An Information-based Theory of Auditor Switching *

Mingcherng Deng†, Jing Li‡, Nan Zhou§

November 16, 2023

Abstract

We model auditor switching via a tender process involving an incumbent auditor, who possesses private information about a client firm's audit cost, and an uninformed outside auditor. When a firm's audit cost is high, the auditor is more susceptible to an audit failure, incorrectly attesting to the firm's favorable report. We show that in equilibrium, high-cost firms are more prone to switching to the outside auditor due to the winner's curse, especially after receiving an unfavorable audited report. Subsequently, after an auditor switch, the firm expects to have a lower audit fee and a high probability of receiving favorable audited reports from the outside auditor. These combined results align with empirical findings commonly interpreted as evidence supporting "opinion shopping," despite our model lacking such an incentive. We recommend that researchers examine opinion shopping with caution, taking into account the potential influence of information asymmetry among auditors on auditor switching.

Keywords: Audit tender, Auditor switching, Opinion shopping
JEL Classification: M41, M49

*We would like to thank Tim Baldenius, Matthias Breuer, Derek Chan, Masako Darrough, Pingyang Gao, Jonathan Glover, Tracy Gu, Eunhee Kim, Tingjun Liu, Evgeny Petrov, Lin Qiu, Xiaoyan Wen, Guochang Zhang, and the seminar participants at Baruch College, Columbia University and The University of Hong Kong for their helpful comments.

†City University of New York (CUNY)-Baruch College, Mingcherng.Deng@baruch.cuny.edu
‡The University of Hong Kong, acjli@hku.hk
§University of Cincinnati, nan.zhou@uc.edu

Electronic copy available at: https://ssrn.com/abstract=4634547

1 Introduction

Auditor switching is a significant event for public companies, carrying a wide range of implications for auditors, clients, and stakeholders (Stefaniak, Robertson, and Houston, 2009). Regulators have expressed concerns about auditor switching, as it connotes opinion shopping (SEC, 1988; Defond and Zhang 2014; Ye 2023). Empirical studies have found that auditor switching is more likely following unfavorable audit opinions and that clients may receive more favorable opinions after switching their auditors (Chow and Rice 1982; Krishnan 1994; Krishnan and Stephens 1995; Lennox 2000).

In this paper, we propose a model in which auditor switching occurs as a result of competitive bidding from auditors with asymmetric information. We demonstrate that even without incentives for opinion shopping, auditor switching can arise due to competition among auditors. Interestingly, our model, albeit abstracting away elements related to opinion shopping or auditor independence, generates predictions that align with prevailing empirical findings. This fresh bidding perspective offers a new interpretation of empirical evidence on auditor switching.

Our model incorporates two distinct features motivated by auditing practices and recent regulations. First, it introduces competition among auditors through an audit tender process. In practice, client firms often invite competitive bids from outside auditors to contest with their incumbent auditors.[1] The European Union's 2016 Audit Reform mandates that a public audit tendering process must be conducted after ten years if a firm wishes to retain its incumbent auditor.[2] Since the implementation of this reform, many firms have initiated a tender process,

[1]Using a single audit firm's proprietary data, Johnstone, Bedard, and Ettredge (2004) found that about half of the firm's bids were competitive bids against some incumbent auditors of target clients. Beattie and Fearnley (1998) conducted interviews of 12 companies and found that about 55% of auditor changes in U.K. companies were caused by an audit tender. Large-sample archival evidence is absent because these competitive bids are unobservable and may not necessarily lead to auditor switching. Hallman, Kartapanis, and Schmidt (2022) addressed the problem that researchers are unable to observe the audit bidding process by applying a machine-learning algorithm to estimate the probability of bidding using competitor auditors' downloads and views of a client firm's public SEC filings. Hallman et al. (2022) show that over 80% of the observations in their sample are associated with an audit tender.

[2]Several EU members have adopted either tendering or rotation prior to the passage of this audit reform regulation. Italy has required auditor rotation every nine years since the 1970s and the Netherlands has im-

Electronic copy available at: https://ssrn.com/abstract=4634547

leading to a substantial increase in auditor switching.[3]

Second, the model incorporates information asymmetry among auditors in the process of audit tender. An incumbent auditor typically obtains private information about a client's audit cost from prior engagements, whereas outside auditors can only access public information. This information asymmetry is a salient feature of audit tender, as the incumbent's information advantage can create a significant barrier for outside auditors seeking engagement. For example, HSBC Bank intended to tender its audit engagement from 2025 onwards but faced challenges in attracting competing bids from other Big-Four auditors due to the complexity of operations and audit-related risks.[4]

We build a two-period model in which a client firm hires an auditor in each period to issue an audited financial report about its uncertain financial conditions. At the beginning of the first period, an incumbent auditor competes with an outside auditor through an audit tender process. The winning auditor is engaged for the first period and becomes the incumbent for the second period's bidding. The baseline audit tender follows the standard first-price auction with asymmetrically informed bidders (Engelbrecht-Wiggans, Milgrom and Weber 1983). Both the informed incumbent and uninformed outside auditors submit sealed bids in the form of audit fees to compete for the audit engagement. The client selects the auditor with the lower bid.[5] To demonstrate theoretical predictions in the most transparent way, we concentrate solely on the incumbent's *information advantage* as the *only* difference between

posed an eight-year rotation period starting January 2016. The U.K. Competition Commission (CC) published a report on October 15, 2013, requiring FTSE 350 companies to retender their audits every ten years. See http://www.iasplus.com/en-gb/news/2013/10/competition-commission-final-audit-remedies.

[3]Willkens, Dekeyser, and Simac (2019) showed that 13 out of 30 non-financial PIEs in their survey engaged in a tender procedure to appoint a new statutory auditor following the EU Audit Reform, and 7 have switched their auditors as a result of tendering.

[4]See the *Financial Times* article, "HSBC faces a struggle to attract bids from Big Four auditors." https://www.ft.com/content/18754ea7-9e2c-4050-a94e-0d5c808f54c6

[5]In our model, it is optimal for the firm to pick the lower-bid auditor, as both auditors are identical otherwise. In practice, audit fee is an important consideration for clients when comparing tender offers (Ettredge, Li, and Scholz 2007). In a field study of audit tendering between an incumbent auditor and several non-incumbent auditors, Fiolleau, Hoang, Jamal, and Sunder (2013) find that despite the client's insistence that audit fee is not a key factor in auditor selection, the audit engagement typically went to a non-incumbent auditor who proposes the lowest fee. Several prior analytical models of auditor switching also rely on the assumption that the client firm picks the auditor with a lower audit fee, e.g., Magee and Tseng (1990), Kanodia and Mukherji (1994), and Petrov and Stocken (2022).

Electronic copy available at: https://ssrn.com/abstract=4634547

the incumbent and outside auditors. Later, we relax this assumption by considering an explicit switching cost.

Without an auditor, the client firm always reports its unaudited financial conditions as favorable (good). Once engaged, the auditor acquires private knowledge about the audit cost, collects audit evidence, attests to the client's financial report, and ultimately issues audited financial reports. The client's audit cost could be either high or low, an aspect not observable to the auditor prior to the engagement. Auditing a high-cost client is more costly for auditors due to factors like complex transactions, large scale of operations, or the lack of proper internal controls. The auditor faces the risk of making a type-II error by not detecting the bad state but is free from a type-I error.[6] The engaged auditor chooses the audit effort to minimize the total audit cost, including the audit liability from the type-II error of not detecting the bad state. Consequently, a high-cost client is more likely to incur type-II errors, resulting a higher likelihood of receiving favorable audited reports.

Our model offers three key results. First, the *high-cost* client is *more* likely to switch its auditor compared to the low-cost client. In the presence of information asymmetry, the outsider is more likely to win a high-cost client, as the incumbent never bids below the true high cost for these clients. But, if the client has low audit cost, the incumbent and outside auditors both randomize their bidding and have an equal chance to win the client. Consequently, in equilibrium, a high-cost client is more likely to switch than a low-cost client–implying that the auditor switching event itself contains information about the client's cost type.

Second, auditor switching is *more* likely following an *unfavorable* (bad) report than a favorable report in the previous period.[7] The rationale behind this reuslt is that, for the outside auditor, the audit report serves as a crucial public signal about the client's audit cost. Upon observing an unfavorable report, the outside auditor infers that the client is less likely

[6]According to a negligence-based rule, auditors face lawsuits for making a Type-II error as investors lose their investment value relying on the audited financial statements. However, auditors are generally not sued by investors for making a Type-I error as investors do not suffer investment losses. Our results also hold if we assume the auditor incurs liability for both types of errors but the good state is less likely ex-ante.

[7]This prediction is supported by empirical evidence on auditor switching documented in the literature. In the context of asset impairments, Ayres, Neal, Reid, and Shipman (2019) and Xing, Yuwen, and Yang (2023) both find that firms are prone to replacing incumbent auditors after reporting a goodwill impairment.

Electronic copy available at: https://ssrn.com/abstract=4634547

to be a high-cost type because the bad state is less likely to be detected due to the larger type-II error for the high-cost clients. Thus, the outside auditor bids more aggressively upon observing an unfavorable audited report, increasing the likelihood of auditor switching.

Third, after auditor switching, the expected audit fee decreases, and the client is more likely to receive a favorable (good) report. Both outcomes stem from the fact that the outside auditor is more likely to win the high-cost client due to her information disadvantage. The fee reduction after switching results from her underbidding for the high-cost client. Similarly, the increased probability of receiving a favorable report after switching also arises from the high-cost client experiencing a larger type-II error. As a result, we show that the informativeness of audited reports for nonswitching firms, on average, surpasses that for switching firms.

These findings collectively align with empirical evidence that is often interpreted as support for opinion shopping, despite our model excluding such an incentive.[8] It is important to note that the "unfavorable" reports in our model can be interpreted as auditors exercising a more stringent threshold on accounting estimates or displaying a preference for more prudent accounting practices, such as impairments. By utilizing an auditor tender model with asymmetric information, our information-based theory of auditor switching provides researchers a new perspective for interpreting empirical evidence on auditor switching. We suggest that when empirically examining the opinion shopping incentives, researchers exercise caution and consider controlling for the varying switching probability due to different client types and the information content of the pre-switching audited reports.[9]

We extend the analysis to a multi-period tender. In this context, the tenure of the incumbent auditor conveys additional information to the outside auditor: the longer the incumbent auditor has continuously served the client, the more likely it is that the client's audit cost is low. This inverse relationship suggests that as the auditor's tenure increases, the probability of future auditor switching rises because the outside auditor becomes more aggressive in

[8] Lu (2005) analytically examines whether opinion shopping impairs auditor independence and audit quality.

[9] Instead of comparing observed pre- and post-switch audit opinion, Lennox (2000) found indirect evidence, suggesting that companies would have received unfavourable reports more often if they had not switched their auditors.

Electronic copy available at: https://ssrn.com/abstract=4634547

bidding when she is less concerned about the winner's curse. Our findings demonstrate that a prolonged auditor tenure is associated with more informative reports and lower audit fees. These predictions align with the findings from the structural estimation reported in Cheynel and Zhou (2023).

We also explore another extension in which the outside auditor incurs additional cost related to initial setup and learning after successfully winning an engagement. The existence of a switching cost exacerbates the effect of information asymmetry on auditor switching by discouraging the outsider from bidding. Nevertheless, our predictions concerning auditor switching remain valid. This is because these predictions are driven by the outsider's information disadvantage, a trade-off that persists regardless of the presence of the switching cost.

Our paper is related to Baldenius, Deng, and Li (2023) who employ a similar first-price common-value auction to model competition for lending between asymmetrically informed lenders. The bidding game and outcomes in our baseline model thus share similarities with Baldenius et al. (2023). Our model centers on audited reports and auditor switching, serving as public information available to uninformed auditors in competing against an informed auditor. Although the auditor optimally chooses his/her audit effort, the bidding outcome does not directly affect the audit effort. In contrast, while Baldenius et al. (2023) also delves into creditor turnover in their study, their focus lies in examining the effect of the precision of an exogenous public signal on the expected debt repayment (as well as creditor turnover). This repayment, in turn, is an outcome of the bidding game, ultimately affecting the borrower's endogenous, unobservable risk-taking decision.

Prior analytical studies in auditing have considered auditor switching with asymmetric information, but in different settings. For example, Dye (1991) models auditor replacement when a firm possesses information about its financial conditions superior to the auditor. In Kanodia and Mukherji (1994), auditor switching arises because a client has bargaining power and makes a take-it-or-leave-it offer to limit the incumbent's rent. In Bockus and Gigler (1998), an incumbent auditor voluntarily resigns from a "risky" client due to uncertainty about the

Electronic copy available at: https://ssrn.com/abstract=4634547

client's hidden litigation risk. Morgan and Stocken (1998) analyze a similar setting to ours in terms of asymmetric information among auditors, but their research question focused on explaining the disparity between audit fees and client risk. Our model focuses on the endogenous auditor switching that results from a tender process involving asymmetrically informed auditors and establishes the link between the information content of auditor switching driven by such competitive bidding and the observable properties of audit fees and audited reports.

Our study also contributes to the literature on low-balling in audit engagement. We echo prior studies that have argued "low-balling" itself does not necessarily lead auditors to compromise their independence. For example, Magee and Tseng (1990) show that the value of incumbency presents a threat to auditor independence only under limited circumstances when the client firm has sufficient bargaining power. Dye (1991) shows that low-balling exists because auditors' quasi-rents cannot be fully disclosed. Gigler and Penno (1995) argue that cost difference among auditors is a source of economic rent to the incumbent auditor and that imperfect competition may increase the binding of non-audit service, even if a rival auditor submits a lower bid. Complementing this line of theoretical work, we provide an information-based explanation regarding the audit fee reduction upon auditor switching.

The rest of the paper proceeds as follows. Section 2 presents the structure and ingredients of the baseline model. Section 3 analyzes the baseline bidding equilibrium. Section 4 provides comparative statics with respect to auditor switching and its implications in terms of audit fees, audit opinions, and audit report informativeness. Section 5 analyzes two extensions of the model, and Section 6 concludes. We relegate all proofs to the Appendix.

