Endogenously Chosen Boards of Directors and Their Monitoring of the CEO

By BENJAMIN E. HERMALIN AND MICHAEL S. WEISBACH*

How can boards be chosen through a process partially controlled by the CEO, yet, in many instances, still be effective monitors of him? We offer an answer based on a model in which board effectiveness is a function of its independence. This, in turn, is a function of negotiations (implicit or explicit) between existing directors and the CEO over who will fill vacancies on the board. The CEO's bargaining power over the board-selection process comes from his perceived ability relative to potential successors. Many empirical findings about board structure and performance arise as equilibrium phenomena of this model. (*JEL* D23, D73, G39, K22, L29)

Corporations are not governed by the process that corporate law would seem to imply. Corporate law states that shareholders choose the board of directors, but, in practice, shareholders almost always vote for the slate proposed by management.[1] Moreover, this slate is approved by, if not chosen by, the very CEO these directors are supposed to monitor (see, e.g., Myles L. Mace, 1971; Jay W. Lorsch and Elizabeth MacIver, 1989; Ada Demb and F.-Friedrich Neubauer, 1992). The resulting governance system has been criticized as ineffective in controlling management (see, e.g., Martin Lipton and Jay W. Lorsch, 1992; Michael C. Jensen, 1993).

Given these apparent shortcomings, it is easy to forget that the current system is, nonetheless, the market solution to an organizational design problem (albeit one that must be solved under legal constraints—e.g., all firms must have boards with certain powers).[2] Thus, as George J. Stigler and Claire Friedland (1983) argued, before any criticism of current practice is taken too seriously, a thorough understanding of the market forces that have led to its existence seems necessary. This, in part, is what we propose to do here.

The previous literature has focussed on what boards do, without asking how they get to be the way they are. However, the answers to these questions are invariably linked. For instance, a board packed with the CEO's relatives will be less effective than one made up of large shareholders. To understand corporate governance, the questions of director choice and director function must be answered simultaneously.

To capture this simultaneity, we assume that the board and the CEO negotiate over both the

* Hermalin: Haas School of Business and Department of Economics, S545 Student Services Building No. 1900, University of California, Berkeley, CA 94720; Weisbach: Department of Finance, College of Business and Public Administration, McClelland Hall, Room 315R, University of Arizona, Tucson, AZ 85721. The authors thank James Brickley, Aaron Edlin, Robert Gibbons, Charles Hadlock, David Hirshleifer, Steven Kaplan, Vojislav Maksimovic, Canice Prendergast, Anil Shivdasani, Sunil Wahal, Jerry Weisbach, two anonymous referees, and seminar participants at the University of Alberta, University of Arizona, Boston College, University of California-Berkeley, UCLA, University of California-San Diego, University of Chicago, Cornell University, Dartmouth College, Hong Kong University of Science and Technology, University of Illinois, Indiana University, University of Maryland, University of Rochester, and the Winter Econometric Society for their helpful comments and suggestions on earlier drafts.

[1] Even when shareholders do challenge management's slate of directors in a proxy fight, Harry and Linda DeAngelo (1989) find that they win a board seat only about one-third of the time.

[2] Mark Roe (1994) expands on the role of legal and political constraints. These, however, are better suited to explaining cross-country differences in corporate governance than the intracountry differences that are our focus.

CEO's wage and the identity of new directors. These negotiations could be explicit. Alternatively, in keeping with the institutional literature (see, e.g., Mace; Lorsch and MacIver; Demb and Neubauer), these negotiations could be implicit—the CEO could nominate new board members subject to a tacit understanding about the set from which they may be chosen. Were the CEO to violate this understanding, the board would refuse to approve his nominees. The CEO's bargaining power in these negotiations comes from his *perceived* ability relative to a replacement.

These negotiations determine the board's level of independence. Independence is important because a director's willingness to monitor the CEO increases with his or her independence. Monitoring provides information about the CEO used by the board in deciding whether to retain or to replace him. In this model, therefore, both the structure of the board and its actions are endogenously derived.

To evaluate the model's realism, we compare its predictions to existing empirical findings. Some of the model's predictions are:

1. A CEO who performs poorly is more likely to be replaced than one who performs well.
2. CEO turnover is more sensitive to performance when the board is more independent.
3. The probability of independent directors being added to the board rises following poor firm performance.
4. Board independence declines over the course of a CEO's tenure.
5. Accounting measures of performance are better predictors of management turnover than stock-price performance.

These predictions are consistent with existing studies of large corporations.

Predictions 1 and 2 match the empirical evidence on CEO turnover. A number of papers (e.g., Anne T. Coughlan and Ronald M. Schmidt, 1985; Jerold B. Warner et al., 1988; Jensen and Kevin J. Murphy, 1990), find that CEO turnover is negatively related to prior performance. In addition, Weisbach (1988) finds that the sensitivity of CEO turnover to performance is greater for firms with a higher proportion of outside directors, presumably because these firms' boards are more independent of management than are boards dominated by inside directors.[3]

While prediction 1 follows from other models (e.g., David Hirshleifer and Anjan V. Thakor, 1994), prediction 2 is more novel. The intuition behind it is that new CEOs require more monitoring than old ones, since less is known about their ability. More independent boards have a greater tolerance for this added monitoring, so they can afford to be tougher with an incumbent CEO whose performance is marginal.

Prediction 3 is consistent with the pattern of director turnover found by Hermalin and Weisbach (1988). They also find that the proportion of outside directors on the board decreases over the CEO's career. This finding suggests that board independence declines over a CEO's tenure, consistent with prediction 4.

Prediction 3 follows because poor performance lowers the board's assessment of the CEO's ability, reducing his bargaining position and thus increasing the probability that the CEO will be forced to accept more independent directors. Similar logic explains prediction 4: If a CEO keeps his job, then retaining him must be worth more to the directors than replacing him. This means that this CEO is, to some extent, a rare commodity, which gives him bargaining power vis-à-vis the directors. He is, therefore, able to bargain for a board that is more favorable to him.

Prediction 5 is consistent with both Weisbach (1988) and Murphy and Jerold L. Zimmerman (1993), who estimate equations predicting management changes using both stock returns and earnings and find that earnings do a better job. Intuitively, earnings are a function of current management only, but stock returns reflect both current management and the expectation of future management changes.

[3] Outside directors are nonmanagement directors not otherwise affiliated with the firm and inside directors are management or directors with close ties to the firm (e.g., ex-CEOs of the firm). Some researchers also include a third category, "grey" or "affiliated," intermediate in presumed independence between outsiders and insiders.

In addition, the analysis suggests the following predictions, which have not yet been empirically tested.

1. There should be long-term persistence in corporate governance. In particular, changes that either strengthen or weaken board independence should be "permanent" in that they change the long-term bargaining strength of the board against management.
2. The stock-price reaction to management changes should be negative if the manager is fired on the basis of private information and positive if the manager is fired on the basis of public information.
3. A CEO's salary should be insensitive to past performance at relatively low levels of past performance, but sensitive at relatively high levels of past performance.

The first prediction is consistent with anecdotal evidence of long-term patterns in corporate governance. When a firm has an extremely able CEO, he will be able to use his bargaining position to ensure a relatively weak board throughout his career. Consequently, his successor will inherit a relatively weak board. Thus, the model suggests that there will be long-term persistence in firms' governance practices and long-term interfirm heterogeneity in these practices as well.

The second prediction potentially explains why empirical studies have found no consistent stock-price reaction to management changes (see Warner et al.): there have been no controls for whether the dismissals were due to private or public information. Our prediction follows because a change in management conveys information about both the board and the CEO. If the board bases its firing decision on private information, then a firing reveals that a CEO who was previously seen as better than the expected value of a replacement is not. Expectations of new management are lower than the previous expectations of old management, so the stock price falls. In contrast, if the firing is based on public information, then nothing new is revealed about the CEO, but the firing conveys good news about the board's independence, so the stock price rises.

The third prediction comes from the structure of the bargaining game in our model. When the CEO is either new or a mediocre performer, the lower bound on his wage binds (a bound stemming from a limited-liability assumption). As performance increases, the CEO's bargaining position increases as well, allowing him to capture a fraction of the rents in the form of a higher wage.

Although we focus on explaining phenomena related to boards of directors, the model we develop is fairly general. It extends the job-matching model of Boyan Jovanovic (1979) by allowing for *endogenous* monitoring decisions. Among its features is a formalization of the argument that new workers are more valuable than older, better-known workers, ceteris paribus, because the former have a greater option value (see Proposition 2 below).

The paper has the following organization. The next section reviews some previous work on boards of directors. Section II introduces our model. We extend it in Section III, subsection A, by allowing the board to prefer the incumbent CEO to replacements. In Section III, subsection B, we consider how various governance activities affect the firm's stock price and how measures of firm performance will correlate with governance activities. Section IV considers a reinterpretation of our model that eschews bargaining and ensures that turnover is always optimal from the shareholders' perspective. Many of our results continue to hold under this alternative interpretation, although we lose the ability to analyze management capture of the board. Section V considers some policy prescriptions that have been offered to correct the perceived failings of boards (e.g., requirements that directors be paid in stock rather than cash). Our model predicts that many of these policies will be ineffective. We conclude in Section VI.

I. Boards of Directors in Corporate Governance: Existing Theory and Evidence

Adolph A. Berle, Jr. and Gardiner C. Means (1932 p. 87) observed that the separation of ownership and control inherent in a diversely held corporation leads to a board of directors controlled by management. They argued that:

> ... control will tend to be in the hands of those who select the proxy committee

> and by whom, the election of directors for the ensuing period will be made. Since the proxy committee is appointed by the existing management, the latter can virtually dictate their own successors.

Management's apparent control of the board selection process led Berle and Means, as well as more contemporary authors such as Jensen, to question whether directors can be effective monitors.

A counterargument is that directors' concern for their reputations in the managerial or directorial labor market causes them to be effective monitors (Eugene F. Fama, 1980; Fama and Jensen, 1983). Steven N. Kaplan and David Reishus (1990) find evidence consistent with this argument: directors of poorly performing firms, who therefore may be perceived to have done a poor job overseeing management, are less likely to become directors at other firms. On the other hand, as Bengt Holmstrom (1983) shows, reputational concerns need not correct all agency problems and can, in fact, create new ones.

