

**The Determinants of Corporate Board Size and Composition:
An Empirical Analysis**

Audra L. Boone
Laura Casares Field
Jonathan M. Karpoff
Charu G. Raheja

September 5, 2005

Version 3-0-9

JEL Classification: G30

We thank Tom Bates, Hank Bessembinder, Jay Coughenour, Jarrad Harford, Mike Klausner, Mike Lemmon, Paul Malatesta, Ron Masulis, Bob Parrino, Jay Ritter, Ralph Walkling, Mike Weisbach, Karen Wruck, an anonymous referee, and participants at the University of Arizona, University of Arkansas, University of Delaware, University of Houston, the 2004 Batten Young Scholars Conference at the College of William & Mary, Vanderbilt University, University of Massachusetts Amherst, the 2005 American Finance Association meeting, and the 2004 Financial Management Association meeting for their valuable comments and suggestions. Contact information: alboone@ku.edu; laurafield@psu.edu; karpoff@u.washington.edu; charu.raheja@owen.vanderbilt.edu.

The Determinants of Corporate Board Size and Composition: An Empirical Analysis

Abstract

Many theories have been proposed to explain how corporate boards are structured. This paper groups these theories into four hypotheses and tests them empirically. We utilize a unique panel dataset that tracks corporate board development from the time of a firm's IPO through 10 years later. The data support three distinct but mutually compatible hypotheses of board development: (i) board size and independence increase as firms grow in size and diversify over time; (ii) board independence is negatively related to the manager's influence and positively related to constraints on such influence; and (iii) board size reflects a trade-off between the firm-specific benefits of monitoring and the costs of such monitoring. The data do not support the view that boards are structured randomly or to facilitate managers' consumption of value-decreasing private benefits. These results are consistent with the view that economic considerations – in particular, the specific nature of the firm's competitive environment and managerial team – drive corporate board size and composition.

The Determinants of Corporate Board Size and Composition: An Empirical Analysis

1. Introduction

Corporate boards are the focus of many attempts to improve corporate governance. Shareholder advocates such as Institutional Shareholders Services, Inc. and the Council of Institutional Investors have called for smaller boards with greater outside representation among U.S. corporations, sentiments that are echoed by the National Association of Corporate Directors and The Business Roundtable.¹ Institutional investors such as TIAA-CREF have issued specific recommendations for how boards should be structured and run. Some of these recommendations were codified into law via the Sarbanes-Oxley Act of 2002, which includes, for example, a requirement that boards have audit committees that consist only of independent outside directors. The movement toward specific board guidelines, typically calling for greater outside representation, is also a characteristic of the Codes of Best Practice issued in many countries (see Denis and McConnell 2003).

Yet despite the importance of corporate boards and the widespread call for their reform, financial economists have reached few firm conclusions about the forces that drive board size and composition. This paper examines these forces empirically. To structure our tests, we group existing theories about corporate boards into four testable hypotheses. These hypotheses are summarized in Table 1. The first hypothesis, which reflects the views of Fama and Jensen (1983), Coles et al. (2005), and Lehn et al. (2004), implies that board structure is driven by the scope and complexity of the firm's operations. We call this the *scope of operations hypothesis*. The second hypothesis, reflecting the work by Hermalin and Weisbach (1998) and Baker and

¹ See The Business Roundtable (1997), National Association of Corporate Directors (2001), and Institutional Shareholders Services, Inc. (2003).

Gompers (2003), implies that board composition results from a negotiation between the firm's CEO and its outside board members. We call this the *negotiation hypothesis*. The third hypothesis is that board size and composition are determined by the specific business and information environment in which the firm operates. We call this view – which borrows from ideas expressed by Demsetz and Lehn (1985) and Gillan et al. (2004), and is modeled by Raheja (2004) and Harris and Raviv (2005) – the *monitoring hypothesis*. The fourth hypothesis – the *inefficient board hypothesis* – is that corporate boards are structured either haphazardly or perversely to yield large private benefits to managers. This is the view that underlies attempts to impose external rules to regulate the board's size and composition.

As illustrated in Table 1 and developed further in section 2, each of these hypotheses yields testable predictions about the forces that shape board size, composition, or both. We test these predictions using hand-collected data from a panel of 1,019 firms that went public between 1988 and 1992, which we track for periods of up to ten years. Our tests exploit the panel nature of the data, and control for the endogeneity of board size and composition. Because of the notorious problem in corporate finance in measurement error, and the resulting biases in coefficient estimates, we employ several proxy variables to test each of the hypotheses.

Our dataset offers several advantages over previous empirical investigations into corporate boards. First, by focusing on young companies, the data address a concern voiced by Hermalin and Weisbach (2003) that most research on corporate boards has been limited to large, established companies. Second, the 10-year period of the data allows us to measure the evolution of corporate boards as firms mature. Third, the time surrounding the initial public offering offers a particularly rich setting for studying board issues. This is because, as Baker and Gompers (2003) argue, the IPO typically is a time of significant change in the firm's governance. Also, as Gertner and Kaplan (1996) point out, firms undertaking a public offering are more likely

than already-public firms to choose value-maximizing governance features because the selling insiders directly bear the financial effects of such features.

The results provide support for the first three hypotheses. In particular:

(i) Measures of the scope and complexity of the firm's operations – including firm size, firm age, and the number of the firm's business segments – are positively related to both board size and the fraction of independent outsiders on the board. This indicates that boards grow in response to the increasing net benefits of monitoring and specialization by board members that accompany a firm's growth.

(ii) The fraction of independent outsiders is negatively related to measures of the CEO's influence – including the CEO's share ownership and job tenure – and positively related to constraints on such influence, including the ownership of outside directors, the presence of a venture capitalist, and the reputation of the firm's investment bank at the time of its IPO. This supports Hermalin and Weisbach's (1998) theory that corporate boards reflect the outcome of a negotiation between the CEO and outside board members. Furthermore, the evidence indicates a significant degree in persistence in the bargaining outcome, as the CEO's bargaining power at the time of the IPO helps explain board composition even several years after the IPO.

(iii) Board size is positively related to measures of the private benefits available to insiders – including the industry concentration and the presence of takeover defenses – and negatively related to measures of the cost of monitoring insiders, including CEO ownership, the market-to-book ratio, the R&D expenditure in the firm, and the return variance. This is consistent with arguments forwarded by Gillan et al. (2004), Raheja (2004), and Harris and Raviv (2005) that board size reflects a trade-off between the firm-specific benefits of increased monitoring and the costs of such monitoring.

In contrast, the results do not support the inefficient board hypothesis. We cannot rule out the possibility that some boards are structured inefficiently, or that regulations on board composition could generate external benefits for investors. But our results indicate that it is useful to view the evolution of corporate boards as endogenously molded by the firm's unique business and managerial characteristics. That is, board size and composition vary across firms, and change over time, to accommodate the specific growth, managerial, and monitoring characteristics of the firm. This implies that uniform rules imposed through political means, such as the addition of independent outsiders, is unlikely to be a value-increasing policy for all firms, or perhaps even very many firms.

The rest of this paper is organized as follows. In section 2 we discuss related research on corporate boards and develop the four hypotheses that coalesce the views of prior researchers. Section 3 describes the characteristics of corporate boards at the time of the IPO for our sample of 1,019 firms going public from 1988-1992, and describes the evolution of these firms' boards and ownership structures over the next ten years. Our tests raise several issues common in corporate finance empirical research, and in section 4 we describe how we address problems related to poor data, endogeneity, and measurement error in the proxy variables. Section 5 then reports on tests of the four main hypotheses, and section 6 reports the results of sensitivity tests that probe the robustness of the results. Section 7 examines the economic importance of the effects we measure, and section 8 concludes.

2. Hypotheses of the determinants of corporate boards

2.1. The scope of operations hypothesis

Fama and Jensen (1983) propose that the way a firm is organized depends on the scope and complexity of its production process: larger or more complex processes lead to larger and

more hierarchical firms. The firm's board, in turn, has the job of ratifying and monitoring senior managers' decisions. It follows that the information requirements of more complex operations tend to require larger boards.

This view, which we call the *scope of operations hypothesis*, is consistent with arguments made by Lehn et al. (2004) and Coles et al. (2005). It implies that a firm growing into new product lines or new geographical territory will seek new board members to help oversee managers' performance. As a firm grows, or simply survives as a public entity, its demands for specialized board services also are likely to grow. As Bhagat and Black (1999) and Agrawal and Knoeber (2001) argue, new directors may have specialized knowledge that applies to the new growth areas. Boards of larger or more diverse firms also may increase their demands for new board members as such tasks as succession planning, compensation, and auditing are assigned to committees rather than handled by the board as a whole. The scope of operations hypothesis is also consistent with results reported by Denis and Sarin (1999) and Yermack (1996), which suggest that board size is positively related to firm size.

In addition to affecting board size, the scope and complexity of a firm's operations can affect the board's composition. Crutchley et al. (2004) and Lehn et al. (2004) argue that larger firms demand more outside directors because their large size gives rise to more significant agency problems. Using a similar argument, Anderson et al. (2000) and Coles et al. (2005) argue that diversified firms deploy more independent directors to monitor their wider scope of operations.²

Thus, as shown in Table 1, the views that we summarize as the scope of operations hypothesis predict that board size and the fraction of independent outsiders on the board are both

² A plausible counter-argument is that greater firm complexity requires more *insiders* on the board to help oversee the firm's operations. Thus, our tests distinguish empirically between this conjecture and existing theories.

positively related to the scope and complexity of the firm's operations. In our empirical tests, we use three measures of the firm's scope and complexity: firm size, firm age, and the firm's number of business segments. The scope of operations hypothesis implies that all three measures will be positively related to board size and the fraction of independent outsiders.

2.2. *The negotiation hypothesis*

Hermalin and Weisbach (1998) propose a model in which board structure is the outcome of a negotiation between the CEO and outside directors. In this model, CEOs that generate surpluses for their firms – that is, for whom good substitutes are unavailable – wield influence with their outside directors. CEOs use their influence to capture some of these surpluses by placing insiders and affiliated outsiders in open board positions. We refer to this argument as the *negotiation hypothesis*.

Kieschnick and Moussawi (2004) introduce a variation of the negotiation hypothesis and argue that board independence shrinks with managers' influence and grows with institutional investor influence. Stated more generally, the negotiation hypothesis implies that the fraction of outsiders on the board will be negatively related to the CEO's influence and positively related to constraints on the CEO's influence. Notice that the hypothesis does not imply that the resulting board is inefficient. Rather, board composition is simply part of the compensation earned by a CEO who generates quasi-rents for the firm.

As shown in Table 1, we use two measures of the CEO's influence in our empirical tests: the CEO's job tenure and the CEO's stock ownership. Measures of constraints on this influence include outside directors' stock ownership, a dummy variable that represents the presence of a venture capital investor at the time of the IPO, and the Carter-Manaster (1990) ranking of the reputation of the firm's investment banker at the time of its IPO. In our tests, we examine

whether the CEO's influence affects the board's composition both at the IPO and afterwards. We also include the presence of an outside blockholder as an additional proxy for this hypothesis in our robustness tests.

2.3. *The monitoring hypothesis*

A third view is that boards develop in response to the specific monitoring requirements of the firm's business activity. We call this the *monitoring hypothesis*. Partial versions of the monitoring hypothesis are expressed in several papers on board and ownership structure. Demsetz and Lehn (1985) propose that the noisiness of a firm's operating environment will affect monitoring costs, a notion that Gillan et al. (2004) use to argue that boards will monitor less in noisy environments. Lehn et al. (2004) argue that high growth firms will have relatively small boards with a high proportion of insiders because the cost of monitoring such firms is relatively high. Coles et al. (2005) argue that the fraction of independent outsiders will be negatively related to the firm's R&D expenditures because outside board members are ineffective in monitoring firms with high growth potential. Yang, Linck and Netter (2005) argue that firms facing greater information asymmetry will have smaller and less independent boards because of the higher costs of monitoring.

These ideas are formalized and expanded in theoretical models of board structure developed by Raheja (2004) and Harris and Raviv (2005). In these models, the net benefits of external monitoring increase with managers' opportunities to consume private benefits, but decrease with the cost of monitoring. Thus, optimal boards will employ large numbers of outside directors, and be larger in overall size, when managers' private benefits are high and the cost of monitoring is low. That is, both board size and the fraction of outside directors are positively related to managers' private benefits and negatively related to the cost of monitoring.

In our tests, we use three measures of managers' potential private benefits: the firm's free cash flow, a Herfindahl measure of industry concentration, and a variation of Gompers, Ishii, and Metrick's (2003) *G*-index of the extent to which managers are insulated from the market for control by firm and state-level takeover defenses. We reason that managers' opportunities to extract private benefits increase with all three of these measures, increasing the net benefits of increased board monitoring.

We use four variables to measure the cost of monitoring. The variables we use are CEO ownership, market-to-book ratio, R&D intensity, and the variance of the firm's daily stock return. We presume that the cost of monitoring is positively correlated with all four measures, implying that board size and the fraction of independent outsiders should be negatively related to all four. Our rationale for CEO ownership is that the CEO may hold a large ownership stake as an endogenous response to a costly monitoring environment, to mitigate the agency problem that arises from costly monitoring (see for example, Demsetz and Lehn (1985) and Himmelberg, Hubbard and Palia (1999)). Thus, although CEO ownership may not directly increase the costs of monitoring, its correlation with monitoring costs make it a reasonable proxy for such costs. This prediction is also consistent with Raheja's (2004) model, which predicts a negative relation between CEO ownership and board size and independence because higher managerial ownership decreases private benefits to insiders by better aligning their incentives with the shareholders (Note that the negotiation hypothesis also implies a negative relationship between board independence and CEO ownership. We interpret evidence of such a relationship as consistent with both the negotiation and monitoring hypotheses).

The rationale for the latter three measures is similar. Firms with high log market-to-book ratios or high research and development expenses tend to have significant growth opportunities, the management of which are more costly for outsiders to monitor and verify than are assets in

place. Similarly, the cost of monitoring managers is likely to increase with the volatility of the firm's stock price, because volatility reflects background uncertainty about the firm's prospects and performance and increases the difficulty of judging managers' performance. Similar arguments and measurements are made by Yermack (1995), Smith and Watts (1992), Bizjak, Brickley, and Coles (1993), Gaver and Gaver (1993), Kole (1997), Klein (1998), Lehn, Patro and Zhao (2004) and Coles, Daniel and Naveen (2005).