2 The Model

We consider a two-period model in which a client firm hires an auditor in period $t \in \{1, 2\}$ to attest a financial report about its financial conditions. The financial conditions may represent the profitability of the firm's investment or the future cash flows of acquired assets. In each period, the firm has two possible states $i \in \{G, B\}$. With probability $p \in (0, 1)$, the

Electronic copy available at: https://ssrn.com/abstract=4634547

state is good (G); with probability $1 - p$, the state is bad (B). The probability p is common knowledge and the state in each period is independent from each other. The true state is not observable to all parties. In the absence of any information about the state, the firm has incentive to report the good financial condition to investors in capital market.[10] Therefore in the audit process, the firm initially proposes an unaudited "good" (favorable) report to the auditor.

Following the auditing process outlined in Lennox, Wu, and Zhang (2016), the auditor exerts efforts to collect audit evidence about the firm's financial conditions, proposes adjustments to financial statements during year-end audits, and attests to the firm's report by issuing an audited financial report, either good (favorable, g) or bad (unfavorable, b).

Because of the firm's incentive to overstate rather than understate the report, the auditor and the investors are more concerned about a type-II error. For simplicity, we assume that the auditor makes no type-I error—given the good project state (G), the auditor can always collect sufficient evidence to verify the good state and provide a good report, i.e., $\Pr(g|G) = 1$. However, given the bad state, the auditor may make a type-II error, failing to detect the bad state (B) and incorrectly issuing a good report. Specifically, given the auditor effort q, we have

$$\Pr(b|B) = q, \quad \Pr(g|G) = 1. \tag{1}$$

Given the audit technology, a bad report is perfectly informative about the bad state, but a good report is a noisy signal about the good state. Increasing audit effort q reduces the type-II error in the audited report.[11]

In our model, unfavorable reports can be interpreted as auditor-adjusted income-decreasing

[10] The firm's incentive to overstate its financial conditions may come from its financing need or the capital market pressure. These specific contexts are not explicitly considered in our model. We also abstract away the firm's interactions or negotiation with auditors in the audit process with regard to the auditor's adjustments to their financial statements (Gibbons, Salterio, and Webb 2001) and simply assume that firms agree with the auditor's proposed reports. Adding these additional elements to our model may bring more tensions but do not change the primary insights of the information-based audit tender.

[11] A similar audit technology that assumes away type-I error is also adopted in other studies, for example, Dye (1993), Chan and Pae (1998), Hillegeist (1999), Radhakrishnan (1999), Ye and Simumic (2013), and Gao and Zhang (2019).

Electronic copy available at: https://ssrn.com/abstract=4634547

accruals through prudent accounting estimates and choices in audited financial statements (Lawrence, Sloan, and Sun 2013).[12] An illustrative example is the asset impairment audit process. SFAS 142 (now ASC section 350-20) mandates firms to forecast future cash flows to justify whether recognizing an asset impairment loss is necessary. Research has shown that firms are prone to postpone recognizing an asset impairment.[13] Given the audit technology, the bad report means impairment recognition, which is a signal of prudent accounting practices.[14] In contrast, an audit failure occurs if a good report (no impairment) is issued (g) but the true state is bad (B). Therefore a favorable report of no impairment (g) is a noisy signal about the firm's good state (G), because it is possible that the client postpones the recognition of impairment, which is not detected by the auditor.

At the beginning of each period, an incumbent auditor who previously engaged with the client competes with an outside auditor through an audit tendering process.[15] For convenience, throughout the paper, we use "she" to refer to the outside auditor and "he" as the incumbent auditor. In period 1, an existing incumbent auditor competes with an outside auditor for the period-1 engagement; and the winning auditor in period 1 will be the incumbent auditor for period 2 and compete with another outside auditor with no prior engagement for the period-2 engagement. The auditor who submits a lower bid wins the engagement and performs the audit service in that period.

The direct audit cost of exerting effort q is given by $C(q, r) = \frac{1}{2}c_r q^2$, which has two components. First, the audit cost depends on the audit risk related to the client's inherent characteristics (Hay, Knechel and Wong 2006). We assume that the client's type, *a priori*, can be either high or low, $r \in \{h, l\}$. If the client has more complex transactions that require

[12]The "unfavorable" report in our model does not necessarily mean a "going concern" or "qualified" audit opinion. In practice, we rarely observe the going-concern opinion, and qualified opinions are also very infrequent.

[13]See, for example, Beatty and Weber (2006), Ramanna and Watts (2012).

[14]This is consistent with Chen, Keung, and Lin (2019) who suggest that auditors make goodwill-related disclosures as a signal of truthful goodwill accounting.

[15]The model can be extended to multiple outside auditors who are equally uninformed. The incumbent's bidding strategy remains unchanged because his information advantage remains, and each outside auditor's bidding strategy must be altered to take the total number of uninformed auditors in the tender into consideration. Nevertheless, we obtain a similar bidding outcome in terms of how likely the client switches to any outside auditor. Detailed analysis is available upon request.

Electronic copy available at: https://ssrn.com/abstract=4634547

a higher degree of judgment (i.e., high inherent risk), its audit risk is higher so the marginal cost to conduct the audit effort is higher to complete audit process. This audit cost difference is captured by c_r, with $c_l < c_h$. Second, the direct audit cost also depends on the level of audit effort q.

The client type r is unknown to an outside auditor prior to an engagement and remains unchanged throughout the two periods. At the beginning of period 1, the prior probability of being the high-cost type is $\lambda \in (0, 1)$. After the engagement, the auditor conducts audit planning, learns the scale of audit complexity, and identifies potential internal control problems. Consequently, the engaged auditor can perfectly observe the client's type r before exerting the audit effort.[16]

An audit failure occurs if the audited financial report is good (g) but the state is bad (B). In the case of an audit failure, investors sue the auditor and the auditor incurs a legal liability L. The auditor's legal liability may include a damage penalty to investors and litigation costs through the court, legal fees, and opportunity costs of time spent in court.[17] We assume that the auditor is only responsible for an audit failure in the engaged period. The auditor in each period will take into account the expected audit liability when conducting the audit.[18] Figure 1 presents the timeline of events.

[16]We assume that the incumbent auditor has private information about the client's control risk or inherent risk through the audit cost, not the business risk (i.e., p). This is because empirical audit studies show that business risk is shown to be driven by the business operation environment and is independent of the audit inherent risk and control risk (Brumfield, Elliott and Jacobson 1983). In addition, audit standards provide limited guidance in the presence of these factors (Houston, Peters and Pratt 1999). Borrowing from these studies, we assume that business risk, while a source of auditor's litigation risk, is not the source of information asymmetry in our model.

[17]Our assumption is consistent with prior literature that has shown the damage payment has no direct effect on the audit effort (Laux and Newman, 2010). Our analysis does not change if we allow investors to receive a non-zero penalty payment from the auditor.

[18]Auditors are frequently sued when clients restate their financial statements, most of which occur after a few periods following the period the financial statements were misstated. It takes even longer for accounting fraud to be detected and reported. In the case of Enron, for example, the scandal went undetected for almost a decade before the accounting maneuvers exploded.

Electronic copy available at: https://ssrn.com/abstract=4634547

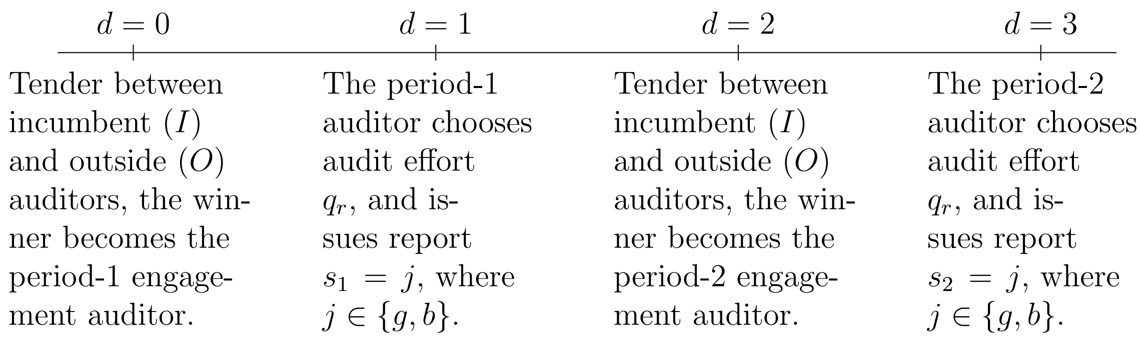

Figure 1: Timeline of events.

3 Equilibrium Analysis

3.1 The Baseline Tender Model

We model the tender process as a first-price auction between two auditors with asymmetric information. At the beginning of each period, the incumbent auditor already observes the client firm's audit cost (type) perfectly from his previous engagement with the client. The incumbent auditor thus possesses an "information advantage" about the audit cost over the outside auditor, who only knows the prior distribution of the cost when participating in the tender for the audit engagement. The incumbent and outside auditors simultaneously submit sealed bids (stated as audit fees) to the client firm based on their own information set. The firm accepts the lower bid and engages the winning auditor to perform the audit.

The outsider's information set. The outside auditor does not observe the client's true type, so her bidding will be based on public information. Let Ω denote public information available to the outsider prior to bidding at the beginning of each period. The outside auditor updates her belief about the high-cost type given the public information set Ω. Let $\hat{\lambda} \equiv \Pr(h|\Omega)$ denote the outside auditor's belief about the high-cost type conditional on Ω. For the sake of clarity, in this baseline model, we first analyze the bidding equilibrium, taking as given the outsider's belief $\hat{\lambda}$. We later characterize public information Ω available to the outsider in period $t \in \{1, 2\}$ in Section 3.2. We also omit the period indicator t in the baseline model to avoid notation clutter.

Electronic copy available at: https://ssrn.com/abstract=4634547

The audit effort and cost. A bid submitted by an auditor should at least cover the expected cost—i.e., the audit liability plus the direct cost of audit effort. Hence, before solving the bidding game, we first solve the audit effort to obtain the total audit cost for the engaged auditor.

Any winning auditor, either the incumbent or the outsider, perfectly observes the client's type after engagement and chooses effort q_r, $r \in \{h, l\}$, to maximize the expected payoff, taking the winning price (the audit fee) ω as given.[19] The auditor's optimal effort is given by

$$q_r \in \underset{q}{\operatorname{argmax}} \;\; \omega - (1-p)(1-q)L - \frac{1}{2}c_r q^2,$$

where $\frac{1}{2}c_r q^2$ is the direct cost of the effort that depends on the client type $r \in \{l, h\}$, and $(1-p)(1-q)L$ is the expected litigation cost if the bad state is not identified (type-II error). Solving the problem above, we obtain the optimal audit effort, given the firm type r,

$$q_r = \frac{(1-p)L}{c_r}. \tag{2}$$

To ensure that the audit effort q_r in equilibrium is an interior solution—i.e., $q_r \in (0,1)$—we assume that the legal cost L is not too large relative to the marginal cost of the audit effort, $L \leq c_l/(1-p)$. When the client cost is higher, the auditor is more likely to incorrectly attest the client's favorable report, making a type-II error ($q_h < q_l$). The auditor's total cost for the r-type firm is

$$w^r = (1-q_r)(1-p)L + \frac{1}{2}c_r q^2. \tag{3}$$

We denote by $\bar{w}$ as the outside auditor's expected total audit cost,

$$\bar{w} \equiv \hat{\lambda} w^h + (1-\hat{\lambda}) w^l, \tag{4}$$

which represents the audit fee to break even from an outsider's perspective.

[19] We assume that audit fees cannot be renegotiated or adjusted after the engagement. A field study by Goddard and Schmidt (2021) shows that negotiation audit fees, such as for chargeable hour overruns and additional work required, may have negative implications for the auditor-client relationship in practice. In our model, the winner's curse to the outside auditor cannot be completely avoided through the ex-post price adjustment on additional hours.

Electronic copy available at: https://ssrn.com/abstract=4634547

The bidding strategies. Each auditor submits a bid in the form of an audit fee ω, and the client chooses the auditor with a lower fee for the audit engagement. Though the incumbent auditor observes the client type perfectly, his bidding for the audit engagement is contingent on both his private information and the public information (i.e., the audited report issued in the precious period) that the outside auditor observes.[20]

Let $\mathcal{F}_O(\omega)$ denote the cumulative distribution function (c.d.f) of the bid from an uninformed outside auditor, conditional on public information Ω. Let $\mathcal{F}_I^r(\omega)$ denote the c.d.f. of the bid from an informed incumbent auditor, conditional on his private information about the type r. Given the incumbent's bidding strategy $\mathcal{F}_I^r(\omega)$, the uninformed outside auditor's expected payoff, when submitting a bid ω, is

$$U_O(\omega) = \hat{\lambda}(1 - \mathcal{F}_I^h(\omega))(\omega - w^h) + (1 - \hat{\lambda})(1 - \mathcal{F}_I^l(\omega))(\omega - w^l), \tag{5}$$

where $\omega - w^r$ is the outside auditor's profit after paying the expected total cost w^r when the client firm's type is r, and $1 - \mathcal{F}_I^r(\omega)$ is the probability that the outside auditor wins the bid given that the incumbent's bid follows the distribution $\mathcal{F}_I^r(\cdot)$. Notice that the outside auditor takes the expectation of her profit over her updated belief about the cost being high as $\hat{\lambda}$, after observing public information Ω. The incumbent's expected payoff when submitting a bid ω for the firm r is given by

$$U_I^r(\omega) = (1 - \mathcal{F}_O(\omega))(\omega - w^r), \quad r \in \{h, l\}, \tag{6}$$

where, similarly, $1 - \mathcal{F}_O(\omega)$ is the probability that the incumbent auditor wins the bid given that the outsider's bid follows the distribution $\mathcal{F}_O(\omega)$.

The equilibrium. The equilibrium bidding strategies follow the general result from the first-price auction with asymmetrically informed bidders in Engelbrecht-Wiggans et al. (1983). No pure strategy exists in such bidding equilibrium because any pure strategy would

[20]We assume that the tender process including bids are not observable to outsiders, which is consistent with practice. For example, General Electric reported in its 2020 Proxy Statement that it commenced an audit tender in 2019 and invited several audit firms to participate in the process, without disclosing the specific details of tender offers in its proxy statement.

