Bargaining Within the Corporate Firm: Why There is Too Much Inertia*

Meg A. Sato†

Jan 07, 2009

Abstract

Even if one of the Nash bargaining players may be replaced with a new player after the bargaining stage with a certain probability, the players involved in the bargaining maximize their expected utilities without internalizing the potential newcomer's welfare. In other words, the expected utility of the potential newcomer can be considered as a leakage from the whole group. This paper argues that one important example of this kind of decision making is the decision regarding CEO replacement. CEO replacement involves the board monitoring of the CEOs and the CEO succession policy, which is in regards to the inside promotion or the outside recruiting of the new CEO when the incumbent CEO is fired. I show that the inefficient retention of the CEO may occur when the incumbent CEO and the incumbent directors negotiate. Furthermore, I show that the equilibrium succession policy may depart from the optimum succession policy, the latter of which is the optimum from the shareholders' perspective.

Keywords: Corporate Governance; CEO Succession Policy; Board Monitoring; Incumbent CEO; Nash Bargaining

JEL Codes: G30, D79, K22

*An earlier version of this paper was titled "A Theory of CEO Replacement."

†University of Tokyo, Tokyo, Japan. University of Southern California (2008-2009), Los Angeles, CA, USA. E-mail: meg.a.sato@gmail.com Tel: +1.213.821.3631 I would like to thank Hideshi Itoh, Kazuya Kamiya, and Richard A. Braun for their invaluable advice and their constructive comments from the early stages of my research. I am also truly grateful to Ricardo Alonso, Harrison Cheng, Keiichi Kubota, and Hiroshi Osano for their very helpful comments. I acknowledge the financial support from Japan Society for the Promotion of Sciences (JSPS). I would also like to thank Yuk-fai Fong, Bard Harstad, Jin Li, and all the participants at the Economic Theory Seminar and Game Theory 604 at the Economics Department, University of Southern California, Microeconomics Workshop at Tokyo University, and Contract Theory Workshop East at Hitotsubashi University for their helpful comments.

1 Introduction

The board of directors is responsible for monitoring management on behalf of the shareholders. The shareholders expect the CEOs to perform in a way to maximize the corporate profit. However, the CEOs' performance do not always meet the shareholders' expectations. In such a case, the job of the board is to dismiss the current CEO and to bring a new CEO to the firm. Empirically, Ocasio [1999] observes inertia in CEO succession process, for directors' decisions are guided by both historical precedents and formal rules. Agrawal et al [2006] finds that new CEOs are more likely to be promoted from within. Clutterbuck [1998] argues that the majority of companies prefer to appoint from within the board.

This paper considers inefficient decision makings inside the board room. I analyze the mechanism of how corporate boards exhibit inertia, which can be seen as the board of directors and the CEO colluding to reduce the board of directors' monitoring of the CEO. I offer a new theoretical angle for analyzing inertia in corporate governance. This inertia results in only a fraction of the CEO turnovers that should occur, based on the CEO's ability or match. I also argue that this inertia occurs regardless of the board composition. Furthermore, I show why the board often does not hire the talented potential outside CEO, but instead promotes one of the insiders to the new CEO when the incumbent CEO is fired.

The longer the incumbent CEO is at his service, the more advantageous the incumbent CEO becomes against the potential CEOs, and thus the incumbent CEO obtains the rent as compared to the potentials. In such a case, the board has the incentive to keep the incumbent CEO because the board becomes better off through bargaining with this CEO. As for the incumbent CEO, as long as he is retained, he enjoys the non-pecuniary and the non-contractable benefits, such as status and/or private benefits that are additional to the wage, and thus the incumbent CEO has no incentive to be forced out of the company.

In this paper, if the board believes that the net expected profit dependent on the incumbent CEO is larger than the net expected profit brought by the potential CEO, the board of directors negotiates with the incumbent CEO in order to benefit from this amount of difference. Specifically, they negotiate for a lower wage of the incumbent CEO in exchange for a

longer tenure which gives the incumbent CEO the non-pecuniary and the non-contractable benefits.[1] In short, not only the incumbent CEO, but also the board of directors becomes better off by retaining the incumbent CEO. Therefore, another implication of my paper is that even if business relations or friendships are nonexistent between the board members and the CEO, the board still has an incentive to retain the incumbent CEO.[2]

I analyze this framework using Nash bargaining game following Hermalin and Weisbach [1998]. There are two players: the board of directors and the incumbent CEO. The board of directors is treated as a single player, and hence, there is no free-rider problem. The players sign a contract determined by Nash bargaining. They bargain over three topics to be written on the contract: the wage of the CEO, the monitoring level, and the succession policy of whether to hire the next CEO from inside the board or outside the board. The incumbent CEO is perceived to have higher ability and thus has a rent compared to any potential CEOs. Thus the incumbent CEO has the bargaining power to determine his own wage.[3] [4] There are several ways to interpret monitoring levels. For simplicity, in this paper I interpret it as the amount of money the board is willing to pay to the specialist who reviews the incumbent CEO's conduct.[5] [6] Regarding the succession policy, I show in the Appendix

[1]The incumbent board does not bargain with potential CEOs (potential newcomers), as in Aghion and Bolton [1987], but instead, it bargains only with the efficient incumbent CEO, for there is a rent that board can extract from the incumbent CEO.

[2]The NYSE and NASDAQ rules of requiring nominating committees of listed companies to be composed entirely of independent directors is intended to reduce director's personal allegiance to the CEO, where the SOX Acts provide a definition of what constitutes independence. The SEC's requirement of at least one financial expert on the audit committee is to supplement financial knowledge to the board.

[3]The incumbent CEO can be involved in Nash bargaining and determines his "wage," for he has been working in the firm for a while and the board has found him more talented than those in the market. The wage of the CEO is determined in Nash bargaining by the board members and the CEO himself, as in Hermalin and Weisbach [1998], for some abilities that make the CEO more capable than other CEOs are specific to the firm, making them unable to be evaluated properly outside the firm.

[4]The new CEO will receive some wage, but he does not have the bargaining power to negotiate over it with the board. Any potential CEO's ability is assumed to be the same as those in the market and hence he does not have any rent.

[5]In Hermalin and Weisbach [1998], monitoring levels are defined through board composition, which is determined by the board and the incumbent CEO. Specifically, they Nash bargain over a new board member, whose monitoring cost is determined by how independent s/he is from the incumbent CEO.

[6]The term monitoring is used to mean learning CEO's ability by reviewing his conduct. Similar to Hermalin and Weisbach [1998], the CEO in this paper does not make efforts, and monitoring is done to replace bad match CEO with a new CEO, for the profit of the firm is dependent on the ability of the CEO.

that the board of directors does not have an incentive to breach the succession policy even after the incumbent CEO's tenure is terminated.[7]

When the two incumbent players bargain over these three topics, what is going to happen is that the decision making is done in a way to maximize only the incumbents' joint expected payoffs, which does not internalize the welfare of the potential newcomer to the corporate board. In other words, depending on the monitoring level, the incumbent CEO will be replaced with a new CEO after the monitoring. That is, expressed more generally, one of the Nash bargaining players will be replaced with a new player after the bargaining stage with a certain probability. Despite the fact that there are three players that may be affected by Nash bargaining, the two incumbent players who actually do the bargaining do not internalize the potential newcomer's expected welfare (which is considered as leakage from their expected joint welfare to the incumbent players), thus creating an inefficiency.[8]

Due to this non-internalization of the potential newcomer's welfare, the equilibrium monitoring level departs from the optimum monitoring level of the corporation, thus too often resulting in CEO retention when CEO turnover is in fact more optimal for the corporation. More specifically, the monitoring level is determined at the level that reduces the probability of having leakage. (The leakage is either a private benefit to the new CEO, if recruited from outside the board, or a pay to a new board member who is recruited to keep the board size fixed if the board recruits the new CEO from inside the board.) Moreover, the equilibrium succession policy may depart from the optimum succession policy, the latter of which is the optimum from the shareholders' perspective. That is, the succession policy is chosen not only by comparing the net expected profits brought to the firm by the potential CEOs (insider or outsider), but also by comparing the amount of leakages to them.

