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Audit Committees -
A Corporate Governance Problem**

Barbara Schöndube-Pirchegger • Jens Robert Schöndube

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Reputation Concerns and Herd Behavior of Audit Committees - A Corporate Governance Problem*

Barbara Schöndube-Pirchegger, Jens Robert Schöndube
Otto-von-Guericke University of Magdeburg
Postfach 4120, 39016 Magdeburg
e-mail: barbara.schoendube@ovgu.de,
jens.schoendube@ovgu.de

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Abstract

This paper offers an explanation for audit committee failures within a corporate governance context. We consider a setting in which the management of a firm sets up financial statements that are possibly biased. These statements are reviewed/audited by an external auditor and by an audit committee. Both agents report the result of their audit, the auditor acting first. The auditor and the audit committee use an imperfect auditing technology. As a result of their work they privately observe a signal regarding the quality of the financial statements. The probability for a correct signal in the sense that an unbiased report is labeled correct and a biased one incorrect, depends on the type of the agent. Good as well as bad agents exist in the economy. Importantly, two good agents observe identical informative signals while the signal observed by a bad agent is uninformative and uncorrelated to those of other good or bad agents. The audit committee as well as the auditor are anxious to build up reputation regarding their ability in the labor market. Given this predominate goal they report on the signal in order to maximize the market's assessment of their ability. At the end of the game the true character of the financial statements is revealed to the public with some positive probability. The market uses this information along with the agents' reports to update beliefs about the agents' types. We show that a herding equilibrium exists in which the auditor reports based on his signal but the audit committee "herds" and follows the auditor's judgement no matter what its own insights suggest. This results holds even if the audit committee members are held liable for detected failure. However, performance based bonus payments induce truthful reporting at least in some cases.

Keywords: corporate governance, audit committee, game theory, herding, incentive contracts

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1 Introduction

Over the past decade institutions in various countries made considerable efforts in order to improve corporate governance structures. For instance the "Sarbanes Oxley Act" (SOX) resulted from such effort in the US, "The Combined Code: Principles of Good Governance and Code of Best Practice" in the UK, and the "German Code of Corporate Governance" (GCCG) in Germany. The list could be extended easily.¹

One of the main objectives of these regulations is to improve the quality of financial reporting. To achieve this, special attention has been devoted to audit committees and the way they are composed. For instance firms listed at the NYSE are required to maintain audit committees composed of all independent directors.² In addition the SOX requires these firms to disclose to the SEC whether they have a financial expert on the audit committee.³ Similar regulations apply in Germany. In particular the German Stock Companies Act requires that at least one independent financial expert serves on the supervisory board of listed companies. Moreover, the GCCG recommends to set up an audit committee as a sub-committee of the supervisory board whose chairman should be a financial expert.⁴

The underlying idea of such recommendations of course is that independent and highly qualified audit committee members would effectively monitor the reporting process of a firm, detect audit errors, report their findings truthfully, and thus enhance reporting quality.

To provide some anecdotal but well documented evidence, e.g., the case of Enron seems to be at odds with this idea. Enron's audit committee comprised a number of independent and presumably highly qualified experts but obviously did not oppose to dubious accounting practices of both, the management and the auditor.⁵ Certainly, this startling failure may be regarded as an unfortunate, exceptional case in which an audit committee, highly qualified and acting for the best, was fooled for some reason. Alternatively, it might be worth it to consider the potential existence of adverse incentives that persist after independence and adequate capabilities have been ensured. Following the latter idea, we model audit committee members as economic agents pursuing personal goals that are in potential conflict with investors' interests.

Specifically, we assume that career concerns matter and that audit committee members aim at building reputation in the labor market. This is in line with previous contributions to the literature. E.g. Fama and Jensen (1983) and Zajac and Westphal (1996) state that a primary incentive for outside directors to effectively monitor managers and their financial reporting is to enhance reputation in the labor market for outside directors. Yermack (2004) empirically quantifies that statement and finds that 40% of total outside director incentives are related to

¹For a comprehensive overview see http://www.ecgi.org/codes/all_codes.php.

²For more details on specific listing rules see Klein (2006), pp. 4f.

³See Sec. 407 of the Sarbanes Oxley Act.

⁴See §100 (5) of the German Stock Companies Act and section 5.3.2 of the German Corporate Governance Code.

⁵See, e.g., Benston and Hargraves (2002), Demski (2002), Revsine (2002).

reputation, which basically drives the chance to get and the risk to lose directorships.

Reputation, however, is likely to suffer severe damage if financial reporting failures are detected. This manifests itself for instance in a significant increase in the number of board turnovers and losses of other board positions of outside directors (audit committee members) following an accounting restatement, as documented by Srinivasan (2005). A similar effect has been shown for directors whose companies suffer bankruptcy (Gilson 1990).

In this paper, we add a particular aspect when we model the market's response to financial reporting failures. Basically, we assume that the reputational loss for an audit committee that fails to detect financial fraud is less severe if the auditor is fooled, too, and vice versa. Moreover, reputation of the audit committee is assumed to suffer extreme damage if the auditor does not object to the financial statements presented by the management, the audit committee does so, and finally the financial statements turn out to be correct. The underlying idea is that with both parties being fooled some "sharing the blame" effect occurs that renders the labor market's reaction to a failure moderate. If only one is fooled, however, the one fooled suffers great losses while the other one's reputation rises.

Our analysis is based on a learning model closely related to the one introduced by Scharfstein and Stein (1990). We assume that in an economy an exogenously given percentage of the financial statements is biased (does not comply with GAAP). The financial statements are audited by an auditor and by an audit committee. "Auditing" in what follows is used in a broad sense noticing that the auditor and the audit committee do not perform identical tasks. However, the audit committee is supposed to do "auditing", too, as it closely follows and monitors the reporting process. Both parties use imperfect auditing technologies and possibly get incorrect results. They might either conclude from their audit that the financial statements are biased even though they are correct or fail to detect an existing bias. Both parties have to report on their audit. Importantly, the auditor acts first and thus bases his report on his ex ante beliefs and the privately observed result of his audit. The audit committee acting second does the same thing but additionally considers the auditor's report when forming beliefs about the true character of the financial statements.

Even though both parties are assumed to be well educated and qualified, different types of auditors and audit committee members are assumed to exist. Good types act cleverly and pick auditing strategies that provide them with valuable information. Thus they obtain informative results from their audit. Bad ones fail to pick a fruitful strategy and the information received from the audit is pure noise. Good types, however, are assumed to observe identical audit results. The type of the auditor and audit committee in place, good or bad, is unknown to everyone. At the end of the game, after both parties have reported, the true character of the financial statements is learned at least with some positive probability. For instance, certain estimates underlying measurement and valuation of assets and debt might either turn out to be correct on average or systematically biased. More dramatically, sudden restatements, as in the case of Enron, WorldCom, and the like, may become necessary and thus discover previous

misstatements.

Having learned the reports and possibly the quality of the financial statements, the labor market updates beliefs regarding the type of the auditor and the audit committee. We show that if both parties are anxious to build up reputation and report in order to maximize the market's assessment of their abilities, there is an incentive for the audit committee to herd and to mimic the auditor's report no matter what its private information indicates. This result holds even if we extend our model and assume that audit committee members are held liable for detected failure. Adding a bonus payment, however, in some cases cures herding incentives.

Our paper contributes to the literature on opportunistic board behavior. Previous theoretical work on that issue includes Hermalin and Weisbach (1998), Cyert et al. (2002), Bebchuk and Fried (2003), Ozerturk (2005), Adams and Ferreira (2007), Drymiotis (2007), and Schöndube-Pirchegger and Schöndube (2009). Cyert et al., Bebchuk and Fried, and Ozerturk stress the role of the board in determining CEO compensation and analyze effects of an agency conflict between the board and shareholders on such contracts. In Schöndube-Pirchegger and Schöndube the board can additionally increase the CEO's cost to bias a report via supervisory effort. Hermalin and Weisbach investigate the effectiveness of monitoring as a function of the board's independence from the CEO. Drymiotis shows that a less independent board may increase the effectiveness of monitoring the CEO and Adams and Ferreira demonstrate the superiority of a less independent board when the board has two tasks: to monitor and to advise the CEO.

In contrast, this paper focuses on financial reporting control and refers to the audit committee as the relevant institution to perform this task.

A similar focus can be found in several empirical papers. Triggered by the recent changes as described above, e.g., Defond et al. (2005) investigate whether appointments of outside directors or financial experts to the audit committee is perceived as good news by the capital market and thus leads to abnormal returns. Xie et al. (2003), Klein (2006), and Carcello et al. (2006) study the relation between audit committee composition and earnings manipulation. These papers find some evidence that better corporate governance structures are perceived to work or indeed work, but naturally do not investigate underlying incentive effects explicitly.

Finally, the paper ties in with the literature on (reputational) herding.⁶ Previous research for instance identified herd behavior among security analysts and investors.⁷ Herd behavior of audit committee members to our best knowledge, has not been addressed in the literature so far.

The paper is organized as follows. Section 2 presents the model. In section 3 we consider a benchmark setting in which the auditor and the audit committee report based on their best knowledge. Section 4 derives a herding equilibrium where the audit committee mimics the auditor no matter what its personal beliefs are. Section 5 investigates measures to counteract herding tendencies and section 6 sums up our findings.

⁶See Dechow and Welch (1996) for a survey over different herding models in financial economics.

⁷See Welch (2000), Arya and Mittendorf (2005), and Scharfstein and Stein (1990), respectively.