Electronic copy available at: https://ssrn.com/abstract=4634547

put the outside auditor at a loss in expectation upon winning. Proposition 1 characterizes the auditors' equilibrium mixed-bidding strategies with asymmetric information.

Proposition 1 *Given the outside auditor's belief $\hat{\lambda} \equiv \Pr(h|\Omega)$ at the beginning of each period, there exists a unique mixed-strategy bidding equilibrium for incumbent and outside auditors as below:*

1. *The outside auditor randomizes her bid over the support $[\bar{w}, w^h)$ according to $\mathcal{F}_O(\omega) = \frac{\omega - \bar{w}}{\omega - w^l}$, and bids w^h with probability $\hat{\lambda}$.*
2. *The incumbent auditor always bids $\omega = w^h$ if the client's audit cost is high $(r = h)$; if the client's audit cost is low $(r = l)$, the incumbent auditor randomizes his bid according to $\mathcal{F}_I^l(\omega) = \frac{\omega - \bar{w}}{(1-\hat{\lambda})(\omega - w^l)}$.*

The detailed proof of Proposition 1 follows similar steps in Baldenius, et al. (2023) and is provided in the Appendix.[21] In equilibrium, both auditors will bid over the same range, $[\bar{w}, w^h]$. The incumbent auditor submits his bid based on the private information about the client's cost type. The outside auditor is subject to the winner's curse for the high-cost client. To alleviate the winner's curse, the outside auditor bids the upper bound with a mass point $1 - \mathcal{F}_O(w^h) = \hat{\lambda}$, and randomizes her bid over $[\bar{w}, w^h)$ with a cumulative probability of $\mathcal{F}_O(w^h) = 1 - \hat{\lambda}$ to break even on expectation—i.e., $U_O(\omega) = 0$.

The mass point at the upper bound can be interpreted as the outside auditor's bidding aggressiveness—a smaller mass point implies a more aggressive bidding strategy. Intuitively, the outside auditor seeks to protect himself from the winner curse based on the public information available. Using public information Ω to update her belief about the high-cost type (i.e., $\hat{\lambda}$), the outside auditor adjusts the bidding strategy accordingly.

The incumbent always bids w^h to break even in the high-cost client, but randomizes his bids in the low-cost client. As the best response to the outside auditor's bidding, the incumbent

[21] Baldenius et al. (2023) also depict the density functions of both informed and uninformed bidders in a similar bidding model when bidders have asymmetric information about underlying binary values.

Electronic copy available at: https://ssrn.com/abstract=4634547

randomizes his bidding in the low-cost firm following $\mathcal{F}_I^l(\omega) = \mathcal{F}_O(\omega)/(1-\hat{\lambda})$. For any randomized bid $F \in [\bar{w}, w^h]$, the incumbent earns a constant profit of $(1-\mathcal{F}_O(\omega))(\omega - w^l) = \bar{w} - w^l$ (by substituting $\omega = \bar{w}$) in order for the mixed-strategy bidding equilibrium to hold. This *information rent* $(\bar{w} - w^l)$ is earned due to the incumbent's information advantage over the outside auditor.

Expected audit fees. Following the bidding strategies in Proposition 1, the expected audit fee conditional on the firm's type r, $E[\omega|r]$, is

$$E[\omega|r=l] = \int_{\bar{w}}^{w^h} (1-\mathcal{F}_O(\omega))\omega f_I^l(\omega)d\omega + \int_{\bar{w}}^{w^h} (1-\mathcal{F}_I^l(\omega))\omega f_O(\omega)d\omega, \tag{7}$$

$$E[\omega|r=h] = \hat{\lambda} w^h + \int_{\bar{w}}^{w^h} \omega f_O(\omega)d\omega. \tag{8}$$

When the client firm's cost is low, both the incumbent and the outside auditors randomize their bids over $[\bar{w}, w^h]$. In (7), $1-\mathcal{F}_O(\omega)$ and $1-\mathcal{F}_I^l(\omega)$ represent the winning probability of the incumbent and the outside auditor, respectively. Thus $\int_{\bar{w}}^{w^h}(1-\mathcal{F}_O(\omega))\omega f_I^l(\omega)d\omega$ and $\int_{\bar{w}}^{w^h}(1-\mathcal{F}_I^l(\omega))\omega f_O(\omega)d\omega$ are the expected audit fee when the incumbent or the outside auditor wins, respectively. When the client firm's cost is high, the incumbent always bids w^h, but the outside auditor bids with a mass point $\hat{\lambda}$ at the upper bound w^h and randomizes her bid over the range $[\bar{w}, w^h)$. Thus with probability $\hat{\lambda}$, the audit fee is w^h. Otherwise, the outside auditor randomizes her bid below w^h, in which case she always wins, yielding an expected audit fee of $\int_{\bar{w}}^{w^h} \omega f_O(\omega)d\omega$. The average audit fee is

$$E[\omega] = \hat{\lambda}E[\omega|r=h] + (1-\hat{\lambda})E[\omega|r=l] = \bar{w} + \underbrace{(1-\hat{\lambda})(\bar{w} - w^l)}_{\text{Information rent}}. \tag{9}$$

Despite the complicated bidding process, the expected audit fee takes a simple form with two components: the break-even audit fee, $\bar{w}$, plus the expected information rent in the low-cost firm, $(1-\hat{\lambda})(\bar{w}-w^l)$. From the firm's perspective, the outside auditor always breaks even and earns zero rent over the two types; but the incumbent auditor earns information rent $\bar{w} - w^l$ if he observes the low-cost type (i.e., with probability $1-\hat{\lambda}$). Therefore the average audit fee across two types of firms always exceeds the expected break-even audit fee.

Electronic copy available at: https://ssrn.com/abstract=4634547

Auditor switching. The client firm switches auditors whenever it receives an external bid lower than the incumbent auditor. In the case of a tie, we assume that the client stays with the incumbent auditor—a reasonable assumption as long as there exists a small transaction cost of switching.[22] Let denote ϕ^h and ϕ^l the probability of switching to the outside auditor when the marginal cost is high and low, respectively. In the absence of information asymmetry, both types of clients would have the same probabilities of switching.[23] With information asymmetry, the bidding strategies characterized in Proposition 1 lead to different probability of switching.

Recall when the client's audit cost is high, the incumbent always bids maximum audit fee w^h. Hence, the outside auditor wins the audit engagement whenever her bid is below w^h, which leads to a total probability of switching,

$$\phi^h = \mathcal{F}_O(w^h) = 1 - \hat{\lambda}.$$

If the client's audit cost is low, however, both the incumbent and the outside auditors play mixed strategies $\{\mathcal{F}_O(\omega),\ \mathcal{F}_I^l(\omega)\}$ over the bidding range. In this case, the incumbent and the outsider has an equal chance to win the tender, so the probability of the outside auditor winning the bid is

$$\phi^l = \int_{\bar{w}}^{w^h} \mathcal{F}_O(\omega) f_I^l(\omega) d\omega = \frac{1-\hat{\lambda}}{2},$$

which is one half of the probability that the outsider does not bid w^h. Comparing the probability of switching for different types of firms, we have the following result.

Lemma 1 *A high-cost client is more likely to switch to an outside auditor than a low-cost*

[22] The tie-breaking rule is a reasonable assumption if the firm incurs an explicit switching cost (that we do not model) when switching to a new auditor (see DeAngelo 1981; Kanodia and Mukherji 1994). If we assume alternative tie-breaking rules, our main results still hold. This is because any other tie-breaking rule only increases the probability of high-cost firms switching to outside auditors, yet it does not change the switching probability for the low-cost firms—the difference between these two probabilities is the key driving force of our main results. Notice that the audit fee does not depend on the assumption about particular tie-breaking rules.

[23] If there is no information asymmetry, both auditors follow the exactly same strategy. Thus no switching would occur given a tie-breaking rule that favors the incumbent or both high- and low-cost firms switch with half probability given a a 50-50 tie-breaking rule.

Electronic copy available at: https://ssrn.com/abstract=4634547

client ($\phi^h > \phi^l$).

In equilibrium, a high-cost client is more likely to switch its auditor than a low-cost client ($\phi^h > \phi^l$) because the outsider is subject to the "winner's curse" when bidding against an informed auditor. The winner's curse and auditor switching are thus more prominent when a client firm is likely to have a high cost.

The probability of switching depends on the outsider's belief about the client's type $\hat{\lambda}$, which is the mass point that the outside auditor always bids the upper bound w^h. The higher the belief, the less aggressively the outsider bids, and thus the less likely the auditor switching occurs for either type of client. Knowing the client type being high cost, the incumbent never bids below w^h. Whenever the outside auditor randomizes her bid below the upper bound (with a probability $1-\hat{\lambda}$), she always wins the high-cost client (i.e., auditor switching occurs). But for the low-cost type, the incumbent also randomizes his bid over the bidding range and thus both the incumbent and outside auditor has an equal likelihood of winning. The winning probability of the outside auditor is therefore only half of the randomization mass, i.e., $(1-\hat{\lambda})/2$.

3.1.1 Information Content of Auditor Switching and Audited Reports

The information content of auditor switching. Auditor switching in this competitive tender model is purely driven by information asymmetry among auditors. Conditional on the bidding outcome – switching (O) or nonswitching (I), the probabilities of the client's type being high ($r = h$) are

$$Pr(h|O) = \hat{\lambda}\frac{\phi^h}{\phi} \text{ and } Pr(h|I) = \hat{\lambda}\frac{1-\phi^h}{1-\phi}, \tag{10}$$

respectively, where ϕ is the overall expected probability of switching given any prior belief $\hat{\lambda}$ before the bidding, and is calculated as $\phi = \hat{\lambda}\phi^h + (1-\hat{\lambda})\phi^l = (1-\hat{\lambda}^2)/2$.

The following Corollary characterizes the information content of auditor switching by comparing these two probabilities.

Electronic copy available at: https://ssrn.com/abstract=4634547

Corollary 1 *For any given belief $\hat{\lambda}$, the client who switches its auditor is more likely to have a high audit cost than the client who does not, i.e.,* $\Pr(h|O) > Pr(h|I)$.

The result in Corollary 1 is the key driving force of many implications generated from our auditor switching model. Due to the differential switching probabilities for different types of clients, the tender outcome (i.e., switching or nonswitching) itself thus conveys information about the underlying client's type. In our model, the only friction is the information asymmetry about the firm's cost type between the incumbent and outside auditors. Therefore, even without any explicit incentive to switch such as opinion shopping, the information-based auditor switching has a nontrivial effect on the observed audit fees, auditor opinions and audited report informativeness, which we will discuss later.

The information content of the audited report. The audited report issued from the previous period also conveys information about the client's type to an outside auditor in future tenders. After winning the engagement, the auditor can observe the client's true type and thus choose the auditor effort q_r contingent on the client type $r \in \{h, l\}$. When the client's cost is higher, the auditor is more likely to incorrectly attest the client's good report, making a type-II error ($q_h < q_l$). Thus, a high-cost client is more likely to issue a good audited report than a low-cost client. As a result, the audited report offers incremental information to an outside auditor, who cannot observe the client's type.

Specifically, let $\{p_r^g, p_r^b\}$ denote the probability of observing a good and bad audited report for the type-r client, respectively. Having observed the audited report $s \in \{g, b\}$, an outside auditor, without knowing the client type, updates the posterior belief as

$$Pr(h|g) = \frac{\hat{\lambda} p_h^g}{\hat{\lambda} p_h^g + (1-\hat{\lambda}) p_l^g},$$
$$\text{or } Pr(h|b) = \frac{\hat{\lambda} p_h^b}{\hat{\lambda} p_h^b + (1-\hat{\lambda}) p_l^b},$$

where $p_r^g \equiv p + (1-p)(1-q_r)$ and $p_r^b \equiv (1-p)q_r$ represent the probability of issuing a good and bad audited report given the client's type r, respectively.

Given the auditor's different effort levels in these two types of clients, it is straightforward

Electronic copy available at: https://ssrn.com/abstract=4634547

that the high-cost client is more likely to issue a good audited report ($p_h^g > p_l^g$) and less likely to issue a bad audited report ($p_h^b < p_l^b$) than the low-cost client. Therefore, we have the following result about the updated belief about the high-cost type after receiving an audited report.

Corollary 2 *Given any given belief $\hat{\lambda}$, the updated belief about the high-cost type after receiving a good audited report ($s = g$) is higher than that after receiving a bad report ($s = b$), i.e., $Pr(h|g) > Pr(h|b)$.*

This relationship holds regardless of the tender outcome because the outsider, once engaged, can deliver the same auditor effort q_r as the incumbent.

The information content of an audited report is another driving force in our model. At first, it may appear counter-intuitive that the perceived audit cost (or the auditor's concern for the client risk) is lower when a bad (unfavorable) report is observed. To understand the intuition, notice that an outsider auditor's posterior belief on the client's type is different from the posterior beliefs about the firm state, for which a bad report always indicates that the bad state is more likely. An unfavorable audited report, such as goodwill impairment or asset write-down, suggests that the engaged auditor can collect sufficient audit evidence to attest to the client's initial favorable report, implying that the client is less likely to be the high-cost type—lowering the auditor's concern for winner's curse.

3.2 Information Updating in Two-Period Tender

After characterizing the equilibrium bidding strategies in the baseline model, we now explicitly explore the information environment in which an outsider competes with the informed incumbent in a two-period audit tender. The public information Ω determines the outsider's belief of the client's type and subsequently her bidding strategies. The outsider at the beginning of period 1 has only the prior belief of the client's audit cost (that is, the outsider's belief in period 1 is $\hat{\lambda}_1 \equiv \Pr(h|\Omega) = \lambda$). Consequently, in the period-1 tender, the outsider and the incumbent follow the bidding strategies in Proposition 1 where $\hat{\lambda} = \lambda$.