The remainder of the paper is organized as follows. The next section of the paper

[7] That is, the same result is obtained if the board redetermines the succession policy after the incumbent CEO is fired. It is proved in the Appendix that the directors are not making commitment to the succession policy determined together with the initial CEO, but instead, determining the succession policy together with the other two topics is just a simplification. Moreover, the succession theory developed in this paper can be applied to both voluntary and forced CEO turnover.

[8] Coase [1960].

discusses relevant literature. Section three develops a theoretical model and discusses how non-internalization of the potential newcomer to the corporate board affects the board's monitoring levels and decisions on CEO succession policy. Section four concludes.

2 Literature Review

There are several literatures that theoretically discuss the cause of board lax monitoring.[9] Some of them specify the cause and further discuss it in relation to board composition. However, to the extent of my knowledge, there has not been literature that argues utility loss for the group (non-internalization of the potential newcomer's welfare) as a cause of weak board monitoring.[10] This paper provides a theoretical model on how a certain "leakage" from the joint expected payoff of the incumbent board members affects board monitoring and how it differs depending on a succession policy. It also examines how decisions regarding CEO successions are made, an area in which there has not been much effort devoted to providing a theoretical formulation of CEO succession policy in the existing literature.

Hermalin and Weisbach [1998] provide a model in which the board member is endogenously determined in Nash bargaining between the board and the CEO. They argue that when the CEO is involved in appointing a new director, someone who is less independent from the CEO is appointed and weakens board monitoring of the CEO. They measure this with notation $\overline{k}$: the board's lack of independence, where it changes from $\overline{k}_0$ to $\overline{k}_1$ ($\overline{k}_0 < \overline{k}_1$) as the board members change. This $\overline{k}$ can be interpreted as a measure of comradeship or allegiance to the CEO, and they argue that the higher the $\overline{k}$ (or the stronger the comradeship or allegiance to the CEO is), the less the board monitors the CEO. Another cause may be a fear of being ousted from the board. That is, the directors do not always show their disagreement to the CEO for fear of being ousted from the board when the CEO has the power to remove the directors from the board. This framework is developed by Warther [1998], in which he shows that a director does not express his disagreement to the CEO when

[9] See also the surveys provided by Hermalin and Weisbach [2003], Gillan [2006], Adams et al [2008] for both theoretical and empirical studies. Also refer to Tirole [2006].

[10] In Sato [2007], I compare two corporate governance systems using the concept developed in this paper.

the other director is standing on the CEO's side.

With respect to the cause of lack of knowledge or information, Raheja [2005] develops a model in which inside directors and outside directors face asymmetric information about a project implemented by the CEO.[11] The insiders are successor CEO candidates themselves. They have the expertise knowledge in management and know the quality of the project proposed by the CEO, whereas the outsiders cannot tell the quality of the proposed project unless insiders share their superior information with them. When the information is shared, the outsiders decide to vote for or against the proposed project, but to vote against it requires verification that their decision is correct, and hence, monitoring is performed by outsiders. It is assumed that monitoring (verifying) is so costly that the outsiders do not monitor absent the insiders' information. This implies that in order for boards to function as monitoring devices, the board must be comprised of both inside and outside directors. The study of Raheja [2005] may seem somewhat similar to my paper, for it considers both the monitoring levels and the CEO succession policy. In her paper, when outsiders verify the information, the next CEO is voted from one of the insiders who had revealed the information. However, the CEO succession policy itself is not completely determined endogenously; specifically, the insiders have the choice of whether or not to reveal the information. From where to hire the successor, though, is given as a rule when it comes to the stage of appointment. In my model, the CEO successor himself is endogenously determined in the game through maximizing the utilities of all incumbent members. Despite the differences in our approaches, Raheja [2005], Hermalin [2005], and this paper are thus far the papers that have attempted to endogenously choose the successor CEO.

Regarding the board composition and the monitoring levels, Adams and Ferreira [2007], Harris and Raviv [2008], and Raheja [2005] provide theories about board monitoring along the line of information asymmetry, and they show that the board composition determines the interactions between the insiders and the outsiders. Almazan and Suarez [2003] and Laux [2008] offer theories that argue less independent boards can render a firm better off.

[11] In Raheja [2005], the insiders are more well informed of management than outsiders as argued by Fama and Jensen [1983].

My paper attempts to show that monitoring levels are attenuated regardless of board composition. In other words, the incumbent board members are likely to pursue their own utility maximization which often departs from the shareholders optimum, irrelevant to the characteristics of the board members.

3 Model: Monitoring Levels and Succession Policies

3.1 Basic Structure

In this section, I show that CEO replacement induces a certain utility loss (which is hereinafter referred to as "leakage") to the incumbent members' whole utility and that it deprives them of the incentive to fire (or monitor) the incumbent CEO to avoid such "leakage." I also show that the type of "leakage" varies according to the succession policy (inside promotion or outside recruiting), and the incumbents prefer the succession policy with the smaller amount of leakage, holding other things equal. The CEO's true ability is assumed to be either high(H) or low(L), and not known to any player, but the incumbent CEO is perceived to have higher ability as compared to any other potential CEOs. Then, all the incumbent members jointly determine the succession policy, the wage, and the monitoring level. When they jointly determine these issues, they do not internalize the welfare of the potential newcomer. Thus, the incumbents are maximizing their joint expected utility, but what they are maximizing has a utility leakage from the whole group. I show that the equilibrium monitoring level departs from the optimum monitoring level of the corporation, thus too often resulting in inefficient CEO retention. Moreover, I show that the equilibrium succession policy may depart from the optimum succession policy, the latter of which is the optimum from the shareholders' perspective.

There are two players. The board and the incumbent CEO. I use the term board to refer to n directors who act as one player. All n directors act as one player, the board, and hence there is no free-rider problem.[12]

There are four stages. They sign a contract determined through Nash bargaining in the

[12] See Wilson [1968] for treating players of the same utility function as one group.

first stage.

