External Verifiability of Accounting Information and Intangible Asset Transactions

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Abstract:

Firms commonly use disaggregated accounting information to facilitate efficient contracting over intangible assets. However, reliance on accounting measures creates information asymmetries and thus a role for contract audits. Using a hand-collected sample of technology licensing agreements with royalties based on product-line revenues, I investigate how perceived weaknesses in the licensee's accounting system and reporting flexibility affect the design of two key audit terms—(1) the scope of audit rights, and (2) penalties for adverse audit outcomes. I find that perceived weaknesses in the licensee's reporting system lead to the granting of broader audit rights to the licensor, consistent with licensors demanding broader auditor rights when the licensee's accounting system is believed to be less reliable. However, when the licensee has greater reporting flexibility, the contracting parties are more likely to include penalties in their agreements, consistent with the deterrence theory that penalties are a more cost-effective means to discourage intentional misreporting. Licenses covering more territory and having longer durations are associated with narrower audit scope terms, consistent with the self-enforcement theory that the greater the opportunity cost of early termination, the greater the licensee's incentives to self-enforce. Overall, my results suggest that audit scope and penalties can improve contracting efficiency in two different ways.

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1. Introduction

Intangible asset transactions have grown dramatically in volume and complexity, largely driven by technology licensing agreements (TLA) (e.g., Grindley and Teece, 1997; Gu and Lev, 2001; Arora et al., 2001). TLAs are contracts in which the licensor (i.e., the owner of intellectual property (IP) assets) grants the licensee the right to incorporate its IP into products or services. Approximately 90% of TLAs include accounting-based royalties instead of pure fixed payments (Bessy et al. 2002). The benefits of these royalty arrangements include alleviating adverse selection, moral hazard, and inefficient risk sharing between the contracting parties (e.g., Stiglitz 1974; Allen and Lueck 1993; Bhattacharyya and Lafontaine 1995). While accounting-based royalties mitigate many of these contractual hazards, their reliance on disaggregated accounting information (e.g., product-level sales) induces the risk of misreporting between the contracting parties. In particular, the royalty holder is exposed to weaknesses in its counterparty's reporting process, as well as the risk of opportunistic reporting. As a result, the royalty holder needs a means to enforce the accuracy of contracted accounting proxies—an aspect largely overlooked in the economics literature.[1]

This paper addresses this gap by examining the contractual audit terms included in a hand-collected sample of technology licensing agreements that base royalties on product-line revenues. TLAs are a useful setting to examine how the licensor's misreporting risk affects the design of the contractual audit terms for several reasons. First, these agreements are economically significant; the worldwide incomes from TLAs are US$310 billion in 2013 alone, and their growth has outpaced the growth of worldwide GDP (World Trade Organization 2014). Second, contracting

[1] The economics literature assumes that the royalty holder costlessly observes (verifies) disaggregated accounting information (e.g., product-level sales) (Gallini and Wright 1990; Beggs 1992; Bousquet, Cremer, Ivaldi, and Wolkowicz 1998; among others).

parties bilaterally negotiate and voluntarily incorporate audit terms in these contracts, leading to wide variations across contracts. Third, and most importantly, contractual audit terms are ubiquitous elements of these contracts. Financial audits do not eliminate the need for contractual audits because royalty reports require a level of detailed information that is much finer than that included in the audited financial statements. However, there is limited research on the characteristics of contractual audit terms, which are necessary enforcement clauses for these accounting-based royalties. This study contributes to our understanding of how contractual audit terms are used to mitigate misreporting problems not only in TLAs, but also in other contracts that rely on disaggregated accounting information.

I investigate two main dimensions of contractual audit terms in TLAs: (1) the scope of the licensor's audit rights, and (2) the penalties for negative audit results. First, the audit clauses can limit the scope of the royalty audit to certain prior periods (i.e., how far back the licensor may audit) and/or restrict the number of audits performed on the licensee. Second, the licensor may penalize the licensee by shifting the burden of audit fees to the licensee upon detecting a substantial error, and/or imposing interest penalties on underpaid prior royalties. In addition to these explicit penalty terms, an implicit penalty is early termination of the contract following a material breach, including willful underreporting. These explicit and implicit penalties can have deterrence effects by making misreporting more costly to the licensee.

To motivate the empirical analyses, I rely on the prior research on financial audits, law enforcement, and contract economics. I first investigate how *ex ante* signals regarding the strength and reliability of the licensee's accounting system affect the audit terms. Although weaknesses in the licensee's accounting system can have direct impact on royalty reporting errors (Throckmorton 2008), the licensor typically has limited information about the licensee's overall reporting system

at the time of contracting. Given this limited information, the licensor may instead rely on the licensee's financial auditor characteristics as signals of accounting system weaknesses.[2] When the licensee employs a lower-quality auditor (e.g., non-Big N or industry non-specialist auditor), the licensor will infer a higher chance of reporting weaknesses and find broader audit rights more valuable. However, while broader audit rights are useful in detecting both intentional and unintentional misreporting due to reporting weaknesses, penalties work as an effective deterrent only for *intentional* misbehaviors (e.g., Becker 1968). To the extent the licensor expects a higher chance of unintentional errors from the licensee with a lower-quality auditor, imposing explicit penalties on such a licensee leads to higher expected penalties—even in the absence of any intentional misreporting—without necessarily achieving greater deterrence effects. Thus, I predict that contracts are more (less) likely to include broader audit rights (penalties) when the licensee is perceived to have a weaker reporting system.

Second, I consider how the licensee's reporting flexibility shapes the audit terms. The licensee has greater reporting flexibility (i.e., discretion to report royalties opportunistically) when more deductible items are included in the royalty base. The royalty base can range from *gross* revenues to contractually-defined *net* revenues, where allowed deductibles (e.g., returns, discounts and transportation costs) are subtracted from gross revenues. Royalty auditors suggest that these deductions are frequent sources of intentional misreporting due to issues such as unfair allocation of costs relative to underlying economic activities, licensee-favorable interpretations on various deductibles, and failure to incorporate agreement-based limitations to deductions (Stewart et al. 2017; Ruey 2013; Nolte 2017). To the extent that greater licensee reporting flexibility increases the licensor's concern for *intentional* misreporting, the licensor will prefer penalties to broader

[2] This argument is based on discussions with royalty auditors, as well as research on the use of auditor quality as a signal of accounting system quality (e.g., Krishnan 2003; Khurana and Rama 2004; Mansi et al. 2004).

audit scope terms because penalties are more cost-effective in deterring intentional misbehaviors (Becker 1968). The licensee with greater reporting flexibility will also prefer penalties to broader audit rights because the potential for more extensive, frequent audits increases the cost of preparing for and hosting royalty audits. Thus, I predict that contracts are less (more) likely to include broader audit rights (penalties) when the licensee has greater reporting flexibility.

Lastly, contract theory suggests that the implicit cost of termination can increase the licensee's incentive to self-enforce accurate royalty reporting, leading to a lower need for auditing. The licensee is incentivized to self-enforce the contractual terms when its opportunity cost of contract termination (i.e., a stream of future foregone rents) increases (Klein and Leffler, 1981; Williamson, 1985; Klein and Murphy, 1988; among others). Theory predicts that the licensor can reduce its auditing intensity when the contract includes specifications that induce self-enforcement, such as features that guarantee future expansion opportunities and exclusive market positions (Klein 1980 & 1995; Lafontaine and Raynaud 2002). Accordingly, I expect that contractual features such as (i) a worldwide license, (ii) a long-term license (i.e., features that provide expansion opportunities), and (iii) an exclusive license (i.e., a feature that ensure exclusive market positions) reduce the need for broader audit rights.

Consistent with my predictions, I find that licensees with low-quality auditors are associated with broader audit rights, consistent with licensors perceiving firms with low-quality auditors to have less reliable accounting systems. In contrast, I find evidence that penalty terms are less likely to be imposed on licensees whose reporting systems are expected to produce more unintentional errors. In addition, I show that when the licensee has high reporting flexibility, penalties are more likely to be used as a deterrent, while broad scope audit rights are less likely to be employed. These findings are consistent with the deterrence role of penalties being more cost

effective for intentional misreporting. Finally, the evidence suggests that licenses covering more territory and having longer durations lead to less stringent audit terms, consistent with the self-enforcement theory that the greater expansion opportunities increase the licensee's incentive to self-enforce, and thus reduce the licensor's need for audits. I further find that these results are not driven by the licensors price-protecting themselves against the misreporting risk via higher royalty rates. Overall, my findings suggest that audit scope and penalties can improve contracting efficiency differentially, depending upon the contractual parties' concerns regarding unintentional and intentional misreporting.

My paper makes two main contributions. First, the evidence in this study, combined with prior evidence on the prevalence of accounting-based royalties (e.g., Bessy et al., 2002), suggests that firms can mitigate the contracting problems associated with intangibles (e.g., intellectual properties) by relying on disaggregated accounting measures and designing audit terms to verify the contractible proxies. These findings support the view of Christensen and Demski (2003), who argue that external verifiability by third parties is the comparative advantage of accounting information relative to other information sources. This paper also complements a recent study by Lisowsky and Minnis (2017), which shows that verified and standardized accounting information can be more important for firms with high intangible assets than those with high physical assets. My results suggest that the reliability of accounting reporting systems becomes important for intangible-intensive firms in facilitating intangible asset transactions.

Second, I contribute to the literature investigating various accounting-based means for mitigating information asymmetries in contractual relationships. A growing literature examines information asymmetry problems in supply contracts. For example, Costello (2013) finds that the use of financial covenants and contract duration can mitigate the information asymmetry problems

in supply contracts, while Samuels (2017) suggests that customer monitoring of supplier financial systems can improve the supplier's internal information environment. In addition, there is an extensive literature in debt contracting that investigates how accounting-based covenants can be used to mitigate information asymmetries in these contracts.[3] My paper adds to this literature by showing that contractual audit rights and penalties can also be used to mitigate accounting-related information asymmetry problems.

The remainder of the paper proceeds as follows. Section 2 provides background information on technology licensing agreements and develops my empirical predictions. Section 3 discusses the data, the main variables, and the descriptive statistics. Section 4 presents the research design. In Section 5, I discuss the main results. Section 6 discusses potential threats to the paper's inferences and robustness tests. Section 7 concludes the paper.

2. Background and predictions

2.1. Background

2.1.1. Why license?

A potential licensor (i.e., the owner of proprietary technology) may license its intellectual properties (IP) instead of exploiting them on its own for a variety of reasons. First, the licensor may save costs when an external party (e.g., the potential licensee) has lower costs of exploiting the IP than the licensor, which creates potential gains for entering into a licensing contract. Second, the licensor and licensee may have different competitive advantages. The licensor may specialize in conducting R&D activities and building core technology while the potential licensee may have competitive advantages in producing, marketing, and distributing final products. Third, the

[3] See Barclay and Smith (1995), Sufi (2007), Frankel and Litov (2007), Ball, Bushman, and Vasvari (2008), Bharath, Sunder, and Sunder (2011), Nikolaev (2010), Costello and Wittenberg-Moerman (2011), Demerjian (2007), and Demerjian (2011), among others.

licensor may benefit by accessing the licensee's resources, such as existing facilities, global distribution network, and expertise in the regulatory process (e.g., FDA compliance), which can improve time-to-market for new products and lead to faster market penetration. This benefit is especially important when timing is critical, the pace of innovation is accelerating, or the nature of future competition and markets is difficult to determine (Teece and Pisano, 1994).

