developed by R. R. Donnelley Financial and IPO Crossroads. For 1996, we start with IPOs from <http://www.iporesources.org/>. We eliminate IPOs before May (not required to file electronically prior to this) and use the SEC's EDGAR database to obtain complete prospectuses. For 1998, we use SDC data to form the list of IPOs and again use EDGAR to obtain prospectuses. For bank holding companies and other financials we collect additional prospectus (for all three years) from *SNL Interactive's* document archive. Compustat and CRSP data are utilized for financial data. Our final samples consist of 436 IPOs in 1993, 444 in 1996, and 281 in 1998.

3.1. Governance data

We focus on seven commonly used measures of the firm's governance structure, which include the proportion of independent outside directors, proportion of venture capitalist directors, size of the board, shareholdings of outside blockholders, shareholdings of venture capitalists, percentage of equity-based compensation, and officer and director shareholdings (inside holdings). We also examine monitoring directors, which we define to be independent outside

⁴ These specific years were chosen for the following reasons: data availability, internet bubble of 1999, changes in executive compensation disclosure requirements in 1993, and to be consistent with Booth et al. (2002). While it is possible these years are anomalous, our sample is comparable to other studies (Mikkelson, Partch, and Shah, 1997; Chen and Ritter, 2000; Carter, Dark, and Singh, 1998).

directors and venture capitalist directors combined, as well as monitoring holdings, which is the combination of outside blockholdings and venture capitalist holdings.

Adams and Mehran (2003) note typical external governance mechanisms (e.g., hostile takeovers) are absent in regulated firms. They argue it is more appropriate to focus on internal governance structures and shareholder block ownership than potential ineffectual external mechanisms. Furthermore, past studies suggest monitoring mechanisms are designed to control or reduce agency problems and should be alternatives. Empirically, Booth et al. (2002) show other monitoring mechanisms are used in lieu of officer and director ownership (inside ownership) at unregulated firms, but the interdependencies are weaker for regulated firms. We follow this approach by examining whether trade-offs exist between monitoring mechanisms and inside ownership for regulated and unregulated firms.

Our focus on inside ownership also relates to Jensen and Meckling (1976). The authors associate a lack of insider control with agency problems between managers and shareholders and the need for shareholders to protect their interests. One means to monitor managers is through the board (Weisbach 1988, Hermalin and Weisbach 1998). John and Senbet (1998) argue how effective a board is in its monitoring function is determined by composition and size. Researchers argue increasing board independence is beneficial for firms, since these directors are more likely to monitor the executives. Likewise, the board's monitoring potential may increase as more directors are added, especially for startup companies with relatively small boards.⁵ In

⁵ For well-established firms with larger boards, the costs of poor communication and decision-making with a large group may outweigh benefits of additional monitoring. Some evidence on established firms suggests large boards are less efficient (Yermack, 1996). Adams and Mehran (2005) find the opposite for banking firms. Our focus is not on board efficiency but monitoring potential. Further, Baker and Gompers (2003) note IPO boards are substantially smaller than those of large, public companies, suggesting the large group issues may be less of a concern.

addition to traditional outside directors, IPOs also may receive monitoring from venture capitalists on their board (Lerner 1995, Baker and Gompers 2003, Hellman and Puri 2000).⁶

Large blockholders may also monitor. Huddart (1993) argues because large shareholders have a stake in profits, they will monitor management more carefully and establish incentives for better performance. Denis and Denis (1995) note forced management turnover may be more related to outside blockholder pressure than to monitoring by the board itself. Barry, Muscarella, Peavy, and Vetsuypens (1990) show venture capitalists own economically significant equity positions in portfolio companies and participate directly in the governance of these firms.

In addition, equity-based compensation may be an alternate for inside ownership. One way to align manager and shareholder interests is through ex-ante contracting, where agency costs are mitigated by incentive compensation (Jensen and Murphy, 1990; Hall and Liebman, 1998). Mehran (1995) finds firms with high inside ownership rely on less equity-based compensation for top executives.

Governance data are from the prospectus and proxy statements. Independent outside directors include outside directors and exclude insiders and “gray” or quasi-outside directors. To illustrate, former executives, spouses of executives, and lawyers or consultants with a working relation are not outsiders. Gray directors are not considered independent directors since they may have conflicting goals.⁷ Board size is the total number of directors. Outside blockholders are institutions or companies that own at least 5% of shares outstanding. Inside ownership is the percentage of shares owned by officers and directors. The percentage of incentive compensation is measured as average percentage of compensation that is equity-based for top-executives,

⁶ Baker and Gompers (2003) group independent outside directors and venture capitalist directors together.

⁷ Consistent with prior studies (e.g., Adams and Mehran, 2003), directors with lending relationships with the bank or savings institutions are not eliminated from being labeled independent.

whose compensation is reported in the prospectus/proxy.⁸ Equity-based components include stock options, restricted stock, and performance shares from long-term incentive plans.⁹

3.2. Degree of regulation

The literature is not always consistent as to which types of firms are considered regulated. We consider a spectrum of regulation from partially to heavily regulated firms. Heavily regulated include banks, savings institutions, and gas and electric utility companies. Prior studies suggest these industries face an enhanced level of regulatory influence. Both depository institutions and public utilities have experienced deregulation over recent years; however, they remain substantially regulated.

Partially regulated firms include transportation, telecommunications, and other financial, non-depository firms. The literature is inconsistent on how to treat these firms. Booth et al. (2002) consider telecommunications firms as utilities, but transportation and other financials as unregulated. Other studies (Baker and Gompers, 2003, Hochberg, 2005, etc.) classify all financials as regulated. In terms of the regulatory environment, Moore (1995) notes federal rules still prevent transportation firms from operating as freely as those in non-regulated industries. The telecommunications industry also has been partially deregulated, but not completely (Crandall, 2002). Other financial firms include insurance, securities brokers, mortgages, and real estate. Such companies act as financial intermediaries, but are less regulated and subject to greater market discipline than depository institutions (Brewer, Mondschean, and Strahan, 1993). Nonetheless, these firms still face regulations and restrictions not faced by unregulated firms.

⁸ Results are robust to using the percentage of equity-based compensation for the CEO only.

⁹ To calculate stock option grant values, we apply a variant of Black-Scholes (Noreen and Wolfson, 1981). In the year prior to the offering, we estimate stock return variance two ways. First, we use twenty-day after market standard deviation (Beatty and Zajac, 1994). Second, we follow Baker and Gompers (1999) and use industry median annual standard deviation of monthly returns for the year pre-IPO. Industries are defined at the four-digit SIC level (or 3-digit level if insufficient data are available). The methods produce near identical results as the correlation between these two values is 0.99. Results are reported using the Beatty and Zajac (1994) approach.