The basic structure of the interaction between the board and the incumbent CEO is followed from Hermalin and Weisbach [1998]. (Their paper is described in section two.)[13]

3.2 Timing

First stage: The firm has one incumbent CEO and the board. All the incumbent members Nash bargain over the contract regarding monitoring level p (which is the amount of money the board pays to the specialist who reviews the CEO's conduct), the wage of the incumbent CEO denoted w, and the succession policy of whether to hire a new CEO from outside the incumbent board or to promote one of the directors. The incumbent CEO's prior about having a good ability is assumed to be more than $\frac{1}{2}$, where any other potential CEOs' priors about their abilities are assumed to be precisely $\frac{1}{2}$.[14]

Second stage: The specialist monitors the incumbent CEO on behalf of the board. Based on the information provided by the specialist, the board updates the priors about the incumbent CEO's ability. With probability p, the board receives an informative information to update its belief about the ability of the incumbent CEO. That is, with probability p, it receives the information of $\{y_G, y_B\}$. With probability $(1-p)$, it receives non informative information y_I. The larger p is, the higher the probability of obtaining additional information about the CEO's ability. Moreover, $q = Pr(y_G|\{y_G, y_B\})$, and $1-q = Pr(y_B|\{y_G, y_B\})$. If the board receives y_G, it updates its belief about the incumbent CEO to be likely to be high ability. If the board receives y_B, it updates him to be likely to be low skill.

Third stage: The board retains or replaces the incumbent CEO based on the information. It retains the incumbent CEO when y_G is observed, but also with probability $(1-p)$, there

[13] In their model, CEO turnover can induce "leakage." However, they do not argue about this concept of "leakage," nor do they discuss the effect of it on board decision makings. Hence, I would like to provide a model of how "leakage" affects the decisions determined by the board by extending their model. Also, another new feature of this paper is to incorporate the process in which the board determines the next CEO, which was given exogenous to the model proposed by Hermalin and Weisbach [1998].

[14] In Hermalin and Weisbach [1998], the initial CEO's talent is updated before the negotiation, in order to give the CEO some bargaining power. However, this process can be shortened by assuming the prior about his ability to be higher than any new potential CEOs, in terms of being a good match. See the Appedix about the priors and the posteriors.

is no choice but to retain him. It fires the incumbent CEO when it receives y_B, and it hires a new CEO from outside or inside the board based on the decision made in the first stage. (All the remaining directors may renegotiate the succession policy after the incumbent CEO has been fired, but even if they renegotiate the succession policy, the same conclusion as determined in the first stage is derived. The proof is in the Appendix.[15])

Fourth stage: Production is made and all the players receive their pays.

3.3 The Players' Objectives

The number of directors (n) on the board, the non-contractable private benefit b the CEO who is serving at the last stage of the game receives, and the wages to the newly hired CEO ($w_{\widehat{N}}$ if recruited from outside, and w_N if recruited from inside the incumbent board), are exogenously given.[16]

The incumbent CEO's expected utility is expressed as

$$[pq + (1-p)]\, b + w, \tag{1}$$

for he receives the wage w determined in the negotiation, but the non-contractable private benefit b is only given when he is retained to the end of the game. He is retained when the specialist gives the board y_G (occurs with probability pq) or y_I (occurs with probability $(1-p)$).[17] In other words, if the incumbent CEO is dismissed prior to the last stage, he will not obtain b, but instead, the newly hired CEO will obtain it.

The expected profit of the firm is dependent on the ability of the CEO. For simplicity, I assume that the board obtains ρ from the firm profit. That is, the expected profit of the firm

[15] Even if the remaining directors renegotiate the succession policy after they dismiss the initial CEO in stage three, they still choose the same policy as determined in the first stage. Therefore, it may seem as if the directors commit to the succession policy determined in the first stage, but it is not a commitment. The succession policy is determined in the first stage to simplify the analysis.

[16] From the perspective of the game theory, the wage w_N that will be paid to the internally promoted CEO could be endogenously determined. If I do so, the incumbent directors will increase the amount of wage w_N as much as possible ($\because \frac{n-1}{n}\pi_N + b + \frac{1}{n}w_N$, which can be derived from the expression (3) presented later in this subsection). However, the shareholders will not allow such extremely high wage determined by the inside directors who are CEO candidates themselves.

[17] The substantial result in my paper will not be affected if the amount of b is different for the CEO who was monitored and retained and who was retained without monitoring.

is denoted by $\overline{X}_i$, where i denotes the ability of the CEO, which is high (H) or low (L). Then the board obtains $\pi = \rho[\alpha\overline{X}_H + (1-\alpha)\overline{X}_L]$, where α is the probability of the CEO's ability being high, and it is determined through the Bayes' update as described in the Appendix. If the incumbent CEO serves to the end without any monitoring, the board is expected to receive π_I; if the incumbent CEO is monitored and perceived to have high ability, the board is expected to receive π_H; if the incumbent CEO is monitored and perceived to have low ability, the board will receive π_L, but this is not realized in the equilibrium, for such a CEO would be fired. If the new CEO is hired after the dismissal of the incumbent CEO, and is recruited from the outside, the board is expected to receive $\pi_{\widehat{N}}$, whereas it is expected to receive π_N when promoted from inside the incumbent board. The relations among expected profits to the board are induced by Bayes' update as described in the Appendix, and they are $\pi_H > \pi_I > \pi_L$, $\pi_H > \pi_{\widehat{N}} > \pi_L$, and $\pi_H > \pi_N > \pi_L$. I assume $\pi_I > \pi_{\widehat{N}}$ and $\pi_I > \pi_N$. The difference between $\pi_{\widehat{N}}$ and π_N comes from whether the new CEO is hired from outside the incumbent board, or whether he is promoted from inside the board. I do not specify the relation between $\pi_{\widehat{N}}$ and π_N, since there are both merits and demerits for both types of potential CEOs.[18]

The expected utility of the board (total of n directors) if the new CEO is to be hired from outside the incumbent board members is expressed as[19]:

$$npq\frac{\pi_H}{n} + np\,(1-q)\,\frac{\pi_{\widehat{N}} - w_{\widehat{N}}}{n} + n\,(1-p)\,\frac{\pi_I}{n} - d(p) - w. \tag{2}$$

The first and the second term of (2), $np\left[q\frac{\pi_H}{n} + (1-q)\,\frac{\pi_{\widehat{N}} - w_{\widehat{N}}}{n}\right]$, is the expected utility to the

[18] For example, outside CEO candidates may be management experts in the same industry and may be talented. However, they may not fit the culture of the company. On the other hand, insider CEO candidates may be very knowledgeable about their company, but at the same time, may not be able to make the necessary changes in management. Bower [2007] argues that the insider with the outsider's perspective (which he refers to as *inside outsiders*) would be the best successor. Since it is beyond the scope of this paper to argue about *inside outsiders*, I assume the priors about the abilities of both candidates to be the same, even though the outcome may be different. The detail is in the Appendix.

