The Economics of Auditor Capture: Implications for Empirical Research

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Abstract

The empirical literature has found mixed results when measuring the effects of economic bonding on reporting quality, though high-profile auditing scandals repeatedly call into question the conclusion that economic capture is not a significant problem. Furthermore, behavioral research has demonstrated that auditors are at risk of capture via common psychological mechanisms. To help evaluate the conflicting evidence, this paper models the strategic interactions between a rational auditor and manager. The model explicitly defines the conditions under which the auditor retains her independence and under which the two will collude. The results derived in the model provide insights that help address these puzzles. First, the model demonstrates that the use of revenues as a proxy for financial gain is problematic. Second, in a repeated play context, there does not need to be an explicit exchange of bribes to sustain a collusive equilibrium, suggesting that social norms and psychological biases could be reinforcing rational action and allowing profitable collusion to occur with little conscious intent. Furthermore, it shows that high quality audits and high reputation firms are distinct constructs with empirical implications.

Keywords: Auditing independence, collusion, game theory, capture

JEL: D82, D86, L14, M42

Accounting is the language of economic communication. It is a necessary vehicle for contracts, compensation, regulatory compliance, and corporate strategy (Bushman & Smith, 2001). Auditors help ensure that this form of communication is true, coherent and communicative (Watts & Zimmerman, 1983). When accounting information is true and coherent, it becomes easier—and less costly—to make sound investment decisions, incentivize intelligent decisions and hard work, and to understand the competitive landscape.

High quality financial reporting has been linked to economic growth and increased productivity (De Nicolò et al., 2008), lower volatility in labor and factor markets (Kedia & Philippon, 2009), as well as lower costs of capital (e.g. Bhattacharya et al., 2003; Biddle et al., 2009; J. Francis et al., 2008; Easley & O'Hara, 2004). Given the importance of high quality financial reporting to the integrity of the financial system, the persistent occurrence of auditing failures—even in high quality regimes such as the U.S.—are a cause of considerable policy concern.

Like any natural language, accounting can never be exact, and yet it is important to ensure that the information contained in financial statements is as relevant and reliable as possible, given the constraints inherent in the reporting process. As a consequence, it is natural to ask whether some of these audit failures are due in part to auditor capture by the management they are supposed to be monitoring? Though auditor independence and audit quality are of critical importance to the value of an audit, answering these questions has proven surprisingly challenging, both for academic investigators and for the market, despite the clear economic benefits of ensuring a well-functioning system.

For example, Romano (2005) catalogues 25 empirical studies on the literature on the connection between non-audit services (thought to be the primary vehicle for rational capture) and audit quality. Of these, 15 find no statistically significant relationship, three find that non-audit services improve audit quality, six find that non-audit services are associated with lower quality audits, and one finds a negative relationship only with non-Big Five firms. Romano herself takes this as evidence that non-audit services are not a problem and therefore should not be regulated. This has generally also been the conclusion of the accounting literature (e.g. J. R. Francis, 2006; Schneider et al., 2006), though there remains worry about the *appearance* of a loss of independence even as the evidence is presumed to settle the question about the *fact* of independence. Given the high political and public policy stakes surrounding regulation of auditors and financial reporting, however, it is appropriate to consider the alternate hypotheses that might lead to the inconclusive results of the empirical studies as they have been conducted to date.

This paper proposes a game theoretic model that considers the conditions under which a rational auditor chooses to either conduct a rigorous, independent audit or collude with the manager in misrepresenting the economic condition of his company. The model is designed to provide analytical support to the interpretation of existing empirical work and to the design of future studies.

The modeling considers the issue in three stages. The first looks at a one-shot game where, if collusion occurs, collusion is explicit and entered into on on purely rational grounds, in the spirit of Gary Becker's model of the economics of crime (Becker, 1968). The Becker framework provides an explanation of the origins of rationally-driven choices for either socially desirable or deviant behavior, which allows us to consider the components necessary for retaining independence or succumbing to inducements to collude. As a result of the single-shot game, it becomes evident that the value to an auditor of revenue from engagements with different equilibria will not be equivalent: the profit margin of a collusive relationship, prior to the consideration of the added engagement risk, will be higher than that of a non-collusive relationship. Therefore, revenue is not necessarily a good proxy for inducements to collude, particularly when firms have heterogeneous clients and therefore heterogeneous costs.

The next stage of the model extends the one-shot game into a repeated-play game of indefinite duration. This better reflects the nature of real auditor-manager relationships and introduces an interesting wrinkle to the model when considering the capture equilibrium. The repeated play game results provide a scenario where there need not be moment of explicit collusion, and therefore much of the heavy lifting of maintaining a profitable and collusive relationship with a client can be done by the types of "moral seduction" processes described in Moore et al. (2006). This work, in considering a rational basis for capture, should be seen as complementary to work that examines the psychological bases for auditor capture (Moore et al., 2006; Bazerman & Tenbrunsel, 2011; Prentice, 2000). Pairing the economic and psychological dynamics at play this way offer a plausible path to the capture of a professional. Furthermore, this dynamic, if it exists, will be particularly difficult to see in the data. I prove that the standard empirical approach that uses revenues to proxy for the likelihood of financial capture will generally find null or close to null results regardless of the existence or prevalence of financial capture.

The third stage of the modeling exercise recognizes that each audit firm has many clients, and that firms are known to manage their portfolios of clients carefully. Because their clients are heterogeneous, we need to consider that an audit firm might not choose to perform audits of equal intensity in all situations. Indeed, the same firm, if it operates rationally, might be in a different independence equilibrium with different clients. Furthermore, the model helps to clarify that the market cannot observe the contribution of the audit firm to an individual company's reporting quality. Instead, the market observes the performance of the auditing firm's portfolio of clients. This portfolio performance suggests a natural way to operationalize an audit firm's *reputation*, a construct distinct from audit quality. As the results of the model will make clear, reputation is observable, whereas individual engagement quality is not, and, as a consequence, reputation is more likely the attribute that firms differentiate on. The implications of this suggest that using reputation on its own as a proxy for quality is problematic—either by the market or by empirical researchers—since the two can diverge.

The rest of the paper is presented as follows: section 1 places this model into the context of the relevant accounting and economic literatures, section 2 presents the model, and section 3 discusses the implications of the model's results. Section 4 concludes.

1 Background

For a high-quality audit to occur, the auditor must both have a high probability[1] of discovering a breach and then, if such a breach is discovered, cause the breach to be remedied (DeAngelo, 1981). There are two, widely-recognized avenues by which auditors be incentivized to conduct a high quality audit, both of which are generally characterized as "sticks" rather than "carrots:" reputation concerns and liability risk.

The value of reputation is a market-based driver of auditor incentives to audit effectively. DeAngelo (1981) argues that the "client-specific quasi-rents" earned through a high reputation provide sufficient incentives for (at least) large firms to remain independent and to conduct high quality audits. Datar & Alles (1999) formalize this notion in a model of auditor shirking. For reputation to be a sufficient motivator, the cost to an audit firm's reputation of an audit failure must be greater than any compensation the manager can provide. Both models cited assume that reputational costs from a failure are high, assuming that once an auditor has been found to be low quality in one engagement, her audits will be discounted for all clients

[1] What constitutes a "high probability" depends on the cost and value of discovering a particular breach, and leads as well to a consideration of materiality.

going forward.

