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# **The Effect of Mandatory Rotation on Monitoring Cost and Audit Fee**

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## ***1. Introduction***

Legislators ever and again concern audit effectiveness and, in turn, improve the quality of financial reporting. They examine what regulations can effectively decrease the number of dishonest reporting and investigate what situations might impair auditor independence. Recent events, such as Enron, WorldCom, Global Crossing, Adelphia Communications, and HelathSouth, have drawn numerous legislative proposals and rules to enhance audit quality because the public took a shot at the lack-of-independence auditors. The major contents of recent reforms to oversee audit function, in general, are in three ways, which are to strengthen the functioning of independent audit committee, to restrict the scope of non-audit services, and to require the mandatory auditor rotation. This study is to analytically examine the potential cost of mandatory rotation, especially from the view of monitoring cost and audit fee payment of the firm, to address issue of the debate on mandatory auditor rotation.<sup>1</sup>

While familiarity with clients is crucial in auditing process to produce greater understanding and improved ability to identify and evaluate risks of clients, some auditing profession also recognizes that over-familiarity might be one of the significant threats to impair independence. It is the basic reason to require auditor rotation. In fact, the section 203 of *Sarbanes-Oxley Act of 2002* (hereafter *the Act*) treats audit services as unlawful if the lead or the coordinating audit partner provides services for five consecutive years of a certain client. Besides, the section 207 of *the Act* as well requires

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<sup>1</sup> In fact, the Report of the Commission on Auditors' Responsibilities (Cohen Commission) (1978) recommended the mandatory rotation. The Cohen Report reasons that "[s]ince the tenure of the independent auditor would be limited, the auditor's incentive for resisting pressure from management would be increased" (p. 108).

the Comptroller General to conduct a study of the potential effects of requiring the mandatory rotation of registered public accounting firms within one year of the passage of *the Act*. In a word, to restore the credibility of the audit function, the lawmakers seriously suggest that mandatory rotation is a rigid but effective way. In this regard, this study examines the effectiveness and economic consequence of the mechanism of mandatory rotation. Especially, I study this issue under the antecedent that there is an independent board (or an independent audit committee) in the firm required by the section 301 of *the Act*.

From the viewpoints of the audit committee playing an active role in corporate governance and there exists a potential side payment to auditor from the managers (Lee and Gu 1998),<sup>2</sup> I analytically examine the effectiveness of mandatory rotation. Specifically, conventional wisdom suggests that requiring mandatory rotation will enhance auditor independence. This study, however, suggests that the mandatory rotation requirement is likely to make the audit committee adopt a more aggressive investigation strategy about examining the collusion between the manager and the auditor as well as preparing a higher audit fee payment. Hence, the mandatory requirement makes a cost burden to the firm – an extra audit fee payment and a higher monitoring cost due to a more aggressive collusion-free strategy. The conclusion of this study is contrary to the conventional perspective that treats mandatory as a means to enhance audit effectiveness and, in turn, improve the quality of financial reporting. The implication of this

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<sup>2</sup> Even though the manager-auditor side payments are generally prohibited, Lee and Gu (1998) indicates that side payment can take several forms, some of which are *prima facie* legal (e.g., the auditor is appointed by the manager on behalf of the shareholders and the manager can use the appointment itself as a side payment to sway auditor) and some of which may be legally justified (e.g., grant the auditor with consulting contracts). Generally speaking, preventing or detecting side payments can be legally difficult and expensive. See footnote 5 (p.536) of Lee and Gu (1998) for detailed discussions about potential side payment between the manager and auditor.

perspective provides some insights about the potential costs of mandatory rotation, to my knowledge, has not been addressed in the prior literature.

The remaining sections of this paper are organized as follows. Section 2 reviews the debate of prior literature on auditor independence, tenure, and mandatory rotation. Section 3 describes the audit pricing model and the investigation strategy of the audit committee in a non-rotation-required and rotation-required environment respectively. Section 4 discusses the solution and explains the economic consequence of the mandatory rotation. I present concluding remarks in Section 5.

## ***2. The Debate***

Since independence is the cornerstone of the auditing function, both legislators and financial statement users highly concern the issue. To reduce the potential threats to hurt auditor independence, proponents of mandatory rotation express the belief that poor-quality of financial statements are associated with extended auditor tenure. For example, In July 2003, International Federation of Accountants (hereafter IFAC) issued a report, *Rebuilding Public Confidence in Financial Reporting*, which treats excessive familiarity may result in auditors' complacency or hesitancy to challenge appropriately and thereby reduces the level of skepticism necessary for an effective audit (IFAC 2003). Louwers (1998) found that the length of auditor-client relationship affects auditors' propensity to issue a going-concern disclosure to a distressed client. Hence, the proponents suggest that rotation could significantly improve the overall quality of an audit and enhance the quality of the financial reporting process (e.g., Imhoff 2003 and Dopuch et al. 2001).

However, if there is a well-function independent board (or an independent audit committee) such as the requirement by the section 301 of *the Act*, those arguments might be invalid. The independent board or audit committee is now at the forefront of the representative of shareholders, particularly in ensuring the objective of the audit process. IFAC (2003) also believes that the audit committee needs to interact directly and at times forcefully with both management and the auditors in areas that in the past have been largely handled outside the committee on the board.<sup>3</sup>

Members of the board are independent of management are more likely to be effective in overseeing management than those that do not. This study assumes that there exists a well-functioned independent board or an audit committee (hereafter the audit committee) in the firm. In particular, before discussing the effectiveness of the mandatory rotation, it is important to understand that whether the firm installs an effective audit committee or not. In prior literature, the discussions of the function of audit committee (e.g., Booth et al. 2002; Klein 2002) and the effectiveness of mandatory rotation (e.g., Arrunada and Paz-Ares 1997; Catanach and Walker. 1999; Dopuch et al. 2001) generally treat each other as independent. However, the conclusion on the effectiveness of mandatory rotation is context related to the process of “information-chin”, especially affected by the function of audit committee.