Electronic copy available at: https://ssrn.com/abstract=4634547

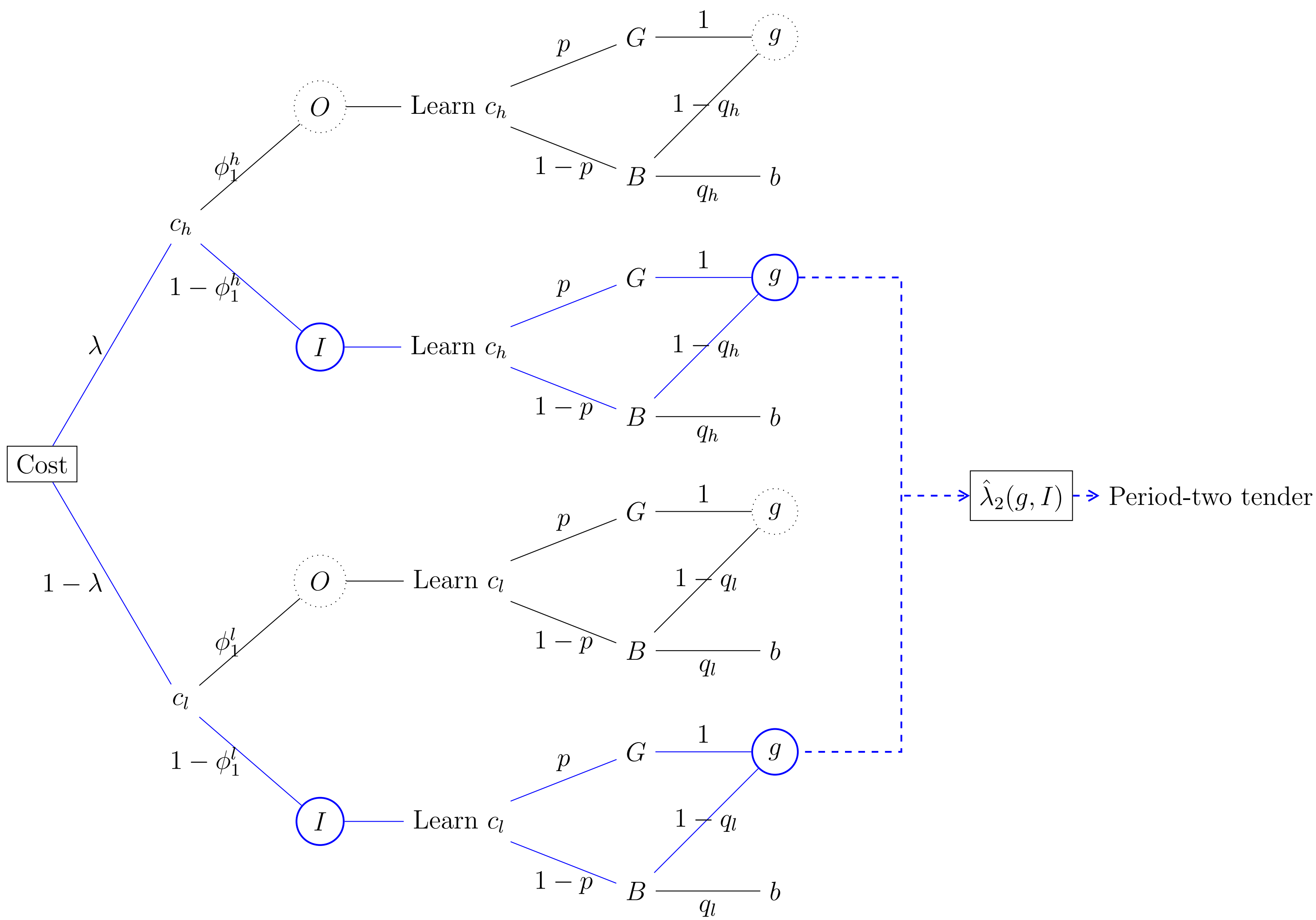

Figure 2: Audit tender outcome and report structure in a two-period model. For period two, the bidding game repeats between the then-incumbent auditor and an outside auditor with the belief about the client's type now being $\hat{\lambda}_2(s_1, z_1)$.

Electronic copy available at: https://ssrn.com/abstract=4634547

At the beginning of period 2, the outsider observes the audited report and the bidding outcome in period 1. Let $s_1 \in \{g, b\}$ denote the period-1 audited report being either good (g) or bad (b) and $z_1 \in \{O, I\}$ denote the bidding outcome in period 1 when an outsider O (or the incumbent auditor I) wins the period-1 engagement. Figure 2 illustrates the bidding outcomes and audited reports after the period-1 bidding.

As Corollary 1 and 2 show, both the audited report s_1 and the bidding outcome z_1 convey information about the client's type to the outsider. Thus, given the public information $\Omega = (s_1, z_1)$, the outside auditor updates the posterior belief about the client's type before bidding in the period-2 tender. Let $\hat{\lambda}_2(s_1, z_1) \equiv Pr(h|s_1, z_1)$ denote the outsider auditor's belief. There are four possible realizations in total as shown in Figure 2. If the outsider observes the audited report $s_1 = g$ and a nonswitching outcome $z_1 = I$ in period 1, the updated belief, following Bayes' rule, is

$$\hat{\lambda}_2(g, I) = \frac{\lambda(1-\phi_1^h)p_h^g}{\lambda(1-\phi_1^h)p_h^g + (1-\lambda)(1-\phi_1^l)p_l^g},$$

where $\phi_1^h = 1-\lambda$ and $\phi_1^l = (1-\lambda)/2$ are the probabilities of an auditor switch in period 1 for the client type h and l, respectively. This case is illustrated by the tree branches with blue lines in Figure 2.

Likewise, the outsider's posterior beliefs for the other cases are given by

$$\hat{\lambda}_2(g, O) = \frac{\lambda\phi_1^h p_h^g}{\lambda\phi_1^h p_h^g + (1-\lambda)\phi_1^l p_l^g},$$
$$\hat{\lambda}_2(b, O) = \frac{\lambda\phi_1^h p_h^b}{\lambda\phi_1^h p_h^b + (1-\lambda)\phi_1^l p_l^b},$$
$$\hat{\lambda}_2(b, I) = \frac{\lambda(1-\phi_1^h)p_h^b}{\lambda(1-\phi_1^h)p_h^b + (1-\lambda)(1-\phi_1^l)p_l^b},$$

where $p_r^g \equiv p + (1-p)(1-q_r)$ and $p_r^b \equiv (1-p)q_r$ are the probabilities of good and bad reports respectively, for any client type r. We compare these updated beliefs for the period-2 tender in Corollary 3.

Corollary 3 *Given the period 1 outcome $\Omega = (s_1, z_1)$ at the beginning of period 2,*

(i) for any switching outcome $z_1 \in \{I, O\}$, the outsider's posterior belief about the high-

Electronic copy available at: https://ssrn.com/abstract=4634547

cost type is higher when the audited report is good than when it is bad, i.e., $\hat{\lambda}_2(g, z_1) > \hat{\lambda}_2(b, z_1)$*;*

(ii) for any audited report $s_1 \in \{g, b\}$*, the outsider's posterior belief about the high-cost type is higher when an auditor switch occurs in period 1, i.e.,* $\hat{\lambda}_2(s_1, O) > \hat{\lambda}_2(s_1, I)$*.*

Corollary 3 compares the magnitudes of the updated belief in one dimension while holding the other information constant. The results follow directly from Corollary 1 and 2. However, when the outsider observes a mixed information set, the comparison can be ambiguous. For example, the updated belief $\hat{\lambda}_2(b, O)$ can be higher or lower than $\hat{\lambda}_2(g, I)$ depending on the prior belief λ.

With the updated belief $\Omega(s_1, z_1)$, the outsider competes with the incumbent auditor in the period-2 tender following the equilibrium bidding strategies in Proposition 1 where $\hat{\lambda} = \hat{\lambda}_2(s_1, z_1)$.

4 Information-Based Auditor Switching and Empirical Implications

The auditing literature has been concerned about auditor switching because it connotes opinion shopping (Lennox, 2000) or impairment of auditor independence (Huang, Raghunandan, Huang, and Chiou, 2015). Although auditor switching is more likely to occur after receiving unfavorable opinions (Krishnan, 1994), most empirical studies have found that clients do not necessarily garner more favorable opinions after changing their auditors (Chow and Rice 1982; Krishnan and Stephens, 1995). In this section, we provide empirical implications of our information-based auditor switching with respect to audit fees, post-switching audited report and audited report informativeness, as well as the link to pre-switching audited report. We abstract away such incentive issues from either clients or auditors since the switching in our model is based solely on a competitive bidding process under asymmetric information.

Electronic copy available at: https://ssrn.com/abstract=4634547

4.1 Auditor Switching and Audit Fees

Empirical evidence shows that audit fees are lower when a client firm switches its auditor through a competitive tender process than when it does not switch the auditor.[24] We derive the expected audit fees from our model and compare the expected audited fees before and after switching.

Let $E[\omega_I]$ and $E[\omega_O]$ denote the expected audit fee if the incumbent or the outside auditor wins, respectively. They are given by:

$$E[\omega_I] = \sum_{r=h,l} \Pr(r) \int_{\bar{w}}^{w^h} \omega(1-\mathcal{F}_O(\omega)) f_I^r(\omega) d\omega,$$
$$\text{and} \quad E[\omega_O] = \sum_{r=h,l} \Pr(r) \int_{\bar{w}}^{w^h} \omega(1-\mathcal{F}_I^r(\omega)) f_O(\omega) d\omega,$$

where $\Pr(r)$ is the outsider's belief that the client's cost is c_r in period $t \in \{1,2\}$. Substituting the equilibrium bidding strategies, $\mathcal{F}_O(\omega)$ and $\mathcal{F}_I^r(\omega)$ in Proposition 1, we obtain the expected audit fees as follows

$$E[\omega_I] = \hat{\lambda} w^h + \frac{1}{2}(1-\hat{\lambda})^2 w^l, \tag{11}$$
$$E[\omega_O] = \hat{\lambda}(1-\hat{\lambda}) w^h + \frac{1}{2}(1-\hat{\lambda})^2 w^l. \tag{12}$$

Proposition 2 *Given any given belief $\hat{\lambda}$, the expected audit fee is always lower when the client firm switches to an outside auditor, i.e., $E[\omega_O] < E[\omega_I]$.*

Because of information advantage, the incumbent auditor earns informational rent in the low-cost client and breaks even in the high-cost client. In contrast, the outside auditor bids w^h with probability $\hat{\lambda}$ and randomizes his bids with total probability of $(1-\hat{\lambda})$, expecting to break even across the client types. However, due to her information advantage, the outsider underbids for the high-cost client. Therefore, from the client's perspective, the incumbent's expected audit fee is higher than the outsider's; that is, $E[\omega_I] - E[\omega_O] = \hat{\lambda}^2 w^h$.

[24] Simon and Francis (1988) show a significant fee reduction in the initial engagement year—an average fee reduction of 24% for ongoing engagements and 15% for each of the next two years. Ettredge and Greenberg (1990) find that for 389 firms that switched auditors in the 1983–1987 period, the mean and median fee cuts reported for initial engagements were 25% and 23%, respectively.

Electronic copy available at: https://ssrn.com/abstract=4634547

Our information-driven fee cut following an auditor switch is related to explanations of low-balling from the private information perspective. For example, Dye (1991) shows that low-balling exists because auditors' quasi-rents cannot be fully disclosed. Kanodia and Mukherji (1994) show that low-balling may arise from a combination of the auditor's private information and switching costs, though they did not directly model auditor competition with asymmetric information.

Although it is often argued that low-balling or a fee reduction might lead to a perceived threat to auditor independence (Huang et al. 2015), we demonstrate that a fee cut can be an outcome of audit tenders with information asymmetry. In our model, once an auditor is engaged and observes the true client type, he or she chooses the optimal audit quality that minimizes the audit cost and legal liability, given the winning price (audit fee). Thus both the incumbent and the outside auditor deliver the same level of audit quality after engagement. In other words, the fee cut by the outside auditor does not impair audit quality in our model.

4.2 Auditor Switching and Post-Switching Audited Reports

In searching for evidence of opinion shopping, research examines whether auditor switching leads to more favorable audit opinions and uses a positive association as supportive evidence (e.g., Lennox 2000). In our model, when the client switches to an outsider, the probability of issuing a good (favorable) audited report indeed changes. We now formally derive and compare the probability of receiving a good audited report from switching and non-switching firms.

For any given belief $\hat{\lambda}$ at the beginning of period t, the probability that the client receives a good report ($s = g$) conditional on an auditor switching (the outside auditor O wins) or nonswitching (the outside auditor I wins), is given by

$$\Pr(s = g|O) = \sum_{r=h,l} \Pr(r|O)[p + (1-p)(1-q_r)],$$
$$\Pr(s = g|I) = \sum_{r=h,l} \Pr(r|I)[p + (1-p)(1-q_r)],$$

Electronic copy available at: https://ssrn.com/abstract=4634547

where the audited report $s \in \{g, b\}$ and the switching outcome $z \in \{O, I\}$ are observable at the end of the period-t tender. As shown in Corollary 1, Conditional on switching, the client is more likely to be a high-cost type ($\Pr(h|O) > \Pr(h|I)$). In addition, when the auditor engages in a high-cost client, the auditor is more likely to incur a type-II error ($q_h < q_l$) and incorrectly issues a good audited report g for the bad state. Together, we show that the overall probability of observing a good audited report conditional on switching is greater than that conditional on non-switching.

Proposition 3 *Given any given belief $\hat{\lambda}$, the probability of issuing a good audited report ($s = g$) is greater upon switching than that upon non-switching, i.e.,* $\Pr(s = g|O) > \Pr(s = g|I)$.

Proposition 3 offers an alternative explanation for the positive association between an auditor switch and post-switching favorable audit opinions. In the absence of opinion shopping, a client has a higher likelihood of receiving a good audited report after auditor switching. As such, researchers may interpret the association with caution.