To resolve these conflicting arguments about board effectiveness, an empirical literature assessing the board's role has developed. Unfortunately, measuring the day-to-day effect of board independence on corporate profits is made difficult by simultaneity problems, since board independence itself changes because of corporate performance (see Hermalin and Weisbach, 1991, for further discussion).[4] This literature has been more successful analyzing the relation between corporate decision-making in specific circumstances and some measure of the board's independence, such as its composition in terms of insiders and outsiders or other characteristics correlated with independence (e.g., directors' shareholdings). For instance, Brickley et al. (1994a) find that board composition affects their decision to adopt poison pills; John W. Byrd and Kent A. Hickman (1992) find that the greater the fraction of outside directors, the better the stock market's reaction to their firm's tender offers for other firms; and Weisbach finds that the sensitivity of CEO turnover to firm performance increases with the fraction of outside directors on the board. Anil Shivdasani (1993) suggests that outside directors who own a substantial number of shares and who hold more corporate directorships (presumably measuring the value they place on their reputations) are better at negotiating a favorable deal for shareholders who face a takeover bid. Lastly, Kevin Hallock (1997) finds that firms whose boards are interlocked (contain a CEO on whose board the firm's CEO serves) tend to pay their CEOs more. He argues that interlocked directors are less independent and, consequently, give the CEO a larger fraction of the rents than would other directors.

While the empirical literature on boards is fairly well developed at this point, there has been little formal modeling of the board. Existing papers have considered important issues about the board's conduct, but have ignored the process by which boards get to be the way they are (see Hirshleifer and Thakor, 1994; Vincent A. Warther, 1994; Brickley et al., 1994b; Thomas H. Noe and Michael Rebello, 1996). Our view is that such modeling is useful, but it ignores the fundamental question of how boards can, in many instances, be effective monitors of the CEO despite being chosen through a process partially controlled by him.

II. The Model

We model the board selection process as a bargaining game between the CEO and the board. We assume no active role for the shareholders (although some of them could be directors). Consistent with practice, shareholders simply ratify the slate put forward by the company. We discuss shareholder activity, particularly in crisis situations, later.

[4] Some papers that nonetheless attempt to estimate the day-to-day effect are Paul MacAvoy et al. (1983) and Barry D. Baysinger and Henry N. Butler (1985). Also see James A. Brickley and Christopher M. James (1987), Stuart Rosenstein and Jeffrey G. Wyatt (1990), William Brown and Michael T. Maloney (1992), Omesh Kini et al. (1994), Anup Agrawal and Charles R. Knoeber (1996), Sanjai Bhagat and Bernard Black (1996), James R. Booth and Daniel N. Deli (1996), Kenneth A. Borokhovich et al. (1996), David Yermack (1996), James F. Cotter et al. (1997), Robert Gertner and Kaplan (1997), David Mayers et al. (1997), and April Klein (1998) for related empirical work.

A. *Timing*

The game has multiple stages with the following timing.

1. At the start of the game, the firm has a new CEO. The *commonly* held prior distribution about his ability, α, is normal with mean zero and variance $1/\tau_0$ (τ_0 is the *precision* of the distribution). We set the mean to zero for convenience, but without loss of generality.
2. The first realization of earnings, x_1, occurs. Earnings are distributed normally with a mean equal to the CEO's true ability, α, and a variance equal to $1/r$.
3. Based on x_1, the board updates its estimate of the CEO's ability. The board may at this stage decide to fire the CEO and hire a replacement. The prior distribution of *any* replacement CEO's ability is normal with mean zero and variance $1/\tau_0$.
4. The CEO (either the incumbent or the replacement) negotiates with the board over filling vacancies on the board and his wage, w.[5] If the bargaining is unsuccessful, the CEO is fired and a replacement is hired. If a replacement is hired at this stage, the board bargains with him about the filling of vacancies on the board.
5. The board may then acquire a private signal, y, about the CEO. The probability that the board acquires this signal depends on the intensity with which it monitors the CEO. The signal is distributed normally with a mean equal to the CEO's ability, α, and a variance equal to $1/s$.[6]
6. If the board acquires the signal, it updates its estimate of the CEO's ability. Based on this posterior estimate, the board may decide to fire the CEO and hire a replacement.
7. The second realization of earnings (profits gross of the CEO's compensation), x_2, occurs. Again, earnings are distributed normally with a mean equal to the CEO's true ability and a variance equal to $1/r$. The random variables $y - \alpha$, $x_1 - \alpha$, and $x_2 - \alpha$ are independently distributed.

B. *Preferences and Ability*

The CEO in charge at stage 7 receives a control benefit of $b > 0$. A CEO who is dismissed prior to this stage (or not hired) receives a benefit of 0.

The CEO is also compensated with a wage, w, determined by the bargaining process between him and the board. This wage is paid *regardless* of whether the CEO survives to stage 7. A critical assumption is that the CEO is protected by limited liability; specifically, the wage must be nonnegative (i.e., $w \geq 0$).

A CEO's ability is fixed throughout his career. We follow Holmstrom (1983) by assuming that the CEO, like the board, knows only the *distribution* of his ability (i.e., that it is a normal distribution with mean zero and precision τ_0). We justify this assumption by noting that the uncertainty about a CEO's ability in a *particular* job is largely uncertainty about the match between him and the firm, which is similarly unknown to both the board and the CEO.

We assume that each director, i's, utility is

$$\theta_i x_2 - \kappa_i d(p). \tag{1}$$

The constant $\theta_i > 0$ equals the director's marginal utility from firm profits, x_2.[7] We imagine that directors put different weights on profits for two reasons. First, directors' incomes depend on their own shareholdings. Second, di-

[5] We treat the creation of vacancies on the board as exogenous. This is fairly realistic, since many vacancies arise for presumably exogenous reasons such as death, illness, or reaching the customary retirement age. We also do not explicitly consider how the number of vacancies might limit the ability of the board to adjust board composition. This is with little loss of generality, since (i) only the proof of Proposition 6 depends on achieving an interior solution (i.e., one in which vacancy limits do not bind); and (ii) board size often changes (see Hermalin and Weisbach, 1988, for evidence).

[6] Alternatively, we could assume that the board always receives a signal, but its precision (i.e., s) is endogenous (we thank Canice Prendergast for this point). This alternative leads to similar results, except the comparative statics with respect to τ are ambiguous.

[7] First-stage profits, x_1, are sunk by the time the directors act, so we need not explicitly account for their impact on directors' utilities.

rectors' concerns for building reputations as competent managers may vary.

The variable p is the probability that the board obtains an additional signal, y, about the CEO. It reflects the intensity with which the board monitors the CEO. The disutility of monitoring is $\kappa_i d(p)$, where $d(\cdot)$ is a common, strictly increasing, strictly convex, and twice-differentiable function and κ_i is the director's distaste for monitoring. We imagine that directors' distastes for monitoring vary for three reasons. First, inside directors' careers are tied to the CEO's, so they rarely find it in their interest to monitor him. Second, the opportunity cost of the directors' time will vary among outside directors. Finally, directors who value the opportunity to serve on other boards could have an incentive to establish reputations for not "rocking the boat"; i.e., for not intensely monitoring the CEO.

Since utility functions are defined up to an affine transformation only, we can replace (1) with

$$x_2 - k_i d(p), \tag{2}$$

where $k_i = \kappa_i / \theta_i$. We interpret k_i as a measure of director i's *lack* of independence, at least in terms of the way he or she behaves.

We assume k_i is *fixed* for a given director i (at a specific firm and for a specific set of pecuniary incentives). In particular, it is invariant with respect to who the CEO is. We relax this assumption in Section III, subsection A, where we show it does not change the qualitative nature of our results. In addition, we discuss below the implications of basing individual director monitoring costs on the group level of monitoring.

C. *Updating Beliefs and Optimal Monitoring*

When new information is observed, either profits or a signal, the players update their beliefs about the CEO's ability. Specifically, if $\hat{\alpha}$ and τ are the prior estimates of the mean and precision of the distribution of the CEO's ability, then the posterior estimates are

$$\hat{\alpha}' = \frac{\tau\hat{\alpha} + tz}{\tau + t} \text{ and } \tau' = \tau + t, \tag{3}$$

where z is either x_1 or y and t is either r or s (see Morris H. DeGroot, 1970 p. 167). The posterior distribution is also normal.

From (3), the board has a more precise estimate of an *incumbent* CEO's ability at stage 3 than it would of any *replacement* CEO it hires. That is,

$$\tau > \tau_0, \tag{4}$$

where τ is the precision of its estimate of the incumbent CEO's ability. Intuitively, an incumbent is a "known entity," so there is less uncertainty about him than there would be about a new CEO.

The distribution of the signal y given the CEO's *true* ability, α, is normal with mean α and variance $1/s$; hence, the distribution of y given the CEO's *estimated* ability, $\hat{\alpha}$, is normal with mean $\hat{\alpha}$ and variance $1/s + 1/\tau$.[8] Define

$$H = \frac{s\tau}{s + \tau}$$

to be the precision of y given $\hat{\alpha}$.[9]

Observe that the board's posterior estimate of a CEO's ability is also the expected value of x_2. After fixing (sinking) the CEO's wage, it is also the expected value of profits.

The alternative to retaining a CEO is to hire a replacement. The expected earnings from a replacement are, by assumption, zero. Moreover, because all replacements are *ex ante* identical, they have no bargaining power. Hence, the directors can set a minimum wage, $w = 0$. The expected profit from a *replacement* CEO is, therefore, zero. Subsequent to obtaining a signal, y, the incumbent CEO will thus

[8] The random variable $y - \hat{\alpha}$ is the sum of two independently distributed normal variables: $y - \alpha$ and $\alpha - \hat{\alpha}$; hence $y - \hat{\alpha}$ is also normally distributed. Since the means of these two random variables are both zero, the mean of y given $\hat{\alpha}$ is, therefore, $\hat{\alpha}$. The variance of the two variables are $1/s$ and $1/\tau$ respectively, so the variance of $y - \hat{\alpha}$ and, thus, y given $\hat{\alpha}$ is $1/s + 1/\tau$.