Because of the already enforcement of the section 301 of *the Act*, I assume that the improper threaten of the manager to the auditor is eliminated. Hence, some traditional

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<sup>3</sup> The report recommends that each member of an audit committee should be financially literate, and at least one (and preferably a majority) of the committee’s members should have substantial financial experience. The report also recommends that non members of management presents in the audit committee as well as the members should receive training both with respect to their general responsibilities and regarding the operations, business issues, financial reporting, control systems, and risk management processes of the company itself.

concern such as the inadequacy influence might come from the risk of losing clients if the auditors do not agree with managers' financial reporting preferences (e.g., Farmer et al. 1987) will be already disappeared after the enforcement of *the Act*. In addition, the recent issued auditing standards require communication between auditors and audit committees about unrecorded misstatements (SAS No. 89 [AICPA 1999a]) and the auditor judgments about the quality, not just the acceptability, of accounting principles and underlying estimates in the financial statements (SAS No. 90 [AICPA 1999b]). Those requirements enhance the importance of the audit committee, rather than the managers, as a critical role that dominates the outcome of accounting negotiation with the client. IFAC (2003) also points out that excessive familiarity may result in complacency or hesitancy to challenge appropriately, and thereby reduce the level of skepticism necessary for an effective audit.

On the other hand, the opponents assert that the auditors have to gain experience and to build client-specific assets from the ongoing relationship and in turn have a greater ability to detect accounting irregularities (Arrunada and Paz-Ares 1997). Geiger and Raghunanda (2002) also demonstrated that there were significantly more audit failures in the earlier years of the auditor-client relationship. Some recent empirical studies investigated the relation between auditor tenure and discretionary accruals and found that short audit tenure leads to lower audit quality (e.g., Johnson et al. 2002; Myers et al. 2003; Ghosh and Moon 2003).<sup>4</sup> These evidences show that mandatory rotation diminishes audit effectiveness and, therefore, lowers the quality of financial reporting. Besides, the National Commission on Fraudulent Financial Reporting (Treadway Commission) (1987) recommended that the peer review program of the AICPA's SEC Practice Section pay

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<sup>4</sup> This approach treats audit quality is a function of the earnings quality that is measured by signed or unsigned discretionary accruals.

more closer attention to the first-year audits of public clients, in part because the Commission's review of fraud-related cases revealed that there is a significant number involved with companies that had recently changed auditors (p. 54). Further, the Quality Control Inquiry Committee of the AICPA's SEC Practice Section found audit failure occurs almost three times as often on the first- or second-year audits (AICPA 1992). In summary, these investigations suggest that mandatory rotation might diminish audit effectiveness and thus lower the quality of financial reporting.

In spite of the existing empirical evidence, there are at least two reasons to examine the issue via the analytical approach. First, the evidence of the literature (e.g. Johnson et al. 2002; Myers et al. 2003; Ghosh and Moon 2003) were found in an environment where the legal environment does not exist mandatory audit rotation; hence, I believe the analytical work can provide some supplement arguments and another perspectives beyond prior empirical evidences. Second, audit quality is jointly determined by the auditor's ability to discover errors or breaches and the degree of independence to report the discovered evidences truthfully (DeAngelo 1981). However, all empirical evidence shown is the joint result test of professional skill and independence. To address how mandatory rotation affects the auditor's independence and audit pricing, I assume the audit effort is unchanged either in a rotation-required or in a non-rotation required environment.

To address the effectiveness of mandatory rotation, I simplify the model of Lee and Gu (1998). They analyzed the interaction among the firm owner, the manager and the auditor and concluded that low-balling constitutes an efficient dynamic contracting mechanism for hierarchal agency. Specifically, low-balling creates a disincentive for



unscrupulous audit behavior when the right to hire and fire the auditor lies in the independent board (or the independent audit committee).

### ***3. The investigation strategies***

To examine how mandatory rotation affects audit pricing and auditor independence, I analyze what is the audit fee payment and optimal investigation strategy of the audit committee in a non-rotation-required and rotation-required environment respectively.

#### ***3.1 The optimal investigation strategy in a non-rotation-required environment***

As the prior auditing studies, I assume audit market is highly price competitive as well as client's switching cost and auditor's start-up cost are non-zero. Following the model from DeAngelo (1981), I calculate the audit fee in a non-rotation-required environment (denoted by NR). Let  $F_{1;NR}$  represent the audit pricing in the initial engagement and subsequent audit fee is  $F_{n;NR} = F_{NR}$  (for  $n \geq 2$ ). Besides, to perform the audit engagement, the audit cost contains a constant component in each period,  $A_n = A$  (for  $n \geq 2$ ), and the initial start-up cost of  $K$ , which  $A_1 = A + K$  for the initial audit. Finally, for a client who switches his or her auditor will incur a transaction cost, denoted by  $S$  and rate  $r$  to discount future profit of the auditors.

**FACT 1:** In a non-rotation environment, the audit fee on the initial engagement is

$$F_{1;NR}^* = A + K - \frac{K + S}{1 + r}, \text{ the audit fee on all other subsequent audits are all}$$

$$F_{NR}^* = A + \frac{r}{1 + r} \cdot (K + S), \text{ and } F_{NR}^* - F_{1;NR}^* = S > 0.$$

*Proof:* See DeAngelo (1981) or a brief outline in the appendix 1.

If the firm with well-functioned audit committee that has a responsibility on hiring and firing the auditor, Lee and Gu (1998) find out that law-balling can enhance auditor independence. Specifically, the board employs a manager to handle production and an auditor to verify the reported information. However, the auditor might accept a side payment  $B$  to report biased in favor of the manager.<sup>5</sup> Because the auditor is relatively efficient and equipped for expertise, it is not cost-benefit for the board to adopt a pure strategy to investigate whether there exists collusion between auditor and manager or not all the time. Base on the same reason, a pure strategy that never-investigated neither is a best move for the board. Accordingly, I assume the board chooses a mixed strategy to scrutinize the collusion with a probability  $\pi_{1, NR}$ , a randomized investigation strategy in the first period of auditing, and  $\pi_{NR}$ , a randomized investigation strategy in each subsequent period when the audit environment is non-rotation-required. Furthermore, if the board investigates and the two agents (i.e., the manager and the auditor) collude,  $p$  (where  $0 < p < 1$ ) denotes the probability of the board finds out the misconduct behavior. In addition, obviously, when the two agents behave loyalty, there is no evidence can remark an allegation of malpractice on the two agents, whether the boards investigates or not,. Finally, when the collusion is revealed at a certain time, the auditor pays a one-time legal punishment  $D$  at that time and his future income is normalized to zero.<sup>6</sup>

At first, I explain the auditor's strategy at the non-initial period. If the auditor does

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<sup>5</sup> To focus on the issue of mandatory rotation, I treat the side payment  $B$  exogenously for tractability.