2.4. The inefficient board hypothesis

The previous hypotheses regard board size and composition as adjusting to facilitate firm success by decreasing the net costs of the agency relationship between directors and managers. Implicit in these arguments is Alchian's (1950) notion that firm characteristics that do not facilitate success tend to be weeded out in the competitive process. An alternate view is that, due to high transaction and information costs, competitive pressures are insufficient to encourage efficient adaptation among corporate boards. According to this view, board structure cannot be viewed as generally increasing firm value. Instead, boards will tend to be structured inefficiently unless regulations force them to a more efficient size and composition.

We call this the *inefficient board hypothesis*. This is the view that underlies attempts to impose changes in board structure through regulation. It is reflected in the NYSE and NASDAQ's 2003 governance rules, which require listed companies to have a majority of independent directors (see www.nyse.com/pdfs/finalcorpgovrules.pdf and <http://www.nasdaq.com/about/RecentRuleChanges.stm>). The hypothesis is also reflected in the

board requirements of the 2002 Sarbanes-Oxley Act and in such defenses of this act as voiced by Paul Volcker and Arthur Levitt Jr. (Volcker and Levitt, 2004).³

If boards are structured inefficiently, they may be structured either haphazardly or perversely. If haphazard, then none of the other three hypotheses will be able to explain the cross-section or time-series variation in board size and composition. To the extent that the data are consistent with the scope of operations, negotiation, or monitoring hypotheses, we can infer that boards are not *in general* haphazard. If boards are perversely inefficient, they will be structured not to increase firm value, but to facilitate managers' extraction of private benefits at shareholders' expense. This implies that board monitoring will be low when the possibility of private benefits is high – precisely the opposite prediction as that of the monitoring hypothesis. As summarized in Table 1, this version of the inefficient board hypothesis implies that measures of managers' opportunities to consume private benefits will be negatively related to board size and independence.

3. Description of the data

Our sample is based on all industrial firms that went public in U.S. markets from 1988 through 1992. To be included in the sample, the IPO must involve common stock offered at a minimum price of \$1.00 per share and issued through a firm commitment underwriting agreement. In addition, the firm must be incorporated in the United States at the offer date and be identified on the CRSP daily tape as having been listed within three months of the offer date. These criteria yield a sample of 1,019 IPOs, which explicitly excludes IPOs by financial institutions, real estate investment trusts, and closed-end mutual funds. We then collect board

³ Volcker and Levitt (2004) also articulate an additional justification for regulations affecting firms' corporate governance, namely, that such regulations increase investors' confidence in the financial system, generating benefits that are external to the firm.

and ownership data on all sample firms at the IPO and at one year, four years, seven years, and ten years after the IPO. Data at the IPO come from the offering prospectuses, and data for subsequent years come from proxy statements. These data allow us to track the evolution in board structure and ownership over time.

Panel A of Table 2 reports on the sample size from the time of the IPO until 10 years later. Many of the 1,019 IPO firms from the 1988-1992 period were delisted over time, such that only 422 remain as independent publicly-traded firms 10 years after their IPOs. The annual number of firms going public increased during the 1988-1992 period, although the percentage of firms that were delisted is roughly equal across each year's cohort of IPO firms.

The reasons for the delistings are summarized in Panel B of Table 2. Very few – only 0.6 percent – are delisted within one year of the IPO. Greater proportions are delisted by year 4 relative to the IPO year. But the majority of delistings (67 percent) occur after year 4. Most of the delisted firms (63 percent) were acquired by other firms. An additional 36 percent were delisted because they no longer met listing requirements. Only two firms are classified by CRSP as liquidated.

In the tables that follow we use data from all surviving firms in any given year relative to the IPO. We also re-calculated our tests using data only from the 422 firms that survived through year 10. The results of such tests are virtually identical to those reported below in the tables. Thus, the changes over time that we report below do not reflect a change in the composition of the sample, but rather, the general trends in ownership and board structure as firms mature from the IPO stage.

3.1. Board characteristics and ownership at the time of the IPO

Table 3 reports on the board and ownership characteristics of the 1,019 firms at the times of their IPOs. Panel A indicates that the IPO firms are small, averaging \$150.2 million in equity value. As a basis of comparison, the mean equity value in Denis and Sarin's (1999) sample of seasoned firms is \$434.6 million. Compared to Denis and Sarin's sample, the IPO firms also have a lower mean debt-to-total assets ratio (35 percent vs. 56 percent) and a higher expenditure on research and development compared to total assets (11 percent vs. 1.58 percent). These averages are consistent with the stereotype of many firms at the IPO stage: they are relatively small, financed significantly by equity capital, and actively engaged in research and development activities.

Panel B of Table 3 reports on characteristics of these firms' ownership and board structures immediately after the IPO. We follow the convention in the literature of labeling directors as insiders if they are currently employees of the firm, as affiliated outsiders if they have substantial business relations with the firm, are related to insiders or are former employees, and as independent outsiders if they are neither insiders nor affiliated outsiders. CEOs owned a mean of 16 percent of their firms' stock, and all officers and directors owned 52 percent of the stock, on average, right after the IPO. The corresponding averages from Denis and Sarin's sample are 7 percent and 16 percent, respectively. The mean number of directors for the IPO firms is 6.2. Of these, 38 percent are insiders, 5.3 percent are affiliated outsiders, and 56.5 percent are independent outsiders. The corresponding averages from Denis and Sarin's sample are 9.35 directors, of which 39 percent are insiders, 20 percent are affiliated outsiders, and 40 percent are independent outsiders. (Consistent with these findings, Gillan, Hartzell and Starks (2004) report that the mean percentage of independent outsiders in their sample of large firms from 1997-2000 is 59 percent. The mean board size in their sample is 9.44 persons.)

Thus, CEO and insider stock ownership tends to be much greater for firms at the time of the IPO than for seasoned corporations. IPO firms also have much smaller boards, on average, than seasoned firms. The fraction of insiders is roughly equal across the two samples, but firms at the time of their IPOs have a significantly greater percentage of independent outsiders.

Given that firms at the IPO stage have great incentive to maximize firm value, these results indicate that small boards with a majority of independent outside directors tend to be optimal for these firms. This holds despite the fact that inside ownership in these firms is relatively high. Thus, even though agency problems in the IPO firms may be relatively small because managers own large amounts of stock, these firms rely heavily upon independent outside directors.

3.2. Changes in board characteristics and ownership over time

Panel A of Table 4 reports on the evolution of ownership for the IPO firms. Ownership by officers and directors declines steadily over the period, declining by half in the first 10 years after going public, from 52 percent at the IPO to 25 percent ten years later. Average CEO ownership is 16 percent immediately after the IPO and drops steadily over time, to an average of seven percent ten years later (which is similar to the seven percent found by Denis and Sarin for seasoned firms). Ownership by officers follows a similar decline, from 26 percent after the IPO to 14 percent at year 10 (the comparable number from Denis and Sarin is 16 percent). Ownership by outside directors also declines steadily over the period, from 26 percent to 11 percent. Interestingly, ownership by five percent blockholders remains fairly steady over time at about 30 percent, as does the number of blockholders (an average of roughly three blockholders per firm). These patterns can be seen graphically in Figure 1.

Panel B of Table 4 reports on characteristics of the CEOs using data on all surviving firms at each year of the analysis. The average CEO is 48 years old at the IPO, with eight years of tenure with the firm. For 43 percent of firms conducting IPOs, the CEO is also the founder. By year 10 only 21 percent of the CEOs are firm founders. The fraction of CEOs who also serve as Chairman of the Board is fairly constant over time, ranging from 60 percent to 64 percent of firms. CEO turnover ranges from six percent in the first public year to almost 10 percent per year in later years (30 percent of all firms experienced CEO turnover between year 1 and year 4, with 25% between year 4 and year 7, and 30% between year 7 and year 10, for an average of almost 10 percent of firms experiencing CEO turnover per year over these periods).

Panel C of Table 4 reports on the board structure for firms at the IPO and afterwards, while Figure 2 shows this evolution graphically. The average number of directors increases steadily after the IPO, starting at 6.21 in the year of the IPO and rising to 7.52 by year 10. Even after 10 years, however, the mean number of directors remains smaller than the mean of 9.35 reported by Denis and Sarin or the 9.44 reported by Gillan, Hartzell and Starks (2004), both using samples of generally more seasoned firms. This suggests that corporate boards continue to grow as a firm ages beyond 10 years.

The increase in board size reflects primarily the addition of independent outside board members, the fraction of which grows steadily until it reaches 69 percent by year 10. The fraction of affiliated outsiders, stays roughly constant over time, while the fraction of insiders decreases steadily, to reach 26 percent by year 10. Thus, the proportion of outside representation on these firms' boards increases as they age. The table also provides data on the fraction of original board members remaining with the firm. In the first year, 90 percent of the original board members remain with the firm. This figure declines to 67 percent by year 4, 51 percent by year 7, and 42 percent by year 10. These patterns can be seen graphically in Figure 2.

To summarize, several patterns emerge about the evolution of leadership structure in the 10 years following a firm's IPO. Ownership by officers and directors falls, presumably as share ownership becomes more widely diffused. The number of directors increases, although not to as high a level as observed in older, seasoned firms. Firms at the IPO stage have a higher fraction of independent outsiders on their boards than do typical seasoned corporations, and this fraction increases over time.

4. Estimation issues in tests for the determinants of board structure

In the following sections we estimate multivariate regressions using panel data methods to test the scope of operations, negotiation, monitoring, and inefficiency hypotheses. Like much research in corporate finance, empirical tests of board structure are notorious for concerns about poor data, endogeneity, and measurement error in the proxy variables. In this section we discuss our approaches to these estimation problems.

4.1. Panel data

As discussed in section 3, we employ hand-collected board data on all 1,019 industrial firms that went public from 1988-1992 for years 1, 4, 7, and 10 relative to the IPO. Our primary tests are robust regressions with clusters, in which observations are clustered by firm and the covariance matrix is estimated using the Huber (1964) or White (1980) estimator. This allows us to exploit information in both the cross-section and time-series nature of the data while still controlling for the serial correlation that is observed in each firm's time series of observations. The results reported in Tables 6 through 9 reflect the key empirical relationships between board size, independence, and the proxy variables. But in section 6 we also report on a number of

sensitivity tests that probe these results regarding the choice of empirical model, the proxy variables used, and our treatments for endogeneity.

4.1.2. Endogeneity

We deploy three strategies to control for the fact that board size and composition are jointly determined with the firm's competitive environment. First, we include industry fixed effects in all regression models. The rationale for industry fixed effects is that they control for the underlying economic environment that might jointly determine board size and independence. This is because firms in the same industry face similar production technologies and market conditions – the very things that give rise to the endogeneity problem in the first place. In these tests, we use Fama-French (1997) industry groupings, although the results are not substantially affected when we use alternative industry definitions (e.g., as examined by Kahle and Walkling (1996)), or when we omit the industry controls altogether.

Our second strategy to control for endogeneity is to introduce instrumental variables for board size and the fraction of independent outsiders. In these tests, our instrumental variables are these variables' lagged values. For example, for firm *j*'s observation at year 10 relative to the IPO, the instrumental variable for board size is firm *j*'s board size at year 7 (because we have data for years 0, 1, 4, 7, and 10). We include instrumental variables for board size in our tests for board independence, and for board independence in our tests for board size. It turns out, however, that including these instruments, or additional instruments for other variables that plausibly could be endogenous, does not affect the results substantially.

As an additional check, we also use a third approach similar to Agrawal and Knoeber (1996) and Himmelberg, Hubbard, and Palia (1999), and specify structural models that explicitly endogenize board size and independence. Previous researchers (e.g., Bhagat and Jefferis, 2002)

report that the results from such models are highly sensitive to the identifying assumptions. Nevertheless, the results from our simultaneous equation tests are very close to those reported in Tables 6-9. We report on the simultaneous equation tests in section 6.

As in many corporate finance tests, the variables we use as regressors also may be endogenous to the firm's operating environment. For example, the stock return variance reflects the firm's investment decisions, which in turn are determined by the firm's monitoring environment and board structure. Fortunately, endogeneity among the proxy variables does not affect the inferences we make about the central hypotheses. This is because the scope of operations, negotiation, and monitoring hypotheses all imply that firm characteristics, including board size and composition, are the endogenous response to the firm's operating environment. The monitoring hypothesis, for example, implies that board size is negatively related to the stock return variance precisely because the two result from adjustments to the firm's operating environment. Thus, our tests should not be viewed as tests of causation, but rather, of correlation between the proxy variables indicated by each of the hypotheses, and board size and composition. (As reported in section 6, we also investigate the effects of using instruments for some of the proxy variables, and obtain results that are similar to those reported in the tables.)

4.1.3. Measurement error and multiple proxy variables

Measurement error in a regressor and the resulting attenuation bias in the coefficient estimate is a common problem in empirical research. Despite this problem, some previous tests of board structure deploy a single proxy variable to test a specific hypothesis. Coles et al. (2005), for example, use R&D intensity to measure the cost of monitoring managers.

We seek to improve upon previous tests by considering several proxy variables for each hypothesis. We first examine the determinants of board size and composition considering each

proxy variable in isolation. The results of these tests – including robustness checks from using different proxies – are reported in Tables 6-9.⁴

We also conduct three additional tests that exploit the use of multiple proxy variables. The first is a Wald test of the joint significance of all proxy variables for each hypothesis. The second uses the principle components from each cluster of proxy variables to test each hypothesis using a reduced number of factors. And the third is a binomial test based on the estimated coefficients from 123 linear regression models, one for each possible combination in which each hypothesis is tested by a unique proxy. The results from the Wald tests are reported throughout section 5, and the results of the principle components and binomial tests are reported in Section 5.4. All of these tests yield similar inferences.