4.3 Auditor Switching and Informativeness of Audited Reports

Audited financial reports provide important information for users such as investors and regulators to make investment or lending decisions. The usefulness of the audited report depends on how informative it is about the true state of the firm. When the audited report is more informative, decisions based on audited reports can be more efficient. In our model, this informativeness only concerns a good report, since a bad report is perfectly informative about the bad state of the firm. We define the audited report's informativeness as the updated belief about the client's good state (G) upon a good report issued by either outside auditor O or incumbent auditor I, i.e.,

$$\Pr(G|s = g, O) = \frac{Pr(G, g|O)}{Pr(g|O)}, \quad \Pr(G|s = g, I) = \frac{Pr(G, g|I)}{Pr(g|I)}.$$

Since the good state is always perfectly detected, we have $Pr(G, g|O) = Pr(G, g|I) = p$. Hence the audited report's informativeness about the good state is inversely related to the

Electronic copy available at: https://ssrn.com/abstract=4634547

overall probability of receiving a good report, which depends on the expected type-II error for the bad state. From Proposition 3, an outsider is more likely to win the high audit-cost client and generate a larger type-II error, and consequently, the switching firm is more likely to issue a good report. Comparing the informativeness of an audited report issued by different types of auditors, we have the following result.

Proposition 4 *Given any given belief $\hat{\lambda}$, the audited report for a switching client is less informative about the good state than that for a nonswitching client, i.e.,* $\Pr(G|s = g, O) < \Pr(G|s = g, I)$.

Note that the difference in the informativeness of audited reports is not driven by the audit quality provided by incumbent and outside auditors, because both auditors exert the same level of effort after engaging with a type-r client. However, because the outside auditor and other users of audited reports lack perfect information about the client's unobservable audit-cost type, the identity of the auditor issuing the report becomes critical to understand the information contained in audited reports. Thus the information content associated with auditor switching leads to the disparity in the audited report's informativeness between switching and nonswitching auditors.

4.4 Audited Reports and Subsequent Auditor Switching

Prior studies have documented a positive association that auditor switching is more likely after a client firm issues unfavorable audited reports in the previous period (Chow and Rice 1982; Krishnan 1994; Xing et al. 2023; Ayres et al. 2019). Regulators are concerned about this empirical evidence because it may connote opinion shopping. To shed light on this issue, we now study the link between the audited report in period 1 and auditor switching in period 2. Specifically, after observing the audited report $s_1 \in \{g, b\}$ and the switching outcome $z_1 \in \{O, I\}$ in period 1, the outsider's updated belief is $\hat{\lambda}_2(s_1, z_1)$ prior to making a bid in the period-2 tender. Subsequently, given the updated belief $\hat{\lambda}_2(s_1, z_1)$, the expected probability

Electronic copy available at: https://ssrn.com/abstract=4634547

of auditor switching in the period-2 audit tender is

$$\phi_2(s_1, z_1) = \frac{1 - \hat{\lambda}_2(s_1, z_1)^2}{2}.$$

As Corollary 3 shows, for any switching outcome $z_1 \in \{I, O\}$, the outsider's posterior belief about the high-cost type is lower when the audited report is bad than when it is good ($\hat{\lambda}_2(b, z_1) < \hat{\lambda}_2(g, z_1)$). When the posterior belief is lower, the outsider bids more aggressively, making a subsequent auditor switch in period 2 more likely ($\phi_2(s_1 = b, z_1) > \phi_2(s_1 = g, z_1)$)). The result holds both unconditional and conditional on the switching outcome in period 1. We state this prediction in the following proposition.

Proposition 5 *Auditor switching in period 2 is more likely when the period-1 report is bad than when it is good. This relationship holds both conditional on the period-1 switching outcome* $z_1 \in \{O, I\}$ *(*$\phi_2(s_1 = b, z_1) > \phi_2(s_1 = g, z_1)$*) and unconditionally (*$\phi_2(s_1 = b) > \phi_2(s_1 = g)$*).*

The results in Proposition 5 align with the empirical evidence that an auditor switch is preceded by unfavorable audited reports. Our result is driven by the competition between informed incumbent and outside auditors. It is worth noting that one does not need to interpret an unfavorable audited report as a "modified", "qualified" or "going concern" auditor opinion as these types of opinions are relatively uncommon in practice. Researchers have documented that the positive association holds in different forms of unfavorable audited financial reports, such as conservative attestations or judgments by auditors (Krishnan 1994) and goodwill impairments (Ayres et al. 2019; Xing, et al. 2023).

4.5 Empirical Implications and Discussions

To summarize, our two-period audit tender model offers the following four predictions that can be linked to empirical metrics:

- A high audit-cost client firm is more likely than a low audit-cost client to switch its auditor.

Electronic copy available at: https://ssrn.com/abstract=4634547

- The audit fee of a switching firm is, on average, lower than that of a nonswitching firm.
- A client firm is more likely to switch its auditor after the auditor issues an unfavorable audited report in period 1.
- A switching firm is more likely to receive a favorable audited report than a nonswitching firm.

These results are generally consistent with the regulatory concerns related to "opinion shopping" related to auditor switching (SEC, 2000; Defond and Zhang 2014). However, in the model, we abstract away "opinion shopping" incentive or "independence" issue when the client firm switches auditors. The auditors possess the same audit technology and can perform the audit equally well after engagement. The only economic force that plays a critical role is asymmetric information about the client firm's cost type between the incumbent and outside auditors in the tender process. We show that information-based auditor switching may lead to the same phenomena that concern regulators. This information perspective has not received much attention to in the literature. In other words, we provide alternative explanations for these empirical phenomena or at least caution empiricists and regulators to consider the information-related factors that drive auditor switches when interpreting the empirical results or attempting to scrutinize the audit market.

EU audit reform. The primary challenge in empirically test our predictions is the unobservability of tender processes. Furthermore, companies might refrain from actively initiating a tender for their audit services if they are concerned about the negative market response, as the tender could be misconstrued as opinion shopping. Consequently, the EU audit reform presents an opportunity to investigate our theory of auditor switching via the tender process. Since the implementation of the EU audit reform, researchers have had the opportunity to observe and analyze the disclosed tender process and its outcomes. As such, they can examine and estimate how the likelihood of auditor switching is influenced by the information asymmetry between the incumbent and outside auditors.

Electronic copy available at: https://ssrn.com/abstract=4634547

Internal control weakness. Another possible application of our model is to examine the impact of internal control weakness (ICW) disclosures on audit market competition and auditor switching after the Sarbanes-Oxley Act of 2002 (SOX). Outside auditors could use ICW disclosures as a lens through which to examine a client's audit cost. If a client discloses a material internal-control weakness, an outside auditor would bid less aggressively (i.e., a higher audit fee) against the incumbent auditor because the client's audit cost is more likely to be high. As a result, in the post-SOX era, all else equal, auditor switching is less likely after a client discloses ICW. In particular, the overall expected audit fees increase with ICW disclosures, which is consistent with the empirical evidence in Hogan and Wilkins (2008).

5 Extensions

5.1 Multi-Period Audit Tender and Auditor Tenure

We extend the analysis to a multi-period tender where in each tender, the incumbent, who has engaged with the client, competes with an outsider who has no prior engagement with the client. This process of audit tendering repeats in each period, with updated beliefs formed at the beginning of each period based on the historical bidding outcomes and audited reports. In this multi-period audit tender context, we intend to explore the interplay between auditor tenure, audited reports and auditor switching.

At the beginning of period t, an outsider auditor can observe the public information, which includes all audited reports and the bidding outcomes in prior periods $\Omega = (s_1, ..., s_{t-1}, z_1, ..., z_{t-1})$. Given the public information Ω, the outside auditor updates the belief about the client's type $\hat{\lambda}_t = \Pr(h|\Omega)$ before bidding in the period-t tender. As we show in the baseline model, given the updated belief $\hat{\lambda}_t$, the probabilities of auditor switching for the high and low risk clients in period t are ϕ_t^h and ϕ_t^l, respectively, where $\phi_t^h = 1 - \hat{\lambda}_t$ and $\phi_t^l = \hat{\lambda}_t/2$.

To analyze the effect of auditor tenure, we consider the special case in which the incumbent auditor has engaged continuously with the client in the previous n periods starting from period 1. The parameter n represents the length of auditor tenure. The outsider's updated belief is

Electronic copy available at: https://ssrn.com/abstract=4634547

influenced by the historical audited reports $(s_1, ..., s_{t-1})$ and the bidding outcomes $(z_1, ..., z_{t-1})$. In order to focus on the effect of auditor tenure, we calculate the outsider's updated belief by taking the expectation over the audited reports in the previous n periods in period t. Let $\hat{\Lambda}_n$ denote the outsider's updated belief given that the incumbent has engaged with the client uninterruptedly during the past n periods. Specifically, at the beginning of period 2, given that the incumbent has engaged with the client for one period (i.e., $n = 1$), the outsider's updated belief, averaging out the audited report $s_1 \in \{g, b\}$ in period 1, is

$$\hat{\Lambda}_1 = Pr(h|z_1 = I) = \frac{2\lambda^2}{1+\lambda^2}.$$

In contrast, given that the incumbent's tenure with the client in both period 1 and 2 ($n = 2$), the outsider's updated belief at the beginning of period 3 is

$$\hat{\Lambda}_2 = Pr(h|z_2 = I, z_1 = I) = \frac{2\hat{\Lambda}_1^2}{1+\hat{\Lambda}_1^2}.$$

We can generalize the outsider's updated belief, provided that the incumbent's uninterrupted tenure during the past n periods, is

$$\hat{\Lambda}_n = Pr(h|z_n = I, z_{n-1} = I, ..., z_1 = I) = \frac{2\hat{\Lambda}_{n-1}^2}{1+\hat{\Lambda}_{n-1}^2}. \tag{13}$$

Figure 5.1 illustrates the relationship between the prior belief λ and the updated beliefs when the incumbent has continuously engaged for 1, 2, 3 periods, respectively. The x-axis represents the prior belief λ whereas the y-axis is the updated belief $\hat{\Lambda}_n$ for $n \in \{1, 2, 3\}$.

The length of the incumbent's uninterrupted tenure n conveys information to the outsider about the client's type. If the client's type is publicly known ($\lambda = 0$ or 1), the incumbent has no information advantage over the outsider. As the audit market is perfectly competitive without information asymmetry, both the incumbent and the outsider have an equal probability to win the engagement. Consequently, the length of the incumbent's tenure n has no information content. Conversely, if there is uncertainty about the client's type, the incumbent is better informed than the outsider and the bidding follows our mixed-strategy equilibrium. As a

Electronic copy available at: https://ssrn.com/abstract=4634547

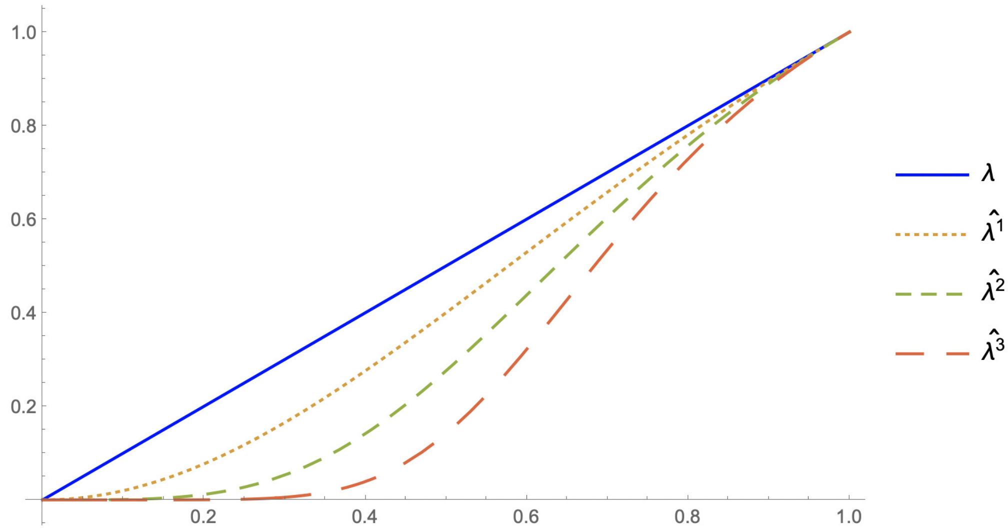

Figure 3: Updated beliefs $\widehat{\lambda^n}$, where $n = 1, 2, 3$.

high-cost client is more likely to switch to an outside auditor than a low-cost client in each period, the length of the incumbent's tenure conveys additional information to the outsider. The longer the incumbent has continuously engaged with the client, the more likely the client's type is low. That is, $\hat{\Lambda}_n$ decreases in n for any $0 < \lambda < 1$. This negation relationship offers some important implications. Following the discussions in Section 4, we summarize these implications in the following proposition.

Proposition 6 *When the incumbent auditor's tenure with the client is longer,*

- *the client firm is more likely to switch;*
- *the audit report becomes more informative;*
- *the audit fee charged by the incumbent auditor decreases;*
- *the audit fee cut is smaller if the client firm switches to an outside auditor.*

Based on the assumption that the incumbent has information advantage, Proposition 6 predict that the likelihood of auditor switching increases as auditor tenure increases. When the incumbent's tenure is longer, the outsider is less concerned about the winner's curse for

Electronic copy available at: https://ssrn.com/abstract=4634547

the high-type client, thus bidding more aggressively and increasing the likelihood of auditor switching.

Regulators have expressed ongoing concerns that long auditor-client relations may threaten auditor independence and impede audit quality (Defond and Zhang 2014). However, most empirical studies have found that long auditor tenure does not necessarily impair audit quality; in fact, it may even improve audit quality.[25] Our multi-period model offers an explanation for this empirical evidence. We show that prolonged auditor tenure is associated with more informative audited reports due to lower type-II errors. This phenomenon arises from the repeated tender with information updating, where auditors are more inclined to retain the engagement when their clients have low audit costs.

In terms of audit fees, we predict that long auditor tenure leads to a gradual decrease in the expected audit fee charged by the incumbent auditor over time. In our model, the actual audit cost remains unchanged over time. However, competition in the audit market, through the tender process, leads to a progressive reduction in information asymmetry, thus lowering the average fees charged by the incumbent over time.

Both predictions are aligned with the results of structural estimation in Cheynel and Zhou (2023). While the main driving force in their study is the decreasing audit costs over auditor tenure, our predictions are based on the reduction of the incumbent's information advantage over time.