<sup>6</sup> To examine how mandatory rotation affects the auditor's independence here, I omit the penalty on the manager.

not collude with the manager, his present value of total profit is:

$$\frac{(F_{NR} - A)(1+r)}{r}. \quad (1)$$

However, when he colludes with the manager, the auditor might be fortunate to receive payoff  $B + F_{NR} - A$  with probability  $(1 - \pi_{NR}) + \pi_{NR}(1 - p)$  since the board could either not investigate (probability  $1 - \pi_{NR}$ ) or investigate (probability  $\pi_{NR}$ ) but no misconduct evidence is discovered (probability  $1 - p$ ). The sum of the two probabilities is  $(1 - \pi_{NR}) + \pi_{NR}(1 - p)$ .

When the board discovers the collusion of the two agents, the auditor pays the penalty  $D$ . Since the auditor has the same optimization problem in each non-initial period, an auditor's best choice is to collude in a certain period, which implies that the collusion will constitute the best strategy in each subsequent period. Consequently, the expected present value of the collusion strategy to the auditor for a non-initial auditing period is:

$$\begin{aligned} & [(1 - \pi_{NR} p)(B + F_{NR} - A) - \pi_{NR} p D] \left\{ 1 + \frac{1 - \pi_{NR} p}{1+r} + \left( \frac{1 - \pi_{NR} p}{1+r} \right)^2 + \dots \right\} \\ & = [(1 - \pi_{NR} p)(B + F_{NR} - A) - \pi_{NR} p D] \cdot \frac{1+r}{r + \pi_{NR} p}. \end{aligned} \quad (2)$$

For an auditor who chooses an independent strategy, his expected present value equals equation (1). Let  $Y$  denote the result of equation (2) subtract from equation (1):

$$Y = \left\{ \frac{(F_{NR} - A)(1+r)}{r} \right\} - \left\{ [(1 - \pi_{NR} p)(B + F_{NR} - A) - \pi_{NR} p D] \cdot \frac{1+r}{r + \pi_{NR} p} \right\} \quad (3)$$

A positive result of equation (3) means the independent strategy is the best response for

the auditor in a non-initial period. On the contrary, to collude with the manager is the auditor's rational behavior for a negative  $Y$ . Taking the partial derivative of equation (3) with respect to  $F_{NA} - A$  and  $B$  yields:

$$\frac{\partial Y}{\partial (F_{NR} - A)} = \frac{(1+r)^2 \pi_{NR} p}{r(r + \pi_{NR} p)} > 0 \quad \text{and} \quad \frac{\partial Y}{\partial B} = -\frac{(1 - \pi_{NR} p)(1+r)}{r + \pi_{NR} p} < 0.$$

The results show that  $Y$  is increasing at the normal audit profit and decreasing at the level of side payment. In particular, either a lower normal engagement profit the auditor earns or a higher side payment the manager affords will hurt the independency of auditing. Because the investigation action is costly, the board will choose a lowest  $\pi_r$  to make equation (3) equals to zero.<sup>7</sup> After a simple arrangement gets  $\pi_r^*$  satisfies the following condition:

$$\pi_{NR}^* = \frac{1}{p} \cdot \frac{B}{B + \frac{1+r}{r}(F_{NR} - A) + D} \quad (4)$$

Substitute  $F_{NR}^*$  in Fact 1 into equation (4) yields

$$\pi_{NR}^* = \frac{1}{p} \cdot \frac{B}{B + K + S + D}. \quad (5)$$

From the comparative static of equation (4) and (5), it is easy to get that the higher successful probability  $p$  or the audit profit during the non-initial periods  $F_{NR} - A$ , the

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<sup>7</sup> In other words, I assume for an auditor who is indifference between independence and collusion will choose keep independency.

lower the investigation  $\pi_{NR}^*$  the board evolves. Besides, the board should adopt a more aggressive investigation strategy when the affordable side payment from the manager increases.

Next, I calculate the optimal investing strategy of the board in the initial period. For a competitive audit market, the present profit of an auditor with independence is zero. However, if the auditor compromises his independence then he earns an extra  $B$  in period 1 (with probability  $1 - \pi_{1;NR} p$ ) or pays punishment  $D$  if he were detected by the board (with probability  $\pi_{1;NR} p$ ). By equation (5), zero profit of audit market assumption, and the backward induction approach shows that the incremental expected value of the collusion strategy is  $(1 - \pi_{1;NR} p)B - \pi_{1;NR} pD$ . The optimal randomized investigation of the board in the initial period  $\pi_{1;NR}^*$  is:

$$\pi_{1;NR}^* = \frac{B}{p(B + D)} \quad (6)$$

Equation (5) subtracts from equation (6) yields:

$$\pi_{1;NR}^* - \pi_{NR}^* = \frac{1}{p} \cdot \left\{ \frac{B \cdot (K + S)}{(B + D) \cdot (B + K + S + D)} \right\} > 0 \quad (7)$$

This is a simplified version of the finding of Lee and Gu (1998) that low-balling constitutes an efficient dynamic contracting mechanism for the hierarchical agency problem. However, section 3.2 shows that the mandatory rotation requirement hurts the economical

mechanism aforementioned.<sup>8</sup>

**Proposition 1:** For an environment without mandatory rotation:

$$\pi_{1;NR}^* = \frac{1}{p} \cdot \frac{B}{B+D}, \quad \pi_{NR}^* = \frac{1}{p} \cdot \frac{B}{B+K+S+D}, \quad \text{and} \quad \pi_{1;NR}^* - \pi_{NR}^* > 0.$$

I use the simplified setting similar to Lee and Gu (1998) as a benchmark to compare with an environment with mandatory auditor rotation.