5. Empirical results

5.1. The scope of operations hypothesis

As summarized in Table 1, we use firm size, firm age, and diversification as measures of the scope and complexity of the firm's operations. The scope of operations hypothesis predicts that board size and the fraction of independent directors are positively related to all three measures. Firm size is measured as the natural log of total assets as of each fiscal year-end.⁵

Age is calculated as the number of years since the firm's IPO.⁶ The number of business

⁴ We also estimate the relations between board size and independence using all proxy variables simultaneously. But this almost surely biases the estimated coefficients toward zero. Noting the problem of estimating one structural coefficient with multiple proxies, Lubotsky and Wittenburg (2005) argue that, "Putting multiple proxies in the regression may likely result in many insignificant individual coefficients."

⁵ With one exception, the results reported below are qualitatively identical when the market value of the firm's equity is used to measure firm size. The exception is that the coefficient for the log of the market-to-book ratio is negative and significant in the Table 8 regressions when the market value of the firm's equity is used. This result appears to reflect the fact that the market value of equity and the market-to-book ratio are strongly correlated.

⁶ Many firms in the sample have long operating histories before they issued stock to the public. When age is calculated as the current year minus the year of incorporation ("total firm age"), the empirical results are similar to those reported in Table 6. When both total firm age and the years since the IPO are included together, the

segments reported by the firm, as carried by Compustat, is used to measure diversification. As reported in Table 5, all three measures of firm scope and complexity are positively correlated. The pairwise correlation between firm size and the number of years since the IPO is 0.32, and the correlation between firm size and the number of business segments is 0.26. The correlation between the number of segments and the years since the IPO is 0.49. All are significant at the 1% level.

As additional controls, we include a dummy variable equal to one for firms that made an acquisition during the previous period, lagged return on assets as measured by operating income divided by total assets in the previous period, and dummy variables for firms that went public in reverse leveraged buyouts and as equity carveouts, and firms with dual-class shares. The results are not significantly affected, however, when any of these control variables are excluded from the sample.

The results of the regressions testing the scope of operations hypothesis are reported in Table 6. In Panel A, the number of directors on the board is the dependent variable, and the lagged value of the fraction of independent outsiders is included as an instrumental variable to control for endogeneity. In Models 1-3, each of the measures of firm scope is entered separately, and all three are positively and significantly related to board size. This provides strong support for the scope of operations hypothesis.

In Model 4, all three measures are included together. As discussed in section 4.3, including multiple proxy variables for a single underlying structural coefficient biases all proxies' coefficients toward zero. Even with such a bias, however, firm size and the number of business segments remain significantly related to board size in Model 4. More to the point, a

coefficient for the years since the IPO remains positive and statistically significant, while that for total firm age does not.

Wald test of the joint significance of the three measures used to test the scope of operations hypotheses indicates that all three are jointly significant at the 1% level. We interpret these results as indicating that board size is indeed shaped by the scope and complexity of the firm's operations.

Panel B of Table 6 reports results when the fraction of independent outsiders is the dependent variable. As reported in Models 1-3, the coefficients for all three measures of scope and complexity are positive and significant at the 1% level when each is entered separately. When all are entered together, as in Model 4, the coefficients all are positive, and those for firm size and age remain statistically significant. A Wald test of the joint significance of the three variables indicates that all three are significant at the 1% level. Overall, these results support the scope of operations hypothesis, which holds that corporate boards increase in size and independence as firm operations grow, mature, and become more complex.

Although not the focus of our study, the results for the control variables yield further insight into the forces that shape corporate boards. Recent merger activity, for example, is associated with larger boards, most likely as representatives from the acquired firm's board are added to the merged firm's board. The fraction of insiders is negatively related to lagged ROA, indicating that firms respond to poor operating performance by increasing the fraction of outsiders on the board. These results bolster the overall conclusion of our investigation, which is that board size and composition tend to react to the firm's specific economic environment.

5.2. The negotiation hypothesis

As summarized in Table 1, we use two sets of variables to test the view that the composition of the board reflects a negotiation between the CEO and outside board members. CEO share ownership and CEO job tenure measure the CEO's influence in the negotiation. CEO

ownership is measured as the fraction of the firm's currently outstanding shares owned by the CEO. CEO tenure is the number of years in which the CEO has held his or her position with the firm. Outside director ownership, venture capital investment, and investment bank reputation measure the constraints on the CEO's influence. Outside director ownership is the fraction of outstanding shares owned by independent outside directors. The venture capital dummy variable is set to one if a venture capital investor owned an equity stake at the IPO, and the investment bank reputation is measured by the bank's Carter-Manaster rank at the time of the firm's IPO. The negotiation hypothesis predicts that board independence is negatively related to CEO ownership and job tenure, and positively related to outside director ownership, venture capital investment, and investment bank reputation.

The results are reported in Table 7. In Models 1–5, each of the five measures is included separately. All five are significantly related to board independence in the predicted direction, providing support for the negotiation hypothesis. As discussed in section 2.3, the result that CEO ownership is negatively related to board independence also is consistent with the monitoring hypothesis.

In Model 6, all five measures are included together. Once again, this introduces an attenuation bias in the coefficient estimates due to the multicollinearity of the proxy variables (see the correlations in Table 5). Nevertheless, all variables except CEO tenure remain significantly related to board independence in Model 6. Model 7 includes also the regressors used to test the scope of operations hypothesis. All five measures used to test the negotiation hypothesis have the predicted signs, and all but the Carter-Manaster rank are statistically significant. The Wald test indicates that the five variables are jointly significant at the 1% level. Overall, these results provide strong support for the negotiation hypothesis. In Model 7, the variables used to test the scope of operations hypothesis have the same sign as the results

reported in Table 6, Panel B, and the Wald test indicates joint significance of these three variables. Overall, we interpret the data as providing support for both the scope of operations and negotiation hypotheses.

Note that two of our measures, the venture capital dummy and the Carter-Manaster rank, are measured at the time of the IPO. Baker and Gompers (2003) argue that the IPO is a particularly ripe time to investigate the negotiation hypothesis. This is because many firms' boards undergo significant changes around the IPO, and any negotiating influence that a CEO has will come into play at such times. Our results indicate that such measures of influence *at the time of the IPO* are useful in explaining board composition even in the years after the IPO. In tests not shown here, we test the negotiation hypothesis separately for each year in our sample. In these tests, we find that CEO tenure, the venture-capital dummy, as well as ownership by outside directors, *when measured at the IPO*, are significant in explaining board independence even 7 years later! CEO tenure at the IPO is significant at the 1% level in explaining the proportion of outside directors even 10 years later. This evidence implies that a CEO's influence at the time of the IPO affects the board's composition in future years.

5.3. *The monitoring hypothesis*

As summarized in Table 1, we use seven different variables to test the monitoring hypothesis. The monitoring hypothesis implies that board size and independence are positively related to managers' opportunities for private benefits. To measure private benefits, we use:

(i) free cash flow, measured as the firm's earnings plus depreciation minus capital expenditures, all divided by assets. As argued by Jensen (1986), free cash flow generates agency conflicts, as managers have incentives to use it for private benefits rather than to create shareholder wealth;

(ii) industry concentration, measured as the Herfindahl index of industry sales using data on Compustat-listed firms. We conjecture that managers at firms with market power are subject to less market discipline, and are better able to extract private benefits than managers of firms in highly competitive industries (e.g., see Gillan, Hartzell, and Starks, 2004);

(iii) takeover defenses, measured using a variation of Gompers, Ishii, and Metrick's (2003) *G*-Index. In our variation, we compute *G* as the firm's number of takeover defenses plus the number of state antitakeover laws that apply to the firm. The takeover defenses and state antitakeover laws are those defined and tracked by Field and Karpoff (2002). Larger levels of the *G*-Index indicate a greater amount of insulation from the external market for control and a greater opportunity for managers to extract private benefits.⁷

The monitoring hypothesis also predicts that board size and independence are negatively related to the cost to outsiders of monitoring the firm's managers. To measure such costs, we use:

- (i) the CEO's share ownership, as introduced in Table 7;
- (ii) the log of market-to-book ratio, defined as the natural log of the book value of debt plus the market value of equity, divided by the book value of assets;
- (iii) a dummy variable that is set equal to one for firms whose R&D expenditures divided by assets ranks in the upper quartile of our firms; and
- (iv) the stock return variance, measured as the variance of the daily logarithmic stock return measured over the preceding fiscal year.

⁷ Reverse causality is a potential issue here, as managers with large private benefits may encourage the firm's directors to adopt many takeover defenses. For our purposes, however, any reverse causality is not a problem, since we simply seek a variable that is correlated with, and hence provides a measure of, managers' potential to extract private benefits.

The empirical results for board size are reported in Table 8. In Models 1–7, each of the seven explanatory measures is entered separately. As predicted by the monitoring hypothesis, board size is positively and significantly related to free cash flow, industry concentration and the takeover defense *G*-index, and is negatively related to CEO ownership, R&D expenditures, and the return variance. The coefficient for the log market-to-book ratio, however, is statistically insignificant. When all seven variables are entered simultaneously, as in Model 8, the coefficients for industry concentration, the takeover defense *G*-index, R&D expenditures, and the stock return variance remain statistically significant at the 5% level or lower. The Wald test indicates that the seven proxy variables jointly are significant, consistent with the monitoring hypothesis.

We also estimated a model that includes all seven variables for the monitoring hypothesis plus the three variables used to test the scope of operations hypothesis. The results are reported as Model 9. The Wald test statistics of joint significance for the monitoring and scope of operations variables both are significant at the 1% level. These results also lend support to both the monitoring and the scope of operations hypotheses.⁸

The tests of the monitoring hypothesis' predictions for board independence are summarized in Table 9. For ease of reporting, Table 9 reports results from a single regression in which all seven measures are entered simultaneously. Also included are the variables used to test the scope of operations and negotiation hypotheses. Board independence is negatively related to the stock return variance and CEO ownership (significant at the 5% level), but the other coefficients are not statistically significant. The Wald test for the monitoring variables indicates that the monitoring hypothesis does explain the cross sectional variation in board

⁸ Raheja's (2004) model implies that board size is positively related to ownership by outside directors because it increases the incentive for outsiders to monitor projects. Consistent with this prediction, we find that the coefficient for outside director ownership is significant at the 1% level when this variable is added to Model 9 of Table 8.

independence but to a much smaller degree than do the scope of operations and negotiation hypothesis variables. Indeed, when the CEO ownership variable is excluded from the monitoring hypothesis (and included in the negotiation hypothesis), the Wald test for the remaining monitoring hypothesis variables is not significant (p-value = 0.149).

5.4. Alternative tests of the hypotheses

In Tables 6-9 we introduce different proxy variables sequentially, following a common form of presentation when more than one proxy variable is used to test a hypothesis (for example, see Brickley, Linck and Coles (1999)). This avoids the attenuation bias from introducing multiple proxies for a single hypothesis. But it also risks introducing omitted variable biases. To examine whether such biases affect our results, we conduct two alternative tests.

5.4.1. A binomial test

In the first alternate test we estimate a series of regressions in which each hypothesis is represented by a single proxy variable. There are, in total, three proxy variables for the scope of operations hypothesis, five for the negotiations hypothesis, and seven for the monitoring hypothesis. Both the scope of operations and monitoring hypotheses yield predictions for board size. So each proxy for the scope of operations (say, firm size) is paired with each of the seven proxies for the monitoring hypothesis in seven separate tests of both hypotheses. In all, this implies $3 \times 7 = 21$ separate regressions for board size. Since all three hypotheses yield predictions about board independence, there are a total of $3 \times 5 \times 7 - 3 = 102$ unique combinations of proxies testing all three hypotheses together. (The reason that the number is not

3 x 5 x 7 = 105 is that one variable, CEO ownership, is used as a proxy for both the negotiation and monitoring hypotheses.)

The results are summarized in Table 10. For tests of board size, firm size appears in seven separate regressions (one for each of the proxies for the monitoring hypothesis). The firm size coefficient is positive and significant at the 1% level in all seven regressions. The same is true for the firm age variable in all seven of the regressions in which it is used as the proxy for the scope of operations hypothesis, and also for the number of business segments in all seven of its regressions. Under the null hypothesis that none of the three proxies is related to board size, the likelihood that 21 out of 21 coefficients would be significant at the 1% level is $(0.01)^{21} = 10^{-42}$. We conclude that the observance of 21 significant coefficients is not due to chance, and reject the null in favor of the scope of operations hypothesis. Likewise, the coefficients for the monitoring hypothesis are significant at the 1% level in 13 out of the 21 regressions and one is significant at the 5% level (with the predicted signs). Thus, this binomial test also indicates that the monitoring hypothesis helps explain board size.

The results for tests of board independence are in Panel B of Table 10. The results strongly support the scope of operations and negotiation hypotheses. For example, all of the coefficients to test the negotiation hypothesis are significant at the 1% level. Under the null hypothesis that none of the negotiation hypothesis proxies are related to board independence, the likelihood of observing 102 or more significant coefficients is $(0.01^{102}) = 10^{-204}$. In contrast, only 22 of the 102 proxies for the monitoring hypothesis variables are significantly related to board independence. These results are qualitatively the same as those summarized in Tables 6-9.

5.4.2. Principal components tests

In the second alternate test, we use principal components to transform the group of proxy variables for each hypothesis into a smaller number of factors that contain the same information as the original proxy variables. The first principal component for the scope of operations hypothesis, for example, is the linear combination of the three variables used to test this hypothesis (firm size, firm age, and the number of business segments) that accounts for the highest proportion of their variance. The second principal component is the orthogonal linear combination of the three proxy variables that explains the highest proportion of the remaining variation.

Following the practice originally proposed by Kaiser (1960), we use all principal components whose Eigenvalues exceed one (i.e., that have more explanatory power than any one of the original proxies by itself). This gives us a single factor for the scope of operations hypothesis, three different factors for the negotiations hypothesis, and four factors for the monitoring hypothesis.

The results from the principal components tests are summarized in Table 11. Panel A shows the eigenvectors for each variable included in each factor with eigenvalues over one. Panel B-1 contains the regression results for board size, using the relevant factors for each hypothesis as exogenous variables, as well as the control variables used in Tables 6-9. Panel B-1 contains similar regression results for board independence.

