Signaling in Debt Contracting via Voluntary Verification of Timely Information

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ABSTRACT

The importance of timely and reliable information is increasing in the focus of lenders, especially when they make investment decisions during the financial year, far apart from the firm's annual report. If firms want to get better financing conditions, they need to provide this information in order to fulfil the lenders' needs. We are interested in the conditions under which firms choose to signal their private information by hiring the auditor for an additional task in the form of a review of interim financial statements. We find that a firm with good underlying economic earnings only signals if the beliefs about the market are pessimistic and the review costs are not too high. If the interim review effort is cheap, the auditor can earn a rent from the review even though he operates in a perfectly competitive market. Only for very low review costs it is beneficial for all firms to hire an auditor for the review, which economically justifies a one-size-fits-all regulation for mandatory reviews. These insights are relevant for regulators in the discussion whether to adopt mandatory reviews. We also derive valuable insights for empiricists about the structure of audit fees.

***Keywords*:** Voluntary Review, Interim Financial Statement, Debt Contracting, Signaling.

JEL: D82, G32, M42

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1. INTRODUCTION

When lenders look for profitable investment opportunities, they face a substantial level of uncertainty about the firm's ability to repay the agreed return. Timeliness and credibility of information are two major concerns with respect to optimal decision making. It is in the interest of firms with good repayment prospects to address this issue and to reduce the lenders' uncertainty in order to attract investments at acceptably low interest rates. For those good firms, one way to show their reliability is to signal private information in order to convince lenders about their ability to fulfill future claims and to get better financing conditions from them. One option to communicate the prospects is by means of the audit engagement. Auditors play an important role by providing an outside opinion on the credibility of annual reports. However, this form of verification occurs only once a year and cannot be considered timely at all, especially when the date of signing the debt contract is relatively far away from the annual reporting date. Based on this starting point, we are interested in answering the question how and in which situations firms use the option of having their interim financial statements reviewed by an independent auditor? The additional interim review of financial statements is costly to the firm, because of the auditor's additional effort costs and because the firm has less funds to invest into the project and must borrow more, which results in a higher face value of debt. On the other hand, the firm can secure lower interest on the loan by acquiring the review. Depending on these countervailing forces, the good firm decides whether to disclose the information more timely through the auditor or not. Additionally, an increasing number of regulators around the world demand a mandatory review of half-year or even quarterly reports, such as the USA, France, and Australia. Hence, we address the question what the consequences for the firm from the adaption of such a regulation are, by comparing the repercussions of such a mandatory regulation to the voluntary review.

We show that the benefits of signaling the type through a voluntary review depend on the lender's prior beliefs about the firm's ability to repay the debt. We interpret pessimistic prior beliefs as an environment where the lender rather expects to deal with a bad firm than with a good firm. Many factors can form such an environment, amongst them general economic circumstances, such as the recent Financial Crisis, or the firm's past performance and reporting behavior, as well as the quality of corporate governance. When the beliefs are pessimistic, it can be beneficial for a firm with good repayment prospects (a good firm) to signal private information. Basically, a signal can be any costly commitment that is not optimal to imitate by other firms from which the good firm seeks to separate. The interim

review is an efficient commitment since it provides additional benefits. First of all, the costly signal is supported by the information generated and confirmed in the reviewed interim financial statement. Second of all, the auditor benefits in the further course of his engagement by isolating the sources of potential misstatements and channeling his effort during the audit, since he can capitalize on the information gained in the interim verification later on in the annual report audit. Naturally, this only works if the costs of the review do not outweigh the benefits. For low costs, we show that the auditor is even able to earn rents although he is assumed to operate in a perfectly competitive market. As a result, the good firm is better off because it gets a better deal from the lender even though it pays higher audit fees to the auditor. The auditor is better off since he has the potential to earn extra rents and to reduce expected litigation. Only the bad firm is worse off since it likes to be pooled with the good firm, but must now, due to its identified unfavorable prospects, offer a higher interest rate to the lender. Nevertheless, signaling improves the overall allocation of resources. In the case where the lender's prior beliefs about the firm are already optimistic, the benefits of separation are comparably lower and signaling does not pay off anymore.

Regulators are also aware of the increasing demand for timely information and hence, often require mandatory interim financial statements. Some of them, such as the SEC (US Security and Exchange Commission), even require a mandatory review of these statements from an independent auditor (SEC Regulation S-X Article 10). Several others, such as the regulators in UK, Canada or Germany, do not have this requirement which shows the lack of a common consensus in this issue and the need for further research. Timely information can also have negative consequences, such as short-termism and transmission of a biased picture of the underlying long-term trend (Wagenhofer, 2014). As a consequence, the European Commission recently abandoned its requirements about mandatory quarterly reports. However, in our model, we show the benefits of timely information under the assumption of stable underlying economic earnings. In this case, regulation can benefit both firm types compared to the voluntary setting, as long as the review costs are very low. This is due to the fact that the good type need not pay rents to the auditor, and those rents are divided between the firm types instead. With slightly higher costs, the mandatory review simply erodes the benefits of the signaling mechanism.

A review is substantially different from an audit in extent and measure, but also serves a different purpose. According to SAS No. 100, the objective of a review of interim financial statements is that the auditor is "aware of any material modifications that should be made to the interim financial information for it to conform to generally accepted accounting

principles". It generally involves inquiries and analytical procedures to achieve this level of verification. By hiring an auditor for an interim review, the users of financial reports receive timely information about the firm's most recent performance that are sufficiently reliable in order to have a broad picture about the firm's ability to serve future claims. In terms of modeling, we transcribe this into the auditor's ability to confirm the firm's reported type. The firm's interim report is assumed not to be credible as such and any information from previous reporting, e.g. the most recent annual report, are reflected in the prior beliefs about the firm.

To show our results, we initially use a setting that incorporates only the audited annual report, based on which the decision about the liquidation of the project is made. Thereby, we explicitly establish the relation of symmetric to asymmetric information about the firm's type (but not the project type). Next, since the good type loses with asymmetric information, we consider signaling as a possibility to mitigate this adverse selection problem where the good firm would signal its type with the help of an auditor. He can do so by hiring the auditor for an additional interim review which confirms the firm's type. Thereby, we analyze certain conditions, characterized by two dimensions, the prior beliefs and the review costs, when signaling is beneficial. Lastly, we compare the voluntary review to a review required by regulation and show that only a specific setting with low costs creates benefits for the firms.