### 3.2 The optimal investigation strategy in a rotation-required environment

To analyze how mandatory affects the investigation strategy of the board in each period, I use  $\pi_{n;R}(N)$  to represent the mixed strategy in period  $n$  ( $1 \leq n \leq N$ ) where 1 is the initial period and  $N$  is the imposition of a limit on the maximum length of a given auditor-client relationship in a rotation-required environment (denoted by  $R$ ). Let  $F_{n;R}(N)$  be the audit fee in period  $n$ . Notation  $\Omega_{n;R}(N)$  represents the future present value, under the antecedent that the auditor does not collude with the manager, in period  $n$  (where the period  $n$  itself is included). I use the following conditions to calculate  $\pi_{n;R}^*(N)$ , the optimal investigation strategy of the board in a rotation-required environment.

$$\textit{Terminal value condition: } \Omega_{N;R}(N) = F_{N;R}(N) - A$$

$$\textit{Present value condition: } \Omega_{n;R}(N) = [F_{n;R}(N) - A] + \frac{\Omega_{n+1;R}(N)}{1+r} \quad (2 \leq n \leq N-1)$$

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<sup>8</sup> Comparing to legal enforcement and investigation strategy, Lee and Gu (1998) explain that law-balling itself is an economical mechanism to self-fulfilled auditor independence.

*Competition condition:*  $\Omega_{1;R}(N) = 0$ .

For the auditor who chooses an independent strategy in each period. The *terminal value condition* describes the auditor's profit at the terminal period; the *present value condition* demonstrate the present value of the auditor in period  $n$  equals his audit profit in current period  $n$  plus the present value of the auditor in period  $n + 1$  discounted to the period  $n$ ; the *competition condition* implies that the audit market is highly competition.

By the skill of the backward induction, the board adopts a mixed strategy  $\pi_{N;R}^*(N)$  to make the auditor treat the expected utility of independent strategy is indifferent to that of the collusion strategy at the terminal audit period  $N$ . That is

$$\Omega_{N;R}(N) = [1 - p \cdot \pi_{N;R}^*(N)] \cdot [B + \Omega_{N;R}(N)] - p \cdot D \cdot \pi_{N;R}^*(N).$$

Left hand side of the equation is the expected utility of the auditor who adopts the independent strategy; however, right hand side of the equation is that of the collusion strategy. Rearranging the term get the result:

$$\pi_{N;R}^*(N) = \frac{1}{p} \cdot \frac{B}{B + \Omega_{N;R}(N) + D}. \quad (8)$$

Next, in the presumption that the board adopts  $\pi_{N;R}^*(N)$  in period  $N$ , the board adopts the following  $\pi_{N-1;R}^*(N)$  to make the auditor treat the expected utility of independent strategy as indifferent to that of adopting the collusion strategy in period  $N - 1$ :

$\Omega_{N-1;R}(N) = [1 - p \cdot \pi_{N-1;R}^*(N)] \cdot [B + \Omega_{N-1;R}(N)] - p \cdot D \cdot \pi_{N-1;R}^*(N)$ , and

$$\pi_{N-1;R}^*(N) = \frac{1}{p} \cdot \frac{B}{B + \Omega_{N-1;R}(N) + D}.$$

By the same procedure, to prevent the collusion strategy, the optimal mixed strategy of the board  $\pi_{n;R}^*(N)$  satisfies the condition of

$$\pi_{n;R}^*(N) = \frac{1}{p} \cdot \frac{B}{B + \Omega_{n;R}(N) + D}. \quad (9)$$

However, in order to find out the exact solution, it is necessary to examine the audit fee in each period  $F_{n;R}(N)$  under a rotation-required environment.

I use  $P$  to denote a potential bidder's offering price. Since the audit market is highly competitive in this study and every new bidder appears each time is in his initial engagement period, the bidder's offering price  $P$  satisfies the condition:

$$(P - A - K) + \frac{P + S - A}{1 + r} + \frac{P + S - A}{(1 + r)^2} + \dots + \frac{P + S - A}{(1 + r)^{N-1}} = 0.$$

The first part  $(P - A - K)$  represents the current audit profit of the bidder, the subsequent parts describes that when the bidder becomes an incumbent auditor, he has a pricing advantage  $S$  and a cost advantage  $K$  compare with all his rivals. The summation equals zero that describes the constraint of the *competition condition* in the audit market. After rearranging, the bidder's offering price is:



$$P = (A - S) + \frac{(S + K) \cdot r \cdot (1 + r)^{N-1}}{(1 + r)^N - 1}.$$

Using the incumbent auditor's pricing advantage  $S$  again, I get  $P + S$  is the audit fee during the non-initial auditing period. In particular,

$$F_{2;R}^*(N) = F_{3;R}^*(N) = \dots = F_{N;R}^*(N) = F_R^*(N) = P + S.$$

That is,

$$F_R^*(N) = P + S = A + \frac{(S + K) \cdot r \cdot (1 + r)^{N-1}}{(1 + r)^N - 1} \quad (10)$$

The audit fee in the initial period  $F_{1;R}^*(N)$  is:

$$F_{1;R}^*(N) = P = (A - S) + \frac{(S + K) \cdot r \cdot (1 + r)^{N-1}}{(1 + r)^N - 1} \quad (11)$$

Consistent with Fact 1 that  $F_{NR}^* - F_1^* = S$ , the equation (10) and (11) also shows that the amount of fee cutting still unchanged in a rotation-required environment because  $F_R^*(N) - F_{1;R}^*(N) = S$ .

**Proposition 2:** For an environment with mandatory rotation:

$$(i) \quad \pi_{1;R}^*(N) = \frac{1}{p} \cdot \frac{B}{B + D},$$

$$(ii) \quad \pi_{n;R}^*(N) = \frac{1}{p} \cdot \left\{ \frac{B}{B + D + (S + K) \cdot \frac{(1 + r)^N - (1 + r)^{n-1}}{(1 + r)^N - 1}} \right\}$$

Proof: See appendix 2.