2 The model

We assume that two types of managements exist in an economy. One type is innately honest and reports truthfully complying with GAAP while the other one does not and biases the financial report to his personal benefit. The ex ante probability for an honest type, α , is publicly known. $R \in \{R_b, R_t\}$ denotes the financial statement information to be reported by the management. t refers to a truthful report of the honest management and b to a biased one.

The financial statements set up by the management are audited by an independent auditor and by an audit committee. For simplicity we model the audit and its result in similar fashion for both agents: The auditor and the audit committee perform an audit which results in a binary privately observed signal $s^j \in \{s_b, s_t\}$, $j = A, AC$. A refers to the auditor and AC to the audit committee. The signal either claims that the financial statements are correct and truthful, s_t . Or it claims that the report is biased and thus does not comply with GAAP, s_b .

Both agents observe a signal but they do not necessarily observe the same one. Auditor and audit committee are required to report on their audit, again in binary fashion: $M^j \in \{M_b, M_t\}$; either they report that the financial statements are correct, M_t , or they report that they are incorrect, M_b .

The information inherent in the private signal depends on the type of the observer which is unknown ex ante to everyone. Two types of auditors and audit committees are assumed to exist: good ones and bad ones, $\tau^j \in \{\text{good}, \text{bad}\}$. The probability of being good for both agents is known to be $\theta^j = \theta$.

If an agent is bad, the observed signal is pure noise such that

$$\Pr(s_t|R_t, \text{bad}) = \Pr(s_t|R_b, \text{bad}) = m$$

and

$$\Pr(s_b|R_b, \text{bad}) = \Pr(s_b|R_t, \text{bad}) = 1 - m.$$

If one is good, the signal is informative with respect to the true character of the financial statements. Thus the conditional probability to observe the signal s_t (s_b) if R_t (R_b) is present exceeds the one to observe s_b (s_t).

$$\Pr(s_t|R_t, \text{good}) > \Pr(s_t|R_b, \text{good})$$

and

$$\Pr(s_b|R_b, \text{good}) > \Pr(s_b|R_t, \text{good}).$$

In addition we assume identical probabilities to observe the correct signal for good agents, no matter whether the report is truthful or biased

$$\Pr(s_t|R_t, \text{good}) = \Pr(s_b|R_b, \text{good}) = p.$$

In turn the conditional probability to observe the wrong signal even though good is identical in both states of nature, too:

$$\Pr(s_t|R_b, good) = \Pr(s_b|R_t, good) = 1 - p.$$

For the signal to be informative but imperfect we require $0.5 < p < 1$.

Importantly, we assume that two good agents receive identical signals, while two bad ones or one good and one bad agent receive independent, possibly different signals. Given this structure, the market can update beliefs regarding the agents capabilities not only based on the reports of both agents taken individually (in combination with R_i if revealed at the end of the game), but draw inferences from whether both agents emit identical or different reports. Identical reports possibly hint towards identical signals, which are certain to be observed if both agents are good.

All the same, we assume that the signal per se is uninformative with regard to the type of agent. Put another way, the agents are supposed not to learn anything about their personal type when observing the signal in isolation. To ensure this we require that the ex ante probability to observe s_t and s_b is identical for both, the good type and the bad one:

$$\Pr(s_i|good) = \Pr(s_i|bad). \tag{1}$$

For signal s_t this results in

$$\begin{aligned} & \Pr(s_t|good) = \Pr(s_t|bad) \\ \Leftrightarrow & \Pr(s_t|good, R_t) \Pr(R_t) + \Pr(s_t|good, R_b) \Pr(R_b) \\ & = \Pr(s_t|bad, R_t) \Pr(R_t) + \Pr(s_t|bad, R_b) \Pr(R_b) \\ \Leftrightarrow & p\alpha + (1 - p)(1 - \alpha) = m\alpha + m(1 - \alpha) \\ \Leftrightarrow & p\alpha + (1 - p)(1 - \alpha) = m. \end{aligned} \tag{2}$$

For signal s_b we obtain analogously

$$(1 - p)\alpha + p(1 - \alpha) = (1 - m). \tag{3}$$

Rearranging terms reveals that (2) and (3) are identical.

In what follows we restrict $\alpha = \frac{1}{2}$. Doing so eases the analysis and simplifies notation considerably. Moreover, it allows to exclude equilibria that are solely driven by a "conform to the prior" effect and therefore provide very limited insights.⁸ As a consequence we are able to derive a unique pure strategy herding equilibrium at least for given out of equilibrium beliefs. Assuming $\alpha = \frac{1}{2}$ implies $m = \frac{1}{2}$.

⁸For this argument see also Scharfstein and Stein, 2000, p. 705.

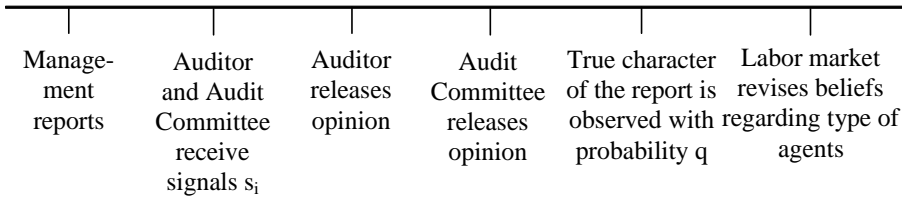


Figure 1: Timeline.

The timeline in figure 1 describes the course of the game.

The management sets up possibly biased financial statements. These are audited by an independent auditor and an audit committee. Both parties privately receive a signal about the quality of the financial statements. As described above, either identical or different signals may be observed. The auditor releases an opinion, which is either M_b or M_t , to the public. Having observed the auditor's report, the audit committee releases its opinion, again M_b or M_t , based on both pieces of information, the auditor's report and its own privately observed signal.

After both reports have been observed publicly, with probability q the true character of the financial statements is learned. At the end of the game the labor market updates its beliefs regarding the type of the auditor and the audit committee based on all available information forming rational conjectures about the agents' reporting strategies.

With regard to the agents' objectives we contrast two different settings: We start with a benchmark setting that analyzes the reporting behavior of both agents assuming that neither one cares about the market's assessment. Both agents try to make truthful and informative statements in the sense that they report what the information observed indicates.

In the second setting we characterize equilibrium reporting behavior given that reputation concerns matter. The agents are assumed to be interested solely in improving the labor market's assessment of their own capabilities. Thus they choose their report M_b or M_t in order to influence the market's belief about their type (capability). We demonstrate that this particular interest distorts reporting incentives and creates herd behavior.

3 Benchmark Setting

3.1 The auditor's choice

In our model the auditor acts first. He receives a signal s_i and is required to report on the quality of the financial statements based on that signal. He does not know his personal type and thus whether the signal received is informative. Given he observes s_i he will report M_i if the following inequality is satisfied:

$$\Pr(R_i|s_i) \geq \frac{1}{2}.$$

Thus the auditor reports M_i if he personally believes that R_i is more likely than not. For the special case where $\Pr(R_i|s_i) = \frac{1}{2}$ we assume that the auditor aims at passing on his private information to the market by reporting M_i if he observed s_i .

We start with $i = t$. According to Bayes' rule

$$\Pr(R_t|s_t) = \frac{\Pr(s_t|R_t)\Pr(R_t)}{\Pr(s_t)}.$$

Note that

$$\Pr(s_t) = \Pr(s_t|R_t)\Pr(R_t) + \Pr(s_t|R_b)\Pr(R_b) \quad (4)$$

and

$$\begin{aligned} \Pr(s_t|R_t) &= \Pr(s_t|R_t, \text{good})\Pr(\text{good}) + \Pr(s_t|R_t, \text{bad})\Pr(\text{bad}) \\ &= p\theta + \frac{1}{2}(1 - \theta), \end{aligned} \quad (5)$$

$$\begin{aligned} \Pr(s_t|R_b) &= \Pr(s_t|R_b, \text{good})\Pr(\text{good}) + \Pr(s_t|R_b, \text{bad})\Pr(\text{bad}) \\ &= (1 - p)\theta + \frac{1}{2}(1 - \theta). \end{aligned} \quad (6)$$

Inserting (5) and (6) into (4) and using $\Pr(R_t) = \alpha = \frac{1}{2}$ results in

$$\Pr(R_t|s_t) = p\theta + \frac{1}{2}(1 - \theta).$$

To summarize, for the auditor to report t having observed s_t we require

$$p\theta + \frac{1}{2}(1 - \theta) \geq \frac{1}{2} \quad (7)$$

to hold.

Similarly, the auditor will report b (will not report t) having observed s_b if the following inequality holds:

$$\Pr(R_b|s_b) \geq \frac{1}{2}. \quad (8)$$

Proceeding as shown above, we obtain

$$\Pr(R_b|s_b) = p\theta + \frac{1}{2}(1 - \theta).$$

Thus, condition (8) is equivalent to (7). Rewriting expression (7) as

$$\frac{1}{2} + \theta(p - \frac{1}{2}) \geq \frac{1}{2}$$

it is easy to see it holds for $p > 0.5$.

Thus in our setting an auditor that reports according to his own assessment based on what he observed will always report what the signal indicates, that is M_b (M_t) if s_b (s_t) has been observed.

3.2 The audit committee's choice

The audit committee updates its beliefs regarding the management's report based on what it learns from the auditor's report and its own signal. Knowing that the auditor reports as described above, the audit committee is able to infer the signal from observing the report. Thus without reputation concerns the audit committee reports M_i whenever the conditional probability for R_i is greater than $\frac{1}{2}$.