As shown in Panel A, the scope of operations hypothesis has one factor, which is a linear combination of firm size, firm age, and number of business segments. There are three factors for the negotiation hypothesis – one factor measuring insiders’ influence, which is a combination of CEO tenure and ownership, and two factors measuring outsiders’ influence, a combination of outside director ownership, venture capital backing and underwriter rank. The monitoring hypothesis is captured by four factors – two measuring private benefits, which are combinations

of free cash flow, industry concentration and the *G*-index, and two factors measuring monitoring costs, which are combinations of market-to-book, R&D expenditures, return variance, and CEO ownership (note: CEO ownership is not included in tests that also contain the negotiation hypothesis).

As shown in Panel B-1, the scope of operations principal component is positively related to board size (the coefficient equals 0.34 with a t-statistic of 9.58). Board size also is significantly positively related to the first private benefits principal component and significantly negatively related to second cost of monitoring principal component (the other two monitoring hypothesis factors are the wrong sign but insignificant). These results are consistent with those reported previously: Board size is positively related to the scope and complexity of the firm's operations. It also is positively related to managers' opportunities to extract private benefits and negatively related to the cost of monitoring managers.

In Panel B-2, the fraction of independent board members is negatively related to the insiders' influence factor and positively related to the scope of operations principal component and also to the two outsiders' influence factors of the negotiation hypothesis. These outsiders' influence factors reflect primarily the constraints on managers' influence, as represented by the fraction of outside directors' shareholdings, the presence of a venture capital investor at the IPO, and the Carter-Manaster ranking of the firm's lead underwriter at its IPO. These results are also similar to those reported previously: Board independence is positively related to the scope and complexity of the firm's operations, and also to the constraints on managers' influence, as implied by the negotiation hypothesis.

5.5. The inefficient board hypothesis

The data clearly reject the view that board structure is unrelated to the firm's characteristics, since the majority of variables used to test the scope of operations, negotiation, and monitoring hypotheses are related to board size and independence in the predicted ways. This indicates that boards are not structured randomly, but rather, in response to the firm's unique operating and monitoring characteristics. The results in Tables 8 and 9 also fail to support the view that boards are structured to facilitate managers' consumption of value-decreasing perquisites. One of the coefficients – for free cash flow in Model 8 of Table 8 – has the sign predicted by the inefficient board hypothesis. But as noted above, this result is not robust to model specification. Furthermore, the other measures of managers' opportunities to consume private benefits are, if anything, positively related to board size and board independence. We cannot rule out the possibility that some boards are structured haphazardly or perversely, especially since much of the cross-sectional variation in board size and independence remains unexplained in our empirical tests. Overall, however, the data fail to support the inefficient board hypothesis as a general characterization of board structure.

6. Sensitivity tests

We conducted three types of tests to probe the robustness of the results reported in Tables 6-10. The first sensitivity tests explore the importance of our controls for the lack of independence in the error terms. Our data consist of a cross-section, time series panel. In the main tests we control for lack of independence among observations from the same firm by estimating robust regressions with clusters based on firms. An alternative test procedure is to use a random effects GLS model. This procedure, however, yields results that are qualitatively identical to those reported in Tables 6-10. We also estimated year-by-year cross-sectional regressions and calculated Fama-Macbeth (1973) regression coefficients. Having only a short

time series that consists of four years (years 1, 4, 7, and 10 relative to the IPO year), the Fama-Macbeth coefficients sometimes have higher significance levels than those reported in Tables 6-10, but the point estimates are similar.

Second, we examined whether the results are sensitive to our industry definitions or our controls for endogeneity. Using Compustat industry definitions rather than Fama-French industries does not affect the results. Eliminating industry controls altogether increases the statistical significance of some coefficients, but does not change our overall inferences. Likewise, eliminating the instrumental variables (e.g., lagged board independence in the board size regressions) increases the significance of some coefficients. If anything, our controls for endogeneity tend to control away some of the very relationships we seek to test. The fact that most of these relationships are statistically significant even when the controls are included, as reported in the Tables, indicates that these are not artifacts of our model specifications.

Another method to control for the endogeneity of board size and independence is to specify a structural model that explicitly endogenizes board size and independence, and to estimate the structural model using simultaneous equation methods. The results of such an estimation are provided in Table 12.

In Panel A of Table 12, we model board size. In the first-stage, we create an instrument for board independence which is used in the second stage, where board size is the endogenous variable. To create the instrument for board independence, we need at least one variable related to board independence but not board size. We use the negotiation hypothesis variables: CEO tenure, outside director ownership, venture backing and the Carter-Manaster underwriter rank as our identifying variables. As argued previously, we expect each of these variables to affect board independence but not necessarily board size.

In Panel B of Table 12, we model board independence. In the first stage, we create an instrument for board size which is used in the second stage, where board independence is the endogenous variable. To create the instrument for board size, we need at least one variable related to board size but not board independence. We use a dummy variable which equals one if the firm has acquired another company. We reason that new board members may join the board from the acquired firm, which would affect board size. However, it is not clear whether these new board members would be insiders or outsiders of the acquiring firm.

The results of the simultaneous regression models tests support the results reported in Tables 6-10. Regardless of the identifying assumptions, board size and independence are strongly related to measures of the firm's scope of operations. Board size is also positively related to measures of the manager's opportunities for private benefits (as measured by free cash flow and the takeover *G*-index) and negatively related to measures of the cost of monitoring (specifically, R&D expenditures and CEO ownership). As shown for the negotiation hypothesis variables, board independence is negatively related to measures of the CEO's influence and positively related to measures of the constraints on such influence.

In a third set of sensitivity tests, we include instrumental variables for some of the regressors that may be endogenous to board size and independence. As discussed in section 4, the endogeneity of some of the proxy variables does not raise inference problems in our context, since we test for correlations rather than causation. Nevertheless, to probe whether endogenous relationships drive any of our inferences, we included instrumental variables for CEO ownership, CEO tenure, the firm's takeover defense *G*-index, and outside director ownership. For CEO tenure, for example, we used the CEO's age as an instrumental variable.

In a fourth set of sensitivity tests, we include additional control variables that are used by previous researchers to examine the empirical determinants of board size and independence,

including debt-to-total assets, sales growth, the CEO's age, whether or not the CEO is the chairman, and whether or not the CEO is the company founder. The large majority of results are unaffected by these additional control variables. One exception is that firm age and the number of business segments become statistically insignificant in Model 4 of Table 6A (for board size), and the significance of firm size is reduced (but still significant at the 10% level) in Model 4 of Table 6B (for board independence). CEO tenure is no longer significant when we add additional CEO control variables in Model 7 of Table 7, but this is due to a high correlation between CEO tenure and CEO age.

One sensitivity test yields noteworthy results. In some model specifications, the fraction of shares held by 5% blockholders who also have a representative on the board is positively related to both board size and board independence. This indicates that when blockholders obtain board representation, they do so by increasing board size rather than displacing other board members.

Overall, the results reported in Tables 6-10 are not highly sensitive to our empirical methods. The data indicate that board size and independence increase with the scope of the firm's operations, especially as measured by firm size. Consistent with the negotiation hypothesis, board independence also decreases with the CEO's influence and increases with constraints on such influence. And consistent with the monitoring hypothesis, board size generally increases with the benefits to monitoring managers and decreases with the cost of such monitoring.

7. The magnitude of impacts on board size and independence

The data indicate that board size and independence depend on proxies for the firm's scope of operations, the CEO influence and constraints on such influence, the opportunities for private benefits, and the cost of monitoring managers. But just how large are these effects?

To investigate this question, we use the coefficients estimated in Tables 6-9 to fit values for board size and independence when all regressors are set at their mean values. For each regressor that is significantly related to board size or independence, we then perturb that regressor by one standard deviation – leaving all other regressors at their mean values – to calculate the predicted change for the dependent variable.

The results are summarized in Table 13. Using fitted values from Model 1 in Table 6A, a one standard deviation increase in firm size predicts an increase in board size by 0.89 people. Using coefficients from Model 2 in Table 6A, a one standard deviation increase in the years since the firm's IPO increases board size by 0.21 people, and (using coefficients from Model 3) a one standard deviation increase in the number of business segments increases board size by 0.22 people. Thus, among the three measures used to investigate the scope of operations hypothesis, perturbations in firm size have the largest impact on board size.

Among the measures used to investigate the monitoring hypothesis, perturbations in the takeover *G*-index, R&D intensity, and the return variance have the largest impact on the predicted number of board members. A one standard deviation in the takeover *G*-index predicts an increase in board size by 0.25 people, while a one standard deviation increase in either R&D intensity or return variance predict a decrease in board size by 0.25 people. A one standard deviation increase in industry concentration predicts an increase of 0.23 people on the board.

The second column in Table 13 reports on the perturbation tests when board independence is the dependent variable. A one standard deviation increase in firm size or the number of years since the IPO predicts an increase in the fraction of independent board members

of 12.3 percentage points. A one standard deviation increase in the number of business segments predicts an increase of 11.8 percentage points. For the negotiation hypothesis, the predicted changes are more modest. A one standard deviation increase in the fraction of CEO ownership decreases the fraction of independent directors by 1.9 percentage points, while a one standard deviation increase in CEO ownership decreases the fraction of independent directors by 3.8 percentage points. A one standard deviation increase in outside director ownership, venture capital backing, and the Carter-Manaster ranking predict a 3.3, 5.4 and 2.9 percentage point increase in the fraction of independent directors, respectively. As mentioned earlier, the variables for the monitoring hypothesis have minimal impact on board independence. Only two of the six variables tested are significant when entered separately (not shown in Table 9) – industry concentration and the R&D measure. A one standard deviation increase in industry concentration predicts only a 1.5 percentage point increase in the fraction of independent directors, while a one standard deviation increase in the R&D measure predicts a 1.9 percentage point increase in the fraction of independent directors.

Overall, these results suggest that firm size, the presence of a takeover defense, R&D intensity, and stock return variance have the biggest impact on board size, while firm size, age, and the number of business segments (the scope of operations hypothesis variables) have the biggest impact on board independence.

8. Conclusion

We examine the development of corporate boards during the first 10 years after a firm's IPO. We find that firms average three fewer directors at their IPOs than large, seasoned firms (6.2 versus 9.4). These new firms add an average of 0.13 board members per year during the 10 years after the IPO. This moves their boards closer in size to those for large seasoned firms, but

after 10 years the average board remains relatively small (7.3 versus 9.4). Boards of these IPO firms have a majority (56.5%) of independent outsiders, and continue to add independent outsiders such that, 10 years later, 65.3% are independent outsiders. The increase in the fraction of independent outsiders occurs even as one important type of outsider – venture capital investors – tends to leave the board.

We use these data to test for the forces that shape corporate boards. The data indicate that: (i) larger, more seasoned, and more diverse firms tend to have larger and more independent boards; (ii) firms in which managers have substantial influence, perhaps because they generate quasi-rents for the firm, and in which the constraints to managerial influence are weak, have less independent boards; and (iii) firms in which managers' opportunities to consume private benefits, or in which the cost of monitoring managers is small, have larger boards. These results indicate that board size and independence are shaped by a broad combination of firm-specific and managerial characteristics.

Corporate board reform is at the center of many attempts to improve corporate governance. Policy arguments, such as those that influenced the Sarbanes-Oxley Act of 2002, presume that outside directives regarding board size or composition can improve board performance. We cannot rule out the possibility that many boards might indeed be inefficient. Overall, however, the data reject the view that boards systematically are randomly or perversely structured. Rather, corporate boards appear to be adapted to the particular nature of the firm's competitive environment and managerial team. Such environment-specific adaptation undermines the view that board performance generally can be improved by imposing uniform rules on board size or composition.

References

- Alchian, A., 1950, "Uncertainty, Evolution and Economic Theory," *Journal of Political Economy* 58, 211-221.
- Agrawal, A. and C. Knoeber, 1996, "Firm Performance and Mechanisms to Control Agency Problems between Managers and Shareholders," *Journal of Financial and Quantitative Analysis* 31, 377-397.
- Agrawal, A. and C. Knoeber, 2001, "Do Some Outside Directors Play a Political Role?" *Journal of Law and Economics* 44, 179-198.
- Anderson, R., T. Bates, J. Bizjak, M. Lemmon, 2000, "Corporate Governance and Firm Diversification," *Financial Management* 21, 5-22.
- Baker, M. and P. Gompers, 2003, "The Determinants of Board Structure at the Initial Public Offering," *Journal of Law and Economics* 46, 569-598.
- Bhagat, S. and B. Black, 1999, "The Uncertain Relationship Between Board Composition and Firm Performance," *Business Lawyer* 54, 921-963.
- Bhagat, S. and R. Jefferis, Jr., 2002, The Econometrics of Corporate Governance Studies, Cambridge, MA: The MIT Press.
- Bizjak, J., J. Brickley, and J. Coles, 1993, "Stock-based Incentive Compensation and Investment Behavior," *Journal of Accounting and Economics* 16, 349-372.
- Brickley, J. A., and J. S. Link and J. Coles, "What Happens to CEO's After They Retire? New Evidence on Career Concerns, Horizon Problems, and Incentives," *Journal of Accounting and Economics* 52, 341-377.
- Carter, R. and S. Manaster, 1990, "Initial Public Offerings and Underwriter Reputation," *Journal of Finance* 45, 1045-1068.
- Chaochharia, V. and Y. Grinstein, 2004, "The Transformation of US Corporate Boards: 1997-2003," Cornell University Working Paper.
- Coles, J., N. Daniel, and L. Naveen, 2005, "Boards: Does One Size Fit All?" Arizona State University Working Paper.
- Crutchley, C., J. Garner, and B. Marshall, 2004, "Does One-Size Fit All? A Comparison of Boards Between Newly Public and Mature Firms," Drexel University Working Paper.
- Demsetz, H. and K. Lehn, 1985, "The Structure of Corporate Ownership: Causes and Consequences," *Journal of Political Economy* 93, 1155-1177.