In our analyses, we analyze both all regulated and heavily regulated firms. Including all regulated firms allows us to examine the broad impact of any regulation and its effect on governance. However, the degree of regulation varies greatly and the relation between regulation and governance likely depends on the nature and scope of regulation. To address this, we examine heavily regulated firms separately. If regulation substitutes for traditional monitoring, regulation should provide a more complete substitute at heavily regulated firms (and similarly if regulation acts as a pressure). In other words, a more powerful test is to compare heavily regulated firms to unregulated firms, in effect controlling for the degree of regulation.

A firm's SIC code is used to separate heavily, partially, and non-regulated firms. To determine if a firm was a regulated utility, we start with all IPO firms with an SIC code of 4900 - 4939 (electric and gas), 1300 (oil and gas extraction); and 6710 - 6719 (holding companies). For banking firms, we start with all firms with an SIC code of 6020 – 6039 as well as 6710 – 6719 (holding companies). To ensure we only include regulated utilities and banking firms, primary and secondary operations were examined. In any case of ambiguity in classifying a firm, its history, productions and operations, industry, and top competitors from *Hoovers*, *Moody's*, *Yahoo Finance*, and individual firm's financial statements and annual reports were analyzed to determine a firm's operations. Of our 1,161 IPO firms, 928 are unregulated, 175 are partially regulated, and 58 are heavily regulated firms (18 in 1993, 24 in 1996, and 16 in 1998).

Table 1 details summary statistics for all regulated (heavy plus partial), heavily regulated, and unregulated firms at the IPO. All regulated have the greatest amount of leverage. Somewhat surprising, heavily regulated and unregulated firms do not differ statistically in terms of leverage, suggesting the increase occurs post-IPO. Regulated firms are significantly larger and older than unregulated firms but we find no significant differences in terms of tangible assets or ROA.

Heavily regulated firms are less likely to have a founder involved, which may be consistent with these firms being older at the IPO. Heavily regulated firms have the lowest adjusted q values.

4. Complements or Substitutes

4.1. Monitoring levels

To explore whether regulation substitutes for or complements governance, we examine how governance structures vary across groups (Hypothesis 1). Summary statistics reported in Table 2 support for the regulatory pressure hypothesis rather than the substitution hypothesis. If regulation substitutes for monitoring, we would expect regulated firms to receive less monitoring from more traditional measures of governance. Specifically, the substitution hypothesis predicts that regulated firms should have lower levels of monitoring directors, smaller boards, less monitoring holdings, and less equity-based compensation than their unregulated counterparts.

Contrary to this hypothesis, we document in Table 2 that heavily regulated firms have greater proportions of monitoring directors and larger boards. Both heavily regulated and all regulated firms have significantly more independent directors. With monitoring holdings, heavily regulated firms do have significantly lower levels; however, all regulated firms and unregulated firms have similar levels. Examining outside blockholdings highlights that the difference for regulated firms is largely attributed to the lack of venture capitalist holdings. The use of equity-based compensation is similar for all firms. Overall, our results are more consistent with the regulatory pressure hypothesis, where regulated firms feel pressure to adopt governance structures that provide higher levels of monitoring.

4.2. Multivariate analyses

To further examine the relation between governance and regulation, we examine the trade-offs between monitoring mechanisms and inside ownership (Hypothesis 2). In Table 3 we regress each measure of governance (monitoring directors, board size, monitoring holdings, and

incentive compensation) on inside holdings, firm characteristics, and other controls. We include binary variables equal to one for all or heavily regulated firms and an interaction term between these variable and inside holdings. For all firms, we expect other monitoring mechanisms to serve as alternatives to inside holdings. With regulatory pressure, the interaction term should be insignificant, consistent with regulated and unregulated firms trading off mechanisms in a similar manner. In contrast, the substitution hypothesis would suggest a positive and significant coefficient on the interaction term.

We control for additional factors that may affect the need for monitoring mechanisms.¹⁰ Gompers (1995) argues the need for monitoring increases as the tangibility of assets decline (ratio of tangible to total assets). Intangible assets are associated with higher agency costs since their liquidation values are lower. As governance may be altered if the founder is involved with the firm at the IPO, we include a binary variable equal to one if the founder is an officer or director at the IPO. We also control for shares outstanding (natural log) since firms may issue additional shares following the IPO, which may alter the ownership structures. We control for profitability using return on assets (ROA).¹¹ Baker and Gompers (2003) show venture capitalist involvement shapes the board of directors; we include a binary variable equal to one if the IPO firm was backed by a venture capitalist. In addition, we include time dummy variables for the sample years to control for the fact governance structures may have evolved over the 1990s. For example, most firms may have increased the proportion of independent directors over time.

Numerous studies argue a link exists between firm performance and governance. For firm performance and growth opportunities, we use Chung and Pruitt's (1994) approximation of

¹⁰ Our control variables are similar to those used by Booth, Cornett, and Tehranian (2002). However, we include more IPO-specific controls such as tangible assets, control for founders, profitability, and others.

¹¹ Results are robust to using return on equity as a proxy for profitability.

Tobin's q ¹², the sum of market value of common stock, long- and short-term debt, and preferred stock all divided by total assets. Research has shown that Tobin's q may also proxy for industry characteristics, making it important to adequately control for industry effects. We subtract median Tobin's q ratio from each firm's performance measure for firms in the same four-digit SIC code. In banking, numerous studies implement a market-to-book ratio to control for investment opportunity set or market power (Smith and Watts 1992, Houston and James 1995, Keeley 1990). Thus, our measure also controls for differing investment opportunity sets.

In addition, regulated and unregulated firms vary substantially in firm characteristics, emphasizing the importance of adequately controlling for such differences. Perhaps the most notable differences are leverage, size, and age. Regulated firms tend to be more highly levered, larger, and older than unregulated firms. Following Booth et al. (2002), we implement total debt divided by total assets to proxy for leverage, while size is the natural log of total assets at the IPO.¹³ Age is the number of years since the firm's first date of incorporation until the IPO.

In Table 3, we show that trade-offs exist for inside holdings. The coefficient on inside holdings is negative and significant when monitoring directors and holdings, as well as equity-based compensation are dependent variables. All IPO firms replace inside holdings with these other monitoring mechanisms. However, firms do not appear to turn to monitoring from larger boards to compensate for low levels of inside ownership, which may be related to inefficiencies associated with larger boards. Yermack (1996) suggests costs of poor communication and decision-making with a large group outweigh the benefits of increased monitoring potential.

¹² Chung and Pruitt (1994) show that this approximation explains 96.6% of the variation in the more theoretically appropriate procedure suggested by Lindenberg and Ross (1981).