However, licensing is not without costs. In choosing to license its technology, the firm incurs monitoring costs because the firm essentially delegates responsibility to its licensee (i.e., the agent) for bringing products to the market. Licensing also exposes the licensor to adverse selection risk because the licensor is asymmetrically informed about the licensee's quality (e.g., the quality of the licensee's capabilities and resources). In addition, the licensor may be concerned about expropriation risk to the extent that the licensee may become a potential competitor upon learning the licensor's proprietary technology. In circumstances where the costs of licensing do not justify licensing transactions, the firm will choose to incorporate its proprietary technology into its own production, rather than licensing it out.

2.1.2. *Fixed fee versus royalties licensing*

A vast theoretical literature has examined the optimal payment scheme when a firm does decide to license its technology. The results of these theoretical studies are mixed regarding the superiority of fixed fee licensing versus royalty licensing. One stream of research argues for the superiority of fixed fee licensing (e.g., Kamien and Tauman 1986; Kamien 1992; Kamien, Oren, and Tauman 1992; among others). In a complete information framework where there is no adverse selection problem, a fixed fee (i.e. high fee for the high demand and low fee or the low demand) is optimal for the contracting parties. In addition, some studies assume that royalties to be unenforceable due to information asymmetry and focus on the superiority of the fixed fee

mechanism (e.g., Katz and Shapiro 1986). Another stream of studies argues for the superiority of royalty licensing. In an incomplete information framework, where the licensor has private information about the actual value of the patent, the licensor offers royalty contracts to signal the high quality of its patent to the potential licensee who is asymmetrically informed. Royalty licensing acts as a signaling device to the potential licensee and is shown to induce a more efficient outcome than fixed-fee licensing (e.g., Beggs, 1992; Gallini and Wright, 1990; among others). In addition, Autrey and Sansing (2014) suggest that the superiority of fixed fee versus royalty licensing depends on the licensees' accounting system. In particular, their theoretical model shows that the strength of the licensee's accounting system increases the desirability of royalty licensing over fixed fee licensing.

Despite the mixed theoretical predictions on the optimality of fixed fee versus royalty licensing, empirical evidence suggests that royalty licensing is most commonly employed in practice.[4] Surveys indicate that between 85% to 92% of licensing agreements include royalty terms.[5] This prevalence of royalty licensing is likely driven by royalties alleviating a licensee's fear of overpaying for a license and a licensor's fear of undercharging when there is great uncertainty over the future value of the licensed technology (Kamien, 1992).

2.1.3. Institutional background on royalty audits

License agreements typically require the licensees to periodically report disaggregated accounting information such as product-level sales, deductions, and sales by territory (Blum 2015). Licensors cannot directly observe this specific accounting information without royalty audits that

[4] E.g.,Taylor and Silberston 1973; Caves, Crookell, and Killing 2009; Rostoker 1983; Macho-Stadler, Martinez-Giralt, and David Pérez-Castrillo 1996; Thursby, Jensen, and Thursby 2001; and Bessy and Brousseau 1998

[5] For instance, Bessy, Brousseau and Saussier (2002) report that 92.4% of sample technology licensing agreements include royalties. Rostoker (1983), using a firms survey, reports royalty-based licensing accounts for 85 percent of the licensing arrangements. Other studies including Contractor (1981), Taylor and Sylberston (1973), and Bessy and Brousseau (1998) document that royalties are the predominant form of payments in TLAs.

are specified in the licensing agreements.[6] A licensor contemplating initiating a contract audit trades off the expected benefits of reduced information asymmetry with the audit costs. The main two benefits of the audit include: (1) detecting and recovering underpayments, and (2) deterring future misreporting by signaling monitoring efforts. In practice, a royalty audit is a complex, difficult, and expensive process (Keller et al., 2003). The licensor is responsible for paying the audit fees, unless the contract specifies otherwise. In addition to the monetary cost of royalty audits, the licensor may also have to bear a non-monetary cost to the extent that the licensee interprets extensive, frequent audits as a sign of mistrust, which potentially limits their future business opportunities.[7] A rational licensor therefore attempts to maximize royalty revenues net of audit costs. To the extent that the expected benefit from an audit (e.g., the expected magnitude of underpayments that will be recouped) does not exceed the audit cost for a given period, the licensor may forego recovering underpaid royalties and choose not to undertake a royalty audit on the given period, even if it is allowed in the contract. For this reason, most licensors do not commit to regularly auditing their licensees in practice.[8]

Once a licensor decides to initiate a royalty audit, the licensee's relevant books of account may be audited according to the contractual audit terms, which are specified in the contract. Because licensees' detailed accounting information is confidential, the licensor is typically

[6] A more convenient method of determining royalty payments is to base the royalties on the licensee's *firm-level* sales, as opposed to the disaggregated (e.g., product-level) sales. To the extent that the firm-level sales information is publicly available in the licensee's audited financial statements, this method can eliminate the need for costly royalty audits. However, royalties on *firm-level* sales are rarely used because they give rise to regulatory concerns (Verbraeken, 2011). Given that the total sales comprise both products that incorporate and do not incorporate the licensed technology, royalties on firm-level sales allow the licensor to extract rents from the licensee that go beyond the scope of the licensed patent(s). This aspect gives rise to patent misuse and antitrust interrogations by the regulatory agencies such as the DOJ.

[7] An article by royalty auditors suggests that some licensors are hesitant to undertake audits because they are afraid of signaling mistrust to their licensees (Stewart et al 2007).

[8] Royalty audits are often done sporadically and randomly, unless the licensors are privately informed of their licensees' suspicious activities. A recent study by royalty auditors reports that conditional on there being a royalty audit, 86 percent of licensees are found to underreport royalties (Stewart et al. 2017).

required to hire a contract compliance or royalty auditor to delegate the audit work. Royalty audit services can be purchased from audit firms or law firms that provide contract compliance and audit services. If royalties have been intentionally underreported, the audit report may be used as a basis for legal action to enforce the contract, to terminate the contract, and/or to collect royalties and damages.

The royalty audit is generally performed in three phases: (1) pre-site work, (2) site work, and (3) post-site work. Phase 1 includes an analysis of all relevant information prior to the site visit. Prior to a site visit, an auditor may also request that certain documentation, books, and records be made available for inspection. Phase 2 includes site work, which typically lasts two to five days. During site work, the auditor interviews the licensee's management and employees, and analyzes and evaluates relevant information. To ensure the completeness of reported licensed sales, the auditor often needs to examine products other than those that are reported to be licensed. For example, they often inspect the specifications of other products to determine whether unreported sales may qualify as licensed product sales. Phase 3 is completion of the report. After completing the site work, the audit team prepares its draft conclusions or report. Depending on the situation, this report is discussed with the licensor and sometimes with the licensee. If required, requests for additional information or follow-up visits are made before a final report is issued. While the final report includes the summary of detected misstatements, if any, the auditor does not necessarily issue an opinion on whether such misstatements are due to unintentional errors and irregularities or intentional misreporting by the licensee—unless the licensor is bringing the issue to court.[9]

Given the extensive involvement of the licensee's personnel throughout the royalty audit, it is not costless for the licensee to grant the full scope of audit rights to the licensor. Frequent

[9] This is because proving intent is difficult and requires costly collection of additional evidence.

audits can be time-consuming and disruptive to the licensee's business. By allowing broader scope audits, the licensee bears additional costs of preparing and hosting the audits, as well as taking actions to address any gaps in compliance once each audit is completed. Even though the licensor may not actually exercise its full audit rights, the licensee must be prepared to respond to allowable audit requests. Thus, the licensee will resist granting excessive contractual audit rights to the licensor.

2.2.Empirical predictions

In the context of technology licensing, audit policies over royalties serve as important enforcement mechanisms that mitigate the information asymmetries surrounding the licensee's disaggregated accounting information. The licensor may rely on two main enforcement terms—(1) the scope of audit rights and (2) penalties for negative audit results—to detect and deter misreporting by the licensee.

In bilateral negotiation, the two contracting parties (i.e., licensor and licensee) have contradictory demands and must exchange proposals in order to reach a deal. The licensor prefers stringent audit terms while the licensee prefers lenient terms regardless of the level of misreporting risk to the licensor. Despite these contradictory preferences, the two parties must agree on sufficient enforcement terms in order to facilitate the viability of the contract and reach a deal. Thus, the observed scope of audit rights and penalties will reflect their relative value (cost) to the licensor (licensee).

Relying on prior research in financial auditing, law enforcement, and contract theory, I consider how the scope in these two key audit terms are driven by perceived weaknesses in the licensee's accounting system, reporting flexibility, and incentives to self-enforce.

2.2.1. Perceived accounting system weaknesses

I investigate how *ex ante* signals regarding the reliability of the licensee's accounting system affect the audit terms. Weaknesses in the licensee's overall accounting system are reported to have direct impacts on royalty reporting errors (e.g., Throckmorton 2008; Stewart et al. 2017). Royalties are more likely to be misreported under a weak reporting system, such as a system that has not been accurately programmed, includes erroneous computer algorithms, or is not fully automated (Stewart et al. 2017).[10] Given that royalty audit rights allow the licensor to audit only subsets of the accounts produced by the licensee's accounting system (i.e., only the accounts relevant to royalty terms), the licensor's demand for broader audit rights will vary with the reliability of the licensee's accounting system.

Prior to entering into the contract, the licensor has limited information about the reliability of the licensee's reporting system. The licensor must instead rely on signals regarding the licensee's accounting system reliability and quality. One informative and readily observable signal is the licensee's financial auditor characteristics.[11] When the licensee has a lower-quality auditor, the licensor will expect a higher likelihood of reporting weaknesses. Based on this expectation, the licensor will find broader audit rights more valuable.

While perceived accounting system weaknesses are expected to lead the licensor to demand broader audit rights, the theory of enforcement economics suggests that the use of penalties will be less effective on the licensee with perceived weaknesses in reporting systems. Stewart et al. (2017) argue that reporting system weaknesses lead to the majority of *unintended* royalty

[10] Specific examples of misreporting attributable to weak reporting systems include material math errors, unreported sales due to new product numbers being assigned to a second generation or updated products, and application of wrong rates to royalty-bearing products (Stewart et al. 2007).

[11] Prior research documents auditor quality is used as a signal of accounting system quality in capital markets (e.g., Krishnan 2003; Khurana and Rama 2004; Mansi et al. 2004).

misreporting. Penalties, on the other hand, work as a deterrence for *intentional* misbehaviors because they increase the licensee's cost of intentional misreporting and thus decrease the net benefits from doing so (Becker 1968). However, the deterrence role of penalties will be largely ineffective in reducing inevitable, unintentional errors, which are produced regardless of the licensee's intent. To the extent that a licensee with a lower-quality auditor is expected to produce more unintentional errors, the licensor will find penalties to be a less effective deterrent than broad audit rights.

The licensee will also have differential preferences for audit rights or penalties depending upon the likelihood of *unintentional* errors. On one hand, if the licensee agrees to grant broader audit rights, the licensee potentially faces the greater burden of responding to frequent audits. On the other hand, if the licensee agrees to explicit penalty terms, it potentially exposes the licensee to penalties for unintentional errors. If the licensee's reporting system is more likely to produce unintentional errors, the licensee faces higher expected penalties due to unintentional errors without necessarily leading to greater deterrence effects.[12] Thus, the licensee would rather accept broader audit terms than penalties.

Based on preceding arguments, I predict that the licensor and licensee are more likely to agree on broader audit rights when the licensee is perceived to have a less reliable accounting system. In contrast, I expect less use of penalties when the licensee's accounting system is perceived to be less reliable.

[12] This prediction is related to Polinsky and Shavell (1979) and Block and Sidak (1980) that suggest the increased chance of penalizing those without fault decreases the desirability of penalties.