Historical experience suggests, however, that we should relax this assumption and explore the consequences of the reputational costs of an audit failure taking a range of possible values. As has been well-documented elsewhere in the literature, there have been frequent instances of high reputation firms caught in high profile audit failures—from the accounting scandals of the first years of the century (Jackson, 2006) to the failures relating to the bankruptcy of Lehman Brothers, the collapse of Bear Sterns, and of subprime lenders, such as New Century (Sikka, 2009)—where public information about the case suggests that it was not merely a consequence of bad luck and instead the facts call into question the competence or independence of the audit firm involved. While Arthur Andersen did collapse as a consequence of its failure with Enron, that may be due more to the specific problem of facing a criminal indictment (Jensen, 2006). Instead, the hits a firm takes to its reputation in the case of an audit failure may have financial consequences that are much more manageable. Partnoy (2006, 1999) argues in the case of credit ratings agencies—audit firms face a very similar circumstance—that when the certifying intermediary (i.e. credit rater or auditor) has a regulatory license, the consequence of reputational debasement are much reduced. Since an audit is necessary for equity issues to the capital markets, all companies wishing to issue equity will hire an auditor, even if there is no auditor available with the desired reputational signaling value. The highly restricted choice of auditors for large companies further diminishes the strength of any reputation costs (Nelson et al., 2008).

Legal liability is the main policy lever used to increase incentives for high quality audits beyond those provided by reputation. The role of legal liability in constraining auditor behavior has been explored in Dye (1993). Specifically, he predicts large firms will conduct a higher quality audit because they have exposure to greater liability, due to their "deep pockets", if there is an audit failure and therefore they have greater incentives to prevent such a failure. As with the reputation arguments, we need to be careful in assuming that legal liability is not a manageable cost, even for a firm that takes risks with some of its clients. While there is certainly the risk of a "tail event" (Talley, 2006) that could bring down a firm, the expected costs of litigation for an audit firm appear to be much more manageable (Cousins et al., 1999).

With these two supports of a high quality audit offering a less robust defense against loss of independence than sometimes assumed, we need to examine more closely the mechanics of how a manager might induce an auditor to collude in order to understand how such inducements might compete with more modest penalties. To do this, the economics literature does offer a *collusion-* or *coalition-proof concept* in more generic contexts, (see, for example, Tirole, 1986; Olsen & Torsvik, 1998; Laffont & Tirole, 1991). The requirements for successful prevention of collusion derived here are similar in their conceptual approach but are tailored to the institutional details of financial audits, since the existing models are structured in such a way as to offer little guidance in the specific context of financial statement audits. These models assume that the output of the agent is costlessly observable by all parties and that the asymmetric information lies in the agent's productivity factor and effort levels. However, in public companies, the challenge is to keep management that presides over a poor outcome from posing as one presiding over a good outcome, an inversion of the problem that concerns most of the principal-supervisor-agent literature.

Lu (2006) presents a model that is very close in spirit to the one presented here, albeit with a very different focus and some different assumptions. His model connects the present value of future cash flows from audit and non-audit fees with auditors' decisions to be either conservative or aggressive in the face of ambiguity in their audit evidence. The value of these future fees are viewed as compensation for the liability the auditor faces if she approves a good report in the absence of definitive evidence and it turns out that she is wrong. While my model is not concerned with ambiguous evidence—I assume the auditor approves the unaudited statements unless she discovers verifiable evidence that the statements are misreporting the company's position—I add some additional nuances to Lu's framework by investigating the incentive effect on the manager of the equilibrium relationship and considering the extent to which the manager recognizes the costs of the future fees in his budget constraint.

The main divergence of our models is in our treatment of the market. Lu dismisses the possibility of the client providing fees so large that the auditor will approve a good report regardless of definitive evidence because he assumes that the market has sufficient understanding of the parameter values in the model to recognize that the auditor's report is meaningless.[2] I do not make this assumption. While assuming full rationality and knowledge of the market is an appropriate simplifying assumption in many cases, for the purposes of supporting empirical models investigating the loss of auditor independence—the purpose of this paper—assuming away the possibility of a problem does the field no favors. I remain agnostic as to whether the market would react incompletely to the implications of a contract because of inefficiency or

[2]Similarly, Lee & Gu (1998) consider the possibility of a bribe exceeding the costs of the discovery of collusion in their consideration of lowballing the initial audit fee. Their model and conclusions otherwise differ significantly from this paper because they assume that shareholders have more power over auditor tenure than does management. This seems overly optimistic, though is ultimately an empirical question. Regardless of whether Lee and Gu's assumptions or mine are a more accurate reflection of real engagements, the central observation of this paper that revenues are not a valid proxy for profits in investigating these questions holds true. The difference between our papers is the predicted direction of effect of profits on auditor decisions.

simply as the result of a semi-strong form of efficiency (Jensen, 2005). As a consequence, I treat the market as a non-strategic force in the model. If, in reality, the market *is* aware of the parameters and behaving rationally, some of the equilibria discussed here will not appear in practice. The purpose of the paper here is to provide a fleshed-out theoretical model to support future empirical research on this and related questions.

To do this, I make four additional important choices that affect the incentives of a financial statement auditor in ways that have not been fully explored before. These choices are made to reflect institutional details observed in many auditor-client relationships:

- Contracts—including ex post penalties—need to be resolved in a finite time horizon. As a consequence, the true outcome of the managements' efforts is not consistently observable within the relevant time frame.

- Auditors recognize a strict commitment to client confidentiality. As a consequence, the contents of the unaudited, preliminary statements are not disclosed by the auditors to anyone, including the board, when changes are made to the auditor's satisfaction.[3] This means that auditors' successes remain invisible. It also implies that when an honest auditor discovers a misstatement, the manager does not suffer penalties beyond the requirement to tell the truth. This allowance for "face saving" means that the auditor does not contribute to a revelation mechanism that would induce truth-telling from the manager (as will be proven below).

- All or almost all audit failures end in out-of-court settlements that come with non-disclosure agreements, so there is little opportunity for the market to determine the level of the auditor's fault: whether the failure was due to bad luck despite a competent audit, negligence, or collusion.

- In the event of successful auditor capture, corporate resources are used to compensate the auditor for the risks associated with capture. As a consequence, the manager does not personally recognize the full cost of the side-payment made to induce capture.

[3]The recent AU 380 standard pushes against this long-standing approach. The official obligation of the auditor is now:

> The auditor should discuss with the audit committee any disagreements with management, whether or not satisfactorily resolved, about matters that individually or in the aggregate could be significant to the entity's financial statements or the auditor's report. For purposes of this section, disagreements do not include differences of opinion based on incomplete facts or preliminary information that are later resolved. (Public Company Accounting Oversight Board, 2003, §13, footnotes removed)

Nominally, the auditor should therefore reveal major changes made to the unaudited financial statements to the audit committee of the Board. However, the second sentence of the above quote creates a loophole that appears to be broadly taken advantage of by auditors and their clients. It also renders the standard unenforceable.

When these institutional realities are taken into consideration, the model helps resolve the contradictory predictions and assessment of the problem among economic and psychological theory and empirical accounting research.

2 Formal model of auditor-manager strategic interactions

The game presented here analyzes the interactions of a manager and an auditor following the acceptance by the players of a contract offered by a representative of the shareholder. The relevant details of this contract are therefore treated as exogenous parameters throughout the model. Since the purpose of the model in this paper is to assist in interpreting empirical results, I do not assume that the contract offered is optimal. Since the financial statement audit is a highly regulated product, and because the audit committee of the board may also be beset with its own agency problems, the existence of some sub-optimal contracts seems plausible.

