



**Corporate Governance, Reputation
Concerns, and Herd Behavior**

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Corporate Governance, Reputation Concerns, and Herd Behavior

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Preliminary

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 labelled 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 publicly learned and the market uses this information along with the agents' reports to update beliefs about the agents' type.

We show that herding equilibria exist 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.

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

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 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, report the results 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

This paper offers an explanation for a lack of audit committee effectiveness that persists even if a firm follows the recommendations described above. In particular we replace two (implicit) assumptions: The one that financial expertise automatically goes along with high ability and the one that audit committee members are always willing to effectively monitor the management and to report truthfully about monitoring. Rather, we model audit committee members as economic agents pursuing personal goals that are in potential conflict with investors' interests.

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

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

³See Sec. 407 of the Sarbanes Oxley Act.

⁴See section 5.3.2 of the German Corporate Governance Code.

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

Correspondingly two alternative assumptions are important in our setting: First, we assume that career concerns matter and that auditors as well as members of audit committees aim at building reputation in their respective labor markets. Second, the labor market's response to a failure depends on whether both, the auditor and the audit committee of a firm, fail to detect fraud correctly or only one of them.

Specifically, 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 suffers severe 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 idea is that with both parties being fooled some "sharing the blame" effect occurs that renders the labor market 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" here 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.

We assume that different types of auditors and audit committee members exist in the economy. Good ones are capable to do the particular job, act cleverly, and pick auditing strategies that provide them with valuable information. Thus they obtain informative results from their audit. Bad ones are incapable 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 statement is learned. 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, might become necessary and discover previous misstatements.

Having learned the reports and the true 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.

Our paper contributes to the literature on opportunistic board behavior. Previous theoretical work on that issue includes Hermalin and Weisbach (1998), Cyert, Kang and Kumar (2002), and Bebchuk and Fried (2003). Hermalin and Weisbach investigate the effectiveness of monitoring as a function of the board's independence from the CEO. 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 contrast, our 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 market and thus leads to abnormal returns. Xie et al (2001), 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 herding. Previous research in particular identified herding behavior among security analysts and investors.⁶ 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

⁶See Welch (2000), Arya and Mittendorf (2005), and Scharfstein and Stein (1990), respectively.

what its personal beliefs are. Section 5 presents a numerical example and section 6 sums up our findings.

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_i with $i = t, b$ 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_i . The signal either claims that the financial statements are correct and truthful, $i = t$. Or it claims that the report is biased and thus does not comply with GAAP, $i = b$.

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: either they report that the financial statements are correct, t , or they report that they are incorrect, b .

The information inherent in the private signal depends on the smartness of the particular observer and is unknown ex ante to everyone. Two types of auditors and audit committees are assumed to exist: good ones and bad ones. If one is bad, the observed signal is pure noise. If one is good, the signal is informative with respect to the true character of the financial statements but not perfect. The probability of being good for both agents is known to be $\theta^j = \theta$ with $j = A, AC$. A refers to the auditor and AC to the audit committee. Given an agent is good, the conditional probability to observe a correct signal is

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

Concurrently the conditional probability to observe the wrong signal even though good is

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

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

If one of the agents' is bad, which occurs with probability $(1 - \theta)$, he receives a completely uninformative signal such that

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

and

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

Importantly, we assume that two good agents receive identical signals, while two bad ones or one good and one bad agent receive uncorrelated, possibly different signals. Given this structure, the market can update beliefs regarding θ^j not only based on the reports of both agents taken individually (in combination with R_i as 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:

$$\Pr(s_i|good) = \Pr(s_i|bad)$$

For signal s_t this results in

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

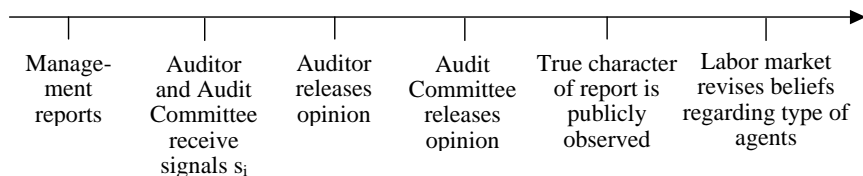
For signal s_b we obtain analogously

$$(1-p)\alpha + p(1-\alpha) = (1-m). \tag{2}$$

Rearranging terms reveals that (1) and (2) are identical. Solving for α we obtain expression (3).

$$\alpha = \frac{m+p-1}{2p-1} \tag{3}$$

(3) is assumed to hold in what follows.