¹³ All reported results are qualitatively similar using one minus the ratio of the book value of equity to total assets for leverage as in Houston and James (1995).

Results in Table 3 strongly support the regulatory pressure hypothesis; regulated and unregulated firms do not exhibit different interdependences between mechanisms (Hypothesis 2B). Specifically, the interaction term between heavily regulated firms and inside holdings is insignificant in all models. If regulation substitutes for governance, trade-offs between mechanisms should not exist and the interaction should capture any differences from unregulated firms. However, we find no differences. Using a broader definition of regulation (all regulated firms), the interaction term remains insignificant except when incentive compensation is the dependent variable.¹⁴ These results may be related to the fact executive compensation is the governance area most influenced by regulation. Nonetheless, our results support the notion regulation is a complement to traditional monitoring at the IPO and contrasts Booth et al.'s (2002) results on mature firms.¹⁵

Table 3 also provides additional support for Hypothesis 1B. With the regulatory pressure hypothesis, monitoring levels should be the same or higher for regulated firms. The coefficient on the heavily regulated dummy variable is positive and significant in the monitoring directors and board size equation and insignificant in the monitoring holdings and equity-based compensation equations. These results contradict the substitution hypothesis which predicts significantly lower levels of monitoring. If we broaden our definition to include all regulated firms, we see a negative and significant coefficient only in one equation (monitoring holdings). With all other equations, regulated firms have similar or higher levels of monitoring.

¹⁴ We also compare heavily regulated to partially regulated firms and partially regulated to unregulated firms. All interaction terms remain insignificant.

¹⁵ Separate regressions for all regulated, heavily regulated, and unregulated firms are also conducted. The results are qualitatively similar. Essentially, we find similar trade-offs between monitoring mechanisms for both regulated and unregulated firms. Equity-compensation continues to be somewhat different.

4.3. Deregulation

Banks and utilities both experienced significant deregulation in the 1990s. During this time, however, all firms adjusted governance structures as corporations became more cognizant of agency problems. Thus changes in governance may be a function of deregulation or a market-wide shift. In Table 4, we compare regulated and unregulated firms in 1993 and 1998. The 1993 sample proxies for a time when regulation was greater while by 1998, substantial deregulation occurred (Energy Policy Act, FIDICIA, Riegle-Neal Act, etc.) for our regulated firms.

According to Hypothesis 3, if regulation substitutes for governance, as regulated firms deregulate their governance structures should change and move closer to that of unregulated firms (Kole and Lehn, 1999).¹⁶ If regulation complements governance, deregulation should either have no affect on monitoring levels or provide regulated firms with the opportunity to reduce monitoring. Results from Table 4 indicate governance structures of regulated firms are stable in the 1990s and do not more closely resemble that of unregulated firms post-deregulation. A notable difference is incentive compensation; regulated IPOs did not increase their reliance on incentive compensation as did unregulated IPOs. This finding is inconsistent with prior studies on more mature firms, where deregulation leads to increased incentive compensation. Also, regulated firms continue to rely on board structures associated with greater monitoring (more monitoring directors and larger boards). However, regulated firms do not alter their percentage of monitoring directors, which again contradicts the substitution hypothesis where deregulation is a shock leading to an increased need for board monitoring (Harris and Raviv 2008).

Table 5 details multivariate analyses of deregulation (1993 to 1998). For regulated firms, we regress each monitoring mechanism on variables identified previously to control for the need for monitoring plus a binary variable equal to 1 for 1993. If deregulation results in firms

¹⁶ However, Kole and Lehn (1999) document that board size declines post-deregulation, which may suggest less monitoring potential of the board. Also, they examine the airline industry during a much earlier time period, 1980s.

increasing monitoring levels, this dummy variable should be negative and significant, indicating monitoring levels were significantly lower prior to the deregulation. We again find no support for the substitution hypothesis. The 1993 binary variable is insignificant in all models, except for monitoring holdings where it is positive and significant (the opposite of substitution).

Overall, Tables 4 and 5 provide evidence regulation is not a substitute for governance, but rather a complement. Relaxing regulation does not appear to cause regulated firms to utilize governance structures similar to those favored by unregulated firms or to significantly increase monitoring levels; rather regulated firms continue to utilize governance structures with greater levels of board monitoring, which is consistent with the regulatory pressure hypothesis.

4.4. Year +2 Results

Baker and Gompers (2003) suggest that governance structures are more likely to be chosen optimally at the IPO. However, it is possible a firm may not understand the importance of monitoring (for a public firm) when it has never been public before. As a result, we examine governance structures of regulated firms two years after the IPO (Table 6). Data are collected from proxy statements. The trade-off between monitoring mechanisms has been well-established for non-regulated firms in the literature, thus we focus only on regulated firms.

Similar to Table 3, we document trade-offs between inside ownership and monitoring directors and holdings, and equity-based compensation, but not board size. Examining heavily regulated firms, we find firms turn toward monitoring directors and holdings when inside ownership decreases. All regulated firms have a negative coefficient on inside holdings for the monitoring holdings and equity-based compensation equations (note the p-value on the inside holdings coefficient in the monitoring directors equation is 0.15). If we replace monitoring directors with outside directors, the p-value becomes significant at 0.05. Likewise, if we exclude the venture capitalist binary variable, the p-value is 0.06. This seems to suggest venture

capitalists on the board of a firm two years after the IPO (when it was backed by a venture capitalist) is probably involved for different reasons than a traditional outside director. Finally, it is interesting to note the change in equity-based compensation. In the IPO year (Table 3) we document that all regulated firms are less likely to turn toward equity-based compensation when inside ownership is low. Two years following the IPO, however, we see strong evidence of a trade-off between these mechanisms, which is consistent with regulatory pressure.

4.5. Matched Sample

Our results could be driven by the unbalanced nature of our sample; the number of unregulated firms is larger than that of heavily regulated firms. To explore this, we construct a matched sample. We match every heavily regulated firm to an unregulated firm based on size (for consistency with past studies that suggest size may be an important factor in explaining differences in monitoring levels for regulated and unregulated firms). In Table 7, we report summary statistics using heavily regulated firms and their matches. The patterns reported mirror those reported in Table 2 and support the regulatory pressure hypothesis. Regulated firms have greater proportions of monitoring directors, larger boards, but less monitoring holdings. Again we find no significant differences in percentages of equity-based compensation.

Regression results for the matched sample (Table 8) are directly comparable to those reported in Table 3. The interaction term for heavily regulated firms and inside holdings is again insignificant in all specifications, which supports the regulatory pressure hypothesis. We continue to find evidence firms trade-off monitoring directors and monitoring holdings for inside holdings. For board size, we find a positive relation, which may again reflect the inefficiencies of increasing board sizes. In other words, if inside ownership is low, firms prefer smaller boards.