The manager's and auditor's decision processes are modeled as a noncooperative game. Initially, I assume a single-shot game to build intuition and then extend the basic analysis to a repeated-play situation. The single-shot game requires a fairly cartoonish interaction between manager and auditor when collusion is the dominant equilibrium—once the infinite time-horizon of a repeated-play game is introduced, we can see how the venal interaction required to pull of collusion in one shot resolves into a potentially much more nuanced interaction that nevertheless has the same roots. The game includes three actors: the manager, the auditor, and the market, where the manager and the auditor are the ones making active decisions and behaving strategically. Throughout the analysis, I assume that all players are risk neutral and profit maximizing. The manager and the auditor play with perfect recall.

The game is played out sequentially over time. At the start of the game, the manager chooses a costly effort investment that results in a probability that the company's outcome in the period is good. (The company can have one of two outcomes: good or bad.) After that effort has been expended, the true state of the company is revealed privately to the manager. The manager then assembles financial statements that may or may not accurately reflect the true state of the company.

Once the manager has compiled his unaudited statements, the auditor conducts an audit of those statements. In the planning for the audit, the auditor chooses an audit intensity, which is defined here as the probability that she will uncover a misstatement, conditional on its existence. After the audit is completed, the financial statements are released to the market and the manager and auditor are paid. After time passes, subsequent events or new public information is used to update the market's assessment of the validity of the financial statements. The market may or may not ever discover deliberate misinformation, if it exists.

A subset of the possible decisions and events could lead to additional actions by the auditor and the manager. If the true outcome of the company in that period is bad and management decides to try to conceal that fact by issuing misleading financial statements, the auditor could find a misstatement if her audit intensity is greater than zero. If the auditor does find the misstatement, the manager must decide whether or not to offer a bribe, and of what size. Then the auditor decides whether or not to accept it. If the bribe is refused, the auditor forces a truthful statement.[4]

Extensive form of game and model parameters

The extensive form of the game is illustrated in Figure 1, and variable definitions are collected in Table 1. At the start of the game, the manager exerts effort to set the probability, μ, that the outcome is good. The outcome is bad with a probability of $(1-\mu)$. The production function for μ is common knowledge, though the manager's choice of a particular μ is unobservable. After the manager has invested in a particular μ at a cost of $C^M(\mu)$, where $C^M_\mu > 0$, $C^M_{\mu\mu} > 0$, and $\lim_{\mu \to 1} C^M(\mu) = \infty$, the manager learns of the actual outcome of the company in that period. I assume here that management has perfect information about the true outcome of the company and that information is private and attained costlessly. Management then has to decide whether or not to tell the truth about the outcome of the company in the financial statements. If the company's true outcome is good, the choice is a trivial one and management tells the truth. The audit confirms management's statements, regardless of audit's intensity,[5] and the manager receives a payoff of $W^H - C^M(\mu)$.

The auditor's payoff is her fee less the cost of the audit production: $F - C^A(\lambda)$. The cost of the audit is a function of the audit intensity, λ. The fee cannot be contracted as a function of λ because λ is

[4] The set of potential outcomes is simplified somewhat from real auditor-manager outcomes. In real life, the manager could refuse to correct a lie and the auditor could issue an unclean opinion; or, if the auditor refuses a bribe, either the manager could fire the auditor or the auditor could choose to resign. In order for any of these outcomes to be non-trivially different to rational actors from the auditor forcing truth-telling, the model would need to be expanded significantly to be internally consistent, similar to the approach taken by Acemoglu & Gietzmann (1997). As none of these outcomes are of particular interest to informing the issues discussed here, I have chosen the parsimonious modeling route.

[5] Following Tirole (1986), I assume there are no false positives that do not get resolved over the course of the audit, so that in this analysis the auditor never commits a Type I error.

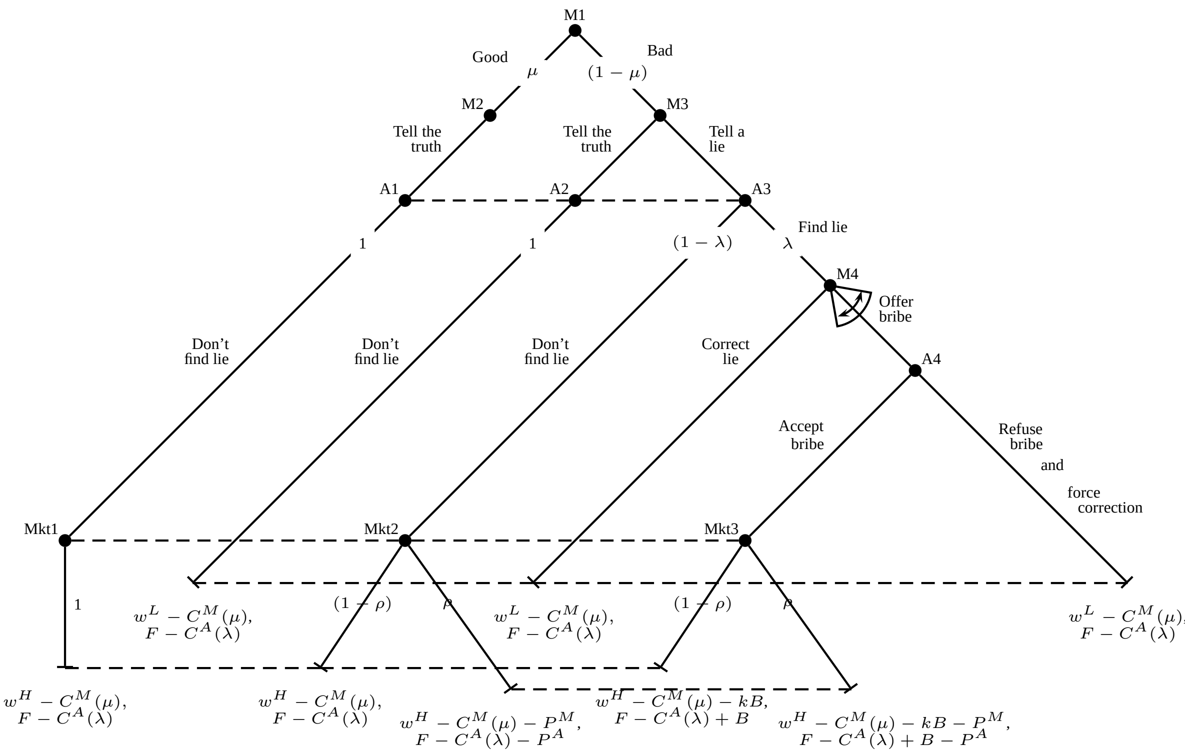

Figure 1: Auditing game

unobservable and non-verifiable. However, since the magnitude of the fee determines the auditor's decision to accept the engagement, it will reflect an ex ante assessment of the likely level of λ. I assume that it is always sufficiently large that the expected value of the contract to the auditor is greater than or equal to her reservation wage and hence that the contract has been accepted. As a consequence, for the purposes of this model, the fee is exogenous and invariant to the choices made within the scope of the model.

If the true outcome of the company in this period is bad, management's decision is no longer trivial. If he tells the truth, the manager's payoff is now $W^L - C^M(\mu)$, where he gets a wage $W^L < W^H$, less the cost of his investment $C^M(\mu)$. The auditor's payoff is still $F - C^A(\lambda)$, regardless of the level of λ chosen.