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 b or t , to the public. Having observed the auditor’s report, the audit committee releases its opinion, again b or t , based on both pieces of information, the auditor’s report and its own privately observed signal.

After both reports have been observed publicly, the true character of the financial statements is learned. Once a truthful or biased report is discovered, the labor market updates its beliefs regarding the type of the auditor and the audit committee based on that information and on their reports.

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 b or t in order to maximize the market’s belief about θ^j . We demonstrate that this particular interest distorts reporting incentives and creates herd behavior.

In section 3 and 4 below we assume that $m = \frac{1}{2}$, which implies $\alpha = \frac{1}{2}$. We do so to ease the analysis and to simplify notation. However, we relax this assumption in section 5 and present a numerical example that fosters our results.

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 i if the following inequality is satisfied:

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

Thus the auditor reports 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 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

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

and

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

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

From (1) combined with $m = \frac{1}{2}$ we know that

$$p\alpha + (1 - p)(1 - \alpha) = \frac{1}{2}$$

and thus

$$\begin{aligned}
\Pr(s_t) &= [p\theta + \frac{1}{2}(1 - \theta)]\alpha + [(1 - p)\theta + \frac{1}{2}(1 - \theta)](1 - \alpha) \\
&= \theta[p\alpha + (1 - p)(1 - \alpha)] + \frac{1}{2}(1 - \theta)[\alpha + (1 - \alpha)] = \frac{1}{2}.
\end{aligned}$$

Finally from (3)

$$\Pr(R_t) = \alpha = \frac{1}{2}$$

and we get

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

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

$$p\theta + \frac{1}{2}(1 - \theta) \geq \frac{1}{2} \quad (4)$$

to hold.

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

$$\Pr(R_t|s_b) < \frac{1}{2}.$$

Proceeding as shown above, we obtain

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

and thus we require

$$(1 - p)\theta + \frac{1}{2}(1 - \theta) < \frac{1}{2}. \quad (5)$$

Rewriting expressions (4) and (5) it is easy to see that both inequalities hold for $p > 0.5$:

$$\frac{1}{2} + \theta(p - \frac{1}{2}) \geq \frac{1}{2} \quad (4')$$

$$\frac{1}{2} + \theta(\frac{1}{2} - p) < \frac{1}{2}. \quad (5')$$

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 b (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 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 i having observed s_i .

Specifically, the audit committee will report 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 b whenever these inequalities are violated.⁷

Calculating the conditional probabilities in similar fashion as above 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

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

⁷Note that 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 .

The conditions

$$\frac{4p\theta + (1 - \theta)^2}{2(1 + \theta^2)} \geq \frac{1}{2} \quad (6)$$

and

$$\frac{4(1 - p)\theta + (1 - \theta)^2}{2(1 + \theta^2)} > \frac{1}{2} \quad (7)$$

simplify to get

$$p \geq \frac{1}{2} \quad (6')$$

and

$$(1 - p) > \frac{1}{2} \quad (7')$$

respectively. While condition (6) holds by assumption, (7) is violated. Thus the audit committee will report t having inferred/observed (s_t, s_t) and 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.

We establish that herding equilibria exist with herding on the part of the audit committee. To do so we proceed in three steps.

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

Second we show that given the auditor's strategy, it might be 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 θ^{AC} .

Finally, we show that given the strategy of the audit committee, 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 t (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 θ^{AC} . Thus to predict the audit committee's choice we need to determine the updating rule used by the market.

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. The following revised beliefs $\hat{\theta}^{AC}$ result using Bayes' rule again:

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

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. For instance let us assume that the auditor has reported t . The audit committee privately observes s_b . It will report b if and only if the following inequality holds:

$$\begin{aligned}\hat{\theta}^{AC}(s_t, s_b, R_t) \Pr(R_t|s_t, s_b) + \hat{\theta}^{AC}(s_t, s_b, R_b) \Pr(R_b|s_t, s_b) &\geq \\ \hat{\theta}^{AC}(s_t, s_t, R_t) \Pr(R_t|s_t, s_b) + \hat{\theta}^{AC}(s_t, s_t, R_b) \Pr(R_b|s_t, s_b)\end{aligned}$$

Lemma 1 *If the auditor reports the signal observed and the market believes that the audit committee does so, too, and updates beliefs with regard to θ^{AC} accordingly, the audit committee has a strict incentive to always mimic the auditor's report. It reports t if the auditor has reported t and b if the auditor has reported b , no matter what signal s_i it observed.*

The proof is in 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. Thus imitating the auditor's reports renders the audit committee's report completely uninformative from the market's perspective and can at best be ignored. An assessment of the audit committee's ability, however, has to be based solely on ex ante beliefs, θ .