With equity-based compensation, we do not find evidence firms trade-off compensation for inside ownership. However, if we examine only unregulated matched firms, the coefficient

on inside holdings is marginally significant in the incentive compensation equation; suggesting unregulated firms use incentive compensation when ownership levels are low. This result highlights that regulation may at least partially substitute for compensation at the IPO. We also run separate models for heavily regulated firms and their matches and obtain qualitatively similar results.¹⁷ Overall, our results do not appear driven by the unbalanced nature of our samples. Results using the matched sample also support the regulatory pressure hypothesis, where firms establish monitoring systems. We find alternative monitoring mechanisms are exchanged for inside ownership at regulated firms and unregulated firms alike.

5. Robustness

Additional characteristics may drive differences between regulated and non-regulated firms and failure to control for these characteristics may lead to spurious conclusions. First, regulated firms may face differing political and legal environments, which may shape their boards. To illustrate, regulated firms may be more involved in politics because of regulation, making it optimal for these firms to add outsiders to the board to help manage the political landscape. Agrawal and Knoeber (2001) and Helland and Sykuta (2004) consider the role of politics and board structure. One measure implemented is the number of directors on the board with political and legal ties. The authors contend that if political pressures are high, a firm will appoint more politically connected directors, where politically connected directors include lawyers as well as directors with government work experience. Such a hypothesis provides a plausible explanation for results documented in the existing literature that are contrary to the substitution hypothesis, such as regulated firms having larger and more independent boards.

¹⁷ To be consistent with Table 3, we repeat all these tests including the year dummies with qualitatively similar results. We omit these in Table 8 because of our relatively small sample sizes.

To explore whether political pressures affect our results, we follow Agrawal and Knoeber (2001) and Helland and Sykuta (2004) and use director background information for nearly 3,000 individual directors for our 1998 sample.¹⁸ Analyses are limited to 1998 because reporting of past director experiences has dramatically improved in the 1990s as well as Agrawal and Knoeber (2001) find the number of political and legal directors increases over the 1990s for electric utility companies.¹⁹ We document a limited role for political directors at regulated or unregulated firms; 2% of executives and directors have political backgrounds (lawyer, regulatory employee, political officer at *any* point in their career). Limiting to board members only, we have 4% political directors (it is negligible if we require directors to currently be political). Further, no significant difference exists between regulated and unregulated firms (p-value of difference 0.33). For regulated firms, the mean (median) is 5% (0%) compared to 3.4% (0%) for unregulated firms. It does not appear differing political environments drives our results or that politics, in general, is not likely a significant determinant of board members for IPO firms.

While our analyses focus on inside ownership, venture capitalists often serve on the board and disentangling their ownership is difficult. We implement several methods to control for this. First, in multivariate analyses, we include a dummy variable for venture-backed IPOs. Second, for the 1998 sample we separate venture capitalists from inside directors for our 3,000 directors. The correlation between inside ownership with and without venture capitalists is extremely high. However, we encounter several difficulties splitting ownership. To match total ownership in the prospectus, we must create “plug” values for 25% of our firms. The average plug size is non-trivial: 184,605 shares (3.71%) pre-IPO and 186,396 shares (4.75%) post-IPO

¹⁸ Relying largely on proprietary data, Agrawal and Knoeber (2001) provide several measures of the political environment. We focus on measures that can be applied to our time periods and sample director backgrounds.

¹⁹ Helland and Sykuta (2004) find deregulation is associated with a decrease in the number of political directors for a sample of natural gas companies.

(maximum 1,309,238 shares or 44.78%). Given these uncertainties, we do not focus on these numbers. Third, we repeat analyses for non venture-backed IPOs only. Results are qualitatively similar, suggesting our findings are not biased by the inclusion of venture capitalist on a board.

It is also possible our measure of director and officer ownership may double count independent outside directors' ownership if they have own a significant stake in the company (unaffiliated blockholder). We implement several measures to control for this potential bias. First, outside blockholdings appear similar at both regulated and unregulated firms, suggesting both groups would experience similar biases (if a bias does exist). Second, for the 1998 sample we collect data on the 3,000 directors and document when independent outside directors are associated with outside blockholders. Only 50 outside directors at 28 firms (3,000 total or 606 independent outside directors at 281 firms) are affiliated with outside blockholders. For 30 of these 50 directors, there are no double counted shares as individual shares are zero or the proxy statement indicates shares held are independent from those held by blockholder. The potential for double counting only exists for 20 directors at 17 firms. Third, segmenting ownership is difficult; the correlation between inside ownership with and without double counted shares is 0.94. Finally, we repeat all analyses for IPOs with no outside blockholdings. While this is a severe restriction, results are qualitatively similar. Overall, our measure of inside ownership does not appear biased by independent outside directors having a large stake in the firm.

Tables 7 and 8 compare a set of matched firms to our heavily regulated sample, where firms are selected based on asset size. Given the skewness in firm size for our regulated firms, we repeat analyses matching on market value of equity; all results are qualitatively similar. To examine if leverage has a nonlinear relationship with our dependent variables we include a squared term in all tests. The squared term, however, is never significant and has no effect on

results. Even after addressing these additional confounding factors, it does not appear regulation substitutes for governance at the time of the IPO but rather serves as a complement. For our unregulated firms, we include Fama French industry dummies (17 industries). The results remain unchanged as we continue to find trade-offs between monitoring mechanisms. Additionally, excluding year dummy variables in Tables 3 and 6 does not alter our results.

Finally, we note causality. While Jensen and Meckling (1976), Booth et al. (2002) and others suggest low levels of inside ownership lead to reliance on alternative monitoring mechanisms, causality may be reversed (Loderer and Martin (1997)). As such, our results should be interpreted as associations rather than causation. Determining causality is not necessary to explore substitution versus complement. Further, utilizing a sample of IPOs may reduce the causality concerns given Baker and Gompers (2003) suggest structures are optimal at the IPO. Finally, defining an appropriate simultaneous equations model would be extremely difficult with the large set of monitoring mechanisms in our analyses. Given that all mechanisms may be interrelated, identifying exogenous variables for such a large system of equations is problematic.

6. Conclusions

In this paper we examine whether regulation substitutes for or is a complement to governance by examining governance structures at regulated and unregulated firms at the time of their IPO as well as two years post-IPO. We document that regulated firms do not have significantly lower levels of monitoring as predicted by the substitution hypothesis. These firms have greater proportions of monitoring directors and larger boards as well as use similar levels of equity-based compensation. These board characteristics support Adams and Ferreira's (2006) contention that board oversight appears to be a complement to regulation.