[19] Note that when the board decides to recruit the new CEO from outside the board, none of the incumbent directors become CEO candidates. One way to interpret this type of board is to consider it as a board composed solely of outside directors. An outside director usually has his primary job elsewhere, such as a professor, and hence he has no incentive to become the successor CEO of the company in which he is serving as an outside director.

board when it receives an informative information about the incumbent CEO; specifically, n is the number of directors serving on the board and p is the probability that the directors obtain informative information about the incumbent CEO. With probability pq, the information y_G is given to the board. Thus, each director on the board will receive $\frac{\pi_H}{n}$. With probability $p(1-q)$, the information y_B is given to the board, and hence the board replaces the incumbent CEO. Then, each director on the board will receive $\frac{\pi_{\widehat{N}}-w_{\widehat{N}}}{n}$ each. The wage $w_{\widehat{N}}$ is paid to the new CEO who will be hired from outside the incumbent board. The new CEO does not have any bargaining power, and hence the amount of this wage is assumed to be determined in the market. The new CEO, if hired with probability $p(1-q)$, will also obtain the non-contractable private benefit b, but this is not internalized in either the board utility or the incumbent CEO's utility. The third term, $n(1-p)\frac{\pi_I}{n}$, is the utility of the board when it receives the non informative signal about the incumbent CEO, and thus he is retained. The fourth term $d(p)$, where $p \in [0,1)$, is the cost of monitoring for the board which is a strictly increasing, strictly convex, twice continuously differentiable function. I assume $d'(p) = 0$, and $d'(p) \to \infty$ as $p \to 1$, which derives interior solutions. The cost of monitoring can be interpreted as the amount of money the board is willing to pay to the specialist who will review the CEO's conduct and give the information to the board. The fourth term w is the amount of wage paid to the incumbent CEO.

On the other hand, the expected utility of the board (total of n directors) is expressed as the following if the new CEO is going to be recruited from inside the incumbent board members[20]:

$$npq\frac{\pi_H}{n} + p(1-q)\left[(n-1)\frac{(\pi_N - w_N)}{n} + b + w_N\right] + n(1-p)\frac{\pi_I}{n} - d(p) - w. \qquad (3)$$

I assume each inside director has an equal chance of being promoted to the new CEO. This is reflected in the second term of (3): $p(1-q)\left[(n-1)\frac{(\pi_N - w_N)}{n} + b + w_N\right] = p(1-q)\cdot n\left[\frac{(n-1)}{n}\frac{(\pi_N - w_N)}{n} + \frac{1}{n}(b + w_N)\right]$; that is when the board obtains the informative signal with

[20] In this model, when the board decides to recruit the new CEO from within, all the incumbent directors become the potential CEOs. Thus the board with the internal promotion policy can be considered to have the same expected utility as the board composed solely of inside directors.

probability p, and it updated the incumbent CEO's ability distribution to be low with probability $(1-q)$, one of the inside directors is promoted to a new CEO and the remaining directors stay on the board. That is, w_N will be paid to the new CEO who was originally the member of the board, so the remaining $n-1$ directors each receive $\frac{(\pi_N - w_N)}{n}$. From the perspective of the newly promoted CEO, he will receive the wage w_N and the private benefit b, but will not receive the pay as a plain director (which is $\frac{\pi_N - w_N}{n}$ per director). The payment of $\frac{\pi_N - w_N}{n}$ will be paid to the newly hired director to refill the vacancy in the board.[21] This new director's expected utility is not internalized in either the expected utility of the current board or the expected utility of the incumbent CEO. Note that the expected payment of $w_N + b$ to the new CEO (a former inside director) is internalized, for he is the original incumbent member. The other terms are as (2).

3.4 Analysis on Board Decision Makings

In this subsection, I show that both incumbent players in this model have the incentives to maximize their *joint expected utility* when making decisions. This is because the players' utilities are transferable, and they Nash bargain. Thus, maximizing the joint expected utility expands the feasible set. However, there are inefficiencies when they are not internalizing the expected utilities of potential newcomers who might join the board in the future. The benchmark is offered after the positive analysis on the choice of a successor CEO and monitoring levels.

3.4.1 The Choice of a Successor CEO and Monitoring Levels

In what follows, I discuss how monitoring levels and succession policies are determined when the incumbent board members are *not* internalizing the potential newcomer's welfare.

[21] Note that there are two possible cases for the newcomers. When the board recruits the CEO from outside, the newcomer is the new CEO. When the board promotes one of the incumbent directors to the board, the newcomer is then the new director who is hired to refill the board. In the long term, the board size may decrease, but in the short term, the board needs to keep a certain number of directors to keep its job operating. Moreover, refilling the board has an aspect of giving incentives to the workers to work hard in order to get internally promoted to be the director in the future.

Nash product is either

$$V_O \equiv \{p\left[q\pi_{_H} + (1-q)\left(\pi_{\widehat{N}} - w_{\widehat{N}}\right)\right] + (1-p)\,\pi_I - d(p) - w - \theta_B\} \times \{[pq + (1-p)]\,b + w - \theta_C\}, \tag{4}$$

or

$$V_I \equiv \left\{pq\pi_{_H} + p\,(1-q)\left[(n-1)\frac{(\pi_{_N} - w_N)}{n} + b + w_N\right] + (1-p)\,\pi_I - d(p) - w - \theta_B\right\} \times \{[pq + (1-p)]\,b + w - \theta_C\}, \tag{5}$$

depending on a succession policy. (4) is when the new CEO is going to be hired from outside the board, while (5) is when the new CEO is going to be internally promoted. The threat points are expressed as $(\theta_{B,}\theta_C)$ for (4) and (5). That is, if the negotiation breaks down, the board will receive $\theta_{B,}$ and the incumbent CEO will receive $\theta_{C.}$

Given the succession policy, the players determine the optimum monitoring level p^* that expands the frontier as outwards as possible. Note that Nash bargaining frontier is linear in forty-five degrees. (See the Appendix.) Hence, when comparing the two succession policies, the board determines to adopt a succession policy with higher frontier.[22] See Figure One. To be more specific, the monitoring level is determined at the level that shifts the bargaining frontier as outward as possible, where the ceiling of the frontier differs according to the succession policy. Thus, the policy that will expand the frontier further outwards than the other policy will be chosen.[23] However, one policy is not always better than the other policy (for example, outside recruiting is not always better than inside recruiting, and vice versa). Whether or not one policy is more desirable than the other depends on the expected profits brought to the firm by the new CEO and the amount of "leakage" that occurs–an amount that varies according to different situations. As shown in the Appendix and Figure One, the frontier can be expressed as the sum of the board expected utility and the incumbent CEO's expected utility.

[22] Free disposal is assumed. Since the frontier is linear, the feasible set of Nash bargaining is convex.

[23] Since one or the other feasible set always encompasses the other, the feasible set with the larger capacity (higher ceiling) always makes the players better off.

The joint expected utility of the incumbent members when the new CEO is to be hired from outside the incumbent board is expressed as

$$pq\pi_{H} + p(1-q)(\pi_{\widehat{N}} - w_{\widehat{N}}) + (1-p)\pi_{I} - d(p) + [pq + (1-p)]\, b, \tag{6}$$

which is the addition of (1) and (2). The joint expected utility of the incumbent members when one of the inside directors is promoted to be the new CEO is expressed as

$$pq\pi_{H} + p(1-q)\left[(n-1)\frac{\pi_{N} - w_{N}}{n} + b + w_{N}\right] + (1-p)\pi_{I} - d(p) + [pq + (1-p)]\, b, \tag{7}$$

which is the addition of (1) and (3).