[9] As a convention, we will denote functions of many variables, such as H, by capital letters. When we need to be explicit about an argument of such functions—for example, the function F evaluated at $x = x'$—we will write $F_{x=x'}$.

be dismissed if $\hat{\alpha}' < 0$. Using (3), we can restate the dismissal condition as

$$(5) \qquad -\frac{\tau\hat{\alpha}}{s} > y.$$

The firm's expected value *if* it will learn y is

$$V \equiv \int_{-\infty}^{\infty} \max\left\{0, \frac{\tau\hat{\alpha} + sy}{\tau + s}\right\}\sqrt{\frac{H}{2\pi}}\, e^{-(H/2)(y-\hat{\alpha})^2}\, dy.$$

Since the option to fire the CEO is a valuable option, it follows that $V > \hat{\alpha}$ for all τ.

Straightforward calculations reveal that V can be written as

$$(6) \quad V = \hat{\alpha}\Phi(-(Y_c - \hat{\alpha})\sqrt{H}) + \frac{\sqrt{H}}{\tau}\phi((Y_c - \hat{\alpha})\sqrt{H}),$$

where Y_c is the left-hand side of (5), $\Phi(\cdot)$ is the distribution function of a standard normal random variable (i.e., with mean zero and variance one), and $\phi(\cdot)$ is its corresponding density function. Note that

$$\Phi(-(Y_c - \hat{\alpha})\sqrt{H})$$

is also the probability that the CEO will be retained if evaluated.

A higher-ability CEO is always better, but the value of the option to fire him is decreasing in $\hat{\alpha}$:[10]

LEMMA 1: *V is increasing in $\hat{\alpha}$, while $V - \hat{\alpha}$ is decreasing in $\hat{\alpha}$.*

That is, the value of additional information about the CEO's ability is smaller the greater is the prior estimate of his ability.

Consider, now, the issue of how the board decides on the intensity (probability, p) with which to monitor the CEO. We assume the board chooses p to maximize:

$$(7) \quad \max_{p \in [0,1]} pV + (1-p)\max\{0, \hat{\alpha}\} - \bar{k}d(p),$$

where $\bar{k}$ reflects, in some way, the collective preferences of the board (i.e., $\partial\bar{k}/\partial k_i \geq 0$ for all i and strictly positive for at least one i). For instance, $\bar{k}$ could be the average of the k_i's. More consistent, perhaps, with theories of voting, $\bar{k}$ could be the median k_i. Note that the resulting p will be Pareto optimal from the perspective of the board members.

The first-order condition for (7) is

$$(8) \quad V - \max\{0, \hat{\alpha}\} - \bar{k}d'(p) = 0.$$

Expression (7) is concave in p, so (8) is sufficient as well as necessary. Define P^* to be the solution to (8). To keep the analysis straightforward, we consider only interior solutions (i.e., $P^* \in (0, 1)$). Corner solutions are a relatively simple extension. Properties of P^* are:

PROPOSITION 1: *The intensity with which the board monitors the CEO, P^*, is*

- *(i) decreasing with its prior estimate of his ability, $\hat{\alpha}$, if $\hat{\alpha} \geq 0$;*
- *(ii) decreasing with the precision of its prior estimate, τ;*
- *(iii) decreasing with its collective lack of independence, $\bar{k}$; but*
- *(iv) increasing with the precision of the signal (i.e., s).*

Intuitively, the more costly monitoring is to the board's members (or the less weight they place on the firm's profits), the greater is the marginal cost of monitoring, so they engage in less of it. The more able the board believes the CEO to be, the less valuable is the option to fire the CEO, so the board monitors less. The option to fire the CEO is similarly less valuable the less uncertainty there is in its prior estimate, so the board monitors less intensely when the CEO's ability is known more precisely. However, the option to fire the CEO is more valuable the greater is the precision of the signal, so the board

[10] All proofs are in the Appendix.

monitors more intensely when the signal is more informative.

Proposition 1 is consistent with the general perception that less-independent boards do less monitoring and that long-established CEOs (i.e., CEOs with high values of τ) receive less scrutiny. Being monitored increases the likelihood of being dismissed, so Proposition 1 is also consistent with the evidence in Weisbach, which suggests that outsider-dominated boards (which are presumably more independent) are more likely to fire a poorly performing CEO than insider-dominated (less-independent) boards.

D. *Negotiations Between the CEO and the Board*

When they enter into negotiations, the board brings

$$pV + (1 - p)\max\{0, \hat{\alpha}\} - \bar{k}d(p) + R$$

in surplus to the bargaining table, where R is the share of b the board can expect to capture from a replacement CEO. However, given the limited-liability assumption ($w \geq 0$), the board cannot capture any share of b from a replacement CEO. Consequently, $R = 0$. The incumbent CEO brings his *expected* benefit,

$$(p\Phi(-(Y_c - \hat{\alpha})\sqrt{H}) + 1 - p)b,$$

to the table. So their joint surplus is

$$(9)\quad pV + (1 - p)\max\{0, \hat{\alpha}\} - \bar{k}d(p) + (p\Phi(-(Y_c - \hat{\alpha})\sqrt{H}) + 1 - p)b.$$

Maximizing (9) with respect to p yields the first-order condition

$$(10)\quad V - \max\{0, \hat{\alpha}\} - \bar{k}d'(p) - (1 - \Phi)b = 0.$$

Comparing (10) to (8), we see that the marginal benefit of monitoring is lower in (10) by $(1 - \Phi)b$, which means that the level of monitoring that maximizes joint surplus (9) is lower than the level of monitoring that maximizes the board's expected utility (7). That is, if P^{**} is the solution to (10), then $P^{**} < P^*$.

It is worth considering why $P^{**} < P^*$. Part of the surplus that can be shared by the *incumbent* CEO and the board is the incumbent's chance of getting the control benefit, b. If he is fired, then this chance is lost; it goes to the *replacement* CEO. Moreover, limited liability prevents the board from recapturing it by setting a negative wage. Consequently, the marginal *joint* benefit of monitoring is reduced.[11]

We assume that the board and the CEO cannot contract *directly* on the probability that the board will evaluate the CEO (i.e., p). This assumption is consistent with the general perception that it is difficult for outside parties to verify how diligent the board is in its monitoring function (if it were easy for outside parties to verify the board's diligence, presumably the board would contract with the shareholders on this issue). This, however, creates a problem, because the board's private incentive is to choose a level of monitoring greater than that which maximizes *joint* surplus; i.e., the board would choose P^* instead of P^{**}.

The only way for the CEO and board to avoid this problem of too much monitoring is to lower the board's incentives to monitor by raising $\bar{k}$. We interpret the negotiations over $\bar{k}$ as decisions over factors likely to affect the independence of the board, such as board composition (e.g., proportion of insiders versus outsiders), board compensation, and so forth.

We assume that when the board negotiates with the CEO over $\bar{k}$ and w it cares about its utility only; that is, it does *not* consider the new (future) directors' utility in their negotiation.

Let $\bar{k}_0$ denote the collective lack of independence of the *continuing* directors.[12] If

[11] In many ways, the situation is similar to Philippe Aghion and Patrick Bolton's (1987) exclusive-dealing model. There, a retailer (our board) and a monopoly producer (our incumbent CEO) enter into an exclusive-dealing contract because of their concern that an entrant (our replacement CEO) will capture future surplus.

[12] Note the flexibility to change board composition comes from filling *exogenous* vacancies or *adding* directors to the board—no continuing director need leave to realize a change in board composition.

bargaining with the CEO yields a new board with a different lack-of-independence parameter, $\bar{k}_1$, then the *continuing* directors' expected utility is

$$(11)\quad P^*_{\bar{k}=\bar{k}_1}V + (1 - P^*_{\bar{k}=\bar{k}_1})\max\{0, \hat{\alpha}\} - \bar{k}_0 d(P^*_{\bar{k}=\bar{k}_1}) - w.$$

Observe that the equilibrium probability of obtaining a signal, P^*, is a function of the *new* board's lack of independence, $\bar{k}_1$, not the continuing directors' lack of independence, $\bar{k}_0$.

We model the negotiations between the CEO and the board as a Nash bargaining game: the CEO and board agree to the level of independence (i.e., $\bar{k}$) and wage that maximize the product of their surpluses from trade. Provided the limited-liability constraint does not bind, the resulting composition (i.e., $\bar{k}$) will also maximize their joint surplus.[13] Assuming that the CEO has bargaining power is consistent with the institutional literature on boards, which suggests that CEOs, both in the United States and abroad, have considerable say over who is nominated for board positions. It is also consistent with the view that a CEO who has proven himself to be more valuable (in expectation) than any potential replacement should have some degree of bargaining power.

The surplus of the players is the difference between what they expect to receive if an agreement is reached and what they expect to receive if no agreement is reached. If no agreement is reached, the CEO leaves the firm—in which case his utility is 0. The CEO's surplus is, therefore,

$$P^*\Phi(-(Y_c - \hat{\alpha})\sqrt{H})b + (1 - P^*)b + w.$$

If no agreement is reached, the board hires a replacement CEO. Let U_0 be the board's expected utility if it hires a replacement (we will derive its value shortly—see Lemma 2 below). The board's surplus is, thus,[14]

$$P^*V + (1 - P^*)\hat{\alpha} - \bar{k}_0 d(P^*) - w - U_0.$$

Under Nash bargaining, the board and the CEO choose $\bar{k}$ and w to maximize

$$(12)\quad (P^*V(\hat{\alpha}, \tau) + (1 - P^*)\hat{\alpha} - \bar{k}_0 d(P^*) - w - U_0) \times (P^*\Phi(-(Y_c - \hat{\alpha})\sqrt{H})b + (1 - P^*)b + w).$$

To maximize (12), we need to know the value of U_0.

LEMMA 2: *$U_0 = P_0V_0 - \bar{k}_0 d(P_0)$, where V_0 is V evaluated for a new CEO—i.e.,*

$$V_0 = \frac{\sqrt{H}}{\tau_0}\phi(0)$$

—and P_0 solves the equation

$$V_0 - \bar{k}_0 d'(p) = 0;$$

that is, P_0 is the existing board's utility-maximizing level of monitoring of a new CEO. Moreover, the wage paid a replacement CEO is zero.

Intuitively, new CEOs have no bargaining power, since they all have equal expected value. Consequently, the board can set a minimum wage and get its most preferred level of independence, which is to replicate its current level (i.e., $\bar{k}_0$).

Recall our assumption that the board can choose to fire the CEO *prior* to bargaining. It might, at first, seem that the board would fire the incumbent CEO if and only if his estimated ability were less than the estimated ability of

[13] Other bargaining games would yield qualitatively similar results provided the CEO's bargaining power increases with his perceived ability.