If the management decides to lie, and issues a statement that depicts the company's outcome as good when it is actually bad, the game gets more complicated. As implied above, the auditor can choose a varying level of λ, where λ is equal to the probability the auditor will detect a misstatement, conditional

Variable	Definition
Probabilities	
μ	Probability of a good client company outcome (from management's perspective)
λ	Probability of auditor finding misstatement conditional on its existence
ρ	Probability of market finding misstatement conditional on its existence
Payoff components	
$W^{H,L}$	Wage management receives (amount depends on client company outcome)
$C^{M,A}$	Cost of effort exerted by manager as a function of μ or by auditor as a function of λ
F	Fee auditor receives for audit
$P^{M,A}$	Penalty assessed manager and auditor respectively when a misstatement is discovered by market
B	Bribe
Scalar	
k	Proportion of B deducted from manager's payoff

Table 1: Definitions of variables

on the existence of a misstatement. I assume that there is either one or no misstatement. As with $C^M(\mu)$, $C^A_\lambda > 0$, $C^A_{\lambda\lambda} > 0$, and $\lim_{\lambda\to 1} C^A(\lambda) = \infty$.

If management decides to misrepresent the company's true state, with a probability of $(1 - \lambda)$ the auditor will not catch the misrepresentation and the incorrect financial statement will be issued to the marketplace. The management will receive an initial payoff of $W^H - C^M(\mu)$, on the basis of the contents of the financial statements, and the auditor will earn $F - C^A(\lambda)$ for the audit. At a later date, however, the market may receive additional information about the validity of the financial statements and will discover the misstatement with a probability of ρ. While ρ is an exogenous parameter in this model, it could well be a function of the size or method of the misstatement, the reputations of auditor and manager, and other factors that would vary from auditor-client pair to auditor-client pair. It would also depend upon the regulatory regime, the funding of government securities oversight bodies, and even such factors as the quality and freedom of the country's investigative business reporters, whistle-blower protection laws, etc.

If the financial statements are found to be misleading by the market, both management and auditor are assessed a penalty, with the present values P^M and P^A respectively. These penalties represent the full expected cost, in terms of both legal penalties and reputation costs, to each of the parties. If the misstatements are never found, the management and auditor keep their initial payoffs. Therefore, the *expected* value of the payoffs when a management cheats and the auditor misses the cheating are $W^H - C^M(\mu) - \rho P^M$ for management and $F - C^A(\lambda) - \rho P^A$ for the auditor.

I impose one assumption on the nature of the manager's penalty and wage structure: $W^H - W^L > \rho P^M$. If this assumption did not hold true, the manager would face a direct revelation mechanism, and would never have an incentive to lie in the first place. In such a situation, the auditor becomes irrelevant, as does the question of collusion. This assumption is made to simplify the analysis presented here: in life, there are clearly managers who will always be honest. Because the choices and contribution of the auditor are irrelevant with an honest manager, an analysis of this scenario makes no contribution to our understanding of auditor choices and is therefore omitted from the equilibrium analysis.[6]

There is some preliminary empirical support for the model of the manager's decision to lie. Wang &

[6]Of course, auditors may provide a variety of other kinds of value via their annual audit in the case of an honest manager, ranging from helping to prevent fraud in the lower levels of the corporate hierarchy, to analyzing business practices, to preventing unintentional reporting errors. As all of these purposes are of direct value to the corporate manager, they do not suffer from the same kinds of incentive problems as does the prevention of C-suite misreporting and are beyond the scope of the model presented here.

Winton (2012) demonstrate that the propensity to misreport is higher in competitive industries where three channels that encourage misreporting are present. The first channel, product market sensitivity (present in less competitive industries), would lower the payoff to misreporting (i.e. $w^H - w^L$), and the second, relative performance evaluation, would increase it. The third channel, lack of information collection, decreases the probability of fraud detection (i.e. ρ). The authors find that all three channels contribute to firms' propensity to commit fraud in economically meaningful ways. Cheng (2011) also finds that relative performance evaluation contributes to managers' propensity to misreport. Neither paper considers the role that auditors might play, either in responding to the increased risk or in increasing the attempts of managers to induce collusion.

In the single-shot game, if the auditor does find the misstatement, management must decide whether to correct the misstatement or offer the auditor a bribe. If the management makes the correction, the payoffs are the same as if management told the truth in the first place: management receives $W^L - C^M(\mu)$ and the auditor receives $F - C^A(\lambda)$. Since auditors observe client confidentiality, if the manager acquiesces to changes demanded by the auditor, the manager suffers no consequences from getting caught by the auditor except for receiving the payoff associated with reporting a poor outcome.

The magnitude of any bribe offered by the manager to the auditor is endogenously determined. If the management decides to offer a bribe, management must therefore first decide how large a bribe to offer. The decision of the bribe's size is determined by what the management believes about the final steps of the game and will be discussed once those steps have been laid out.

As noted above, the bribe, (B), may or may not cost the management what is paid to the auditor—in many instances, some or all of the bribe could be financed through some form of misappropriating the company's resources, either through direct, illicit transfers or through padded fees paid to the auditor. I account for that difference in the private costs and benefits of the bribe by multiplying the auditor's benefit from the bribe by a scalar $k \in [0, 1]$. This allows the bribe to be less costly to management than the value of its benefits to the auditor. If the auditor decides to accept the bribe, the misleading financial statements are issued, the bribe is paid, and the market may or may not eventually discover the misstatement. In this case, the expected value of the payoffs are: $W^H - C^M(\mu) - kB - \rho P^M$ for the manager and $F - C^A(\lambda) + B - \rho P^A$ for the auditor.

If the auditor rejects the bribe, the management is then forced to correct the lie and issue a truthful statement. Again, the payoffs for the two players is the same as the other instances where management ends up revealing the bad outcome to the market.

The dotted lines at the terminal nodes of Figure 1 highlight the information states available to an outside observer, such as an empirical researcher, after all play has been completed. Of particular interest is the indistinguishability of the two states where a misstatement has been discovered *ex poste* by the market: we are unable to parse bad luck and collusion. Furthermore, we cannot distinguish directly the difference between honest reports of good outcomes, dishonest reports of good outcomes that are the consequence of bad luck in the case of an honest auditor, and dishonest reports of good outcomes that are the consequence of collusion between auditor and manager.

Equilibrium strategies

The equilibrium concept used to analyze the possible equilibrium strategies employed by the two players is a *sequential equilibrium* (Kreps & Wilson, 1982). At each step, the auditor and manager consider their *expected* payoffs, prior to the market's move, since the market's "move," similar to moves of nature, is not responsive to the decisions made by the players. The game is solved by backwards induction. It is played in three stages: management invests effort, the auditor selects an audit intensity, and the players chose their strategies in the event the auditor discovers a lie. The following analysis therefore treats them in reverse order.

Lie discovery After the discovery of the lie, the two players have to decide how to respond (nodes M4 and A4). Here, the manager has a discreet choice, to correct the lie, versus a continuous set of choices, to offer bribe of magnitude B where $B \in \mathbb{R}^+$. The question becomes, is there a value, or range of values, of B where the manager wants to offer a bribe the auditor is willing to accept?

Both players will receive the same pair of payoffs for all strategies except (bribe; accept bribe): the manager receives $W^L - C^M(\mu)$ and the auditor receives $F - C^A(\lambda)$. The equilibrium conditions will therefore depend on whether the strategy profile (bribe; accept bribe) offers an improved payoff for both players.