In comparing the above two expressions, (6) > (7) holds, when

$$\pi_{\widehat{N}} - w_{\widehat{N}} - \left[\pi_{N} - w_{N} - \frac{1}{n}(\pi_{N} - w_{N}) + (b + w_{N})\right] > 0,$$

and (6) < (7) holds, when

$$\pi_{\widehat{N}} - w_{\widehat{N}} - \left[\pi_{N} - w_{N} - \frac{1}{n}(\pi_{N} - w_{N}) + (b + w_{N})\right] < 0.$$

In other words, the sufficient condition to hire a CEO from outside the board is:

$$\pi_{\widehat{N}} - (w_{\widehat{N}} + b) > \pi_{N} - \frac{1}{n}(\pi_{N} - w_{N}) \tag{8}$$

and the sufficient condition to promote inside directors to be the CEO is expressed as:

$$\pi_{\widehat{N}} - (w_{\widehat{N}} + b) < \pi_{N} - \frac{1}{n}(\pi_{N} - w_{N}). \tag{9}$$

The possible gross expected payoff to the incumbent players is $\pi_{\widehat{N}} + b$, if the new CEO is recruited from outside the incumbent board, and it is $\pi_{N} + b$, if the new CEO is recruited from inside the incumbent board. The leakage to the newcomer is expressed as $w_{\widehat{N}} + b$ for the former, while it is $\frac{1}{n}(\pi_{N} - w_{N})$ for the latter. Recall that the newly inside promoted CEO is the original incumbent board member, so any expected payment he will receive is not considered as a "leakage." If the expected profits brought to the board by the new CEOs were the same for those hired from outside and inside, (that is, $\pi_{\widehat{N}} = \pi_{N}$), (8) and (9) are

reduced to $w_{\widehat{N}} + b < \frac{1}{n}(\pi_N - w_N)$ and $w_{\widehat{N}} + b > \frac{1}{n}(\pi_N - w_N)$, respectively.

Given the above argument, the incumbents' decision to promote inside director or recruit from outside is determined by comparing the amount of difference between the leakages and the amount of difference between the expected profits brought to the firm by the potential CEOs. This leads to the following Proposition.

Proposition 1 *The incumbents decide to recruit from outside the incumbent board when* (8) *holds, and to promote one of the inside directors as a successor CEO when* (9) *holds.*

This Proposition implies that if the non-contractable private benefit is considered to be big, the incumbent board members have the incentive to let one of themselves become the CEO. At the same time, it implies that if the wage that will be paid to the outside CEO is high, the incumbents have the incentive to promote the inside director to the new CEO, unless the expected profit brought to the board by the outside CEO is extremely high.

An interesting case is when the board promotes one of the inside directors to the post even when there is a potential CEO outside the board who is expected to bring a higher net profit to the firm. ($\pi_{\widehat{N}} > \pi_N$ with not too big difference). This may happen in companies that are or started out as family businesses.[24] For example, consider a case in which all the inside directors are family members and the entrepreneur, who could be the only one who is talented in management, is the CEO. In such a case, when the incumbent CEO retires or is fired, hiring a new CEO from outside the current firm might be better than appointing a less-than-adequate family member as the new CEO. However, as is often observed in practice, the CEO's relatives may succeed the post.

Corollary 1 The board may promote an insider to the post of CEO even when there exist outside potential CEOs who are expected to be more talented than any of the inside potential CEOs.

The above Corollary holds unless $\pi_{\widehat{N}}$ is much higher than π_N, so as to alter the inequality of (9).

[24] Charkham [2005] points out that a manager's attitude (and thus hiring tendencies) may not change even after companies that started as family businesses have grown to publicly quoted companies.

Next, I show the monitoring levels determined unique to the succession policy.[25]

Proposition 2 *The monitoring levels are determined unique to the succession policy and they are expressed as follows.*

1. *If the board determines to promote one of the inside incumbent directors, it is:*

$$d'(p) = q\pi_{H} + (1-q)\,\pi_{N} - \pi_{I} - (1-q)\,\frac{1}{n}(\pi_{N} - w_{N}). \tag{10}$$

2. *If the board determines to recruit from outside the incumbent board members, it is:*

$$d'(p) = q\pi_{H} + (1-q)\,\pi_{\widehat{N}} - \pi_{I} - (1-q)\,(b + w_{\widehat{N}}). \tag{11}$$

These monitoring levels are determined at the level that shifts the bargaining frontier as outward as possible, given the succession policy. The "leakage" that the incumbent board incurs by having CEO replacement is reflected in the last term of both (10) and (11). That is, with probability $(1-q)$, the incumbent CEO is fired, and a newcomer is hired and $\frac{\pi_{N}-w_{N}}{n}$ or $(b + w_{\widehat{N}})$ will not be given to one of the incumbents. Recall that when one of the inside directors is promoted to be the new CEO, the board hires a new director to maintain the number of directors at n. Thus the payment of $\frac{\pi_{N}-w_{N}}{n}$ is given to this new director, and this is considered as a "leakage" from the perspective of the incumbent board members, whereas if the board brings a new CEO from outside the incumbent board, the new CEO is the newcomer and the wage $w_{\widehat{N}}$ and the benefit b he receives in place of the incumbent CEO is the "leakage." As for (10), the higher is the wage to the new CEO, the more the board monitors. This is because the inside directors have the incentive to become the new CEO themselves. However, usually $\pi_{N} - w_{N} > 0$ holds, and thus, monitoring levels are attenuated for both (10) and (11) by the "leakages." (Later in section 3.4.2, I derive the monitoring level which is not affected by a "leakage.")

Note that in the above analysis, the board decides the succession policy. I have shown that the expected utility to the board are different depending on the succession policy it chooses. The expected utility of the board under the outside recruiting policy (which is (2))

[25] Nash products, threat points of the players, and the proofs are in the Appendix.

can be considered as the expected utility of the board that consists solely of outside directors. On the other hand, the expected utility of the board under the internal promotion policy (which is (3)) can be interpreted as the expected utility of the board which is solely composed of inside directors. Therefore, another implication of Proposition 2 is that regardless of the board composition, the board has an incentive to retain the incumbent CEO. I also note that even if the board had both insiders and outsiders (defined from their incentives to become the successor CEO) at the same time, the substantial result is the same.[26]

3.4.2 Benchmark

Below I show that when the incumbent board members *do* internalize the newcomer's welfare, the monitoring level is higher than the equilibrium monitoring levels determined by the incumbent board and the incumbent CEO, and the succession policy equals the optimum succession policy for the shareholders. This leads to:

Benchmark: Optimum Succession Policy and Monitoring Level

The optimum succession policy is to hire a potential CEO who is expected to bring a higher net expected profit to the board:

$$max\left\{\pi_{\widehat{N}} - w_{\widehat{N}},\, \pi_{N} - w_{N}\right\}. \tag{12}$$

This is the optimum for all three players (the incumbent CEO, the board, and the potential newcomers). If, $w_{\widehat{N}} = w_{N,}$ (12) is expressed as:

$$max\left\{\pi_{\widehat{N}},\, \pi_{N}\right\}. \tag{13}$$

This equals the optimum from the shareholders' perspective as well.

