Limits to Auditor Reputational Incentives

Somdutta Basu
Econ One, LLC

Korok Ray*
Texas A&M University

5th October 2017

Abstract

Why do reputable audit firms fail? This paper provides a formal theory of auditor reputation formation. Even under well-functioning reputation mechanisms, an auditor with a strong reputation has incentives to shirk. Above a threshold-reputation, the market belief about the auditor's ability dissipates slowly, leading to low audit quality. Reputation incentives weaken further under fee competition in audit markets. The results are robust under contigent fees for auditors.

*Corresponding author: korok@tamu.edu. We are thankful for helpful suggestions from Kalyan Chatterjee, Matt Ege, Steven Huddart, Vijay Krishna, Vaidyanathan Venkateswaran, James Jordan, Simon Board, Rick Antle, Shyam Sunder, Carlos Corona, Chester Spatt, and seminar participants at the Asia meeting of the Econometric Society, Cornell-Penn State Macro Workshop, Pennsylvania State University, Yale School of Management, Carnegie Mellon University, Indian Statistical Institute, University of Notre Dame, Syracuse University, Chapman University, and University of California Riverside. Jacob Mashburn and Marinda Beauchemin provided excellent research assistance.

1 Introduction

Over the last two decades, accounting scandals have involved highly reputable auditors such as Arthur Anderson, PwC, and KPMG.[1] Although auditors can be sued for negligence in the United States, such suits are rare or effectively absent in Japan, Germany, and India. With the biggest and most reputable auditors failing in all regulatory environments, it is appropriate to revisit the "reputation rationale" (DeAngelo, 1981) for audit quality and investigate to what extent reputation concerns provide incentives for auditors, using a formal model of reputation formation.

The two chief determinants of the supply of audit quality are litigation and reputation. One difference between the two is that litigation risk has only a downside, whereas reputation conceivably has both an upside and a downside (DeFond and Zhang 2014). Specifically, reputation can provide an incentive for auditors not to produce low quality audits, but also to provide an incentive to produce high quality audits. Yet the archival audit literature has difficulty empirically disentangling litigation risk from reputation risk, and more specifically, documents the downside of reputation incentives rather than the upside. As such, the question remains, does reputation play an important role in motivating auditors to provide high quality audits in the U.S.?

Not necessarily. We investigate this question theoretically using a dynamic economic model of reputation formation. The core idea is that reputation takes time to build, and it also takes time to lose. As such, auditors with strong reputations can "rest on their laurels," as market beliefs revise slowly to evidence of low quality performance. This general, theoretical result casts doubt on the ability of reputation alone to provide strong incentives to auditors. This is our primary contribution.

We use a two-period model with three kinds of players: auditors, investors, and issuers. The two audiences in our model are investors and issuers. Both the investor's and the issuer's payoffs depend on the informativeness of the auditor. Our model of reputation incorporates both unobservable types (adverse selection) and unobservable actions (moral hazard). The informative auditor is inherently better than the uninformative auditor irrespective of his choice of effort. Risk-neutral firms are endowed with projects; risk-neutral investors are endowed with cash. Investors face a new firm each period as an investment prospect.

[1] These scandals include the 2001 Enron scandal in the United States (Chaney and Philipich, 2002), the 2002 ComROAD scandal in Germany (Weber et al., 2008), the 2005 Kanebo issue in Japan (Skinner and Srinivasan, 2012), and the 2009 Satyam downfall in India (Bandyopadhyay et al., 2014).

The auditor, who can acquire information about the quality of the project, is hired by the firm for a report in order to secure investment. The accuracy of the report depends on the auditor's choice of effort. The auditor's report contains a signal from which the investor infers project quality and makes an investment decision. If the investor invests, the true state is revealed at the end of that period.

In every variation of our model, we show that reputation does provide downside incentives. In particular, when the reputation of the auditor is sufficiently low, the issuer will no longer hire the auditor, and therefore, the auditor will shirk. As such, the prospect of low reputation can provide an incentive for auditors to work to avoid these bad outcomes. This result permeates all specifications of our model as there is always a lower region for which an auditor with poor reputation will shirk and not be hired.

The upside depends on the level of monitoring by the auditor. If the monitoring is perfect, the auditor can perfectly assess the firm quality. In such a case, the market forms a belief consistent with this perfect assessment, and therefore, the auditor does indeed have an incentive to work because it confirms the market's belief. This sustains the high effort equilibrium in which reputation can in fact motivate high audit quality. [2]

We next turn to the more realistic case of imperfect monitoring. Here the audit report is a noisy signal of true firm quality, and therefore, the investor must infer the quality of the firm through the auditor's report. Because of the noise in the signal, the investor forms beliefs of the auditor's type, which become the reputation of the auditor. But once the auditor establishes a strong reputation in the first period, this reputation is hard to lose in the second period, as the belief revision slowly adjusts to bad signal. In this more realistic setting, reputation fails to provide an upside incentive for the auditor to provide high quality audits.

In this range, the probability that the auditor is informative is high enough for the investor to invest in the firm following a good report. The probability is also low enough (1) to push the auditor out of business in the next period following any inconsistency between the auditor's report and the true state, (2) such that gains from building reputation outweigh the costs, or (3) both. An auditor with a high reputation has weak incentives to expend effort when there is no credible threat of losing business. Gains

[2] This is consistent with DeAngelo (1981, p.191), who argues that reputable auditors have disincentives to "cheat" as "consumers view auditors with established reputations as having 'more to lose' from misrepresentation."

from reputation at the margin shrink as the market becomes convinced of the auditor's type. Once the auditor's reputation is sufficiently strong, the auditor can rest on his laurels and expend low effort. Ultimately, the failure of reputation to provide upside incentive stems from the level of monitoring of the auditor. It is precisely the noise in the auditor's report that obscures its signal to the investor. These beliefs are formed rationally and, therefore, update slowly to bad information.

Next, we show how competition affects reputation-building behavior. The competitive model has two auditors with the same reputation in the first period. In each period, only one auditor is hired by the firm. The actions of the auditor hired by the firm in the first period determine the probability that he is hired in the next period, as well as the payoffs he receives if hired. The range of reputation for which high effort can be sustained shrinks under competition. Bertrand competition drives down the prices auditors can charge, hence reducing the auditor's expected future payoffs. In turn, this reduces their incentives to expend effort, which leads to low quality audits. This contrasts the prevalent argument that competition stimulates reputation-building behavior, as dissatisfied clients have the option of switching auditors (Hörner, 2002). Finally, the situation worsens when firms have private information about the quality of the project they own.

1.1 Related Literature

The two principal forces that motivate audit quality are reputation and litigation. There is a stream of literature that studies auditor's incentives arising from legal liabilities (Dye, 1993; Narayanan, 1994). Extant accounting research on reputation incentives emphasizes the positive role of reputation (Datar and Alles, 1999). Using German data, Weber, Willenborg, and Zhang (2008) suggest that investors value auditor reputation. Skinner and Srinivasan (2012) use data from a litigation-free country (Japan) to investigate the importance of auditor's reputation. Both papers document adverse consequences of reputation loss in light of investor and client behavior following an accounting scandal. However, whether reputation concerns play an important role in motivating auditors to produce high quality audits is an unsettled question (Defond and Zhang 2014).

Corona and Randhawa (2010) is the chief paper in the literature that seeks to study reputational incentives outside of legal liability. Their manager can engage in fraud, and the auditor can detect that fraud and announce it to the market. Rather than an effort decision that determines the probability of a misstated audit report, they focus the analysis on the reporting decision of the auditor. They show the existence of an equilibrium in which reputation can induce the auditor to misreport. Ultimately, their model confirms ours in that reputation alone can be insufficient to enforce behavior of the auditor, even though the actual behavior is of a different nature (reporting vs. effort).

Our paper builds on Mailath and Samuelson (2001) and incorporates the two-audience feature of the audit market along with competition among auditors. There is a developing literature that investigates reputation incentives in two-sided markets. Mathis et al. (2008) study reputation-building behavior by a credit rating agency and investigate if reputation concerns are sufficient to guarantee truthful behavior of a strategic rating agency using a communication game. The authors show that reputation incentives can preclude rating inflation only when a sufficiently large fraction of the rating agency's income comes from sources other than rating complex products. The results of our model are consistent with this result. However, unlike Mathis et al. (2008), we analyze the incentives of an auditor to expend effort in order to produce high quality audits.[3] Moreover, Mathis et al. (2008) do not address competition.

There can be a number of alternative theories for why reputable audit firms fail. One such argument is that since auditors build reputation for two audiences, building reputation with the issuer provides incentives to issue favorable reports (Frenkel 2015). Bouvard and Levy (2013) argue that the presence of low quality issuers who prefer low quality certification can induce a certifier to reduce information quality. The two audiences in their model are the two types of issuers. Our paper adds a second layer to these theories by arguing that the above arguments cannot exist in isolation, as issuers may also care about auditors' reputation. In our model, the value of an audit report to one audience (the issuer firm) also depends on the value of the report to the other audience (the investor). Thus, the results of our model apply to a broader class of problems where reputation can be good or bad.

The theory and the model we propose in this paper fundamentally differ from extant two-audience reputation models, including Frenkel (2015) and Bouvard and Levy (2013), in the following aspects. First, our model incorporates both moral hazard and adverse selection to a two-audience setting; Frenkel (2015) only includes a model of adverse

[3] We focus on the auditors' choice of effort, a common modeling choice in the accounting literature (Dye, 1993, Narayanan,1994), instead of focusing on truth telling behavior by the auditor.

selection focusing on a cheap talk game, while Bouvard and Levy (2013) solely explore a moral hazard problem.

Second, in our model, the good ("informative") type auditor is inherently better than the bad ("uninformative ") type. This kind of type-characterization captures the special characteristic of an audit market where the Big-N firms are inherently superior to the non-Big-N auditors. The type- characterization, along with the two-audience feature, allows us to model a low reputation trap as well as a higher threshold, above which the auditor rests on reputation. Our auditor expends effort in the middle range of reputation not only for future gains from reputation but also to avoid the low reputation trap. The type-characterization also rules out an unraveling equilibrium, observed in Mailath and Samuelson (2001).

Third, in our model, auditors compete on fees (consistent with audit market practices). Both Frenkel (2015) and Bouvard and Levy (2013) model competition as a possible threat to entry and focus on the disciplining effects of competition. Hörner (2002) shows, in the context of experience goods markets, that competition generates reputation building behavior. Our model, on the other hand, shows how competition shrinks expected future payoffs and reduces reputation incentives for auditors.

2 The Model

There are three players: a firm, an investor, and an auditor. The firm and investor are short-lived while the auditor is long-lived. A firm is cashless and needs to raise capital for financing a project it owns. An investor, who faces the firm as an investment prospect, is endowed with cash of amount $w > 0$. Time is indexed by $t = 1, 2$.