[14] The reader will note that we have replaced $\max\{\hat{\alpha}, 0\}$ with $\hat{\alpha}$. As we will show in Proposition 2, any *incumbent* CEO who is not fired prior to bargaining must have an estimated ability greater than zero.

a replacement (i.e., if and only if $\hat{\alpha} < 0$). This is not, however, true:

PROPOSITION 2: *A unique finite cutoff, $A_c > 0$, exists such that an incumbent CEO is fired prior to bargaining if and only if his estimated ability is less than A_c.*

Proposition 2 follows because the right to evaluate a CEO creates a valuable option. The value of this option increases with the prior uncertainty about the CEO (i.e., $1/\tau$). Consequently, its value is greater for a new CEO than for an incumbent CEO. A new CEO is, therefore, more desirable than an incumbent CEO ceteris paribus. So, an incumbent's estimated ability must be strictly greater than a new CEO's if he is to retain his job.

A natural question to ask is whether less-independent boards tolerate worse performance than do more-independent boards; that is, do greater values of $\bar{k}_0$ lead to lower values of A_c. The answer is yes:

PROPOSITION 3: *The minimum estimated ability for the incumbent CEO at which he will be retained, A_c, falls as the board becomes less independent; that is,*

$$\frac{\partial A_c}{\partial \bar{k}_0} < 0.$$

Remark 1: Since $\hat{\alpha}$ is a decreasing function of performance [recall (3)], Proposition 3 implies that CEO dismissals are more sensitive to (negative) firm performance when the board is more independent. As such, Proposition 3 is consistent with the evidence in Weisbach.

Proposition 3 holds because a replacement CEO must be monitored more than an incumbent CEO. The less independent the board (i.e., the greater the board's distaste for monitoring, $\bar{k}_0$), the greater is the cost to such a board from hiring a new CEO because he requires more monitoring. Hence, such a board is more willing to tolerate a mediocre CEO than is a more-independent board (i.e., one with less distaste for monitoring).

Consider, now, bargaining between the board and an incumbent CEO who will be retained (i.e., one for whom $\hat{\alpha} > A_c$). Maximizing (12) with respect to $\bar{k}$ and w yields first-order conditions that are equivalent to

$$(13)\quad (V - \hat{\alpha} - \bar{k}_0 d'(p)) \times (p\Phi b + (1-p)b + w) + (p(V-\hat{\alpha}) + \hat{\alpha} - \bar{k}_0 d(p) - w - U_0) \times (\Phi - 1)b = 0 \text{ and}$$

$$(14)\quad p(V-\hat{\alpha}) + \hat{\alpha} - \bar{k}_0 d(p) - w - U_0 - (p\Phi b + (1-p)b + w) \leq 0.$$

Since $\hat{\alpha} > A_c$, the board's expected utility exceeds U_0, so the second line of (13) is negative. The first line must, therefore, be positive, which implies

$$(15)\quad V - \hat{\alpha} - \bar{k}_0 d'(p) > 0.$$

From the first-order condition for the board's optimal p (8), condition (15) implies that $p < P^*_{\bar{k}=\bar{k}_0}$, which, from Proposition 1, implies $\bar{k} > \bar{k}_0$. We have, thus, established:

PROPOSITION 4: *If the continuing directors choose to retain the CEO, then the new board will have less independence than did the continuing directors (i.e., $\bar{k} > \bar{k}_0$).*

We emphasize the word "continuing" because the new board is less independent only relative to those directors who continue to serve. The proposition does not compare the new board with the previous board (i.e., the continuing *and* departed directors).[15] If, on the

[15] To illustrate this point, consider a hypothetical board with ten directors: five outsiders and five insiders. Suppose that $k_i = k_{\text{out}}$ for the outsiders and $k_i = k_{\text{in}}$ for the insiders, $k_{\text{out}} < k_{\text{in}}$. Suppose, too, that $\bar{k}$ equals the board's average k. This board's average k is $\frac{1}{2}k_{\text{in}} + \frac{1}{2}k_{\text{out}}$. Suppose two insiders depart, then the average k of the *continuing*

other hand, "normal" attrition from the board leads to an average level of independence among the continuing directors that approximates the level of independence of the original board, then Proposition 4 suggests an explanation for the finding that boards become less independent over the career of the CEO (see Hermalin and Weisbach, 1988).

Proposition 4 suggests that corporate governance is subject to a stochastic form of "entropy": in the long run, boards will be relatively ineffective, consistent with the common complaint leveled against them. Proposition 4 is, however, subject to two caveats that potentially affect its interpretation. First, a key assumption behind this result is that the monitoring burden is shared equally by the directors (i.e., each must expend p). If the monitoring burden could be shared unequally—if for instance monitoring was a team production problem such as considered by Holmstrom (1982)—then this entropy result need not hold. Directors would have an incentive to free ride on the diligence of other directors. This in turn would give them an incentive to want new directors with strong proclivities for monitoring (i.e., low k_i's) rather than, as here, the same proclivity they have. In a richer model of board activity, entropy would, then, depend on the degree to which monitoring is a collective activity (as here) versus a private activity (as in a teams problem).

Second, we have assumed away any role for the shareholders, in keeping with the institutional evidence that they rarely play a direct role in either the "normal" selection of directors or the day-to-day operations of the company (see Mace, for example). Proposition 4 serves to emphasize the importance of those occasions when shareholders "break" the entropy through hostile takeovers, proxy fights, or direct negotiations between large shareholders and management.

directors is $^3/_8 k_{in} + {}^5/_8 k_{out}$. Suppose, consistent with Proposition 4, bargaining results in the addition of one insider and one outsider. The new board's average k is $^2/_5 k_{in} + {}^3/_5 k_{out}$. The new board is, therefore, less independent than the continuing directors, but is more independent than the original board.

Whether the bargaining maximizes the board and incumbent CEO's joint surplus depends on whether the limited-liability constraint binds. If it does not bind, then (14) is an equality. Using it, (13) becomes

$$V - \hat{\alpha} - \bar{k}_0 d'(p) - (1 - \Phi)b = 0,$$

which is the first-order condition for maximizing joint surplus (9). If the limited-liability constraint does bind, then (13) is equivalent to

$$V - \hat{\alpha} - \bar{k}_0 d'(p) - (1 - \Phi)\zeta b = 0,$$

where $\zeta < 1$. Consequently, the solution to the problem in which the limited-liability constraint is binding involves more monitoring and, hence, greater board independence than if the constraint is not binding. This establishes:

PROPOSITION 5: *Suppose that the incumbent CEO is retained. If the limited-liability constraint is not binding, then the level of monitoring will maximize the CEO and board's joint surplus. If it is binding, then the level of monitoring will exceed the joint-surplus-maximizing level. Correspondingly, board independence will be greater if the constraint is binding than if it is not binding.*

We also want to know how estimated ability affects the ultimate equilibrium level of scrutiny (the probability of being evaluated) that the CEO will face.

PROPOSITION 6: *The equilibrium probability that the future board evaluates an incumbent CEO who is retained is decreasing with the prior estimate of his ability.*

Remark 2: Given the monotonic relationships between monitoring and board independence and between first-period earnings performance and estimated ability, Proposition 6 implies that performance and the independence of additions to the board should be negatively correlated, which is consistent with Hermalin and Weisbach's (1988) findings.

Propositions 4 and 6 show that history matters in corporate governance; that is, we can

expect some hysteresis. Strong, independent boards will beget stronger, more-independent boards than will weak boards. Consequently, if we follow two firms, A and B, over time, then there is a good probability that we will find A always has a stronger board than B if A initially has the stronger board. Moreover, this could still be true even if B's recent performance is better than A's; indeed, from Proposition 6, better performance by B (i.e., a higher estimate of $\hat{\alpha}$) could actually accentuate the difference between the two boards' relative strength. These results underscore the importance of considering endogeneity in empirical studies of corporate governance and they potentially explain the inconclusive results of MacAvoy et al. and others.

Finally, we consider the relationship between the wage, w, and estimated ability.

PROPOSITION 7: *There exists an* $\tilde{A}, A_c < \tilde{A}$, *such that an incumbent CEO with estimated ability in* $[A_c, \tilde{A}]$ *is paid a wage of zero. There also exists an* $\hat{A}, \tilde{A} < \hat{A} < \infty$, *such that an incumbent CEO's wage is increasing in his estimated ability for estimated abilities in* $[\hat{A}, \infty)$.

For a retained CEO, the relation between his wage and estimated ability (past performance) is initially flat (zero). When the wage is positive, it equals one-half times the difference between the surplus that the board brings to the table and the surplus that the CEO brings. Whether the wage is increasing in estimated ability depends on whose surplus is increasing faster in $\hat{\alpha}$. Since the board's surplus is unbounded but the CEO's is bounded, it must be that the wage is eventually increasing in estimated ability. What we have not been able to establish is how the wage varies with estimated ability between $\tilde{A}$ and $\hat{A}$.[16] Overall, Proposition 7 predicts that the level at which the *non*contingent portion of a CEO's compensation is set should be insensitive to past performance for relatively low levels of past performance, but sensitive at relatively high levels of past performance.

It is worth noting that even if the CEO's wage is nonincreasing in his estimated ability, his overall well-being, $w + (p\Phi + 1 - p)b$, is increasing in his estimated ability.

III. Extensions

A. *The Board Has a Preference for the Incumbent CEO*

It is easy to imagine that the board has a preference for keeping the incumbent CEO. This could be a result of personal loyalty to the CEO—after all, many a directorship is the result of close ties between the CEO and the director (see, e.g., Mace, 1971). Alternatively, an incumbent CEO may take actions to entrench himself.

Let m be the additional value that an incumbent CEO yields the board. If $\hat{\alpha}$ is the board's estimate of his ability, then the board will treat him *as if* his estimated ability were $\hat{\alpha} + m \equiv \tilde{\alpha}$. It follows that the results from the previous section continue to hold, except with $\tilde{\alpha}$ replacing $\hat{\alpha}$. In particular, the next proposition is an immediate corollary of our earlier results.

PROPOSITION 8: *As the additional value that the incumbent CEO yields the board,* m, *rises the following occur:*

(i) the intensity with which the current board monitors the CEO decreases;
(ii) the independence of the future board decreases; and
(iii) the minimum estimated ability for the incumbent CEO at which he will be retained prior to bargaining decreases.

(The three results follow from Propositions 1, 6, and 2, respectively.)