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 t (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:

$$\theta \geq \hat{\theta}^{AC}(s_t, s_b, R_t) \Pr(R_t | s_t, s_b) + \hat{\theta}^{AC}(s_t, s_b, R_b) \Pr(R_b | s_t, s_b) \quad (8)$$

$$\theta \geq \hat{\theta}^{AC}(s_b, s_t, R_t) \Pr(R_t | s_b, s_t) + \hat{\theta}^{AC}(s_b, s_t, R_b) \Pr(R_b | s_b, s_t) \quad (9)$$

(8) and (9) turn out to be equivalent and can both be rewritten to obtain

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

which always holds true.

To sum 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 truly revealed character of the financial statements R_i 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:

$$\begin{aligned} \hat{\theta}^A(s_t, R_t) \Pr(R_t|s_t) + \hat{\theta}^A(s_t, R_b) \Pr(R_b|s_t) &\geq \\ \hat{\theta}^A(s_b, R_t) \Pr(R_t|s_t) + \hat{\theta}^A(s_b, R_b) \Pr(R_b|s_t) & \end{aligned} \quad (10)$$

$$\begin{aligned} \hat{\theta}^A(s_b, R_b) \Pr(R_b|s_b) + \hat{\theta}^A(s_b, R_t) \Pr(R_t|s_b) &\geq \\ \hat{\theta}^A(s_t, R_b) \Pr(R_b|s_b) + \hat{\theta}^A(s_t, R_t) \Pr(R_t|s_b) & \end{aligned} \quad (11)$$

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.*

The proof is in the appendix.

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 θ^j accordingly. It considers the auditor's report and ignores the one provided by the audit committee.*

The equilibrium derived in proposition 4 provides a 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 A numerical example

The analysis above was based on the assumption that $m = \frac{1}{2}$. This assumption simplifies computations and allows to derive a unique pure strategy equilibrium, at least for given (out of equilibrium) beliefs as stated above. However, it also implies that the audit committee places equal probabilities

to R_b and R_t given either s_b/s_t or s_t/s_b has been observed/inferred. One might argue that in such a setting, herding does not do any real harm, as all that happens is that an audit committee that does not know better, decides to report in line with the auditor rather than to announce its private signal.

The numerical analysis below is designed to show that the type of equilibrium derived above is not restricted to $m = \frac{1}{2}$. Rather, similar equilibria arise where audit committees herd even though they should not from what they privately know.

We assume the following numbers apply: $\theta = 0.5$, $p = 0.7$, $m = 0.46$, this implies $\alpha = 0.4$.

5.1 Strategies implemented in the benchmark setting

Similar to the structure in section 3 and 4, we start with an auditor who decides about his report in order to inform the market about the quality of the financial statements.

The auditor requires $\Pr(R_t|s_t) \geq \frac{1}{2}$ to report t having observed s_t and $\Pr(R_t|s_b) < \frac{1}{2}$ to report b having observed s_b . Using the numbers above we obtain

$$\begin{aligned}\Pr(R_t|s_t) &= 0.5043 \\ \Pr(R_t|s_b) &= 0.3111\end{aligned}$$

which ensures that he reports as indicated by the signal observed.

An audit committee that reports according to its own beliefs infers the auditor's signal from his report and decides about b and t based on both, the auditor's information and its own signal. As above it will report t if and only if conditional probabilities $\Pr(R_t|\cdot, \cdot) > (\geq) \frac{1}{2}$. Inserting from above we obtain

$$\begin{aligned}\Pr(R_t|s_t, s_t) &= 0.5684 \\ \Pr(R_t|s_b, s_b) &= 0.2589 \\ \Pr(R_t|s_b, s_t) &= 0.4103 \\ \Pr(R_t|s_t, s_b) &= 0.4103\end{aligned}$$

Accordingly, in the benchmark setting the audit committee reports t if and only if both signals indicate t , that is s_t, s_t . This result of course arises from our assumption that the ex ante probability for an unbiased report is assumed to be $\alpha = 0.4$, only. All other combinations of signals suggest that a biased report is more likely than not.