- Denis, D. and J. McConnell, 2003, "International Corporate Governance," *Journal of Financial and Quantitative Analysis* 38, 1-36.
- Denis, D. and A. Sarin, 1999, "Ownership and Board Structure in Publicly Traded Corporations," *Journal of Financial Economics* 52, 187-223.
- Fama, E. and K. French, 1997, "The Industry Costs of Equity," *Journal of Financial Economics* 43, 153-193.
- Fama, E. and M. Jensen, 1983, "Separation of Ownership and Control," *Journal of Law and Economics* 26, 301-325.
- Fama, E. and J. MacBeth, 1973, "Risk, Return, and Equilibrium: Empirical Tests," *Journal of Political Economy* 81, 607-636.
- Field, L. and J. Karpoff, 2002, "Takeover Defenses of IPO Firms," *Journal of Finance* 57, 1857-1889.
- Frye, M., 2003, "The Evolution of Corporate Governance: Evidence from Initial Public Offerings," Central Florida University Working Paper.
- Gaver, J. and K. Gaver, 1993, "Additional Evidence on the Association Between the Investment Opportunity Set and Corporate Financing, Dividend, and Compensation Policies," *Journal of Accounting and Economics* 16, 125-160.
- Gertner, R. and S. Kaplan, 1996, "The Value-Maximizing Board," University of Chicago and NBER Working Paper.
- Gillan, S., J. Hartzell, and L. Starks, 2004, "Explaining Corporate Governance: Boards, Bylaws, and Charter Provisions," University of Texas Working Paper.
- Gompers, P., J. Ishii, and A. Metrick, 2003, "Corporate Governance and Equity Prices," *Quarterly Journal of Economics* 118, 107-155.
- Hermalin, B. and M. Weisbach, 1998, "Endogenously Chosen Boards of Directors and their Monitoring of the CEO," *American Economic Review* 88, 96-118.
- Hermalin, B. and M. Weisbach, 2003, "Board of Directors as an Endogenously-Determined Institution: A Survey of the Economic Literature," *Economic Policy Review* 9, 7-26.
- Huber, P., 1964, "Robust Estimation of a Location Parameter," *Annals of Mathematical Statistics* 35, 73-101.
- Institutional Shareholders Services, Inc. 2003, ISS Comments on NYSE Governance – 09/04/03 – Seven recommendations include disclosure of issuer compliance. Available at www.issproxy.com.

- Jensen, M., 1986, "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers," *American Economic Review* 76, 323 –329.
- Kaiser, H. F. , 1960, "The application of electronic computers to factor analysis," *Educational and Psychological Measurement*, 20, 141-151
- Kahle, K. and R. Walkling, 1996, "The Impact of Industry Classification on Financial Research," *Journal of Financial and Quantitative Analysis* 31, 309-335.
- Kieschnick, R. and R. Moussawi, 2004, "The Board of Directors: A Bargaining Perspective?" University of Texas at Dallas Working Paper.
- Klein, A, 1998, "Affiliated Directors: Puppets of Management or Effective Directors?" New York University, Center for Law and Business, Working Paper No. 98-010.
<http://ssrn.com/abstract=10569>
- Kole, S., 1997, "The complexity of compensation contracts," *Journal of Financial Economics* 43, 79-104.
- Lehn, K., S. Patro, and M. Zhao, 2004, "Determinants of the Size and Structure of Corporate Boards: 1935-2000," University of Pittsburgh Working Paper.
- J. Linck, J. J. Netter, and T. Yang, 2005, "A Large Sample Study on Board Changes and Determinants of Board Structure," University of Georgia Working Paper.
- Lubotsky, Darren and Martin Wittenberg, 2005. "Interpretation of Regressions with Multiple Proxies," University of Illinois working paper.
- National Association of Corporate Directors, 2001, Report of the NACD Blue Ribbon Commission on Director Professionalism.
- Raheja, C., 2004, "Determinant of Board Size and Composition: A Theory of Corporate Boards," *Journal of Financial and Quantitative Analysis*, forthcoming.
- The Business Roundtable, 1997, Statement on Corporate Governance, Available for download at <http://www.brtable.org/document.cfm/11>.
- Smith, C. and R. Watts, 1992, "The Investment Opportunity Set and Corporate Financing, Dividend, and Compensation Policies," *Journal of Financial Economics* 32, 263-292.
- Volcker, P. and A. Levitt Jr., 2004, "In Defense of Sarbanes-Oxley," The Wall Street Journal, June 14, A14.
- Yermack, D. 1995, "Do Corporations Award CEO Stock Options Effectively?" *Journal of Financial Economics* 39, 237-269.

Yermack, D. 1996, "Higher Valuation of Companies with a Small Board of Directors," *Journal of Financial Economics* 40, 185-212.

White, H. 1980, "A Heteroskedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroskedasticity," *Econometrica* 48, 817-830.

Table 1. Predictions of the Hypotheses

This table summarizes the empirical predictions of the three hypotheses tested in this paper with regard to the size of the board (“Number of Directors”) and independence of the board (“Fraction of Independent Directors). The “Scope of Operations Hypothesis” argues that boards grow in response to the increasing net benefits of monitoring and specialization of board members that accompany a firm’s growth. The “Negotiation Hypothesis” argues that corporate boards reflect the outcome of a negotiation between the CEO and outside board members. The “Monitoring Hypothesis” argues that board size reflects a trade-off between the firm-specific benefits of increased monitoring and the costs of such monitoring. The inefficiency hypothesis argues that board size and composition is structured haphazardly or to facilitate manager’s extraction of private benefits at shareholders’ expense.

	Number of Directors	Fraction of Independent Directors
For the Scope of Operations Hypothesis:		
Firm Size	+	+
Firm Age	+	+
Number of Business Segments	+	+
For the Negotiation Hypothesis		
<i>Measures of insiders' influence:</i>		
CEO Tenure		–
CEO Ownership		–
<i>Measures of constraints on insiders' influence:</i>		
Outside Director Ownership		+
Venture Capital Presence		+
Carter-Manaster Underwriter Rank		+
For the Monitoring Hypothesis		
<i>Measures of private benefits:</i>		
Free Cash Flow	+	+
Industry Concentration	+	+
Takeover Defense (<i>G-Index</i>)	+	+
<i>Measures of monitoring costs:</i>		
Market-to-Book Ratio	–	–
R&D Expenditures	–	–
Return Variance	–	–
CEO Ownership	–	–
For the Inefficient Board Hypothesis		
<i>Measures of private benefits:</i>		
Free Cash Flow	–	–
Industry Concentration	–	–
Presence of Takeover Defense	–	–

Table 2: Sample Size and Changes Over Time

This table shows the sample distribution of 1,019 firms undergoing an IPO between 1988 and 1992. The data are partitioned by the year the firm goes public, and the tables below give the number of firms with data available in years 1, 4, 7, and 10 relative to the year of the IPO.

Panel A. Sample Distribution by IPO Year

IPO Year	Year From IPO				
	IPO	Year 1	Year 4	Year 7	Year 10
1988	111	107	81	67	51
1989	116	114	94	73	52
1990	113	112	96	75	49
1991	286	285	243	178	128
1992	393	389	309	220	142
Total	1019	1007	823	613	422

Panel B. Reasons Given by CRSP for Delistings (by year of delisting)

Reason for Delisting	Year From IPO				Total Delistings
	Year 1	Year 4	Year 7	Year 10	
Merger	3	119	137	121	380 (37%)
Exchange	0	0	1	0	1 (0%)
Delisted by Exchange	3	71	71	69	214 (21%)
Liquidation	0	0	0	2	2 (0%)
Delistings by Year	6	190	209	192	597 (59%)
<i>No Proxy Available</i>	6	0	1	0	

Table 3. Descriptive Statistics for Firms at Time of IPO

This table provides descriptive statistics for 1,019 firms undergoing an IPO from 1988-1992. Firm market value is the price at the end of the year in which the firm went public multiplied by shares outstanding and is given millions. Firm Debt to Assets is the debt of the firm divided by company assets. Firm R&D/Assets is research and development costs divided by firm assets. CEO Ownership is the percent of shares outstanding owned by the CEO. Officer and Director Ownership shows the percent of total shares held by all of the officers and directors. Number of directors is the size of the board at the IPO. Percent Insiders is the percent of the board who are employees of the firm. Percent Outsiders is the fraction of board members who are non-employees of the firm. Affiliated Directors represents the percent of the board that are non-employees but have some relationship with the firm such as being a former employee, related to an employee, or having a business tie with the firm.

Panel A. Firm Characteristics

	Mean	Minimum	25th Percentile	Median	75th Percentile	Maximum
Firm Market Value (\$ millions)	150.2	2.8	29.8	76.4	170.8	1922.7
Firm Debt/Assets	35%	0%	6%	24%	53%	1220%
Firm R&D/Assets	11%	0%	0%	0%	11%	338%

Panel B. Ownership and Board Structure

	Mean	Minimum	25th Percentile	Median	75th Percentile	Maximum
CEO Ownership	16%	0%	2%	8%	21%	97%
Officer & Director Ownership	52%	0%	38%	53%	66%	100%
Number of Directors	6.2	1.0	5.0	6.0	7.0	17.0
Percent Insiders	38%	0%	22%	33%	50%	100%
Percent Outsiders	62%	0%	50%	67%	78%	100%
Percent Affiliated	5%	0%	0%	0%	0%	88%
Percent Unaffiliated	56%	0%	40%	60%	75%	100%

Table 4. Evolution of Ownership, CEO Characteristics, and Board Structure Over Time

This table shows the evolution of ownership, CEO characteristics, and board structure following the IPO. Panel A shows the evolution of ownership for IPO firms. Panel B provides means for characteristics of CEOs for a sample of 1,019 IPO firms occurring from 1988-1992 from the year they go public through ten years later. Panel C provides information on the board structure of the firms at the IPO and afterwards. Ownership by Officers and Directors represents the percent of total shares held by officers and directors. CEO ownership represents the percent of total shares held by the CEO. CEO tenure is the number of years the executive has been in the position of CEO. CEO is Founder is a dummy variable equal to one if the CEO is a founder of the firm. CEO is Chairman is a dummy variable equal to one if the CEO is also the current chairman of the board of directors. CEO turnover is a dummy variable equal to one if the CEO has changed since the previous data collection period. Percent Outside Directors shows the fraction of board members who are not employees of the firm. Percent Affiliated shows the fraction of the board who are grey directors, while Percent Unaffiliated shows the fraction of the board who have no other affiliations with the firm. Percent Original Directors Remaining is the percent of the directors on the board at the IPO who are still on the board after one year, four years, seven years and ten years after the IPO.

Panel A. Evolution of Ownership for IPO Firms

	Year from IPO				
	IPO	Year 1	Year 4	Year 7	Year 10
Ownership by Officers & Directors	52%	45%	34%	28%	25%
Ownership by CEO	16%	14%	10%	8%	7%
Ownership by Officers	26%	23%	18%	15%	14%
Ownership by Outside Directors	26%	22%	16%	12%	11%
Ownership by 5% Blockholders	31%	30%	28%	29%	29%
Number of 5% Blockholders	2.9	3.0	2.9	3.0	3.2

Panel B. Characteristics of CEOs of IPO Firms Over Time

	Year from IPO				
	IPO	Year 1	Year 4	Year 7	Year 10
CEO Age	48	49	51	53	54
CEO Tenure	8	9	10	10	12
CEO is Founder	43%	42%	33%	25%	21%
CEO is Chairman of the Board	60%	63%	64%	62%	60%
CEO Turnover	.	6%	30%	25%	30%

Panel C. Board Structure for IPO Firms Over Time

	Year from IPO				
	IPO	Year 1	Year 4	Year 7	Year 10
Number of Directors	6.21	6.74	6.98	7.17	7.52
Percent Original Directors Remaining		90%	67%	51%	42%
Percent Outside Directors	62%	65%	69%	71%	74%
Percent Affiliated	5%	5%	7%	7%	5%
Percent Unaffiliated	56%	60%	62%	64%	69%

Table 5. Correlation Matrix

This table provides pairwise correlations. *Firm size* is the natural log of the book value of the firm's assets. *Firm age* is the number of years since the IPO. *Nseg* is the number of business segments. *CEO_ten* is the number of years the CEO has been with the firm. *CEOp* is the ownership percentage of the CEO, as a fraction of shares outstanding. *Outown* is the ownership percentage of the independent directors, as a fraction of shares outstanding. *VCdum* is a dummy variable equal to one for venture-backed IPOs. *Carter* is the Carter-Manaster ranking of the lead IPO underwriter. *Cashflow* is free cash flow, defined as (Earnings + Depreciation – Capital Expenditures)/Total Assets. *Ind_Herf* is the Herfindahl index of industry sales using data on Compustat-listed firms. *Gindex* is measured as the firm's number of takeover defenses plus the number of state antitakeover laws that apply to the firm. *Mkt_Bk* is the log of the book value of debt plus the market value of equity divided by total assets. *HighRD* is a dummy variable equal to one for firms in the top quartile of R&D expenditures relative to firm size. *Retvar* is the variance of the firm's daily stock returns measured over the prior 12-month period. P-values are given in parentheses.