Our model draws additional insights regarding the auditor's wage structure which are particularly interesting to empiricists. In the empirical literature, audit fees are often used as proxy for audit quality in the sense that higher audit fees imply higher audit effort and quality (e.g. Choi et al 2009). We show that this monotonic relationship can be disturbed when firms use audit fees as signaling mechanism. Audit fees vary substantially depending on the firm's signaling decision and do not always reflect an increase in the attestation level. Depending on the review costs, the audit fees that include the review can be higher or lower than the benchmark case of annual audit only, but the audit quality is certainly higher.

The rest of the paper is structured as follows. Section two reviews recent literature on auditing and debt contracting and section three introduces the theoretical model. Section four analyzes the base model about audited annual reports, section five adds the signaling game including the review, and section six compares voluntary and mandatory reviews. Section seven considers the empirical consequences of our findings and section eight concludes the paper.

2. LITERATURE REVIEW

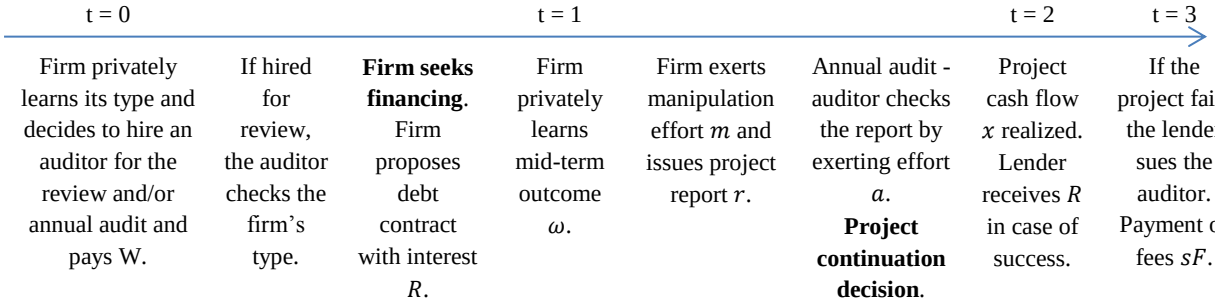
We address asymmetric information in terms of adverse selection and moral hazard. In debt contracting literature, Armstrong et al. (2010) and Shivakumar (2013) give a literature review on the role of information and financial reporting in debt contracting where they call attention to the importance of debt and debt contracting. In our analysis, we use the models of Holmstrom and Tirole (1997) who examine capitally constrained firms, intermediaries and lenders, and Innes (1990), who characterizes optimal monotonic and non-monotonic debt contracts. Similar to Gao (2013), we explore earnings management and financial reporting verification, with the difference that we introduce the auditor as an external source of verification both ex ante and ex post. Similarly to Demerjian (2013), we show that informational asymmetry is crucial for the financial covenants to be used, but contrary to Demerjian (2013), we assume that the borrower knows his type and distribution of the future values. In terms of signaling approaches to overcome asymmetric information, Leland and Pyle (1977) show that the retention of a percentage of the firm's ownership can be used as a signal in the sense that a risk-averse entrepreneur likes to shift all the risk to the lender, but keeps some of it to signal his private information.

The auditing literature addresses adverse selection as well. Most recently, Deng et al. (2012) analyze the lender-firm relationship in a lemons market. They show that the increased auditor liability in the aftermath of SOX led to more conservatism in the auditor's opinion and hence to more foregone investment opportunities. Hillegeist (1999) focuses on different kinds of liability regimes and their influence on the strategic interaction of the firm's owner and the auditor's decision about the quality of the audit. Regarding the signaling approaches, Melumad and Thoman (1990) pin down the foundation of hiring an auditor for voluntary verification as a signal. They analyze various constellations in which the signal of hiring an auditor is used and in which it is not. It turns out that the equilibria in their two-model design vary substantially, i.e. a fully separating equilibrium does only exist in a non-strategic setting, whereas other equilibria can only exist in the strategic setting such as hiring an inefficient auditor. Our model shows fundamental overlap in the results about the verified disclosure signaling. However, since our focus is on the interim review in addition to the annual report, we are able to extend their findings. Melumad and Thoman (1990) only show the benefits of signaling to the firms and the lenders and neglect the auditor. We further show the influence of the timely verification on the annual report and the auditor's benefits from it. This benefit is the ability to earn rents in a perfectly competitive market, as well as, the ability to isolate the area of potential misstatement and to channel his effort in the annual report audit.

Furthermore, we consider the reviewed interim report as the signal and not the act of hiring. Dharan (1992) follows a similar approach to Melumad and Thoman (1990) analyzing the small businesses' choice of having financial statements audited in order to signal their types to potential lenders. He finds that the signal can be used by firms above a certain debt-equity cutoff ratio. Another group of articles focuses on signaling private information by the choice of a quality auditor such as a Big-4 auditor. Bar-Yosef and Livnat (1984) find that the manager would select bigger auditors to communicate their private information to existing shareholders who determine their compensation. Titman and Trueman (1986) as well as Datar et al. (1992) show this signaling premise for firms facing potential shareholders in an IPO.

We also analyze the effects on the auditor arising from moral hazard problems in principal-agent settings. In a very general way, Baiman et al. (1987) analyze the structure of optimal contracts and develop conditions when it is beneficial to hire an auditor. Newman et al. (2005) use the auditor to protect the shareholders from potential expropriation of resources by the manager. They find that higher litigation penalties induce higher levels of investments within the market. Dontoh et al (2013) introduce financial statements insurance as a measure of eliminating the conflict of interest and properly aligning the incentives of auditors with those of shareholders. Laux and Newman (2010) address increased liability from a different angle. They analyze how frequently auditors reject clients due to high risk exposure and find that the rejection rate does not monotonically increase in the litigation risk but is lowest for medium legal liability regimes. Their focus is on the moral hazard problem and how the auditor can be incentivized to exert more effort in the initial stage in order to enable the financing of the project. From the moral hazard perspective, their paper is closest to ours since it also has two different kinds of audit efforts. However, their focus is substantially different as well as the model structure. In our model, two reports are issued, one anterior and one posterior to the debt contract, as opposed to one anterior report in their setting. Additionally, our owner-manager is actively engaged in reporting. Our paper contributes to the literature by extending the existing model structures which enables us to draw new conclusions based on the connection of the auditor's review and his annual audit and the voluntary or mandatory nature of the reviews. These conclusions can be useful for many interest groups, including empiricists and regulators.