Because the players utilities are transferable, and they all Nash bargain, the optimum monitoring level is determined to maximize the joint expected utility of all players, including the incumbent members and those newcomers (a new CEO if recruited from outside and a new director if promoted from inside the board) who may be appointed to the board after

[26] The proof is provided in an earlier verison of this paper; Sato [2008].

the CEO replacement. The joint expected utility of such case is expressed as:

$$pq\pi_{H} + p(1-q)\max\{\pi_{\widehat{N}}, \pi_{N}\} + (1-p)\pi_{I} - d(p) + b, \tag{14}$$

The above expression holds for both outside recruiting and the inside promotion case. See the Appendix for the proof. Taking the first-order condition with respect to p induces the optimum level of monitoring:

$$d'(p) = q\pi_{H} + (1-q)\max\{\pi_{\widehat{N}}, \pi_{N}\} - \pi_{I}. \tag{15}$$

Equation (15) shows that when the incumbent board members internalize the expected utility of future newcomers to the board, the board monitoring level is not attenuated by "leakage" ($w_{\widehat{N}} + b$ or $\frac{\pi_{N} - w_{N}}{n}$).

3.5 The Structure to Avoid Inefficiency Caused by "Leakage"

I have shown in the previous subsection that "leakage" is one of the reasons that exhibit inertia in corporate governance. In this subsection, I argue that some structures allow incumbent board members to prevent "leakage." If there is no newcomer on the board, the monitoring level becomes more intense. This can be done for internal promotion policy when $\pi_{\widehat{N}} \doteqdot \pi_{N}$. One way to ensure this is to keep the fired CEO on the board as a regular director, instead of hiring a newcomer to keep the board size at n, which establishes:

Proposition 3 *The monitoring level with no newcomer to the corporate board is expressed as:*

$$d'(p) = \left[q\pi_{H} - \pi_{I} + (1-q)\,\pi_{N}\right]. \tag{16}$$

Note that (16) equals the optimum level of monitoring (15), when $\pi_{N} > \pi_{\widehat{N}}$ holds, and hence the monitoring level is always larger than (10). In this paper, CEO replacement is forced, but since the reason for the removal does not necessarily have to do with illegal conduct, it is not strange to keep the incumbent CEO on the board as a regular director as if often observed in Japanese companies. Even though the incumbent CEO might not have been a good match as a manager who leads the company, given his knowledge and experience

of the company, he may still remain on the board as one of the directors that participate in principle decision makings or monitoring.

The other way to avoid inertia caused by "leakage" is to compensate the incumbent board members the amount of utility loss they may incur from having CEO turnover. This can be the plan of action, if ρ (the ratio given to the board from the corporate profit) is small, for it may benefit the shareholders' profits as well.

4 Conclusion

This paper concerns one of the reasons that causes inefficient monitoring of the CEOs by the board of directors. I use Nash bargaining game to analyze the process of how a board of directors extracts rent from the incumbent CEO, who is more advantageous and has rent compared to the potential CEOs. Higher monitoring intensity increases the likelihood that the incumbent CEO is replaced, and hence the likelihood that the incumbent corporate board members do not obtain rent. Thus, the board's incentive to replace the incumbent CEO is attenuated. Furthermore, I show that the amount of rent that the incumbent members may not obtain differs by a newcomer to the board. A newcomer is either a new CEO if recruited from outside the board, or a new director if the new CEO is a former board member.

References

1. Adams, Renee B. and Ferreira, Daniel "A Theory of Friendly Boards." *Journal of Finance*, 2007, 62(1), 217-250.

2. Adams, Renee B., Hermalin, Benjamin E., and Weisbach, Michael S. "The Role of Boards of Directors in Corporate Governance: A Conceptual Framework and Survey." 2008, NBER Working Paper.

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

4. Agrawal, Anup, Knoeber, Charles R., and Tsoulouhas, Theofanis "Are Outsiders Handicapped in CEO Successions?" *Journal of Corporate Finance*, 2006, 12, 619-644.

5. Almazan, Andres and Suarez, Javier "Entrenchment and Severance Pay in Optimal Governance Structures." *Journal of Finance*, 2003, 58(2), 519-547.

6. Bower, Joseph L. "*The CEO Within: Why Inside Outsiders are the Key to Succession Planning.*" Boston, Massachusetts: Harvard Business School Publishing Corporation, 2007.

7. Charkham, Jonathan "*Keeping Better Company*: *Corporate Governance Ten Years On.*" New York: Oxford University Press, 2005.

8. Clutterbuck, David "Handing Over the Reins: Should the CEO's Successor be an Insider or an Outsider?" *Corporate Governance*, 1998, 6(2), 78-85.

9. Coase, Ronald "The Problem of Social Cost." *Journal of Law and Economics*, 1960, 1, 1-44.

10. Gillan, Stuart L. "Recent Developments in Corporate Governance: An Overview." *Journal of Corporate Finance*, 2006, 12(3), 381-402.

11. Fama, Eugene and Jensen, Michael "Separation of Ownership and Control." *Journal of Law and Economics*, 1983, 26(2), 301-325.

12. Harris, Milton and Raviv, Artur "A Theory of Board Control and Size." *Review of Financial Studies*, 2008, 4, 1797-1832.

13. Hermalin, Benjamin E. and Weisbach, Michael S. "Endogenously Chosen Boards of Directors and Their Monitoring of the CEO." *The American Economic Review,* 1998, 88(1), 96-118.

14. Hermalin, Benjamin E. and Weisbach, Michael S. "Boards of Directors as an Endogenously Determined Institution: A Survey of the Economic Literature." *Economic Policy Review,* 2003, 9(1), 7-26.

15. Hermalin, Benjamin E. "Trends in Corporate Governance." *Journal of Finance,* 2005, 60(5), 2351-2384.

16. Institute of Directors "*The Handbook of International Corporate Governance.*" London; Sterling, Virginia: The Institute of Directors, 2005.

17. Laux, Volker "Board Independence and CEO Turnover." *Journal of Accounting Research*, 2008, 46, 137-171.

18. Ocasio, William "Institutionalized Action and Corporate Governance: The Reliance on Rules of CEO Succession." *Administrative Science Quarterly*, 1999, 44[2], 384-416.

19. Raheja, Charu G. "Determinants of Board Size and Composition: A Theory of Corporate Boards." *Journal of Financial and Quantitative Analysis*, 2005, 40(2), 283-306.

20. Sato, Meg A. "Separation of CEO and Board: A Comparison of the U.S. and Japan." COE-DP F-161, Faculty of Economics, University of Tokyo, 2007.

21. Sato, Meg A. "A Theory of CEO Replacement." COE-DP F-219, Faculty of Economics, University of Tokyo, 2008.

22. Tirole, Jean "The Theory of Corporate Finance." Princeton, New Jersey: *Princeton University Press,* 2006.

23. Warther, Vincent A. "Board Effectiveness and Board Dissent: A Model of the Board's Relationship to Management and Shareholders." *Journal of Corporate Finance*, 1998, 4(1), 53-70.

24. Wilson, Robert "The Theory of Syndicates." *Econometrica*, 1968, 36(1), 119-132.

Appendix

Proof of Proposition 2(1): (10)

$$V_I \equiv \left\{ pq\pi_H + p(1-q)\left[(n-1)\frac{(\pi_N - w_N)}{n} + b + w_N\right] + (1-p)\pi_I - d(p) - w - \theta_B \right\} \times \{[pq + (1-p)]b + w - \theta_C\}$$

I denote θ_B and θ_C as the threat points of each players, where (θ_B, θ_C) is assumed to be an interior point of the feasible set. In this model, whatever the amount of the threat point which is in the interior of the feasible set, it does not affect the decisions regarding the succession policy and the monitoring levels. Denote the first bracket as A and the second as

B. Then, the first-order condition maximizing V_I with respect to p yields

$$\frac{\partial A}{\partial p}B + \frac{\partial B}{\partial p}A = 0. \tag{17}$$

Next, derive the first-order condition maximizing V_I with respect to w The first-order condition with respect to w yields

$$-B + A = 0 \tag{18}$$

Thus, from (17) and (18), $\frac{\partial A}{\partial p} + \frac{\partial B}{\partial p} = 0$ is obtained, for w is transferable. Then, organize this to obtain $d'(p)$, which is expressed as:

$$d'(p) = q\pi_{_H} - \pi_I + (1-q)\,\pi_{_N} - (1-q)\,\frac{\pi_{_N} - w_N}{n},$$

which is the level of monitoring as shown in (10).