When we examine the substitution and pressure hypotheses in a multivariate setting, we again do not find evidence that regulation substitutes for traditional monitoring but rather support for the notion they are complements. Specifically, at both regulated and unregulated firms, trade-offs exist between traditional monitoring mechanisms and inside ownership, which is consistent with the notion that regulation serves as a complement, pressuring firms to develop a system of governance. If regulation substitutes for governance, the degree of interdependencies would be less or not present at regulated firms. The notable exception is executive compensation. We find some evidence that regulation does at least partially substitute for equity-based compensation. This result is not surprising given that incentive compensation is the only monitoring mechanism that regulators exert direct control over (Houston and James, 1995).

Finally, we examine whether deregulation is a shock to regulated firm's governance structure. With the substitution hypothesis, deregulation would reduce monitoring thus forcing firms to strengthen their governance structures to more closely resemble those of unregulated firms. In contrast, the regulatory pressure hypothesis does not predict an increase in monitoring levels following deregulation. Again, our results support the regulatory pressure hypothesis; governance structures of regulated firms remain relatively stable following deregulation and do not more closely mirror those of unregulated firms.

Our results suggest that regulation and governance are complements where regulators may pressure firms to adopt effective monitoring structures. The regulatory pressure hypothesis provides an explanation for some often puzzling empirical findings in the literature concerning whether regulation substitutes for governance. This paper also has implications for the governance literature in general. Essentially, we conduct a natural experiment examining whether firms utilize governance systems and high levels of monitoring mechanisms when

information asymmetry and managerial discretion are limited. Given that such monitoring is costly, we would expect firms to use less or none if such monitoring were not important. However, our results are not consistent with the substitution notion, implying governance systems appear important to shareholders. Regulation does not replace traditional monitoring.

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Table 1
Firm Characteristics

This table reports means for firm characteristics for heavily regulated, partially regulated, and unregulated firms. The *p*-value reports the significance of the difference between the sample means. Leverage is defined as total debt divided by total assets. Age is the number of from the first date of incorporation until the IPO. Tangible assets are the ratio of tangible to total assets. Founder is a binary variable equal to one if the founder is present at the IPO. Adjusted *q* is Chung and Pruitt's (1994) approximation of Tobin's *q*, adjusted for the industry median. The sample contains 928 unregulated, 223 regulated, and 58 heavily regulated firms. All Regulated includes partially and heavily regulated firms.

	All Regulated (1)	Heavily Regulated (2)	Unregulated (3)	<i>p-value</i>
Leverage	24.35%	16.86%	18.26%	
<i>p-value (1 vs. 3)</i>				<i>0.00</i>
<i>p-value (2 vs. 3)</i>				<i>0.67</i>
Assets	1,122.25	533.00	159.45	
<i>p-value (1 vs. 3)</i>				<i>0.00</i>
<i>p-value (2 vs. 3)</i>				<i>0.00</i>
Age	19.02	22.05	14.49	
<i>p-value (1 vs. 3)</i>				<i>0.00</i>
<i>p-value (2 vs. 3)</i>				<i>0.01</i>
Tangible Assets	73.39%	70.87%	74.51%	
<i>p-value (1 vs. 3)</i>				<i>0.69</i>
<i>p-value (2 vs. 3)</i>				<i>0.49</i>
Founder	48.67%	32.14%	54.18%	
<i>p-value (1 vs. 3)</i>				<i>0.13</i>
<i>p-value (2 vs. 3)</i>				<i>0.00</i>
Shares outstanding	32.05	13.44	16.81	
<i>p-value (1 vs. 3)</i>				<i>0.00</i>
<i>p-value (2 vs. 3)</i>				<i>0.42</i>
Adjusted <i>q</i>	1.64	0.17	1.80	
<i>p-value (1 vs. 3)</i>				<i>0.80</i>
<i>p-value (2 vs. 3)</i>				<i>0.02</i>
ROA	6.44%	5.25%	3.56%	
<i>p-value (1 vs. 3)</i>				<i>0.17</i>
<i>p-value (2 vs. 3)</i>				<i>0.67</i>

Table 2
Levels of Monitoring

This table reports means for levels of monitoring mechanisms for heavily regulated, partially regulated, and unregulated firms. The *p*-value reports the significance of the difference between the sample means. Monitoring directors is the sum of independent outside directors and venture capitalist directors. Monitoring holdings is the sum of outside blockholdings and venture capitalist holdings. Equity-based compensation is the average percentage of compensation that is equity-based for the top executives. The sample contains 928 unregulated, 223 regulated, and 58 heavily regulated firms. All Regulated includes partially and heavily regulated firms.

	All Regulated (1)	Heavily Regulated (2)	Unregulated (3)	<i>p-value</i>
Independent Outside Directors	44.00%	54.11%	33.24%	
<i>p-value (1 vs. 3)</i>				<i>0.00</i>
<i>p-value (2 vs. 3)</i>				<i>0.00</i>
VC Directors	8.08%	3.21%	17.07%	
<i>p-value (1 vs. 3)</i>				<i>0.00</i>
<i>p-value (2 vs. 3)</i>				<i>0.00</i>
Monitoring Directors	52.07%	57.32%	50.30%	
<i>p-value (1 vs. 3)</i>				<i>0.31</i>
<i>p-value (2 vs. 3)</i>				<i>0.03</i>
Board Size	7.54	9.27	6.28	
<i>p-value (1 vs. 3)</i>				<i>0.00</i>
<i>p-value (2 vs. 3)</i>				<i>0.00</i>
Outside Blockholdings	14.95%	11.51%	9.80%	
<i>p-value (1 vs. 3)</i>				<i>0.00</i>
<i>p-value (2 vs. 3)</i>				<i>0.53</i>
VC Holdings	8.16%	3.98%	14.34%	
<i>p-value (1 vs. 3)</i>				<i>0.00</i>
<i>p-value (2 vs. 3)</i>				<i>0.00</i>
Monitoring Holdings	23.11%	15.50%	24.14%	
<i>p-value (1 vs. 3)</i>				<i>0.61</i>
<i>p-value (2 vs. 3)</i>				<i>0.01</i>
Equity-based compensation	16.62%	13.27%	14.44%	
<i>p-value (1 vs. 3)</i>				<i>0.19</i>
<i>p-value (2 vs. 3)</i>				<i>0.70</i>
Inside Holdings	33.01%	33.55%	41.85%	
<i>p-value (1 vs. 3)</i>				<i>0.00</i>
<i>p-value (2 vs. 3)</i>				<i>0.01</i>

Table 3
Substitution versus Pressure Tests: Interaction Terms

This table reports results from regression analysis using robust standard errors with the monitoring mechanisms as the dependent variables. All Regulated Dummy equals one if the firm is heavily or partially regulated. Heavily Regulated dummy equals one if the firm is heavily regulated. Regulation Dummy * Inside Holdings are interaction terms between the regulation dummy variables and inside holdings. Monitoring directors (holdings) is the sum of independent outside directors (holdings) and venture capitalist directors (holdings). Equity-based compensation is the average percentage of incentive compensation for the top executives. Standard errors are in parentheses. ***, **, * signifies significance at the 1%, 5%, and 10% levels, respectively.