Figure 1: Timeline of events



3. THE MODEL SETUP

We use a three-player one period binary model of adverse selection and moral hazard in a lender-firm signaling game. Figure 1 shows the timeline and Figure 2 the probabilities and payoffs for the basic model. A risk neutral firm has a long term project with a positive NPV. In order to generate outcome (cash flow) x the project requires a total investment of I. There are two types of firms in the market, a bad firm with weaker technology and success possibility, and a good firm with better technology and higher success rate, $i \in \{B, G\}$ The firm's type is privately observed by the firm. The ex-ante probability for the firm to be bad (good), is τ ($1-\tau$) which is drawn from nature. Each firm invests the funds into the project at the beginning of the project. The project's success depends on the firm's type and leads to a mid-term economic outcome of the project, $\omega \in \{b, g\}$, which can again be bad or good. A good (bad) firm generates a good project, with the probability p_G (p_B) and a bad project with the counter-probability $1-p_G$ $(1-p_B)$. There is sufficient difference between the types, $p_G \gg p_B$. If the mid-term economic outcome of the project turns out to be good , $\omega = g$, it leads to a final cash flow of $x = X_G$ with a success probability π and to a cash flow of $x = X_B$ with probability $1-\pi$. If the mid-term project outcome is bad, it always yields $x = X_B$. Without loss of generality we set $X_B = 0$ and $X_G = X > 0$.

The firm has insufficient funds, A, to finance the project and hence, needs to borrow external funds from a risk neutral lender in addition.[3] The lender requires a return, R, in exchange for the external investment. She (lender) only receives a return, if the project generates a positive cash flow, because the manager is protected by limited liability ($x \geq R_i$ for every realization of x, $x \in \{0, X\}$).

The project requires a risky long term investment which involves waiting until the end of the project for the final outcome realization. Therefore, the firm introduces a liquidation option for the lender in order to make her participate with an acceptable interest rate. If the

[3] The firm invests the full amount of internal funds into the project. We follow the Pecking order hypothesis, where own funds are considered cheaper than borrowed funds. We normalize the cost of own investment to zero.

realized mid-term economic outcome, $\omega \in \{b, g\}$, is observed, then the continuation/liquidation decision can be granted based on this mid-term outcome to either one of the players. The lender cannot directly observe the project's mid-term outcome. Hence, there exists a demand for a report that indicates the project's mid-term economic outcome. The report from the accounting system can be considered as a report on which the decision covenants are based. The lender receives the accounting system report, r_ω with $\omega \in \{b, g\}$, of the underlying project at mid-term and based on the report she determines whether the project financing should be continued or liquidated. The accounting report is prone to the manager's manipulation, since it determines the future of the project's financing. Hence, for this report, which we call the annual report, the firm needs to hire a (risk neutral) auditor in exchange for an audit fee, W. We assume the firm has enough existing funds to pay for the auditor's fee even if the investment project is unsuccessful in the end, $A - W > 0$. After all, the total borrowed funds sum up to $I - (A - W)$. The manager of the firm is always interested in continuing the project financing until the end of the project, since in addition to the cash flow, he can also earn a non-pledgeable private benefit, V, unconditional of the state.[4] However, if the bad project is abandoned after the first stage, the lender can still salvage some of the value and receive the value, L from liquidating the firm, which is assumed to be a fixed amount lower than her initial investment and lower than the return she might get at the end if the project is successful, $L < I - (A - W) < R$. If the lender knew she was dealing with the good type, she would never want to terminate the project financing at mid-term, but if she knew that it was a bad type with a bad project outcome, then she would like to terminate the project financing at mid-term. We look at ex post socially optimal decision in order to protect the financier from overinvestment (too many continued projects) and the firm from underinvestment (too many terminated projects) by means of a state-contingent covenant. The covenant gives decision rights to the party that makes the socially optimal decision. In the good state it is socially efficient to continue the project ($\pi X + V > L$) so the covenant gives the decision rights to the firm. In the bad state it is socially optimal to terminate the project so the financier has the decision rights ($L > V$). By introducing a state-contingent covenant, which grants the decision rights to the firm in a good state and to the lender in the bad state, we assure that the socially optimal decision prevails.[5]

[4]Private benefit *V* cannot be paid out to the financier, it is non-pledgeable. It can be seen as know-how from a project. The firm has spent time developing and implementing the project and thus accumulated skills and human capital which might improve its position in the future. Also, the firm cares about the social objectives such as retaining the employees and reputation.

[5] We adopt the definition of social optimality form Gao (2013) and consider it as a joint expected outcome to both financier and firm; socially optimal for the whole sector.

The accounting system is assumed to be perfect if there is no manipulation, which means that a bad (good) mid-term outcome of the project, $\omega \in \{b, g\}$, always leads to a bad (good) report from the firm's accounting system, r_ω. However, since the report determines the continuation rights, in case of a bad mid-term outcome, the manager has an incentive to influence the mapping in his favor by exerting manipulation $m \in [0,1]$. At the same time, m also represents the probability to succeed in claiming a good mid-term outcome which is actually bad, $m = Prob(r_\omega = r_g | \omega = b)$. Manipulation is assumed to be costly[6] and is captured by a convex function, i.e. $1/2\, km^2$, where k is a positive parameter larger than 1, which indicates the magnitude of manipulation cost. k can also be interpreted as the strength of corporate governance within the firm. Higher governance makes the manipulation harder and increases the manipulation costs.

After the manager's report, the auditor is asked to check whether the report represents the true underlying state of the project. Initially, the firm's type and the project type are unknown to him. Thus, after observing the firm's report about the project, the auditor exerts effort $a \in [0,1]$, which determines the quality of the audit, and produces an audit report, ρ_ω with $\omega \in \{b, g\}$. Hence, a also represents the probability of identifying and communicating misreporting, $a = Prob(\rho = \rho_b | \omega = b, r = r_g)$.[7] Since the manager has no incentive to manipulate downwards, the auditor would only check if a high report originates from a bad outcome. In addition, type II errors are excluded, this means the auditor does not falsely identify a good report as bad.[8] His effort is also costly and represented by a convex function, i.e. $1/2\, da^2$, where d is a positive parameter larger than 1. It can be interpreted as the auditor's technology which is better for lower values of d. The technology is usually better in Big 4 audit firms which have hence lower values of d compared to non-Big 4 audit firms. The facts that the auditor is effort averse and that his effort is unobservable create a moral hazard problem, where the auditor tries to minimize his costs given the direct costs from exerting the effort and the possible litigation costs from not detecting the manipulation. In case he is not able to identify the manipulation, the expected litigation costs are given by sF, where litigation fee F is the penalty payment to the lender. s captures the probability that the lender sues the auditor for a faulty report as well as the court's decision of ruling that the auditor is