2.2.2. Reporting flexibility

The licensee has greater reporting flexibility (i.e., discretion to report royalties opportunistically) when more deductible items are included in the royalty base. The royalty base can range from gross revenues to contractually-defined net revenues, where allowed deductibles (e.g., returns, discounts and transportation costs) are subtracted from gross revenues. These deductions are reported to be frequent sources of *intentional* misreporting due to issues such as unfair allocation of costs relative to underlying economic activities, licensee-favorable interpretations on various deductibles, and failure to incorporate agreement-based limitations to deductions (Stewart and Byrd 2007; Ruey 2013; Nolte 2017). To the extent that these deductibles increase the risk of intentional misreporting by the licensee, the licensor is expected to prefer penalties to a broader audit scope. This prediction is based on the deterrence theory that penalties are more cost-effective in deterring intentional misbehaviors than the threat of audits because audits are more costly from the licensor's perspective (Becker 1968).

The licensee's preference for audit scope versus penalties is expected to depend on the extent of allowed deductibles. More deductibles increase the number of accounts subject to royalty audits and thus audit complexity.[13] This additional complexity makes it more costly for the licensee to host broader scope audits, even if there is no intentional misreporting. Thus, the licensee with more allowed deductibles is more likely to resist granting broader audit rights. In sum, I predict that the licensor and licensee are less (more) likely to agree on broader audit rights (including penalties) when more allowed deductibles increase the licensee's reporting flexibility.

[13] Audits on gross revenue-based royalties involve inspecting only the revenue accounts, while those on net revenue-based royalties involve reviewing the revenue and other deductible accounts, as well as a greater level of securitizing due to greater likelihood of potential accounting manipulations the licensee may devise.

2.2.3. *Incentives to self-enforce*

The licensee's incentive to "self-enforce" (that is, to ensure accurate royalty reporting) is also expected to influence the audit terms. The licensor has the ability to terminate the contract following a material breach by the licensee, such as intentional underpayments. Contract theory suggests that the opportunity cost of termination can increase the licensee's incentive to self-enforce.[14] Thus, if the contract includes terms that induce self-enforcement, the licensor can reduce its auditing intensity (Lafontaine and Raynaud 2002).

Specifically, I expect that contractual features such as (i) a worldwide license, (ii) a long-term license, and (iii) an exclusive license reduce the need for broader audit rights. Theory suggests that contractual terms that guarantee future expansion opportunities or exclusive market positions can induce self-enforcement because these terms allow the licensee to earn profits that are not dissipated in the long run (Klein 1980, 1995; Lafontaine and Raynaud 2002). A licensee with a worldwide license can access larger markets and potentially generate greater gains by increasing its economies of scale than the licensee with a local license. Similarly, when the license is long term, the licensee is more likely to make relationship-specific investments with less concern for hold-up by the licensor (e.g., Joskow, 1988). These investments will allow the licensee to realize greater returns throughout the contract duration. When the license deal is exclusive between the licensor and the licensee, the licensee is the only firm authorized to utilize and commercialize the technology within the contractual scope. As a result, the licensee likely stands to gain more under the exclusive license than under the non-exclusive license, under which the license may potentially compete against other licensees with the same non-exclusive license. To the extent that the

[14] An extensive theoretical literature focuses on the role of self-enforcement that is induced when a premature termination of the contract is costly to the counterparty (e.g., Telser, 1980; Klein and Leffler, 1981; Williamson 1983, 1985; Klein and Murphy 1988).

presence of these contractual features increases the licensee's opportunity cost of contract termination and thereby its incentive to self-enforce, I predict that licenses covering more territory, having longer durations, and granting exclusive rights are associated with narrower audit scope.[15]

While the contract theory predicts that the terms that induce self-enforcement lower the licensor's monitoring needs, the literature does not factor in the potential role for penalties. Thus, it is an empirical question as to whether the presence of these contractual features would also reduce the need for the penalty terms.

3. Data selection, variables of interest and descriptive statistics

3.1. Sample selection and limitation

3.1.1. Sample selection

I retrieve all technology licensing agreements (TLA) between 1996 and 2015 from KtMine's License Agreement database, which collects material royalty agreements and documents from SEC filings.[16] Licensing agreements are most often included in Exhibit 10 attached in a 10-Q or 10-K filing. I rely upon KtMine's coding of basic facts about each agreement including the licensor, licensee, agreement type, royalty rates, licensed territories, and exclusivity provisions. I focus on patent and technology licensing agreements, as coded by KtMine, yielding an initial sample of 2,821 retrieved documents.[17]

[15] This prediction is under the assumption that the licensor cannot not fully extract the licensee's increased rents via higher royalties or other payments to the licensor. If the licensor fully extracts the increased rents generated by these contractual features, the presence of these terms will have insignificant impact on the audit scope.

[16] The year 1996 was the first year that the SEC required firms to file electronically. Regulation S-K of the Securities Act of 1933 requires publicly filing companies to include all material contracts as exhibits in SEC filings. Material contracts must be attached to the S-1, S-4, S-11, F-1, F-4, 10-Q, 10-K or 8-K for the corresponding period in which the contract is executed.

[17] I acknowledge that data on SEC material contracts have structural limitations. First, observed agreements involve at least one publicly traded firm as a contracting party, which comprise only a subset of all companies. Second, a contract will not be observed if it does not meet the materiality requirements specified in Regulation S-K. Thus, only a subset of agreements, which trigger SEC reporting requirements, will be included in my sample (i.e., agreements that are material to the filing companies). Consequently, my sample may not be representative of the population of

My sample construction consists of the following steps. First, I read each document to confirm that the retrieved document is a licensing contract. I exclude any misclassified contracts and duplicate filings.[18] Second, I hand-match the names of the contracting parties, using the master filing list in Wharton Research Data Services (WRDS) SEC Suites. I then match the licensor's and licensee's Central Indexing Key (CIK), if there is a match, to Compustat North America (US and Canadian firms) or Compustat Global (international firms). Third, I hand-match the subsample of licensors and licensees with no valid CIK to Thomson Reuters Datastream (international firms) to get a broader coverage over international firms. Finally, I manually read each contract to determine the following variables: the length of auditable periods, the number of allowable audits, audit-fee penalties, interest penalties, contract duration, allowed deductibles, and the licensors' obligations for technology support. The resulting dataset is comprised of 975 contracts (Table 1).[19]

In Table 2, columns 1 through 4, I report the distribution of sample licensors and licensees by Fama-French 12-industry classification. Healthcare, Medical Equipment, and Drugs represent the largest portion of licensors and licensees in my sample, followed by Business Equipment.[20]

TLAs. However, given that my sample survives these two significant filters, the sample contracts will likely be economically significant TLAs.

[18] KtMine database includes other documents or sections of 10K/Q that include discussions on royalties, transfer of patent rights, and licensing deals. I exclude any documents that are not contracts nor facilitate transferring of technologies between contracting parties in return for payments.

[19] Given the prior empirical evidence on prevalent royalty terms in TLAs, the empirical investigation in this paper is focused on contracts that include royalty licensing. In addition to regular royalty payments, some sample contracts may include some forms of fixed fees such as an initial upfront fee.

[20] I report the industry classification of licensor firms from only 457 sample contracts because the industry membership information is not available for licensors that are non-corporate entities (e.g., universities, research centers, and government agencies) or companies with missing financial data. There are 441 contracts where the licensors have non-missing financial data, and 16 contracts where the licensors' industry information is available on Dun & Bradstreet.

3.2. Empirical measures of stringency of audit provisions

3.2.1. Proxies for the scope of audit rights

I use two proxies for the scope of audit rights granted to the licensors: (i) *Length of Auditable Periods* and (ii) *Unrestricted Audits*.[21] First, I develop a proxy based on the duration of the licensor's audit rights. The audit provisions limit a royalty audit to certain prior periods. The more prior periods the licensor may go back to audit, the more flexible and cost-effective the licensor can be in its royalty audits. Moreover, the licensor's audit rights are effective beyond the termination of the contract up to the length of its auditable periods. Second, I measure whether the licensor is restricted in the number of allowable audits in a given year. This variable, *Unrestricted Audits*, captures whether the licensor may audit the licensee anytime with no restriction on the time length between two consecutive audits. While some contracts allow the licensor to audit the licensee any time without any limit on the number of audits, other contracts may restrict the number of audits the licensor may perform on the licensee. For instance, if the contract limits the licensor to one audit per year, at least a year must have passed since the last audit.

3.2.2. Proxies for penalties

I utilize two proxies for the penalties on detected underpayments: (i) *Audit Fee Penalties* and (ii) *Interest Penalties*. First, I develop a proxy based on whether the licensee may be charged with incurred audit fees as penalties. By default, the licensor bears audit fees, as it is the licensor's responsibility to monitor the licensee. Some contracts specify that the burden of audit fees be

[21] An article by Royalty Compliance Organization explains that contractual audit rights may vary on four dimensions: (1) number of auditable periods, (2) restrictions on allowable audit frequencies, (3) document retention periods, and (4) when an audit may be performed. I only measure the first two dimensions as the audit scope because the third dimension (i.e., document retention periods) typically coincides with the first dimension (i.e., number of auditable periods). That is, for example, if the licensee is required to retain relevant documents for two years (i.e., document retention period=2 years), the licensor may go back two prior years of the licensee's relevant documents (number of auditable periods=2 years), and vice versa. With regards to the fourth dimension (i.e., when an audit may be performed), I find no meaningful variation in my sample as the sample audit terms invariably specify that audits can be done "during normal business hours."

shifted from the licensor to the licensee when certain levels of underpayments are detected in audits. For example, some contracts may trigger the audit fee shifting provisions upon detecting underpayment exceeding a pre-specified threshold (e.g., 10% of actual royalties owed) while other contracts do not include such audit fee penalties (i.e., the licensor bears the audit fees at all times, regardless of the magnitude of detected underpayments).

Second, I measure whether interest is charged on any underpayment detected during an audit. This variable captures interest penalties that the licensee faces in addition to paying back the detected underpayments. Some contracts, for example, specify that the licensee pay interest at the Wall Street Journal prime rate plus *x*%, while other contracts do not impose any interest penalty.

3.3. Proxies for the independent variables of interest

In the following subsections, I describe the empirical proxies for the three main variables of interest: the licensee's perceived accounting system weaknesses (Section 3.3.1), reporting flexibility (Section 3.3.2), and incentives to self-enforce (Section 3.3.3).

3.3.1. Proxies for perceived accounting system weakness

Given that the licensor typically has limited information about the licensee's overall reporting system at the time of contracting, the licensor can readily rely on the licensee's financial auditor characteristics as signals of accounting system weaknesses.[22] In particular, I use two proxies based on the licensee's financial auditor characteristics. First, I measure whether the licensee's financial auditor is not a big N financial auditor. Prior literature suggests that capital market participants tend to associate clients of big-N auditors with having more reliable accounting

[22] It is important to note that firm-level financial audits do not eliminate the demand for royalty audits because royalty audits are conducted at a finer level than financial audits are conducted. Royalty auditors assess revenue and cost allocations at the product level, while financial statement auditors typically focus on materiality thresholds deemed relevant to acceptable accuracy of overall financial statements.

systems.[23] Thus, I use an indicator variable for the licensees with non big-N auditors to measure the perceived weaknesses in their accounting systems.