5.2 Equilibrium strategies with reputation concerns

To establish the herding equilibrium we proceed in steps similar to section 4. First we assume that the market believes that the auditor and the audit committee behave as described in the benchmark setting 5.1. However, as shown in 5.1 the benchmark audit committee reports b no matter whether it observes s_t or s_b given the auditor's information is s_b . Thus, for our numerical example, the market is unable to infer the audit committee's private information even if it expects benchmark behavior. In fact the audit committee's report is completely uninformative for the market given the auditor has reported b . Accordingly, it ignores the report and refers to ex ante beliefs such that

$$\hat{\theta}^{AC}(s_b, R_t) = \hat{\theta}^{AC}(s_b, R_b) = \theta = \frac{1}{2}$$

In contrast, having observed t from the auditor, the market updates beliefs for θ^{AC} as shown below:

$$\begin{aligned}\hat{\theta}^{AC}(s_t, s_t, R_t) &= 0.6570 \\ \hat{\theta}^{AC}(s_t, s_b, R_t) &= 0.1805 \\ \hat{\theta}^{AC}(s_t, s_t, R_b) &= 0.5561 \\ \hat{\theta}^{AC}(s_t, s_b, R_b) &= 0.4545\end{aligned}$$

To investigate whether the audit committee has an incentive to indeed report as expected by the market, we need to check the following conditions:

$$\begin{aligned}\hat{\theta}^{AC}(s_t, s_b, R_t) \Pr(R_t|s_t, s_b) + \hat{\theta}^{AC}(s_t, s_b, R_b) \Pr(R_b|s_t, s_b) &\geq \quad (12) \\ \hat{\theta}^{AC}(s_t, s_t, R_t) \Pr(R_t|s_t, s_b) + \hat{\theta}^{AC}(s_t, s_t, R_b) \Pr(R_b|s_t, s_b) \\ &\iff 0.3421 \geq 0.5975\end{aligned}$$

$$\begin{aligned}\hat{\theta}^{AC}(s_t, s_t, R_t) \Pr(R_t|s_t, s_t) + \hat{\theta}^{AC}(s_t, s_t, R_b) \Pr(R_b|s_t, s_t) &\geq \quad (13) \\ \hat{\theta}^{AC}(s_t, s_b, R_t) \Pr(R_t|s_t, s_t) + \hat{\theta}^{AC}(s_t, s_b, R_b) \Pr(R_b|s_t, s_t) \\ &\iff 0.6135 \geq 0.2988\end{aligned}$$

$$\begin{aligned}\theta \geq \hat{\theta}^{AC}(s_b, s_t, R_t) \Pr(R_t|s_b, s_t) + \hat{\theta}^{AC}(s_b, s_t, R_b) \Pr(R_b|s_b, s_t) &\quad (14) \\ &\iff 0.5 \geq 0.3210\end{aligned}$$

$$\theta \geq \hat{\theta}^{AC}(s_b, s_t, R_t) \Pr(R_t|s_b, s_b) + \hat{\theta}^{AC}(s_b, s_t, R_b) \Pr(R_b|s_b, s_b) \quad (15)$$

$$\iff 0.5 \geq 0.2919$$

Obviously (12) is violated, thus that the audit committee has an incentive to report t rather than b after the auditor has reported t . At the same time (13) holds, such that an audit committee that observes s_t will report t as the market expects. Moreover, from (14) and (15) we observe that if the market ignores a report b after b from the auditor, there is no incentive for the audit committee to deviate from its strategy. It follows that analogously to section 4 the audit committee always mimics the auditor. The audit committee's report therefore is uninformative about its ability and therefore should be ignored when updating beliefs. Note, however, that in this setting imitation after the auditor has reported b corresponds with the true beliefs of the audit committee regarding the quality of the financial statements. This is not the case, if imitation occurs after the auditor reports t .

The next step is to check whether incentives to mimic persist if the market ignores all reports in line with the ones of the auditor. We stick to the out of equilibrium beliefs established in section 4. For auditor report b we can refer to (14). For auditor report t we insert into (8) to obtain

$$0.5 \geq 0.3421 \quad (8')$$

which holds true, too.