	Firm size	Firm age	Nseg	CEO_ten	CEOp	Outown	VCdum	Carter	Cashflow	Ind_Herf	Gindex	Mkt_Bk	HighRD
Firm age	0.32 (0.00)												
Nseg	0.26 (0.00)	0.49 (0.00)											
CEO_ten	0.22 (0.00)	0.14 (0.00)	0.13 (0.00)										
CEOp	-0.16 (0.00)	-0.15 (0.00)	-0.08 (0.00)	0.26 (0.00)									
Outown	0.03 (0.07)	-0.19 (0.00)	-0.08 (0.00)	-0.12 (0.00)	-0.25 (0.00)								
VCdum	-0.11 (0.00)	0.01 (0.60)	-0.07 (0.00)	-0.22 (0.00)	-0.23 (0.00)	-0.11 (0.00)							
Carter	0.43 (0.00)	0.03 (0.12)	0.04 (0.03)	0.05 (0.02)	-0.13 (0.00)	0.05 (0.01)	0.21 (0.00)						
Cashflow	0.33 (0.00)	0.00 (0.80)	0.03 (0.17)	0.18 (0.00)	0.07 (0.00)	0.00 (0.89)	-0.12 (0.00)	0.10 (0.00)					
Ind_Herf	-0.06 (0.00)	0.05 (0.01)	0.08 (0.00)	-0.01 (0.78)	-0.02 (0.35)	-0.01 (0.76)	0.01 (0.54)	-0.03 (0.09)	-0.01 (0.68)				
Gindex	0.19 (0.00)	0.03 (0.08)	0.04 (0.05)	0.14 (0.00)	-0.02 (0.33)	-0.06 (0.00)	-0.06 (0.00)	0.14 (0.00)	0.10 (0.00)	-0.05 (0.01)			
Mkt_Bk	-0.19 (0.00)	-0.12 (0.00)	-0.11 (0.00)	-0.11 (0.00)	-0.07 (0.00)	-0.07 (0.00)	0.22 (0.00)	0.03 (0.13)	-0.19 (0.00)	0.01 (0.44)	-0.06 (0.00)		
HighRD	-0.26 (0.00)	0.00 (0.83)	-0.08 (0.00)	-0.19 (0.00)	-0.18 (0.00)	-0.11 (0.00)	0.46 (0.00)	0.04 (0.03)	-0.32 (0.00)	0.01 (0.79)	-0.10 (0.00)	0.36 (0.00)	
Retvar	-0.31 (0.00)	0.11 (0.00)	0.03 (0.11)	-0.13 (0.00)	0.01 (0.74)	0.03 (0.10)	0.05 (0.01)	-0.16 (0.00)	-0.22 (0.00)	0.01 (0.45)	-0.10 (0.00)	-0.08 (0.00)	0.12 (0.00)

Table 6. Tests of the Scope of Operations Hypothesis

Estimated coefficients from multiple regressions using pooled data from 1,019 firms for years 1, 4, 7, and 10 after the firms' IPOs. The dependent variable in Panel A is the number of board members. The dependent variable in Panel B is the fraction of the board that consists of independent (non-affiliated) board members. Firm Size is the log of total assets measured at fiscal year-end. Lag(Fraction of Independent Directors) is the percent of independent directors on the board in the previous period. Lag(Number Directors) is the number of directors on the board in the previous period. Dummy for Previous Merger is equal to one for firms which completed an acquisition during the previous period. Lag (ROA) is the return on assets, measured as operating income over total assets in the previous period. All regressions include industry fixed effects, controlling for industry using Fama-French (1997) industry classifications. Standard errors are computed using robust methods (alternately called the Huber or White estimator) in which observations are clustered by firm. P-values are given in parentheses.

Panel A. Number of Board Members as the Dependent Variable

	Model 1	Model 2	Model 3	Model 4
Variables Used to Test the Scope of Operations Hypothesis:				
Firm Size	0.537 (0.000)			0.546 (0.000)
Years Since IPO		0.065 (0.000)		-0.034 (0.010)
Number of Business Segments			0.095 (0.000)	0.038 (0.041)
Control Variables:				
Lag (Fraction Independent Directors)	0.824 (0.001)	1.311 (0.000)	1.332 (0.000)	0.819 (0.002)
Dummy for Previous Merger	0.978 (0.000)	1.092 (0.000)	1.139 (0.000)	0.991 (0.000)
Lag (ROA)	-0.463 (0.000)	0.064 (0.668)	0.054 (0.716)	-0.474 (0.000)
Dummy for Previous Reverse LBO	-0.101 (0.488)	0.426 (0.006)	0.383 (0.016)	-0.147 (0.324)
Dummy of Equity Carve-Out	0.326 (0.123)	0.301 (0.192)	0.274 (0.241)	0.328 (0.130)
Dummy for Dual Class	0.405 (0.133)	0.690 (0.024)	0.716 (0.022)	0.408 (0.133)
Constant	5.131 (0.000)	6.709 (0.000)	6.583 (0.000)	5.096 (0.000)
Adjusted R ²	0.28	0.16	0.16	0.28
Wald Test for the Joint Significance of the Scope of Operations Hypothesis:				
F-statistic (p-value)				77.78 (0.000)

Table 6, Panel B. Tests of the Scope of Operations Hypothesis (continued)

Estimated coefficients from multiple regressions using pooled data from 1,019 firms for years 1, 4, 7, and 10 after the firms' IPOs. The dependent variable in Panel A is the number of board members. The dependent variable in Panel B is the fraction of the board that consists of independent (non-affiliated) board members. Firm Size is the log of total assets measured at fiscal year-end. Lag(Fraction of Independent Directors) is the percent of independent directors on the board in the previous period. Lag(Number of Directors) is the number of directors on the board in the previous period. Dummy for Previous Merger is equal to one for firms which completed an acquisition during the previous period. Lag (ROA) is the return on assets, measured as operating income over total assets in the previous period. All regressions include industry fixed effects, controlling for industry using Fama-French (1997) industry classifications. Standard errors are computed using robust methods (alternately called the Huber or White estimator) in which observations are clustered by firm. P-values are given in parentheses.

Panel B. Fraction of Independent Directors on the Board as the Dependent Variable

	Model 1	Model 2	Model 3	Model 4
Variables Used to Test the Scope of Operations Hypothesis:				
Firm Size	0.017 (0.000)			0.012 (0.001)
Years Since IPO		0.007 (0.000)		0.005 (0.000)
Number of Business Segments			0.006 (0.000)	0.001 (0.579)
Control Variables:				
Lag (Number of Directors)	0.010 (0.000)	0.012 (0.000)	0.013 (0.000)	0.009 (0.002)
Dummy for Previous Merger	0.021 (0.221)	0.022 (0.205)	0.025 (0.143)	0.015 (0.371)
Lag (ROA)	-0.052 (0.000)	-0.036 (0.003)	-0.033 (0.006)	-0.048 (0.000)
Dummy for Previous Reverse LBO	0.066 (0.000)	0.082 (0.000)	0.081 (0.000)	0.071 (0.000)
Dummy of Equity Carve-Out	0.038 (0.028)	0.039 (0.022)	0.034 (0.050)	0.037 (0.034)
Dummy for Dual Class	-0.041 (0.056)	-0.037 (0.077)	-0.032 (0.126)	-0.039 (0.069)
Constant	0.462 (0.000)	0.478 (0.000)	0.484 (0.000)	0.456 (0.000)
Adjusted R ²	0.20	0.20	0.19	0.20
Wald Test for the Joint Significance of the Scope of Operations Hypothesis:				
F-statistic (p-value)				20.61 (0.000)

Table 7. Tests of the Negotiation Hypothesis: Predictions for Board Independence

Estimated coefficients from multiple regressions using pooled data from 1,019 firms for years 1, 4, 7, and 10 after the firms' IPOs. The dependent variable is the fraction of the board that consists of independent (non-affiliated) board members. CEO tenure is the number of years that the CEO has been with the firm. CEO Ownership is the fraction of the firms' outstanding shares owned by the CEO. Outside Director Ownership is the fraction of the firms' outstanding shares owned by the independent directors. Dummy for Venture Backing is a dummy variable equal to one if a venture capital investor owned an equity stake at the IPO. Carter-Manaster Ranking is the ranking of the lead IPO underwriter. Firm Size is the log of total assets measured at fiscal year-end. Lag(Number of Directors) is the number of directors on the board in the previous period. Dummy for Previous Merger is equal to one for firms which completed an acquisition during the previous period. Lag (ROA) is the return on assets, measured as operating income over total assets in the previous period. All regressions include industry fixed effects, controlling for industry using Fama-French (1997) industry classifications. Standard errors are computed using robust methods (alternately called the Huber or White estimator) in which observations are clustered by firm. P-values are given in parentheses.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Variables Used to Test the Negotiation Hypothesis:							
CEO Tenure	-0.002 (0.000)					-0.001 (0.182)	-0.002 (0.010)
CEO Ownership		-0.242 (0.000)				-0.168 (0.000)	-0.123 (0.002)
Outside Director Ownership			0.141 (0.000)			0.101 (0.000)	0.145 (0.000)
Dummy for Venture Backing				0.111 (0.000)		0.085 (0.000)	0.092 (0.000)
Carter-Manaster Ranking					0.019 (0.000)	0.007 (0.022)	0.004 (0.221)
Variables Used to Test the Scope of Operations Hypothesis:							
Firm Size							0.009 (0.042)
Years Since IPO							0.007 (0.000)
Number of Business Segments							0.002 (0.268)
Control Variables:							
Lag (Number of Directors)	0.014 (0.000)	0.011 (0.000)	0.014 (0.000)	0.014 (0.000)	0.011 (0.000)	0.010 (0.001)	0.005 (0.098)
Dummy for Previous Merger	0.039 (0.033)	0.033 (0.063)	0.030 (0.097)	0.028 (0.084)	0.031 (0.081)	0.038 (0.031)	0.020 (0.231)

Table 7 (continued)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Lag (ROA)	-0.031 (0.011)	-0.031 (0.011)	-0.024 (0.050)	-0.027 (0.018)	-0.051 (0.000)	-0.029 (0.019)	-0.030 (0.017)
Dummy for Previous Reverse LBO	0.084 (0.000)	0.068 (0.000)	0.071 (0.000)	0.085 (0.000)	0.063 (0.000)	0.063 (0.000)	0.060 (0.000)
Dummy for Equity Carve-Out	0.039 (0.028)	0.030 (0.079)	(0.531)	0.078 (0.000)	0.046 (0.011)	0.043 (0.016)	0.032 (0.069)
Dummy for Dual Class	-0.031 (0.135)	-0.008 (0.730)	-0.044 (0.037)	-0.014 (0.489)	-0.042 (0.047)	-0.007 (0.751)	-0.014 (0.550)
Constant	0.557 (0.000)	0.616 (0.000)	0.502 (0.000)	0.505 (0.000)	0.503 (0.000)	0.566 (0.000)	0.487 (0.000)
Adjusted R ²	0.18	0.21	0.20	0.25	0.20	0.27	0.30
Wald Test for the Joint Significance of the Negotiation Hypothesis Variables (Model 7): F-statistic (p-value)							33.28 (0.000)
Wald Test for the Joint Significance of the Scope of Operations Hypothesis Variables (Model 7): F-statistic (p-value)							20.73 (0.000)

Table 8. Tests of the Monitoring Hypothesis: Predictions for Board Size

Estimated coefficients from multiple regressions using pooled data from 1,019 firms for years 1, 4, 7, and 10 after the firms' IPOs. The dependent variable is the number of board members. Free Cash Flow is defined as (Earnings + Depreciation – Capital Expenditures) scaled by Total Assets. Industry concentration is measured as the Herfindahl index of industry sales using data on Compustat-listed firms. Takeover Defense (*G-Index*) is measured as the firm's number of takeover defenses plus the number of state antitakeover laws that apply to the firm. Ln (Market-to-Book) is the log of the book value of debt plus the market value of equity, divided by total assets. High R&D is a dummy variable for firms in the top quartile of R&D expenditures relative to firm size. Return Variance is the variance of the firm's daily stock returns measured over the prior 12-month period. Firm Size is the log of total assets measured at fiscal year-end. Dummy for Previous Merger is equal to one for firms which completed an acquisition during the previous period. Lag (ROA) is the return on assets, measured as operating income over total assets in the previous period. All regressions include industry fixed effects, controlling for industry using Fama-French (1997) industry classifications. Standard errors are computed using robust methods (alternately called the Huber or White estimator) in which observations are clustered by firm. P-values are given in parentheses.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Variables Used to Test the Monitoring Hypothesis:									
Free Cash Flow	0.45 (0.01)							0.12 (0.49)	-0.38 (0.03)
Industry Concentration		3.12 (0.01)						2.69 (0.03)	1.68 (0.15)
Takeover Defense (<i>G-Index</i>)			0.10 (0.00)					0.08 (0.00)	0.05 (0.03)
Ln (Market-to-Book)				0.04 (0.61)				0.04 (0.66)	0.08 (0.32)
High R&D					-0.57 (0.00)			-0.59 (0.00)	-0.45 (0.00)
Return Variance						-80.55 (0.00)		-71.35 (0.00)	-21.44 (0.08)
CEO Ownership							-2.05 (0.00)	-2.12 (0.00)	-1.48 (0.00)
Variables Used to Test the Scope of Operations Hypothesis:									
Firm Size									0.51 (0.00)
Years Since IPO									-0.04 (0.01)
Number of Business Segments									0.03 (0.13)

Table 8 (continued)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Control Variables:									
Lag (Fraction Indep. Directors)	1.51 (0.00)	1.47 (0.00)	1.42 (0.00)	1.52 (0.00)	1.62 (0.00)	1.47 (0.00)	1.07 (0.00)	1.11 (0.00)	0.64 (0.02)
Dummy for Previous Merger	1.17 (0.00)	1.19 (0.00)	1.18 (0.00)	1.16 (0.00)	1.14 (0.00)	1.16 (0.00)	1.17 (0.00)	1.17 (0.00)	1.01 (0.00)
Lag(ROA)	-0.06 (0.69)	0.07 (0.64)	0.004 (0.98)	0.09 (0.55)	-0.02 (0.92)	-0.04 (0.80)	0.13 (0.41)	-0.20 (0.19)	-0.44 (0.00)
Dummy for Previous Reverse LBO	0.38 (0.02)	0.41 (0.01)	0.39 (0.01)	0.40 (0.01)	0.29 (0.07)	0.34 (0.03)	0.34 (0.03)	0.16 (0.31)	-0.23 (0.13)
Dummy for Equity Carve-Out	0.31 (0.19)	0.29 (0.22)	0.32 (0.16)	0.31 (0.19)	0.34 (0.14)	0.29 (0.21)	0.23 (0.33)	0.28 (0.22)	0.32 (0.16)
Dummy for Dual Class	0.71 (0.02)	0.72 (0.02)	0.70 (0.02)	0.72 (0.02)	0.70 (0.02)	0.70 (0.02)	0.94 (0.00)	0.88 (0.00)	0.57 (0.04)
Constant	6.98 (0.00)	6.36 (0.00)	6.72 (0.00)	6.93 (0.00)	6.92 (0.00)	7.16 (0.00)	7.67 (0.00)	7.08 (0.00)	5.27 (0.00)
Adjusted R ²	0.15	0.15	0.16	0.15	0.16	0.16	0.18	0.22	0.30
Wald Test for the Joint Significance of the Monitoring Hypothesis Variables (Model 9): F-statistic (p-value)								5.81 (0.00)	
Wald Test for the Joint Significance of the Scope of Operations Hypothesis Variables (Model 9): F-statistic (p-value)								51.77 (0.00)	

Table 9. Tests of the Monitoring Hypothesis: Predictions for Board Independence

Estimated coefficients from multiple regressions using pooled data from 1,019 firms for years 1, 4, 7, and 10 after the firms' IPOs. The dependent variable is the fraction of the board that consists of independent board members. Free Cash Flow is defined as (Earnings + Depreciation – Capital Expenditures) scaled by Total Assets. Industry concentration is measured as the Herfindahl index of industry sales using data on Compustat-listed firms. Takeover Defense (*G-Index*) is measured as the firm's number of takeover defenses plus the number of state antitakeover laws that apply to the firm. Ln (Market-to-Book) is the log of the book value of debt plus the market value of equity, divided by total assets. High R&D is a dummy variable for firms in the top quartile of R&D expenditures relative to firm size. Return Variance is the variance of the firm's daily stock returns measured over the prior 12-month period. Firm Size is the log of total assets measured at fiscal year-end. CEO tenure is the number of years that the CEO has been with the firm. CEO Ownership is the fraction of the firms' outstanding shares owned by the CEO. Outside Director Ownership is the fraction of the firms' outstanding shares owned by the independent directors. Dummy for Venture Backing is a dummy variable equal to one if a venture capital investor owned an equity stake at the IPO. Carter-Manaster Ranking is the ranking of the lead IPO underwriter. Dummy for Previous Merger is equal to one for firms which completed an acquisition during the previous period. Lag (ROA) is the return on assets, measured as operating income over total assets in the previous period. Regression includes industry fixed effects, controlling for industry using Fama-French (1997) industry classifications. Standard errors are computed using robust methods (the Huber or White estimator) in which observations are clustered by firm. P-values are given in parentheses.