	Monitoring Directors	Monitoring Directors	Board Size	Board Size	Monitoring Holdings	Monitoring Holdings	Equity Compensation	Equity Compensation
Constant	0.454*** (0.038)	0.408*** (0.039)	5.367*** (0.455)	5.684*** (0.441)	0.096*** (0.036)	0.070* (0.038)	0.219*** (0.043)	0.237*** (0.046)
Inside Holdings	-0.179*** (0.029)	-0.188*** (0.033)	0.230 (0.341)	0.112 (0.354)	-0.277*** (0.035)	-0.250*** (0.039)	-0.150*** (0.029)	-0.173*** (0.033)
Size	0.012** (0.006)	0.016** (0.006)	0.551*** (0.079)	0.455*** (0.071)	0.040*** (0.006)	0.044*** (0.007)	0.010* (0.006)	0.010 (0.007)
Leverage	-0.112*** (0.029)	-0.114*** (0.031)	-0.741** (0.355)	-0.354 (0.338)	-0.004 (0.029)	-0.013 (0.031)	-0.065** (0.026)	-0.080*** (0.028)
ROA	-0.017 (0.027)	-0.023 (0.027)	-1.422*** (0.265)	-1.268*** (0.250)	-0.037* (0.022)	-0.046** (0.023)	-0.027 (0.025)	-0.024 (0.027)
Ln(age)	-0.012* (0.007)	-0.005 (0.007)	-0.131 (0.087)	-0.177** (0.084)	-0.012 (0.008)	-0.011 (0.008)	-0.013* (0.008)	-0.008 (0.008)
Tangible Assets	-0.022 (0.041)	0.002 (0.047)	-0.671 (0.571)	-0.417 (0.553)	-0.092* (0.054)	-0.070 (0.057)	-0.076 (0.046)	-0.091* (0.052)
Founder dummy	-0.035*** (0.014)	-0.035** (0.015)	-0.470*** (0.162)	-0.438*** (0.162)	-0.074*** (0.013)	-0.071*** (0.014)	0.013 (0.014)	0.016 (0.015)
Ln(# shares)	-0.006* (0.003)	-0.002 (0.003)	-0.007 (0.033)	0.040 (0.032)	0.008*** (0.003)	0.009*** (0.003)	0.006** (0.003)	0.003 (0.003)
Adjusted q	0.001* (0.001)	-0.000 (0.001)	0.019*** (0.007)	0.033** (0.013)	0.003*** (0.001)	0.002 (0.001)	0.003*** (0.001)	0.005*** (0.001)
VC Dummy	0.191*** (0.013)	0.200*** (0.014)	0.888*** (0.154)	0.857*** (0.152)	0.201*** (0.014)	0.206*** (0.015)	0.045*** (0.014)	0.039*** (0.015)
All Reg Dummy	0.022 (0.020)		0.636** (0.267)		-0.044* (0.040)		-0.019 (0.022)	
All Reg Dummy *	0.031 (0.021)		0.072 (0.230)		-0.005 (0.030)		0.066*** (0.019)	
Heavily Reg Dummy		0.089* (0.049)		1.471** (0.691)		-0.054 (0.094)		-0.075 (0.063)
Heavily Reg * Inside Holdings		0.010 (0.110)		2.718 (2.230)		-0.099 (0.217)		0.194 (0.146)
1993 Dummy	0.087** (0.037)	0.075* (0.044)	-0.955* (0.521)	-1.178** (0.496)	0.150*** (0.050)	0.124** (0.054)	-0.002 (0.043)	-0.009 (0.047)
1996 Dummy	0.112*** (0.037)	0.100** (0.042)	-0.584 (0.525)	-0.813* (0.493)	0.153*** (0.051)	0.130** (0.054)	0.008 (0.043)	0.007 (0.047)
Obs	1,072	927	1,072	927	1,072	927	1,062	919
p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
R ²	26.50%	28.78%	19.62%	23.58%	37.35%	37.71%	21.08%	10.20%

Table 4
The Effect of Deregulation

This table reports means for levels of monitoring mechanisms for all regulated, heavily regulated and unregulated firms. The first column reports data for the 1993 IPOs and the second for 1998 sample. *P*-values report significance of difference between sample means. Monitoring directors (holdings) is the sum of independent outside directors (holdings) and venture capitalist directors (holdings). Equity-based compensation is the average percentage of incentive compensation for the top executives. In 1993 (1998), there are 89 (53) regulated, 18 (15) heavily regulated, and 347 (202) unregulated firms.

	1993	1998	<i>p</i> -value
Independent Outside Directors			
All regulated (1)	43.96%	41.01%	<i>0.49</i>
Heavily regulated (2)	52.05%	56.32%	<i>0.58</i>
Unregulated (3)	32.41%	28.67%	<i>0.06</i>
<i>p</i> -value (1 vs. 3)	<i>0.00</i>	<i>0.00</i>	
<i>p</i> -value (2 vs. 3)	<i>0.00</i>	<i>0.00</i>	
VC Directors			
All regulated	9.42%	7.20%	<i>0.46</i>
Heavily regulated	7.61%	0.00%	<i>0.09</i>
Unregulated	19.69%	15.52%	<i>0.03</i>
<i>p</i> -value (1 vs. 3)	<i>0.00</i>	<i>0.00</i>	
<i>p</i> -value (2 vs. 3)	<i>0.01</i>	<i>0.00</i>	
Monitoring Directors			
All regulated	53.38%	48.21%	<i>0.21</i>
Heavily regulated	59.66%	56.32%	<i>0.64</i>
Unregulated	52.10%	44.19%	<i>0.00</i>
<i>p</i> -value (1 vs. 3)	<i>0.67</i>	<i>0.21</i>	
<i>p</i> -value (2 vs. 3)	<i>0.30</i>	<i>0.03</i>	
Board Size			
All regulated	7.12	9.06	<i>0.01</i>
Heavily regulated	8.44	12.47	<i>0.02</i>
Unregulated	5.69	7.56	<i>0.00</i>
<i>p</i> -value (1 vs. 3)	<i>0.00</i>	<i>0.01</i>	
<i>p</i> -value (2 vs. 3)	<i>0.00</i>	<i>0.00</i>	
Outside Blockholdings			
All regulated	19.39%	3.97%	<i>0.00</i>
Heavily regulated	20.63%	0.14%	<i>0.01</i>
Unregulated	8.96%	7.43%	<i>0.32</i>
<i>p</i> -value (1 vs. 3)	<i>0.00</i>	<i>0.17</i>	
<i>p</i> -value (2 vs. 3)	<i>0.00</i>	<i>0.09</i>	
VC Holdings			
All regulated	11.02%	7.23%	<i>0.29</i>
Heavily regulated	11.27%	0.00%	<i>0.05</i>
Unregulated	16.39%	14.32%	<i>0.25</i>
<i>p</i> -value (1 vs. 3)	<i>0.03</i>	<i>0.02</i>	
<i>p</i> -value (2 vs. 3)	<i>0.09</i>	<i>0.00</i>	
Monitoring Holdings			
All regulated	30.42%	11.20%	<i>0.00</i>
Heavily regulated	31.90%	0.14%	<i>0.00</i>
Unregulated	25.35%	21.76%	<i>0.10</i>
<i>p</i> -value (1 vs. 3)	<i>0.10</i>	<i>0.00</i>	
<i>p</i> -value (2 vs. 3)	<i>0.52</i>	<i>0.00</i>	