As for the auditor, we assume that an audit committee that attaches identical probabilities to both types of financial statements being present, that is $\Pr(R_i|\cdot, \cdot) = \frac{1}{2}$, passes on the personally observed signal to the market by reporting M_i having observed s_i .

Specifically, the audit committee will report M_t after having observed two signals if

$$\begin{aligned}\Pr(R_t|s_t, s_t) &\geq \frac{1}{2} \\ \Pr(R_t|s_b, s_t) &\geq \frac{1}{2} \\ \Pr(R_t|s_t, s_b) &> \frac{1}{2} \\ \Pr(R_t|s_b, s_b) &> \frac{1}{2}\end{aligned}$$

and will report M_b whenever these inequalities are violated.⁹

Calculating the conditional probabilities as $\Pr(R_k|s_i, s_j) = \frac{\Pr(R_k, s_i, s_j)}{\Pr(s_i, s_j)}$ with $\Pr(R_k, s_i, s_j) = \Pr(s_i, s_j|R_k) \Pr(R_k)$,¹⁰ we obtain

$$\begin{aligned}\Pr(R_t|s_t, s_t) &= \frac{4p\theta + (1-\theta)^2}{2(1+\theta^2)} \\ \Pr(R_t|s_b, s_b) &= \frac{4(1-p)\theta + (1-\theta)^2}{2(1+\theta^2)}\end{aligned}$$

and

$$\Pr(R_t|s_b, s_t) = \Pr(R_t|s_t, s_b) = \frac{1}{2}.$$

The conditions

$$\frac{4p\theta + (1-\theta)^2}{2(1+\theta^2)} \geq \frac{1}{2} \tag{9}$$

⁹In what follows the first signal refers to the auditor's and the second one to the audit committee's observation. E.g., $\Pr(R_t|s_b, s_t)$ denotes the conditional probability for an unbiased report to be present, given that the auditor has observed s_b and the audit committee has observed s_t .

¹⁰ $\Pr(s_i, s_j|R_k)$ can be further decomposed as $\Pr(s_i, s_j|R_k) = \sum_{\tau^A} \sum_{\tau^{AC}} \Pr(s_i, s_j|R_k, \tau^A, \tau^{AC}) \Pr(\tau^A, \tau^{AC})$ with $\Pr(s_i, s_j|R_k, \tau^A, \tau^{AC}) = \Pr(s_i|R_k, \tau^A) \Pr(s_j|R_k, \tau^{AC})$ if $(\tau^A, \tau^{AC}) \neq (\text{good}, \text{good})$ and $\Pr(s_i, s_j|R_k, \text{good}, \text{good}) = \begin{cases} 0 & \text{if } s_i \neq s_j \\ \Pr(s_i|R_k, \text{good}) & \text{if } s_i = s_j \end{cases}$.

and

$$\frac{4(1-p)\theta + (1-\theta)^2}{2(1+\theta^2)} > \frac{1}{2} \quad (10)$$

simplify to get

$$p \geq \frac{1}{2}$$

and

$$(1-p) > \frac{1}{2},$$

respectively. While condition (9) holds by assumption, (10) is violated. Thus the audit committee will report M_t having inferred/observed (s_t, s_t) and M_b given (s_b, s_b) . If the signals observed differ from each other, it will report what its personally observed signal indicates.

4 Reputation concerns

In this section reputation or career concerns are present. Both agents aim at enhancing their reputation tantamount to the labor market's beliefs about their capability. Define $\tilde{\theta}^j(M^A, M^{AC}, R) \equiv \Pr(\tau^j = \text{good} | M^A, M^{AC}, R)$, $j = A, AC$, the probability that agent j 's type is good conditional on reports (M^A, M^{AC}) and the observation of the true character of financial statements R . If R has not been observed the corresponding probability is denoted by $\tilde{\theta}^j(M^A, M^{AC})$. Irrespective of the observation of R we define

$$\tilde{\theta}^j(M^A, M^{AC}) = \begin{cases} \tilde{\theta}^j(M^A, M^{AC}, R) & \text{if } R \text{ has been observed} \\ \tilde{\theta}^j(M^A, M^{AC}) & \text{else} \end{cases}.$$

Maximizing reputation in the labor market, the auditor's and the audit committee's objective functions become $E(\tilde{\theta}^A | s^A)$ and $E(\tilde{\theta}^{AC} | M^A, s^{AC})$, respectively. Recall that AC knows the other agent's report when it has to report on its audit, while A does not have this information. Hence, A builds expectations over the observation of R , over the realization of R given it is observed, and over AC's report. AC only builds expectations over the observation of R and its realization.

Below we establish that a herding equilibrium exists with herding on the part of the audit committee. Each player forms rational beliefs about the strategies of the other players which are correct in equilibrium. To check whether a strategy of a certain player is possibly part of an equilibrium, we use a ceteris paribus analysis. Thus we take the beliefs and strategies of all other players as given and assume that they are correctly anticipated by the player considered. We proceed in three steps.

First we assume that the auditor reports consistently with the signal observed: M_b if he observes s_b and M_t if he observes s_t .

Second we show that given the auditor's strategy, it is optimal for the audit committee to follow the auditor's opinion and to replicate his report no matter which signal has been privately

observed. This strategy turns out to be optimal even though the labor market anticipates such behavior and thus ignores the report when forming beliefs about AC's ability.¹¹

Finally, we show that given the herding strategy of the audit committee and consistent beliefs of the market, it is indeed optimal from the auditor's perspective to report what the signal observed indicates.

According to step one described above, we presume that the auditor reports as in the benchmark setting. If he does so, the audit committee is able to infer s_t (s_b) from the report M_t (M_b). The audit committee itself observes either the same signal as the auditor or a different one. It chooses its own report to affect the market's belief about its type. To start off, we assume that the market believes both agents behave as described in the benchmark setting. Such behavior would allow the market to infer the signal each agent observed from the reports and to update beliefs accordingly. Conditional on whether the labor market learns the true character of the report R at the end of the game the following revised beliefs $\hat{\theta}^{AC}$ result.

i) If the market has learned R :¹²

$$\begin{aligned}\hat{\theta}^{AC}(s_t, s_t, R_t) &= \hat{\theta}^{AC}(s_b, s_b, R_b) = \frac{2\theta p(1+\theta)}{4\theta p + (1-\theta)^2} \\ \hat{\theta}^{AC}(s_t, s_t, R_b) &= \hat{\theta}^{AC}(s_b, s_b, R_t) = \frac{2\theta(1-p)(1+\theta)}{4\theta(1-p) + (1-\theta)^2} \\ \hat{\theta}^{AC}(s_t, s_b, R_b) &= \hat{\theta}^{AC}(s_b, s_t, R_t) = \frac{2p\theta}{(1+\theta)} \\ \hat{\theta}^{AC}(s_b, s_t, R_b) &= \hat{\theta}^{AC}(s_t, s_b, R_t) = \frac{2(1-p)\theta}{(1+\theta)}\end{aligned}\tag{11}$$

ii) If the market has not learned R :

$$\begin{aligned}\hat{\theta}^{AC}(s_t, s_t) &= \hat{\theta}^{AC}(s_b, s_b) = \frac{\theta(1+\theta)}{1+\theta^2} \\ \hat{\theta}^{AC}(s_t, s_b) &= \hat{\theta}^{AC}(s_b, s_t) = \frac{\theta}{(1+\theta)}\end{aligned}\tag{12}$$

This updating rule, however, holds in equilibrium if and only if there is no incentive for the audit committee to deviate from the perceived reporting strategy, i.e. if the following conditions apply:

$$\begin{aligned}E\left(\tilde{\theta}^{AC}(s_i, s_b) | (s_i, s_b)\right) &\geq E\left(\tilde{\theta}^{AC}(s_i, s_t) | (s_i, s_b)\right) \text{ for } i = b, t \\ E\left(\tilde{\theta}^{AC}(s_i, s_t) | (s_i, s_t)\right) &\geq E\left(\tilde{\theta}^{AC}(s_i, s_b) | (s_i, s_t)\right) \text{ for } i = b, t.\end{aligned}$$

¹¹This result is similar to the signal-jamming literature, where in equilibrium agents distort signals to influence the market's beliefs although the market rationally anticipates distortion of the signal. See Homström (1982) and Fischer and Verrecchia (2000).

¹²See the appendix for detailed description of how $\hat{\theta}^{AC}(\cdot)$ is calculated.

Notice that given A follows his signal and the market believes that both agents follow their signals reports will be translated into signals in evaluating AC's ability: $E\left(\tilde{\theta}^{AC}(M_i, M_j) | (M_i, s_k)\right) = E\left(\tilde{\theta}^{AC}(s_i, s_j) | (s_i, s_k)\right)$. Furthermore, by definition of $\tilde{\theta}^{AC}$, $E\left(\tilde{\theta}^{AC}(s_i, s_j) | s_i, s_j\right) = \hat{\theta}^{AC}(s_i, s_j)$, i.e. if AC reports truthfully the effect of R drops out on average. For instance, assume that the auditor has reported M_t which implies an observation s_t . The audit committee privately observes s_b . It will report M_b if and only if the following inequality holds:

$$E\left(\tilde{\theta}^{AC}(s_t, s_b) | (s_t, s_b)\right) = \hat{\theta}^{AC}(s_t, s_b) \geq E\left(\tilde{\theta}^{AC}(s_t, s_t) | (s_t, s_b)\right)$$

which can be rewritten as

$$\hat{\theta}^{AC}(s_t, s_b) \geq q[\hat{\theta}^{AC}(s_t, s_t, R_t) \Pr(R_t | s_t, s_b) + \hat{\theta}^{AC}(s_t, s_t, R_b) \Pr(R_b | s_t, s_b)] + (1-q)\hat{\theta}^{AC}(s_t, s_t).$$

This inequality, however, is always violated as is shown in lemma 1.