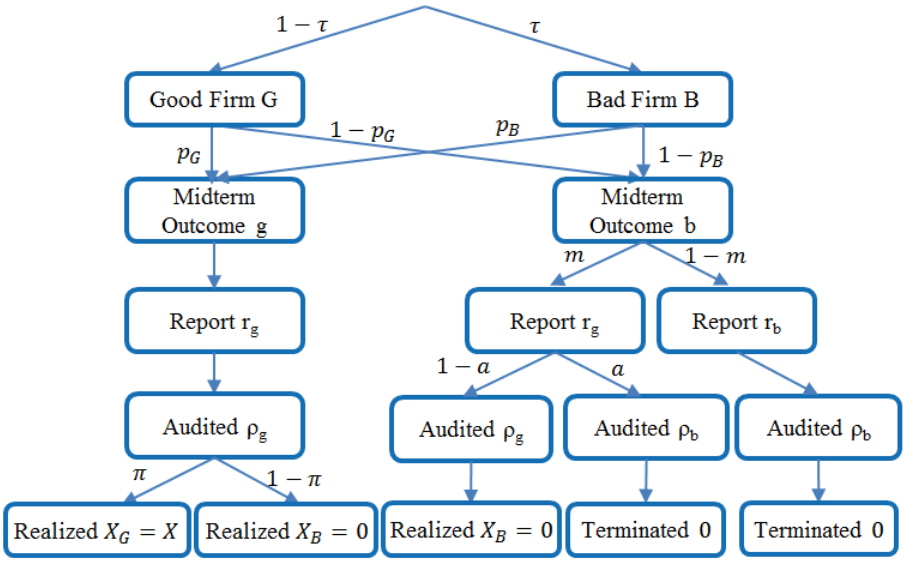
[6]Manipulation cost can be thought of as additional time and energy spent on figuring out how to manipulate the reports. The higher the manipulation, the more is the manager devoted to the manipulation than to regular operation, and therefore the regular operation suffers, which is both costly to the firm and manager himself.

[7] Note: In this setting, we assume that the auditor always reports truthfully. Hence, auditor independence is not an issue.

[8] A standard argument in the literature is that a manager in such a case would have a strong interest (and a credible claim) to convince the auditor that he is wrong.

negligent. It can be assumed that a court would never convict an auditor for bad luck due to reasons not in the responsibility of the auditor, i.e. when a good project still fails $(1-\pi)$. The auditor only faces litigation risk when he de facto fails to identify manipulation. We also assume that the litigation fee that the auditor faces, which the lender receives in case of a failed audit, is lower than the termination value, $sF < L$, since otherwise the lender would also always want to continue the project. The auditing market and the debt market are both assumed to be competitive.

Figure 2: Game Tree



Manager	$X-R+V-W$	$V-W$	$V-W$	$-W$	$-W$
Lender	$R-I$	$-I$	$sF-I$	$L-I$	$L-I$
Auditor	W	W	$W-sF$	W	W

4. AUDITED ANNUAL REPORT

In this section, we analyze the lender-firm relationship when only the annual report is audited. We use this base model as a benchmark to compare to the costs and benefits of (ex-ante) reviewed interim financial statements in the signaling setting later on. In our model, the annual report is the information source for the continuation decision. Thereby, the project's midterm economic state, $\omega \in \{g, b\}$, is always private information to the manager of the firm.[9] The prior beliefs about the type are reflected in τ. The uncertainty regarding the adverse selection problem is resolved and the firm type commonly known when the firm's type is either certainly good $(\tau = 0)$ or bad $(\tau = 1)$. We use this setting as a socially optimal

[9] We interchangeably use the expression manager, firm's manager and firm. This can be done, since the manager's objective in our model is fully aligned with the firm's.

benchmark in terms of efficient resource allocation and call it the "first best" scenario. In contrast, the "second best" scenario considers asymmetric information, where $\tau \in (0,1)$. We compare both settings in order to establish the differences, where superscript n characterizes the setting, $n \in \{FB = first\ best, SB = second\ best\}$. Given the existing framework, both firm types want to maximize their utility by contracting with the lender and the auditor (R, W) and by finding the optimal level of manipulation (m):

$$max_{R_i^n, W_i^n, m_i^n}\, U_i^n = p_i(\pi(X - R_i^n) + V) + (1 - p_i)\left(m_i^n(1 - \hat{a}_i^n)V - \frac{1}{2}km_i^{n\,2}\right) \qquad (1)$$

The firm earns outcome, X, in case of a successful project. The project can reach a successful outcome only if it is continued at midterm (after the annual audit report has been produced). The project is only continued after a good annual audit report. This is the main reason why the manager has an incentive to manipulate a bad report so that he can continue the project and at least receive the private benefit, V. Thereby, he conjectures a certain audit effort, which is denoted by $\hat{a}$. In return for the investment by the lender, he gives up return, R (only in case of success, since the manager is protected by limited liability, $x \geq R_i$ for every realization of x, $x \in \{0, X\}$).[10] We solve the problem for the optimal audit effort, manipulation, return to lender, audit wage, and firm utilities by backward induction according to the timeline in Figure 2.

The auditor's optimal effort, a: The auditor's role is to identify manipulation of the firm and reduce the uncertainty about the underlying project based on his incentive constraint:

$$arg\, max_{a_i^n}\, W_i^n - Prob\left(b\middle|r_g\right)(1 - a_i^n)sF - \frac{1}{2}da_i^{n\,2} \qquad (2)$$

where $Prob\left(b\middle|r_g\right) = \frac{[\tau(1-p_B)+(1-\tau)(1-p_G)]\hat{m}_i^n}{[\tau(1-p_B)+(1-\tau)(1-p_G)]\hat{m}_i^n+\tau p_B+(1-\tau)p_G}$.

The auditor receives an audit fee, W_i^n, in exchange for his effort, which he exerts by trading off the risk from litigation, sF, and the direct costs of effort, d. He conjectures a level of manipulation, $\hat{m}_i^n$, and tries to detect all good reports that actually originate from a bad project outcome. Since the auditor decides about his effort after he observes the manager's report, he updates his belief of the underlying state based on the report issued by the manager with a Bayesian update. This is reflected in the probability $Prob\left(b\middle|r_g\right)$, which weighs the

[10] Initially, one would expect the audit wage, W, and the existing funds, A, to be included in the utility function as well, $A - W$. However, the existing funds only purpose is to make sure that there are enough resources to pay the audit wage. The firm invests the remaining funds, which are not paid to the auditor, into the project and hence $A - W - (A - W)$ cancels out.

probability that the good report comes from a bad (good) type, τ $(1-\tau)$, according to his prior beliefs. In order to find the optimal effort, we take the derivative of (2) w.r.t. a_i^n and rearrange for a_i^n:

$$a_i^n \equiv a_i^n(\hat{m}_i^n) = \frac{[\tau(1-p_B)+(1-\tau)(1-p_G)]\hat{m}_i^n}{[\tau(1-p_B)+(1-\tau)(1-p_G)]\hat{m}_i^n+\tau p_B+(1-\tau)p_G}\frac{sF}{d}$$