Table 4 (continued)
The Effect of Deregulation

	1993	1998	<i>p-value</i>
Equity-based compensation			
All regulated	17.65%	15.76%	<i>0.65</i>
Heavily regulated	14.98%	14.29%	<i>0.93</i>
Unregulated	11.33%	21.78%	<i>0.00</i>
<i>p-value (1 vs. 3)</i>	<i>0.01</i>	<i>0.12</i>	
<i>p-value (2 vs. 3)</i>	<i>0.29</i>	<i>0.28</i>	
Inside Holdings			
All regulated	31.05%	36.51%	<i>0.22</i>
Heavily regulated	42.17%	35.94%	<i>0.37</i>
Unregulated	39.09%	46.10%	<i>0.00</i>
<i>p-value (1 vs. 3)</i>	<i>0.00</i>	<i>0.00</i>	
<i>p-value (2 vs. 3)</i>	<i>0.75</i>	<i>0.07</i>	

Table 5
Multivariate Analyses of Deregulation

This table reports results from regression analysis using robust standard errors with the monitoring mechanisms as the dependent variables. The sample includes regulated firms from 1993 and 1998. Monitoring directors (holdings) is the sum of independent outside directors (holdings) and venture capitalist directors (holdings). Equity-based compensation is the average percentage of incentive compensation for the top executives. Standard errors are in parentheses. ***, **, * signifies significance at the 1%, 5%, and 10% levels, respectively.

	Monitoring Directors		Board Size		Monitoring Holdings		Equity-based Compensation	
	All Regulated	Heavily Regulated	All Regulated	Heavily Regulated	All Regulated	Heavily Regulated	All Regulated	Heavily Regulated
Constant	0.544*** (0.081)	0.448* (0.231)	6.372*** (1.445)	13.689*** (4.820)	-0.196** (0.088)	-0.470 (0.276)	0.169* (0.092)	-0.009 (0.217)
Size	0.021 (0.014)	0.069 (0.044)	0.759*** (0.221)	0.022 (0.940)	0.046*** (0.018)	0.075 (0.055)	0.010 (0.014)	0.049 (0.033)
Leverage	-0.165** (0.079)	-0.645*** (0.196)	-3.664*** (1.381)	-7.770* (4.545)	0.051 (0.087)	0.374 (0.352)	-0.038 (0.084)	-0.057 (0.250)
ROA	-0.328** (0.141)	0.511 (0.489)	-0.230 (2.750)	-4.669 (11.077)	-0.129 (0.119)	1.315* (0.766)	0.153 (0.192)	0.724 (0.444)
Ln(age)	-0.049** (0.022)	-0.092** (0.041)	0.021 (0.383)	-0.798 (0.936)	-0.011 (0.021)	0.004 (0.035)	-0.047** (0.022)	-0.040 (0.044)
Tangible Assets	-0.120 (0.099)	-0.489 (2.302)	-2.201 (2.036)	-13.967 (67.206)	-0.013 (0.104)	-0.364 (2.734)	-0.028 (0.112)	-0.006 (3.759)
Founder dummy	-0.002 (0.042)	-0.040 (0.073)	-0.001 (0.738)	0.383 (2.181)	-0.028 (0.042)	0.051 (0.103)	-0.023 (0.046)	0.077 (0.095)
Ln(# shares)	-0.017** (0.008)	-0.022** (0.011)	-0.308** (0.130)	-0.009 (0.213)	0.009 (0.012)	0.012 (0.012)	0.003 (0.010)	-0.029** (0.011)
Adjusted q	0.004*** (0.001)	-0.140** (0.064)	0.003 (0.019)	-1.530 (1.038)	0.005*** (0.001)	0.064 (0.073)	0.001 (0.001)	0.028 (0.076)
VC Dummy	0.143*** (0.045)	0.051 (0.122)	2.026** (0.869)	1.315 (1.719)	0.224*** (0.064)	0.117 (0.142)	0.111** (0.055)	0.229 (0.151)
1993 Dummy	0.138 (0.089)	0.630 (2.221)	-0.732 (1.860)	12.303 (65.634)	0.201** (0.100)	0.432 (2.674)	0.067 (0.100)	-0.111 (3.740)
p-value	0.00	0.00	0.01	0.11	0.00	0.00	0.00	0.00
R ²	24.91%	39.00%	22.46%	22.13%	40.93%	60.64%	13.49%	24.88%

Table 6
Year + 2 for Regulated Firms

This table reports results from regression analysis using robust standard errors with the monitoring mechanisms as the dependent variables. The sample includes the all regulated and heavily regulated firms. Data are for two years after the IPO year. Monitoring directors (holdings) is the sum of independent outside directors (holdings) and venture capitalist directors (holdings). Equity-based compensation is the average percentage of incentive compensation for the top executives. Standard errors are in parentheses. ***, **, * signifies significance at the 1%, 5%, and 10% levels, respectively.