Production takes place only if the entire w is invested in the project. The true type of the project may either be good (G) or bad (B). A project is good with probability p and returns to the investor $r_1 > 0$. With probability

(1-p)*theprojectisbadandyieldsanegativereturn*$\mathrm{r}_2 \in [-1, 0)$ to the investor. The project quality is *a priori* unknown to the investor and the firm itself.[4] The auditor can acquire

[4] This assumption is relaxed in Section 5, where the firm has private information about its project quality.

information about the quality of the project and produce a report $s \in \{g, b\}$, which is a publicly observable signal about the firm's project.

Firms want to raise capital for production, and their payoff from the investment is normalized to 1. Investors are risk-neutral and are faced with the following problem:

$$\max_{a \in [0,1]} wa\Big[p(1 + r_1) + (1 - p)(1 + r_2)\Big] \tag{1}$$

Maximization gives

$$a^* = \begin{cases} 1, & pr_1 + (1 - p)r_2 \geq 0 \\ 0, & pr_1 + (1 - p)r_2 < 0. \end{cases} \tag{2}$$

Define $\overline{p}$ such that $\overline{p}r_1 + (1 - \overline{p})r_2 = 0$, the posterior probability (that the project quality is good) makes the investor indifferent between investing all her wealth and not investing. Clearly, if $p \geq \overline{p}$ the firm is capable of securing investment by issuing an unaudited financial report. However, for priors lower than $\overline{p}$, firms fail to obtain investment without hiring the auditor. For the rest of this paper, we focus on the interesting case with $p < \overline{p}$.

Informativeness: Auditors are of two types: "informative" and "uninformative." Auditors can choose an effort level $e \in \{0, 1\}$, which determines the probability that the audit report is misstated. The auditor's choice of effort is the only action that affects audit quality, as in Dye (1993) and Narayanan (1994).[5]

Following Mailath and Samuelson (2001), we assume that the uninformative auditor can only choose to shrink (exert low effort), which generates uninformative audit reports $s \in \{g, b\}$. Independent of the true state, he issues report g with probability p and b with probability $1 - p$. Hence, the report does not carry any additional information about the true expected cash flow from the project.

On the other hand, an "informative" auditor can choose to be diligent (to work) or to shirk. When the "informative" auditor chooses to shirk ($e = 0$), his informativeness is captured by $\alpha \geq 0$ and $\beta \geq 0$, where α is the probability that a bad project is reported g (false positive) and β is the probability that a good project is reported b (false negative). The informative auditor can improve precision by being diligent (working), that is, by choosing $e = 1$ for which he has to bear a cost $c \in (0, \bar{c})$. By being diligent, the auditor

[5] Truth telling behavior by a certification intermediary has been studied by Mathis et al.(2008) and Frenkel (2015) and is not the focus of this paper.

reports a bad project as good with a lower probability $\alpha' \in [0, \alpha)$ and a good project as good with probability 1.[6] Suppose $c > 0$ is small enough so that the cost of diligence is lower than the information gain, that is, it is efficient to expend effort. The following assumptions impose plausible restrictions on the parameter values.

Assumption 1: $(1 - \beta) > p$. Given the true state is G, the informative auditor issues the report g with a higher probability than the uninformative auditor. In other words, compared to the uninformative auditor, the informative auditor is less likely to make a mistake when the true state is G.

Assumption 2: $\alpha < p$. Compared to the uninformative auditor, the informative auditor is also less likely to make a mistake when the true state is B.

Assumption 3: $p\beta \leq (1 - p)\alpha$. Ex-ante, the informative auditor is more likely to commit a mistake when the project quality is bad than when the project quality is good.[7]

Notice that α and β are the parameters that depict the extent to which information is distorted. Higher parameter values imply lower informativeness of the auditor. Suppose that the non-diligent informative auditor is informative enough so that $Pr(G|g) \geq \overline{p}$, which in turn implies $Pr(G|b) < \overline{p}$. In other words, if the auditor is known to be "informative" for sure, the investor finds it profitable to invest only if the audit report states $s = g$.

At any period t, the reputation of an auditor, denoted θ_t, gives the probability that the auditor is "informative."

Timeline: The model consists of two periods. The two period are essentially identical, with the chief difference that the parties (the firm and the investor) update the beliefs in between the two periods. The game in period 1 starts where the auditor is already hired, paid, and makes a decision about his choice of effort. At the beginning of period 1, the auditor decides whether to be diligent by paying the cost c and acquires information about the project quality of the firm. He issues a publicly observable report $s \in \{g, b\}$, and the investor then decides how much to invest. If the investor invests, the true expected cash flow is revealed at the end of period 1. The investor does not observe the

[6] This is a case of one-sided imperfect monitoring. In the case of perfect monitoring, $\alpha' = 0$ and the informative auditor can perfectly distinguish between a good project and a bad project.

[7] This assumption ensures that the returns of the auditor is increasing in reputation and the auditor has incentives to improve reputation to begin with. However, this assumption is not crucial as far as the results of the paper are concerned. Whether the return function is increasing or decreasing in reputation also depends on the probability with which the uninformative auditor generates the signal g. The above assumptions capture conditions conducive to reputation-building behavior.

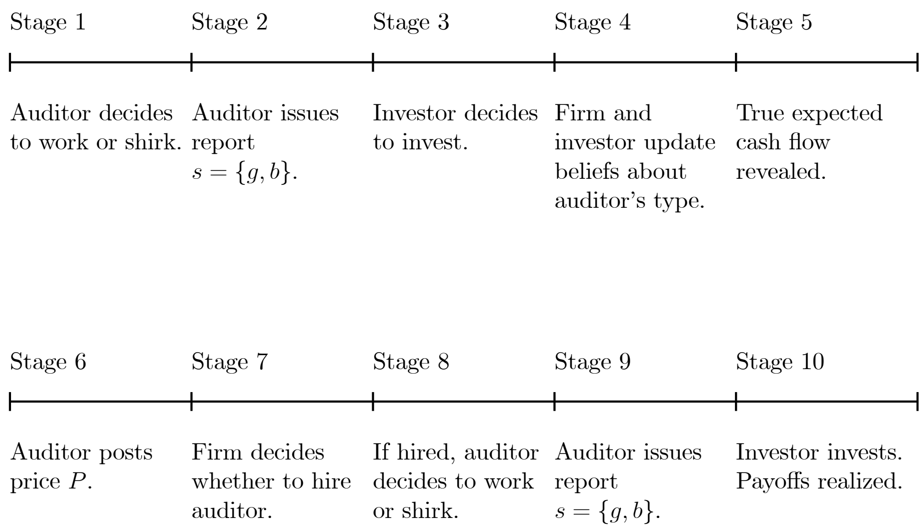

Figure 1: Timeline of the Game

true expected cash flow if no investment takes place. At the end of period 1, the firm and the investor update their belief about the auditor's type using Bayes' rule.

In period 2, the auditor posts a price P, and the firm decides whether to hire the auditor. If the auditor is hired, the payment is made upfront, and the hired auditor decides whether to be diligent by paying cost c. After the auditor acquires information about the project quality, he issues a report $s \in \{g, b\}$, and the report is observed by the investor. The investor then decides how much to invest. Cash-flows and payoffs are realized. The game ends.

Strategies and beliefs: A strategy for the auditor is a triple (P, γ_1, γ_2): a fee and effort-choices. Formally, $\gamma_1 : [0,1] \to [0,1]$, where $\gamma_1(\theta)$ is the probability that the auditor is diligent in period 1, $\gamma_2 : [0,1] \to [0,1]$ is the probability that the auditor is diligent in period 2, and $P : [0,1] \to \mathbb{R}$ is the fee the auditor posts in period 2.

1. A firm's strategy is a hiring function h from $\mathbb{R} \times [0,1] \to \{0,1\}$, where $h = 0$ implies the firm does not hire the auditor in period 2, and $h = 1$ implies the auditor is hired in period 2.

2. The investor's investment strategy $a^* : [0,1] \times \{g, b, \phi\} \times \{1,2\} \to [0,1]$ depicts

the investment decisions in each period as a function of reputation and observed audit report s.

3. The belief function $\pi : [0,1] \times \{g, b, \phi\} \times \{1,2\} \rightarrow [0,1]$ gives the probability that the project is good given report s in each period. $\pi(\theta, s)$ is calculated using Bayes' rule.

At the beginning of each period, the investor and the firm observe a report $s \in \{g, b, \phi\}$, and at the end of that period, a good (G) outcome is observed if a good project is financed, a bad (B) outcome is observed if a bad project is financed, and no (N) outcome is observed if no investment takes place. We denote by $\varphi(\theta|s,i)$ or φ_s^i the posterior probability that the auditor is "informative" given report $s \in \{g, b\}$, outcome $i \in \{G, B, N\}$, and prior probability θ.

Define $v(\theta)$ as the maximum willingness to pay by the firm for an auditor's report.

$$v(\theta) = \theta\Big[p\Big\{\hat{\gamma}(\theta) + (1-\hat{\gamma}(\theta))(1-\beta)\Big\} + (1-p)\Big\{\hat{\gamma}(\theta)\alpha' + (1-\hat{\gamma}(\theta))\alpha\Big\}\Big] + (1-\theta)p, \quad (3)$$

where $\hat{\gamma}(\theta)$ is the belief about the auditor's choice of effort. The equilibrium concept is Perfect Bayes. In equilibrium, players maximize their payoffs, and their beliefs coincide with actions.

Definition 1 *Equilibrium consists of a hiring strategy h by the firm, effort-choices (γ_1, γ_2), a fee P by the auditor, an investment strategy a^* by the investor, a posterior function π, and an updating rule φ such that:*

1. *h is optimal for the firm.*

2. *γ_1 and γ_2 maximize expected lifetime payoff for the auditor in each period.*

3. *P maximizes period 2 payoff.*

4. *a^* is optimal for the investor.*

5. *π and φ are obtained using Bayes' rule.*

3 Equilibrium Analysis

We begin the analysis of perfect monitoring as a benchmark.

3.1 Perfect Monitoring

Perfect monitoring refers to the case where the informative auditor, if diligent, can distinguish perfectly between a good project and a bad project. He can improve precision by being diligent, in which event the auditor reports a good project as g and a bad project as b with probability 1 (so $\alpha' = 0$).

Proposition 1 *When cost of effort is small, there exists $\theta_1 \in [0, \overline{\theta}]$ so that the following pure strategy profile constitutes an equilibrium:*

1. At t=2, the auditor posts the fee $P(\theta) = \theta[p(1-\beta) + (1-p)\alpha] + (1-\theta)p$ and is hired only if $\theta \geq \overline{\theta}$. The investor invests if and only if $\theta \geq \overline{\theta}$ and $s = g$.

2. At t=1, the auditor shirks for $\theta \in [0, \theta_1)$, and works otherwise. The investor invests if and only if $\theta \geq \theta_1$ and $s = g$.

All proofs are in the appendix. Proposition 1 states that, in equilibrium, the auditor is diligent whenever he is hired. For the lower range of reputation $[0, \theta_1)$, the auditor is not hired in the second period, and hence, if hired in the first period, he never expends effort. In the higher range $\theta \in [\theta_1, 1)$, the auditor always faces the possibility of falling in the lower range. Thus, for small enough cost of effort, the auditor always has incentive to be diligent. Consistent with the reputation rationale for audit quality, this proposition shows how higher-reputation auditors may have more to lose by not being diligent.