Lemma 1 *If the auditor reports the signal observed and the market believes that the audit committee does so, too, and updates beliefs accordingly, the audit committee has a strict incentive to always mimic the auditor's report. It reports M_t if the auditor has reported M_t and M_b if the auditor has reported M_b , no matter what signal s_i it observed.*

Proof. See the appendix. ■

Corollary 1 *There does not exist an equilibrium in which the auditor and the audit committee report what the signals indicate and the market correctly infers the signals from the reports and updates accordingly.*

Given this result, it is not rational from the market's perspective to believe the audit committee's report and to update beliefs as demonstrated above. A rational market rather anticipates the audit committee's incentives. Imitating the auditor's report renders the audit committee's report completely uninformative. From the market's perspective it can at best be ignored and thus the prior belief θ is used to evaluate AC.

If the market adopts that strategy, we need to check whether it is still optimal for the audit committee to imitate the auditor. To do so we establish the following natural out of equilibrium beliefs of the market:

If the market observes a report from the audit committee that differs from the one the auditor provided, the market believes that the audit committee reports what the observation of its private signal indicates, that is M_t (M_b) having observed s_t (s_b).

Given this scenario the audit committee has an incentive to mimic the auditor's report if the following inequalities hold:

$$\theta \geq E\left(\tilde{\theta}^{AC}(s_t, s_b) | s_t, s_b\right) = \hat{\theta}^{AC}(s_t, s_b) \quad (13)$$

$$\theta \geq E\left(\tilde{\theta}^{AC}(s_b, s_t) | s_b, s_t\right) = \hat{\theta}^{AC}(s_b, s_t) \quad (14)$$

$$\theta \geq E\left(\tilde{\theta}^{AC}(s_t, s_b) | s_t, s_t\right) \quad (15)$$

$$\theta \geq E\left(\tilde{\theta}^{AC}(s_b, s_t) | s_b, s_b\right) \quad (16)$$

(13) and (14) are equivalent. Inserting (12) we obtain

$$\theta \geq \frac{\theta}{1 + \theta}$$

which always holds true. The RHS of (15) and (16) is known from the proof of Lemma 1, part iii) and iv). Accordingly, (15) and (16) are equivalent and can be written as

$$\theta \geq \frac{\theta(1 - \theta)^2 + 8p\theta(1 - p)}{(\theta + 1)(\theta^2 + 1)} \Leftrightarrow \frac{\theta(3 + \theta^2 - 8p(1 - p))}{(\theta + 1)(\theta^2 + 1)} \geq 0.$$

As $8p(1 - p)$ is less than 2, (15) and (16) are fulfilled, too.

Even though the market ignores the report and uses its prior belief on AC's type, it remains optimal from the AC's perspective to mimic the auditor. Put another way, truthful reporting damages reputation on average as the market interprets different reports, implying different signals, as an indicator of bad types.

Summing up, we find that whenever the auditor reports what the signal he observes indicates, the audit committee optimally mimics the auditor's report and the market ignores this report when updating beliefs on the audit committee's type.

It remains to show that it is indeed part of the equilibrium that the auditor reports truthfully as assumed so far. Given that the audit committee mimics the auditor's report, the market is unable to infer anything from observing the second report. Thus it will use the auditor's report as well as the true character of the financial statements R_i , if revealed, to update beliefs regarding the auditor's type.

If the market believes the auditor's report and updates accordingly the auditor has no incentive to deviate from such reporting if the following relations hold:

$$E\left(\tilde{\theta}^A(s_t) | s_t\right) \geq E\left(\tilde{\theta}^A(s_b) | s_t\right) \quad (17)$$

$$E\left(\tilde{\theta}^A(s_b) | s_b\right) \geq E\left(\tilde{\theta}^A(s_t) | s_b\right) \quad (18)$$

This is indeed the case which results in lemma 2.

Lemma 2 *The auditor has a strict incentive to report what the signal observed indicates given that the market anticipates such behavior and updates beliefs accordingly.*

Proof. See the appendix. ■

Note that the above Lemma holds true for all $q \in (0, 1]$.

Having completed the three-step analysis described at the beginning of this section, we are able to state the following result.

Proposition 1 *The following strategies constitute an equilibrium: The auditor reports what the signal observed indicates. The audit committee mimics the auditor's report such that its own report does not depend on the signal it privately observes. The market anticipates the strategies of both agents and updates beliefs with regard to their capabilities accordingly. It considers the auditor's report and ignores the one provided by the audit committee.*

The equilibrium derived in Proposition 1 provides a systematic rationale for the lack of opposition we observe on the part of audit committees. If reputation concerns are present, it might in particular be rational from the audit committee's perspective not to object to what the management reports and the auditor confirms. These incentives prevail no matter what private information suggests.

5 Countervailing measures

So far we have assumed that the sole objective of audit committee members is to maximize the market's perception of their ability. Naturally, the question arises whether other objectives are likely to exist or can be created via legislation, institutions or contracting. In what follows we discuss two measures that come to mind in this context: First, we assume that the AC is held liable for failure by imposing a fine. Second, a reward for good performance is considered.

5.1 Imposing a fine for AC failure

This section covers a setting in which the audit committee is held liable if its report M^{AC} does not coincide with the subsequently revealed true quality of the financial statements R . We extend the model to include a fine β to be paid by the AC if either the AC reports M_t and R_b is revealed or vice versa.

Accordingly we adapt the AC's objective function to reflect that the AC maximizes some kind of "net compensation" composed of expected reputation less expected fine:

$$\max E \left(\tilde{\theta}^{AC} | \cdot \right) - E (\beta | \cdot).$$

Assume again that the auditor behaves as in the benchmark solution, i.e., he reports what his signal indicates. By definition if the true character of the financial statements is not observed at the end of the period, which happens with probability $(1 - q)$, liability of the AC does not

apply. Given the true character of financial statements is learned, AC's expected fine conditional on both signals and its report is given by

$$E(\beta|s_i, s_j, M_k) = \beta \Pr(R_l|s_i, s_j, l \neq k)$$

with $i, j, k, l \in \{b, t\}$. For instance, assume AC has observed signal s_t and inferred s_b from the auditor's report M_b . If AC reports M_t its expected fine is given by

$$\begin{aligned} E(\beta|s_b, s_t, M_t) &= \beta \Pr(R_b|s_b, s_t) + 0 \Pr(R_t|s_b, s_t) \\ &= \beta \frac{1}{2}. \end{aligned}$$

Given the auditor acts as in the benchmark solution and the market conjectures that both agents behave like in the benchmark solution, benchmark behavior by AC is induced via a fine β if and only if the following four conditions hold:

$$\text{i) } E(\tilde{\theta}^{AC}(s_t, s_b)|s_t, s_b) - qE(\beta|s_t, s_b, M_b) \geq E(\tilde{\theta}^{AC}(s_t, s_t)|s_t, s_b) - qE(\beta|s_t, s_b, M_t) \quad (19)$$

$$\text{ii) } E(\tilde{\theta}^{AC}(s_b, s_t)|s_b, s_t) - qE(\beta|s_b, s_t, M_t) \geq E(\tilde{\theta}^{AC}(s_b, s_b)|s_b, s_t) - qE(\beta|s_b, s_t, M_b)$$

$$\text{iii) } E(\tilde{\theta}^{AC}(s_t, s_t)|s_t, s_t) - qE(\beta|s_t, s_t, M_t) \geq E(\tilde{\theta}^{AC}(s_t, s_b)|s_t, s_t) - qE(\beta|s_t, s_t, M_b) \quad (20)$$

$$\text{iv) } E(\tilde{\theta}^{AC}(s_b, s_b)|s_b, s_b) - qE(\beta|s_b, s_b, M_b) \geq E(\tilde{\theta}^{AC}(s_b, s_t)|s_b, s_b) - qE(\beta|s_b, s_b, M_t)$$

From Lemma 1 we know that without any liability considerations, $\beta = 0$, conditions i) and ii) and conditions iii) and iv), respectively, are equivalent. Hence, (19) can be rewritten as

$$\text{i) } A - q\beta \Pr(R_t|s_t, s_b) \geq B - q\beta \Pr(R_b|s_t, s_b) \quad (21)$$

$$\text{ii) } A - q\beta \Pr(R_b|s_b, s_t) \geq B - q\beta \Pr(R_t|s_b, s_t)$$

$$\text{iii) } C - q\beta \Pr(R_b|s_t, s_t) \geq D - q\beta \Pr(R_t|s_t, s_t)$$

$$\text{iv) } C - q\beta \Pr(R_t|s_b, s_b) \geq D - q\beta \Pr(R_b|s_b, s_b) \quad .$$

with $A < B$ and $C > D$ as known from the proof of Lemma 1.