	Coefficient (p-value)	
Variables Used to Test the Monitoring Hypothesis:		
Free Cash Flow	-0.002	(0.925)
Industry Concentration	-0.069	(0.520)
Takeover Defense (<i>G-Index</i>)	0.003	(0.161)
Ln (Market-to-Book)	-0.004	(0.610)
High R&D	0.024	(0.107)
Return Variance	-3.423	(0.028)
CEO Ownership	-0.137	(0.000)
Variables Used to Test the Scope of Operations Hypothesis:		
Firm Size	0.008	(0.068)
Years Since IPO	0.007	(0.000)
Number of Business Segments	0.002	(0.107)
Variables Used to Test the Negotiation Hypothesis:*		
CEO Tenure	-0.002	(0.006)
Outside Director Ownership	0.168	(0.000)
Dummy for Venture Backing	0.087	(0.000)
Carter-Manaster Ranking	0.003	(0.407)
Control Variables:		
Lag (Number of Directors)	0.004	(0.157)
Dummy for Previous Merger	0.023	(0.203)
Lag (ROA)	-0.027	(0.026)
Dummy for Reverse LBO, Carve-Out or Dual Class	0.059	(0.000)
Constant	0.540	(0.000)
Adjusted R ²	0.30	
Wald Test for the:		
Joint Significance of the Monitoring Hypothesis Variables	3.49 (0.001)	
Joint Significance of the Scope of Operations Hypothesis Variables	20.88 (0.000)	
Joint Significance of the Negotiation Hypothesis Variables	27.36 (0.000)	

*Note that CEO ownership is included under the monitoring hypothesis here.

**Table 10. A Binomial Test:
Regressions Introducing Proxy Variables Sequentially, by Hypothesis**

For this table, we sequentially choose one unique proxy to represent each hypothesis and run regressions on board size (Panel A) and board independence (Panel B) where the independent variables include sequentially only one proxy variable per hypothesis, as well as the control variables used in Tables 6-9 (to save space, results for control variables not shown). There are, in total, three different proxy variables used for the scope of operations hypothesis, seven for the monitoring hypothesis, and five for the negotiation hypothesis (used only to explain board independence). In each cell shown in the tables below, the fraction of coefficients for each variable that are significant at various levels are given. Thus, for example, in Panel A the firm size regression is significant in all seven regressions in which firm size was included. All variables are defined in Table 9.

Panel A: Number of Board Members as the Dependent Variable

Panel A provides tests on board size, in which 21 unique regressions are run. One example of such a regression includes firm size to represent the scope of operations hypothesis and free cash flow to represent the monitoring hypothesis. Another regression includes firm size and industry concentration. In all, firm size is included in seven regressions, whereby each regression sequentially also includes one of the monitoring proxies. Likewise, each monitoring hypothesis proxy is included three times, whereby each one sequentially also includes one of the scope of operations proxies. The cells below show the number of regressions in which each regressor is significant (at a particular level). The total number of regressions run for each variable is given in the far right column. (Control variables are included in all regressions but not shown.)

Explanatory Variables	Number of Coefficients Significant at Each Level:				# Regressions Including Variable
	1%	5%	10%	Not Significant	
Variables Used to Test the Scope of Operations Hypothesis:					
Firm Size	7	0	0	0	7
Years Since IPO	7	0	0	0	7
No. of Business Segments	7	0	0	0	7
<hr style="border-top: 1px dashed black;"/>					
Variables Used to Test the Monitoring Hypothesis:					
Free Cash Flow	1	1	0	1	3
Industry Concentration	0	0	0	3	3
Takeover Defense (<i>G</i> -Index)	3	0	0	0	3
Ln (Market-to-Book)	0	0	0	3	3
High R&D	3	0	0	0	3
Return Variance	3	0	0	0	3
CEO Ownership	3	0	0	0	3

**Table 10. A Binomial Test:
Regressions Introducing Proxy Variables Sequentially, by Hypothesis (Continued)**

Panel B: Fraction of Independent Directors on the Board as the Dependent Variable

Panel B provides tests on board independence, in which 102 unique regressions are run, each including one proxy variable per hypothesis. When testing for board independence, we include three different hypotheses: we examine three different proxies for the scope of operations hypothesis, five proxies for the negotiation hypothesis, and seven proxies for the monitoring hypothesis (note that CEO ownership is used as a proxy for both the negotiation and monitoring hypotheses, leaving a total of $3 \times 5 \times 7 - 3 = 102$ unique combinations, each representing one regression). One example of such a regression includes firm size to proxy for the scope of operations hypothesis, CEO tenure to proxy for the negotiation hypothesis, and free cash flow to proxy for the negotiation hypothesis. Another example is a regression that includes firm size for the scope of operations hypothesis, CEO ownership for the negotiation hypothesis, and free cash flow for the monitoring hypothesis. Thus, we sequentially include one proxy for each hypothesis until all combinations are exhausted, leaving a total of 102 different regressions. The cells below show the number of regressions in which each regressor is significant (at a particular level). The total number of regressions run for each variable is given in the far right column. (Control variables are included but not shown.)

Explanatory Variables	Number of Coefficients Significant at Each Level:				# Regressions Including Variable
	1%	5%	10%	Not Significant	
Variables Used to Test the Scope of Operations Hypothesis:					
Firm Size	33	1	0	0	34
Years Since IPO	34	0	0	0	34
No. of Business Segments	34	0	0	0	34
<hr/>					
Variables Used to Test the Negotiation Hypothesis:					
CEO Tenure	21	0	0	0	21
CEO Ownership*	18	0	0	0	18
Outside Director Ownership	21	0	0	0	21
Dummy for Venture Backing	21	0	0	0	21
Carter-Manaster Ranking	21	0	0	0	21
<hr/>					
Variables Used to Test the Monitoring Hypothesis:					
Free Cash Flow	0	0	2	13	15
Industry Concentration	0	1	1	13	15
Takeover Defense (<i>G</i> -Index)	0	0	0	15	15
Ln (Market-to-Book)	0	0	1	14	15
High R&D	9	3	0	3	15
Return Variance	1	1	2	11	15
CEO Ownership*	12	0	0	0	12

**CEO ownership regressions run for both the negotiation and monitoring hypotheses. For regressions where CEO ownership was chosen simultaneously for both hypotheses, CEO ownership entered the regression only once and was counted toward the negotiation hypothesis (three occurrences).*

Table 11. Principal Components Analysis

Panel A provides results from principal components analysis (PCA) used to transform the proxy variables for each hypotheses into a smaller number of factors. For each hypothesis, the first factor is the linear combination of variables used to test the hypothesis accounting for the highest proportion of their variance, while the second factor is the orthogonal linear combination of the variables explaining the highest proportion of the remaining variation. We include only factors with Eigenvalues exceeding one. In Panel A, we show the factors determined by PCA, the eigenvectors associated with each variable, and the proportion of variation explained by each factor. In Panels B-1 and B-2, we utilize these factors as explanatory variables in regressions of board size and independence.

Panel A: Factors Derived for Each Hypothesis from Principal Components Analysis

	Hypothesis:				
	Scope of Ops	Negotiation		Monitoring	
	Factor 1	Factor 1	Factor 2	Factor 1	Factor 2
Scope of Operations Hypothesis					
Ln (Total Assets)	0.518				
Years Since IPO	0.627				
No. of Business Segments	0.582				
<i>Proportion Explained</i>	59%				
Negotiation Hypothesis					
<i>Insiders' Influence:</i>					
CEO Tenure		0.707			
CEO Ownership*		0.707			
<i>Proportion Explained</i>		61%			
<i>Outsiders' Influence:</i>					
Outside Director Ownership		0.032	0.907		
Dummy for Venture Backing		0.700	-0.321		
Carter-Manaster Ranking		0.713	0.274		
<i>Proportion Explained</i>		40%	35%		
Monitoring Hypothesis					
<i>Private Benefits:</i>					
Free Cash Flow				0.611	0.496
Industry Concentration				-0.378	0.868
Takeover Defense (<i>G-Index</i>)				0.696	0.036
<i>Proportion Explained</i>				37%	33%
<i>Monitoring Costs (including CEO Ownership):</i>					
CEO Ownership*				-0.396	0.040
Ln (Market-to-Book)				0.611	-0.282
High R&D				0.681	0.168
Return Variance				0.079	0.944
<i>Proportion Explained</i>				36%	26%
<i>Monitoring Costs (excluding CEO Ownership):</i>					
Ln (Market-to-Book)				0.690	-0.300
High R&D				0.717	0.163
Return Variance				0.096	0.940
<i>Proportion Explained</i>				45%	35%

* CEO ownership is included in both the negotiation and monitoring hypotheses. For regressions testing board independence, we use monitoring costs without CEO ownership (since CEO ownership enters in through the negotiations hypothesis). For tests of board size, we use monitoring costs with CEO ownership since the negotiation hypothesis is not used.

Table 11. Principal Components Analysis (Continued)

Panel B-1: Regression of Board Size Using Principal Components Factors from Panel A

Panel B-1 provides results of OLS regressions of board size using the principal components factors from Panel A above as explanatory variables for the scope of operations and monitoring hypotheses (the monitoring hypothesis factors here include CEO ownership). Control variables are defined in Table 9. Standard errors are computed using the White estimator in which observations are clustered by firm. P-values are given in parentheses.

Explanatory Variable	Coefficient (p-value)
Scope of Operations Hypothesis:	
Scope of Operations Factor	0.337 (0.00)
Monitoring Hypothesis:	
Private Benefits Factor #1	0.202 (0.00)
Private Benefits Factor #2	-0.047 (0.59)
Monitoring Costs Factor #1	0.027 (0.63)
Monitoring Costs Factor #2	-0.249 (0.00)
Control Variables:	
Lag (Fraction Independent Directors)	1.011 (0.00)
Dummy for Previous Merger	1.134 (0.00)
Lag (ROA)	-0.307 (0.05)
Dummy for Previous Reverse LBO	0.209 (0.18)
Dummy for Equity Carve-Out	0.331 (0.15)
Dummy for Dual Class	0.624 (0.04)
Constant	6.933 (0.00)
Adjusted R ²	0.22

Table 11. Principal Components Analysis (Continued)

Panel B-2: Regression of Board Independence Using Principal Components Factors from Panel A

Panel B-2 provides results of OLS regressions of board independence using the principal components factors from Panel A above as explanatory variables for the scope of operations, monitoring and negotiation hypotheses (the monitoring hypothesis factors here exclude CEO ownership). Control variables are defined in Table 9. Standard errors are computed using the White estimator in which observations are clustered by firm. P-values are given in parentheses.

Explanatory Variable	Coefficient (p-value)
Scope of Operations Hypothesis:	
Scope of Operations Factor	0.020 (0.00)
Monitoring Hypothesis:	
Private Benefits Factor #1	0.004 (0.45)
Private Benefits Factor #2	-0.004 (0.60)
Monitoring Costs Factor #1	0.004 (0.49)
Monitoring Costs Factor #2	-0.004 (0.45)
Negotiations Hypothesis:	
Insiders' Influence Factor	-0.029 (0.00)
Outsiders' Influence Factor #1	0.036 (0.00)
Outsiders' Influence Factor #2	0.020 (0.00)
Control Variables:	
Lag (Number of Directors)	0.005 (0.11)
Dummy for Previous Merger	0.029 (0.10)
Lag (ROA)	-0.043 (0.00)
Dummy for Previous Reverse LBO	0.057 (0.00)
Dummy for Equity Carve-Out	0.027 (0.14)
Dummy for Dual Class	-0.019 (0.39)
Constant	6.933 (0.00)
Adjusted R ²	0.15

Table 12. Two-Stage Least Squares Regressions

Estimated coefficients from two-stage least squares regressions using pooled data from 1,019 firms for years 1, 4, 7, and 10 after the firms' IPOs. We use a two-stage approach to control possible endogeneity between board size and board independence. In Panel A, we create an instrument for board independence (the fitted value of the first stage regression), which is then utilized as an independent variable for the second stage, in which board size is the endogenous variable. In Panel B, we create an instrument for board size (the fitted value of the first stage regression), which is then utilized as an independent variable for the second stage, in which board independence is the endogenous variable. All variables are defined in Table 9. Standard errors are computed using the White estimator in which observations are clustered by firm. P-values are given in parentheses.