The dynamics work as follows. The auditor is hired by a firm with a good project with probability p. In this event, gains from building reputation approach zero as θ approaches 1. Now the auditor meets a firm with a bad project with probability $1 - p$, in which event reputation gains may not diminish as θ approaches 1. This is sustained by the market belief that the diligent, informative auditor never makes a mistake. If he chooses to shirk, there is always a positive probability of making a mistake and moving to a lower reputation $\varphi_g^B(\theta)$. If the firm and the investor believe that the informative auditor never makes a mistake, then $\varphi_g^B(\theta)$ takes the value 0. As long as the cost of this mistake is higher than the cost of being diligent, the informative auditor chooses to be diligent. At $\theta = 1$, learning stops, and the optimal action for the auditor is to not exert diligence at that level of reputation. However, $\theta = 1$ is never reached if reputation in the first period is strictly less than 1, which is almost always the case.

Our first benchmark result can be compared to the baseline result in Cornona and Randhawa (2010). We find that the reputation argument of Datar and Alles (1999) does actually hold when the auditor's assessment is perfect. Alternatively, Corona and Randhawa (2010) finds that the reputation incentives hold in a one period setting when reputation cannot form because of the lack of a second period. Thus, our result is a complement to theirs. They base their benchmark on time (one period versus two periods). We base our benchmark on the quality of the auditor's assessment (perfect versus imperfect). Observe that in our model, a one period setting would, by its very structure, lead the auditor to shirk since the lack of a second period eliminates any long term incentives for the auditor. In fact, in every equilibrium of our model, the auditor will always shirk in the second period, precisely because it is the final period, and there is no incentive at that point; the existence of the second period supports the reputation incentive in the first period. This is not true with Cornona and Randhawa (2010) because their auditor does not face a moral hazard problem of shirking but rather a problem of reporting fraud.

The pure strategy equilibrium described in Proposition 1 is the high-effort equilibrium that arises only under the restrictive assumption of perfect monitoring.[8] Ultimately, the perfect monitoring of the auditor sharpens the signal, and therefore, the audit report is informative of the auditor's effort. This provides strong incentives for the auditor to work, upholding the equilibrium of reputational equilibrium. Unfortunately, with even a small amount of imperfection in the monitoring, this equilibrium falls apart, and these reputation incentives can vanish, to which we now turn.

3.2 Imperfect Monitoring

Now, consider imperfect monitoring, in which the auditor cannot distinguish perfectly between a good and a bad project. This can occur because the auditor himself cannot fully observe project quality, and there is undiversifiable uncertainty about that assessment. Thus $\alpha > \alpha' > 0$ and $\beta > \beta' = 0$.

Investor's Behavior: The investor's investment decision depends on the auditor's reputation θ, the auditor's choice of effort e, and the audit report s. Notice that it is optimal for the investor to invest only if the report states $s = g$. The investor's decision depends on reputation in the following way. Suppose the investor believes that

[8]It is not the only pure strategy equilibrium; there exists a continuum of threshold equilibria. In fact, Proposition 1 is just a special case of the more general Proposition 2.

the auditor is "informative" with probability θ and can perfectly observe $e \in \{0, 1\}$. Then, there exists a $\underline{\theta} \in (0, 1)$, such that the investor is indifferent between investing and not investing if $e = 1$ and $s = g$. That is, $\pi(\underline{\theta}|e = 1, s = g) = \bar{p}$. There is another important threshold reputation $\overline{\theta} \in (\underline{\theta}, 1)$, such that if the observed signal is g, the investor is indifferent between investing and not investing even if $e = 0$. That is, $\pi(\overline{\theta}|e = 0, s = g) = \bar{p}$.

In equilibrium, for all $\theta \in [0, \underline{\theta})$, the auditor is not hired even if he puts effort. This is an absorbing state, and the auditor can never make it to the market once he falls into this region. Hence, the auditor has no incentive to be diligent if his reputation falls in the region $\theta \in [0, \underline{\theta})$. Also, in equilibrium, the auditor must exert diligence with positive probability for the range $\theta \in [\underline{\theta}, \overline{\theta})$ in order to get hired. Now, whether the auditor puts effort beyond $\overline{\theta}$ is the question of interest. The desired "high-effort" equilibrium that supports the reputation rationale is one where the auditor exerts diligence whenever he is hired by the firm.

Reputation Revision: Suppose the investor invests if and only if $s = g$. We characterize how reputation is revised following audit reports and expected cash flows. The results in turn explain how auditors' incentives line up with market belief, reputation revision, and choice of effort. We prove the results formally in the appendix.

Lemma 1 $\varphi_g^G(\theta) > \theta$ *and*

$\varphi_b^N(\theta), \varphi_g^B(\theta) < \theta$.

First, reputation is revised upwards when a report g is followed by a good (G) outcome. This result follows Assumption 1. An auditor is rewarded with a higher reputation whenever there is a correspondence between the report and the observed true state. On the other hand, the history (g, B) is followed by a downwards revision of reputation. In other words, an auditor is penalized with a lower reputation following a discrepancy between his report and the true state-realization. Also, the auditor faces a downward reputation-revision if the audit report is b. This result follows Assumption 3. However, this does not necessarily imply that the auditor is penalized for reporting b when the true state is B.[9]

[9] The fall in reputation following the report b follows from the assumptions made on the probability distribution of signals. The results of the paper hold true whenever $\varphi_b^N(\theta) < \varphi_g^B(\theta) < \varphi_g^G(\theta)$.

Lemma 2 *Suppose α and β are small enough such that $\varphi_g^B(\theta) - \varphi_b^N(\theta) < 0$ when $\gamma = 0$. As $\alpha \to 0$, $\varphi_g^B(\theta) - \varphi_b^N(\theta) < 0$ when $\gamma = 1$. As $\alpha, \beta \to 0$, $\varphi_g^B(\theta) - \varphi_b^N(\theta) < 0$ when $\gamma = 0$.*

Second, reputation falls more when a report g is followed by a bad expected cash flow in comparison to the fall in reputation followed by the report b. In the case of no investment, the reputation revision is less stark than what it is when there is an explicit discrepancy between the report and the outcome. This ensures that the auditor is rewarded with a higher reputation when he detects a bad project as bad. The lower the values of α and β, the starker the reputation revision. In fact, with perfect monitoring and $\hat{\gamma}_1 = 1$, reputation is revised all the way to zero.

Lemma 3 *Given θ,*

$$p \in \left(\varphi_g^G(\theta) - \varphi_b^N(\theta)\right) + (1-p)(\alpha - \alpha')\left(\varphi_b^N(\theta) - \varphi_g^B(\theta)\right)\Big|_{\hat{\gamma}=1} \tag{4}$$

$$> p \in \left(\varphi_g^G(\theta) - \varphi_b^N(\theta)\right) + (1-p)(\alpha - \alpha')\left(\varphi_b^N(\theta) - \varphi_g^B(\theta)\right)\Big|_{\hat{\gamma}=0}.$$

Third, suppose the auditor's reputation is such that the auditor is hired with probability 1 in the second period. At any such reputation θ, the auditor's expected payoff from expending effort with $\hat{\gamma} = 1$ is strictly greater than his expected payoff from expending effort with $\hat{\gamma} = 0$ (Lemma 3). In other words, gains from high effort are higher if the investor believes that the auditor is diligent. An "informative" auditor exerting effort generates audit reports with higher precision than he would without effort. Consequently, reputation revisions are starker and payoffs are more sensitive to actions when the investor expects the auditor to expend effort.

In the short-term, the auditor has incentives to shirk because effort is costly. However, in order to have value to the firm, the auditor's reports must also be credible to the investor. Reputation of the auditor is both the investor's and the firm's posterior expectation that the auditor is informative. Firms and investors only infer the informativeness of the auditor from the correspondence between his report and the true state. Beliefs about the auditor's type are revised using Bayes' rule.

Based on the discussion on investor's behavior and reputation revision, Proposition 2 shows that, under imperfect monitoring, the auditor has no incentive to put effort for a very high and low range of reputation.

Proposition 2 *When cost of effort is small, this exists* $\theta_1 \in [0, \overline{\theta}]$ *and* $\theta_2 \in [\overline{\theta}, 1)$ *so that the following pure strategy profile constitutes an equilibrium:*

1. At t=2, the auditor posts the fee $P(\theta) = \theta[p(1-\beta) + (1-p)\alpha] + (1-\theta)p$ *and is hired only if* $\theta \geq \overline{\theta}$*. The investor invests if and only if* $\theta \geq \overline{\theta}$ *and* $s = g$*.*

2. At t=1, the auditor works for $\theta \in [\theta_1, \theta_2]$ *and shirks otherwise. The investor invests if and only if* $\theta \geq \theta_1$ *and* $s = g$*.*

Proposition 2 states that the auditor is diligent only where the incremental gains from building reputation are strictly higher than the cost of exerting effort. For the lower range of reputation $[0, \theta_1)$ the auditor is not hired in the second period, so he never expends effort in this range. In the upper range $[\theta_2, 1]$, incremental gains from building reputation fall below the cost of effort.In the middle range $[\theta_1, \theta_2)$, the auditor faces the possibility of falling in the lower range, so he works.

The dynamics work as follows. The auditor is hired by a firm with a good project with probability p. By expending effort, the auditor improves the probability of moving to a higher level reputation $\varphi_g^G(\theta)$ instead of moving to a lower level of reputation $\varphi_b^N(\theta)$. The gains from effort are captured by the difference between the expected capital raised by the firm at $\varphi_g^G(\theta)$ and expected capital raised at $\varphi_b^N(\theta)$. The auditor is hired by a firm with a bad project with probability $1-p$. By expending effort, the auditor reduces the probability of moving to a lower reputation $\varphi_g^B(\theta)$. Gains from reputation are captured by the difference between the fee the auditor can charge by moving to the level of reputation $\varphi_b^N(\theta)$ and the fee he can charge if he moves to a lower level of reputation

$\varphi_g^B(\theta)$ by reporting a B firm as g. The auditor is hired in the second period only if his reputation is above $\overline{\theta}$. Thus, for any reputation θ below $\overline{\theta}$, the auditor is not diligent.

In equilibrium, for the auditor to be diligent, the difference between the value of choosing high effort and the value of choosing low effort must exceed the cost of choosing high effort. Suppose the cost of expending effort is small. Now, for a given belief about the auditor's choice of effort, the value functions corresponding to high effort and low effort approach each other as $\theta \to 1$. This is because the values diverge only through the effect of current outcome on future posteriors. Current outcomes have very little effect on future posteriors if the market is quite sure of the auditor's type. Thus, for posteriors close to unity, no matter how small the cost is, the gains from being diligent are surpassed by the cost of exerting effort, which gives rise to the threshold equilibria. Proposition 2 formally shows that even when cost of effort is small, reputation concerns fail to solve the moral hazard problem when reputation of the auditor is high.