Proposition 2 *Given A reports like in the benchmark setting, there exists no fine β such that benchmark reporting of AC can be induced as equilibrium behavior.*

Proof. See the appendix. ■

Note that the incentive compatibility conditions i) and ii) refer to a situation in which A and AC have observed different signals $s_i \neq s_j$. As has been shown above, the conditional probability $\Pr(R_k|s_i, s_j) = \frac{1}{2}$, $i, j, k \in \{b, t\}$. Accordingly, given that R is revealed at all, both, R_t and R_b , are equally likely to pop up and the expected fine to be paid by the AC is identical, too, no

matter whether it reports in line with the signal personally observed or not. Technically spoken, the fine drops out of both sides of the inequality. What is left is identical to our setting without liability considerations where we have shown that herding incentives are present. Conditions iii) and iv), in contrast, cover identical observations of both agents. We know from the previous analysis that ACs that care solely about reputation report what they personally observe and thus follow the auditor. If a fine is imposed the expected fine is minimized for truthful reporting. This results from the fact that $\Pr(R_i|s_i, s_i) > \Pr(R_j|s_i, s_i), i \neq j$. Accordingly, the fine provides additional incentives to follow the auditor in this setting.

It follows that adding a fine to the objective function of the AC does not at all countervail the AC's incentives to herd.

5.2 Performance based bonus contracts

To start with the most basic setting let us consider a bonus contract for AC that pays a bonus $\beta > 0$ if AC's report M^{AC} coincides with the revealed character of the financial statements R . The incentive problem arising from such a bonus offer, however, is structurally very similar to the one created when a fine is imposed: Specifically, if A and AC observe different signals, the expected bonus to be obtained is identical, no matter whether AC reports what it personally observes or not. If both agents observe identical signals, the AC maximizes its expected bonus by reporting in line with the auditor and its personal observation. As a formal analysis would largely parallel the one above, we omit such an analysis and refer to the previous section.

Alternatively we proceed to allow the compensation contract for AC to depend on its own report as well as on A's report. We assume that AC obtains a bonus $\beta > 0$ if and only if its report coincides with the true character of the financial statements and A's report does not coincide with it. This contract captures that the audit committee will be highly rewarded if it has completed its tasks in an optimal way: Namely, to effectively monitor the reporting process and the auditor.

Given the auditor reports what his signal indicates, AC's expected bonus conditional on both signals and its report M_k is given by

$$E(\beta|s_i, s_j, M_k) = \beta \cdot \Pr(R_k|s_i, s_j, M_k, i \neq k).$$

Accordingly, the four conditions (see (19) and (21)) that ensure benchmark behavior by AC assuming A reports truthfully and the market believes that both agents report truthfully are given by

$$\begin{aligned} \text{i) } & A + q\beta \Pr(R_b|s_t, s_b) \geq B & (22) \\ \text{ii) } & A + q\beta \Pr(R_t|s_b, s_t) \geq B \\ \text{iii) } & C \geq D + q\beta \Pr(R_b|s_t, s_t) \\ \text{iv) } & C \geq D + q\beta \Pr(R_t|s_b, s_b) \end{aligned} .$$

Again conditions i) and ii) cover the case where both agents observe different signals. Hence, AC has only a chance to obtain the bonus if it reports truthfully. Conditions iii) and iv), in contrast, cover the setting in which AC and A observe identical signals. As by assumption the auditor reports truthfully the audit committee can only obtain the bonus if it reports contrary to the signals observed by both agents. The latter effect potentially counteracts the objective to motivate truthful reports and may lead to anti-herding by AC.

From previous sections we know that $A < B$ and $C > D$. Therefore, if β is sufficiently high, one can ensure that i) and ii) are fulfilled. However, if β becomes too high anti-herding will be motivated. Hence, β must be not too high to fulfill iii) and iv). The question is whether there exists a set of values for β such that all four conditions are fulfilled simultaneously.

Lemma 3 *If $\beta \in [\beta_{\min}, \beta_{\max}]$, conditions i)-iv) are fulfilled, where $\beta_{\min} \equiv \frac{2(B-A)}{q} > 0$, $\beta_{\max} \equiv \frac{C-D}{q\sigma} > 0$, $\beta_{\max} > \beta_{\min}$ and $\sigma \equiv \Pr(R_b|s_t, s_t) = \Pr(R_t|s_b, s_b)$.*

Proof. See the appendix. ■

Lemma 3 shows that there exists a continuum of positive bonuses such that AC can be motivated to report what its signal indicates rather than to follow the auditor. To avoid that AC will be induced to misstate its information if both agents observe the same signal there is an upper bound β_{\max} for the bonus. To provide AC with incentives to report truthfully if both agents observe different information there is a lower bound β_{\min} which an appropriate bonus must exceed.

Lemma 4 *Comparative statics: a) $\beta_{\min}: \frac{\partial \beta_{\min}}{\partial q} < 0, \frac{\partial \beta_{\min}}{\partial p} < 0, \frac{\partial \beta_{\min}}{\partial \theta} > 0$.
b) $\beta_{\max}: \frac{\partial \beta_{\max}}{\partial q} < 0, \frac{\partial \beta_{\max}}{\partial p} > 0, \frac{\partial \beta_{\max}}{\partial \theta} > 0$.*

Proof. See the appendix. ■

The higher the probability q that the true character of financial statements will be eventually observed the lower the lower and the upper bound for an incentive-compatible bonus. With q increasing a lower bonus is required to motivate truthful reporting if both agents observe different signals in i) and ii). At the same time the maximum feasible bonus that just ensures that AC reports truthfully if agents observe the same signals decreases as the RHS in iii) and iv) increases in q . Hence, the upper and the lower bound of incentive-compatible bonuses will be shifted downwards if q increases. As the marginal effect on β_{\min} turns out to be stronger than on β_{\max} , the bandwidth of incentive-compatible bonuses is decreasing in q . In contrast, if p increases the interval $[\beta_{\min}, \beta_{\max}]$ is enlarged. The higher the probability p that good types observe the "correct" signal the lower AC's average gain (B) from herding if both agents observe different signals (A does not depend on p). Therefore, a smaller bonus is required to motivate truthful reporting. At the same time, AC's gain from anti-herding (D) with identical signals is decreasing in p such that β_{\max} increases in p (C does not depend on p). If the ex ante

probability θ of an agent being good increases, the lower and the upper bound for β that allow to motivate truthful reports increase. The intuition is the following: The higher θ the higher AC's reputational loss (in terms of $B - A$ and $C - D$) from deviating from the herding strategy. This relaxes iii) and iv) but at the same time makes i) and ii) more restrictive.

To establish benchmark reporting by both agents as an equilibrium we finally have to investigate if the auditor has actually an incentive to report truthfully (as assumed so far) given the audit committee reports what its signal indicates and assuming benchmark beliefs by the market. The auditor reports as in the benchmark solution if and only if the following two conditions are fulfilled:

$$\begin{aligned} 1) \quad E\left(\tilde{\theta}^A(s_b, s^{AC}) | s_b\right) &\geq E\left(\tilde{\theta}^A(s_t, s^{AC}) | s_b\right) \\ 2) \quad E\left(\tilde{\theta}^A(s_t, s^{AC}) | s_t\right) &\geq E\left(\tilde{\theta}^A(s_b, s^{AC}) | s_t\right). \end{aligned} \tag{23}$$

The first condition requires that it is optimal for A to report M_b having observed s_b . The second one states that it needs to be optimal to report M_t having observed s_t . As by assumption AC reports according to its signal and the market believes that both agents report what their signals indicate, it follows that $\tilde{\theta}^A(M_j, M^{AC}) = \tilde{\theta}^A(s_j, s^{AC})$.

Lemma 5 *Given AC reports as in the benchmark solution and the market conjectures benchmark behavior of both agents, A has an incentive to report like in the benchmark setting.*

Proof. See the appendix. ■

Having shown that it is optimal for the auditor to follow his signal if AC follows its signal, too, we can state the following Proposition:

Proposition 3 *If the bonus for AC is from the interval $[\beta_{\min}, \beta_{\max}]$, there exists an equilibrium in which both agents report in line with the benchmark solution.*

6 Conclusion

At least anecdotal evidence suggests that audit committees established by boards tend not to oppose to dubious accounting practices employed by the management and approved by the auditor. In this paper we provide a rationale for such behavior. We use a learning model to show that audit committees may have an incentive to simply mimic the auditor's report and to ignore relevant private information. Such herding results in a setting in which auditors and audit committees solely care about reputation. Moreover, "sharing the blame" effects shield audit committees from reputational losses. The latter effect is particularly crucial for our results. The fact that a failure damages reputation of one agent really hard only if the other one does not fail renders imitation on the side of the agent acting second, that is the audit committee, optimal.

This strategy of ensuring that either both or none of the agents fail remains optimal even though the market anticipates herding behavior and completely ignores the audit committee's report.

Though optimal from the audit committee's perspective, herding is generally undesirable. It advances fraud to remain undetected which harms shareholders, investors and other stakeholders. To counteract such misbehavior, various alternatives have been proposed in academia as well as in politics. We discuss two of the most frequently mentioned options in the final sections of our paper: bonus contracts and fines. Importantly, we find that fines, discussed in many jurisdictions as a means to legally align incentives, turn out to be unsuitable to avoid herding at all. The same result is obtained for bonus contracts that solely rely on the audit committee's report. In contrast, a more sophisticated bonus contract, that ties the bonus to both, the auditor's and the audit committee's report, turns out to work in our setting.