The wage w is determined as:

$$w = \frac{1}{2}\left\{ \begin{array}{c} pq\pi_H + p\,(1-q)\,(n-1)\left(\frac{\pi_N - w_N}{n} + w_N\right) + (1-p)\pi_I - d(p) \\ -\theta_B + \theta_C + b(2p - 2pq - 1). \end{array} \right\}$$

q.e.d.

Proof of Proposition 2(2): (11)

$$\begin{aligned} V_O \;\equiv\; & \{p\,[q\pi_{_H} + (1-q)\,(\pi_{_{\widehat{N}}} - w_{_N})] + (1-p)\,\pi_I - d(p) - w - \theta_B\} \\ & \times \{[pq + (1-p)]\,b + w - \theta_C\} \end{aligned}$$

I denote θ_B and θ_C as the threat points of each players, where (θ_B, θ_C) is assumed to be an interior point of the feasible set. Denote the first bracket as A and the second as B. Then, the first-order condition maximizing V_O with respect to p yields

$$\frac{\partial A}{\partial p}B + \frac{\partial B}{\partial p}A = 0. \tag{19}$$

Next, derive the first-order condition maximizing V_O with respect to w. The first-order con-

dition with respect to w yields

$$-B + A = 0 \tag{20}$$

Thus, (19) and (20) yields $\frac{\partial A}{\partial p} + \frac{\partial B}{\partial p} = 0$. Organize this and $d'(p)$ is obtained as:

$$d'(p) = q\pi_{_H} + (1-q)\,\pi_{\widehat{N}} - \pi_I - (1-q)\,(b + w_{\widehat{N}}),$$

which is the level of monitoring as shown in (*11*).

The wage w is determined as:

$$w = \frac{1}{2}\left\{ \begin{array}{c} pq\pi_H + p(1-q)\,(\pi_{\widehat{N}} - w_{\widehat{N}}) - (1-p)\,\pi_I - d(p) \\ -\theta_B + \theta_C - [pq + (1-p)]\,b. \end{array} \right\}$$

q.e.d.

The proof of renegotiation about the succession policy

Below I show that even if the existing board redetermines the succession policy after the incumbent CEO's tenure has been terminated, it still adopts the same succession policy as what have been determined together with the incumbent CEO in the first stage.

If the board were to redetermine the succession policy, it will take place between the third and the fourth stage. At this stage, the wage to the incumbent CEO is already determined and they cannot change the contract even after the CEO has been dismissed. Therefore, the board's expected utility will be expressed as

$$\pi_{\widehat{N}} - w_{\widehat{N}}, \tag{21}$$

if they decide to hire from outside. On the other hand, if the board decides to recruit one of the inside directors to the new CEO, its expected utility will become

$$(n-1)\frac{\pi_N - w_N}{n} + (b + w_N). \tag{22}$$

The comparison of (21) and (22) yields to the same result as Proposition 1.

q.e.d.

The assumptions for deriving the firm profit and board profit in section four

The ability of the CEO is given exogenous as a_i, $i \in \{H, L\}$,where a_H stands for high ability and a_L stands for low ability. No player knows the true ability of the CEO. The prior distribution of the ability of the incumbent CEO is given exogenous as γ^i, $i \in \{H, L\}$, where $\gamma^H > \gamma^L$,and $\gamma^H + \gamma^L = 1$. γ^H represents the incumbent CEO is of type a_H, and γ^L represents that the incumbent CEO is of type a_L. On the other hand, the prior distribution of the ability of any new potential CEO (regardless of whether he is a director on the board or an outsider) is assumed to be $\frac{1}{2}$ for both being a_H and a_L. The profit of the firm is denoted X_j, $j \in \{H, L\}$, where $X_H > X_L \neq 0$. Then the conditional probability of outcome dependent on the ability of the CEO is expressed as $P_j^i \equiv \Pr\{X_j | a_i\}$. For example, P_L^H is the probability that the CEO produces X_L conditional on a_H. See Table A.

Table A

	a_H	a_L
X_H	P_H^H	P_H^L
X_L	P_L^H	P_L^L

I assume $P_H^H > P_H^L$, and hence, $P_L^L > P_L^H$ holds. Given these assumptions, the expected firm profit conditional on CEO's ability is expressed as $\overline{X}^H \equiv P_H^H X_H + P_L^H X_L$ when the CEO is of type a_H. It is expressed as $\overline{X}^L \equiv P_H^L X_H + P_L^L X_L$ when the CEO is of type a_L. The board receives a share of ρ from $\overline{X}^H$and $\overline{X}^L$. That is, the expected board profit can be expressed as $\rho\, \overline{X}^H$ and $\rho \overline{X}^L$. Thus, the expected board profit when the incumbent CEO serves to the end is expressed as

$$\pi_I \equiv \rho \left[\gamma^H \left(P_H^H X_H + P_L^H X_L \right) + \gamma^L \left(P_H^L X_H + P_L^L X_L \right) \right].$$

On the other hand, the expected board profit when a new CEO is appointed (from inside the board) is expressed as

$$\pi_N \equiv \rho \left[\frac{1}{2} \left(P_H^H X_H + P_L^H X_L \right) + \frac{1}{2} \left(P_H^L X_H + P_L^L X_L \right) \right].$$

I denote as $\pi_{\widehat{N}}$, the expected board profit when a new CEO is appointed from outside the board:

$$\pi_{\widehat{N}} \equiv \rho \left[\frac{1}{2} \left(P_H^H \widehat{X}_H + P_L^H \widehat{X}_L \right) + \frac{1}{2} \left(P_H^L \widehat{X}_H + P_L^L \widehat{X}_L \right) \right],$$

where the outcome $\widehat{X}_H$ is different from X_H, and $\widehat{X}_L$ is different from X_L. A new CEO has the prior ability distribution of $H = \frac{1}{2}$, whether recruited from inside the board or from outside the board, but outcomes are different. That is why the expected outcomes depending on these CEO's ability distribution are different. I assume $\pi_I > \pi_{\widehat{N}}$ and $\pi_I > \pi_N$.

The expected profit of the board when the specialist monitors and it gives the information to the board (The board updates the incumbent CEO's ability) is as follows. See Table B.