3.3 Connecting to Existing Literature

It is worthwhile to compare Proposition 2 to a similar result in Corona and Randhawa (2010), which finds that reputational incentives alone may be insufficient for auditors to behave appropriately. Corona and Randhawa (2010) employ a different setting than ours: their managers are long lived whereas ours are short lived; their managers have types (dishonest and honest) whereas our manager does not; they examine mixed strategy equilibrium whereas we focus on pure strategy equilibrium; they do not allow for false negatives, whereas we allow for both false positives and false negatives. However, the main difference is the action space of their auditor. Their auditor engages in fraud identification and reporting; he detects fraud and subsequently decides whether to report this to the market. Auditors care about their reputation because it affects their compensation, as more able auditors earn higher fees because of their higher detection probabilities.

Corona and Randhawa (2010) discover the existence of an equilibrium ("the handcuff equilibrium"), in which an auditor with a strong reputation is unwilling to report fraud. This occurs when a high type manager is in place, so the market forms a baseline belief that an absence of an auditor's disclosure means that the manager is indeed high quality. Were the auditor is to reveal fraud when it occurs, the market would rationally assume that fraud must have occurred in the past as well, and will therefore penalize the auditor and discount his reputation accordingly.

In contrast, our auditor faces a moral hazard problem and is tempted to shirk because exerting effort is costly. An auditor that has already developed a strong reputation balances the saved effort from shirking against the subsequent loss in reputation. If his reputation is sufficiently high, then the cost of effort exceeds the discount to his reputation, and therefore high type auditors will be tempted to shirk. Ultimately, the auditor in Corona and Randhawa (2010) cares exclusively to preserve his reputation, and this is why he fails to report fraud. Our auditor cares to save on costly effort, and that is why he shirks.

Taken together, we see our model as a complement to Corona and Randhawa (2010), since auditing has both a reporting component as well as a moral hazard component. Combined, the results of both papers show that reputation incentives do not necessarily provide sufficient incentives for the auditor to either report fraud or to exert effort in monitoring the firm.

4 Competition Among Auditors

Regulators and policymakers have expressed concerns about the lack of competition in the audit market and that weak competition may reduce incentives for auditors to produce high audit quality. This section investigates how competition affects reputation-building behavior. We consider a competitive model with two auditors, one investor and one firm. [10] We name the two identical auditors auditor 1 and auditor 2. Each of these auditors can be informative or uninformative, and they have the same reputation at the beginning of the first period. In each period, the firm must hire only one auditor.[11]

The competitive model keeps the key aspects of the benchmark framework and gives rise to similar threshold equilibria as described in Proposition 2. The main result of this analysis shows that high effort can be sustained for a smaller range of reputation under the competitive model.

Timeline: Period 1 is identical to the benchmark model where the firm hires one of the two auditors. The firm then decides which auditor to hire in the second period. At the beginning of period 2, the investor and the firm believe that the hired auditor and the not-hired auditor are informative with probabilities θ and θ', respectively. The hired and not-hired auditor post prices P and P', respectively. The auditor hired in the second period receives his fee upfront. He then decides whether to be diligent (by paying the cost c) and acquires information about the project quality. He reports $s \in \{g, b\}$ depending on his choice of effort, and the report is observed by the investor. The investor then decides how much to invest. The game ends.

[10] The monopoly and duopoly setup can also be interpreted as substitutability of auditors. A monopoly model reflects a situation where switching costs are high for the client. A duopoly model can be interpreted as a situation where two auditors are perfect substitutes and there is no switching cost.

[11] The analysis in this section does not allow for "opinion shopping." The focus of the analysis is to capture the effect of competition on reputation incentives when auditors compete for clients.

Strategies and Beliefs: A strategy for an auditor is a triple (P, γ_1, γ_2), i.e., a fee and effort-choices. Formally, $\gamma_1 : [0,1] \times [0,1] \to [0,1]$, where $\gamma_1(\theta, \theta')$ is the probability that the auditor is diligent in period 1 if hired and $\gamma_2 : [0,1] \to [0,1]$ is the probability that the auditor is diligent in period 2 if hired. These are functions of his own reputation and his rival's reputation. Similarly, $P : [0,1] \times [0,1] \to \mathbb{R}$ gives the fee an auditor posts in period 2.

1. A firm's strategy is a hiring function h: $\mathbb{R} \times \mathbb{R} \times [0,1] \times [0,1] \to \{0,1,2\}$, where $h = 0$ implies the firm does not hire any auditor, $h = 1$ implies auditor 1 is hired, and $h = 2$ implies auditor 2 is hired. Each of these hiring strategies are for period 2.

2. The investor's investment strategy $a^* : [0,1] \times \{g, b, \phi\} \times \{1,2\} \to [0,1]$ depicts in each period how much the investor invests from a wealth w as a function of reputation of the hired auditor and the observed report s.

3. The belief function $\pi : [0,1] \times \{g, b, \phi\} \times \{1,2\} \to [0,1]$ in each period gives the probability that the project is good given the report s, and $\pi(\theta, s)$ is calculated using Bayes' rule.

If the "informative" auditor is diligent with probability $\gamma(\theta)$ in period 1, then the posterior beliefs are updated using (1)-(3).

The expected capital raised by the firm for an auditor's certification is:

$$v(\theta) = \theta\Big[p\Big\{\hat{\gamma}(\theta) + (1-\hat{\gamma}(\theta))(1-\beta)\Big\} + (1-p)\Big\{\hat{\gamma}(\theta)\alpha' + (1-\hat{\gamma}(\theta))\alpha\Big\}\Big] + (1-\theta)p, \quad (5)$$

where θ is the auditor's reputation and $\hat{\gamma}(\theta)$ is the belief about the auditor's choice of effort.

Definition 2 *Equilibrium consists of a hiring strategy h by the firm, a choice of effort γ_1 by the hired auditor, fees P and P' by the auditors, an investment strategy a^* by the investor, a posterior function π, and an updating rule φ such that:*

1. *h is optimal for the firm.*

2. *γ_1 maximizes expected lifetime payoff for the hired auditor.*

3. *P and P' maximize period 2 payoffs.*

4. *a^* is optimal for the investor.*

5. *π and φ are obtained using Bayes' rule.*

The following proposition characterizes the threshold equilibria in a competitive model.

Proposition 3 *There exists $\theta_1 \in [0, \overline{\theta}]$ and $\theta_2 \in [\overline{\theta}, 1)$ so that the following pure strategy profile constitutes an equilibrium:*

1. At t=2, an auditor whose reputation is θ and whose rival's reputation is θ' posts a fee

$$P(\theta, \theta') = \begin{cases} \max\left\{0, (\theta - \theta')\Big[(1-p)\alpha - p\beta\Big]\right\} & \text{if } \theta' \geq \overline{\theta} \\ v(\theta) & \text{otherwise.} \end{cases} \tag{6}$$

An auditor is hired only if $\theta \geq \overline{\theta}$ and expected capital raised by hiring that auditor is higher than that of his rival. The investor invests if and only if $\theta \geq \overline{\theta}$ and $s = g$.

2. At t=1, the auditor works for $\theta \in [\theta_1, \theta_2)$ and shrinks otherwise. The investor invests if and only if $\theta \geq \theta_1$ and $s = g$.

Proposition 3 states that the auditor does not expend effort for a low range of reputation given by the interval $[0, \theta_1)$ and for a high range of reputation depicted by the interval $[\theta_2, 1]$. The intuition for the result is same as that of Proposition 2. However, in the competitive model the threat of losing the client is more prominent because of the presence of a rival auditor. Even if reputation is higher than $\overline{\theta}$ in the second period, he is not hired whenever his reputation falls below his rival's reputation. Thus, for the same cost of effort, the threshold θ_2 under competitive model is different from that under the benchmark framework.

The reputation dynamics work as follows. The auditor is hired by a firm with a good project with probability p. By expending effort, the auditor improves his chances of moving to a higher level of reputation $\varphi_g^G(\theta)$ instead of moving to a lower level of reputation $\varphi_b^N(\theta)$. The gains from effort are captured by the difference between the fee the auditor can charge at $\varphi_g^G(\theta)$ and $\varphi_b^N(\theta)$. The auditor is hired by a firm with a bad project with probability $1 - p$. By expending effort, the auditor reduces his chances of moving to an even lower level of reputation $\varphi_g^B(\theta)$. Again, gains from reputation are captured by the difference between the fee the auditor can charge by moving to the level of reputation $\varphi_b^N(\theta)$ and the fee he can charge if he moves to a lower level of reputation

$\varphi_g^B(\theta)$. The auditor is hired in the second period only if his reputation is above $\overline{\theta}$. Thus, for any reputation θ below $\overline{\theta}$, the auditor is not diligent. This is the same argument that works for both Proposition 2 and Proposition 1.

Because of the presence of the rival, the fee that the auditor can charge in equilibrium is zero at reputation levels $\varphi_b^N(\theta)$ and

$\varphi_g^B(\theta)$. The fee the auditor charges at $\varphi_g^G(\theta)$ is essentially the difference between the expected capital raised by the firm at $\varphi_g^G(\theta)$ and the expected capital raised at θ. As $\theta \to 1$, the difference approaches zero. Thus, for posteriors close to unity, if the market believes that the auditor is not diligent, the gains from being diligent are surpassed by the cost of exerting effort, no matter how small the cost is. This gives rise to threshold equilibria in the competitive model.

Proposition 3 formally shows that even with competition, reputation concerns fail to solve the moral hazard problem when reputation of the auditor is sufficiently high, no matter how small cost of effort is. Notice that the high-effort equilibrium does not exist in the competitive model set-up. Even with the restrictive assumption of perfect monitoring, competition leads to threshold equilibria as described in Proposition 3.

How does competition affect reputation-building behavior? Proposition 4 compares the ranges of reputation for which high effort can be sustained under the monopoly and the competitive model regime:

Proposition 4 *Consider the range of c for which the "threshold" equilibria hold for both the benchmark and the competitive model. For any such c, the range of reputation for which high effort can be sustained under benchmark is strictly larger than the range for which high effort can be sustained under the competitive model.*

Notice that reputation incentives for the sole auditor are captured by

$$p\beta\Big[v(\theta_G) - v(\theta_N)\Big] + (1-p)(\alpha - \alpha')\Big[v(\theta_N) - v(\theta_B)\Big], \tag{7}$$

while the reputation incentives for a duopolist are captured by $p\beta[v(\theta_G) - v(\theta)]$. Since $\theta_B < \theta$ and $v(\theta)$ is increasing, gains from building reputation are always greater under the benchmark. The above result is counter intuitive in that reputation incentives are lower under competition. The prevalent argument in favor of competition is that competition stimulates reputation-building behavior, as dissatisfied clients have the option of switching auditors. However, in the audit market, competition is manifested in the form of price competition, not quality competition. In order to attract clients, the fees the duopolists charge in equilibrium are strictly lower than the fees they would charge under monopoly. This drives down the expected future profit of an auditor and, hence, reduces incentives to expend effort. In a setting as described in our model, an auditor can best reap the benefits of building reputation when he does not face competition.