Similarly, I use the financial auditor industry specialization, measured by client industry concentration, as a second signal the licensor can readily observe. The financial auditor's knowledge of the industry is known to increase financial audit quality and improve the accuracy of error detection (e.g. Solomon, Shields, and Whittington 1999; Owhoso, Messier, and Lynch 2002). Specialist auditors are also expected to have greater competency and stronger reputation incentives to provide high quality audited financial statements. Following prior studies, I measure auditor industry specialization using the auditor's within-industry market share. For each auditor and year, industry market share is calculated as follows:

$$MARKETSHARE_{ki} = \frac{\sum_{j=1}^{J} S_{kij}}{\sum_{i=1}^{I}\sum_{j=1}^{J} S_{kij}}$$

where $MARKETSHARE_{ki}$ is the market share of auditor I in industry k, S_{kij} represents the total assets of client firm j in industry k audited by auditor i, I represents the number of audit firms in industry k. Auditors are specialists if they audit 30 percentage of the market (Neal and Riley, 2004).[24] I label this variable *Industry Non-Specialist Financial Auditor*, which takes a value of one if the licensee's auditor is not an industry specialist.

3.3.2. Proxies for reporting flexibility

I use the number of allowed deductibles in royalty terms to measure the licensee's reporting flexibility. Most contracts tailor the contractual definition of royalty-bearing sales; some contracts define royalty-bearing sales on gross revenues before deducting any expenses, while other

[23] See Krishnan 2003, Behn et al. 2008, DeFranco et al. 2011, Fan and Wong 2005, Gul et al. 2010, Khurana and Raman 2004, Pittman and Fortin 2004, Mansi et al. 2004, Choi and Wong 2007, Chang et al. 2009.
[24] In untabulated analysis, for robustness, I also use 10 and 20 percentages.

contracts allow a varying degree of deductibles before applying the royalty rates (i.e., gross revenues net of allowed deductibles). The licensee's reporting flexibility increases with the number of allowed deductibles because the licensee may misallocate or make favorable assumptions on these deductibles to underreport royalties (e.g., Ruey 2013). Examples of deductible items include transportation costs and sales commissions. (See Tables 3B and 3C for the frequency and distribution of deductible items.)

3.3.3. Proxies for incentives to self-enforce

I measure three distinct contractual terms that likely increase the licensee's incentive to self-enforce. Theory suggests contractual terms that guarantee future expansion opportunities or exclusive market positions can induce self-enforcement because these terms allow the licensee to earn profits that are not dissipated in the long run (Klein 1980 & 1995; Lafontaine and Raynaud 2002). Accordingly, a worldwide license and a long-term license will likely provide greater future expansion opportunities to the licensee. In addition, an exclusive license allows the licensee to enjoy exclusive market positions and face lower potential competition. In particular, I use an indicator variable for (i) a worldwide license and (ii) a long-term license and (iii) an exclusive license, respectively, to measure the presence of contractual terms that induce self-enforcement.

3.4. Descriptive statistics

Table 3 reports the descriptive statistics for the sample. All variables are defined in Appendix A. The average length of auditable periods is 4.06 years. Fifty-one percent of the sample has a limitation on the number of allowed audits per year (i.e., *Unrestricted Audits*=0); the rest of the sample allows for unrestricted audit frequencies in a given year. Fifty-one percent of the sample includes audit fee penalties while 32 percent of the sample imposes interest penalties on underpaid royalties. On average, royalty rates are 11 percent of royalty-bearing sales, and 36 percent of the

contracts had a duration until the patents expire. Ninety-three percent of the sample licenses is exclusive, and 68 percent of the licenses allows for worldwide sales. Twenty-nine percent of the sample licensees has non Big-N financial auditors, and 84 percent of the licensees has industry non-specialist financial auditors. This implies, 29 percent of the licensees has non Big-N auditors who are also industry non-specialist auditors, and 55 percent of the licensees has industry non-specialist Big-N auditors. Thirty-two percent of the licensors and licensees are in the same industries.

4. Research Design

I test the impact of the licensee's accounting system weakness, reporting flexibility and incentives to self-enforce on the stringency of audit terms using the following model:

$$\begin{aligned} AuditTerm = {} & \alpha + \beta_1 PerceivedAcctWeakness + \beta_2 ReportFlexibility \\ & + \beta_3 SelfEnforceIncentive + \boldsymbol{\lambda} ContractChar \\ & + \boldsymbol{\gamma} OtherControls + \epsilon \end{aligned} \quad (1)$$

where the dependent variable is *Length of Auditable Periods, Unrestricted Audits, Audit Fee Penalties* or *Interest Penalties.* The former two variables are used to measure the licensor's audit rights while the latter two are used for penalties. For ease of interpretation, dependent variables are increasing in stringency of the term. *Perceived Acct Weaknesses* is one of the two measures described in Section 3.3.1., which are *Non-Big N Financial Auditor* and *Industry Non-Specialist Financial Auditor*. I use the number of deductible items in the royalty base to measure *Reporting Flexibility* (See Section 3.3.2.). Lastly, I use three distinct measures of *Self Enforce Incentive: Worldwide License, Duration until Patent Expiration,* and *Exclusive License* (See Section 3.3.3.). See Appendix A for variable definitions.

For analyses on the audit rights, I predict that the coefficient on the licensee's perceived accounting system weaknesses to be positive if the licensor demands broader audit rights when the licensee's accounting system is perceived to be less reliable. I also expect the licensee's reporting flexibility will be negatively associated with the audit rights if broader audit rights are less likely to be cost effective deterrents against *intentional* misreporting. I expect when the contract includes terms that induce self-enforcement, the licensor's need for monitoring is likely lowered. Thus, I predict that the licensee's incentive to self-enforce is negatively correlated with the scope of audit rights.

In contrast, for the penalty analyses, I predict that the coefficient on the licensee's perceived accounting system weaknesses is negative to the extent that penalties do not deter inevitable, *unintentional* misreporting. I also expect that the licensee's reporting flexibility will be positively related to the inclusion of penalty terms if the penalties are cost-effective means of deterring *intentional* misreporting. Lastly, as the relation between the licensee's incentive to self-enforce and the penalties is an empirical question, I do not have a directional prediction on the impact of *Self Enforce Incentive* on the penalty terms.

I include a number of control variables. I control for whether the licensor and licensee are in the same industry because a licensor in the same industry is more likely to be privately informed about the licensee's internal developments and may better assess the impropriety of the licensee's royalty reports. I include whether the licensor is obliged to provide technology support to the licensee because this obligation will likely lead to on-going conversations between the licensor and licensee, serving as an additional information channel for the licensor. I expect the licensor's better access to private information to ease the stringency of the audit right terms.

I also include *Material to Licensee* and *Royalty Rate* to control for the economic significance of the transaction to the licensee. I control for the licensee's size because smaller firms are likely to be more informationally opaque. To the extent that information uncertainty increases the need for broader audit scope, I expect smaller licensee firms to face broader audit scope terms. Finally, I control for the licensee's business uncertainty by including the licensee's profit volatility and product market fluidity (Hoberg et al., 2014) because general uncertainty about the licensee's business and future product demand may increase the licensee's incentives to misreport.[25]

5. Empirical Results

5.1. The scope of audit right analyses

I present the results of the audit right analyses in Table 4. In Panels A and B, I report the analyses on *Length of Allowed Audit Periods* and *Unrestricted Audits*, respectively. Consistent with my predictions, I find evidence that the licensee with a non-big N auditor or an industry non-specialist financial auditor is more likely to grant broader audit rights to the licensor, consistent with the licensor valuing broader audit rights on the licensee whose accounting system is perceived to be less reliable.[26,27] The results in columns 1 and 2 (3 and 4) in Panel A show that licensees with non-big N financial auditors (industry non-specialist financial auditors) are associated with allowing the licensor to go further back to audit prior periods (i.e., longer auditable periods). Moreover, when the licensee has high reporting flexibility, the licensor and licensee agree on

[25] Product market fluidity measures the competitive threats faced by a firm in its product market by capturing changes in rival firms' product space relative to the firm (Hoberg et al., 2014). The measure is available on http://hobergphillips.usc.edu/industryconcen.htm/.

[26] In untabulated analyses, I use the indicators for internal control material weakness (ICMW) and Accounting and Auditing Enforcement Releases (AAER) in the prior year to proxy for perceived weaknesses in the licensee's accounting system. However, there are only 49 observations with ICMW and 15 observations with AAER. There is no meaningful variation in my sample, and I find insignificant results with these proxies.

[27] In untabulated analyses, I use the abnormal audit fee to proxy for audit quality after controlling for determinants of audit fees, following the prior literature. To the extent that audit fees reflect efforts by financial auditors and thus financial audit quality, I find qualitatively similar results for the licensee with negative abnormal audit fees. Due to data availability of audit fees, the untabulated analysis is limited to a subsample of between 2003 and 2015.

narrower audit rights. The coefficients on *Worldwide License* and *Duration until Patent Expiration* are negative, consistent with these contractual features reducing the licensor's need for longer length of audit rights.

Panel B of Table 4 also shows that licensees with accounting system weaknesses are positively associated with granting the right to audit without restricting the frequencies.[28] The coefficients on N*on-big N financial auditors* (*Industry non-specialist financial auditors*) are positive, though statistically significant only for the licensee with non-big N financial auditors. In addition, *Number of Deductible Items* are negatively correlated with the tendency to including the audit right with unrestricted frequencies, consistent with audit scopes being less effective in deterring *intentional* misreporting. The coefficients on *Worldwide license* and *Duration until Patent Expiration* are negative and statistically significant, consistent with the self-enforcement theory that the licensee's incentive to self-enforce reduces the licensor's need for audits.

In columns (2) and (4) in Panels A and B, I add industry fixed effects to the regressions to eliminate alternative explanations for cross-industry differences in contract design. The results show that within-industry variation in the variables of interest (i.e., the licensee's perceived accounting system weakness, reporting flexibility and incentive to self-enforce) affects the scope of the licensor's audit rights in the predicted manners.

5.2. The penalty analyses

In Table 5, I report the results of the penalty analyses. In Panels A and B, I report the analyses on *Audit Fee Penalties* and *Interest Penalties*, respectively. As predicted, I find that as the licensee's reporting flexibility increases, the probability of imposing penalties increases. The

[28] In untabulated analyses, I run the logit and probit regressions using the same set of variables and find consistent results.

results in columns 1 through 4 in Panel A show that the greater number of allowed deductibles associated with including audit fee penalties in the contracts. This is consistent with the deterrence role of penalties being more effective on those with greater ability to misreport. I also find weak evidence that the penalty terms are less likely to be imposed on the licensee with industry non-specialist financial auditors, consistent with the law enforcement theory that the deterrence effects of penalties are lower for the licensee with a greater likelihood of unintentional errors (i.e., without fault). The coefficients on *Exclusive License* and *Duration until Patent Expiration* are positive and statistically significant.

Similarly, Panel B of Table 5 shows that the number of allowed deductibles is positively associated with imposing interest penalties on underpaid royalties. In columns 1 and 2 (3 and 4), the coefficients on *Non-Big N financial auditor* (*Industry non-specialist financial auditor*) are negative, though the coefficients are statistically significant only on *Industry non-specialist financial auditor*. Contracts with *Exclusive license* and *Duration until Patent Expiration* are more likely to include interest penalties. I add industry fixed effects to the regressions in columns 2 through 4 of Panels A and B, and find consistent results.

In untabulated analyses, I develop a dependent variable that combines *Audit Fee Penalties* and *Interest Penalties* such that the variable takes the value of two if including both of the penalties, one if including either of the penalties, and zero if including no penalty terms; the variable is increasing in the stringency of the combined penalty terms. Using this new measure, I repeat the penalty analyses and find consistent results. Moreover, the results are qualitatively similar using multinomial logit and OLS regressions.