Table B *with probability* p

	a^H	a^L
y_G	R_G^H	R_G^L
y_B	R_G^H	R_G^L

with probability $(1-p)$

	a^H	a^L
y_I	1	1

The board obtains information $y \in \{y_G, y_B, y_I\}$. When the informative information $\{y_G, y_B\}$ is obtained with probability p, the probability distribution on $\{y_G, y_B\}$ conditional on the ability of the CEO is expressed as $R_j^i = \Pr\{y_j | a_i\}$. With probability $(1-p)$, the board receives non-informative signal y_I with probability 1. When the board receives y_G, it believes that the CEO is likely to have high ability with probability of $\frac{\gamma^H R_G^H}{\gamma^H R_G^H + \gamma^L R_G^L} \equiv \mu_G^H$. It is assumed that $\mu_G^H > \gamma^H > \frac{1}{2}$ ($\mu_G^L = 1 - \mu_G^H < \frac{1}{2}$) for the monitoring raises the expected outcome of the firm if the initial CEO is believed to be likely of type H. Likewise, $\mu_B^H \equiv \frac{\gamma^H R_B^H}{\gamma^H R_B^H + \gamma^L R_B^L}$, and this is assumed to be $\mu_B^H < \frac{1}{2}$ ($\mu_B^L > \frac{1}{2}$). Given these assumptions, if the board receives y_G with probability q, the board is expected to obtain:

$$\pi_H \equiv \rho \left[\mu_G^H \left(P_H^H X_H + P_L^H X_L \right) + \mu_G^L \left(P_H^L X_H + P_L^L X_L \right) \right].$$

If the board observes y_B with probability $(1-q)$, the expected board profit is expressed as:

$$\pi_L \equiv \rho \left[\mu_B^H \left(P_H^H X_H + P_L^H X_L \right) + \mu_B^L \left(P_H^L X_H + P_L^L X_L \right) \right].$$

Therefore, $\pi_{_H} > \pi_I > \pi_{_L}$ and $\pi_{_H} > \pi_{_N} > \pi_{_L}$ are derived. I assume $\pi_{_H} > \pi_{\widehat{N}} > \pi_{_L}$ holds.

q.e.d.

The proof for the benchmark in section 3.4.2

The expected utility of the whole group under outside recruiting policy is expressed as follows: The expected utility for the board (n directors) is

$$pq\pi_H + p(1-q)\left(\pi_{\widehat{N}} - w_{\widehat{N}}\right) + (1-p)\pi_I - w - d(p). \tag{23}$$

The expected utility for the incumbent CEO is

$$pqb + (1-p)b + w. \tag{24}$$

The expected utility for the potential CEO (who is the newcomer to the group under outside recruiting policy) is

$$p(1-q)(b + w_{\widehat{N}}). \tag{25}$$

Thus, the sum of all three players (the sum is derived as a result of Nash bargaining) is expressed as

$$pq\pi_H + p(1-q)\pi_{\widehat{N}} + (1-p)\pi_I - d(p), \tag{26}$$

and the equilibrium monitoring level is derived as:

$$d'(p) = q\pi_H + (1-q)\pi_{\widehat{N}} - \pi_I. \tag{27}$$

The expected utility of the whole group under inside promotion policy is expressed as follows: The expected utility for the board (n directors) is

$$pq\pi_H + p(1-q)\left[\frac{n-1}{n}(\pi_N - w_N) + b + w_N\right] + (1-p)\pi_I - w - d(p), \tag{28}$$

where the potential new CEO's expected utility is internalized in the above expected utility as $p(1-q)(b+w_N)$. This is because one of the incumbent directors becomes the new CEO

if the incumbent CEO is dismissed. The expected utility of the incumbent CEO is the same as that of the outside recruiting policy, and it is (24).

The expected utility of the new director who will be hired after the CEO turnover (who is the newcomer to the group under inside promotion policy) is expressed as

$$p(1-q)\frac{1}{n}(\pi_N - w_N). \tag{29}$$

Thus, the sum of all three players (the sum is derived as a result of Nash bargaining) is expressed as

$$pq\pi_H + p(1-q)\pi_N + (1-p)\pi_I - d(p), \tag{30}$$

and the equilibrium monitoring level is derived as:

$$d'(p) = q\pi_H + (1-q)\pi_N - \pi_I. \tag{31}$$

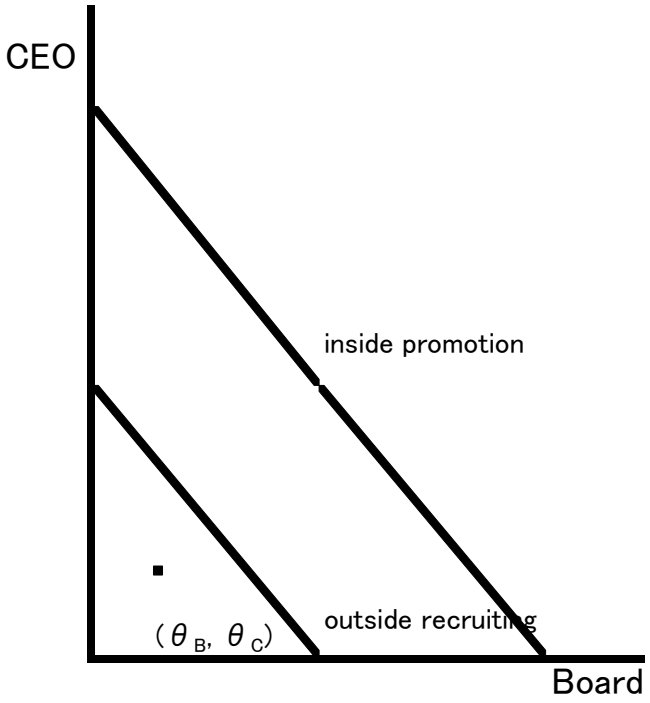
From (27) and (31), the optimum monitoring level for the group is expressed as

$$d'(p) = q\pi_H + (1-q)Max\left\{\pi_{\widehat{N}},\ \pi_N\right\} - \pi_I. \tag{32}$$

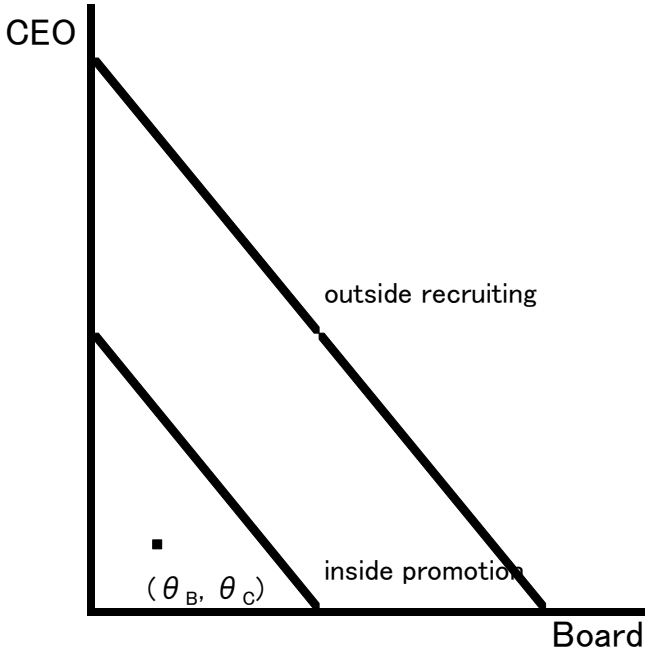
Hence (32) is the same as (15).

q.e.d.

Figure One



Inside Promotion Case



Outside Recruiting Case