In other words, Proposition 8 simply indicates that the more the board values the incumbent CEO independent of his ability, the less intensely he will be monitored by the board and the lower the standard to which he will held by the board. These results are consistent with the widely held belief that entrenched CEOs or CEOs who have cultivated personal loyalty are less scrutinized and face lower standards.

[16] We have been able to establish it, however, for specific examples. For instance, wage is strictly increasing in estimated ability (above $\tilde{A}$) if $d(p) = \frac{1}{2}p^2$, $\bar{k}_0 = 1$, $\tau = 1$, $\tau_0 = \frac{1}{2}$, $s = 1$, and $b = \frac{1}{4}$.

To the extent m is endogenous, Proposition 8 predicts that a CEO would undertake activities that raise m. An example of such an activity is given by Andrei Shleifer and Robert W. Vishny (1989). They argue that CEOs attempt to reduce the probability that they will be dismissed by making investments that are more profitable under them than any replacement CEO. Even if such investments decrease firm value, a CEO has an incentive to make them because they raise his value vis-à-vis a replacement.

Proposition 8 identifies another cost of entrenchment in addition to Shleifer and Vishny's investment-distortion cost: The more entrenched the CEO is, the less intensely he is monitored. Consequently, the board is less likely to identify problem CEOs who should be dismissed (even if the benefit m must be foregone), which further reduces expected firm value.

This analysis also shows that a CEO is better off with his friends on the board (i.e., people for whom m is positive). A CEO is, therefore, likely to use whatever influence he has to put directors who will be loyal to him on the board and to ensure the loyalty of those already on board.[17] Given this, it is not surprising that boards often become interlocked (see Hallock for evidence).

B. *Effects of Board Action on Share Price*

How is the value of the firm affected by the board's decision to fire or to retain the CEO? We consider the answer at two points: prior to when the board could obtain a signal and after it would have obtained a signal. Without loss of generality, we again assume the incumbent CEO offers no additional benefit to the board (i.e., $m = 0$).

Prior to monitoring, but after the first fire/retain decision, the value of the firm is[18]

$$(16) \qquad P^*V + (1 - P^*)\hat{\alpha}.$$

Since P^* is decreasing in $\hat{\alpha}$ (recall Proposition 1), (16) need not be increasing in $\hat{\alpha}$. If, however, the disutility-of-effort function, $d(\cdot)$, is convex enough, then (16) will be increasing in $\hat{\alpha}$.

LEMMA 3: *If*

$$(17) \quad d(p) \leq d(1) - \frac{d(1) - d(0)}{\log(2)} \log(2 - p) \quad \forall p \in [0, 1],$$

then (16) *is increasing in* $\hat{\alpha}$.

We will henceforth assume that (17) holds.[19]

Let FV equal (16) under an incumbent CEO and let FV_0 equal (16) under a replacement CEO. The probability of realizing a first-period profit such that the CEO is *dismissed* is

$$\Phi\left(\frac{\tau_0 + r}{r} A_c \sqrt{\frac{r\tau_0}{r + \tau_0}}\right),$$

where A_c is the cutoff ability level defined in Proposition 2. Consequently, at the beginning of the game the firm will be worth

$$\mathbb{E}_x\left\{\mathrm{FV} \middle| x_1 \geq \frac{\tau_0 + r}{r} A_c\right\} \times \left(1 - \Phi\left(\frac{\tau_0 + r}{r} A_c \sqrt{\frac{r\tau_0}{r + \tau_0}}\right)\right) + \mathrm{FV}_0 \Phi\left(\frac{\tau_0 + r}{r} A_c \sqrt{\frac{r\tau_0}{r + \tau_0}}\right).$$

[17] For an extreme example see Bryan Burrough and John Helyar's (1990) discussion of the board of RJR-Nabisco.

[18] Our analysis ignores the present discounted value of the firm *beyond* the period considered by our model. This is slightly problematic because, as we argued in Propositions 4 and 6, we should expect hysteresis across CEO regimes. Given, however, the relatively long tenure of CEOs (ten years on average—see, e.g., Hermalin and Weisbach, 1988), this future omitted part of firm value will generally represent a very small portion of the firm's value.

[19] If $d(\cdot)$ is not convex enough, then (16) may be decreasing in $\hat{\alpha}$ over some range of $\hat{\alpha}$. To see this, suppose $d(\cdot)$ were affine. Then there would exist an $\hat{\alpha}^*$ such that $P^* = 1$, for $\hat{\alpha} < \hat{\alpha}^*$ and $P^* = 0$, for $\hat{\alpha} > \hat{\alpha}^*$. Since $V > \hat{\alpha}$, this would imply that (16) must decrease as $\hat{\alpha}$ crosses $\hat{\alpha}^*$.

After the first realization of profits, x_1, the firm's value is

$$x_1 + \chi \mathrm{FV} + (1 - \chi)\mathrm{FV}_0, \tag{18}$$

where

$$\chi = \begin{cases} 1 & \text{if } P^*V + (1 - P^*)\hat{\alpha} - \bar{k}_0 d(P^*) \\ & \quad > U_0 \\ 0 & \text{otherwise} \end{cases}$$

indicates whether the incumbent CEO is retained or fired.

From Section II, subsection D,

$$\mathrm{FV}_{\hat{\alpha}=A_c} - \bar{k}_0 d(P^*_{\hat{\alpha}=A_c}) = \mathrm{FV}_0 - \bar{k}_0 d(P_0) \equiv U_0.$$

Moreover, from Proposition 1, $P^*_{\hat{\alpha}=A_c} < P_0$;[20] hence, $\mathrm{FV}_{\hat{\alpha}=A_c} < \mathrm{FV}_0$. There thus exists an interval of $\hat{\alpha}$'s starting at A_c such that investors would prefer that the CEO be fired, but such that the board would prefer to retain the CEO. Consequently, there is a discontinuous drop in the value of the firm at $\hat{\alpha} = A_c$. Since $\hat{\alpha}$ and x_1 are monotonically related, we can conclude that firm value, expression (18), is increasing for all values of x_1 *except* at

$$x_1 = \frac{\tau_0 + r}{r} A_c,$$

where there is a discontinuous drop in firm value.

We summarize the analysis so far.

PROPOSITION 9: *Higher first-stage profit is positively related to whether the CEO keeps his job. But higher firm value is not monotonically related to whether the CEO keeps his job. Moreover, there is a range of first-stage profits such that investors would prefer that the CEO be fired, while the board prefers to retain him.*

Remark 3: Proposition 9 suggests that earnings (i.e., x_1) should be a better predictor of CEO turnover than share price, which is consistent with the empirical literature (see, e.g., Weisbach or Murphy and Zimmerman).

Proposition 9 and the discussion preceding it indicates that a tension can exist between investors and directors over whether the CEO should be fired, with the investors preferring to fire and the directors preferring to retain. This provides an explanation for the common phenomenon of investors seeming more eager than the board to dismiss management. It can also explain why takeovers and other costly control contests can be worth mounting.

Now we turn to the stock reaction when the board bases its fire/retain decision on its private signal. If the board fires the CEO, then the expected value of *future* cash flows is zero. Prior to evaluation, the expected value of future cash flows is positive. It follows, therefore, that:

PROPOSITION 10: *The firm's stock price falls if the CEO is fired on the basis of the board's private information.*

Finally, suppose $\bar{k}$ is *not* known to investors. Ignorance of $\bar{k}$ does not change Proposition 10, so we will focus on what happens when the board fires the CEO based on public information. For any value of $\bar{k}$ if the board wants to fire the CEO, investors would also want the CEO fired. If we imagine a distribution over $\bar{k}$ such that it is uncertain whether the board will fire the CEO for a given level of first-stage profits, then firing the CEO will be considered good news by investors and will cause the stock price to rise. The stock price will also rise because firing the CEO signals that the board is relatively more independent than was anticipated and will, thus, monitor more intensely. This yields:

PROPOSITION 11: *Suppose that the board's independence is unknown to investors. Then the firm's stock price rises if the CEO is fired on the basis of public information.*

[20] Recall P_0 is the optimal intensity of monitoring for a replacement CEO.

Remark 4: Our result that the stock price reaction to a CEO dismissal differs depending on whether the board used public or private information is consistent with, and could even explain, the ambiguous relation between CEO dismissal and stock price reaction found in event studies of CEO turnover. See Warner et al. for a survey of these studies and a similar explanation for their inconclusive findings.

IV. A Nonbargaining Interpretation

A potential concern is the realism of the bargaining game and the extent to which our results depend on it. Hence, it is worth reinterpreting the model in a way that does not depend on bargaining.

In this interpretation, the timing is the same, except that the bargaining stage, stage 4, no longer exists. We also want to reinterpret stage 5: Let

$$p(V - \hat{\alpha}) + \hat{\alpha} - \bar{k}d(p)$$

be the firm's expected profit; where, now, $\bar{k}d(p)$ is the cost of monitoring. We now interpret $\bar{k}$ to be a cost parameter known to the firm's decision makers, but possibly unknown to investors.

We assume, now, that a board's level of monitoring, p, is an intrinsic attribute of the board. In particular, it is invariant with respect to $\hat{\alpha}$ or other parameters. Boards that monitor more—have a higher p—are more costly for the firm than boards that monitor less—have a lower p. That is, $d'(p) > 0$. We assume, additionally, that this *marginal* cost is also increasing in p (i.e., $d''(p) > 0$).[21]

[21] For example, there could be benefits to having inside directors on the board (perhaps to groom them as potential successors to the CEO—see Richard F. Vancil [1987] on this point) or less-intensely-monitoring outside directors (perhaps because they bring needed expertise to the firm). These benefits are increasing in the number of such directors, but with diminishing marginal returns. When these directors are seen as the opportunity cost of more-intensely-monitoring outside directors, we have $d'(p) > 0$ and $d''(p) > 0$.

We can now reinterpret Proposition 1 as a statement about board composition and the underlying parameters.

COROLLARY 1: *Under the alternative interpretation of this section, the level of board independence, p, is*

(i) decreasing with the prior estimate of the CEO's ability, $\hat{\alpha}$;
(ii) decreasing with the precision of the prior estimate, τ; but
(iii) increasing with the precision of the signal, s.

Observe that Corollary 1(i) and (ii) are substitutes for Proposition 4 (surviving CEOs have easier boards), while Corollary 1(i) is a substitute for Proposition 6 (board independence is decreasing with estimated CEO ability).