It is easy to see that the optimal effort increases in manipulation, $\hat{m}_i^n$, and litigation risk, sF, and decreases in direct cost factor, d. These implications are well documented in the auditing literature and need no further discussion. The prior beliefs about the firm type are solely reflected in the updated probability. Audit effort changes monotonically with the prior beliefs about the type, $\frac{\partial a}{\partial \tau} > 0$ (See Appendix A). The bad type ends up more often in situations where he is tempted to manipulate, i.e. a bad mid-term outcome. Ceteris paribus, the auditor has to exert more effort on the bad type (with $\tau = 1$) and less on the good type (with $\tau = 0$) in order to detect the manipulation. The second best solution constitutes a weighted average of both types according to the prior beliefs about the firm type: [11]

$$a_G^{FB}(\hat{m}_G^{FB}, \tau = 0) < a^{SB}(\hat{m}^{SB}, \tau) < a_B^{FB}(\hat{m}_B^{FB}, \tau = 1) \quad (3)$$

The manager's optimal manipulation, m: Similarly to the auditor, the manager conjectures a certain verification level of the auditor and chooses his manipulation accordingly. He decides about the manipulation level after observing a bad project outcome:

$$arg\,max_{m_i^n}\, m_i^n(1-\hat{a}_i^n)V - \frac{1}{2}k{m_i^n}^2 \quad (4)$$

The manager manipulates to receive his private benefit, V, from continuing the project but manipulation comes at a cost. In order to find the optimal effort, we take the derivative of (4) w.r.t. m_i^n and rearrange:

$$m_i^n \equiv m_i^n(\hat{a}_i^n) = \frac{(1-\hat{a}_i^n)V}{k}$$

Not surprisingly, the manipulation increases in the size of the benefit, V, and decreases in the manipulation costs factor, k, and the conjectured audit effort, $\hat{a}_i^n$.[12] The decreasing effect of auditing on manipulation emphasizes the value of an auditor to the lender, since manipulation prevents the transfer of decision rights to the lender, and therefore, deprives her of the option to withdraw the investment after the first period. The relation between first best and second best manipulation level is as follows:

[11] In the second best case, types are pooled and $a_G^{SB}(\hat{m}^{SB}) = a_B^{SB}(\hat{m}^{SB})$. Hence, there is only one audit effort level for both types and for convenience we leave out the subscript.

[12] We assume that manipulation cost factor k is high enough so that the benefit cost ratio is never so high that any of the types would choose maximal manipulation, $m_i^n(\hat{a}_i^n) = min\left\{\frac{(1-\hat{a}_i^n)V}{k}, 1\right\}$.

$$m_B^{FB}(\hat{a}_B^{FB}, \tau = 0) < m^{SB}(\hat{a}^{SB}, \tau) < m_G^{FB}(\hat{a}_G^{FB}, \tau = 1) \quad (5)$$

The level of manipulation is higher with a good type, $\frac{\partial m}{\partial \tau} < 0$ (See Appendix A). This might be surprising at the first glance but follows an intuitive explanation. Note that the manipulation always follows the same decision rule independent of the type since both types decide whether to manipulate when they, de facto, observe a bad project outcome. The prior beliefs about the types enter the manager's incentives only indirectly via the conjectured audit effort. Since manipulation decreases linearly with conjectured audit effort, the relationship from (3) is simply reversed. However, the probability leading up to a bad outcome is still higher for the bad type, $1 - p_B > 1 - p_G$. This means, the bad type manipulates more frequently than the good type, but the latter one's level of manipulation is higher on average. Due to the assumption $p_G \gg p_B$, the frequency effect dominates the level of manipulation on average and the bad type's gain from manipulation is, indeed, larger.

Return to the lender, *R*: The lender only participates in the contract if the firm offers a return which is at least as high as the investment. Due to our assumption of a perfect lending market and the intuition that the firm wants to pay the lowest possible return to lenders, there are zero rents and the following participation constraint is binding:

$$I - (A - W_i^n) \leq (1 - \tau)[p_G \pi R_i^n + (1 - p_G)(\hat{m}_i^n(1 - \hat{a}_i^n)sF + (1 - \hat{m}_i^n(1 - \hat{a}_i^n))L)]$$
$$+\tau[p_B \pi R_i^n + (1 - p_B)(\hat{m}_i^n(1 - \hat{a}_i^n)sF + (1 - \hat{m}_i^n(1 - \hat{a}_i^n))L)]$$

For each type, the lender is partially insured from manipulation by the option to sue the auditor for malpractice, $\hat{m}_i^n(1 - \hat{a}_i^n)sF$, and receives the option to liquidate more often in case the auditor detects manipulation, $(1 - \hat{m}_i^n(1 - \hat{a}_i^n))L$. Rearranging for the R_i^n results in:

$$R_i^n = \frac{I - A + W_i^n - [(1-\tau)(1-p_G) + \tau(1-p_B)](\hat{m}_i^n(1-\hat{a}_i^n)sF + (1-\hat{m}_i^n(1-\hat{a}_i^n))L)}{\pi[\tau p_B + (1-\tau)p_G]} \quad (6)$$

It is also true for the return that in the second best case, where the information about the type is unknown, the prior beliefs construct a weighted average of the first best cases. It can be seen (in the Appendix A) that $\frac{\partial R}{\partial \tau} > 0$. Consequently,

$$R_G^{FB}(\hat{a}_G^{FB}, \hat{m}_G^{FB}, \tau = 0) < R^{SB}(\hat{a}^{SB}, \hat{m}^{SB}, \tau) < R_B^{FB}(\hat{a}_B^{FB}, \hat{m}_B^{FB}, \tau = 1) \quad (7)$$

The good type needs to pay a higher return to the lender in the second best case, compared to his first best case, due to the increased uncertainty. Contrary, the bad type benefits from the uncertainty since his contract includes a higher return if the lender knows his type.