Finally we need to show that for our example the auditor prefers to report what the signal indicates, anticipating the behavior of the audit committee and the market.

If the market believes the auditor's report to be in line with the signal and ignores the audit committee's report it updates θ^A as follows

$$\begin{aligned} \hat{\theta}^A(s_t, R_t) &= 0.6034 \\ \hat{\theta}^A(s_t, R_b) &= 0.3947 \\ \hat{\theta}^A(s_b, R_b) &= 0.5645 \\ \hat{\theta}^A(s_b, R_t) &= 0.3571. \end{aligned}$$

The auditor will behave as assumed so far if from (10)

$$\begin{aligned}
0.6034 \cdot 0.5043 + 0.3947 \cdot (1 - 0.5043) &\geq & (10') \\
0.3571 \cdot 0.5043 + 0.5645 \cdot (1 - 0.5043) & & \\
&\Leftrightarrow 0.5 \geq 0.4599
\end{aligned}$$

and from (11)

$$\begin{aligned}
0.5645 \cdot (1 - 0.3111) + 0.3571 \cdot 0.3111 &\geq & (11') \\
0.3947 \cdot (1 - 0.3111) + 0.6034 \cdot 0.3111 & & \\
&\Leftrightarrow 0.5 \geq 0.4597.
\end{aligned}$$

Both inequalities are satisfied which establishes the equilibrium.

We conclude that in this setting herd behavior on the part of the audit committee is present no matter what the auditor reports. If the auditor reports b (observes s_b) there is good reason to follow this opinion as, no matter what the audit committee observes, R_b is truly more likely than R_t . In contrast, if the auditor observes s_t and reports t the audit committee herds and reports t having observed s_b even though R_b here is more likely than R_t , too. Thus the audit committee fails to perform as required due to reputation concerns and possibly harms investors.

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 undesirable as valuable information about the firm is kept from shareholders, investors and other stakeholders.

7 Appendix

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.

The following conditions need to hold:

(i) If the auditor has reported t , the audit committee prefers to report t having observed b :

$$\begin{aligned} \hat{\theta}^{AC}(s_t, s_t, R_t) \Pr(R_t | s_t, s_b) + \hat{\theta}^{AC}(s_t, s_t, R_b) \Pr(R_b | s_t, s_b) &> \quad (\text{A1}) \\ \hat{\theta}^{AC}(s_t, s_b, R_t) \Pr(R_t | s_t, s_b) + \hat{\theta}^{AC}(s_t, s_b, R_b) \Pr(R_b | s_t, s_b) & \end{aligned}$$

$$\begin{aligned} \Leftrightarrow \frac{2\theta p(1+\theta)}{4\theta p + (1-\theta)^2} \frac{1}{2} + \frac{2\theta(1-p)(1+\theta)}{4\theta(1-p) + (1-\theta)^2} \frac{1}{2} &> \\ \frac{2(1-p)\theta}{(1+\theta)} \frac{1}{2} + \frac{2p\theta}{(1+\theta)} \frac{1}{2} & \end{aligned}$$

To show that this inequality always holds true we show that

$$\frac{2\theta p(1+\theta)}{4\theta p + (1-\theta)^2} > \frac{2p\theta}{(1+\theta)} \quad (\text{A2})$$

and

$$\frac{2\theta(1-p)(1+\theta)}{4\theta(1-p) + (1-\theta)^2} > \frac{2(1-p)\theta}{(1+\theta)}. \quad (\text{A3})$$

(A2) can be rewritten to obtain

$$p < 1$$

and (A3) to obtain

$$p > 0.$$

Both inequalities hold by assumption.

(ii) If the auditor has reported b , the audit committee prefers to report b having observed t :

$$\begin{aligned} \hat{\theta}^{AC}(s_b, s_b, R_t) \Pr(R_t|s_b, s_t) + \hat{\theta}^{AC}(s_b, s_b, R_b) \Pr(R_b|s_b, s_t) &> \\ \hat{\theta}^{AC}(s_b, s_t, R_t) \Pr(R_t|s_b, s_t) + \hat{\theta}^{AC}(s_b, s_t, R_b) \Pr(R_b|s_b, s_t) & \end{aligned} \quad (\text{A4})$$

(A4) is equivalent to (A1) and thus (A4) holds as well.