6. Potential threats to the paper's inferences

For empirical tractability, my analysis is limited to observable audit terms. Contracting parties may rely on other contractual terms or unobservable monitoring mechanisms rather than on audit terms to mitigate misreporting risks. The purpose of this section is to discuss potential alternative mechanisms and address them in additional tests, as well as to note several caveats of this study.

6.1. Royalty terms as alternative mechanisms to mitigate misreporting risk

Institutionally, the contracting parties tend to negotiate and determine the royalty terms and *then* tailor the audit terms to meet the enforcement needs for the determined royalty terms. However, an alternative argument may be that the contracting parties adjust the royalty terms, instead of audit terms, to mitigate the licensor's misreporting risk. To address this concern, I investigate the determinants of the royalty characteristics: (1) royalty rates, and (2) royalty bases.

First, the licensor may increase royalty rates in order to price-protect its claims against potential losses due to the licensee's misreporting, thereby reducing the audit needs. To mitigate this concern, I control for royalty rates in the main analyses (Tables 4 and 5). Furthermore, in an additional test, I examine whether the licensee's perceived weaknesses in the accounting system and reporting flexibility have statistically significant effects on the royalty rates. Theoretically, royalty rates are determined by the licensor's contribution to the licensee's licensed sales (e.g., Stiglitz 1974). Thus, I expect the royalty rates to increase with the licensor's contribution to the contractual relationship, such as its obligations to provide technical support to the licensee throughout the contract duration. Alternatively, however, if the licensor relies on higher royalty rates to compensate for higher misreporting risk, the perceived weaknesses in the licensee's

accounting systems and reporting flexibility should lead to greater royalty rates. I test this alternative argument using the following model:

$$RoyaltyRates = \alpha + \beta_1 PerceivedAcctWeakness + \beta_2 ReportFlexibility + \beta_3 SelfEnforceIncentive + \boldsymbol{\lambda} ContractChar + \boldsymbol{\gamma} OtherControls + \epsilon \quad (2)$$

where the dependent variable is either *Royalty Rates*. I measure *Perceived Acct Weaknesses* as either *Non-Big N Financial Auditor* or *Industry Non-Specialist Financial Auditor* (See Section 3.3.1.). I measure *Reporting Flexibility* by using the number of deductible items (See Section 3.3.2.).

Second, the contracting parties may adjust the royalty bases (i.e., number of deductible items) to limit the licensee's reporting flexibility and reduce the misreporting risk. Prior theoretical research suggests that the extent of allowed deductibles (i.e., cost sharing) for royalties is motivated by risk sharing considerations (i.e., sharing uncertainty in environment changes) (e.g., Braverman and Stiglitz 1986; Allen and Lueck 1995 & 1999). I expect that the extent of cost sharing is greater when the contractual relationships are exposed to greater uncertainty. Alternatively, however, if the contracting parties reduce the number of deductible items in the royalty base to reduce misreporting risk, the perceived weaknesses in the licensee's accounting systems should lead to fewer deductible items in the royalty base. In order to test this alternative argument, I investigate whether the independent variables of interest in this study have an impact on the royalty bases, using the following model:

$$RoyaltyBase = \alpha + \beta_1 PerceivedAcctWeakness + \beta_2 SelfEnforceIncentive + \boldsymbol{\lambda} ContractChar + \boldsymbol{\gamma} OtherControls + \epsilon \quad (3)$$

where the dependent variable is *Number of Deductible Items*. I measure *Perceived Acct Weaknesses* as either *Non-Big N Financial Auditor* or *Industry Non-Specialist Financial Auditor*

(See Section 3.3.1.). I use three distinct measures for *Self Enforce Incentive*: *Exclusive License*, *Worldwide license* and *Duration until Patent Expiration* (See Section 3.3.3.).

In Table 6, I report the determinants of *Royalty Rate* and *Number of Deductible Items.* Panel A shows results from estimating equation (2). I find little evidence that the licensor's misreporting risk has first-order effects on *Royalty Rate;* perceived accounting system weaknesses are statistically insignificantly related to *Royalty Rate*. The coefficient on the licensee's reporting flexibility is also insignificant. However, I find that the licensee pays lower royalty rates (i.e., retains greater portions of the sales) when the licensee's product market is exposed to greater volatility, or when the contract has a long duration.[29] Supporting the prior theory, I also find that the licensor's obligations to provide technology support to the licensee increase royalty rates. This finding is consistent with the royalty rates capturing the licensor's relative contribution to the contractual relationship (e.g., Lafontain and Reynaud 2002).

Panel B of Table 6 reports the determinants of *Number of Deductible Items,* showing results from estimating equation (3). I find no evidence that perceived accounting system weaknesses have first-order impact on the royalty bases (i.e., *Number of Deductible Items).* However, I find that *Worldwide License*, *Duration until Patent Expiration* (i.e., long contract duration) and *Licensee Volatility* are positively correlated with the number of deductible items. To the extent worldwide sales, long contractual durations, and volatile business environments are exposed to greater future uncertainty, these findings are consistent with the theoretical prediction that greater future uncertainty leads to the greater extent of cost sharing (e.g., Allen and Lueck 1995 & 1999).

[29] A potential explanation for this finding is that lower royalty rates allow the licensee to retain greater residual claims and thereby can serve as an incentive mechanism (Lafontain and Reynaud 2002). To the extent that long-term contracts are associated with higher levels of relationship-specific investments by the licensee (e.g., Joskow 1988), lower royalty rates can provide additional incentives for the licensee to make relationship-specific investments.

Overall, while the determinants of royalty characteristics are largely consistent with prior theoretical predictions, I do not find evidence supporting the potential alternative argument that royalty terms are used to mitigate the licensor's misreporting risk.[30]

6.2. Implicit contractual terms

The contractual settings have potential limitations because the contracting parties may rely on implicit terms that are not observable in the contracts. Alternatively, unobservable monitoring mechanisms might substitute for explicit audit provisions. Although it is impossible to fully account for all implicit terms, I test for a potential mechanism that the licensors may use to put pressure on the licensees to improve their reporting quality: a change in financial auditors prior to signing the contracts. To test this potential mechanism, I investigate the licensees' likelihood of changing their financial auditors prior to entering the contracts, relative to other firms in the same industry-year. In subsequent tests, I also examine the likelihood of auditor changes among a subsample of licensee firms with big N financial auditors.

In Table 7, I report the difference in mean likelihoods of changing financial auditors prior to entering the contracts. In Panel A, I find little evidence that licensee firms are more likely to change their auditors than other firms in the same industry-year. In Panel B, I restrict the analysis to a subsample of firms with big N financial auditors at the time of entering the contracts.[31] I find statistically insignificant differences in the licensees' likelihood of changing their financial

[30] Nevertheless, given that there is no exogenous variation in the royalty characteristics nor any other contractual terms, I acknowledge that these additional analyses fall short of addressing endogeneity concerns due to the simultaneous nature of contract negotiation. I also recognize that there might be potential sample selection biases because a contract is included in my sample if it meets the materiality requirements under Regulation S-K, has non-missing financial data, and has unredacted audit terms. In addition, I do not observe failed negotiations or contracts among privately-held firms. Thus, the sample in this study may not be representative of the population of technology license agreements, and the findings should therefore be interpreted with these caveats in mind.

[31] Throughout the study, I measure all the variables for the licensee's firm characteristics, including financial auditor characteristics, in the year prior to entering into the contract. For consistency, I use a subsample of licensees that have big N financial auditors one year prior to signing the contract (i.e., at t-1). However, for robustness, I repeat the analysis using a subsample of firms with big N auditors in the year of contract and find similar results.

auditors prior to signing the contracts. Overall, I do not find evidence supporting the alternative argument that licensors demand financial auditor changes as an implicit enforcement mechanism.[32]

6.3. Bargaining power

Another threat to my inferences is the potential effects of bargaining power. Although my main tests include the licensee's firm size (*Licensee Size)* and whether the licensee and licensor belong to the same industry (*Same Industry)* to partially control for bargaining power, I perform additional analyses to mitigate concerns related to bargaining power. I include a proxy for bargaining power that increases in value as the licensor's relative size increases. In Table 8, I find results consistent with the main results from Sections 5.1 and 5.2 after explicitly controlling for bargaining power.

In addition, the bargaining power between the licensor and licensee may change as they engage in repeated transactions. However, given that I can only assess *material* agreements disclosed in SEC filings, I cannot observe all repeated contracts. Only 42 contracts out of 975 sample contracts include repeated licensor-licensee pairs. I drop these contracts with repeated licensor-licensee pairs and repeat the main analyses estimated from Eq (1). I find consistent results (untabulated). I also find consistent results when I cluster standard errors by repeated licensors and licensees.

7. Conclusions

This paper examines how perceived weaknesses in the licensee's accounting system, reporting flexibility, and incentives to self-enforce influence the design of two key audit terms in technology licensing contracts—(1) scope of audit rights, and (2) penalties for negative audit

[32] Nevertheless, I acknowledge the caveats of this study that other implicit, unobservable terms may still substitute for the explicit audit terms.

results. This paper shows that perceived weaknesses in the licensee's accounting system lead to broader audit rights and lower reliance on penalties. These findings are consistent with licensors demanding broader audit rights and relying less on penalty terms, when licensees' accounting systems are perceived to be less reliable and produce more *unintentional* errors. When the licensee has high reporting flexibility due to the inclusion of more allowed deductibles, penalties are more likely to be used as a deterrent, while broader audit rights that increase the threat of more frequent, intrusive audits are less likely to be employed. These findings are consistent with penalties being more cost-effective deterrents to *intentional* misreporting. I also show that licenses covering more territory and having longer durations are associated with less stringent audit scope terms, consistent with the self-enforcement theory that the higher opportunity cost of early termination associated with greater expansion opportunities induces the licensee to self-enforce, thereby reducing the licensor's need for audits. These results are not driven by the licensors price-protecting themselves against the misreporting risk via higher royalty rates. Overall, my findings suggest that audit scope and penalties can improve contracting efficiency differentially, depending upon the contractual parties' concerns regarding unintentional and intentional misreporting.

The evidence in this paper highlights that external verifiability of accounting information can serve an important role in intangible asset transactions, such as technology licensing. Firms can reduce the *ex ante* risk of undercharging or overpaying for intangibles by allowing the future realized value to determine the payment terms (i.e., royalties). Taking advantage of external verifiability of accounting information, firms can rely on disaggregated accounting proxies to capture the realized value of the intangibles and design the audit terms to enforce the accuracy of the accounting-based payments. Consequently, the reliability of accounting systems is an important factor in negotiating and facilitating these intangible asset transactions. I also provide

evidence that penalty terms, in addition to audit scope, can be used to mitigate accounting-related information asymmetry problems. Taken together, these results highlight how accounting information and auditing can facilitate contracting on intangible assets.

Although my study focuses on technology licensing agreements, a combination of accounting-based royalties and contractual audit terms is commonly used in many contracts involving intellectual properties or transfer of intangible properties. For example, royalty terms are often used in transacting on trademarks, book publishing, music, film, and software—all of which can be protected under intellectual property laws. In these royalty-based contracts, contractual audit terms are ubiquitous enforcement terms. In addition, franchise contracts are another type of agreements that rely on sales-based royalty and audit terms because the intangible assets (e.g., brand name and know-hows of franchisors) involved in the transactions create contracting problems (Lafontaine and Raynaud, 2002). To the extent that the combination of accounting-based royalties and contractual audit terms is used to mitigate contractual hazards associated with intangible assets, I expect my results to generalize beyond technology licensing settings.