5.2 Audit Tender with Switching Costs

In the main model, we concentrate on examining the impact of the incumbent's information advantage. Consequently, we assume that auditors do not incur any exogenous switching costs when engaging with a new client. It is worth noting that the tie-breaking rule in our model implicitly assumes the existence of such a switching cost. Specifically, when the incumbent and the outside auditors submit the same audit fee bids, the client firm chooses to retain the

[25]For example, Ghosh and Moon (2005) found that longer tenure is associated with better earnings quality as perceived by equity market investors. Johnson, Khurana, and Reynolds (2002) also find that auditor's long tenure does not impair audit quality.

Electronic copy available at: https://ssrn.com/abstract=4634547

incumbent, primarily because auditor switching could result in an (un-modelled) switching cost.

However, in practice, auditors may encounter non-negligible set-up and learning costs when beginning engagements with new client firms (DeAngelo, 1981; Magee and Tseng, 1990; Cheynel and Zhou 2023). In order to account for these practical considerations, we extend the model to include an additional switching cost $k > 0$, which represents the set-up costs incurred by the outsider after successfully winning an engagement.[26] We still denote the incumbent bidding strategy as $\mathcal{F}_I^r(\omega)$ and the outsider's as $\mathcal{F}_O(\omega)$ when submitting a bid ω.[27] We characterize the auditors' bidding strategies with information asymmetry and a switching cost in the following Lemma.

Lemma 2 *Given the outside auditor's belief $\hat{\lambda} \equiv \Pr(h|\Omega)$ and the switching cost k, there exists a unique mixed-strategy bidding equilibrium for the incumbent and outside auditors as below:*

1. *The uninformed outside auditor randomizes her bid over the support $[\bar{w} + k, w^h + k]$ according to $\mathcal{F}_O(\omega) = \frac{\omega - \bar{w} - k}{\omega - w^l}$, and bids $w^h + k$ with probability*

$$1 - \mathcal{F}_O(w^h + k) = \hat{\lambda} + \frac{k(1 - \hat{\lambda})}{k + w^h - w^l}.$$

2. *If the client's audit cost is high ($r = h$), the informed incumbent auditor always bids $\omega = w^h + k$; if the client's audit cost is low ($r = l$), the informed incumbent auditor randomizes his bid according to $\mathcal{F}_I^l(\omega) = \frac{\omega - \bar{w} - k}{(1-\hat{\lambda})(\omega - w^l - k)}$.*

The bidding range of both auditors is now upward shifted by the switching cost k, i.e., $[\bar{w} + k, w^h + k]$. Notice that when $k = 0$, the equilibrium converges to the main model in Proposition 1. In addition, it is worth noting that although the incumbent's actual audit

[26] It is worth noting that the tie-breaking rule in our model implicitly assumes the existence of a potential switching cost. Specifically, when the incumbent and the outside auditors submit the same audit fee bids, the client firm chooses to retain the incumbent, if auditor switching may result in any switching cost.

[27] The analysis and proof of the bidding strategies is available upon request.

Electronic copy available at: https://ssrn.com/abstract=4634547

cost in the high-cost firm is w^h, he is able to obtain additional rent due to the switching cost imposed on the outside auditor. In the case of the low-cost client, the incumbent earns rent from both the switching cost and information advantage.

The outside auditor's switching cost k increases her own bid to ensure break-even upon winning, and the incumbent also increases his bid to maximize his own profit from bidding. The outsider's bidding becomes *less aggressive* with a mass point of bidding the upper bound at $\hat{\lambda} + \frac{k(1-\hat{\lambda})}{k+w^h-w^l}$, which increases with the switching cost k. As a result, the switching cost decreases the probability of auditor switching.

Proposition 7 *The probability of auditor switching always decreases with the switching cost k. For any given $k > 0$, a high-audit-cost client is more likely to switch than a low-cost client.*

The presence of a switching cost lessens the impact of information asymmetry on auditor switching because it discourages the outsider from participating in the tender and thus reduces the probability of switching. However, the predictions concerning auditor switching in Section 4 remain valid. This is primarily because these predictions are rooted in the outsider's information disadvantage, which remains unaffected by the presence of a switching cost.

6 Concluding Remarks

In this paper, we present a model of information-driven auditor switching in a two-period setting where a client firm seeks to engage an auditor in each period. The incumbent auditor, equipped with private information regarding the client's cost type, competes against an uninformed outside auditor. Auditor switching occurs when the client chooses an outside auditor who submits a lower bid than the incumbent. The incumbent's information advantage puts the outside auditor at risk of the winner's curse if winning a high-cost client.

Drawing from auditor competition, our information-based theory of auditor switching provides researchers a new perspective for interpreting empirical evidence on auditor switching. We show that in equilibrium, a high-audit-cost client firm is more prone to switching to an outside auditor, especially following an unfavorable audited report. Our findings indicate that

Electronic copy available at: https://ssrn.com/abstract=4634547

firms that switch auditors tend to have lower audit fees and a higher probability of receiving a favorable audited report from the outside auditor, compared to non-switching firms.

Abstracting away elements of opinion shopping or auditor independence, our model relies on information asymmetry to generate predictions aligning with prevailing empirical findings. While extant studies have frequently attributed auditor switching to opinion shopping, we show that even in the absence of incentives for opinion shopping, auditor switching can naturally occur as a result of auditor competition. Our study suggests that when empirically examining the incentives of opinion shopping, researchers may need to control for the varying switching probability due to different client types and information content from the pre-switching audited reports.

Our baseline model relies on information asymmetry to explain established empirical findings. Future research may incorporate the element of opinion shopping into an audit tender, thereby disentangling the conditions influencing auditor switching, whether driven by information asymmetry, opinion shopping, or a combination of both.

Electronic copy available at: https://ssrn.com/abstract=4634547

References

[1] Antle, R., Nalebuff, B., 1991. Conservatism and auditor-client negotiation. *Journal of Accounting Research* 29 (Supplement): 31-54.

[2] Ayres, D. R., T. L. Neal, L. C. Reid, and J. E. Shipman. 2019. Auditing goodwill in the post-amortization era: Challenges for auditors. *Contemporary Accounting Research* 36 (1): 82-107.

[3] Baldenius, T., M. Deng, and J. Li. 2023. Accounting information and risk shifting with asymmetrically informed creditors. *Journal of Accounting and Economics* forthcoming.

[4] Beattie, V., and S. Fearnley. 1998. Audit market competition: auditor changes and the impact of tendering. *The British Accounting Review* 30 (3): 261-289.

[5] Beatty, A., and J. Weber. 2006. Accounting discretion in fair value estimates: An examination of SFAS 142 goodwill impairments. *Journal of Accounting Research* 44 (2): 257-288.

[6] Bockus, K., and and F. Gigler. 1998. A theory of auditor resignation. *Journal of Accounting Research* 36 (2): 191-208.

[7] Brumfield, C., R. Elliot, and P. Jacobson. 1983. Business risk and the audit process. *Journal of Accountancy* 155: 60-68.

[8] Chan, D., and S. Pae. 1998. An analysis of the economic consequences of the proportionate liability rule. *Contemporary Accounting Research* 15 (4): 457-480.

[9] Chen, V., Keung, E., Lin. I-M., 2019. Disclosure of fair value measurement in goodwill impairment test and audit fees. *Journal of Contemporary Accounting and Economics* 15(3): 100160.

[10] Cheynel, E. and F. S. Zhou. 2023. Auditor tenure and misreporting: Evidence from a dynamic oligopoly game. *Management Science* forthcoming.

Electronic copy available at: https://ssrn.com/abstract=4634547

[11] Chow, C.W. and J. Rice. 1982. Qualified audit opinions and auditor switching. *The Accounting Review* 57 (2): 326-335.

[12] DeAngelo, L. 1981. Auditor independence, "low-balling", and disclosure regulation. *Journal of Accounting and Economics* 3 (2): 113-127.

[13] DeFond, M., and J. Zhang. 2014. A review of archival auditing research. *Journal of Accounting and Economics* 58 (2-3): 275-326.

[14] Dye, R. A. 1991. Informationally motivated auditor replacement. *Journal of Accounting and Economics* 14 (4): 347-374.

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

[16] Engelbrecht-Wiggans, R., P. R. Milgrom, and R. J. Weber. 1983. Competitive bidding and proprietary information. *Journal of Mathematical Economics* 11 (2): 161–169.

[17] Ettredge, M. L., and R. Greenberg. 1990. Determinants of fee cutting on initial audit engagements. *Journal of Accounting Research* 28 (1): 198-210.

[18] Ettredge, M. L., C. Li, and S. Scholz. 2007. Audit fees and auditor dismissals in the Sarbanes-Oxley era. *Accounting Horizons* 21 (4): 371-386.

[19] Ghosh, A., and D. Moon. 2005. Auditor tenure and perceptions of audit quality. *The Accounting Review* 80 (2): 585–612.

[20] Gibbins, M., S. Salterio, and A. Webb. 2001. Evidence about auditor-client management negotiation concerning client's financial reporting. *Journal of Accounting Research* 39 (3): 535â€“563.

[21] Fiolleau, K., K. Hoang, K. Jamal, and S. Sunder. 2013. How do regulatory reforms to enhance auditor independence work in practice? *Contemporary Accounting Research* 30 (3): 864-890.

[22] Gao, P., and G. Zhang. 2019. Accounting manipulation, peer pressure, and internal control. *The Accounting Review* 94 (1): 127-151.

Electronic copy available at: https://ssrn.com/abstract=4634547

[23] Gigler, F., and M. Penno. 1995. Imperfect competition in audit market and its effect on the demand for audit-related services. *The Accounting Review* 70 (2): 317-336.

[24] Goddard, F., and M. Schmidt. 2021. Exploratory insights into audit fee increases: A field study into board member perceptions of auditor pricing practices. *International Journal of Auditing* 25 (3): 637-660.

[25] Hallman, N., A. Kartapanis, and J. Schmidt. 2022. How do auditors respond to competition? Evidence from the bidding process. *Journal of Accounting and Economics* 73 (2-3): 101475.

[26] Hillegeist, S. A. 1999. Financial reporting and auditing under alternative damage apportionment rules. *The Accounting Review* 74 (3): 347-369.

[27] Houston, R. W., M. F. Peters, and J. H. Pratt. 1999. The Audit Risk Model, Business Risk and Audit-Planning Decisions. *The Accounting Review* 74 (3): 281-298.

[28] Huang, H. W., K. Raghunandan, T. C. Huang, and J. R. Chiou. 2015. Fee discounting and audit quality following audit firm and audit partner changes: Chinese evidence. *The Accounting Review* 90 (4): 1517-1546.

[29] Johnson, V. E., I. K. Khurana, and J. K. Reynolds. 2002. Audit-firm tenure and the quality of financial reports. Contemporary Accounting Research 19 (4): 637-660.

[30] Johnstone, K. M., J. C. Bedard, and M. L. Ettredge. 2004. The effect of competitive bidding on engagement planning and pricing. *Contemporary accounting research* 21 (1): 25-53.

[31] Kanodia, C,. and A. Mukherji. 1994. Audit pricing, low-balling and auditor turnover: A dynamic analysis. *The Accounting Review* 69 (4): 593-615.

[32] Krishnan, J. 1994. Auditor switching and conservatism. *The Accounting Review* 69 (1): 200-215.

[33] Krishnan, J., and R. G. Stephens. 1995. Evidence on opinion shopping from audit opinion conservatism. *Journal of Accounting and public Policy* 14 (3): 179-201.

Electronic copy available at: https://ssrn.com/abstract=4634547

[34] Laux, V. and P. Newman. 2010. Auditor liability and client acceptance decisions. *The Accounting Review* 85 (1): 261-285.

[35] Lawrence, A., R. Sloan, Y. Sun. 2013. Non-discretionary conservatism: Evidence and implications. *Journal of Accounting and Economics* 56 (2): 112-133.

[36] Lennox, C. 2000. Do companies successfully engage in opinion-shopping? Evidence from the UK. *Journal of Accounting and Economics* 29 (3): 321-337.

[37] Lu, T. 2006. Does opinion shopping impair auditor independence and audit quality?. *Journal of Accounting Research* 44 (3): 561-583.

[38] Magee, R., and M. Tseng. 1990. Audit pricing and independence. *The Accounting Review* 65 (2): 315-336.

[39] Milgrom, P., and R. Webber. 1982. The value of information in a sealed-bid auction. *Journal of Mathematical Economics* 10: 105-114.

[40] Morgan, J., and P. C. Stocken. 1998. The effects of business risk on audit pricing. *Review of Accounting Studies* 3: 365-385.

[41] Petrov, E., and P. C. Stocken. 2022. Auditor specialization and information spillovers. *The Accounting Review* 97 (7): 401-428.

[42] Radhakrishnan, S. 1999. Investors' recovery friction and auditor liability rules. *The Accounting Review* 74 (2): 225-240.

[43] Ramanna, K., and R. Watts. 2012. Evidence on the use of unverifiable estimates in required goodwill impairment. *Review of Accounting Studies* 17: 749-780.

[44] Securities and Exchange Commission (SEC). 1988. SEC Accounting Guide. 1 June 1988. Chicago: Commerce Clearing House.

[45] Securities and Exchange Commission (SEC). 2000. Revision of the commission's auditor independence requirements. Financial Reporting Release No. 56. Washington, DC: SEC.

Electronic copy available at: https://ssrn.com/abstract=4634547

[46] Simon, D. T., and J. R. Francis. 1988. The effects of auditor change on audit fees: Tests of price cutting and price recovery. *The Accounting Review* 63 (2): 255-269.

[47] Stefaniak, C. M., J. C. Robertson, and R. W. Houston. 2009. The causes and consequences of auditor switching: a review of the literature. *Journal of Accounting Literature* 28: 47-121.

[48] Willekens, M., D. Rakic, and J. Cujkova. 2019. EU Statutory Audit Reform—Impacts on costs, concentration and competition. European Parliament's Committee on Economic and Monetary Affairs.

[49] Xing, C., H. Yuwen, and D. Yang. 2023. Goodwill impairment, auditor dismissal and opinion shoppingâ€“evidence from China. *China Journal of Accounting Studies* forthcoming.

[50] Ye, M. 2023. The Theory of Auditing Economics: Evidence and Suggestions for Future Research. *Foundations and Trends in Accounting* 18 (3): 138-267.