The intuition follows. With probability p, the auditor is hired by a firm with a good project. By expending effort, the auditor improves his chances of moving to a higher-level reputation $\varphi_g^G(\theta)$. By moving to a higher level of reputation, the auditor can charge a positive fee that equals the difference between the expected capital the firm can raise by hiring the auditor and the expected capital the firm can raise by hiring his rival (whose reputation is θ). Under a monopoly, the fee that the auditor can charge at $\varphi_g^G(\theta)$ equals the expected capital raised at that level of reputation. Gains from reputation under a monopoly are captured by the difference between the fee the auditor can charge by moving to a higher level of reputation ($\varphi_g^G(\theta)$) and the fee he can charge if he moves to a lower level of reputation ($\varphi_b^N(\theta)$) by committing a mistake. The fee that the duopolist can charge if he moves to a lower level of reputation ($\varphi_b^N(\theta)$) is zero, as his rival (who has a higher reputation θ) can cut price and still charge a positive fee. Thus, the gains from building reputation are captured by the difference between the expected capital raised at $\varphi_g^G(\theta)$ and $\varphi_b^N(\theta)$ in a monopoly set-up while the gains from building reputation under the competitive model are captured by the difference between the expected capital raised at $\varphi_g^G(\theta)$ and θ.

With probability $(1-p)$, the auditor is hired by a firm with a bad project. By expending effort, the auditor reduces his chances of moving to a lower level of reputation $\varphi_g^B(\theta)$. Gains from reputation under a monopoly are captured by the difference between the fee the auditor can charge by moving to the lower level of reputation ($\varphi_b^N(\theta)$) and the fee he can charge if he moves to a lower level of reputation by reporting a bad firm as good ($\varphi_g^B(\theta)$). The fee that the duopolist can charge if he moves to any of these levels of reputations, $\varphi_b^N(\theta)$ or $\varphi_g^B(\theta)$,

$$iszero, ashisrival(whohasahigherreputation$$

θ) can cut price and still charge a positive fee. The gains from building reputation under the competitive model disappear fully while the gains from building reputation under monopoly are still positive and are captured by the difference between the expected capital raised at $\varphi_b^N(\theta)$ and $\varphi_g^B(\theta)$. Thus, the presence of a rival leads to a reduction in fees that the auditors can charge, and this reduces their incentives to expend effort.

5 Firms with Private Information

Firms and investors are often asymmetrically informed about the true expected cash flow from a project. This section deals with a situation when firms have private information about the project quality. In the model, auditors do not possess prior information about the project quality and can acquire information only if hired by the firm. Thus, auditors cannot price discriminate and have to post a single fee for the firms. The fee can be a pooling fee or a separating fee.

Suppose the firms are of two types, the high type (H firms) and the low type (L firms). These types can be perceived as firms' virtual types, as there is still some uncertainty about the firms' true project quality. The true project quality can either be good (G) or bad (B). A high type firm produces a good outcome with probability $\rho \in (p, 1)$, and a bad outcome with probability $1 - \rho$. A low type firm, on the other hand, produces a good outcome with probability $\rho' \in (0, p)$ and a bad outcome with probability $1 - \rho'$. The firm has private information about its own type. However, the firm does not know the true quality of the project it owns, that is, whether the project is G or B. Whether the project is good (G) or bad (B) is revealed after the investor invests in it.

In period 2, the H firm's maximum willingness to pay for an auditor with reputation θ is

$$P_H(\theta) = \theta[\rho(1 - \beta) + (1 - \rho)\alpha] + (1 - \theta)p. \tag{8}$$

The L firm's maximum willingness to pay for an auditor with reputation θ, on the other hand, is

$$P_L(\theta) = \theta[\rho'(1 - \beta) + (1 - \rho')\alpha] + (1 - \theta)p. \tag{9}$$

Suppose that $\rho'(1-\beta)+(1-\rho')\alpha < p < \rho(1-\beta)+(1-\rho)\alpha$, so the ex-ante probability that an informative auditor reports an H firm as g is higher than the probability that an informative auditor reports an L firm as g. The assumption also ensures that the ex-ante probability that an informative auditor reports an L firm as g is less than the probability that an uninformative auditor reports an L as g. Notice that $P_H(\theta) > P_L(\theta)$ for $\theta \geq \overline{\theta}$. Therefore, P_L is the pooling price at which both H firms and L firms hire an auditor. An auditor can charge the separating price P_H, in which event he is only hired by H firms.

Assume that the H firms cannot credibly disclose the hiring decision to the investor unless an audit report is produced. The H firms, therefore, hire an auditor as there is no other way they can signal their type, and investors invest only if the report is g. This is because there is still some uncertainty about the true type of the project and the report s is the only source of information to the investor. Now, at a particular θ, which fee gives higher revenue to an auditor depends on the proportion of high type firms in the economy. Let x be the probability of meeting a high type firm every period.[12] Now, revenue of an auditor from posting the separating price is $x\theta[\rho(1-\beta)+(1-\rho)\alpha]+x(1-\theta)p$, which is increasing in

θ. Revenue from posting the pooling price, on the other hand, is $\theta[\rho'(1-\beta)+(1-\rho')\alpha]+(1-\theta)p$, which is decreasing in θ. For $\theta \geq \overline{\theta}$, define $R(\theta)$ such that

$$R(\theta) = \max\{x\theta[\rho(1-\beta)+(1-\rho)\alpha]+x(1-\theta)p, \theta[\rho'(1-\beta)+(1-\rho')\alpha]+(1-\theta)p\}. \quad (10)$$

Consider two identical auditors, auditor 1 and auditor 2. Each of these auditors can be informative or uninformative. Because of the presence of a rival, the only fee an auditor can post in equilibrium is the pooling fee. The timeline, strategies, beliefs, and equilibrium definition are the same as before.

Now consider the case where auditor 1 is hired in the first period, and his reputation is θ. Suppose in period 1, auditor 2's reputation is same as auditor 1's reputation(θ) if $\theta \geq \overline{\theta}$ and $\overline{\theta}$ otherwise. This assumption ensures that auditor 1 faces competition in period 2. The following proposition characterizes auditor 1's behavior in equilibrium.

Proposition 5 *At t=2, an auditor is never diligent. An auditor whose reputation is θ and whose rival's reputation is θ' posts a fee of*

$$P(\theta, \theta') = max\Big\{0, (\theta' - \theta)\Big[\rho'(1-\beta) + (1-\rho')\alpha - p\Big]\Big\}. \quad (11)$$

[12] Thus, $x\rho + (1-x)\rho' = p \Longrightarrow x = \frac{p-\rho'}{\rho-\rho'}$.

An auditor is hired only if $\theta \geq \overline{\theta}$ *and the expected capital raised by hiring that auditor is higher than that of his rival. The investor invests if and only if* $\theta \geq \overline{\theta}$ *and* $s = g$*.*

At t=1, the auditor is never diligent, i.e. $\gamma_1(\theta) = 0$ *for all* θ*. The investor invests if and only if* $\theta \geq \overline{\theta}$ *and* $s = g$*.*

The presence of a rival makes it impossible for a duopolist to post any fee above the pooling fee. The return function that the duopolist takes into account is guided by the pooling fee, which is decreasing in reputation. The focus of Proposition 5 is on the range of reputation where an auditor faces his rival in period 2 with probability 1. We are particularly interested in this range of reputation as we seek to know the impact of competition on reputation-building behavior.

The auditor is hired by a firm with a good project with probability p. By expending effort, the auditor improves his chances of moving to a higher level of reputation $\varphi_g^G(\theta)$. By moving to a higher level of reputation, the auditor does not benefit as the fee he can charge is zero. On the other hand, his rival (whose reputation is θ) can charge a positive fee, which equals the difference between the expected capital an L type firm can raise by hiring the rival and the expected capital an L type firm can raise by hiring the auditor. The fee that the duopolist can charge if he moves to a lower level of reputation $\varphi_b^N(\theta)$ is positive and equals the difference between the expected capital an L type firm can raise by hiring the auditor and the expected capital an L type firm can raise by hiring his rival (who has a higher reputation θ).

The auditor is hired by a firm with a bad project with probability $1-p$. By expending effort, the auditor reduces his chances of moving to a even lower level of reputation $\varphi_g^B(\theta)$. If he moves to a lower level of reputation

$\varphi_g^B(\theta)$ by reporting a bad firm as good, the fee he can post equals the difference between the expected capital an L type firm can raise by hiring the auditor and the expected capital an L type firm can raise by hiring his rival (who has a higher reputation θ). This is higher than the fee he can charge if he moves to $\varphi_b^N(\theta)$ by not committing a mistake. The fee the duopolist can charge at $\varphi_b^N(\theta)$ is the difference between the expected capital an L type firm can raise by hiring the auditor at $\varphi_b^N(\theta)$ and the expected capital an L type firm can raise by hiring his rival (who has a higher reputation θ).

Thus, for the situation where an auditor's rival remains in the market in period 2 with probability 1, the hired auditor in period 1 has no incentive to exert effort. When firms have private information about the project quality they own, the auditors compete to attract clients and can never charge a fee above the pooling fee. Thus, they end up attracting the low type firms along with the high type firms. The H firms pay much less than their maximum willingness to pay, and the pricing decision is solely driven by the maximum willingness to pay by the L firms. This hinders reputation incentives by making the return function decreasing in reputation. When firms and investors are symmetrically informed, as the cost of being diligent goes to zero, the threshold beyond which effort cannot be sustained in equilibrium approaches unity. However, when firms have private information about the project quality, the duopolist never expends effort. No matter how small the cost of effort, high effort is not sustained in equilibrium for any range of reputation. Notice that under a monopoly, even if the auditor's return function is guided by the pooling fee, the auditor has incentives to expend effort for a middle range of reputation. However, the monopolist stops expending effort for the range of reputation where the probability of reaching the self-absorbing state in the second period is zero. Since the auditors cannot charge a separating fee, it becomes a race to the bottom for auditors.

6 Contingent Fees

The focus of the preceding sections have been on whether reputation concerns are sufficient to provide incentives for auditors assuming up-front payments to auditors. In this section, we present a brief discussion on how reputation-incentives are affected under an alternative payment method, namely, report-contingent payment in the context of our model. Motivated by a debate on whether report-contingent payments should be banned, Dye et al. (1990) examine how auditors and their clients respond to the introduction of report-contingent contracts in audit markets. Consistent with Dye et al. (1990), we argue that upfront payment can improve informativeness of an auditor by motivating the auditor to expend effort. We also argue that, though upfront payment can substantially weaken adverse effects of a conflict of interest, it cannot eliminate the moral hazard problem embedded in these two-sided markets.

Consider the following report-contingent payment structure. The firm pays the auditor only if the report is g, and no payment is made if the report is b.

The sequence of events follows. At the beginning of period 1 the auditor posts a price P, and the firm decides whether to hire the auditor. If the auditor is hired, he decides whether to be diligent by paying cost c and acquires information about the project quality. He generates reports $s \in \{g, b\}$ depending on his choice of effort, and the report is observed by the investor and the firm. The investor decides how much to invest. The firm pays P to the auditor if and only if $s = g$. If the investor invests her entire wealth, then the true project quality is revealed at the end of period 1. The investor does not observe project quality if no investment takes place. In period 2, the firm and the investor update their belief about the auditor's type using Bayes' rule, and the same sequence of events is repeated in period 2.