Appendix

Derivation of $\hat{\theta}^{AC}(\cdot)$ in Section 4

i) Assume the market has learned R . We have to determine

$$\hat{\theta}^{AC}(s_i, s_j, R_k) \equiv \Pr(\tau^{AC} = \text{good} | s_i, s_j, R_k), i, j, k \in \{b, t\}.$$

We know from Bayes' rule that $\Pr(\text{good} | s_i, s_j, R_k) = \frac{\Pr(\text{good}, s_i, s_j, R_k)}{\Pr(s_i, s_j, R_k)}$. The joint probabilities $\Pr(s_i, s_j, R_k)$ are calculated according to section 3.2, Fn. 10. $\Pr(\text{good}, s_i, s_j, R_k)$ can be written as

$$\begin{aligned} \Pr(\text{good}, s_i, s_j, R_k) &= \Pr(s_i, s_j | R_k, \tau^{AC} = \text{good}) \Pr(R_k, \tau^{AC} = \text{good}) \\ &= \Pr(s_i, s_j | R_k, \tau^{AC} = \text{good}) \Pr(R_k) \Pr(\tau^{AC} = \text{good}). \end{aligned} \quad (24)$$

$\Pr(s_i, s_j | R_k, \tau^{AC} = \text{good})$ can be written as

$$\begin{aligned} \Pr(s_i, s_j | R_k, \tau^{AC} = \text{good}) &= \Pr(s_i, s_j | R_k, \tau^A = \text{bad}, \tau^{AC} = \text{good}) \Pr(\tau^A = \text{bad} | R_k, \tau^{AC} = \text{good}) + \\ &\quad \Pr(s_i, s_j | R_k, \tau^A = \text{good}, \tau^{AC} = \text{good}) \Pr(\tau^A = \text{good} | R_k, \tau^{AC} = \text{good}). \end{aligned}$$

The agents' types (τ^A, τ^{AC}) and R are independently distributed such that $\Pr(\tau^A | R_k, \tau^{AC}) = \Pr(\tau^A | \tau^{AC}) = \frac{\Pr(\tau^A, \tau^{AC})}{\Pr(\tau^{AC})}$. Hence, (24) can be written as

$$\Pr(\text{good}, s_i, s_j, R_k) = \left[\begin{array}{l} \Pr(s_i, s_j | R_k, \tau^A = \text{bad}, \tau^{AC} = \text{good}) \Pr(\tau^A = \text{bad}, \tau^{AC} = \text{good}) + \\ \Pr(s_i, s_j | R_k, \tau^A = \text{good}, \tau^{AC} = \text{good}) \Pr(\tau^A = \text{good}, \tau^{AC} = \text{good}) \end{array} \right] \Pr(R_k).$$

As in section 3.2, $\Pr(s_i, s_j | R_k, \tau^A, \tau^{AC}) = \Pr(s_i | R_k, \tau^A) \Pr(s_j | R_k, \tau^{AC})$ if $(\tau^A, \tau^{AC}) \neq (\text{good}, \text{good})$

$$\text{and } \Pr(s_i, s_j | R_k, \text{good}, \text{good}) = \begin{cases} 0 & \text{if } s_i \neq s_j \\ \Pr(s_i | R_k, \text{good}) & \text{if } s_i = s_j \end{cases}.$$

ii) If the market has not learned R , AC's reputation is given by $\hat{\theta}^{AC}(s_i, s_j) \equiv \Pr(\tau^{AC} = \text{good} | s_i, s_j)$. Knowing $\hat{\theta}^{AC}(s_i, s_j, R_k)$ from i), $\hat{\theta}^{AC}(s_i, s_j)$ can be calculated as

$$\hat{\theta}^{AC}(s_i, s_j) = \hat{\theta}^{AC}(s_i, s_j, R_b) \Pr(R_b | s_i, s_j) + \hat{\theta}^{AC}(s_i, s_j, R_t) \Pr(R_t | s_i, s_j).$$

Proof of Lemma 1

To prove Lemma 1 we need to show that there is a strict incentive for the audit committee to report in line with the auditor, no matter what its privately observed signal suggests. Assume the market conjectures that both agents report as in the benchmark solution for the whole proof.

The following conditions need to hold:

(i) If the auditor has reported M_t , the audit committee prefers to report M_t having observed s_b , $E(\hat{\theta}^{AC}(s_t, s_t) | s_t, s_b) > E(\hat{\theta}^{AC}(s_t, s_b) | s_t, s_b)$:

$$q[\hat{\theta}^{AC}(s_t, s_t, R_t) \Pr(R_t | s_t, s_b) + \hat{\theta}^{AC}(s_t, s_t, R_b) \Pr(R_b | s_t, s_b)] + (1 - q)\hat{\theta}^{AC}(s_t, s_t) > \hat{\theta}^{AC}(s_t, s_t). \quad (25)$$

(25) can also be written as

$$q\left[\frac{2\theta p(1+\theta)}{4\theta p+(1-\theta)^2}\frac{1}{2}+\frac{2\theta(1-p)(1+\theta)}{4\theta(1-p)+(1-\theta)^2}\frac{1}{2}\right]+(1-q)\left[\frac{\theta(1+\theta)}{1+\theta^2}\right]>\frac{\theta}{1+\theta}.$$

Writing the latter condition as $q[1]+(1-q)[2]>\frac{\theta}{1+\theta}$ we prove that this inequality always holds true by showing that $[1]>\frac{\theta}{1+\theta}$ and $[2]>\frac{\theta}{1+\theta}$. The latter two conditions are fulfilled if

$$\frac{\theta p(1+\theta)}{4\theta p+(1-\theta)^2}>\frac{p\theta}{(1+\theta)} \quad (26)$$

and

$$\frac{\theta(1-p)(1+\theta)}{4\theta(1-p)+(1-\theta)^2}>\frac{(1-p)\theta}{(1+\theta)} \quad (27)$$

and

$$\frac{\theta(1+\theta)}{1+\theta^2}>\frac{\theta}{(1+\theta)}. \quad (28)$$

(26), (27), and (28) can be rewritten to obtain $p < 1$, $p > 0$, and $2\theta > 0$, respectively. All three inequalities hold by assumption.

(ii) If the auditor has reported M_b , the audit committee prefers to report M_b having observed s_t , $E\left(\tilde{\theta}^{AC}(s_b, s_b)|s_b, s_t\right) > E\left(\tilde{\theta}^{AC}(s_b, s_t)|s_b, s_t\right)$:

$$q[\hat{\theta}^{AC}(s_b, s_b, R_t)\Pr(R_t|s_b, s_t)+\hat{\theta}^{AC}(s_b, s_b, R_b)\Pr(R_b|s_b, s_t)]+(1-q)\hat{\theta}^{AC}(s_b, s_b) > \hat{\theta}^{AC}(s_b, s_t) \quad (29)$$

(29) is equivalent to (25) and thus (29) holds as well.

(iii) If the auditor has reported M_t , the audit committee prefers to report M_t having observed s_t , $E\left(\tilde{\theta}^{AC}(s_t, s_t)|s_t, s_t\right) > E\left(\tilde{\theta}^{AC}(s_t, s_b)|s_t, s_t\right)$:

$$\hat{\theta}^{AC}(s_t, s_t) > q[\hat{\theta}^{AC}(s_t, s_b, R_t)\Pr(R_t|s_t, s_t)+\hat{\theta}^{AC}(s_t, s_b, R_b)\Pr(R_b|s_t, s_t)]+(1-q)\hat{\theta}^{AC}(s_t, s_b) \quad (30)$$

\Leftrightarrow

$$\frac{\theta(1+\theta)}{1+\theta^2} > q\left[\frac{2(1-p)\theta}{(1+\theta)}\frac{4p\theta+(1-\theta)^2}{2(1+\theta^2)}+\frac{2p\theta}{(1+\theta)}\left(1-\frac{4p\theta+(1-\theta)^2}{2(1+\theta^2)}\right)\right]+(1-q)\left[\frac{\theta}{(1+\theta)}\right] \quad (31)$$

From (i) we know that $\frac{\theta(1+\theta)}{1+\theta^2} > \frac{\theta}{(1+\theta)}$. To show that (31) holds we show below that

$$\frac{\theta(1+\theta)}{1+\theta^2} > \frac{2(1-p)\theta}{(1+\theta)}\frac{4p\theta+(1-\theta)^2}{2(1+\theta^2)}+\frac{2p\theta}{(1+\theta)}\left(1-\frac{4p\theta+(1-\theta)^2}{2(1+\theta^2)}\right) = \frac{\theta(1-\theta)^2+8p\theta(1-p)}{(\theta+1)(\theta^2+1)} \quad (32)$$

(32) can be rewritten as

$$\frac{4\theta^2(1-2p+2p^2)}{(1+\theta)(1+\theta^2)} > 0$$

which holds true. Accordingly (30) holds true.

(iv) If the auditor has reported M_b , the audit committee prefers to report M_b having observed $s_b, E\left(\tilde{\theta}^{AC}(s_b, s_b)|s_b, s_b\right) > E\left(\tilde{\theta}^{AC}(s_b, s_t)|s_b, s_b\right)$:

$$\hat{\theta}^{AC}(s_b, s_b) > q[\hat{\theta}^{AC}(s_b, s_t, R_t) \Pr(R_t|s_b, s_b) + \hat{\theta}^{AC}(s_b, s_t, R_b) \Pr(R_b|s_b, s_b)] + (1-q)[\hat{\theta}^{AC}(s_b, s_t)] \quad (33)$$

(33) is equivalent to (30) and thus (33) holds as well.