Proposition 1. *The strategy profile (bribe; accept bribe) will be the equilibrium strategy profile for the bribing subgame iff the following condition is met:*

Condition 1. $\rho P^A \leq \frac{1}{k}(W^H - W^L - \rho P^M)$

Furthermore, the bribe offered will be set such that $B \in [\rho P^M, \frac{1}{k}(W^H - W^L - \rho P^M)]$*. If Condition 1 does not hold, the manager will be indifferent to offering a bribe that is rejected by the auditor (i.e.* $B < \rho P^A$*) and to correcting the lie without offering a bribe.*

Proof. See Appendix A. □

Intuitively, the manager will offer a bribe that the auditor accepts if the manager can "afford" a bribe that is large enough to compensate the auditor for the risks she is taking. The rest of this analysis, therefore, will look separately at two scenarios, whose dominance is determined by whether or not condition 1 holds. The first considers the scenario where the equilibrium strategy profile is either (correct lie; refuse bribe) or (offer bribe; refuse bribe): where the manager ultimately corrects the lie if it is found by the auditor. I call this scenario the "compliant manager" scenario. The second considers the scenario where the equilibrium strategy profile is (offer bribe; accept bribe). This is the "collusive auditor" scenario.

Compliant manager scenario In this scenario, the bribing condition is not met, and the game ends with the manager correcting the misstatement if the course of play results in the auditor finding a misstatement.

Proposition 2. *Given that* $W^H - W^L > \rho P^M$ *by assumption, the manager can* always *do at least as well by lying if there is a bad outcome. Therefore, he will never tell the truth if the outcome is bad.*

Proof. See Appendix A. □

An important implication of proposition 2 is that in this setting, an auditor does not contribute at all to the manager's incentive to tell the truth to begin with. This is a direct consequence of the "face saving" confidentiality that auditors provide when management complies with their requests to adjust unaudited books. This result could help explain the extremely limited evidence that tougher auditing deters misreporting that falls short of the most egregious fraud (Chen et al., 2012; Uecker et al., 1981; Schneider & Wilner, 1990).

Instead of deterring misrepresentation, the auditor increases the incentive pressure on the manager to pick a higher μ to begin with. To see how, we can determine the players' ex ante payoffs, given that the condition is met for the "compliant manager" equilibrium. For the two players, the ex ante payoffs are therefore:

Manager's Payoff 1. $W^H - C^M(\mu) - (1-\mu)[\lambda(W^H - W^L) + (1-\lambda)\rho P^M]$

Auditor's Payoff 1. $F - C^A(\lambda) - (1-\mu)(1-\lambda)\rho P^A$

The first two terms of the manager's payoff are the payoff if there is a good business outcome or the manager gets away with lying in the financial statements. The final term is the expected cost to the manager of getting caught (by the auditor or the market), weighted by the probability of a bad outcome. The auditor's payoff is similarly straightforward: it is the audit fee less the cost of the audit and less the expected cost of the market finding a misstatement that the auditor failed to discover.

With the expected payoffs for the equilibrium, we can now determine how the manager and the auditor will set their individual effort levels: the manager will choose μ and the auditor will choose λ. Because the audit must, by definition, follow the determination of the true outcome of the company, management always has the first player advantage and can choose his effort level based on his assessment of how the auditor will respond to his effort. The auditor can only maximize her payoff subject to her assessment of the manager's investment decision. Auditors can never do better than react to their assessment of management's choice of μ, since they have no credible way of committing to an alternative value of λ. Even in a repeated game, auditors cannot use a reputation for a different value of λ, as long as the assumption that λ is not observable or verifiable by an outside party holds true. The strategies of both players are again determined by backward induction, so I begin by looking at the auditor's decision, taking the value of μ as given.

The ex ante expected payoffs are what the auditor uses to set her optimal audit intensity, λ. For payoffs given in this scenario, the auditor sets λ such that:

Auditor's Utility Maximizing Choice 1. $C^A_\lambda = (1-\mu^\circ)\rho P^A$

where μ° is the manager's optimal value of μ in the compliant manager scenario. The dynamics of this scenario are well understood in the literature and the profession: the auditor sets her audit intensity proportionate to her estimation that the company has a poor outcome and therefore the manager could be lying in the financial statements, $(1-\mu^\circ)$, and the expected cost to her of missing a misstatement, ρP^A.

Given that the manager can be secure in his first-move advantage, he optimizes his expected payoff by treating λ as a function of μ. In scenario 1, management sets μ such that:

Manager's Utility Maximizing Choice 1.

$$C^M_\mu = \lambda\xi(W^H - W^L) + (1 - \lambda\xi)(\rho P^M)$$

where

$$\xi = 1 + \frac{(1-\mu)}{\lambda}\frac{\partial\lambda}{\partial(1-\mu)}$$

or

$$= 1 + \eta_{\lambda,1-\mu}$$

where $\eta_{\lambda,1-\mu}$ is the elasticity of the auditor's intensity level to an increased risk of a poor business outcome and therefore an increased risk of the existence of a misstatement. This result sets the optimal value of μ higher than it would be if the manager did not take into consideration his effect on the auditor's intensity level. How much higher depends on the elasticity of audit intensity.

Collusive auditor scenario The logic used to solve the game under this scenario is the same as in the first scenario. Proposition 2 still holds true, so the players' ex ante expected payoffs are:

Manager's Payoff 2. $W^H - C^M(\mu) - (1-\mu)[\lambda(kB) + \rho P^M]$

Auditor's Payoff 2. $F - C^A(\lambda) + (1-\mu)(\lambda B - \rho P^A)$

For this set of payoffs, the auditor sets her optimal λ such that:

Auditor's Utility Maximizing Choice 2. $C^A_\lambda = (1-\mu^*)B,$

where μ^* is the equilibrium effort level of the manager in the collusive auditor scenario. This scenario is noteworthy in that the auditor's decision is no longer driven by the cost of getting caught, but instead by the size of the bribe on offer. Certainly, the cost of getting caught is implicitly included here, since the bribe must be greater than the expected value of the cost of getting caught. But the dynamic has changed from one of the auditor trying to protect herself from the consequences of an audit failure to one of pursuing a share of the rents that the management may be appropriating. Furthermore, this equilibrium predicts that auditors chasing rents will actually audit with greater intensity than will those in a compliant manager equilibrium. This finding may not hold true in a repeated game, though, as will be explored in the next section.

In this scenario, management will set μ such that:

Manager's Utility Maximizing Choice 2. $C_{\mu}^{M} = \lambda\xi(kB) + (\rho P^{M})$

where again ξ is the same as it was defined in the first scenario. Important to note is that in the special case where $k = 0$ the manager will set his effort level at the same, lower level he would set if there were no auditing at all. If k is positive, the manager's effort will increase, but given that $kB < W^{H} - W^{L} - \rho P^{M}$ for the "collusive auditor" scenario to be the equilibrium scenario, it would not increase to the level where it would be if the auditor were incorruptible.

Repeated play

Auditors and managers are almost never in a single-shot game. Many companies have only had one audit firm their entire history as public companies. Therefore, it is important to consider how the dynamics of the game might change given a repeated relationship. When the pair are in a compliant manager equilibrium, there is little that might change in a repeated play game.[7] However, if the pair are in a collusive relationship, examining the repeated play game reveals dynamics that allow for a much less venal interaction than would occur if the pair were in the collusive equilibrium of a single-shot game. Nevertheless, these dynamics express what is, at root, a collusive equilibrium.

To build the repeated play model, focusing on the collusive equilibrium, from the foundations of the fundamental dynamics set out in the single play game, consider first the consequences of a manager deciding to offer a different sort of side-contract to induce collusion: rather than transfer the full bribe amount in the

[7] Recall that the single-shot game modeled here assumes that both parties know the parameters of the game. In a more complicated model with repeated play, we would expect to see extensive learning done by the auditor of the true risk of the manager. Such complications, while very interesting in their own right, are beyond the scope of the model presented here (see Beck & Wu, 2006). Otherwise, since there is no exchange between the two players in the compliant manager equilibrium, there is little scope for the use of time to affect the dynamics of the play, unlike in the collusive manager scenario.

current period, he offers the auditor an on-going engagement with sufficient profit margins to ensure that the discounted present value of the engagement is equal to (or greater than) the B solved for in the previous section. Importantly, the engagement is one that is at the management's discretion.