The audit wage, W: Similarly to the lender, the auditor only participates if his direct costs and the litigation risk are covered. He also operates on a perfect market which means there are zero rents. Consequently, the manager offers the following audit wage:

$$W_i^n \geq [(1-\tau)(1-p_G)+\tau(1-p_B)](\widehat{m}_i^n(1-a_i^n)sF+\frac{1}{2}\widehat{m}_i^n d{a_i^n}^2)$$

The equation is binding and the audit wage increases in litigation risk, sF, direct costs, d, as well as manipulation, m. In contrast to the other variables, the audit wage is not necessarily monotone in τ. For a higher relative importance of litigation risk towards direct costs (lower d and/or higher sF), the audit wage is higher for the good type compared to the bad type ($\frac{\partial W}{\partial \tau} < 0$) and vice versa for a higher relative importance of the direct costs ($\frac{\partial W}{\partial \tau} > 0$). If they are equally important, the second best audit wage is the highest (See Appendix A). For convenience, we continue our analysis with the following relationship:

$$W_G^{FB}(\hat{a}_G^{FB},\widehat{m}_G^{FB},\tau=0) < W^{SB}(\hat{a}^{SB},\widehat{m}^{SB},\tau) < W_B^{FB}(\hat{a}_B^{FB},\widehat{m}_B^{FB},\tau=1) \qquad (8)$$

A change in the relationship does not have a qualitative effect on our results since W does not enter the firm's utility function directly, only indirectly via the return. However, (7) is always true and it follows that there are no further consequences.

Finally, we insert all of the previously calculated values into function (1) in order to determine the firm's optimal utility. In equilibrium, due to rational expectations of all players, all conjectures are true, $a_i^n(\widehat{m}_i^n)=\hat{a}_i^n=a_i^n$ and $m_i^n(\hat{a}_i^n)=\widehat{m}_i^n=m_i^n$. The resulting utilities for every $i\in\{B,G\}$ and $n\in\{FB,SB\}$ are:

$$U_i^n=(1-p_i)\left(m_i^n(1-a_i^n)V-\frac{1}{2}k{m_i^n}^2\right)+p_i(V+\pi X - \frac{I-A+[(1-\tau)(1-p_G)+\tau(1-p_B)]\left(1/2\ d{m_i^n}{a_i^n}^2-\left(1-m_i^n(1-a_i^n)\right)L\right)}{[\tau p_B+(1-\tau)p_G]}) \qquad (9)$$

In the second best scenario, it is in the interest of the bad type to simply mimic the good type's contracting strategy since the market participants cannot distinguish them and therefore, pool them together. As a result, there only exist one type of contract (R^{SB},W^{SB}) but the utilities of the firms are still different due to the inherent probabilities of a successful project. In the first best scenario, the market participants are able to separate the types and offer a specific contract for each type (R_i^{FB},W_i^{FB}), which results in the following relationship:

$$U_B^{SB}>U_B^{FB} \text{ and } U_G^{SB}<U_G^{FB} \qquad (10)$$

It can be seen that the bad type improves by being pooled together with the good type while the good type loses with asymmetric information. This is due to the increase in the return to the lender who demands a higher return in order to participate in the contract when the probability of a successful project decreases.

Lemma 1

When the annual reports are audited, the following is true when comparing the symmetric setting (known types – FB) to the asymmetric setting (unknown types - SB) following the equations (3), (5), (7), (8), and (10):

a) $a_B^{FB} > a^{SB} > a_G^{FB}$,

b) $m_B^{FB} < m^{SB} < m_G^{FB}$

c) $W_G^{FB} < W^{SB} < W_B^{FB}$,

d) $R_G^{FB} < R^{SB} < R_B^{FB}$,

e) $U_B^{SB} > U_B^{FB}$ and $U_G^{SB} < U_G^{FB}$

5. INTERIM REVIEW FROM THE AUDITOR

The Signaling Game

The analysis in the previous section showed that the bad type benefits from the adverse selection problem which arises due to the information asymmetry at the point of the financing decision. He is better off by being pooled together with the good type. Contrary, the information asymmetry is detrimental to the good type who would be better off in a first best world where the firm types are known. Hence, there is an incentive for the good type to reveal his private information. We also showed in the previous section that the auditor is a suitable channel to reduce uncertainty. He checks the annual report for manipulation in order to enable a socially more efficient termination decision. Naturally, the auditor could be valuable for the good type at the financing decision, as well.

We observe the situation where the initial financing decision is made during the financial year, when the information from the previous annual report is outdated. Hence, the firm needs to provide a recent update in the form of an interim financial statement, which informs the lender about the current state of operations. This information is important to the lender in order to assess the firm's prospects of repaying the claims. However, the interim report is assumed not to be credible enough, which requires a review by the auditor. In this section, hiring of the auditor for the interim review is viewed as an ex-ante voluntary choice by the firm. Consequently, the good firm can use the review as a means of signaling its private

information about the firm type, in order to prevent the imitation strategy of his contract by the bad type in the pooling equilibrium.

For this purpose, the firm reports its type in the interim financial statement, either good ,G^+, or bad, B^+. There is no incentive to report B^+, which means that if a bad type reports the interim financial statement, he would always try to appear better than he actually is. This is in line with the literature which states that those reports are prone to manipulation and complies with our idea that the interim reports are not credible without third party verification (Joon and Krishnan 2005). We assume in the main paper for simplicity that the auditor if hired certainly confirms the firm's reported type.[13] The firm can hire the auditor for this costly additional task, but since the auditor always breaks even, the costs fall on the firm. In our model of perfect audit verification, these costs are fixed and exogenously given at some monetary level *c*. From an ex-ante perspective, the auditor accepts to exert effort for this task if he at least breaks even jointly for both the review and the audit, and for each firm type. In order for the separation from the bad type to be successful, the good type must offer such a contract to the lender and the auditor which they accept, but a contract that is too costly for the bad type to mimic. Signaling is successful if the following conditions are fulfilled, where the wage W_G^S is the total auditor's wage for both review and audit tasks (Superscript S stands for Signaling):

$$\max_{R_G^S, W_G^S, m_G^S} U_G^S = p_G(\pi(X - R_G^S) + V) + (1 - p_G)\left(m_G^S(1 - \hat{a}_G^S)V - \frac{1}{2}k{m_G^S}^2\right)$$

Lender's set of PC:

$$I - (A - W_G^S) \leq p_G \pi R_G^S + (1 - p_G)(\hat{m}_G^S(1 - \hat{a}_G^S)sF + \left(1 - \hat{m}_G^S(1 - \hat{a}_G^S)\right)L) \tag{11}$$

$$I - (A - W_B^{FB}) \leq p_B \pi R_B^{FB} + (1 - p_B)(\hat{m}_B^{FB}(1 - \hat{a}_B^{FB})sF + \left(1 - \hat{m}_B^{FB}(1 - \hat{a}_B^{FB})\right)L)$$

Auditor's Set of PC:

$$W_G^S \geq (1 - p_G)\hat{m}_G^S(1 - \hat{a}_G^S)sF + \frac{1}{2}(1 - p_G)\hat{m}_G^S d{\hat{a}_G^S}^2 + c \tag{12}$$

$$W_B^{FB} \geq (1 - p_B)(\hat{m}_B^{FB}(1 - \hat{a}_B^{FB})sF + \frac{1}{2}(1 - p_B)\hat{m}_B^{FB} d{\hat{a}_B^{FB}}^2$$