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Appendix A. Data definition

Audit characteristics

Length of Auditable Periods	The number of months required of the licensee to retain relevant documents for audit purposes.
Unrestricted Audits	An indicator variable equal to one if the contract specifies that the licensors are unrestricted to a certain number of audits per year, zero if there is some restriction.
Audit Fee Penalties	An indicator variable equal to one if the contract specifies that the licensors can charge the audit fee to the licensees upon detecting material errors, zero otherwise.
Interest Penalties	An indicator variable equal to one if the contract specifies that the licensor can impose on the licensees interest penalties for underpayments detected during an audit, zero otherwise.

Contract characteristics

Royalty %	Royalty rates.
Material to Licensee	An indicator variable equal to one if the contract meets the licensee's materiality threshold to file the contract with the SEC, zero otherwise.
Exclusive License	An indicator variable equal to one if the contract specifies that the licensor grants an exclusive license to the licensee, zero otherwise.
Worldwide License	An indicator variable equal to one if the contract specifies that the licensor grants a worldwide license to the licensee, zero otherwise.
Licensor's Tech Support	An indicator variable equal to one if the contract specifies that the licensee may request technical support from the licensor when necessary, zero otherwise.
Duration until Patent Expiration	An indicator variable equal to one if the contract duration is until expiration of patents, zero otherwise.
Number of Deductible Items	The number of deductible items allowed in royalty calculation.

Firm characteristics

Licensee Size	The licensee’s total assets in the year prior to entering into the contract.
Licensee Volatility	The standard deviation of the Licensee’s EBITDA scaled by total assets over the five year period prior to entering into the contract.
Non-Big N Financial Auditor	An indicator variable equal to one if the firm’s financial auditor is not one of the big N auditors in the year prior to entering the contract, zero otherwise.
Industry Non-Specialist Financial Auditor	Auditors are non-specialists if they audit less than 30 percentage of the market in the year prior to entering the contract.
Same Industry	An indicator variable equal to one if the Licensor and Licensees are in the same industry (Fama-French 12 Industry), zero otherwise.

Product Market Fluidity	A measure of firm-level competitive threats based on the description of firms' product space and rival moves in their 10-K's developed by Hoberg et al. (2014). The measure is available on http://hobergphillips.usc.edu/industryconcen.htm/.
Bargaining Power	A discrete variable takes a value of zero if the licensor is a non-corporate entity or a privately-held company; one if the asset size difference between the licensor and licensee is below the median; and two if the asset size difference between the licensor and licensee is above the median.

Variables used in Appendix C

Assets - Total	Total assets.
Lev	Long term debt plus short term debt, scaled by total assets.
ROA	Return on assets, measured as income before extraordinary items scaled by total assets.
Fixed Assets	Property, plant and equipment (net), scaled by total assets.
R&D	Research and development expenses.
COGS/Sales	Cost of goods sold, scaled by sales.
Financial (Big N) Auditor Change$_{[t-i,t-1]}$	An indicator variable that takes a value of one if the firm changed its (big N) financial auditors between *i* years and one year prior to entering the contract; zero otherwise.

Appendix B. Example audit clauses

CONTRACT 1

(a) AUDIT RIGHTS; PROCEDURE. Upon the written request of LICENSOR, and not more than once in each calendar year, LICENSEE will permit an independent certified public accounting firm selected by LICENSOR, and reasonably acceptable to LICENSEE, at LICENSOR's expense, to have access during normal business hours, and upon reasonable prior written notice, to such of the records of LICENSEE as may be reasonably necessary to verify the accuracy of any financial reports to LICENSOR for any quarter within the preceding three (3) years.

(b) ADDITIONAL PAYMENTS; COST REIMBURSEMENT. If such accounting firm concludes that additional royalties or other payments were owed during such period, LICENSEE will pay the additional royalties or other payments, with interest from the date originally due at the prime rate, as published in The Wall Street Journal (Eastern U.S. Edition) on the last business day preceding such date, within thirty (30) days after the date Examiner delivers to Examinee such accounting firm's written report. If the amount of the underpayment is greater than five percent (5%) of the total amount owed, then LICENSEE will in addition reimburse LICENSOR for its reasonable costs related to such audit.

Length of auditable periods	36 months (3 years)
Unrestricted Audits	YES
Audit fee penalties	YES
Interest penalties	YES

CONTRACT 2

A. Licensee shall keep, and shall require its Affiliates and use commercially reasonable efforts to require its Sublicensees to keep, full, true and accurate books and records…in sufficient detail to enable LICENSOR to determine Licensee's compliance with this Agreement. Said books and records, including books of account, shall be kept at Licensee's principal place of business or the principal place of business of the appropriate division of Licensee to which this Agreement relates. Said books and the supporting data shall be retained for at least six (6) years following the end of the calendar year to which they pertain.

B. In the event of a suspected breach by the Licensee of its payment obligations hereunder or its obligations pertaining to sublicenses, … Licensor shall have the right to inspect, copy and audit, on fifteen (15) days prior written notice, at Licensor's expense, the books described above from time to time to verify the reports provided for herein or compliance in other respects with this Agreement. Any person(s) conducting such audit on behalf of Licensor shall be a Certified Public Accountant. … Such accountant shall perform such inspection, copying and auditing at Licensor's expense during Licensee's regular business hours. Each party agrees to treat the results of any such accountant's review of the other party's records under this paragraph as Confidential Information.

Appendix B. Example audit clauses (cont'd)

Length of auditable periods	72 months (6 years)
Unrestricted Audits	NO
Audit fee penalties	NO
Interest penalties	NO

Appendix C. Descriptive analysis on licensee firm characteristics

This table presents differences in mean values of firm characteristics for licensee firms compared to other firms. Panel A presents the difference in mean values for all the licensee firms (N_1=975) compared to all licensor firms with non-missing financial data (N_2=441). Panel B presents the difference in mean values for the licensee firms in the *same* industry as the licensor firms (N_1=314) compared to those in the *different* industries (N_2=661). Panel C presents the difference in mean values for the licensee firms (N_1=975) compared to other Compustat firms in the same industry-year with non-missing financial data (N_2=15,096). *p*–values (two–tailed) test for differences in means and appear in brackets.

Panel A. *Sample licensee firms versus licensor firms*

	Licensee Firms		Licensor Firms		Diff. in	*p*-value
Variable	Mean	N	Mean	N	means	
Assets - Total($M)	2960.30	975	4681.06	441	-1720.76*	[0.02]
Lev	0.82	975	0.38	441	0.44**	[0.01]
ROA	-1.45	975	-0.79	441	-0.66**	[0.01]
Fixed Assets	0.16	971	0.15	439	0.01	[0.21]
R&D ($M)	233.01	850	403.22	396	-170.21**	[0.01]
COGS/Sales	0.32	969	0.28	431	0.05**	[0.00]
Big N Auditor	0.71	975	0.68	441	0.03	[0.21]

Panel B. *Sample licensee firms in the same versus in different industries as licensor firms*

	In Same Industries		In Diff. Industries		Diff. in	*p*-value
Variable	Mean	N	Mean	N	means	
Assets - Total($M)	6666.02	314	1199.94	661	5466.07***	[0.00]
Lev	0.33	314	1.06	661	-0.73**	[0.00]
ROA	-0.42	314	-1.94	661	1.52***	[0.00]
Fixed Assets	0.16	313	0.16	658	-0.01	[0.60]
R&D ($M)	570.59	287	60.92	563	509.67***	[0.00]
COGS/Sales	0.28	311	0.35	658	-0.07***	[0.00]
Big N Auditor	0.84	314	0.65	661	0.19***	[0.00]

Panel C. *Sample licensee firms versus Compustat firms*

	Licensee Firms		Compustat Firms		Diff. in	*p*-value
Variable	Mean	N	Mean	N	means	
Assets - Total($M)	2960.30	975	1427.77	15096	1532.53***	[0.00]
Lev	0.82	975	0.46	15096	0.36*	[0.02]
ROA	-1.45	975	-0.83	15096	-0.62*	[0.01]
Fixed Assets	0.16	971	0.14	15096	0.01**	[0.01]
R&D($M)	233.01	850	120.20	15096	112.81***	[0.00]
COGS/Sales	0.32	969	0.31	15096	0.01	[0.25]
Big N Auditor	0.71	975	0.67	15096	0.04**	[0.00]

Table 1. Sample selection

This table presents my sample selection process.

Filters	Contracts	
KtMine License Agreement Database[1]		2,231
Excluding Other Contracts[2]	–	634
		1,597
Excluding licensees with missing data[3]	–	622
		975

[1] For the period from January 1996 to December 2015, I search KtMine License Agreement Database for all royalty contracts for technology licensing using the filter "patent" and "technology" in the search options.

[2] As a second filter, I manually read each contract and eliminate observations that are not technology license agreements (TLA) or do not have royalty components. KtMine database occasionally misclassifies other types of agreements or documents. I drop these misclassified documents and duplicate filings.

[3] I require the public licensees to have non-missing Compustat data and all contract-specific variables.

Table 2. Distribution of firms by industry

This table reports the distribution of firms by Fama-French 12 industries. The first two columns report the distribution of 457 licensors and 975 licensees from my sample of 975 contracts. Among 975 contracts, 518 licensors are missing the industry classification because they are either non-corporate entities (e.g., research institutes, universities, and government agencies), privately-held companies, or publicly-traded companies with missing financial data on Compustat.

	Licensors		Licensees	
Industry Description	Number (1)	%Frequency (2)	Number (3)	%Frequency (4)
Consumer Non Durables	13	2.84%	20	2.05%
Consumer Durables	3	0.66%	18	1.85%
Manufacturing	15	3.28%	53	5.44%
Energy Oil, Gas, and Coal Products	0	0.00%	7	0.72%
Chemicals and Allied Products	9	1.97%	35	3.59%
Business Equipment	74	16.19%	155	15.90%
Telephone and Television Transmission	3	0.66%	12	1.23%
Wholesale, Retail, and Some Services	9	1.97%	29	2.97%
Healthcare, Medical Equipment, and Drugs	282	61.71%	556	57.03%
Finance	16	3.50%	20	2.05%
Other	33	7.22%	70	7.18%
TOTAL	457	100.0%	975	100.0%

Table 3. Descriptive statistics

Panel A of this table presents all descriptive statistics for the sample contracts. In Panel B, I report descriptive details of the deductible items allowed in royalty calculation. In columns 1 and 2 of Panel B, I report the frequencies of deductible items for the total sample of royalty contracts. There are 225 contracts that do not include any deductible expenses (i.e., "Gross Revenue"), and 750 contracts that include at least one deductible item. Among those 750 contracts, 403 contracts allow deducting allowance accounts; 600 contracts allow deducting transportation & handling expenses; and 161 contracts allow deducting sales commissions. In Panel C, I report the frequency for the total number of deductible items allowed in royalty calculation. All variables are defined in Appendix A.