Panel A: Number of Board Members as the Dependent Variable

Exogenous Variables:	First-Stage	Second-Stage
	<i>Endogenous Variable: Board Independence</i>	<i>Endogenous Variable: Board Size</i>
Instrument for Board Independence		0.193 (0.88)
Variables Used to Test the Scope of Operations Hypothesis:		
Firm Size	0.009 (0.01)	0.507 (0.00)
Years Since IPO	0.008 (0.00)	-0.034 (0.03)
Number of Business Segments	0.002 (0.21)	0.034 (0.08)
Variables Used to Test the Negotiation Hypothesis:		
CEO Tenure	-0.002 (0.00)	
Outside Director Ownership	0.158 (0.00)	
Dummy for Venture Backing	0.088 (0.00)	
Carter-Manaster Ranking	0.004 (0.17)	
Variables Used to Test the Monitoring Hypothesis:		
Free Cash Flow	-0.004 (0.81)	-0.360 (0.07)
Industry Concentration	-0.050 (0.67)	1.451 (0.24)
Takeover Defense (<i>G</i> -Index)	0.003 (0.02)	0.041 (0.06)
Ln (Market-to-Book)	-0.005 (0.42)	0.075 (0.37)
High R&D	0.025 (0.03)	-0.426 (0.02)
Return Variance	-3.356 (0.01)	-20.546 (0.13)
CEO Ownership	-0.125 (0.00)	-1.503 (0.00)
Control Variables:		
Dummy for Previous Merger	0.024 (0.25)	0.954 (0.00)
Lag (ROA)	-0.030 (0.02)	-0.435 (0.00)
Dummy for Previous Reverse LBO	0.062 (0.00)	-0.218 (0.24)
Dummy for Equity Carve-Out	0.029 (0.03)	0.339 (0.14)
Dummy for Dual Class	-0.012 (0.43)	0.525 (0.06)
Constant	0.120 (0.15)	6.946 (0.00)
Adjusted R²	0.287	0.288

Table 12. Two-Stage Least Squares Regressions (continued)

Panel B: Fraction of Independent Directors on the Board as the Dependent Variable

Exogenous Variables:	First-Stage	Second-Stage
	<i>Endogenous Variable: Board Size</i>	<i>Endogenous Variable: Board Independence</i>
Instrument for Board Size		0.026 (0.18)
Variables Used to Test the Scope of Operations Hypothesis:		
Firm Size	0.533 (0.00)	-0.005 (0.68)
Years Since IPO	-0.020 (0.18)	0.008 (0.00)
Number of Business Segments	0.036 (0.05)	0.001 (0.50)
Variables Used to Test the Negotiation Hypothesis:		
CEO Ownership	-1.247 (0.00)	-0.094 (0.04)
CEO Tenure	-0.010 (0.06)	-0.001 (0.03)
Outside Director Ownership	0.824 (0.00)	0.137 (0.00)
Dummy for Venture Backing	-0.305 (0.00)	0.096 (0.00)
Carter-Manaster Ranking	-0.018 (0.56)	0.004 (0.28)
Variables Used to Test the Monitoring Hypothesis:		
Free Cash Flow	-0.343 (0.07)	0.005 (0.79)
Industry Concentration	0.759 (0.57)	-0.070 (0.53)
Takeover Defense (<i>G-Index</i>)	0.046 (0.00)	0.002 (0.35)
Ln (Market-to-Book)	0.094 (0.16)	-0.007 (0.37)
High R&D	-0.277 (0.03)	0.032 (0.06)
Return Variance	-26.71 (0.05)	-2.674 (0.12)
Control Variables:		
Dummy for Previous Merger	-0.373 (0.01)	
Lag (ROA)	-0.247 (0.02)	-0.021 (0.16)
Dummy for Previous Reverse LBO	0.080 (0.60)	0.068 (0.00)
Dummy for Equity Carve-Out	0.399 (0.02)	0.027 (0.15)
Dummy for Dual Class	0.944 (0.00)	-0.022 (0.38)
Constant	3.667 (0.00)	0.355 (0.01)
Adjusted R²	0.277	0.270

Table 13. Economic Impact of Variables for the Three Hypotheses in Tables 6-8

This table reports on the economic impact of each variable used to test the three hypotheses in Tables 6-8. Specifically, coefficient estimates from Tables 6-8 are used to fit values for board size and independence when all regressors are set at their mean values. We then perturb each key explanatory variable by one standard deviation – leaving all other regressors at their mean values – to calculate the predicted change in the dependent variable. The numbers indicate the effect of a one-standard deviation in the explanatory variable on board size (measured in # of people) or the fraction of independent board members (measured in percentage points). Results are reported for each key explanatory that, when isolated, is significantly related to board size (or independence).

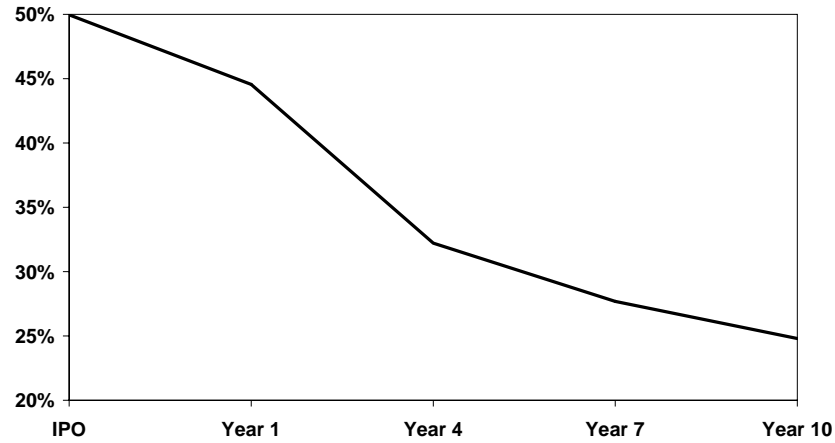
	Board Size (# of people)	Board Independence (change in %)
Tests of the Firm Scope of Operations Hypothesis:		
Firm Size	0.89	12.3
Years Since IPO	0.21	12.3
Number of Business Segments	0.22	11.8
Tests of the Negotiation Hypothesis:		
CEO Tenure	n/a	-1.9
CEO Ownership	n/a	-3.8
Outside Director Ownership	n/a	3.2
Venture Capital Backing	n/a	5.4
Carter-Manaster Ranking	n/a	2.9
Tests of the Monitoring Hypothesis:		
Free Cash Flow	0.12	(a)
Industry Concentration	0.23	1.5
Takeover Defense (<i>G</i> -Index)	0.25	(a)
Market-to-Book	(a)	(a)
High R&D	-0.25	1.9
Return Variance	-0.25	(a)
CEO Ownership*		n/a

**CEO ownership included under monitoring hypothesis for board size but included under negotiation hypothesis for board independence (there is no prediction for board size under negotiation hypothesis).*

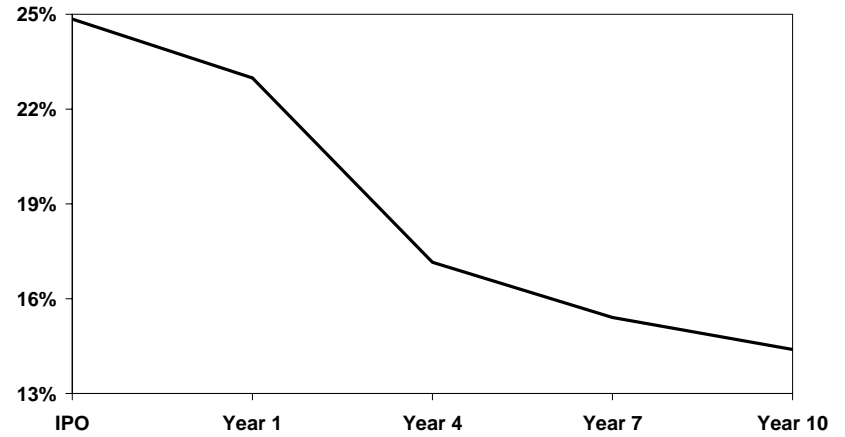
(a) Coefficient not significant in regression, so economic significance not computed.

Figure 1: Evolution of Ownership from the IPO through 10 Year Later

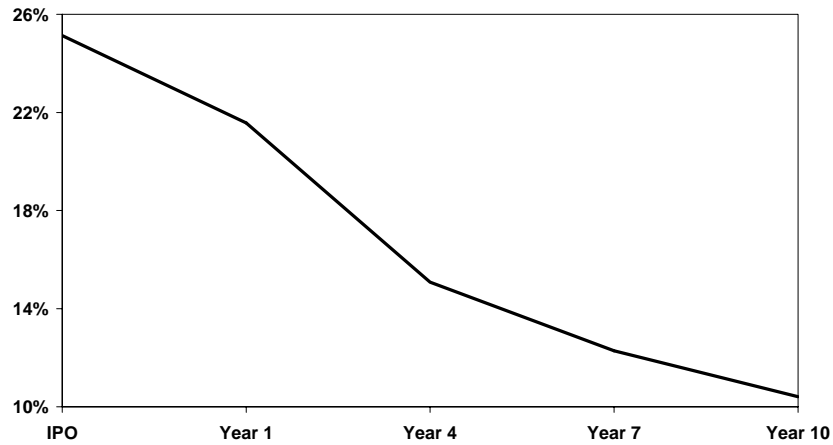
Panel A: Ownership by Officers and Directors



Panel B: Ownership by Officers



Panel C: Ownership by Outside Directors



Panel D: Number of 5% Blockholders

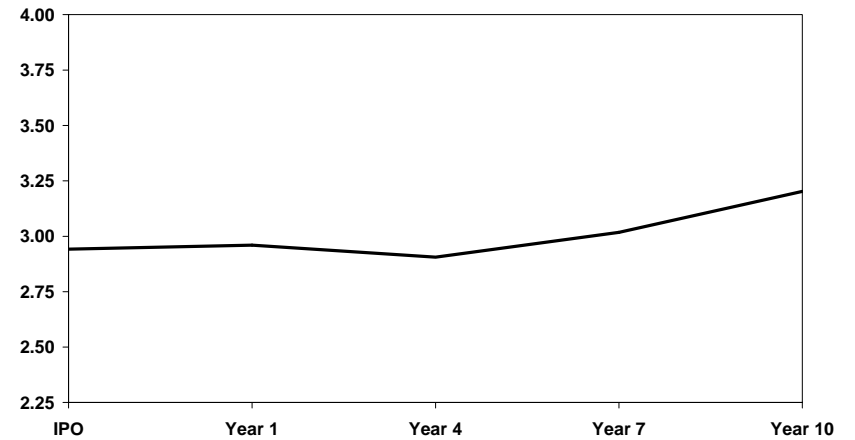
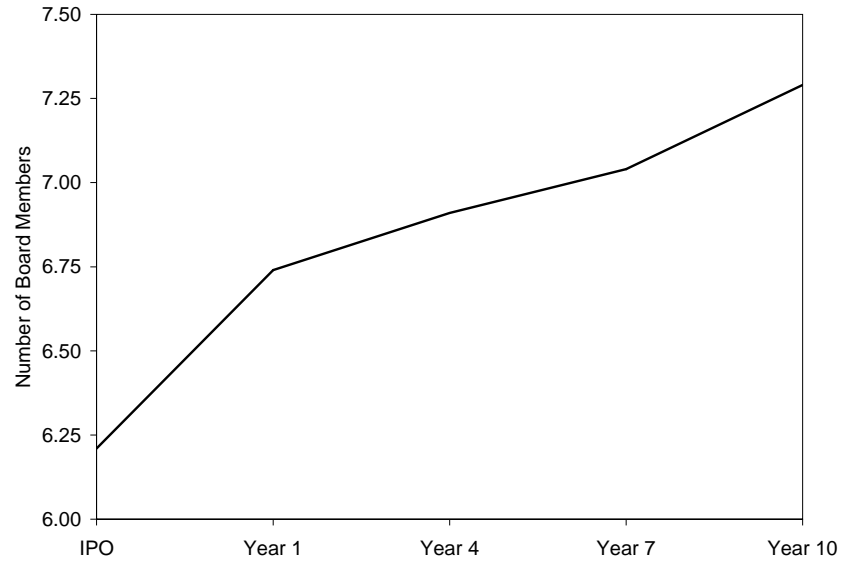
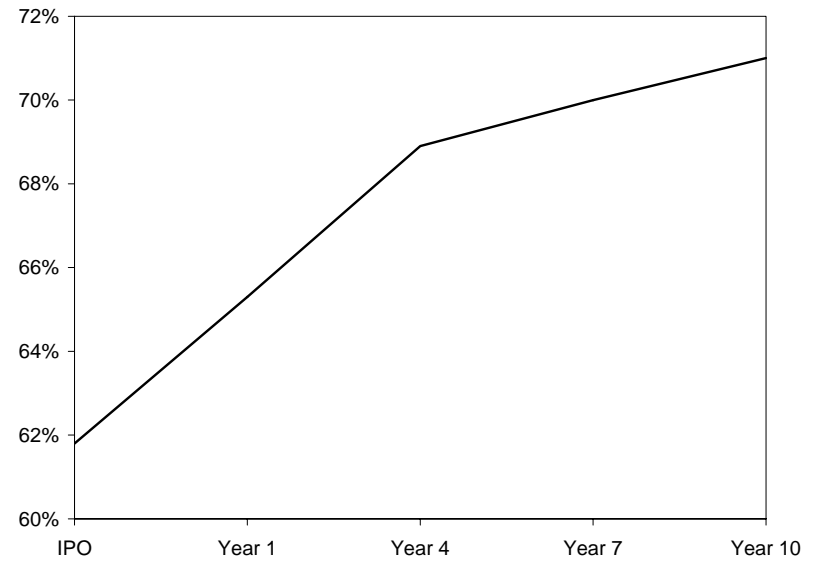


Figure 2: Evolution of Board Characteristics from the IPO through 10 Years Later

Panel A: Size of Board of Directors



Panel B: Fraction of Outsiders on the Board



Panel C: Percent of Original Board Members Remaining