Firms' set of IC:

$$U_G^S(W_G^S, R_G^S) \geq U_G^B(W_B^{FB}, R_B^{FB}) \tag{13}$$

[13]We also explore the option of the auditor not being able to perfectly verify the firm's type. The results carry over to the setting with some additional restrictions. The proof is in Appendix B.

$$U_B^{FB}(W_B^{FB}, R_B^{FB}) \geq U_B^S(W_G^S, R_G^S)$$

Auditor's IC:

$$arg\,max_{a_i^S}\, W_i^S - Prob\big(b\big|r_g\big)\big(1 - a_i^S\big)sF - \frac{1}{2}da_i^{S^2} \tag{14}$$

Firm's IC (for manipulation, m):

$$arg\,max_{m_i^S}\, m_i^S(1 - \hat{a}_i^S)V - \frac{1}{2}km_i^{S^2} \tag{15}$$

The good type credibly signals his type with the review to the lender, who adjusts the return of her participation constraints (11). These constraints indicate that the lender will only participate if she at least breaks even with each type. Therefore, an interim audit report induces the lender to accept a lower interest rate, R, for the good type (compared to the asymmetric information and to the bad type's contract) since the additional signal reveals the type to the lender. The revelation of the type would imply that the return for the bad type equals his first best return, R_B^{FB}. Given the signal, the auditor must also at least break even for each type as displayed in his participation constraints (12) whereby c depicts the cost for the review. The firms' set of incentive constraints (13) guarantees that each type chooses the contract designed for him and not the other type's contract. Hence, the first equation says that the good type's utility with the separating contract must be at least as high as his utility with the bad type's contract which uses the auditor's wage and the return from the bad type's first best setting. The second equation ensures that the contract from separation for the bad type (first best contract) must yield a higher utility than anything he might receive with the good type's signaling contract. If all the conditions are fulfilled, the signal is credible and the firm types are known to the auditor and the lender. The auditor's constraint for audit effort (14) and the firm's incentive constraint for manipulation (15) are still the same as in (2) and (4). Since the types are known after the signal, it means that in equilibrium $a_i^S = a_i^{FB}$ and $m_i^S = m_i^{FB}$.

The bad type's incentive compatibility constraint (13) only plays a role if we assume that the bad firm will not be punished for misreporting in the interim financial report, in the sense that the auditor cannot increase the audit wage ex-post.[14] If a bad type could be punished ex post for misreporting, he would never mimic the contract of the other type. The underlying reason for this is the auditor's perfect ability to detect the type. In that case the bad type will always be discovered and a punishment would make him worse off. This scenario yields a

[14] This corresponds to the general idea that legal consequences more likely arise from annual reports and not from interim financial statements.

trivial separating equilibrium. However, if the bad type cannot be punished, the former mentioned constraint does play a role. The auditor contracts with the firm prior to the interim review and can only charge one wage for both audit tasks, the interim review and the annual audit.[15] In this case the bad type would mimic any good type's contract that gives him higher utility than his first best case. Due to this reason, the firm's incentive constraints, (13), have to be fulfilled in order to deter mimicking behavior from any type. We want to emphasize the second equation from (13) which is in place to avoid mimicking by the bad type which is the more critical case.[16]

Suppose the auditor's total wage in the signaling approach is lower than the bad type's audit fee in the first best case, $W_B^{FB} > W_G^S$. The bad type would then mimic the good type in order to achieve a better contract with the auditor. A lower audit wage decreases the return to the lender, R (see equation (6)). This improves the bad type's utility (1), even though he would be identified as a bad type by the auditor in the course of the review. This does not have negative consequences, which means that the bad type would be able to scam a lower total audit fee from asking for a review. Hence, the good type needs to contract with the auditor in a way which deters mimicking behavior from the bad type. With $W_G^S \geq W_B^{FB}$, the bad type is better off not to mimic the contract and the good type can successfully separate, ergo the second equation in (13). The auditor will accept this contract because it assures him that he at least breaks even on both types. This is important, since he does not know in advance the type that is approaching him for the contract, which includes the interim review.

The lender, after observing the auditor's interim report, knows the firm's type and would only participate if she at least breaks even with each of the types. Both participation constraints of the lender are binding, the lender accepts the first best return from the bad type and a return higher than first best for the good type due to higher initial loan, $I - (A - W_G^S)$.

For the separating audit wage, W_G^S, these considerations have the following implications. When the review costs *c* are low, the separating audit wage equals the bad type's first best audit wage, W_B^{FB}. As soon as the costs of verification rise above a certain threshold the audit wage rises accordingly. The following wage is the result of the separating game:

[15] Note that this scenario is sensitive to timing and only holds when the total wage is contracted before the interim review. However, this is generally the case in practice. The audit wage is determined on a yearly basis and non-contingent on the outcome or input as well as not renegotiable ex post.

[16] The first equation of (13) exists to avoid mimicking by the good type. This is trivially fulfilled because the good type wants to improve from the second best case. Taking on the bad type's first best contract makes him even worse off than the second best since $\frac{\partial U}{\partial \tau} < 0$. This implies that this condition is slack.

$$W_G^S = \begin{cases} W_G^{FB} + c, & (W_B^{FB} - W_G^{FB}) \leq c < (\overline{W}_G - W_G^{FB}) \\ W_B^{FB}, & c < (W_B^{FB} - W_G^{FB}) \end{cases} \quad (16)$$

The auditor's total wage $\overline{W}_i$ for $i \in \{B, G\}$ is the maximal wage the good (bad) type is willing to pay in order to separate (mimic) from the bad (good) type's contract and to receive the good type's separating return R_G^S, if possible. This results in the same utility for the good (bad) type compared to the utility that the good (bad) type receives from the bad type's first best contract. ($\overline{W}_i$ is characterized in the proof of Proposition 1 in the Appendix A)

$$\overline{U}_G(\overline{W}_G, \bar{R}_G^S) = U_G^B(W_B^{FB}, R_B^{FB}) \text{ and}$$
$$\overline{U}_B(\overline{W}_B, \bar{R}_G^S) = U_B^{FB}(W_B^{FB}, R_B^{FB})$$

As can be seen from (16), separation depends on the costs for the review of the interim financial statements c. The differences in the equation represent the maximal addition to the auditor's first best wage, or in other words the maximal signaling costs, that the good type is willing to pay the auditor in order to separate from the bad type. Therefore, extremely high costs are not worth encountering and no signaling takes place because they do not lower the return adequately. If the costs of separation are not extremely high, but high enough (first line from (16)), then separation is possible with an additional review. It is worthwhile noting that for high costs c where $(\overline{W}_B - W_G^{FB}) < c \leq (\overline{W}_G - W_G^{FB})$ separating with additional review occurs, but would be even less efficient than a "pure separating" mechanism. "Pure separating signal" can be thought of as any kind of signal which incurs costs without adding any other benefits, such as sponsoring a race car or just burning money. Hence, this option can also be disregarded. For moderate and low costs, where $c \leq (\overline{W}_B - W_G^{FB})$, separating with additional review is more efficient than "pure separating". Additionally, if the costs of separation are low (second line in (16)) then the total audit fee is set at W_B^{FB}, above which the bad type does not want the good type's contract. The results of the game are presented in Proposition 1.