In each period, an auditor who is a monopolist posts a fee $P = 1$, that is, the auditor extracts all the rent when $s = g$. Now the choice of effort not only affects expected future payoff but also affects current payoff of the auditor. In the one-shot game, the informative auditor puts effort if $c \leq (1-p)(\alpha' - \alpha) + p\beta$. Suppose $(1-p)(\alpha - \alpha') - p\beta > 0$, that is, the auditor has short-term incentive to shirk. Since there is no reputation concern in the second period, the auditor will not exert effort. In the first period, the auditor has to face a short-term loss in order to have reputation gain in the second period. Now in the second period, the expected payoff of an informative auditor who knows his own type is independent of reputation as long as the auditor is hired by the firm. Therefore, if the auditor is hired in the second period, $EP(\theta) = p(1-\beta) + (1-p)\alpha$ for $\theta \geq \overline{\theta}$. Also, there exists $\hat{\theta} \in (\overline{\theta}, 1)$ such that $\varphi_g^B(\hat{\theta}) = \overline{\theta}$. Hence, the auditor never exerts diligence in the first period for $\theta \geq \hat{\theta}$, no matter how small c is. On the other hand, as $c \to 0$, the range of reputation for which high effort can be sustained in the first period approaches unity with an upfront payment structure.

In a competitive model with two auditors, one firm and one investor, the auditor with a higher net expected payoff is hired. In case of a tie, the auditor who reports $s = g$ with a higher probability is hired by the firm. Now notice that in period 2, if the auditor with a higher reputation charges $P = 1$, the auditor with lower reputation can cut price and get hired by the firm. Thus, the price the higher reputation auditor charges in period 2 must be such that the expected net gain from hiring the auditor with higher-reputation is same as that of hiring the auditor with lower-reputation. Hence, the expected second-period payoff of the auditor with a higher reputation is the difference between the probability of him generating g and the probability that the lower reputation auditor generates g. Thus, report-contingent payments generate the same reputation incentives as upfront payments in terms of expected payoff in period 2. However, the upfront payment structure performs better than the report-contingent payment structure by not allowing the choice of effort to affect the current payoff of the auditor.

7 Conclusion

Adherents of the reputation rationale believe that market discipline, embodied by the cost associated with the loss of reputation, can provide sufficient incentives for high-quality auditing. If investors determine a given audit is of low quality, they will stop valuing the auditor's judgment, which in turn will have adverse capital market consequences for the issuer. As a result, the issuer firm will stop hiring the auditor, and the auditor will lose business. The prospect of loss of reputation deters poor performance, and, thus, liability or other *ex post* legal remedies are not necessary.

We argue that the "reputation rationale" for audit quality does not always work for large, reputable audit firms and can give rise to significant audit failure at the top level. Revision of reputation is usually sluggish for high-reputation audit firms, which not only discourages the reputable auditors from building reputation but also reduces the severity of the consequences following a reputation-loss. Nonetheless, a firm's reputation may suffer from a serious blow, and the firm may fall into a low-reputation trap following a sequence of audit failures. Thus, low quality of audits may originate from both low-reputation and high-reputation audit firms. While low-reputation auditors have little to lose by producing low quality audits, the high-reputation auditors can simply rest on their laurels and not expend effort.

Lack of competition has been a serious cause of concern for regulators. We show that reputation concerns fail to provide highly reputable audit firms incentives to exert effort even in the presence of a rival. In fact, reputation incentives are weakened by price competition, which is a typical feature of the audit market. Price competition drives down the future expected payoff of an auditor and, thus, reduces reputation incentives to expend effort. Reputation incentives are weakened further when firms have private information about their own types.

The results of this paper also apply to other certification-intermediary markets. Certification intermediaries play an important role in mitigating information risk for a buyer by acquiring information about a seller. The audit market is a typical example of a certification intermediary market. Other examples include bond-rating agencies, laboratories in markets for industrial products (such as Underwriters Laboratory), schools rating the ability of students, and investment banks and underwriters evaluating the quality of firms that seek to raise capital. Along with the audit market, the results of our model are particularly relevant to the bond-rating agencies through some common characteristics like issuer-pays payment and high market concentration.

8 Appendix

Proof of I: f the auditor is hired at $t = 2$, the firm pays him first, and then the auditor decides whether to be diligent. His decision in that period does not affect his payoff in period 2. Thus, not exerting effort in period 2 is a dominant strategy for the auditor. Now at $t = 2$, $P(\theta) = v(\theta)$, that is, the auditor extracts all the rents.

Suppose the auditor is diligent at $t = 1$. With probability p, the informative auditor meets a G firm and moves to a higher level of reputation $\theta_G = \varphi_g^G(\theta)$. With probability $(1-p)$, he meets a B firm and reports $s = b$ with probability 1. No investment takes place, and reputation is revised to $\theta_N = \varphi_b^N(\theta)$.

Therefore, the expected payoff by exerting effort in period 1 is given by

$$pv(\theta_G) + (1-p)v(\theta_N) - c.$$

Now if the auditor does not put effort in period 1, he moves to a higher level of reputation θ_G with probability $p(1-\beta)$. With probability $p\beta$ he makes a mistake and reports $s = b$, which is followed by no investment, and reputation falls to θ_N. With probability $(1-p)$, he meets a B firm and reports $s = b$ with probability $(1-\alpha)$. No investment takes place, and reputation is revised to θ_N. With probability α the auditor makes a mistake and reports $s = g$. The investor invests, and the true quality of the project is revealed. This pushes reputation down to $\theta_B = \varphi_g^B(\theta)$.

Therefore, the expected payoff by not exerting effort in period 1 is given by

$$p[(1-\beta)v(\theta_G) + \beta v(\theta_N)] + (1-p)[(1-\alpha)v(\theta_N) + \alpha v(\theta_B)].$$

The auditor will put effort in period 1 if

$$c \leq p\beta[v(\theta_G) - v(\theta_N)] + (1-p)\alpha[v(\theta_N) - v(\theta_B)] \tag{12}$$

$$= [(1-p)\alpha - p\beta][p\beta(\theta_G - \theta_N) + (1-p)\alpha(\theta_N - \theta_B)] \;\; if \; \theta_N \geq \overline{\theta}.$$

Consider the range $\theta \in [0, \overline{\theta}]$. $\varphi_b^N(\theta), \varphi_g^B(\theta) < \overline{\theta}$ for this range. Thus, $v(\theta_N) = v(\theta_B) = 0$. Also, there exists a $\theta' < \overline{\theta}$ such that $\varphi_g^G(\theta') = \overline{\theta}$.

Notice that for $c > 0$ the auditor is not diligent for $\theta \in [0, \theta')$. Also notice that with $\hat{\gamma}_1 = 1$ and $\alpha' = 0$, $\varphi_g^B(\theta) = \theta_B = 0$.

Now, as $\theta \to 1$, the right hand side of the above inequality goes to $(1-p)\alpha[(1-$

$p)\alpha - p\beta] > 0$. Also, $p\beta[v(\theta_G) - v(\theta_N)] + (1-p)\alpha[v(\theta_N) - v(\theta_B)]$ is increasing in θ for $\theta \in [\theta', 1)$

Define $\bar{c} = p\beta v(\varphi_g^G(\overline{\theta}))$. Fix $c \leq \bar{c}$. There exists $\theta'' \in [\theta', \overline{\theta}]$ such that $\gamma_1 = 1$ is optimal for the auditor for $\theta \in [\theta'', \overline{\theta}]$. This is because $v(\theta)$ is increasing.

Define, $\theta_1 = \max\{\underline{\theta}, \theta''\}$. Therefore, the auditor is hired only for $\theta \geq \theta_1$, and for $c \leq \bar{c}$, the auditor has incentive to be diligent whenever hired. This gives us the "high-effort" equilibrium. ■

Proof of T: he posterior beliefs are

$$\varphi_g^G(\theta) = \frac{\theta[\gamma(\theta) + (1-\gamma(\theta))(1-\beta)]}{\theta[\gamma(\theta) + (1-\gamma(\theta))(1-\beta)] + (1-\theta)p}, \tag{13}$$

$$\varphi_g^B(\theta) = \frac{\theta[\gamma(\theta)\alpha' + (1-\gamma(\theta))\alpha]}{\theta[\gamma(\theta)\alpha' + (1-\gamma(\theta))\alpha] + (1-\theta)p}, \tag{14}$$

$$\varphi_b^N(\theta) = \frac{\theta[p(1-\gamma(\theta))\beta + (1-p)\{\gamma(\theta)(1-\alpha') + (1-\gamma(\theta))(1-\alpha)\}]}{\theta[p(1-\gamma(\theta)\beta + (1-p)\{\gamma(\theta)(1-\alpha') + (1-\gamma(\theta))(1-\alpha)\}] + (1-\theta)(1-p)}. \tag{15}$$

Suppose the probability that the auditor exerts effort is γ.

$$\varphi_g^G(\theta) - \theta = \frac{\theta(1-\theta)[\gamma(\theta) + (1-\gamma(\theta)(1-\beta) - p]}{\theta[\gamma\theta + (1-\gamma(\theta))(1-\beta)] + (1-\theta)p} > 0, \tag{16}$$

$$\varphi_g^B(\theta) - \theta = \frac{\theta(1-\theta)[\gamma(\theta)\alpha' + (1-\gamma(\theta)\alpha - p]}{\theta[\gamma\theta + (1-\gamma(\theta))(1-\beta)] + (1-\theta)p} < 0, \tag{17}$$

$$\varphi_b^N(\theta) - \theta \tag{18}$$

$$= \frac{\theta(1-\theta)[p(1-\gamma(\theta))\beta + (1-p)\{\gamma(\theta)(1-\alpha') + (1-\gamma(\theta))(1-\alpha)\} - (1-p)]}{\theta[p(1-\gamma(\theta))\beta + (1-p)\{\gamma(\theta)(1-\alpha') + (1-\gamma(\theta))(1-\alpha)\}] + (1-\theta)(1-p)} < 0.$$

■

Proof of W: ith $\gamma = 1$,

$\varphi_g^B(\theta) = \frac{\theta\alpha'}{\theta\alpha'+(1-\theta)p}$ and $\varphi_b^N(\theta) = \frac{\theta(1-\alpha')}{\theta(1-\alpha')+(1-\theta)}$,

$$\varphi_g^B(\theta) - \varphi_b^N(\theta) = \frac{\theta(1-\theta)[\alpha'(1-p)-p]}{[\theta\alpha' + (1-\theta)p][\theta(1-\alpha')+(1-\theta)]}, \tag{19}$$

$$As\ \alpha \to 0,\ \varphi_g^B(\theta) < \varphi_b^N(\theta) \quad since,\ \alpha' < \alpha. \tag{20}$$

With $\gamma = 0$,

$\varphi_g^B(\theta) = \frac{\theta\alpha}{\theta\alpha+(1-\theta)p}$ and $\varphi_b^N(\theta) = \frac{\theta[p\beta+(1-p)(1-\alpha)]}{\theta[p\beta+(1-p)(1-\alpha)]+(1-\theta)(1-p)}$,

$$\varphi_g^B(\theta) - \varphi_b^N(\theta) = \frac{\theta(1-\theta)[\alpha - \alpha p^2 - \beta p^2 - p + p^2]}{[\theta\{p\beta + (1-p)(1-\alpha)\} + (1-\theta)(1-p)][\theta\alpha + (1-\theta)p]}, \tag{21}$$

$$\Rightarrow \text{As} \quad \alpha, \beta \to 0, \quad \varphi_g^B(\theta) < \varphi_b^N(\theta).$$

■

Proof of N: otice that $\varphi_g^G(\theta)$ is increasing in γ and $\varphi_g^B(\theta)$ is decreasing in γ, that is, revisions are milder when the believed choice of effort is zero. For notational convenience, let us denote the believed choice of effort as γ (instead of

$\hat{\gamma}$) for the rest of the proof.