[51] Ye, M., and D. A. Simunic. 2013. The economics of setting auditing standards. *Contemporary Accounting Research* 30 (3): 1191-1215.

Electronic copy available at: https://ssrn.com/abstract=4634547

Appendix I: Proofs

Proof of Proposition 1

First of all, following similar arguments in Baldenius, Deng and Li (2023), we can show the following results: a) the bidding range is $[\bar{w}, w^h]$; b) the uninformed outside auditor will adopt a randomized bidding strategy over the bidding range; c) the informed incumbent auditor also randomizes over the bidding range if the client's audit cost is low. When the client's audit cost is high, the incumbent will adopt a pure strategy to always bid w^h.

Denote the outside auditor's bidding strategy by its cumulative distribution function (c.d.f) of the bid $\mathcal{F}_O(\omega)$, conditional on public information Ω. Let $\mathcal{F}_I^r(\omega)$ denote the c.d.f. of the bid from an informed incumbent auditor, conditional on her private information about the type r. The incumbent always bids w^h for the high-cost type and earns zero profit. We only need to solve $\mathcal{F}_O(\omega)$ and $\mathcal{F}_I^l(\omega)$. For any bid ω, the outside auditor's expected payoff given the incumbent's bidding strategy is

$$E[U_O(\omega)] = \hat{\lambda}(1 - \mathcal{F}_I^h(\omega))(\omega - w^h) + (1 - \hat{\lambda})(1 - \mathcal{F}_I^l(\omega))(\omega - w^l).$$

In the expected payoff, $(1 - \mathcal{F}_I^r(\omega))$ is the probability that the outsider wins the bid. Since the incumbent always bids w^h in the high-cost firm, $1 - \mathcal{F}_I^h = 1$ for any ω. The outside auditor should always break even for any bid. Therefore, setting the outsider's expected payoff to be zero, $E[U_O(\omega)] = 0$, we obtain that

$$\mathcal{F}_I^l(\omega) = \frac{\omega - \bar{w}}{(1 - \hat{\lambda})(\omega - w^l)}.$$

When the client's type is low cost, the incumbent's payoff is

$$E[U_I^l(\omega)] = (1 - \mathcal{F}_O(\omega))(\omega - w^l).$$

For any bid submitted, the incumbent expects to earn a constant payoff (i.e., information rent) in order for the mixed strategy equilibrium to sustain, which is the difference between the outsider's break-even bids $\bar{w}$ and the audit cost for the low-type client, $\bar{w} - w^l$. Solving

Electronic copy available at: https://ssrn.com/abstract=4634547

$E[U_I^l(\omega)] = \bar{w} - w^l$, we get

$$\mathcal{F}_O(\omega) = \frac{\omega - \bar{w}}{\omega - w^l}.$$

Given $\mathcal{F}_O(\omega)$ and $\mathcal{F}_I^l(\omega)$, we can show that the c.d.f. over the support $[\bar{w}, w^h)$ for both bidders as

$$\lim_{\omega \to w^h} \mathcal{F}_O(\omega) = \frac{w^h - \bar{w}}{w^h - w^l} = 1 - \hat{\lambda},$$
$$\lim_{\omega \to w^h} \mathcal{F}_I^l(\omega) = 1.$$

Therefore, the outside auditor randomizes her bid over the support $[\bar{w}, w^h)$ according to $\mathcal{F}_O(\omega) = \frac{\omega - \bar{w}}{\omega - w^l}$, and bids the upper bound w^h with probability $\hat{\lambda}$. The incumbent auditor randomizes his bid over $[\bar{w}, w^h)$ according to $\mathcal{F}_I^l(\omega) = \frac{\omega - \bar{w}}{(1-\hat{\lambda})(\omega - w^l)}$. This completes the proof. QED

Proof of Equation (9)

From the bidding strategies in Proposition 1, we have the probability density function of bidding as

$$f_O(\omega) = \frac{\hat{\lambda}(w^h - w^l)}{(\omega - w^l)^2},$$
$$f_I^l(\omega) = \frac{\hat{\lambda}(w^h - w^l)}{(1 - \hat{\lambda})(\omega - w^l)^2}.$$

Substituting $\mathcal{F}_I^l(\omega)$, $\mathcal{F}_O(\omega)$, $f_I^l(\omega)$, and $f_O(\omega)$ into the audit fee equations in (7) and (8), we obtain that

$$\begin{aligned} E[\omega^l] &= \int_{\bar{w}}^{w^h} (1 - \frac{\omega - \bar{w}}{(1-\hat{\lambda})(\omega - w^l)}) \frac{\omega \hat{\lambda}(w^h - w^l)}{(\omega - w^l)^2} + (1 - \frac{\omega - \bar{w}}{\omega - w^l}) \frac{\omega \hat{\lambda}(w^h - w^l)}{(1-\hat{\lambda})(\omega - w^l)^2} d\omega \\ &= w^l + 2\hat{\lambda}(w^h - w^l) + \frac{\hat{\lambda}(w^h - w^l)}{1 - \hat{\lambda}} \ln(\hat{\lambda}) \end{aligned}$$

and

$$E[\omega^h] = \hat{\lambda} w^h + \int_{\bar{w}}^{w^h} \omega \frac{\hat{\lambda}(w^h - w^l)}{(\omega - w^l)^2} d\omega = \hat{\lambda} w^h + (1 - \hat{\lambda}) w^l - \hat{\lambda}(w^h - w^l) \ln(\hat{\lambda}).$$

Electronic copy available at: https://ssrn.com/abstract=4634547

The ex-ante expected audit fee is

$$E[\omega] = \hat{\lambda} E[\omega^h] + (1-\hat{\lambda})E[\omega^l] = \hat{\lambda}\bar{w}^j + (1-\hat{\lambda})(\bar{w} - w^l).$$

QED

Proof of Lemma 1

When the audit cost is high, the outside auditor wins as long as she bids any price below w^h. Thus the probability that the outside auditor wins the audit engagement is $\phi_h = \mathcal{F}_O(w^h) = 1 - \hat{\lambda}$. When the audit cost is low, the probability that the outside auditor wins the audit engagement is

$$\begin{aligned}
\phi_l &= \int_{\bar{w}}^{w^h} \int_{\omega}^{w^h} f_I^l(x) dx f_O(\omega) d\omega \\
&= \int_{\bar{w}}^{w^h} \left[\frac{\omega - \bar{w}}{\omega - w^l} \frac{\hat{\lambda}(w^h - w^l)}{(1-\hat{\lambda})(\omega - w^l)^2} \right] d\omega \\
&= \frac{1-\hat{\lambda}}{2}.
\end{aligned}$$

Hence $\phi_h > \phi_l$. Ex ante, without observing the client type, the client firm expects to switch to the outside auditor with a probability of

$$\phi \equiv \hat{\lambda}\phi_h + (1-\hat{\lambda})\phi_l = \frac{1-\hat{\lambda}^2}{2}.$$

QED

Proof of Corollary 1

The posterior probabilities of the high-cost type conditional on switching (O) and non-switching (I) are given by

$$\begin{aligned}
\Pr(r = h|O) &= \frac{\hat{\lambda}\phi_h}{\hat{\lambda}\phi_h + (1-\hat{\lambda})\phi_l} = \frac{\hat{\lambda}\phi_h}{\phi}, \\
\textit{and } \Pr(r = h|I) &= \frac{\hat{\lambda}(1-\phi_h)}{\hat{\lambda}(1-\phi_h) + (1-\hat{\lambda})(1-\phi_l)} = \frac{\hat{\lambda}(1-\phi_h)}{1-\phi},
\end{aligned}$$

Electronic copy available at: https://ssrn.com/abstract=4634547

respectively, where $\phi = \hat{\lambda}\phi_h + (1-\hat{\lambda})\phi_l$ is the overall expected probability of switching.

Since $\phi_h > \phi > \phi_l$ from Lemma 1, we can show that

$$\frac{\phi_h}{\phi} > 1 > \frac{1-\phi_h}{1-\phi} \Rightarrow \Pr(r = h|O) > \Pr(r = h|I).$$

QED

Proof of Corollary 2

Given the audited report $s \in \{g, b\}$, an outside auditor's posterior belief about the high-cost type is

$$Pr(h|g) = \frac{\hat{\lambda}p_h^g}{\hat{\lambda}p_h^g + (1-\hat{\lambda})p_l^g} = \frac{\hat{\lambda}}{\hat{\lambda} + (1-\hat{\lambda})\frac{p_l^g}{p_h^g}},$$
$$\text{or } Pr(h|b) = \frac{\hat{\lambda}p_h^b}{\hat{\lambda}p_h^b + (1-\hat{\lambda})p_l^b} = \frac{\hat{\lambda}}{\hat{\lambda} + (1-\hat{\lambda})\frac{p_l^b}{p_h^b}},$$

where $p_r^g \equiv p + (1-p)(1-q_r)$ and $p_r^b \equiv (1-p)q_r$, and $q_r = \frac{(1-p)L}{c_r}$.

Since $c_h > c_l$, we have $q_h < q_l$, which leads to $p_h^g > p_l^g$ and $p_h^b < p_l^b$. Substituting these into $Pr(h|g)$ and $Pr(h|b)$, we have $Pr(h|g) > Pr(h|b)$. QED

Proof of Corollary 3

The outsider's posterior beliefs conditional on the audited report s and switching outcome z are given by

$$\hat{\lambda}_2(g, I) = \frac{\lambda}{\lambda + (1-\lambda)\frac{(1-\phi_1^l)p_l^g}{(1-\phi_1^h)p_h^g}},$$
$$\hat{\lambda}_2(g, O) = \frac{\lambda}{\lambda + (1-\lambda)\frac{\phi_1^l p_l^g}{\phi_1^h p_h^g}},$$
$$\hat{\lambda}_2(b, I) = \frac{\lambda}{\lambda + (1-\lambda)\frac{(1-\phi_1^l)p_l^b}{(1-\phi_1^h)p_h^b}},$$
$$\hat{\lambda}_2(b, O) = \frac{\lambda}{\lambda + (1-\lambda)\frac{\phi_1^l p_l^b}{\phi_1^h p_h^b}}.$$

Electronic copy available at: https://ssrn.com/abstract=4634547

Given that $\frac{\phi_1^l}{\phi_1^h} < 1 < \frac{1-\phi_1^l}{1-\phi_h}$ and $\frac{p_l^g}{p_h^g} < 1 < \frac{p_l^b}{p_h^b}$, we have the following results:

$$\hat{\lambda}_2(g, I) > \hat{\lambda}_2(b, I), \text{ and } \hat{\lambda}_2(g, O) > \hat{\lambda}_2(b, O);$$
$$\hat{\lambda}_2(g, I) < \hat{\lambda}_2(g, O), \text{ and } \hat{\lambda}_2(b, I) < \hat{\lambda}_2(b, O).$$

QED

Proof of Proposition 2

The expected audit fee from the outside auditor is given by

$$E[\omega_O] = \sum_{r=h,l} \Pr(r) \int_{\bar{w}}^{w^h} (1 - \mathcal{F}_I^r(\omega))\omega f_O(\omega) d\omega,$$

which is the expected audit fee if the outsider wins the auction, i.e., if her bid exceeds that from the incumbent. The probability of the outsider winning the high-cost and low-cost clients is $1 - \mathcal{F}_I^r$. We substitute the c.d.f functions from the equilibrium bidding strategies into the above equation and obtain

$$\begin{aligned}
E[\omega_O] &= \hat{\lambda} \int_{\bar{w}}^{w^h} \omega f_O(\omega) d\omega + (1 - \hat{\lambda}) \int_{\bar{w}}^{w^h} (1 - \frac{\omega - \bar{w}}{(1 - \hat{\lambda})(\omega - w^l)})\omega f_O(\omega) d\omega \\
&= \int_{\bar{w}}^{w^h} [\hat{\lambda} + (1 - \hat{\lambda})(1 - \frac{\omega - \bar{w}}{(1 - \hat{\lambda})(\omega - w^l)})]\omega f_O(\omega) d\omega \\
&= \int_{\bar{w}}^{w^h} \frac{\bar{w} - w^l}{\omega - w^l} \omega f_O(\omega) d\omega \\
&= \int_{\bar{w}}^{w^h} \frac{\omega(\bar{w} - w^l)^2}{(\omega - w^l)^3} d\omega \\
&= \hat{\lambda}(1 - \hat{\lambda}) w^h + (1 - \hat{\lambda})^2 \frac{w^l}{2}
\end{aligned}$$

The expected audit fee from the incumbent auditor is given by

$$E[\omega_O] = \sum_{r=h,l} \Pr(r) \int_{\bar{w}}^{w^h} (1 - \mathcal{F}_O(\omega)) f_I^r(\omega)\omega d\omega,$$

Electronic copy available at: https://ssrn.com/abstract=4634547

We again substitute the c.d.f functions into the equation above and obtain

$$
\begin{aligned}
E[\omega_I] &= \hat{\lambda}(1-\mathcal{F}_O(w^h))w^h + (1-\hat{\lambda})\int_{\bar{w}}^{w^h}(1-\frac{\omega-\bar{w}}{\omega-w^l})\omega f_I^l(\omega)d\omega \\
&= \hat{\lambda}^2 w^h + (1-\hat{\lambda})\int_{\bar{w}}^{w^h}\omega(\frac{\bar{w}-w^l}{\omega-w^l})\frac{\hat{\lambda}(w^h-w^l)}{(1-\hat{\lambda})(\omega-w^l)^2}d\omega \\
&= \hat{\lambda}^2 w^h + \int_{\bar{w}}^{w^h}\frac{\omega(\bar{w}-w^l)^2}{(\omega-w^l)^3}d\omega \\
&= \hat{\lambda}^2 w^h + \hat{\lambda}(1-\hat{\lambda})w^h + (1-\hat{\lambda})^2\frac{w^l}{2} \\
&= \hat{\lambda}w^h + (1-\hat{\lambda})^2\frac{w^l}{2}
\end{aligned}
$$

Therefore the difference in the expected audit fees from the outside auditor and the incumbent auditor is

$$E[\omega_O] - E[\omega_I] = -\hat{\lambda}^2 w^h < 0.$$

QED

Proof of Proposition 3

Conditional on the switching outcome O or I, the probability of issuing a good report is

$$
\begin{aligned}
\Pr(s=g|O) &= \Pr(h|O)p_h^g + (1-\Pr(h|O))p_l^g. \\
\Pr(s=g|I) &= \Pr(h|I)p_h^g + (1-\Pr(h|O))p_l^g
\end{aligned}
$$

where $p_h^g = p + (1-p)(1-q_h)$ and $p_l^g = p + (1-p)(1-q_l)$.