Panel A: Descriptive statistics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variable	N	mean	sd	p5	p10	p25	p50	p75	p90	p95
Audit Terms										
Length of Auditable Periods (years)	975	4.056	1.345	1	2	3	5	5	5	7
Unrestricted Audits	975	0.490	0.500	0	0	0	0	1	1	1
Audit Fee Penalties	975	0.509	0.500	0	0	0	1	1	1	1
Interest Penalties	975	0.316	0.465	0	0	0	0	1	1	1
Contract Characteristics										
Royalty %	975	10.748	13.862	0.5	1.125	3	5	10	50	50
Worldwide License	975	0.676	0.468	0	0	0	1	1	1	1
Excl. License	975	0.926	0.262	0	0	1	1	1	1	1
Material to Licensee	975	0.778	0.415	0	0	1	1	1	1	1
Duration until Patent Expiration	975	0.362	0.481	0	0	0	0	1	1	1
Licensor's Tech Support	975	0.265	0.453	0	0	0	0	1	1	1
No of Deductible Items	975	1.958	1.298	0	0	1	2	3	4	4
Firm Characteristics										
Licensee Size ($M)	975	2960.298	9815.305	0.006	0.508	7.863	56.015	342.101	19118	46420
Licensee Volatility	975	1.255	3.953	0.201	0.027	0.063	0.172	0.538	2.686	6.951
Non-Big N Financial Auditor	975	0.286	0.452	0	0	0	0	1	1	1
Industry Non-Specialist Financial Auditor	975	0.84	0.367	0	0	1	1	1	1	1
Same Industry	975	0.322	0.468	0	0	0	0	1	1	1
Product Market Fluidity	975	9.348	4.225	0.513	3.445	5.974	9.118	12.322	16.448	20.263

Table 3: Panel B

Allowed Deductible Items	Total Sample	
	N	%Freq
	(1)	(2)
None *(Gross Revenue)*	225	23.08
Returns and Discounts	750	76.92
Sales Allowances	348	35.69
Allowance for Doubtful Accounts	158	16.21
Transportation & Handling	600	61.54
Sales Commissions	161	16.41

Table 3: Panel C

Total number of deductible items	(1) Freq.	(2) Percent
0	225	23.08
1	84	8.62
2	253	25.95
3	251	25.74
4	137	14.05
5	25	2.56
Total	975	

Table 4. The audit scope analysis

In this table, I report the results from Eq. (1) where the dependent variable captures the stringency of the scope of audit rights. The dependent variable in Panels A is the length of auditable periods. The dependent variable in Panel B is whether the licensor has an unrestricted number of audits in a given year. Columns (1) through (4) in each Panel report the results for different specifications of the licensee's accounting system weakness. Columns (2) and (4) include industry fixed effects. Standard errors are heteroskedasticity robust. Standard errors are reported in parentheses, and ***, **, * denote significance at the 1, 5, and 10 percent levels, respectively. All variables are defined in Appendix A.

Panel A. Measure of audit scope: Length of auditable periods

Variable	Pre-dicted	*Length of Auditable Periods* (1)	(2)	(3)	(4)
PERCEIVED ACCOUNTING SYSTEM WEAKNESSES					
Non-Big N Financial Auditor	+	0.181*	0.178*		
		(0.0949)	(0.0965)		
Industry Non-Specialist Financial Auditor	+			0.292**	0.309***
				(0.116)	(0.116)
REPORTING FLEXIBILITY					
No of Deductible Items	-	-0.174***	-0.168***	-0.175***	-0.168***
		(0.0305)	(0.0311)	(0.0304)	(0.0311)
SELF ENFORCE INCENTIVE					
Worldwide License	-	-0.184**	-0.188**	-0.194**	-0.199**
		(0.0911)	(0.0893)	(0.0905)	(0.0886)
Duration until Patent Expiration	-	-0.0539	-0.0330	-0.0691	-0.0471
		(0.0930)	(0.0942)	(0.0928)	(0.0939)
Excl. License	-	0.124	0.117	0.129	0.125
		(0.148)	(0.146)	(0.148)	(0.145)
OTHER CONTRACT CHAR.					
Licensor's Tech Support		-0.221**	-0.200**	-0.231**	-0.211**
		(0.0928)	(0.0937)	(0.0920)	(0.0927)
Material to Licensee		-0.109	-0.121	-0.115	-0.129
		(0.120)	(0.119)	(0.119)	(0.118)
Royalty %		-0.00309	-0.00227	-0.00308	-0.00223
		(0.00292)	(0.00298)	(0.00292)	(0.00298)
LICENSEE FIRM CHAR.					
Licensee Size		-1.223**	-1.232**	-1.205**	-1.200**
		(0.582)	(0.584)	(0.567)	(0.570)
Licensee Volatility		-0.0521***	-0.0619***	-0.0482***	-0.0584***
		(0.000694)	(0.000768)	(0.000713)	(0.000786)
Licensee Product Market Fluidity		-0.0167	-0.0201*	-0.0142	-0.0172
		(0.0109)	(0.0117)	(0.0110)	(0.0118)
Same Industry		-0.151	-0.187*	-0.139	-0.173
		(0.102)	(0.108)	(0.101)	(0.107)
Industry FE		NO	YES	NO	YES
Observations		975	975	975	975
R-squared		0.094	0.105	0.096	0.108

Table 4: Panel B. Measure of audit scope: Unrestricted audit

Variable	Pre-dicted	*Unrestricted Audits* (1)	(2)	(3)	(4)
PERCEIVED ACCOUNTING SYSTEM WEAKNESSES					
Non-Big N Financial Auditor	+	0.0764**	0.0694*		
		(0.0346)	(0.0358)		
Industry Non-Specialist Financial Auditor	+			0.0521	0.0531
				(0.0412)	(0.0412)
REPORTING FLEXIBILITY					
No of Deductible Items	-	-0.0565***	-0.0573***	-0.0570***	-0.0575***
		(0.0115)	(0.0118)	(0.0114)	(0.0118)
SELF ENFORCE INCENTIVE					
Worldwide License	-	-0.0606*	-0.0605*	-0.0618*	-0.0617*
		(0.0332)	(0.0331)	(0.0331)	(0.0331)
Duration until Patent Expiration	-	-0.160***	-0.155***	-0.166***	-0.160***
		(0.0337)	(0.0341)	(0.0339)	(0.0342)
Excl. License	-	0.0166	0.0191	0.0178	0.0208
		(0.0540)	(0.0541)	(0.0538)	(0.0539)
OTHER CONTRACT CHARACTERISTICS					
Licensor's Tech Support		-0.0598*	-0.0545	-0.0629*	-0.0576*
		(0.0331)	(0.0337)	(0.0329)	(0.0335)
Material to Licensee		0.106***	0.0954**	0.112***	0.0996**
		(0.0407)	(0.0410)	(0.0410)	(0.0413)
Royalty %		0.0122	0.0133	0.0123	0.0134
		(0.0105)	(0.0109)	(0.0105)	(0.0109)
LICENSEE FIRM CHARACTERISTICS					
Licensee Size		-0.143	-0.148	-0.162	-0.161
		(0.184)	(0.180)	(0.184)	(0.179)
Licensee Volatility		-0.0948**	-0.0115***	-0.0916**	-0.0110***
		(0.0395)	(0.0421)	(0.0397)	(0.0421)
Licensee Product Market Fluidity		-0.0160***	-0.0201***	-0.0142***	-0.0186***
		(0.00306)	(0.00361)	(0.00283)	(0.00339)
Same Industry		-0.114***	-0.126***	-0.116***	-0.125***
		(0.0363)	(0.0382)	(0.0368)	(0.0386)
Industry FE		NO	YES	NO	YES
Observations		975	975	975	975
R-squared		0.162	0.178	0.159	0.176

Table 5. The penalty analysis

In this table, I report the results from Eq. (1) where the dependent variable captures the inclusion of penalties. The dependent variable in Panels A is whether the burden of audit fee is shifted to the licensee if misreported royalties are detected. The dependent variable in Panel B is whether interest is charged on underpayments. Columns (1) through (4) in each Panel report the results for different specifications of the licensee's accounting system weakness. Columns (2) and (4) include industry fixed effects. Standard errors are heteroskedasticity robust. Standard errors are reported in parentheses, and ***, **, * denote significance at the 1, 5, and 10 percent levels, respectively. All variables are defined in Appendix A.

Panel A. Measure of penalty: Audit fee penalties

Variable	Pre-dicted	*Audit Fee Penalties* (1)	(2)	(3)	(4)
PERCEIVED ACCOUNTING SYSTEM WEAKNESSES					
Non-Big N Financial Auditor	-	0.0437	0.0444		
		(0.0342)	(0.0344)		
Industry Non-Specialist Financial Auditor	-			-0.0783*	-0.0763*
				(0.0413)	(0.0413)
REPORTING FLEXIBILITY					
No of Deductible Items	+	0.0923***	0.101***	0.0914***	0.100***
		(0.0111)	(0.0113)	(0.0110)	(0.0113)
SELF ENFORCE INCENTIVE					
Worldwide License	?	0.0493	0.0488	0.0534	0.0535
		(0.0338)	(0.0338)	(0.0337)	(0.0338)
Duration until Patent Expiration	?	0.142***	0.142***	0.140***	0.140***
		(0.0342)	(0.0345)	(0.0341)	(0.0344)
Excl. License	?	0.180***	0.184***	0.180***	0.183***
		(0.0566)	(0.0573)	(0.0575)	(0.0583)
OTHER CONTRACT CHAR.					
Licensor's Tech Support		-0.0596	-0.0112	-0.0592	-0.0116
		(0.0340)	(0.0341)	(0.0341)	(0.0342)
Material to Licensee		-0.0468	-0.0387	-0.0320	-0.0239
		(0.0431)	(0.0423)	(0.0432)	(0.0424)
Royalty %		-0.0128	-0.0149	-0.0126	-0.0149
		(0.0103)	(0.0103)	(0.0103)	(0.0104)
LICENSEE FIRM CHAR.					
Licensee Size		-0.165	-0.123	-0.216	-0.171
		(0.177)	(0.172)	(0.172)	(0.167)
Licensee Volatility		0.0459	0.0625	0.0362	0.0547
		(0.0396)	(0.0418)	(0.0398)	(0.0420)
Licensee Product Market Fluidity		0.0134***	0.0113***	0.0146***	0.0125***
		(0.00249)	(0.00344)	(0.00241)	(0.00347)
Same Industry		0.0827	0.0280	-0.0268	0.0201
		(0.0352)	(0.0372)	(0.0358)	(0.0377)
Industry FE		NO	YES	NO	YES
Observations		975	975	975	975
R-squared		0.145	0.167	0.147	0.168

Table 5: Panel B. Measure of penalty: Interest penalties

Variable	Pre-dicted	*Interest Penalties* (1)	(2)	(3)	(4)
PERCEIVED ACCOUNTING SYSTEM WEAKNESSES					
Non-Big N Financial Auditor	-	-0.0188	-0.0116		
		(0.0323)	(0.0333)		
Industry Non-Specialist Financial Auditor	-			-0.119***	-0.113***
				(0.0424)	(0.0428)
REPORTING FLEXIBILITY					
No of Deductible Items	+	0.0515***	0.0473***	0.0511***	0.0468***
		(0.0105)	(0.0109)	(0.0106)	(0.0109)
SELF ENFORCE INCENTIVE					
Worldwide License	?	-0.0105	-0.00902	0.0391	0.0447
		(0.0311)	(0.0307)	(0.0314)	(0.0309)
Duration until Patent Expiration	?	0.0792**	0.0744**	0.0818**	0.0763**
		(0.0337)	(0.0342)	(0.0334)	(0.0340)
Excl. License	?	0.0862*	0.0847*	0.0845*	0.0826*
		(0.0482)	(0.0486)	(0.0489)	(0.0493)
OTHER CONTRACT CHARACTERISTICS					
Licensor's Tech Support		0.0655**	0.0763**	0.0681**	0.0783**
		(0.0325)	(0.0329)	(0.0324)	(0.0327)
Material to Licensee		0.0963**	0.0865**	0.107***	0.0971**
		(0.0401)	(0.0410)	(0.0404)	(0.0413)
Royalty %		0.0197*	0.0208*	0.0198*	0.0207*
		(0.0112)	(0.0112)	(0.0112)	(0.0113)
LICENSEE FIRM CHARACTERISTICS					
Licensee Size		0.368**	0.344**	0.333*	0.308*
		(0.167)	(0.166)	(0.172)	(0.171)
Licensee Volatility		0.0929**	0.0586	0.0808**	0.0474
		(0.0375)	(0.0403)	(0.0376)	(0.0403)
Licensee Product Market Fluidity		0.0121***	0.0117***	0.0119***	0.0117***
		(0.00291)	(0.00347)	(0.00282)	(0.00333)
Same Industry		0.0776**	0.0456	0.0682*	0.0378
		(0.0358)	(0.0378)	(0.0356)	(0.0375)
Industry FE		NO	YES	NO	YES
Observations		975	975	975	975
R-squared		0.090	0.100	0.098	0.107