Let

$\varphi_b^N(\theta)\Big|_{\gamma=0} - \varphi_b^N(\theta)\Big|_{\gamma=1} = \Delta$. Now if $p\beta > (1-p)(\alpha - \alpha')$, $\Delta > 0$.

Also, the difference between $\varphi_b^N(\theta)\Big|_{\gamma=0} - \varphi_g^B(\theta)\Big|_{\gamma=0}$ and $\varphi_b^N(\theta)\Big|_{\gamma=1} - \varphi_g^B(\theta)\Big|_{\gamma=0}$ equals Δ, which is same as the difference between $\varphi_g^G(\theta)\Big|_{\gamma=0} - \varphi_b^N(\theta)\Big|_{\gamma=1}$ and $\varphi_g^G(\theta)\Big|_{\gamma=0} - \varphi_b^N(\theta)\Big|_{\gamma=0}$.

Since $p\beta > (1-p)(\alpha - \alpha')$,

$$p\beta(\varphi_g^G(\theta) - \varphi_b^N(\theta)) + (1-p)(\alpha - \alpha')(\varphi_b^N(\theta) - \varphi_g^B(\theta))\Big|_{\gamma=1} \tag{22}$$

$$> p\beta(\varphi_g^G(\theta) - \varphi_b^N(\theta)) + (1-p)(\alpha - \alpha')(\varphi_b^N(\theta) - \varphi_g^B(\theta)\Big|_{\gamma=0}.$$

Similarly, when $p\beta < (1-p)(\alpha - \alpha')$, $\triangle < 0$.

Also, the difference between $\varphi_b^N(\theta)\Big|_{\gamma=0} - \varphi_g^B(\theta)\Big|_{\gamma=0}$ and $\varphi_b^N(\theta)\Big|_{\gamma=1} - \varphi_g^B(\theta)\Big|_{\gamma=0}$ equals Δ, which is same as the difference between $\varphi_g^G(\theta)\Big|_{\gamma=0} - \varphi_b^N(\theta)\Big|_{\gamma=1}$ and $\varphi_g^G(\theta)\Big|_{\gamma=0} - \varphi_b^N(\theta)\Big|_{\gamma=0}$.

Since $p\beta < (1-p)(\alpha - \alpha')$,

$$p\beta(\varphi_g^G(\theta) - \varphi_b^N(\theta)) + (1-p)(\alpha - \alpha')(\varphi_b^N(\theta) - \varphi_g^B(\theta))\Big|_{\gamma=1} \tag{23}$$

$$> p\beta(\varphi_g^G(\theta) - \varphi_b^N(\theta)) + (1-p)(\alpha - \alpha')(\varphi_b^N(\theta) - \varphi_g^B(\theta)\Big|_{\gamma=0}.$$

■

Proof of I: f the auditor is hired at $t = 2$, the firm pays him upfront, and the auditor decides whether to be diligent. His decision in that period does not affect his payoff in period 2. Thus, not expending effort in period 2 is a dominant strategy for the auditor. Since the auditor posts the fee, he can extract all the rent. Thus, the auditor posts a fee equal to the firm's maximum willingness to pay. Hence,

$$P(\theta) = \theta[p(1-\beta) + (1-p)\alpha] + (1-\theta)p = v(\theta).$$

Suppose the auditor exerts diligence at $t = 1$. With probability p the informative auditor meets a firm with a good project, issues the report $s = g$, and moves to a higher level of reputation, say to $\theta_G = \varphi_g^G(\theta)$. With probability $(1-p)$ he meets a firm with a bad project and reports $s = b$ with probability $(1-\alpha')$. No investment takes place and reputation is revised to $\theta_N = \varphi_b^N(\theta)$. With probability α' the auditor makes a mistake and reports $s = g$. The investor invests, and the true quality of the project is revealed. This pushes reputation down to $\theta_B = \varphi_g^B(\theta)$.

Therefore, the expected payoff by exerting effort in period 1 is given by,

$$pv(\theta_G) + (1-p)[\alpha' v(\theta_B) + (1-\alpha')v(\theta_N)] - c.$$

Now if the auditor does not put effort in period 1, he moves to a higher level of reputation θ_G with probability $p(1-\beta)$. With probability $p\beta$, he makes a mistake and reports $s = b$, which is followed by no investment and reputation falls to θ_N. With probability $(1-p)$, he meets a B firm and reports $s = b$ with probability $(1-\alpha)$. No investment takes place and reputation is revised to θ_N. With probability α the auditor makes a mistake and reports $s = g$. The investor invests, and the true expected cash flow is revealed. This pushes reputation down to θ_B.

Therefore, the expected payoff by not exerting effort in period 1 is given by,

$$p[(1-\beta)v(\theta_G) + \beta v(\theta_N)] + (1-p)[\alpha v(\theta_B) + (1-\alpha)v(\theta_N)].$$

The auditor will put effort in period 1 if,

$$c \leq p\beta[v(\theta_G) - v(\theta_N)] + (1-p)(\alpha - \alpha')[v(\theta_N) - v(\theta_B)]. \tag{24}$$

The right hand side equals

$$[(1-p)\alpha - p\beta][p\beta(\theta_G - \theta_N) + (1-p)(\alpha - \alpha')(\theta_N - \theta_B)] \;\; if \; \theta_B \geq \overline{\theta}.$$

Now from Lemma 1,

$\varphi_g^G(\theta) > \theta$ and

$\varphi_b^N(\theta), \varphi_g^B(\theta) < \theta$.

Consider the range $\theta \in [0, \overline{\theta}]$. $\varphi_b^N(\theta), \varphi_g^B(\theta) < \overline{\theta}$ for this range. Thus $v(\theta_N) = v(\theta_B) = 0$.

Also, there exists a $\theta' < \overline{\theta}$ such that with $\hat{\gamma}_1 = 1$, $\varphi_g^G(\theta') = \overline{\theta}$.

Notice that, for $c > 0$ the auditor never puts effort for $\theta \in [0, \theta')$.

Now, as $\theta \to 1$, $\varphi_g^G(\theta)$,

$\varphi_b^N(\theta), \varphi_g^B(\theta) \to 1$,which implies that the right hand side of inequality (4) goes to zero. Thus, there exists a $\theta^* < 1$ such that for all $\theta > \theta^*$ the right hand side of inequality (4) is decreasing in θ.

Define

$$\overline{c} = \min_{\theta \in [\overline{\theta}, \theta^*]} [p\beta[v(\varphi_g^G(\theta)) - v(\varphi_b^N(\theta))] + (1-p)(\alpha - \alpha')[v(\varphi_b^N(\theta)) - v(\varphi_g^B(\theta))]].$$

Fix $c \leq \overline{c}$. There exists $\theta'' \in [\theta', \overline{\theta}]$ such that $\gamma_1 = 1$ is optimal for the auditor for $\theta \in [\theta'', \overline{\theta}]$. This is because $v(\theta)$ is increasing.

Define $\theta_1 = \max\{\underline{\theta}, \theta''\}$. Now, with $\hat{\gamma}_1 = 1$, there exists a threshold $\hat{\theta} > \overline{\theta}$, beyond which putting effort is not optimal for the auditor. Beyond this threshold c is strictly greater than $p\beta[v(\theta_G) - v(\theta_N)] + (1-p)(\alpha - \alpha')[v(\theta_N) - v(\theta_B)]$.

Also, with $\hat{\gamma}_1 = 0$ there exists another threshold $\widetilde{\theta}$ such that the auditor has no incentive to be diligent if $\theta > \widetilde{\theta}$.

From Lemma 3, we know that, given θ, $p\beta(\varphi_g^G(\theta) - \varphi_b^N(\theta)) + (1-p)(\alpha - \alpha')(\varphi_b^N(\theta) - \varphi_g^B(\theta))$ is increasing in γ. Thus $\widetilde{\theta} < \hat{\theta}$.

θ_2 can take any value between $\widetilde{\theta}$ and $\hat{\theta}$, and the threshold equilibrium holds.

Therefore, there exists a continuum of thresholds $\theta_2 \in [\widetilde{\theta}, \hat{\theta}]$ such that the strategy described in Proposition 2 is an equilibrium. ■

Proof of I: f the auditor is hired at $t = 2$, the firm pays him first, and then the auditor decides whether to be diligent. His decision in that period does not affect his payoff in period 2. Thus, not expending effort in period 2 is a dominant strategy for the auditor.

Now $P(\theta) = \max\{0, v(\theta) - v(\theta')\}$, that is, the hired auditor can post a positive fee only if his reputation is higher than his rival's reputation. If the auditor with reputation θ posts any price above $P(\theta)$, his rival can cut price and get hired by the firm.

Suppose the auditor exerts due diligence at $t = 1$.

The expected payoff by exerting effort in period 1 is given by,

$$pP(\theta_G) + (1-p)[\alpha' P(\theta_B) + (1-\alpha')P(\theta_N)] - c.$$

If the auditor does not expend effort in period 1, his expected payoff in period 1 is given by,

$$p[(1-\beta)P(\theta_G) + \beta P(\theta_N)] + (1-p)[\alpha P(\theta_B) + (1-\alpha)P(\theta_N)].$$

The auditor will exert effort in period 1 if,

$$c \leq p\beta[P(\theta_G) - P(\theta_N)] + (1-p)(\alpha - \alpha')[P(\theta_N) - P(\theta_B)]. \tag{25}$$

Since, from Lemma 1, we know that, $\varphi_g^G(\theta) > \theta$ and

$\varphi_b^N(\theta), \varphi_g^B(\theta) < \theta$, $P(\theta_N) = P(\theta_B) = 0$ and

$$p\beta[P(\theta_G) - P(\theta_N)] + (1-p)(\alpha - \alpha')[P(\theta_N) - P(\theta_B)] = p\beta[v(\theta_G) - v(\theta)]. \tag{26}$$

Now,

$$p\beta[v(\theta_G) - v(\theta)] = p\beta(\theta_G - \theta)[(1-p)\alpha - p\beta] \;\; if \; \theta \geq \overline{\theta}.$$

Consider the range $\theta \in [0, \overline{\theta}]$. $\varphi_b^N(\theta), \varphi_g^B(\theta) < \overline{\theta}$ for this range. There exists a $\breve{\theta} < \overline{\theta}$ such that $\varphi_g^G(\breve{\theta}) = \overline{\theta}$. Notice that there does not exist $c > 0$ such that the auditor exerts effort for $\theta \in [0, \breve{\theta})$.