Because $\Pr(h|O) > \Pr(h|I)$ from Corollary 1, and $p_h^g > p_l^g$ because $q_h < q_l$, we easily see that $\Pr(s=g|O) > \Pr(s=g|I)$. QED

Proof of Proposition 6

We first derive equation (13). Suppose the client has chosen the incumbent for all previous $n-1$ periods, the updated belief by the outsider is given by $\hat{\Lambda}_{n-1}$. Then in the n^{th} if the incumbent continues to win the auction and stays with the client, the outsider's updated belief

Electronic copy available at: https://ssrn.com/abstract=4634547

$\hat{\Lambda}_n$ becomes

$$\hat{\Lambda}_n = \frac{\hat{\Lambda}_{n-1}(1-\phi^h_{n-1})}{\hat{\Lambda}_{n-1}(1-\phi^h_{n-1}) + (1-\hat{\Lambda}_{n-1})(1-\phi^l_{n-1})} = \frac{2\hat{\Lambda}^2_{n-1}}{1+\hat{\Lambda}^2_{n-1}}$$

by substituting in $\phi^h_{n-1} = 1 - \hat{\Lambda}_{n-1}$ and $\phi^l_{n-1} = \frac{1-\hat{\Lambda}_{n-1}}{2}$. Thus

$$\hat{\Lambda}_n - \hat{\Lambda}_{n-1} = -\frac{\hat{\Lambda}_{n-1}(2 + (1-\hat{\Lambda}_{n-1})^2)}{1+\hat{\Lambda}^2_{n-1}}. \tag{A-1}$$

Therefore for any n, we can show that $\hat{\Lambda}_n < \hat{\Lambda}_{n-1}$, which implies that $\hat{\Lambda}_n$ decreases with n.

To show Proposition 6, given $\hat{\Lambda}_n$ decreases with n, we have the following.

(i) The overall switching probability, $\phi_n = (1-\hat{\Lambda}^2_{n-1})/2$, increases with n.

(ii) The informativeness of a good report when the incumbent auditor has engaged with the client for n periods is calculated as

$$\begin{aligned} Pr(G|g,n) &= \frac{p(1-\phi_n)}{\hat{\Lambda}_n(1-\phi^h_n)p^h_g + (1-\hat{\Lambda}_n)(1-\phi^l_n)p^l_g}, \\ &= \frac{p(1+\hat{\Lambda}_n{}^2)}{\hat{\Lambda}_n{}^2(2p^h_g - p^l_g) + p^l_g} \end{aligned}$$

Taking the derivative of $Pr(G|g,n)$ w.r.t. $\hat{\Lambda}_n$, we have

$$D[Pr(G|g,n), \hat{\Lambda}_n] = \frac{4p\hat{\Lambda}_n(p^l_g - p^h_g)}{(\hat{\Lambda}_n{}^2(2p^h_g - p^l_g) + p^l_g)^2} < 0.$$

Since $p^l_g < p^h_g$, the informativeness of good report $Pr(G|g,n)$ increases with n.

(iii) From the proof of Proposition 2, the expected audit fee charged by the incumbent is given by

$$E[\omega_I(n)] = \hat{\Lambda}_n w^h + (1-\hat{\Lambda}_n)^2 \frac{w^l}{2}.$$

It can be shown that $E[\omega_I(n)]$ increases with $\hat{\Lambda}_n$, which implies that $E[\omega_I(n)]$ decreases with n, i.e., the longer the audit tenure, the lower the expected audit fee.

(iv) From the proof of Proposition 2, the expected audit fee difference between the incumbent and the outside auditors is $E[\omega_I(n)] - E[\omega_O(n)] = \hat{\Lambda}^2_n w_h$, which increases with $\hat{\Lambda}_n$.

Electronic copy available at: https://ssrn.com/abstract=4634547

Therefore, the fee cut upon switching decreases with n. QED

Proof of Lemma 2

Given the incumbent's bidding strategy $\mathcal{F}_I^r(\omega)$, the uninformed outside auditor's expected payoff, when submitting a bid ω, is

$$U_O(\omega, k) = \hat{\lambda}(1 - \mathcal{F}_I^h(\omega))(\omega - w^h - k) + (1 - \hat{\lambda})(1 - \mathcal{F}_I^l(\omega))(\omega - w^l - k),$$

where $\mathcal{F}_I^r(.)$ represents the incumbent's bidding strategy conditional on the true audit cost $r \in \{h, l\}$. In contrast, The incumbent's expected payoff when submitting a bid ω for the firm r is given by

$$U_I^r(\omega) = (1 - \mathcal{F}_O(\omega))(\omega - w^r),$$

where, similarly, $1 - \mathcal{F}_O(\omega)$ is the probability that the incumbent auditor wins the bid given that the outsider's bid follows the distribution $\mathcal{F}_O(\omega)$.

Each auditor chooses the bidding strategy to maximize one's own payoff, taking the other auditor's optimal response as given. The key difference from the main model is the outsider's payoff is reduced because of the switching cost. The bidding equilibrium is similar to that with the main setting. But since the incumbent and outsider have different costs, we need to discuss in more detail.

First, the pure strategy again cannot be sustainable in equilibrium. To see this, suppose that the outsider always bids $\omega \in [w^h, w^h + k]$. The incumbent will always bids a price slightly below $\omega - \epsilon$ and always wins the engagement, leaving the outsider zero profit. Suppose that the outsider always bids $\omega \in [\bar{w} + k, w^h]$, the incumbent always bids $\omega = w^h$ when the audit cost is high and bids the same w as the outsider when the audit cost is low. In this case, the outsider can win only when the audit cost is high, leading to loss (the winner's curse). Thus, the pure strategy by the outsider is not sustainable in equilibrium. Therefore, the outsider will play a mixed strategy in equilibrium.

Second, we will show that the outsider's randomization range is $[\bar{w}+k, w^h+k]$. The outside

Electronic copy available at: https://ssrn.com/abstract=4634547

bidder will never bid below $\bar{w} + k$, which is the break-even audit cost with a switching cost k. Otherwise, he will make a loss for the engagement upon winning given the incumbent's monotone strategy. Next, the outsider will bid at least to $w^h + k$ because otherwise the outsider may win the client with a strictly negative profit. However, the outsider will not bid more than $w^h + k$, because both auditors can always undercut the bid by a small amount and win with a strictly positive profit with certainty. Thus, the outsider's randomization range is exactly $[\bar{w}+k, w^h+k]$. If the incumbent knows the client is low cost, the incumbent will adopt a mixed strategy and bid over the same range as the outside auditor for the same argument we provide in the proof of Proposition 1.

Third, we show the incumbent's strategy for the high-cost client is to always bid the exact audit fee of $w^h + k$ for the high-cost client. That is, although the incumbent's lowest possible bid for the high cost firm is w^h, he will put zero density over the range $[w^h, w^h+k)$. The reason is as follows. Suppose the incumbent bids a fee $\omega \in [w^h, w^h + k)$ with positive probability. Then given that the incumbent's bid for the high cost firm always exceeds that for the low-cost firm, the incumbent will not bid over $[w^h, w^h + k)$ if the client is low cost. Then the outside auditor is not likely to win a low-cost client, i.e., the outsider suffers a winner's curse, if she bids with positive probability over $[w^h, w^h + k)$. Therefore, the outsider will not submit any bid within this range, $[w^h, w^h + k)$ if the incumbent bids $\omega \in [w^h, w^h + k)$ with positive probability for the high-cost client. As a response, the incumbent finds that he can increase the profit strictly, without decreasing the probability of winning the outsider, by bidding at the highest possible fee $w^h + k$ for the high-cost client. Therefore, the incumbent always bids $w^h + k$ for the high-cost client.

Finally, we solve the outsider's mixed bidding strategy $\mathcal{F}_O(\omega)$ by setting $U_I^l(\omega) = \bar{w}+k-w^l$ and the incumbent's mixed bidding strategy in the low cost firm $\mathcal{F}_I^l(\omega)$ by setting $U_O(\omega, k) = 0$, following the same approach as outlined in the proof of Proposition 1. QED

Electronic copy available at: https://ssrn.com/abstract=4634547

Proof of Proposition 7

Given the bidding strategies in Lemma 2, the high-cost client's switching probability is

$$\phi^h = \mathcal{F}_O(w^h + k) = (1 - \hat{\lambda})\frac{w^h - w^l}{w^h - w^l + k}.$$

It is easy to see that $\partial\phi^h(k)/\partial k < 0$. In addition, when the transaction cost approaches zero ($k \to 0$), the switching probability $\phi^h(k) \to 1 - \hat{\lambda}$.

The probability of switching for the low-cost client is

$$\begin{aligned}
\phi^l &= \int_{\bar{w}+k}^{w^h+k} \mathcal{F}_O(\omega) f_I^l(\omega) d\omega \\
&= \int_{\bar{w}+k}^{w^h+k} \frac{\omega - \bar{w} - k}{\omega - w^l} \frac{\hat{\lambda}(\omega - \bar{w} - k)}{(1-\hat{\lambda})(\omega - w^l - k)^2} d\omega \\
&= \frac{\hat{\lambda}(w^h - w^l)}{k^2(1-\hat{\lambda})} \left\{ \begin{array}{c} k\hat{\lambda} + \left(k + \hat{\lambda}(w^h - w^l)\right)\left[\ln\left(w^h - w^l\right) - \ln\left(k + w^h - w^l\right)\right] - \\ \left[k + \left(k + \hat{\lambda}(w^h - w^l)\right)\left[\ln\left(\hat{\lambda}\left(w^h - w^l\right)\right) - \ln(k + \hat{\lambda}(w^h - w^l)\right]\right] \end{array} \right\}.
\end{aligned}$$

To show $\partial\phi^l/\partial k < 0$, taking a derivative with respect to k yields

$$\frac{\partial\phi^l}{\partial k} = \frac{\lambda\left(w^h - w^l\right)}{k^2(1-\lambda)} \left\{ \begin{array}{c} \left(k + \hat{\lambda}(w^h - w^l)\right)\left[\ln\left(w^h - w^l\right) - \ln\left(k + w^h - w^l\right)\right] \\ + \left[\left(k + \hat{\lambda}(w^h - w^l)\right)\left[\ln\left(\hat{\lambda}\left(w^h - w^l\right)\right) - \ln(k + \hat{\lambda}(w^h - w^l)\right]\right] \\ -k(1-\hat{\lambda}) \end{array} \right\}.$$

Given that $\ln\left(k + w^h - w^l\right) > \ln\left(w^h - w^l\right)$ and $\ln(k + \hat{\lambda}(w^h - w^l) > \ln\left(\hat{\lambda}\left(w^h - w^l\right)\right)$ for any $k > 0$, it follows that $\partial\phi^l/\partial k < 0$.

Second, we prove that $\phi^l \to (1-\hat{\lambda})/2$ when $k \to 0$. To prove this, we apply L'Hospital's Rule and *twice* differentiate the numerator and differentiate the denominator of ϕ^l with respect to k:

$$\begin{aligned}
\lim_{k\to 0}\phi^l &= \frac{\hat{\lambda}(w^h - w^l)}{(1-\hat{\lambda})} \frac{1}{2} \frac{(1-\hat{\lambda})^2(w^h - w^l)^2}{(k + w^h - w^l)^2\left(k + \hat{\lambda}(w^h - w^l)\right)} \\
&= \frac{\hat{\lambda}(w^h - w^l)}{(1-\hat{\lambda})} \frac{1}{2} \frac{(1-\hat{\lambda})^2}{\hat{\lambda}(w^h - w^l)} = \frac{1-\hat{\lambda}}{2}.
\end{aligned}$$

Electronic copy available at: https://ssrn.com/abstract=4634547

Third, we prove $\phi^h > \phi^l$. We can rewrite

$$\begin{aligned}
\phi^l &= \frac{\hat{\lambda}(w^h - w^l)}{k^2(1-\hat{\lambda})} \left\{ \begin{array}{c} k\hat{\lambda} + \left(k + \hat{\lambda}(w^h - w^l)\right)\left[\ln\left(w^h - w^l\right) - \ln\left(k + w^h - w^l\right)\right] - \\ \left[k + \left(k + \hat{\lambda}(w^h - w^l)\right)\left[\ln\left(\hat{\lambda}\left(w^h - w^l\right)\right) - \ln(k + \hat{\lambda}(w^h - w^l)\right]\right] \end{array} \right\} \\
&= \frac{\hat{\lambda}(w^h - w^l)}{k^2(1-\hat{\lambda})}[k + \hat{\lambda}(w^h - w^l)] \ln\left(\frac{k + \hat{\lambda}(w^h - w^l)}{\hat{\lambda}(k + w^h - w^l)}\right) - \frac{\hat{\lambda}(w^h - w^l)}{k} \\
&= \frac{\hat{\lambda}(w^h - w^l)}{k}\left[\frac{k + \hat{\lambda}(w^h - w^l)}{k(1-\hat{\lambda})} \ln\left(1 + \frac{(1-\hat{\lambda})k}{\hat{\lambda}(k + w^h - w^l)}\right) - 1\right].
\end{aligned}$$

Since $\ln(1+x) < x$ for any $x > 0$, it follows that

$$\begin{aligned}
\phi^l &< \frac{\hat{\lambda}(w^h - w^l)}{k}\left[\frac{k + \hat{\lambda}(w^h - w^l)}{k(1-\hat{\lambda})} \frac{(1-\hat{\lambda})k}{\hat{\lambda}(k + w^h - w^l)} - 1\right] \\
&= (1-\hat{\lambda})\frac{w^h - w^l}{w^h - w^l + k} = \phi^h.
\end{aligned}$$

QED

Electronic copy available at: https://ssrn.com/abstract=4634547