Proof of Lemma 2

To prove Lemma 2 we need to show that (17) and (18) hold. Notice that $E\left(\tilde{\theta}^A(s_i)|s_i\right) = \hat{\theta}^A(s_i) = \theta$; the latter equality holds as in expectation the effect of possibly observing R cancels out and by (1) a single signal in isolation is not informative about an agent's type. With $E\left(\tilde{\theta}^A(s_i)|s_i\right) = \theta$ and $E\left(\tilde{\theta}^A(s_i)|s_j\right) = q\left(\hat{\theta}^A(s_i, R_t) \Pr(R_t|s_j) + \hat{\theta}^A(s_i, R_b) \Pr(R_b|s_j)\right) + (1-q)\theta$, inserting on both sides of (17) and (18) results in

$$\theta \geq q\left[\frac{2(1-p)\theta}{2(1-p)\theta + (1-\theta)}\left(\frac{1}{2}(1-\theta) + p\theta\right) + \frac{2p\theta}{2p\theta + (1-\theta)}\left(\frac{1}{2}(1-\theta) + (1-p)\theta\right)\right] + (1-q)\theta$$

for both conditions. This inequality can be rewritten to obtain

$$\left(\frac{2p\theta}{2p\theta + (1-\theta)} - \frac{2(1-p)\theta}{2(1-p)\theta + (1-\theta)}\right)\theta(2p-1) \geq 0 \quad (34)$$

As $p > 0.5$ by assumption $(2p-1) > 0$. It remains to show that

$$\frac{2p\theta}{2p\theta + (1-\theta)} \geq \frac{2(1-p)\theta}{2(1-p)\theta + (1-\theta)}$$

which simplifies to

$$p \geq 1-p.$$

This is strictly true by assumption.

Proof of Proposition 2

Incentive compatibility conditions for AC are given by

$$\begin{aligned} \text{i) } & A - q\beta \Pr(R_t|s_t, s_b) \geq B - q\beta \Pr(R_b|s_t, s_b) \\ \text{ii) } & A - q\beta \Pr(R_b|s_b, s_t) \geq B - q\beta \Pr(R_t|s_b, s_t) \\ \text{iii) } & C - q\beta \Pr(R_b|s_t, s_t) \geq D - q\beta \Pr(R_t|s_t, s_t) \\ \text{iv) } & C - q\beta \Pr(R_t|s_b, s_b) \geq D - q\beta \Pr(R_b|s_b, s_b) \end{aligned} \quad (35)$$

with $A = \frac{\theta}{1+\theta}$ and $B = q\left[\frac{\theta p(1+\theta)}{4\theta p + (1-\theta)^2} + \frac{\theta(1-p)(1+\theta)}{4\theta(1-p) + (1-\theta)^2}\right] + (1-q)\frac{\theta(1+\theta)}{1+\theta^2}$, $B > A$, and with $C = \frac{\theta(1+\theta)}{1+\theta}$ and $D = q\left[\frac{2\theta(1-p)}{1+\theta} \frac{4\theta p + (1-\theta)^2}{2(1+\theta^2)} + \frac{2\theta p}{1+\theta} \frac{4(1-p)\theta + (1-\theta)^2}{2(1+\theta^2)}\right] + (1-q)\frac{\theta}{1+\theta}$, $C > D$. Note that $\Pr(R_t|s_b, s_t) = \Pr(R_t|s_t, s_b) = \frac{1}{2}$. Hence i) and ii) are identical and can be written as

$$A - \frac{1}{2}q\beta \geq B - \frac{1}{2}q\beta.$$

As $B > A$ i) and ii) are always violated. Conditions iii) and iv) are identical, too. As $\Pr(R_i|s_i, s_i) > \Pr(R_j|s_i, s_i)$ both are fulfilled for any $\beta \geq 0$. It follows that herding remains optimal for any β .

Proof of Lemma 3

In (22), conditions i) and ii), and conditions iii) and iv) are equivalent. For conditions i)/ ii) and iii)/iv) we obtain

$$A + \frac{q\beta}{2} \geq B \quad (36)$$

$$C \geq D + q\beta\sigma \quad (37)$$

with A, B, C and D as defined in the proof of Proposition 2 above and $\sigma \equiv \Pr(R_b|s_t, s_t) = \Pr(R_t|s_b, s_b) = \frac{4(1-p)\theta + (1-\theta)^2}{2(1+\theta^2)}$. Equivalently, (36) and (37) can be written as

$$\beta \geq \frac{2(B-A)}{q} \equiv \beta_{\min} \quad (38)$$

$$\beta \leq \frac{C-D}{q\sigma} \equiv \beta_{\max}. \quad (39)$$

Conditions (38) and (39) can only be fulfilled simultaneously if $\beta_{\max} \geq \beta_{\min}$ where

$$\beta_{\max} - \beta_{\min} = \frac{-8\theta^2(2p-1)Z}{\left(4\theta p - (1+\theta)^2\right)\left(4\theta p + (1-\theta)^2\right)q(1+\theta)^2(1+\theta)}$$

with $Z = (2p-1)(\theta^4 q + q + 2\theta^2) + (\theta^3 + \theta)(1+q+4qp(p-1))$. Notice that $\beta_{\max} - \beta_{\min}$ is positive, if Z is positive. As $p > 1/2$, $(1+q+4qp(p-1))$ is always greater than one. Hence, $\beta_{\max} > \beta_{\min}$ and if $\beta \in [\beta_{\min}, \beta_{\max}]$, conditions i)-iv) in (22) are fulfilled.

Proof of Lemma 4

a) For the comparative statics for β_{\min} we obtain

$$\frac{\partial \beta_{\min}}{\partial q} = -\frac{4\theta^2}{q^2(1+\theta)(1+\theta^2)} < 0, \quad \frac{\partial \beta_{\min}}{\partial p} = -\frac{16\theta^2(1+\theta)(1+\theta^2)(\theta-1)^2(2p-1)}{\left(4\theta p - (1+\theta)^2\right)^2\left(4\theta p + (1-\theta)^2\right)^2} < 0,$$

$$\frac{\partial \beta_{\min}}{\partial \theta} = \frac{8\theta Y + 2\theta^2 Y'}{N} - \frac{4\theta^2 Y N'}{N^2}$$

$$\text{with } Y = (q-1)(1+\theta^2)^2 + (1-p)(8\theta^2 p(q-2) - 4qp(1+\theta^4)); \quad Y' = \partial Y / \partial \theta$$

$$N = \left(4\theta p + (1-\theta)^2\right)\left(4\theta p - (1+\theta)^2\right)(1+\theta^2)(1+\theta)q; \quad N' = \partial N / \partial \theta.$$

To prove that $\beta_{\min}^\theta \equiv \frac{\partial \beta_{\min}}{\partial \theta} > 0$ we show that it is positive for all q and θ at its minimum with respect to p . This minimum is given by $p = 0$ and $p = 1$. Both values of p lead to a function value of $\beta_{\min}^\theta = \frac{4\theta(\theta^3 - \theta - 2)(q-1)}{q(1+\theta)^2(1+\theta^2)^2} > 0$ for all q and θ . Hence, $\frac{\partial \beta_{\min}}{\partial \theta} > 0$ for all p, q, θ .

b) For β_{\max} we obtain

$$\begin{aligned}\frac{\partial \beta_{\max}}{\partial q} &= \frac{4\theta^2}{q^2(1+\theta)(4\theta p - (1+\theta)^2)} < 0, \\ \frac{\partial \beta_{\max}}{\partial p} &= -16\theta^2 \frac{(q\theta^2+q)(1-2p) + \theta(q-1) + 4qp\theta(p-1)}{q(1+\theta)(4\theta p - (1+\theta)^2)^2} > 0, \\ \frac{\partial \beta_{\max}}{\partial \theta} &= -\frac{4\theta(1+q+4qp(p-1))(4\theta p - 3\theta - 2 + \theta^3)}{q(1+\theta)^2(4\theta p - (1+\theta)^2)^2} > 0.\end{aligned}$$

To verify the sign of $\frac{\partial \beta_{\max}}{\partial \theta}$ notice that $4qp(p-1)$ is greater than $-q$ and $4\theta p - 3\theta - 2 + \theta^3$ is negative for the maximum value $p = 1$ for all θ .

Proof of Lemma 5

Inserting into (23) we obtain

$$\begin{aligned}1) \theta &\geq q \left[\begin{aligned} &\widehat{\theta}^A(s_t, s_b, R_t) \Pr(R_t, s_b|s_b) + \widehat{\theta}^A(s_t, s_t, R_t) \Pr(R_t, s_t|s_b) + \\ &\widehat{\theta}^A(s_t, s_b, R_b) \Pr(R_b, s_b|s_b) + \widehat{\theta}^A(s_t, s_t, R_t) \Pr(R_b, s_t|s_b) \end{aligned} \right] + \\ &\quad (1-q) \left(\widehat{\theta}^A(s_t, s_b) \Pr(s_b|s_b) + \widehat{\theta}^A(s_t, s_t) \Pr(s_t|s_b) \right) \end{aligned} \quad (40)$$

$$\begin{aligned}2) \theta &\geq q \left[\begin{aligned} &\widehat{\theta}^A(s_b, s_b, R_t) \Pr(R_t, s_b|s_t) + \widehat{\theta}^A(s_b, s_t, R_t) \Pr(R_t, s_t|s_t) + \\ &\widehat{\theta}^A(s_b, s_b, R_b) \Pr(R_b, s_b|s_t) + \widehat{\theta}^A(s_b, s_t, R_t) \Pr(R_b, s_t|s_t) \end{aligned} \right] + \\ &\quad (1-q) \left(\widehat{\theta}^A(s_b, s_b) \Pr(s_b|s_t) + \widehat{\theta}^A(s_b, s_t) \Pr(s_t|s_t) \right). \end{aligned} \quad (41)$$

As both agents are symmetric, it holds $\widehat{\theta}^A(s_i, s_j, R_k) = \widehat{\theta}^{AC}(s_j, s_i, R_k)$ and $\widehat{\theta}^A(s_i, s_j) = \widehat{\theta}^{AC}(s_i, s_j)$ with $i, j, k \in \{b, t\}$. The $\widehat{\theta}^{AC}$'s are given in (11) and (12), respectively.