Also, as $\theta \to 1$, $\varphi_g^G(\theta) \to 1$, which implies that the right hand side of the above inequality goes to zero. Thus, there exists a $\theta^{**} < 1$ such that for all $\theta > \theta^{**}$ right hand side of inequality (6) is decreasing in θ.

Define $\overline{c} = \min_{\theta \in [\overline{\theta}, \theta^{**}]}[p\beta[v(\varphi_g^G(\theta)) - v(\theta)]]$. Fix $c \leq \overline{c}$. There exists $\theta'' \in [\breve{\theta}, \overline{\theta}]$ such that $\gamma_1 = 1$ is optimal for the auditor for $\theta \in [\theta'', \overline{\theta}]$. This is because $v(\theta)$ is increasing.

Define $\theta_1 = \max\{\underline{\theta}, \theta''\}$. Now, there exists a threshold $\hat{\theta} > \overline{\theta}$, above which putting effort is not optimal for the auditor when $\hat{\gamma}_1 = 1$.

Also, if the investor believes that the informative auditor does not put effort, then there exists another threshold $\widetilde{\theta}$ such that the auditor has no incentive to be diligent if $\theta > \widetilde{\theta}$.

From Lemma 3, we know that, given θ, $\varphi_g^G(\theta)$ is increasing in γ. Thus $\widetilde{\theta} < \hat{\theta}$.

θ_2 can take any value between $\widetilde{\theta}$ and $\hat{\theta}$, and the threshold equilibrium holds.

Therefore, there exists a continuum of thresholds $\theta_2 \in [\widetilde{\theta}, \hat{\theta}]$ such that the strategy described in Proposition 3 is an equilibrium. ■

Proof of D: efine

$$c^M = \min_{\theta\in[\overline{\theta},\theta^*]} [p\beta[v(\varphi_g^G(\theta)) - v(\varphi_b^N(\theta))] + (1-p)(\alpha-\alpha')[v(\varphi_b^N(\theta)) - v(\varphi_g^B(\theta))]]$$

and

$$c^D = \min_{\theta\in[\overline{\theta},\theta^{**}]} [p\beta[v(\varphi_g^G(\theta)) - v(\theta)]],$$

where θ^* and θ^{**} are defined in the proofs of Proposition 2 and Proposition 3, respectively. Now define $\overline{\overline{c}} = \min\{c^M, c^D\}$. For fixed c, define θ_M^2 and θ_D^2 as the maximum values of reputation at which $\gamma_1 = 1$ holds in equilibrium under monopoly and competitive model, respectively. In other words, for $\theta > \theta_M^2(\theta_D^2)$, $\gamma_1 = 1$ never holds in equilibrium under monopoly(competitive model).

Suppose $c \leq \overline{\overline{c}}$. Then $\theta_M^2 > \theta_D^2$. Define, θ' such that $\varphi_g^G(\theta') = \overline{\theta}$. Under monopoly, the auditor is diligent at θ' if $c \leq p\beta v(\overline{\theta})$. Under competitive model, the auditor is diligent at θ' if $c \leq p\beta P(\overline{\theta})$. Also,

P$(\overline{\theta}) = v(\overline{\theta})$. Define, $\theta_1 = \max\{\underline{\theta}, \theta'\}$ as before. Thus, if

c$\leq p\beta v(\overline{\theta})$ the auditor will be diligent for $[\theta_1, \overline{\theta}]$.

Now, consider the range $\theta \in [\overline{\theta}, 1]$ and suppose that the auditor is diligent. Define θ^N such that

$\varphi_b^N(\theta^N) = \overline{\theta}$. Fix θ. From Proposition 3, we know that,

$$p\beta[P(\theta_G) - P(\theta_N)] + (1-p)(\alpha-\alpha')[P(\theta_N) - P(\theta_B)] = p\beta(\theta_G - \theta)[(1-p)\alpha - p\beta]. \quad (27)$$

From Proposition 2, we know

$$\begin{aligned} & p\beta[v(\theta_G) - v(\theta_N)] + (1-p)(\alpha-\alpha')[v(\theta_N) - v(\theta_B)] \\ &= [(1-p)\alpha - p\beta][p\beta(\theta_G - \theta_N) + (1-p)(\alpha-\alpha')(\theta_N - \theta_B)], \end{aligned} \quad (28)$$

where $\theta_G = \varphi_g^G(\theta)$, $\theta_N = \varphi_b^N(\theta)$ and $\theta_B = \varphi_g^B(\theta)$.

Now, $\varphi_b^N(\theta) < \theta$ and

with

$\gamma_1 = 1$,

$$\varphi_g^B(\theta) = \frac{\theta\alpha'}{\theta\alpha' + (1-\theta)p} \text{and} \varphi_b^N(\theta) = \frac{\theta(1-\alpha')}{\theta(1-\alpha') + (1-\theta)}.$$

From Lemma 2, we know that $\varphi_g^B(\theta) < \varphi_b^N(\theta)$.

Thus, the right hand side of equation (9) is equal to the right hand side of equation (10) for the range $\theta \in [\overline{\theta}, \theta^N)$ and is strictly greater for the range $[\theta^N, 1)$.

Therefore, the maximum range for which $\gamma_1 = 1$ can be sustained in equilibrium is larger under monopoly. ■

Proof of I: f the auditor is hired at $t = 2$, the firm pays him first, and then the auditor decides whether to be diligent. Thus, not putting effort in period 2 is a dominant strategy for the auditor.

Now, consider the range $\theta \in [\overline{\theta}$,11].].

The auditor faces his rival and

$$P(\theta) = \max\{0, P_L(\theta') - P_L(\theta)\} = \max\{0, (\theta' - \theta)[\rho'(1-\beta) + (1-\rho')\alpha - p]\}.$$

The hired auditor can post a positive fee only if his reputation is lower than his rival's reputation.

Suppose the auditor exerts due diligence at $t = 1$.

The expected payoff by exerting effort in period 1 is given by,

$$pP(\theta_G) + (1-p)[\alpha' P(\theta_B) + (1-\alpha')P(\theta_N)] - c,$$

where $\theta_G = \varphi_g^G(\theta)$, $\theta_N = \varphi_b^N(\theta)$ and $\theta_B = \varphi_g^B(\theta)$.

If the auditor does not put effort in period 1, his expected payoff is given by,

$$p[(1-\beta)P(\theta_G) + \beta P(\theta_N)] + (1-p)[\alpha P(\theta_B) + (1-\alpha)P(\theta_N)].$$

The auditor expends effort in period 1 if,

$$c \leq p\beta[P(\theta_G) - P(\theta_N)] + (1-p)(\alpha - \alpha')[P(\theta_N) - P(\theta_B)]. \tag{29}$$

Now, define, $\hat{\theta}$ such that $\varphi_g^G(\hat{\theta}) = \overline{\theta}$, and consider $\theta \in [\hat{\theta}, \overline{\theta})$. Since $\varphi_g^B(\theta) < \varphi_b^N(\theta) < \theta$,$P(\theta_N) = P(\theta_B) = 0$.

Notice that the rival's reputation $\theta' = \overline{\theta}$.

Now, $\varphi_g^G(\theta) > \theta$ and therefore, $P(\theta_G) < 0$, which makes the right hand side of equation (9) zero. Therefore, for any $c > 0$, $\gamma_1 = 1$ cannot be sustained in equilibrium for $\theta \in [\hat{\theta}, \overline{\theta})$.

Now consider the range $\theta \in [0, \overline{\theta}]$. $\varphi_b^N(\theta), \varphi_g^B(\theta) < \overline{\theta}$ for this range.

Now consider the range $\theta \in [\overline{\theta}, 1]$. The rival's reputation is also θ.

Since $\varphi_g^B(\theta) < \varphi_b^N(\theta) < \theta$, $[P(\theta_N) - P(\theta_B)] \leq 0$. Also, $\varphi_g^G(\theta) > \theta$, which means $[P(\theta_G) - P(\theta_N)] = 0$.

Therefore, there does not exist $c > 0$ such that $\gamma_1 = 1$ can be sustained in equilibrium, and $\gamma_1 = 0$ is the optimal action for the auditor. ■

References

[1] Bandyopadhyay, S., R. Jha, and K. Sen, Consequences of auditor reputation loss: Market reaction, audit fees, auditor change and audit quality in the case of Satyam Ltd. and PriceWaterhouseCoopers India.

[2] Bouvard, M., and R. Levy. 2013. Two-sided reputation in certification markets. *Working Paper.*

[3] Chaney, P. K., and K. L. Philipich. 2002. Shredded reputation: The cost of audit failure. *Journal of Accounting Research* 40: 1221- 1245.

[4] Corona, C., and R.S. Randhawa. 2010. The auditor's slippery slope: An analysis of reputational incentives. *Management Science* 56(6): 924-937.

[5] Datar, S., and M. Alles. 1999. The formation and role of reputation and litigation in the auditor-manager relationship. *Journal of Accounting, Auditing, Finance* 14(4): 401- 428.

[6] Deangelo, L.E. 1981. Auditor Size and Audit Quality. *Journal of Accounting and Economics* 3: 183-200.

[7] Defond, M., and J. Zhang. 2014. A review of archival auditing research. *Journal of Accounting and Economics* 58: 275-326.

[8] Dye, R.A., B.V. Balachandran, and R.P. Magee. 1990. Contingent fees for audit firms. *Journal of Accounting Research* 28(2): 239-266.

[9] Dye, R.A. 1993. Auditing standards, legal liability, and auditor wealth. *Journal of Political Economy* 101(5): 887-914.

[10] Frenkel, S. 2015. Repeated interaction and rating inflation: A model of double reputation. *American Economic Journal: Microeconomics* 7(1): 250-80.

[11] Horner, J. 2002. Reputation and competition. *The American Economic Review* 92(3): 644-663.

[12] Mailath, G., and L. Samuelson. 2001. Who wants a good reputation? *Review of Economic Studies* 68(2): 415-441.

[13] Mathis, J.,J. Mcandrews, and J. Rochet. 2009 Rating the Raters: Are Reputation Concerns Powerful enough to Discipline Rating Agencies? *Journal of Monetary Economics*, 56(5): 657-674.

[14] Narayanan, V. 1994. An analysis of auditor liability rules. *Journal of Accounting Research* 32: 39-59.

[15] Skinner, D.J. and S. Srinivasan. 2012. Audit quality and auditor reputation: Evidence from Japan. *The Accounting Review* 87(5): 1737- 1765.

[16] Weber, J., M. Willenborg, and J. Zhang. 2008. Does auditor reputation matter? The case of KPMG Germany and ComROAD AG. *Journal of Accounting Research* 46: 941- 972.