This repeated engagement may be simply a continuation of the audit relationship with a fee that includes a rent, or it may be a separate engagement for non-audit services of one sort or another, again where the profit margin would need to be significant enough to have a bribe component. It would be for a service that would, under normal circumstances, be re-engaged routinely but could be terminated or renegotiated by the manager. There may be some chance that the relationship would be cancelled in any given year via external factors but that risk would be factored into the valuation of this ongoing relationship.[8] We could describe the value of such an income stream to the auditor thus:

$$V_R = \sum_{t=1}^{\infty} \delta^t R = \frac{\delta R}{1-\delta},$$

where the discount factor, δ, includes both the discount for the time value of money (r) and the risk of exogenous cancellation (c):

$$\delta = \frac{1-c}{1+r}.$$

R is the rental income diverted to the auditor in each period.

Note, it is quite conceivable that a manager in a compliant manager equilibrium may contract with his auditor for tax or, if allowed, consulting services that would assist in his efforts to maximize the chances of a good outcome: just because some auditor-client dyads use non-audit services to induce capture does not preclude economies of scope in other engagements. It would be difficult for an outside observer, including board members, shareholders and empirical accounting researchers, to tell the difference between such a relationship and one where the non-audit services are a vehicle for a bribe. The only difference between the two is that the manager in a compliant equilibrium will have no interest in agreeing to a contract that contains excess fees for the auditor. Given that non-audit contracts are not commodities in most cases, there are considerable challenges in distinguishing instances where there are excessive fees paid.

Assuming the on-going payments to the auditor are indeed a form of inducement to capture, as before, the manager will recognize some fraction, l, of the cost of these rents in his own payoff function,

[8] For example, the manager may eventually quit or be fired and the new management may decide to cancel the contract.

where $0 \leq l \leq k$. I allow here for the possibility that a stream of revenue may be easier for the manager to finance than a one-off bribe would be, and therefore that the costs he recognizes are a smaller fraction of the total cost than in the single play game. At most, he is indifferent between the two mechanisms, since he can always chose to finance each payment of the revenue stream in an identical manner as he would in the single-play game.

In the next period, I assume that the exogenous parameters of the game remain constant from period to period, and also that the chance parameters (μ, λ and ρ) result in draws independent from those the period before. However, the auditor now has an income stream V_R that will normally continue indefinitely, but which the manager can choose not to renew. So after the audit has been conducted and the financial statements have been issued, the manager now has an additional decision to make: whether or not to renew the contract that generates V_R. This changes the set of options available to the manager downstream of the auditor discovering a misstatement. To solve the repeated game equilibrium, therefore, we need to investigate how that renewal decision feeds back into the previous strategy choices.

First, the manager lives up to his promise to renew the contract paying rents in "uneventful" plays of the game if the auditor uses a grim-trigger strategy: if the manager defects, any future attempts to achieve the collusive equilibrium in that auditor-manager pair can be credibly denied by the auditor—or, indeed, a successor auditor if reneging involves dismissing the original auditor—given that the manager can no longer be trusted to follow through with full payment of the bribe. Since the collusive equilibrium is preferred by the manager when the necessary conditions are met, he is unlikely to fail to follow through with his promise. (Note, for these results to be relevant for empirical consideration, it does not have to be a unique equilibrium, merely a plausible one.)

If the auditor discovers a misstatement in a period where she is receiving the rent cash flow, the manager no longer needs to offer an additional bribe to induce continued collusion. Instead, he can threaten to remove the current cash flow if she attempts to force a correction, resulting in the same payoff that was dominated in the earlier round by the offer of the rent cash flow. Given the nature of the present value of constant cash flows over time, it is still valued at $\frac{\delta R}{1-\delta}$, so the auditor would still prefer to collude with management if he is issuing a misstatement. However, unlike the single play game, the auditor will receive this cash flow regardless of whether or not she actually finds another misstatement. This leads to an important difference in behavior from the single play equilibrium results:

Proposition 3. *In a repeated play game that resolves in a bribing equilibrium where the bribe is financed by a stream of rents, V_R, the auditor will always set her audit intensity to zero: $\lambda = 0$.*

Proof. See Appendix A ☐

The basic intuition here is that, when the collusive auditor equilibrium dominates, the auditor no longer has any incentive to invest in audit intensity because she no longer needs to discover the misstatement as a pre-condition to sharing in the rents the manager gains from misrepresenting the outcome. Note that pre-payment of a bribe will *not* work in the single-play game, since it would not be sequentially rational for the auditor to set $\lambda = 0$ without the future cash flow at risk. If a manager were to attempt a pre-payment, the requirements of sequential rationality predict that the auditor would invest in the audit intensity solved for in the previous section and then hold up the manager for an additional bribe. In contrast, pre-payment is sustainable even at the initiation of the collusive equilibrium in a repeated play game, since the pre-payment is only "delivered" to the auditor after the resolution of the current reporting period.

Now that the game is a repeated play, the audits performed by the auditor offer no additional risk of financial consequences to the manager, and he will now behave as if he were not being audited at all, setting his own effort levels to the lower level implied by

$$C_{\mu}^{M} = \rho P^{M}$$

which is less than that expended in the single-play case. These shifts in investment by both the manager and auditor have two, countervailing effects on their respective payoff functions and their relative strengths will determine whether this form of side contracting will be attractive to the auditor-manager pair in a collusive auditor equilibrium. First, the costs both actors face for their effort or intensity investments decline. Second, the risk of facing a penalty in the case of a misstatement discovered by the market increases slightly, since the decreased manager effort will lead to an increase in the likelihood of a bad outcome and ultimately the discovery of a misstatement. The per-period payoffs in this scenario are:

Manager's Payoff 3. $w^{H} - C^{M}(\hat{\mu}) - lR - (1-\hat{\mu})\rho P^{M}$

Auditor's Payoff 3. $F - C^{A}(0) + R - (1-\hat{\mu})\rho P^{A}$

With these payoffs, we can then compare the relative net present value to the players of choosing a scheme where the bribe is paid through a rental cash flow to that of playing the single-play game repeatedly with a bribing equilibrium. In both situations (and in the compliant auditor equilibrium), we can assume the same exogenous continuation rate, thus facilitating comparisons in net present value.

Proposition 4. *Managers and auditors in a collusive equilibrium will choose to finance that collusion with a cash flow rather than with one-off bribes if the following condition is met:*

Condition 2.

$$\frac{1}{l}\left[C^M(\mu^*) - C^M(\hat{\mu})\right] + \left[C^A(\lambda^*) - C^A(0)\right] + (\frac{k}{l} - 1)\left[(1-\mu^*)\lambda^* B^*\right] \geq (\mu^* - \hat{\mu})\rho(P^M + P^A),$$

*where terms with a * are the equilibrium solutions to the single-play scenario and those with a ˆ are those to the repeated play scenario. If the condition is met then the per-period size of the cash flow will take a value*

$$R \in \Big[(1-\mu^*)\lambda^* B^* - (\mu^* - \hat{\mu})\rho P^A - \left[C^A(\lambda^*) - C^A(0)\right],\\ \frac{1}{l}\left[C^M(\mu^*) - C^M(\hat{\mu}) + (\mu^* - \hat{\mu})\rho P^M + k(1-\mu^*)\lambda^* B^*\right]\Big]$$

Proof. See Appendix A ☐

Condition 2 is met when the effort and intensity investment savings, along with any reduction in the financing rate the manager faces (i.e. the extent to which $l < k$), outweigh the increased costs associated with the expected penalties that flow from lower manager effort. It seems plausible that the condition may well be met in at least some cases and therefore the implications of such a form of financing collusion must be considered when testing the question empirically.