Propositions 2 and 3 continue to hold under this alternative interpretation (although Proposition 3 has little economic meaning). The loyalty-entrenchment result, Proposition 8, continues to hold under this alternative interpretation. Likewise, provided $\bar{k}$ is unknown to investors, the share-price results, Propositions 9–11, also continue to hold under this alternative interpretation.

Most of our results are, therefore, not dependent on the existence of a bargaining stage. Rather they are driven by combining a matching model, similar to Jovanovic's, with endogenous monitoring. Bargaining enables us to address the central enigma, set forth by Berle and Means and others, of how a seemingly inefficient institution has survived. In particular, it serves to explain how, why, and when CEOs have a say over who serves on the board. It also serves to explain how, despite this say, the board can still provide a valuable monitoring role.

V. Policy Implications of the Model

As corporate governance has remained essentially the same since the days of Berle and Means, so too have the criticisms and proposed reforms of it. For example, Lipton and Lorsch call for a number of changes, including a smaller board (to reduce free-riding), for

more outsiders, more meetings, director pay linked to stock performance, and appointment of a "lead" director (if not the chairman) who is separate from the CEO.[22] These policies, in Lipton and Lorsch's view, would lead to better monitoring of the CEO.

In the context of our model, each element of the Lipton and Lorsch proposal serves to reduce the $\bar{k}$ of the board. For example, stock-based incentives lower the k_i's of all directors, while replacing high-k insiders with lower-k outsiders lowers average k. At first glance, one might think that efforts to lower the board's $\bar{k}$ through regulation or political pressure would lead to more effective monitoring.

This argument, however, ignores the nature of the equilibrium in the model. The CEO and board bargain over the *effective* $\bar{k}$, which takes account of all incentives that potential directors will have while they are on the board. As long as the bargaining process is itself unaffected by reforms, the equilibrium $\bar{k}$ will be little affected.

It follows that we need to distinguish between those policies that will affect the bargaining process and those that will not. For instance, requiring a specified fraction of the board to be outsiders would result in an outsider-dominated board, but not necessarily one that is more independent than the insider-dominated board that would otherwise prevail—the CEO and board members will have latitude in the selection process to offset whatever benefits are created by exogenously imposed "independence."[23] On the other hand, the model suggests that requiring incentive pay for directors could have an effect: By lowering $\bar{k}_0$, this requirement would affect the bargaining, leading to more independent boards and greater monitoring (see Proposition 6). Moreover, because of hysteresis, these benefits can persist—although entropy could lead them to diminish over time.

Of course this analysis begs the question of why corporations do not voluntarily adopt effective reforms such as this. One answer is that just as the board and the CEO negotiate over board composition, they would also negotiate over the implementation of reforms. Provided his past success gave him sufficient bargaining power, the CEO would be able to block or blunt such reforms.[24]

VI. Concluding Remarks

A recent *Harvard Business Review* "Perspectives Section" provides some insight into the realism of our model (Smale et al.). John Smale, who became the nonexecutive chairman of General Motors following Robert Stempel's forced resignation, describes policies adopted by the GM board that have dramatically improved its effectiveness. In contrast, Alan Patricof, a leading venture capitalist, argues: "Deep down [CEOs] really wish they didn't have boards. That's why, at the end of the day, most independent directors get neutralized in one fashion or another (Smale et al., p. 8)." A model of corporate governance should be consistent with both perspectives; it should explain both how some boards are active monitors of management, yet how some CEOs are able to avoid scrutiny.

By studying the determinants of board composition as a bargaining process, our model is consistent with both active monitoring in some firms and CEO dominance in others. The process by which GM acquired a strong board is illustrative of the model's logic: The company had a crisis induced by poor profits and the

[22] This proposal is fairly representative of the many governance reforms that have been proposed by the business press, academics, and business people themselves (see American Law Institute, 1982; Jensen, 1993; John G. Smale et al., 1995). See, too, Brickley et al. (1997) for a discussion and evidence on one of these potential reforms, the separation of the CEO and chairman's positions.

[23] Since an outsider is simply someone with no other ties to the corporation, it is hard to imagine that high-k outsiders could not be found (e.g., through interlocking boards).

[24] An additional prediction of our analysis is that new firms or those with weak CEOs (i.e., firms less subject to the agency problems considered here) will be the first to adopt reforms.

board was forced to act. The new CEO had no bargaining power and, thus, had to contend with an active board. None of this would have happened had the previous managers performed better; they would have maintained their jobs and their control over the board. Subsequently, after a period of good performance, GM went back to a more traditional arrangement of have the CEO also serve as chairman (*Wall Street Journal,* December 5, 1995 p. B1).

The model is consistent with a number of empirical regularities: CEO turnover is negatively related to performance and this relation is stronger when the board is more independent. The probability that independent directors are added to the board increases following poor corporate performance. And boards tend to become less independent over the course of the CEO's career. The model also explains why management turnover is more related to earnings than to stock returns. Finally, the model provides insight into the effectiveness of various policies designed to enhance the board's monitoring.

Despite the model's consistency with existing empirical evidence, a number of directions for future research remain. One is to model the board's operation in greater detail. For instance, we have assumed that the board chooses a common intensity of monitoring, p. What we have not considered is how the board implements this choice. For instance, does p represent the collective output of the board (e.g., what it does at board meetings) or is it an aggregate of individual directors' efforts (e.g., carefully reading reports prior to board meetings)? If it is the second, to what extent is the board able to overcome the problem of free-riding endemic to team production (see, e.g., Holmstrom, 1982)? Once free-riding among directors is an issue, the dynamics of board composition become more complicated. For example, the continuing directors can reduce their own workloads by adding very independent directors (i.e., low-k directors) to the board. This, in turn, could offset the entropy prediction of Proposition 4.

For example, unlike most American companies, a German or Japanese company typically has strong ties to one particular bank and representatives of this bank usually serve on the company's board.[25] These representatives presumably have a strong interest in the company's well-being.[26] The diligence of the rest of the board is unclear; free-riding considerations would tend to reduce their effectiveness, while the bank representatives have incentives to ensure that directors be selected who will be less likely to free ride. Similar issues could be expected to arise in family-owned firms in the United States.

One limitation of our model is that it focuses solely on the monitoring role of boards. The institutional literature (see, e.g., Mace or Vancil) emphasizes that boards also play important roles providing information and advice to management, and serving as a training ground for future CEOs. A richer model of boards should take into account these roles as well. To the extent they represent opportunity costs of monitoring [make $d'(p) > 0$], these other roles complement our analysis.

Our model could also be extended to investigate the transition from an entrepreneurial firm to a managerial firm. In this transition, an entrepreneur (or his or her venture capital firm) has an incentive to maximize the value of the firm by minimizing the impact of the entropy problem.

A last topic for future research would be to consider noncorporate situations where boards play a monitoring role. For example, universities, trusts, and other nonprofit institutions all have bodies that function much like corporate boards of directors. Much of the analysis presented above would seem equally applicable to these boards, but as with international comparisons further work is worth pursuing.[27]

[25] See Kaplan (1994a, b) for recent evidence on the effects of these banking relationships on corporate governance in Germany and Japan.

[26] Although it should be remembered that such directors are themselves agents (of the bank), which could create a second set of agency problems. Despite this, it is still reasonable to expect these directors to be more concerned about the firm's profits than other directors.

[27] See William G. Bowen (1994) for a discussion of the differences between profit and nonprofit boards.

APPENDIX: PROOFS

PROOF OF LEMMA 1:

$$\frac{\partial V}{\partial \hat{\alpha}} = \Phi + \hat{\alpha}\phi\sqrt{H} + \frac{H}{\tau}(Y_c - \hat{\alpha})\phi\sqrt{H}\left(\text{note } \frac{\partial V}{\partial Y_c} = 0\right)$$

$$= \Phi > 0\left(\text{recall } H = \frac{s\tau}{\tau + s} \quad \text{and} \quad Y_c - \hat{\alpha} = -\frac{\tau + s}{s}\hat{\alpha}\right).$$

Consequently,

$$\frac{\partial(V - \hat{\alpha})}{\partial \hat{\alpha}} = \Phi - 1 < 0.$$

PROOF OF PROPOSITION 1:

Let Ω be the expression to be maximized in (7). Consider (i), if $\hat{\alpha} \geq 0$, then:

$$\frac{\partial^2 \Omega}{\partial \hat{\alpha}\partial p} = \frac{\partial[V - \hat{\alpha}]}{\partial \hat{\alpha}} < 0 \text{ by Lemma 1,}$$

so, by the usual comparative statics, $\partial P^*/\partial \hat{\alpha} < 0$. Similarly,

$$\frac{\partial^2 \Omega}{\partial \bar{k}\partial p} = -d'(p) < 0; \text{ and } \frac{\partial^2 \Omega}{\partial \tau \partial p} = \frac{\partial V}{\partial \tau} = \left(-1 + \frac{1}{2}\frac{s}{s + \tau}\right)\frac{\sqrt{H}}{\tau^2}\phi < 0$$

(where the second result uses the fact that $\partial V/\partial Y_c = 0$). Hence, $\partial P^*/\partial \bar{k} < 0$ and $\partial P^*/\partial \tau < 0$. Finally,

$$\frac{\partial^2 \Omega}{\partial s \partial p} = \frac{\partial V}{\partial s} = \frac{\tau}{2(\tau + s)^2\sqrt{H}}\phi > 0,$$

so, by the usual comparative statics, $\partial P/\partial s > 0$.

PROOF OF LEMMA 2:

Consider bargaining with a new CEO. If this bargaining is unsuccessful, the board can hire yet another CEO. Hence, from (12), bargaining entails maximizing

$$(P^*V_0 - \bar{k}_0 d(P^*) - w - U_0) \times ((P^*\Phi + 1 - P^*)b + w)$$

with respect to $\bar{k}$ and w. Given the monotonic relationship between P^* and $\bar{k}$ (Proposition 1) we can equivalently maximize this product in P^* and w. The first-order conditions are

$$\text{(A1)} \quad (V_0 - \bar{k}_0 d'(P^*)) \times ((P^*\Phi + 1 - P^*)b + w) + (P^*V_0 - \bar{k}_0 d(P^*) - w - U_0) \times (\Phi - 1)b = 0 \quad \text{and}$$

$$\text{(A2)} \quad P^*V_0 - \bar{k}_0 d(P^*) - w - U_0 \cdot - ((P^*\Phi + 1 - P^*)b + w) \leq 0.$$

In equilibrium, $P^*V_0 - \bar{k}_0 d(P^*) - w = U_0$—one new CEO yields the board the same utility as another new CEO. It follows, then, from (A2) that $w = 0$. Plugging that back into (A1) yields

$$V_0 - \bar{k}_0 d'(P^*) = 0.$$

This is the first-order condition (8). Since P^* is monotonic in $\bar{k}$, the solution to the Nash bargaining game is therefore $\bar{k}_1 = \bar{k}_0$.