Using the results from section 3.2 the probabilities $\Pr(R_k, s_j|s_i) = \frac{\Pr(R_k, s_j, s_i)}{\Pr(s_i)}$ and $\Pr(s_j|s_i) = \frac{\Pr(s_j, s_i)}{\Pr(s_i)}$ can be calculated as

$$\begin{aligned}\Pr(R_t, s_b|s_b) &= \Pr(R_b, s_t|s_t) = (1-p)\theta + \frac{1}{4}(1-\theta)^2 \\ \Pr(R_t, s_t|s_b) &= \Pr(R_b, s_t|s_b) = \Pr(R_t, s_b|s_t) = \Pr(R_b, s_b|s_t) = \frac{1}{4}(1-\theta^2) \\ \Pr(R_b, s_b|s_b) &= \Pr(R_t, s_t|s_t) = p\theta + \frac{1}{4}(1-\theta)^2. \\ \Pr(s_b|s_t) &= \Pr(s_t|s_b) = \frac{(1-\theta^2)}{2}, \Pr(s_t|s_t) = \Pr(s_b|s_b) = \frac{(1+\theta^2)}{2}\end{aligned}$$

Inserting $\widehat{\theta}^A(s_i, s_j, R_k)$, $\widehat{\theta}^A(s_i, s_j)$ and the probabilities into (40) and (41) we obtain for both conditions

$$\theta \geq qX_1 + (1-q)X_2 \quad (42)$$

with

$$X_1 = -\frac{\theta(8\theta p(p-1) - 1 + 2\theta - \theta^2)(8\theta^2 p(p-1) + \theta^3 + \theta^2 - \theta - 1)}{(1+\theta)(4p\theta + (1-\theta)^2)(4p\theta - (1+\theta^2))}$$

$$X_2 = -\frac{\theta(\theta^3 - \theta^2 - \theta - 1)}{(1+\theta^2)(1+\theta)}.$$

We proceed to prove that (42) holds by showing that both X_1 and X_2 are lower than θ . From

$$\theta - X_2 = \frac{2\theta^4}{(1+\theta^2)(1+\theta)}$$

it follows $\theta > X_2$. $\theta - X_1$ can be factorized as

$$\theta - X_1 = \frac{2\theta^2[-\theta^4 + \theta^2(32p^4 - 20p + 52p^2 + 2 - 64p^3) + 4p - 1 - 4p^2]}{(1+\theta)(4p\theta + (1-\theta)^2)(4p\theta - (1+\theta^2))}. \quad (43)$$

The denominator of (43) is negative as $4p\theta < (1+\theta^2)$. Hence, (43) is positive, if $P = -\theta^4 + \theta^2(32p^4 - 20p + 52p^2 + 2 - 64p^3) + 4p - 1 - 4p^2$ is negative. We proceed to prove negativity of P by showing that P is negative for all θ at the P -maximizing value for p , i.e., $P(p^*(\theta), \theta) < 0$ for all $\theta \in (0, 1)$ with $p^*(\theta) \in \arg \max_p P(p, \theta)$.

From the optimality condition $\frac{dP(\cdot)}{dp} = 0$ we obtain three candidates for a local maximizer

$$p_1^* = \frac{1}{2}, p_2^* = \frac{2\theta + \sqrt{1-\theta^2}}{4\theta}, p_3^* = \frac{2\theta - \sqrt{1-\theta^2}}{4\theta}.$$

For the second derivatives w.r.t. p we obtain

$$\frac{d^2 P(p_1^*, \cdot)}{dp^2} = 8(\theta^2 - 1) < 0, \frac{d^2 P(p_2^*, \cdot)}{dp^2} = \frac{d^2 P(p_3^*, \cdot)}{dp^2} = -16(\theta - 1)(\theta + 1) > 0.$$

Hence, $p = 1/2$ is the unique local maximizer with $P(\frac{1}{2}, \theta) = -\theta^4 - \theta^2$. To search for absolute maxima we also need to check the function values of P at the limits of its domain: $P(1, \theta) = P(0, \theta) = -1 + 2\theta^2 - \theta^4$. Hence, if $1 < 3\theta^2$ $p = 0$ and $p = 1$ are the absolute maximizers of P and for $1 > 3\theta^2$ $p = 1/2$ is the absolute maximizer.¹³In any case, the corresponding function values $-\theta^4 - \theta^2$ and $-1 + 2\theta^2 - \theta^4$, respectively, are negative for all $\theta \in (0, 1)$ such that $\theta - X_1 > 0$. Having shown that X_1 and X_2 are smaller than θ it follows $\theta > qX_1 + (1-q)X_2$ such that (42) is fulfilled.

¹³For $1 = 3\theta^2$ we have three absolute maximizers: $p = 0$, $p = 1$, and $p = 1/2$.

References

- Adams, R.B./Ferreira, D. (2007), A theory of friendly boards, *Journal of Finance*, Vol. 62, pp. 217-250.
- Arya, A./Mittendorf, B. (2005), Using disclosure to influence herd behavior and alter competition, *Journal of Accounting and Economics*, Vol. 40, pp. 231-246.
- Bebchuk, L./Fried, J. (2003), Executive Compensation as an Agency Problem, *Journal of Economic Perspectives*, Vol. 17, No. 3. pp. 71-92.
- Benston, G./Hartgraves, A. (2002), Enron: what happened and what we can learn from it, *Journal of Accounting and Public Policy*, Vol 21, pp. 105-127.
- Carcello, J./Hollingsworth, C./Klein, A./Neal, T. (2006), Audit Committee Financial Expertise, Competing Corporate Governance Mechanisms, and Earnings Management, Working Paper University of Tennessee.
- Cyert, R./Kang, S./Kumar, P. (2002), Corporate Governance Takeovers, and Top-Management Compensation: Theory and Evidence, *Management Science*, Vol. 48, No.4, pp. 453-469.
- Demski, J. (2002), Enron et al.- a comment, *Journal of Accounting and Public Policy*, Vol. 21, pp. 129-130.
- Defond, M./Hann, R./Hu, X. (2005), Does the Market Value Financial Expertise on Audit Committees of Boards of Directors?, *Journal of Accounting Research*, Vol. 43, pp.153-193.
- Devenow, A./Welch, I. (1996), Rational herding in financial economics, *European Economic Review*, Vol. 40, pp. 603-615.
- Drymiotis, G. (2007), The monitoring role of insiders, *Journal of Accounting and Economics*, Vol. 44, pp. 359-377.
- Fama, E.F./Jensen, M.C. (1983), Separation of Ownership and Control, *Journal of Law and Economics*, Vol. 26, pp. 301-325.
- Fischer, P./Verrecchia, R. (2000), Reporting Bias, *The Accounting Review*, 75 (2), pp. 229-245.
- Gilson, S.C. (1990), Bankruptcy, boards, banks, and blockholders, *Journal of Financial Economics*, Vol. 27, pp. 355-387.
- Hermalin, B./Weisbach, M.(1998), Endogenously chosen boards of directors and their monitoring of the CEO, *American Economic Review*, Vol. 88, 96-118.
- Holmström, B. (1982), Managerial Incentive Problems: A Dynamic Perspective, in Walross, B. (ed.): *Essays in Economics and Management in Honor of Lars Wahlbeck*, pp. 209-230 (Helsinki: Swedish School of Business).

- Klein, A. (2006), Audit Committee, board of Director Characteristics, and Earnings Management, Working Paper New York University School of Law.
- Ozerturk, S. (2005), Board independence and CEO Pay, *Economics Letters*, Vol 88, pp. 260-265.
- Revsine, L. (2002) Enron: sad but inevitable, *Journal of Accounting and Public Policy*, Vol 21, pp.137-145.
- Scharfstein, D./Stein, J. (1990), Herding Behavior and Investment, *The American Economic Review*, Vol. 80, No. 3, pp. 465-479.
- Scharfstein, D./Stein, J. (2000), Herding Behavior and Investment: Reply, *The American Economic Review*, Vol. 90, pp. 705-706.
- Schöndube-Pirchegger, B./Schöndube, J.R. (2009), On the appropriateness of performance based supervisory board compensation - an agency theoretic approach, *European Accounting Review* (forthcoming).
- Srinivasan, S. (2005), Consequences of Financial Reporting Failure for Outside Directors: Evidence from Accounting Restatements and Audit Committee Members, *Journal of Accounting Research*, Vol. 43, pp. 291-334.
- Welch, I. (2000), Herding among security analysts, *Journal of Financial Economics*, Vol. 58, pp. 369-396.
- Xie, B./Davidson, W./DaDalt, P. (2003), Earnings Management and Corporate Governance: The Roles of the Board and the Audit Committee, *Journal of Corporate Finance*, Vol. 9, pp. 295-316.
- Yermack, D. (2004), Remuneration, Retention, and Reputation Incentives for Outside Directors, *Journal of Finance*, Vol. 59, pp. 2281-2308.
- Zajac, E. J./Westphal J. D. (1996), Director Reputation, CEO-Board Power, and the Dynamics of Board Interlocks, *Administrative Science Quarterly*, Vol. 41, pp. 507-529.