This equilibrium may help explain the "expectation gap" phenomenon that has persisted in the auditing profession for decades (Koh & Woo, 1998). Auditors assert, contrary to their mandate in the U.S. Securities Acts of 1933 and 1934 and similar laws in other countries, that it is not their responsibility to look for fraud by executive management, even as such an insistence costs the profession reputationally. Furthermore, the phenomenon has persisted despite frequent attempts to "close the expectation gap" by tightening auditing standards (Guy & Sullivan, 1988; Public Oversight Board, 1993). If the most profitable course of action is to not audit top management, in at least some engagements, however, the expectation gap could be a useful tool to help create norms within an auditing firm that discourage skepticism and make those involved in captured engagements less likely to question the lack of meaningful investigation of top management's statements.

These dynamics could also underlie the findings of field studies (McCracken et al., 2008; Beattie et al., 2001) and experimental studies (Gibbins et al., 2010) that demonstrate how cordial, on-going relationships between auditors and client managers are more likely to result in auditor concessions, which result in a more positive relational experience but a potentially less informative reporting result. In these studies, it is easy to see how the imperatives of client management can overwhelm the focus on honest reporting when the equilibrium no longer involves an explicit bribe but instead is a profitable, on-going relationship.

3 Implications

The preceding model provides us with some insights into the equilibrium conditions needed to either prevent or sustain capture between an economically rational manager and his auditor. The driving factor in the decision by the auditor to agree to a collusive or captured relationship with her client is the net income from the engagement before accounting for the expected costs of an audit failure—in other words, the value of B_i. The existing literature uses revenues (from audit, nonaudit or a combination of the two), $V_i = F_i + B_i$, in an effort to test the relationship between B_i and various measures of audit quality (e.g. Ashbaugh et al., 2003; Chung & Kallapur, 2003; DeFond et al., 2002; Frankel et al., 2002; Gul et al., 2007; Paterson & Valencia, 2011; Reynolds & Francis, 2001; Ruddock et al., 2006).

We can consider the effectiveness of this strategy by considering a simplified regression model that assumes that all other characteristics that affect the measure of audit quality, Y_i, are either orthogonal to the variables of interest here (V_i, F_i, B_i) or else directly controlled for. Current approaches therefore estimate $\hat{\pi}$, with the hypothesis that if $\hat{\pi} > 0$ that would be evidence that auditors do indeed sacrifice their independence for the economic value of their engagement with the manager. The effectiveness of this strategy can be evaluated with a slight variation on the standard omitted variable bias analysis:

$$Y_i = V_i\hat{\pi} + \epsilon_i \tag{1}$$

The estimate for $\hat{\pi}$ is calculated by the usual:

$$\hat{\pi} = (V'V)^{-1}V'Y \tag{2}$$

The true data generation process hypothesized for Y is, however:

$$Y_i = B_i\beta + \epsilon_i \tag{3}$$

Substituting this into the estimation equation for $E[\hat{\pi}]$, we get:

$$\begin{aligned} E[\hat{\pi}] &= (V'V)^{-1}V'(B\beta + \epsilon_i) \\ &= (V'V)^{-1}V'((V - F)\beta + \epsilon_i) \\ &= \beta - \beta(V'V)^{-1}V'F \end{aligned} \tag{4}$$

This identification strategy returns an unbiased estimate of β if F does not vary—if the cost of an audit or non-audit service is uniform across all clients. Clearly, however, this is not the case when clients are heterogeneous in the costs of supplying services. If there are no auditor-client pairs in a collusive equilibrium and if fees have a uniform rate of return, this empirical strategy will return the correct estimate by "mistake": in this case the $Corr(V, F) = 1$, and we estimate $E[\hat{\pi}] = 0$. If, instead, we assume a mix of collusive and compliant equilibria, each with distinct rates of return,

$$\gamma \equiv (V'V)^{-1}V'F \neq I,$$

but the resulting estimate

$$E[\hat{\pi}] = \beta - \beta\gamma,$$

where $\gamma \in (0, 1)$, will return a value considerably closer to zero than the underlying β. Finally, if there is no collusion but the rates of return vary across engagements—plausible particularly for nonaudit engagements—we will estimate a non-zero value for $\hat{\pi}$ that does not reflect collusion. Overall, the implication of this analysis is that it is premature to interpret the current literature as speaking to the extent of auditor loss of independence in fact as a consequence of economic bonding.

There are some empirical papers that have begun to grapple with these questions, and they can provide a foundation, in concert with the theoretical framework provided here, to future empirical work that resolves these challenges. Ruddock et al. (2006); DeFond et al. (2002) both use a set of independent variables to predict audit and/or non-audit fees in a first stage regression. They then use the difference between the actual and expected fees as the independent variable of interest in a second stage regression on their measure of audit quality. These "excess revenues" are equivalent to the bribe portion of the total revenue in a single-shot game and therefore offers an important fix to the problem. However, the task of estimating expected fees properly is extremely challenging, as is made clear in Chan et al. (2012). Furthermore, if the repeated play scenario discussed here is a prevalent form of collusion, a considerable portion of the inducement to collude comes in the form of lowered costs, rather than increased revenues, so the "excess revenue" measure would capture only a fraction of the value of collusion in those cases.

Antle et al. (2006) rightly focus on the endogenous choice of audit and non-audit fees and abnormal accruals. Their work could be extended, however, by recognizing that there might be several equilibria in the mix of client-auditor pairs. In some cases a high audit fee might be the result of high audit risk in a compliant manager equilibrium. High non-audit fees might also be paid in this case to help the client lower its risk. We might expect to see large abnormal accruals in such a case. We would see the same in a collusive equilibrium, though the fees would be providing an inducement to collusion, rather than covering the high effort needed to audit effectively.

Paterson & Valencia (2011) recognize the importance of recurring versus non-recurring engagements. As this model demonstrates, though, we would expect to see rents measured in a recurring engagement that purchase collusion in a different period than the one measured. This makes it still more difficult to identify the true risks of recurring engagements.

Audit quality and firm reputation

The above analysis considers auditor-client dyads independently from each other. In practice, of course, the same audit firm has relationships with hundreds or thousands of clients, and how firms aggregate these client relationships into a portfolio is of interest as well. There exists an extensive literature on auditor portfolio design already (e.g. Choi et al., 2010; J. R. Francis & Krishnan, 2003; Gaeremynck et al., 2008; Johnstone

& Bedard, 2004; Shu, 2000; Simunic & Stein, 1990), though it largely focuses on audit firms managing litigation risk. This section demonstrates that the model developed here can provide additional nuance to this discussion by highlighting the role that portfolio design can affect audit firm reputation and therefore the potential mix of compliant and collusive equilibria that one firm will engage with across its heterogeneous clients.