#### ***4. The Analysis of Investigation Strategies and Audit Pricing between the Two Regimes***

From the views of optimal investing strategy and audit pricing, this section examines what is the economic consequence of mandatory rotation. First, Table 1 summaries the board's optimal investing strategies in Proposition 1 and Proposition 2 via two dimensions – “rotation-required vs. non-rotation required” by “initial period vs. non-initial period”.

**[Insert Table 1]**

***Proposition 3*** For  $2 \leq n \leq N$  :

(i) Either in a rotation required environment or a non-rotation required environment, the investing strategy of the board is more aggressive in the initial auditing period than that in the non-initial auditing period. Specifically,  $\pi_{1;R}^*(N) > \pi_{n;R}^*(N)$  and  $\pi_{1;NR}^* > \pi_{n;NR}^*$ .

(ii) In a rotation-required environment where  $N$  is fixed, the optimal investigation strategy of the board is a strictly increasing function with  $n$  (i.e.); also, the incremental investigation level of the board with respect to  $n$  is still a strictly increasing function of  $n$ . Specifically,  $\pi_{n+1;R}^*(N) - \pi_{n;R}^*(N) > 0$  and  $[\pi_{n+2}^R(N) - \pi_{n+1}^R(N)] - [\pi_{n+1}^R(N) - \pi_n^R(N)] > 0$ .

(iii) Whether the rotation is required or not, the optimal investigation strategy of the board in the initial auditing period remains unchanged. Nonetheless, compare with a non-rotation required environment, the board should adopt a more aggressive investigation strategy in a rotation-required environment. Specifically,  $\pi_{1;R}^*(N) - \pi_{1;NR}^* = 0$  and  $\pi_{n;R}^*(N) - \pi_{NR}^* > 0$ .

(iv) In a rotation-required environment where  $N$  is various but  $n$  is fixed at a certain period. The investigation level at a certain period  $n$  is a decreasing function of  $N$ . Specifically,  $\pi_{n;R}^*(N+1) - \pi_{n;R}^*(N) < 0$ .

Proof: See appendix 3.

I use Figure 1 and 2 to illustrate the intuition of Proposition 3. The horizontal axis measures the certain auditing period  $n$ , and the vertical axis measures the corresponding optimal investigation strategy of the board. The bold line reveals the investigation strategy in a rotation-required environment and the dot line portrays that in a non-rotation-required environment. Proposition 3 finds out that no matter the auditor rotation is required or not, the board chooses the most aggressive investigation in the initial audit period. Next, in a rotation-required environment, the lowest investigation level appeared in the “first” non-initial auditing period (i.e.,  $n = 2$ ). The investigation level will be more aggressive as  $n$  increases and the positive marginal effect of investigation becomes stronger when the auditing period  $n$  increases. Besides, except for the initial audit period that  $\pi_{1;NR}^*$  equals  $\pi_{1;R}^*(N)$ , the board has to pay more investigation cost in a mandatory rotation environment.

**[Insert Figure 1]**

Furthermore, I use figure 2 to demonstrate the comparative analysis of investigation strategy with respect to  $N$ . When the mandatory rotation period form a shorter  $N1$  to a longer  $N2$ , Proposition 3 (iv) mentions that for all period of  $2 \leq n \leq N1$ ,  $\pi_{n;R}^*(N1) > \pi_{n;R}^*(N2)$ . In other words, the board should choose a more aggressive investigation strategy in a rotation-required more often environment.

**[Insert Figure 2]**

From Fact1, equation (10) and (11), Table 2 tabulates how mandatory rotation affects audit fee in each period. Proposition 4 reports the details.

**[Insert Table 2]**

***Proposition 4:***

- (i) Either in an initial auditing period or in a non-initial auditing period environment, the audit fee is higher in a rotation-requirement environment compared with a non-rotation-required environment. In other words,  $F_{1;R}^*(N) > F_{1;NR}^*$  and  $F_{n;R}^*(N) > F_{NR}^*$ .
- (ii) In a rotation-required environment, both initial audit fee  $F_{1;R}^*(N)$  or non-initial audit fee  $F_{n;R}^*(N)$  are decreasing functions of  $N$ .

Proof: See appendix 4.

I use Figure 3 and 4 to illustrate the intuition of Proposition 4. The horizontal axis measures the certain auditing period  $n$ , and the vertical axis measures the corresponding audit fee. The bold line reveals the audit fee in a rotation-required environment and the

dot line portrays that in a non-rotation-required environment. Although the cost advantage of the incumbent auditors constitutes a fee cutting no matter in a rotation-required environment or not, auditing price is strictly higher in an environment with mandatory auditor rotation than that of a non-rotation-required environment. In a word, from the view of audit fee payment, the mandatory rotation requirement is to accompany the firm with much cost burden.

**[Insert Figure 3]**

Furthermore, I use figure 4 to demonstrate the comparative analysis of audit fee with respect to  $N$ . When the mandatory rotation period form a shorter  $N1$  to a longer  $N2$ , Proposition 4 (ii) finds out that  $F_{n,R}^*(N1) > F_{n,R}^*(N2)$  for all period of  $2 \leq n \leq N1$ . That is the cost burden of audit fee payment increases for a mandatory rotation is frequently.

**[Insert Figure 4]**

#### ***4. Conclusion***

The public is outraged by recent accounting scandals, which makes the perception of the function of auditing falls into pieces. In order to restore the credibility of corporate financial reporting, an edict of mandatory rotation is required by the Act. Because the strengthening role of the audit committee can significantly alleviates the potential independent concern on auditor who has been familiarity with the client, the foundation to acclaim of mandatory rotation in prior literature is not impenetrable. In a setting where the auditor relationship with the firm is with the board (or the audit committee) instead of

with manager, I examine the effectiveness of mandatory rotation from the view of costly monitoring strategy of the board and the audit fee payment of the firm.

Under a circumstance where a firm has a well-functioned of audit committee, this paper demonstrates that the mandatory rotation will increase the monitoring cost of the audit committee and the audit fee payment compared with a non-rotation-required environment. Hence, this paper demonstrates that it is ineffective to just stick auditor with the responsibility of quality of financial reporting. Since familiarity is vital in an effective audit process, the concern of improperly excess familiarity results in the Act to require auditors rotate off in a certain audit not exceeding five years. However, this study demonstrate that if the section 307 of *the Act* is effective in essential, the economic consequence of section 203 of *the Act* are a higher audit fee payment of the firm and the board should adopt a more aggressive strategy to monitor the potential collusion between the manager ad the auditor.