Table 6. The determinants of royalty characteristics

This table reports the results from regressions investigating the determinants of royalty characteristics as specified in Equations (2) and (3). In Panel A, the dependent variable is royalty rates. Panel B reports the results where the dependent variable is equal to the number of deductible items allowed in royalty calculation. In columns (2) and (4) in each Panel, industry fixed effects are included. Standard errors are heteroskedasticity robust. Standard errors are reported in parentheses, and ***, **, * denote significance at the 1, 5, and 10 percent levels, respectively. All variables are defined in Appendix A

Panel A. Measure of royalty characteristics: Royalty rate

	Royalty %			
Variable	(1)	(2)	(3)	(4)
PERCEIVED ACCOUNTING SYSTEM WEAKNESSES				
Non-Big N Financial Auditor	0.238	0.132		
	(0.998)	(1.047)		
Industry Non-Specialist Financial Auditor			0.155	-0.0634
			(1.264)	(1.266)
REPORTING FLEXIBILITY				
No of Deductible Items	-0.279	-0.235	-0.281	-0.236
	(0.288)	(0.292)	(0.288)	(0.292)
SELF ENFORCE INCENTIVE				
Worldwide License	0.436	0.357	0.433	0.363
	(0.926)	(0.953)	(0.928)	(0.953)
Duration until Patent Expiration	-1.676*	-1.595	-1.694*	-1.603*
	(0.954)	(0.970)	(0.946)	(0.962)
Excl. License	2.292*	2.361*	2.296*	2.361*
	(1.265)	(1.319)	(1.265)	(1.319)
OTHER CONTRACT CHARACTERISTICS				
Licensor's Tech Support	3.477***	3.130***	3.468***	3.127***
	(1.052)	(1.094)	(1.051)	(1.094)
Material to Licensee	-2.267	-2.264	-2.250	-2.238
	(1.514)	(1.514)	(1.542)	(1.545)
LICENSEE FIRM CHARACTERISTICS				
Licensee Size	7.306	8.081	7.246	7.998
	(5.966)	(5.982)	(5.938)	(5.950)
Licensee Volatility	0.0235	0.0884	0.0245	0.0877
	(0.114)	(0.123)	(0.116)	(0.125)
Licensee Product Market Fluidity	-0.0217***	-0.0158*	-0.0212***	-0.0155*
	(0.00666)	(0.00897)	(0.00634)	(0.00874)
Same Industry	2.405**	3.039***	2.399**	3.028***
	(1.136)	(1.171)	(1.121)	(1.162)
Industry FE	NO	YES	NO	YES
Observations	975	975	975	975
R-squared	0.048	0.058	0.048	0.058

Table 6: Panel B. Measure of royalty characteristics: Royalty base

	No of Deductible Items			
Variable	(1)	(2)	(3)	(4)
PERCEIVED ACCOUNTING SYSTEM WEAKNESSES				
Non-Big N Financial Auditor	-0.103	-0.0637		
	(0.0987)	(0.0972)		
Industry Non-Specialist Financial Auditor			-0.0727	-0.0685
			(0.121)	(0.111)
SELF ENFORCE INCENTIVE				
Worldwide License	0.197**	0.178*	0.199**	0.180*
	(0.0970)	(0.0942)	(0.0967)	(0.0940)
Duration until Patent Expiration	0.703***	0.571***	0.711***	0.576***
	(0.0912)	(0.0908)	(0.0906)	(0.0905)
Excl. License	0.0776	0.0512	0.0759	0.0493
	(0.176)	(0.168)	(0.175)	(0.168)
OTHER CONTRACT CHARACTERISTICS				
Licensor's Tech Support	0.137	0.134	0.141	0.137
	(0.0972)	(0.0931)	(0.0969)	(0.0930)
Material to Licensee	-0.137	-0.171	-0.144	-0.173
	(0.116)	(0.110)	(0.114)	(0.108)
Royalty %	-0.00266	-0.00210	-0.00268	-0.00211
	(0.00274)	(0.00261)	(0.00274)	(0.00261)
LICENSEE FIRM CHARACTERISTICS				
Licensee Size	0.485	0.124	0.510	0.128
	(0.413)	(0.410)	(0.412)	(0.412)
Licensee Volatility	0.0530***	0.0320***	0.0526***	0.0314***
	(0.0108)	(0.0115)	(0.0108)	(0.0115)
Licensee Product Market Fluidity	-0.00142	-0.000704	-0.00166	-0.000839
	(0.00129)	(0.00138)	(0.00132)	(0.00140)
Same Industry	0.350***	0.176*	0.352***	0.174*
	(0.101)	(0.104)	(0.102)	(0.104)
Industry FE	NO	YES	NO	YES
Observations	975	975	975	975
R-squared	0.152	0.212	0.151	0.212

Table 7. Financial Auditor Changes Prior to Entering the Contracts

This table presents whether the sample licensee firms are more likely to change their financial auditors prior to entering the contracts, relative to other firms in the same industries. Panel A presents the difference in mean values for all the licensee firms (N_1=975) compared to other firms in the same industry-year with non-missing financial data on Compustat (N_2=15,096). Panel B presents the difference for the licensee firms *with big N financial auditors* in the year prior to entering the contract (N_1=696) compared to other Compustat firms *with big N financial auditors* in the same industry-year (N_2=10,136). *Financial (Big N) Auditor Change*$_{[t-i,t-1]}$ is an indicator variable that takes a value of one if the firm changed its (big N) financial auditors between *i* years and one year prior to entering the contract; zero otherwise. *p*–values (two–tailed) test for differences in means and appear in brackets.

Panel A. *Sample licensee firms*

	Licensee Firms		Compustat Firms		Diff. in	*p*-value
Variable	Mean	N	Mean	N	means	
Financial Auditor Change$_{[t-2,t-1]}$	0.18	975	0.18	15096	0.00	[0.90]
Financial Auditor Change$_{[t-3,t-1]}$	0.24	975	0.24	15096	0.00	[0.90]
Big N Auditor Change$_{[t-2,t-1]}$	0.13	975	0.14	15096	-0.00	[0.66]
Big N Auditor Change$_{[t-3,t-1]}$	0.17	975	0.18	15096	-0.01	[0.41]

Panel B. *Subsample of licensee firms with big N financial auditor one year prior to entering the contracts*

	Licensee Firms		Compustat Firms		Diff. in	*p*-value
Variable	Mean	N	Mean	N	means	
Financial Auditor Change$_{[t-2,t-1]}$	0.14	696	0.14	10136	-0.00	[0.75]
Financial Auditor Change$_{[t-3,t-1]}$	0.19	696	0.19	10136	-0.00	[0.76]
Big N Auditor Change$_{[t-2,t-1]}$	0.09	696	0.12	10136	-0.03*	[0.02]
Big N Auditor Change$_{[t-3,t-1]}$	0.13	696	0.15	10136	-0.03*	[0.03]

Table 8. Bargaining Power

This table presents results from my analysis of audit terms after explicitly controlling for bargaining power. The dependent variables in Panels A are *Length of Auditable Periods* and *Unrestricted Audit*. The dependent variables in Panel B are *Audit Fee Penalties* and *Interest Penalties*. Columns (1) through (4) in each Panel include industry fixed effects. *Bargaining Power* takes a value of zero if the licensor is a non-corporate entity (e.g., research institute, universities) without manufacturing capacities, or a privately-held company; one if the asset size difference between the licensor and licensee is below the median; and two if the asset size difference between the licensor and licensee is above the median. Control variables include *Licensor's tech support*, *Material to Licensee*, *Royalty %*, *Licensee Volatility*, and *Licensee Product Market Fluidity*. For parsimony, I do not tabulate coefficients on control variables. Standard errors are heteroskedasticity robust, and ***, **, * denote significance at the 1, 5, and 10 percent levels, respectively. All variables are defined in Appendix A.

Panel A. Audit scope analysis

		Audit Scope			
Variable	Predic-ted	Length of Auditable Period	Length of Auditable Period	Unrestricted Audit	Unrestricted Audit
Bargaining Power		-0.0828	-0.0904*	-0.0657***	-0.0682***
		(0.0528)	(0.0525)	(0.0198)	(0.0198)
PERCEIVED ACCOUNTING SYSTEM WEAKNESSES					
Non-Big N Financial Auditor	+	0.204**		0.0721**	
		(0.0960)		(0.0358)	
Industry Non-Specialist Financial Auditor	+		0.357***		0.0708*
			(0.116)		(0.0408)
REPORTING FLEXIBILITY					
No of Deductible Items	-	-0.173***	-0.173***	-0.0603***	-0.0605***
		(0.0312)	(0.0311)	(0.0118)	(0.0117)
SELF ENFORCE INCENTIVE					
Worldwide License	-	0.116	0.125	0.0231	0.0252
		(0.148)	(0.146)	(0.0547)	(0.0545)
Duration until Patent Expiration	-	-0.195**	-0.207**	-0.0614*	-0.0632*
		(0.0893)	(0.0885)	(0.0333)	(0.0332)
Excl. License	-	-0.0301	-0.0438	-0.152***	-0.156***
		(0.0945)	(0.0943)	(0.0343)	(0.0343)
Controls		YES	YES	YES	YES
Industry FE		YES	YES	YES	YES
Observations		975	975	975	975
R-squared		0.102	0.107	0.178	0.177

Table 8: Panel B. Penalty analysis

		Penalties			
Variable	Predic-ted	Audit Fee Penalties	Audit Fee Penalties	Interest Penalties	Interest Penalties
Bargaining Power		0.0215	0.0202	0.0419**	0.0428**
		(0.0188)	(0.0190)	(0.0193)	(0.0191)
PERCEIVED ACCOUNTING SYSTEM WEAKNESSES					
Non-Big N Financial Auditor	-	0.0476		-0.0165	
		(0.0341)		(0.0330)	
Industry Non-Specialist Financial Auditor	-		-0.0745*		-0.125***
			(0.0408)		(0.0423)
REPORTING FLEXIBILITY					
No of Deductible Items	+	0.102***	0.101***	0.0489***	0.0482***
		(0.0113)	(0.0113)	(0.0108)	(0.0109)
SELF ENFORCE INCENTIVE					
Worldwide License	?	0.182***	0.181***	0.0838*	0.0811*
		(0.0575)	(0.0586)	(0.0484)	(0.0491)
Duration until Patent Expiration	?	0.0477	0.0520	-0.000490	0.00480
		(0.0338)	(0.0338)	(0.0307)	(0.0309)
Excl. License	?	0.141***	0.138***	0.0700**	0.0716**
		(0.0345)	(0.0344)	(0.0342)	(0.0340)
Controls		YES	YES	YES	YES
Industry FE		YES	YES	YES	YES
Observations		975	975	975	975
R-squared		0.167	0.168	0.099	0.108