A commonly used definition of audit quality is the one proposed in DeAngelo (1981): "The quality of audit services is defined to be the market-assessed joint probability that a given auditor will *both* (a) discover a breach in the client's accounting system, and (b) report the breach" (DeAngelo, 1981, 186). A similar definition is proposed in Watts & Zimmerman (1986, 314), but with a small additional clause: "conditional on the breach occurring." Both definitions are cited frequently in subsequent literature but with no discussion of the relevance of Watts and Zimmerman's clarification that the assessed probability is conditional on the existence of a breach to begin with. The distinction is critical when considering audit quality empirically, since the existence of a breach is a function of client risk. This means that the Watts and Zimmerman definition of quality is unobservable to the market or the empirical research, since quality is confounded with client risk. It is, however, more intuitively satisfying than is the unconditional probability.

The model presented here provides a mathematical operationalization of a possible resolution of the differing definitions. If we accept the Watts and Zimmerman refinement of the definition of *audit quality* as the joint probability of discovery and reporting a breach, conditional on the breach's existence, we can then mathematically define a firm's average unconditional joint probability of discovery and reporting a breach and the resulting avoidance of an audit failure as the firm's *reputation*. These two constructs can be defined precisely in the terms of the model developed here. Audit quality is λ if the auditor–manager pair fall into the compliant manager equilibrium and zero otherwise. Audit firm reputation is defined as

$$Reputation := 1 - \frac{1}{n}\left[\sum_{i=1}^{a}(1-\mu_i)(1-\lambda_i)\rho_i + \sum_{i=a+1}^{n}(1-\mu_i)\rho_i\right]$$

where the auditor-client pairs of the firm $(1, a), (a + 1, n)$ fall into the compliant manager and collusive auditor (however financed) scenarios, respectively. Auditors can manage their reputations through choosing a combination of audit quality levels and types of clients.

These definitions lead to some observations. First, audit quality and audit firm reputation are related but distinct constructs. Since audit quality is not observable by the market, it is not rational for a firm to specialize in a particular audit quality level unless all clients are homogeneous. Instead, firms specialize in a reputation level and manage their portfolio of clients accordingly. As a result, high reputation firms may on occasion choose a client with whom they may collude, and in the instances in which that client has a bad outcome, the audit quality provided by the firm would be zero.

Indeed, if some clients do choose a reputable auditor to signal their honesty, high reputation audit firms will be in demand from honest—or low-risk—clients (i.e. those with a very high μ). It is mathematically possible to construct scenarios where such firms may be able to maintain a lower overall audit failure rate than firms with a lower reputation even if the high reputation firm always colludes and the low reputation never does. Nonetheless, investors are still rational to trust the financial statements coming from clients of the high reputation firm over those coming from the low reputation firm. Furthermore, regulators would also be rational to focus their attention on clients of the low reputation firm, possibly lowering the risk of ex-post discovery for those clients of the high reputation firm and therefore further contributing to that firm's reputation.

This dynamic creates the possibility for positive feedback loops that might create a far more complex competition environment than has been traditionally assumed. A potentially fruitful direction for future research would investigate the consequences of firms managing simultaneously the values of λ_i, μ_i, and ρ_i, and the relative payoffs to audit firms investing in audit technology, client recruitment, selection, and retention procedures, and currying favor—and trust—with entities that might discover audit failures ex-post.

4 Conclusion

The task of successfully measuring the risk and extent of auditor capture presents extraordinary methodological challenges, some of which are explored here. Refinement of existing approaches will benefit from more analytical support. The model presented here offers an explanation of why we might not see evidence of collusion in empirical studies, even as known scandals and our understanding of the psychology of the relationship between auditors and managers would suggest that there is indeed a problem with auditor capture, if not explicit bribery. This paper provides much needed theoretical underpinnings to explain the mixed empirical results and suggests possible directions for fruitful research.

This work also highlights the potential for complexity in the competition for clients, as firms may have the potential to simultaneously manage their reputation while pursuing rents from collusion. The parameters treated as exogenous for the purposes of deriving the equilibrium conditions explored here are also potentially under the audit firms' partial control, as they balance their client portfolios, participate in rule-making, and manage their relationships with regulators.

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A Appendix: Mathematical proofs

Proof of Proposition 1. The auditor will reject all bribe offers that do not improve on her payoff of $F - C^A(\lambda)$ that she gets when the lie is corrected (either before or after a bribe is proffered). Therefore for the auditor to accept a bribe, $F - C^A(\lambda) + B - \rho P^A > F - C^A(\lambda)$ must be true. Simplifying the expression, the auditor will accept the bribe iff $B > \rho P^A$.

For the manager to prefer to offer a bribe than report the true poor outcome, $W^H - C^M(\mu) - kB - \rho P^M > W^L - C^M(\mu)$ must be true. Therefore, there is a feasible B such that the equilibrium strategy profile for the bribing subgame is (bribe; accept bribe) iff $\rho P^A \leq \frac{1}{k}(W^H - W^L - \rho P^M)$. Directly following, the B chosen is $B \in [\rho P^M, \frac{1}{k}(W^H - W^L - \rho P^M)]$. □

Proof of Proposition 2. Assume that the manager will tell the truth with a probability of $\alpha \in [0, 1]$ in the instance where the company's outcome is bad. To conform to the assumption of sequential rationality, the manager will chose a value of α that maximizes his expected payoff given that he has reached the node M3 (i.e. a bad outcome has been realized). His expected payoff is

$$\Pi^M = \alpha[W^L - C^M(\mu)] + (1-\alpha)[W^H - C^M(\mu) - (\lambda(W^H - W^L) + (1-\lambda)\rho P^M)].$$

The derivative of his payoff with respect to α is: $\Pi^M_\alpha = -(1-\lambda)(W^H - W^L + \rho P^M) \leq 0 \quad \forall \quad \lambda \in [0,1]$. Since the manager's marginal payoff is monotonically decreasing for all feasible values of λ, a corner solution prevails, and the manager will select $\alpha = 0$ and always lie about his bad outcome. □

Proof of Propostion 3. The auditor's expected, per-period payoff is: $F - C^A(\lambda) - (1-\mu)\rho P^A + R$. She will attempt to set marginal payoff equal to zero, $-C^A_\lambda = 0$, but our assumptions about the audit cost function state that $C^A_\lambda > 0\ \forall\lambda$, which forces the auditor into a corner solution where $\lambda = 0$. □

Proof of Proposition 4. For a manager to prefer financing collusion via a rental payment stream:

$$\frac{\delta}{1-\delta}\left(w^H - C^M(\mu^*) - (1-\mu^*)(k\lambda^* B^* + \rho P^M)\right) \leq \frac{\delta}{1-\delta}\left(w^H - C^M(\hat{\mu}) - lR - (1-\hat{\mu})\rho P^M\right)$$

(I assume for notational convenience but with no loss of generality that the manager faces the same discount rate as the auditor.) This condition can be reduced to a maximum value of R:

$$R \leq \frac{1}{l}\left((C^M(\mu^*) - C^M(\hat{\mu})) + (\mu^* - \hat{\mu})\rho P^M + k(1-\mu^*)\lambda^* B^*\right)$$

For the auditor to prefer this financing mechanism, she must make at least as much in expected net present value as she would if there were a one-off bribe, to ensure that the collusion equilibrium remains her dominant strategy:

$$\frac{\delta}{1-\delta}\left(F - C^A(\lambda^*) + (1-\mu^*)(\lambda^* B^* - \rho P^A)\right) \leq \frac{\delta}{1-\delta}\left(F - C^A(0) + R - (1-\hat{\mu})\rho P^A\right)$$

This can then be reduced to derive the minimum value of R: $R \geq (1-\mu^*)\lambda^* B^* + (\mu^* - \hat{\mu})\rho P^A - (C^A(\lambda^*) - C^A(0))$. These restrictions on the feasible values of R do not form an empty set as long as Condition 2 is met. □