	Monitoring Directors		Board Size		Monitoring Holdings		Equity-based Compensation	
	All Regulated	Heavily Regulated	All Regulated	Heavily Regulated	All Regulated	Heavily Regulated	All Regulated	Heavily Regulated
Constant	0.703*** (0.116)	1.204*** (0.314)	5.575*** (1.531)	-4.743 (6.473)	0.001 (0.125)	0.344 (0.428)	0.280* (0.167)	0.441 (0.418)
Inside Holdings	-0.101 (0.071)	-0.351** (0.143)	1.423 (1.058)	0.942 (2.612)	-0.336*** (0.086)	-0.282* (0.166)	-0.245*** (0.093)	0.101 (0.199)
Size	0.000 (0.009)	0.003 (0.029)	0.856*** (0.145)	1.571*** (0.396)	-0.016 (0.012)	-0.067** (0.029)	0.033** (0.014)	0.052 (0.035)
Leverage	-0.201*** (0.061)	-0.351* (0.175)	-2.938*** (0.931)	-7.316** (3.453)	0.220** (0.094)	0.408* (0.234)	0.128 (0.084)	0.422** (0.194)
ROA	-0.017 (0.022)	-0.000 (0.001)	-0.743 (0.456)	0.020 (0.016)	0.068** (0.028)	-0.000 (0.000)	-0.011 (0.032)	-0.002* (0.001)
Ln(age)	-0.031 (0.019)	-0.022 (0.046)	-0.699** (0.275)	-1.336 (1.033)	0.050** (0.025)	-0.044 (0.038)	-0.036 (0.025)	0.045 (0.046)
Tangible Assets	0.000 (0.087)	-0.324 (0.264)	1.871* (1.025)	5.406 (6.076)	0.067 (0.120)	0.198 (0.383)	-0.092 (0.129)	-0.274 (0.324)
Founder dummy	0.003 (0.033)	0.061 (0.068)	0.098 (0.566)	-0.106 (1.596)	-0.104** (0.041)	-0.021 (0.072)	0.002 (0.041)	-0.010 (0.084)
Ln(# shares)	-0.005 (0.008)	-0.017 (0.013)	0.091 (0.117)	0.063 (0.190)	0.024** (0.009)	0.018 (0.017)	0.011 (0.014)	-0.005 (0.015)
Adjusted q	-0.013* (0.007)	-0.069** (0.029)	0.152* (0.085)	-0.393 (0.458)	-0.021* (0.013)	-0.029 (0.035)	0.051*** (0.008)	0.038 (0.033)
VC Dummy	0.112*** (0.032)	0.180* (0.097)	-0.078 (0.484)	1.781 (2.137)	0.056 (0.047)	-0.040 (0.181)	0.070 (0.053)	0.210 (0.156)
1993 Dummy	0.008 (0.045)	-0.039 (0.133)	-2.042*** (0.616)	5.001 (3.789)	0.124** (0.054)	0.192 (0.119)	-0.054 (0.057)	-0.538*** (0.180)
1996 Dummy	0.083* (0.046)	-0.032 (0.148)	-1.711** (0.688)	4.850 (4.120)	0.042 (0.057)	0.045 (0.097)	0.026 (0.062)	-0.512*** (0.173)
Obs	168	44	168	44	168	44	153	44
p-value	0.00	0.00	0.00	0.03	0.00	0.05	0.00	0.00
R ²	17.23%	16.51%	28.77%	42.80%	31.88%	16.75%	29.53%	39.01%

Table 7
Levels of Monitoring: Matched Sample

This table reports means for levels of monitoring mechanisms for heavily regulated firms and a matched sample of unregulated firms. Firms are matched based on total assets. The *p*-value reports the significance of the difference between the sample means. Monitoring directors (holdings) is the sum of independent outside directors and venture capitalist directors (holdings). Equity-based compensation is the average percentage of compensation that is equity-based for the top executives. The sample consists of 58 heavily regulated and 58 matched unregulated firms. Standard errors are in parentheses. ***, **, * signifies significance at the 1%, 5%, and 10% levels, respectively.

	Heavily Regulated	Matched	p-value
Independent Outside Directors	54.11%	31.06%	0.00
VC Directors	3.21%	18.18%	0.00
Monitoring Directors	57.32%	49.24%	0.04
Board Size	9.27	5.85	0.00
Outside Blockholdings	11.51%	10.63%	0.83
VC Holdings	3.98%	18.35%	0.00
Monitoring Holdings	15.50%	28.98%	0.00
Equity-based compensation	13.27%	17.49%	0.29
Inside Holdings	33.55%	37.98%	0.35

Table 8
Substitution versus Pressure Tests: Matched Sample

This table reports results from regression analysis using robust standard errors with the monitoring mechanisms as the dependent variables. The sample includes heavily regulated firms and unregulated firms, which were selected by matching asset size to the heavily regulated firms. Monitoring directors (holdings) is the sum of independent outside directors (holdings) and venture capitalist directors (holdings). Equity-based compensation is the average percentage of incentive compensation for the top executives. The sample consists of 58 heavily regulated and 58 matched unregulated firms. Standard errors are in parentheses. ***, **, * signifies significance at the 1%, 5%, and 10% levels, respectively.

	Monitoring Directors	Board Size	Monitoring Holdings	Equity-based Compensation
Constant	0.594*** (0.126)	6.043*** (1.846)	-0.050 (0.167)	0.192 (0.151)
Inside Holdings	-0.237*** (0.088)	3.234* (1.816)	-0.230* (0.132)	-0.155 (0.125)
Size	-0.006 (0.020)	0.460* (0.234)	0.013 (0.025)	-0.009 (0.021)
Leverage	-0.116 (0.087)	-1.185 (1.400)	0.170 (0.130)	0.082 (0.110)
ROA	0.336* (0.197)	-4.135* (2.444)	0.395 (0.294)	-0.061 (0.238)
Ln(age)	-0.001 (0.018)	-0.549 (0.351)	0.024 (0.020)	0.018 (0.020)
Tangible Assets	-0.011 (0.053)	-2.308** (1.111)	0.082** (0.034)	-0.065 (0.055)
Founder dummy	-0.032 (0.046)	-0.841 (0.746)	-0.004 (0.043)	0.027 (0.047)
Ln(# shares)	-0.009* (0.005)	-0.005 (0.073)	0.010 (0.009)	0.007 (0.010)
Adjusted q	0.026 (0.018)	-0.293* (0.174)	-0.008 (0.014)	0.009 (0.019)
VC Dummy	0.106** (0.046)	0.940 (0.647)	0.266*** (0.055)	0.084 (0.063)
Heavily Reg Dummy	0.090 (0.058)	3.231*** (0.933)	0.067 (0.122)	-0.042 (0.100)
Heavily Reg Dummy * Inside Holdings	0.043 (0.131)	-0.456 (2.892)	-0.178 (0.247)	0.146 (0.191)
Obs	104	104	104	102
p-value	0.00	0.00	0.00	0.63
R ²	25.47%	35.36%	46.62%	8.59%