PROOF OF PROPOSITION 2:

Let U^E equal the equilibrium expected utility of the board if it bargains with the incumbent CEO. Since $P^*_{\bar{k}=\bar{k}_0}$ is the board's most preferred level of monitoring, we know

$$\text{(A3)} \quad U^E \leq P^*_{\bar{k}=\bar{k}_0}V + (1 - P^*_{\bar{k}=\bar{k}_0}) \times \max\{0, \hat{\alpha}\} - \bar{k}_0 d(P^*_{\bar{k}=\bar{k}_0}).$$

Using the envelope theorem, it is readily shown that the right-hand side of (A3) is increasing in $\hat{\alpha}$. Moreover, as $\hat{\alpha}$ goes to infinity, the right-hand side of (A3) also goes to infinity. Differentiating the right-hand side of (A3) with respect to τ using the envelope theorem yields

$$\text{(A4)} \quad P^*_{\bar{k}=\bar{k}_0}\left[-1+\frac{1}{2}\frac{s}{\tau+s}\right]\frac{\sqrt{H}}{\tau^2}\phi<0$$

(the option value is decreasing with the precision with which the CEO's ability is estimated). Suppose, now, that $\hat{\alpha}=0$. It follows from (4) and (A4) that

$$\text{(A5)} \quad P^*_{\bar{k}=\bar{k}_0}V-\bar{k}_0 d(P^*_{\bar{k}=\bar{k}_0}) < P_0V_0-\bar{k}_0 d(P_0)$$

$$\text{(A6)} \quad = U_0.$$

Combining (A3) and (A6) establishes that $A_c>0$. Since the right-hand side of (A3) is continuous and increasing without bound but is less than U_0 for an estimated ability of 0, it follows that A_c exists and is unique.

PROOF OF PROPOSITION 3:

In the proof of Proposition 2, we established that

$$\text{(A7)} \quad P^*_{\bar{k}=\bar{k}_0}(V_{\hat{\alpha}=A_c}-A_c)+A_c-\bar{k}_0 d(P^*_{\bar{k}=\bar{k}_0})-U_0=0$$

for all $\bar{k}_0$. Since (A7) holds for all $\bar{k}_0$, it is an identity. Differentiating (A7) with respect to $\bar{k}_0$ using the envelope theorem yields

$$\text{(A8)} \quad [P^*\Phi+1-P^*]\frac{\partial A_c}{\partial \bar{k}_0}-d(P^*_{\bar{k}=\bar{k}_0})+d(P_0)=0.$$

From Proposition 1, $P^*_{\bar{k}=\bar{k}_0}<P_0$. Hence, since $d(\cdot)$ is an increasing function, it follows from (A8) that $\partial A_c/\partial \bar{k}_0<0$.

PROOF OF PROPOSITION 6:

There are two cases to consider: (i) the limited-liability constraint is binding ($w=0$) and (ii) it is not binding. Begin with case (i): From Proposition 1, the probability that the CEO is monitored is monotonic in $\bar{k}$, so maximizing (12) with respect $\bar{k}$ is equivalent to maximizing

$$\text{(A9)} \quad (pV(\hat{\alpha},\tau)+(1-p)\hat{\alpha}-\bar{k}_0 d(p)-U_0)\times(p\Phi+1-p)$$

with respect to p (since the CEO will be retained, we know $\hat{\alpha}>0$). Define Ψ to equal (A9). By well-known comparative statics results, it is sufficient to show $\partial^2\Psi/\partial\hat{\alpha}\partial p$ is negative:

$$\text{(A10)} \quad \frac{\partial^2\Psi}{\partial\hat{\alpha}\partial p}=2p(\Phi-1)^2+2(\Phi-1)+\frac{\partial\Phi}{\partial\hat{\alpha}}p[V-\hat{\alpha}-\bar{k}_0 d'(p)]+\frac{\partial\Phi}{\partial\hat{\alpha}}[p(V-\hat{\alpha})+\hat{\alpha}-\bar{k}_0 d(p)-U_0].$$

Using the first-order condition for (A9), (A10) can be rewritten as

$$\frac{\partial^2\Psi}{\partial\hat{\alpha}\partial p}=2p(\Phi-1)^2+2(\Phi-1)+\frac{\partial\Phi}{\partial\hat{\alpha}}\frac{V-\hat{\alpha}-\bar{k}_0 d'(p)}{1-\Phi}.$$

Hence, we have

$$\text{(A11)} \quad \frac{\partial^2\Psi}{\partial\hat{\alpha}\partial p}<2(\Phi-1)^2+2(\Phi-1)+\frac{\partial\Phi}{\partial\hat{\alpha}}\frac{V-\hat{\alpha}}{1-\Phi}.$$

We will now show that the right-hand side of (A11) is negative. Note, first, that

$$\frac{\partial \Phi}{\partial \hat{\alpha}} = \sqrt{H}\left(\frac{\tau + s}{s}\right)\phi\left(\sqrt{H}\left(\frac{\tau + s}{s}\right)\hat{\alpha}\right).$$

Next, make the substitution

$$z = \sqrt{H}\left(\frac{\tau + s}{s}\right)\hat{\alpha} \tag{A12}$$

and use (6) to rewrite the right-hand side of (A11) as

$$2(\Phi(z) - 1)^2 + 2(\Phi(z) - 1) + \sqrt{H}\left(\frac{\tau + s}{s}\right)\phi(z)\left(-\frac{zs}{(\tau + s)\sqrt{H}} + \frac{\phi(z)\sqrt{H}}{(1 - \Phi(z))\tau}\right).$$

Simplifying, this reduces to

$$2(\Phi(z) - 1)^2 + 2(\Phi(z) - 1) - z\phi(z) + \frac{\phi(z)^2}{1 - \Phi(z)}. \tag{A13}$$

Straightforward calculations reveal that this last expression is negative for all $z \geq 0$ (and, hence, for all $\hat{\alpha} \geq 0$). So the right-hand side of (A11) is negative, which, from (A11), entails

$$\frac{\partial^2 \Psi}{\partial \hat{\alpha} \partial p} < 0.$$

Now consider case (ii). From Proposition 5, the level of monitoring satisfies (10):

$$V - \hat{\alpha} - \bar{k}_0 d'(p) - (1 - \Phi)b = 0. \tag{A14}$$

Let Ω be the left-hand side of (A14). The result follows if $\partial\Omega/\partial\hat{\alpha} < 0$.

$$\begin{aligned}\frac{\partial \Omega}{\partial \hat{\alpha}} &= \Phi - 1 + b\frac{\partial \Phi}{\partial \hat{\alpha}} \\ &= \Phi - 1 + \frac{\partial \Phi}{\partial \hat{\alpha}}\frac{V - \hat{\alpha} - \bar{k}_0 d'(p)}{1 - \Phi} \qquad \text{(A15)} \\ &< \Phi - 1 + \frac{\partial \Phi}{\partial \hat{\alpha}}\frac{V - \hat{\alpha}}{1 - \Phi}\end{aligned}$$

where (A15) follows from (A14). Using the z-transformation, we have

$$\frac{\partial \Omega}{\partial \hat{\alpha}} < \Phi(z) - 1 - z\phi(z) + \frac{\phi(z)^2}{1 - \Phi(z)}.$$

Straightforward calculations reveal that this last expression is negative for all $z \geq 0$ (and, hence, for all $\hat{\alpha} \geq 0$).

PROOF OF PROPOSITION 7:

Consider $\tilde{A}$ first. From (14), $w = 0$ if

$$[p(V - \hat{\alpha}) + \hat{\alpha} - \bar{k}_0 d(p) - U_0] - [p\Phi b + (1 - p)b] < 0.$$

At $\hat{\alpha} = A_c$, the first bracketed term is zero, while the second is strictly positive. The existence of $\tilde{A}$ then follows from continuity.

Turn to $\hat{A}$. If $w > 0$, then

$$2w = [p(V - \hat{\alpha}) + \hat{\alpha} - \bar{k}_0 d(p) - U_0] - [p\Phi b + (1 - p)b].$$

The first bracketed term increases without limit in $\hat{\alpha}$, while the second has an upper bound of b. It follows then that beyond a certain level, $\hat{A}$, that w must be increasing in $\hat{\alpha}$.

PROOF OF LEMMA 3:

From Proposition 2, we know $\hat{\alpha} \geq A_c > 0$ or $\hat{\alpha} = 0$. Differentiate (16) with respect to $\hat{\alpha}$:

$$1 + P^*(\Phi - 1) + (V - \hat{\alpha})\frac{dP^*}{d\hat{\alpha}}.$$

From (8), this can be rewritten as

$$1 + P^*(\Phi - 1) + \bar{k}d'(P^*)\frac{dP^*}{d\hat{\alpha}}.$$

Also from (8), it is readily shown that

$$\frac{dP^*}{d\hat{\alpha}} = \frac{\Phi - 1}{\bar{k}d''(P^*)}.$$

So (16) is increasing in $\hat{\alpha}$ if

$$\text{(A16)} \quad 1 + (\Phi - 1)\left(P^* + \frac{d'(P^*)}{d''(P^*)}\right) \geq 0.$$

Since $\hat{\alpha} \geq 0$, $\Phi \geq {}^1/_2$, so (A16) holds if

$$\text{(A17)} \qquad 2 \geq P^* + \frac{d'(P^*)}{d''(P^*)}.$$

Define $\bar{d}(p)$ to equal the right-hand side of (17). It is readily shown that

$$p + \frac{\bar{d}'(p)}{\bar{d}''(p)} = 2,$$

so (A17) follows if $d'(p)/d''(p) \leq \bar{d}'(p)/\bar{d}''(p)$. By (17), $d(\cdot)$ is more convex than $\bar{d}(\cdot)$. By adapting a well-known result on when one individual will have a greater Arrow-Pratt measure of absolute risk aversion than another individual (see, e.g., Chi-fu Huang and Robert H. Litzenberger, 1988 p. 29), it readily follows that $d'(p)/d''(p) \leq \bar{d}'(p)/\bar{d}''(p)$ for all $p \in [0, 1]$.