Finally, one thing particularly noteworthy is that the conclusion I have is based on a critically assumption that all firms with well and qualified audit committees. The policy implication of this paper demonstrates that it is more worth to enhance the real function of audit committee rather than just evolves a less merit of rotate off requirement. However, if the firm with a well-functioned audit committee is “Empire’s New Clothes”, the conclusion of this study brings home the other “new clothes” that is ironed out all real problems and it is suitable in a shelter life.

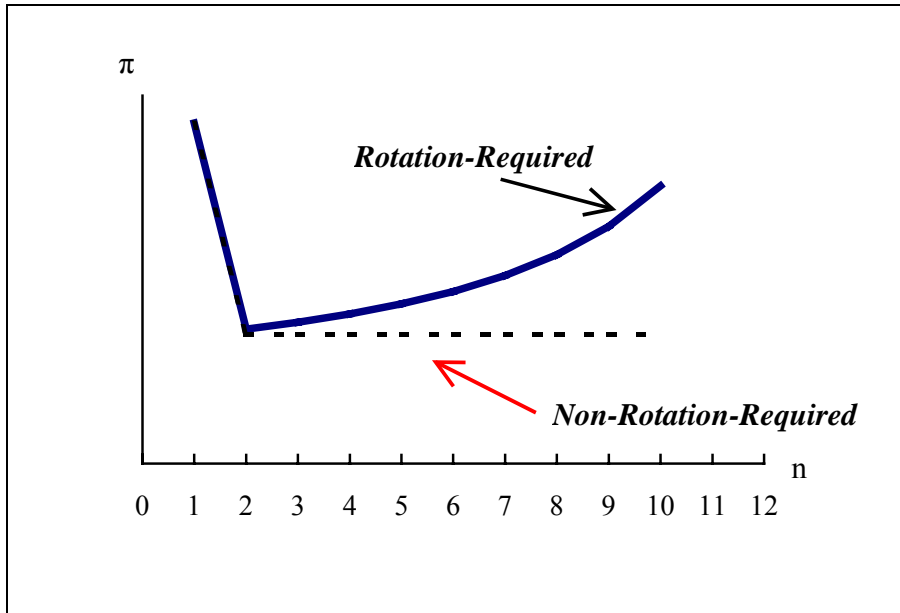
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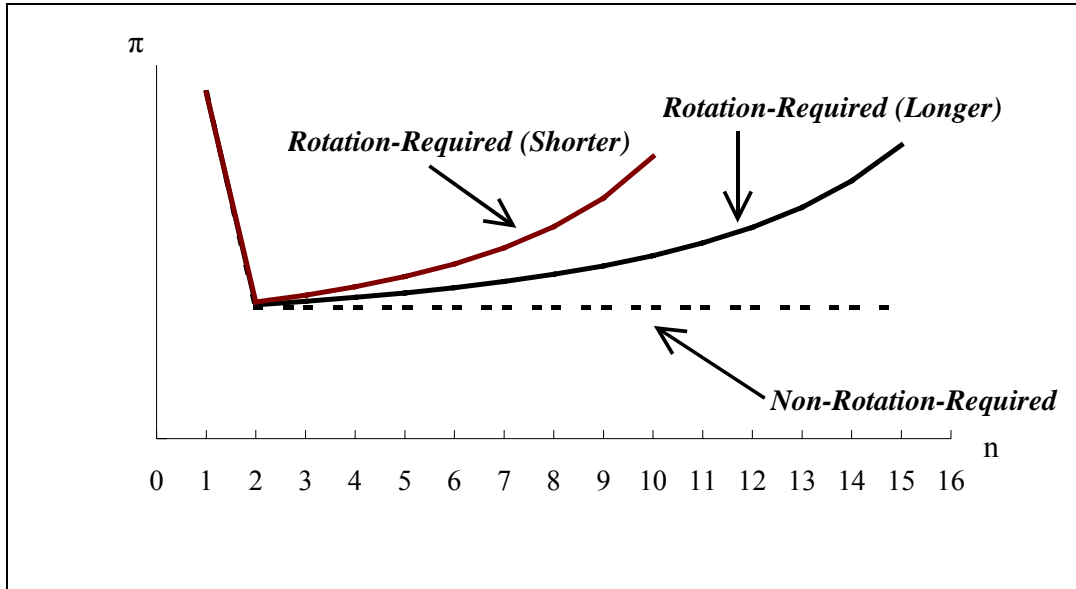
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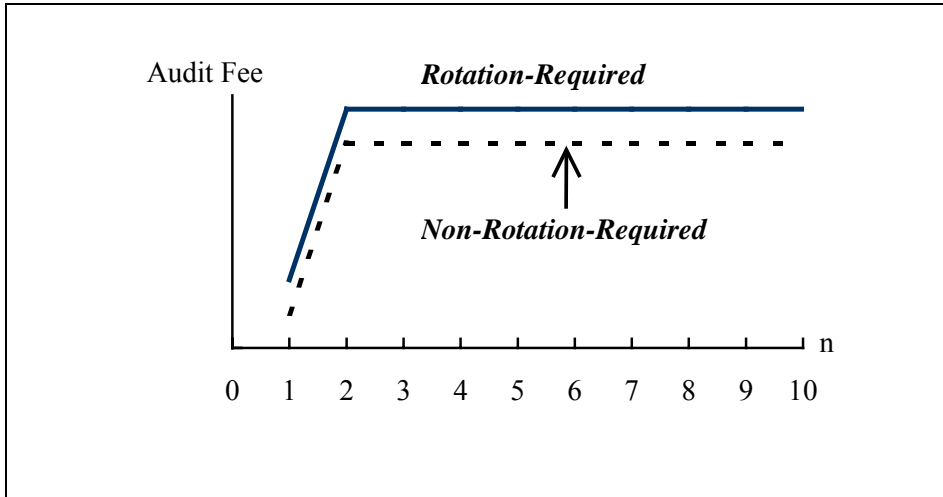
**Figure 1:**  
**The Comparison of Rotation-Required and Non-Rotation-Required**  
**– Investigation Strategies**