(iii) If the auditor has reported t , the audit committee prefers to report t having observed t :

$$\begin{aligned} \hat{\theta}^{AC}(s_t, s_t, R_t) \Pr(R_t|s_t, s_t) + \hat{\theta}^{AC}(s_t, s_t, R_b) \Pr(R_b|s_t, s_t) &> \\ \hat{\theta}^{AC}(s_t, s_b, R_t) \Pr(R_t|s_t, s_t) + \hat{\theta}^{AC}(s_t, s_b, R_b) \Pr(R_b|s_t, s_t) & \end{aligned} \quad (\text{A5})$$

$$\begin{aligned} \Leftrightarrow \frac{2\theta p(1+\theta)}{4\theta p + (1-\theta)^2} \pi + \frac{2\theta(1-p)(1+\theta)}{4\theta(1-p) + (1-\theta)^2} (1-\pi) &> \\ \frac{2(1-p)\theta}{(1+\theta)} \pi + \frac{2p\theta}{(1+\theta)} (1-\pi) & \end{aligned}$$

$$\begin{aligned} \Leftrightarrow \left[\frac{2\theta p(1+\theta)}{4\theta p + (1-\theta)^2} - \frac{2(1-p)\theta}{(1+\theta)} \right] \pi &> \\ \left[\frac{2p\theta}{(1+\theta)} - \frac{2\theta(1-p)(1+\theta)}{4\theta(1-p) + (1-\theta)^2} \right] (1-\pi) & \end{aligned} \quad (\text{A6})$$

with $\pi = \frac{4p\theta + (1-\theta)^2}{2(1+\theta^2)}$ and $(1-\pi) = \frac{4(1-p)\theta + (1-\theta)^2}{2(1+\theta^2)}$.

Note that

$$\frac{2p\theta}{(1+\theta)} > \frac{2(1-p)\theta}{(1+\theta)} \quad (\text{A7})$$

and

$$\frac{2\theta p(1+\theta)}{4\theta p + (1-\theta)^2} > \frac{2\theta(1-p)(1+\theta)}{4\theta(1-p) + (1-\theta)^2}. \quad (\text{A8})$$

From (A7) and (A8) combined with (A2) and (A3) we obtain:

$$\frac{2(1-p)\theta}{(1+\theta)} < \frac{2p\theta}{(1+\theta)} < \frac{2\theta(1-p)(1+\theta)}{4\theta(1-p) + (1-\theta)^2} < \frac{2\theta p(1+\theta)}{4\theta p + (1-\theta)^2}.$$

Thus the l.h.s. of (A6) is positive while the r.h.s. of (A6) is negative and thus (A5) is true.

(iv) If the auditor has reported b , the audit committee prefers to report b having observed b :

$$\begin{aligned} \hat{\theta}^{AC}(s_b, s_b, R_t) \Pr(R_t | s_b, s_b) + \hat{\theta}^{AC}(s_b, s_b, R_b) \Pr(R_b | s_b, s_b) &> \quad (\text{A9}) \\ \hat{\theta}^{AC}(s_b, s_t, R_t) \Pr(R_t | s_b, s_b) + \hat{\theta}^{AC}(s_b, s_t, R_b) \Pr(R_b | s_b, s_b) & \end{aligned}$$

(A9) is equivalent to (A5) and thus (A9) holds as well.

Proof of lemma 2:

To prove lemma 2 we need to show that (10) and (11) hold. (10) and (11) are equivalent. Inserting on both sides results in

$$\frac{2p\theta}{2p\theta + (1 - \theta)} \left(\frac{1}{2}(1 - \theta) + p\theta \right) + \frac{2(1 - p)\theta}{2(1 - p)\theta + (1 - \theta)} \left(\frac{1}{2}(1 - \theta) + (1 - p)\theta \right) \quad (\text{A10})$$

\geq

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

(A10) can be rewritten to obtain

$$\left(\frac{2p\theta}{2p\theta + (1 - \theta)} - \frac{2(1 - p)\theta}{2(1 - p)\theta + (1 - \theta)} \right) \theta (2p - 1) \geq 0 \quad (\text{A11})$$

As $p > 0.5$ by assumption it follows that the second expression in brackets on the l.h.s. of (A11) is positive. It remains to show that the first one is positive, too. We require

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

which simplifies to

$$p \geq 1 - p.$$

This is strictly true by assumption.

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