REFERENCES

Aghion, Philippe and Bolton, Patrick. "Contracts as a Barrier to Entry." *American Economic Review*, June 1987, *77*(3), pp. 388–401.

Agrawal, Anup and Knoeber, Charles R. "Firm Performance and Mechanisms to Control Agency Problems between Managers and Shareholders." *Journal of Financial and Quantitative Analysis*, September 1996, *31*(3), pp. 377–97.

American Law Institute. *Principles of corporate governance and structure: Restatement and recommendations*. American Law Institute, Tenetative Draft No. 1, 1982.

Baysinger, Barry D. and Butler, Henry N. "Corporate Governance and the Board of Directors: Performance Effects of Changes in Board Composition." *Journal of Law, Economics and Organization*, Spring 1985, *1*(1), pp. 101–24.

Berle, Adolph A. and Means, Gardiner C. *The modern corporation and private property*. New York: MacMillan, 1932.

Bhagat, Sanjai and Black, Bernard. "Do Independent Directors Matter?" Working paper, Columbia University, 1996.

Booth, James R. and Deli, Daniel N. "Factors Affecting the Number of Outside Directorships Held by CEOs." *Journal of Financial Economics*, January 1996, *40*(1), pp. 81–104.

Borokhovich, Kenneth A.; Parrino, Robert P. and Trapani, Teresa. "Outside Directors and CEO Selection." *Journal of Financial and Quantitative Analysis*, September 1996, *31*(3), pp. 337–55.

Bowen, William G. *Inside the boardroom: Governance by directors and trustees*. New York: Wiley, 1994.

Brickley, James A.; Coles, Jeffrey L. and Jarrell, Gregg A. "The Leadership Structure of the Corporation: Separating the Positions of CEO and Chairman of the Board." *Journal of Corporate Finance*, June 1977, *3*(3), pp. 189–220.

Brickley, James A.; Coles, Jeffrey L. and Terry, Rory L. "Outside Directors and the Adoption of Poison Pills." *Journal of Financial Economics*, June 1994a, *35*(3), pp. 371–90.

_____. "Appendix to Accompany 'Outside Directors and the Adoption of Poison Pills'." Working paper, Arizona State University, 1994b.

Brickley, James A. and James, Christopher M. "The Takeover Market, Corporate Board Composition, and Ownership Structure: The Case of Banking." *Journal of Law and Economics*, April 1987, *30*(1), pp. 161–80.

Brown, William and Maloney, Michael T. "Acquisition Performance and Corporate Board Composition." Working paper, Clemson University, 1992.

Burrough, Bryan and Helyar, John. *Barbarians at the gate*. New York: Harper and Row, 1990.

Byrd, John W. and Hickman, Kent A. "Do Outside Directors Monitor Managers? Evidence from Tender Offer Bids." *Journal of Fi-*

nancial Economics, October 1992, *32*(2), pp. 195–221.

Cotter, James F.; Shivdasani, Anil and Zenner, Marc. "Do Independent Directors Enhance Target Shareholder Wealth during Tender Offers?" *Journal of Financial Economics*, February 1997, *43*(2), pp. 195–218.

Coughlan, Anne T. and Schmidt, Ronald M. "Executive Compensation, Managerial Turnover, and Firm Performance: An Empirical Investigation." *Journal of Accounting and Economics*, April 1985, *7*(1/2/3), pp. 43–66.

DeAngelo, Harry and DeAngelo, Linda. "Proxy Contests and the Governance of Publicly Held Corporations." *Journal of Financial Economics*, June 1989, *23*(1), pp. 29–60.

DeGroot, Morris H. *Optimal statistical decisions*. New York: McGraw-Hill, 1970.

Demb, Ada and Neubauer, F.-Friedrich. *The corporate board*. Oxford: Oxford University Press, 1992.

Fama, Eugene F. "Agency Problems and the Theory of the Firm." *Journal of Political Economy*, April 1980, *88*(2), pp. 288–307.

Fama, Eugene F. and Jensen, Michael C. "Separation of Ownership and Control." *Journal of Law and Economics*, June 1983, *26*(2), pp. 301–26.

Gertner, Robert and Kaplan, Steven N. "The Value-Maximizing Board." Working paper, University of Chicago, 1997.

Hallock, Kevin. "Reciprocally Interlocking Boards of Directors and Executive Compensation." *Journal of Financial and Quantitative Analysis*, September 1997, *32*(3), pp. 331–44.

Hermalin, Benjamin E. and Weisbach, Michael S. "The Determinants of Board Composition." *Rand Journal of Economics*, Winter 1988, *19*(4), pp. 589–606.

_____. "The Effects of Board Composition and Direct Incentives on Firm Performance." *Financial Management*, Winter 1991, *20*(4), pp. 101–12.

Hirshleifer, David and Thakor, Anjan V. "Managerial Performance, Boards of Directors, and Takeover Bidding." *Journal of Corporate Finance*, March 1994, *1*(1), pp. 63–90.

Holmstrom, Bengt. "Moral Hazard in Teams." *Bell Journal of Economics*, Autumn 1982, *13*(2), pp. 324–40.

_____. "Managerial Incentive Problems—A Dynamic Perspective." Working paper, Northwestern University, 1993.

Huang, Chi-fu and Litzenberger, Robert H. *Foundations for financial economics*. Amsterdam: North-Holland, 1988.

Jensen, Michael C. "The Modern Industrial Revolution, Exit, and the Failure of Internal Control Systems." *Journal of Finance*, July 1993, *48*(3), pp. 831–80.

Jensen, Michael C. and Murphy, Kevin J. "Performance Pay and Top-Management Incentives." *Journal of Political Economy*, April 1990, *98*(2), pp. 225–64.

Jovanovic, Boyan. "Job Matching and the Theory of Turnover." *Journal of Political Economy*, October 1979, *87*(5), pp. 972–90.

Kaplan, Steven N. "Top Executives, Turnover, and Firm Performance in Germany." *Journal of Law, Economics and Organization*, April 1994a, *10*(1), pp. 142–59.

_____. "Top Executive Rewards and Firm Performance: A Comparison of Japan and the United States." *Journal of Political Economy*, June 1994b, *102*(3), pp. 510–46.

Kaplan, Steven N. and Reishus, David. "Outside Directorships and Corporate Performance." *Journal of Financial Economics*, October 1990, *27*(2), pp. 389–410.

Kini, Omesh; Krakaw, William and Mian, Shehzad. "Corporate Takeovers, Firm Performance, and Board Composition." *Journal of Corporate Finance*, April 1994, *1*(3/4), pp. 383–412.

Klein, April. "Firm Productivity and Board Committee Structure." *Journal of Law and Economics*, 1998 (forthcoming).

Lipton, Martin and Lorsch, Jay W. "A Modest Proposal for Improved Corporate Governance." *Business Lawyer*, November 1992, *48*(1), pp. 59–77.

Lorsch, Jay W. and MacIver, Elizabeth. *Pawns or potentates: The reality of America's corporate boards*. Boston: Harvard Business School Press, 1989.

MacAvoy, Paul; Cantor, Scott, Jr.; Dana, James D. and Peck, Sarah. "ALI Proposals for Increased Control of the Corporation by the Board of

Directors: An Economic Analysis." *Statement of the business roundtable on the American Law Institute's proposed principles of corporate governance and structure: Restatement and recommendations*. New York: Business Roundtable, 1983.

Mace, Myles L. *Directors: Myth and reality*. Boston: Harvard Business School Press, 1971.

Mayers, David; Shivdasani, Anil and Smith, Clifford. "Board Composition in the Life Insurance Industry." *Journal of Business*, January 1997, *70*(1), pp. 33–62.

Murphy, Kevin J. and Zimmerman, Jerold L. "Financial Performance Surrounding CEO Turnover." *Journal of Accounting and Economics*, January/April/July 1993, *16*(1/2/3), pp. 273–315.

Noe, Thomas H. and Rebello, Michael. "The Design of Corporate Boards: Composition, Factions, and Turnover." Working paper, Georgia State University, 1996.

Roe, Mark. *Strong managers, weak owners: The political roots of American corporate finance*. Princeton, NJ: Princeton University Press, 1994.

Rosenstein, Stuart and Wyatt, Jeffrey G. "Outside Directors, Shareholder Independence, and Shareholder Wealth." *Journal of Financial Economics*, August 1990, *26*(2), pp. 175–92.

Shivdasani, Anil. "Board Composition, Ownership Structure, and Hostile Takeovers." *Journal of Accounting and Economics*, January/April/July 1993, *16*(1/2/3), pp. 167–98.

Shleifer, Andrei and Vishny, Robert W. "Management Entrenchment: The Case of Manager-Specific Investments." *Journal of Financial Economics*, November 1989, *25*(1), pp. 123–39.

Smale, John G.; Patricof, Alan J.; Henderson, Denys; Marcus, Bernard and Johnson, David W. "Redraw the Line between the Board and the CEO." *Harvard Business Review*, March/April 1995, *73*(2), pp. 5–12.

Stigler, George J. and Friedland, Claire. "The Literature of Economics: The Case of Berle and Means." *Journal of Law and Economics*, June 1983, *26*(2), pp. 237–68.

Vancil, Richard F. *Passing the baton: Managing the process of CEO succession*. Boston: Harvard Business School Press, 1987.

***Wall St. Journal*.** "GM Decides One Head Is Better Than Two." December 5, 1995, p. B1.

Warner, Jerold B.; Watts, Ross L. and Wruck, Karen H. "Stock Prices and Top-Management Changes." *Journal of Financial Economics*, January/March 1988, *20*(1/2), pp. 461–92.

Warther, Vincent A. "Board Effectiveness and Board Dissent: A Model of the Board's Relationship to Management and Shareholders." Working paper, University of Michigan, 1994.

Weisbach, Michael S. "Outside Directors and CEO Turnover." *Journal of Financial Economics*, January/March 1988, *20*(1/2), pp. 431–60.

Yermack, David. "Higher Valuation of Companies with a Small Board of Directors." *Journal of Financial Economics*, February 1996, *40*(2), pp. 185–212.