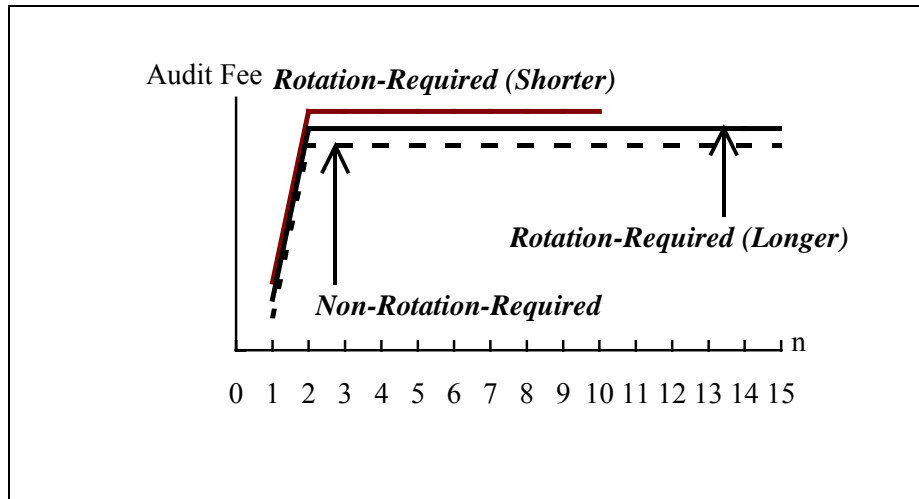
**Figure 2:**  
**The Investigation Strategies in Different Rotation off Period**



**Figure 3:**  
**The Comparison of Rotation-Required and Non-Rotation-Required**  
**– Audit Fee Payment**



**Figure 4:**  
**The Audit Fee Payment in Different Rotation off Period**



**Table 1:**  
**Summary of the board's investing strategy\***

	<i>Initial Period</i>	<i>Non-Initial Period</i>
<i>Rotation-Required</i>	$\frac{1}{p} \cdot \frac{B}{B+D}$	$\frac{1}{p} \left[ \frac{B}{B+D+(S+K) \cdot \frac{(1+r)^N - (1+r)^{n-1}}{(1+r)^N - 1}} \right]$
<i>Non-Rotation</i>	$\frac{1}{p} \cdot \frac{B}{B+D}$	$\frac{1}{p} \times \frac{B}{B+K+S+D}$

\* Where N is the maximum length of the auditor-client relationship and n ( $2 \leq n \leq N$ ) is a certain period.

**Table 2:**  
**Summary of the auditing pricing\***

	<i>Initial Period</i>	<i>Non-Initial Period</i>
<i>Rotation-Required</i>	$(A - S) + \frac{(S + K) \cdot r \cdot (1 + r)^{N-1}}{(1 + r)^N - 1}$	$A + \frac{(S + K) \cdot r \cdot (1 + r)^{N-1}}{(1 + r)^N - 1}$
<i>Non-Rotation</i>	$A + K - \frac{K + S}{1 + r}$	$A + \frac{r \cdot (K + S)}{1 + r}$

\* Where N is the maximum length of the auditor-client relationship.

*Appendix 1: A simple description of DeAngelo's Model (1981)*

Under a non-rotation environment, the present value of the auditor profit from obtain the initial engagement for a given client is

$$\Pi = (F_{1;NR} - A_1) + \frac{(F_{NR} - A)}{r}. \quad (A1-1)$$

If the client does not switch his auditor, the present value of the audit fee payment is  $F_{NR} + (F_{NR}/r)$ . However, the present value of audit fee payment becomes  $(A + K) + (A/r)$  when the auditor decides to switch another auditors. Because of existing the switching cost of client  $S$ , the upper bound of audit fee on non-initial engagement period proposed by the incumbent auditor is

$$F_{NR} + \frac{F_{NR}}{r} \leq (A + K) + \frac{A}{r} + S. \quad (A1-2)$$

In particular,  $K$  and  $S$  determine the incumbent value of the auditors. For a profit maximization auditor who extracts all the quasi-rent, rearranging equation (A1-2) get:

$$F_{NR}^* = A + \frac{r \cdot (K + S)}{1 + r}.$$

Finally, the competition of audit market implies that

$$(F_{1;NR}^* - A_1) + \frac{F_{n;NR}^* - A}{r} = 0 \Rightarrow F_{1;NR}^* = A + K - \frac{K + S}{1 + r}.$$

Q.E.D.

**Appendix 2: Proof of Proposition 2**

I calculate  $\Omega_{n,R}(N)$  in the denominator of equation (9) to prove the proposition.

Since the *competition condition* (i.e.,  $\Omega_{1,R}(N) = 0$ ), the optimal investigating strategy in

the initial period of an engagement  $\pi_{1,R}^*(N) = (1/p) \cdot [B/(B+D)]$ .

For the other period:

$$\begin{aligned}\Omega_n &= [F_R^*(N) - A] + \frac{F_R^*(N) - A}{(1+r)} + \frac{F_R^*(N) - A}{(1+r)^2} + \dots + \frac{F_R^*(N) - A}{(1+r)^{N-n}} \quad (\text{where: } 2 \leq n \leq N) \\ &= \frac{[F_R^*(N) - A]}{(1+r)^{N-n}} \cdot \{1 + (1+r) + (1+r)^2 + \dots + (1+r)^{N-n}\} = \frac{[F_R^*(N) - A]}{(1+r)^{N-n}} \cdot \frac{(1+r)^{N-n+1} - 1}{r}\end{aligned}$$

Plug equation (10) into the above  $\Omega_n$  find that:

$$\Omega_n = \left\{ \frac{(S+K) \cdot r \cdot (1+r)^{N-1}}{(1+r)^N - 1} \right\} \cdot \left\{ \frac{(1+r)^{N-n+1} - 1}{r} \right\} = \frac{S+K}{(1+r)^N - 1} \cdot \{(1+r)^N - (1+r)^{n-1}\}.$$

Plug the above  $\Omega_n$  into equation (9) get that:

$$\pi_{n,R}^*(N) = \frac{1}{p} \cdot \left\{ \frac{B}{B+D + (S+K) \cdot \frac{(1+r)^N - (1+r)^{n-1}}{(1+r)^N - 1}} \right\}.$$

Q.E.D.



### Appendix 3: Proof of Proposition 3

*Proof of Proposition 3 (i):*

Let  $\gamma = \frac{(1+r)^N - (1+r)^{n-1}}{(1+r)^N - 1}$ . It is obviously that  $0 < \gamma < 1$ . Hence  $\pi_{n;R}^*(N) = \frac{1}{p} \cdot \frac{B}{B+D+(S+K)\gamma}$ .

And its is easy to get the result of  $\pi_{1;R}^*(N) > \pi_{n;R}^*(N)$ .

*Proof of Proposition 3 (ii):*

From Proposition 2:

$$\pi_{n;R}(N) = \frac{\frac{B}{p}}{B + D + \frac{S+K}{(1+r)^N - 1} \cdot [(1+r)^N - (1+r)^{n-1}]} = \frac{k_1}{k_2 + k_3 \cdot f(n)}$$

where

$$k_1 = \frac{B}{p} > 0, \quad k_2 = B + D > 0, \quad k_3 = \frac{S+K}{(1+r)^N - 1} > 0, \quad \text{and} \quad f(n) = (1+r)^N - (1+r)^{n-1}.$$

I summarize the following six mathematical facts.

- (1)  $f(n) > 0$  (because of  $N \geq n \geq 1$ ).
- (2)  $f(n+1) - f(n) = -(1+r)^n + (1+r)^{n-1} = (1+r)^{n-1} \cdot (1-1-r) = -r \cdot (1+r)^{n-1} < 0$ .
- (3)  $[f(n+2) - f(n+1)] - [f(n+1) - f(n)] = f(n+2) - 2f(n+1) + f(n) = -r^2 \cdot (1+r)^{n-1} < 0$ .
- (4)  $f(n) \cdot [f(n+1) - f(n+2)] + f(n+2) \cdot [f(n+1) - f(n)] > 0$ .

*proof:* First, multiply fact (3) by  $-f(n+2)$  can get a result of

$$f(n+2) \cdot [f(n+1) - f(n+2)] + f(n+2) \cdot [f(n+1) - f(n)] > 0. \text{ Next, use the}$$

fact of  $f(n) > f(n+2) > 0$  (from fact 2) and  $[f(n+1) - f(n+2)] > 0$

can find  $f(n) \cdot [f(n+1) - f(n+2)] + f(n+2) \cdot [f(n+1) - f(n)] > 0$ .

$$(5) \quad \pi_{n+1;R}(N) - \pi_{n;R}(N) = \frac{-k_1 k_3 [f(n+1) - f(n)]}{[k_2 + k_3 f(n+1)] \cdot [k_2 + k_3 f(n)]} > 0$$

$$(6) \quad [\pi_{n+2}^R(N) - \pi_{n+1}^R(N)] - [\pi_{n+1}^R(N) - \pi_n^R(N)] = \pi_{n+2}^R(N) - 2\pi_{n+1}^R(N) + \pi_n^R(N) > 0$$

*proof:* Use Fact (5) twice get:

$$= \frac{k_1 \cdot \left\{ \begin{array}{l} -k_2 k_3 [f(n+2) - 2f(n+1) + f(n)] \\ + k_3^2 \{f(n)[f(n+1) - f(n+2)] + f(n+2)[f(n+1) - f(n)]\} \end{array} \right\}}{[k_2 + k_3 f(n+2)] \cdot [k_2 + k_3 f(n+1)] \cdot [k_2 + k_3 f(n)]} > 0.$$

*Proof of Proposition 3 (iii)*

The first part is obvious. Besides,  $\pi_{n;R}^*(N) - \pi_{n;NR}^* = \frac{1}{p} \cdot \frac{B(S+K)(1-\gamma)}{[B+D+(S+K)\gamma] \cdot [B+K+S+D]} > 0$

*Proof of Proposition 3 (iv)*

Let  $\gamma = \frac{(1+r)^N - (1+r)^{n-1}}{(1+r)^N - 1}$ ; hence  $\pi_{n;R}^*(N) = \frac{1}{p} \cdot \frac{B}{B+D+(S+K)\gamma}$ . Since  $(1+r)^N > (1+r)^{n-1} > 1$ ,

$0 < \gamma < 1$ . Using  $\gamma$  is a decreasing function of  $N$ ; it implies that  $\pi_{n;R}^*(N)$  is a

decreasing function of  $N$ .

Q.E.D.

**Appendix 4: Proof of Proposition 4**

*Proof of Proposition 4 (i):*

From Table 2, the relative magnitude of  $F_{n;R}^*(N)$  and  $F_{NR}^*$  depends on the relative size of  $\frac{(1+r)^{N-1}}{(1+r)^N - 1}$  and  $\frac{1}{1+r}$ . Because

$$\frac{(1+r)^{N-1}}{(1+r)^N - 1} - \frac{1}{(1+r)} = \frac{1}{(1+r) - \frac{1}{(1+r)^{N-1}}} - \frac{1}{(1+r)} > 0,$$

$F_{n;R}^*(N) - F_{NR}^* > 0$  is proved. Besides, using the fact of  $F_{n;R}^*(N) - F_{1;R}^* = F_{NR}^* - F_{1;NR}^* = S$  and  $F_{n;R}^*(N) - F_{NR}^* > 0$ , it implies that  $F_{1;R}^*(N) > F_{1;NR}^*$ .

*Proof of Proposition 4 (ii):*

From the formulas of  $F_{1;R}^*(N)$  and  $F_{n;R}^*(N)$ , it is easy to find that  $N$  affects them *via* the factor:

$$\frac{(1+r)^{N-1}}{(1+r)^N - 1} = \frac{1}{(1+r) - \frac{1}{(1+r)^{N-1}}}.$$

Hence, it is straightforward to get the result that either  $F_{1;R}^*(N)$  or  $F_{n;R}^*(N)$  is a decreasing function of  $N$ .

Q.E.D.