Proposition 1

There exists a signaling equilibrium, where the good type separates from the bad type by hiring an auditor for an additional interim review. The equilibrium depends on the review costs c:

I The good type separates by proposing the contract (W_G^S, R_G^S). For the following verification costs the signaling wage takes on different forms:

a) Low verification costs: ($c < (W_B^{FB} - W_G^{FB})$) results in the total separating audit wage for the good type $W_G^S = W_B^{FB} \geq W_G^{FB} + c$. The auditor earns extra rents on the good type, $w = W_B^{FB} - (W_G^{FB} + c)$.[17]

b) Moderate verification costs: ($(W_B^{FB} - W_G^{FB}) \leq c < (\overline{W}_B - W_G^{FB})$) results in the total separating audit wage for the good type $W_G^S = W_G^{FB} + c$.

c) High verification costs: ($(\overline{W}_B - W_G^{FB}) \leq c < (\overline{W}_G - W_G^{FB})$) results in the total separating audit wage for the good type $W_G^S = W_G^{FB} + c$. Separating with additional verification is not efficient.

II The bad type proposes his first best audit and financing contract without a reviewed interim financial statement (W_B^{FB}, R_B^{FB}).

III The auditor accepts audit wage, W_G^S (W_B^{FB}), from the good (bad) type, conducts the review which costs him c and exerts audit effort a_G^{FB} (a_B^{FB}) for the good (bad) type.

When the verification costs are moderate or low as in *I a)* and *b)* of Proposition 1, in order for the good type to separate from the bad type is through the auditor's additional verification of the interim financial statement - review. When the costs of verification are very low, the good firm must pay additional rents to the auditor in order to motivate the bad type in choosing his own first best contract. This result is indicative of the auditor's work in practice. The verification costs, c, are most likely to be influenced by various auditor specific factors, for example, the level of experience with the client firm. An auditor who is familiar with the client due to his long term engagement has probably lower costs than a new auditor and is more likely to be beneficial to the firms in terms of signaling private information and more likely to earn extra rents. Second, Big 4 auditors tend to have lower costs since they have more resources and better processes. It should also be mentioned that we analyze the first time adoption of an interim review in our model. This means that c can also indicate the costs of future interim reviews resulting from a possible lock-in effect in the sense that the interim review cannot be reversed immediately. We do not consider the benefits from this information. When the costs of verification are high as in *I c)* of Proposition, the additional review of the interim financial statement is too costly and there is no separating through a review. Ettredge et al. (1994) document anecdotal evidence that review costs generally range from approximately 5% of annual audit costs for large clients to 20% for smaller clients. We

[17] If the ordering of the audit wage were opposite to what we suggested in Lemma 1, i.e. $W_G^{FB} > W^{SB} > W_B^{FB}$, the auditor could not earn a rent here in this scenario, because a good firm would never have to additionally pay a signaling premium.

are not able to put these numbers into proportion in our model. Nevertheless, it provides an intuition that our scenarios with very high review costs might not be highly likely.

Part *III* of Proposition 1 is important in several ways. First of all, the auditor is more efficiently able to concentrate his audit effort on the annual report of the respective firm. He learns about the firm type and adjusts his effort accordingly to the first best effort, exerting more effort on the bad type and less effort on the good type. The empirical implications from this result will be discussed later in Section seven.

Signaling the Type with the interim review vs Pooling with the Bad Type

We have shown that separating the good type from the bad type by means of hiring the auditor for an additional task is possible. Now, we want to specify when separation is optimal. We compare the good type's utilities from the signaling game and his utilities from the asymmetric information case from the previous section. Therefore, as long as it holds that the good type's utility from separating is higher than his utility from pooling on a joint contract with the bad type, it is in the interest of the good type to separate from the bad type, $U_G^S(W_G^S, R_G^S) \geq U_G^{SB}(W^{SB}, R^{SB}) = \overline{U}_G^{SB}(\overline{W}_G^{SB}, \overline{R}_G^{SB})$.

Proposition 2

The good type chooses to separate from the bad type by hiring the auditor for an additional review, when $U_G^S(\cdot) \geq U_G^{SB}(\cdot)$.

a) With low review costs ($0 \leq c < (W_B^{FB} - W_G^{FB})$*), there exists a cut-off value of beliefs,* $\bar{\tau}_1$*, that solves* $U_G^S(W_B^{FB}, R_G^S) = U_G^{SB}(W^{SB}, R^{SB})$ *and above which the good type is willing to separate,* $\tau > \bar{\tau}_1$.

b) With moderate review costs ($(W_B^{FB} - W_G^{FB}) \leq c < (\overline{W}_G - W_G^{FB})$*), there exists a cut-off value of beliefs,* $\bar{\tau}_2$*, that solves* $U_G^S(W_G^{FB} + c, R_G^S) = U_G^{SB}(W^{SB}, R^{SB})$*, and above which the good type is willing to separate,* $\tau > \bar{\tau}_2$.

Proof in the Appendix A. ■

Therefore, when the interim review is voluntary, the good firm would use this mechanism to indicate its type only when the prior beliefs are pessimistic (τ is high) and when the auditor's costs of confirming the type were not very high. Otherwise, the good type would wish to be pooled with the bad type on a joint asymmetric contract (with sufficiently many good firms on the market or extremely costly review). Since τ represents the weight of the prior belief on a bad type, a higher τ moves the second best utility of the good type further away from his first best utility. The more pessimistic the prior beliefs are, the lower is the

second best utility for the good type, $\frac{\partial U_G^{SB}}{\partial \tau} < 0$ (See proof of Lemma 1 in the Appendix A). This means that the likelihood of a successful separation increases in τ, because the second best equilibrium becomes detrimental to the good type who can gain more from separation.

Figure 3: Signaling with an interim review

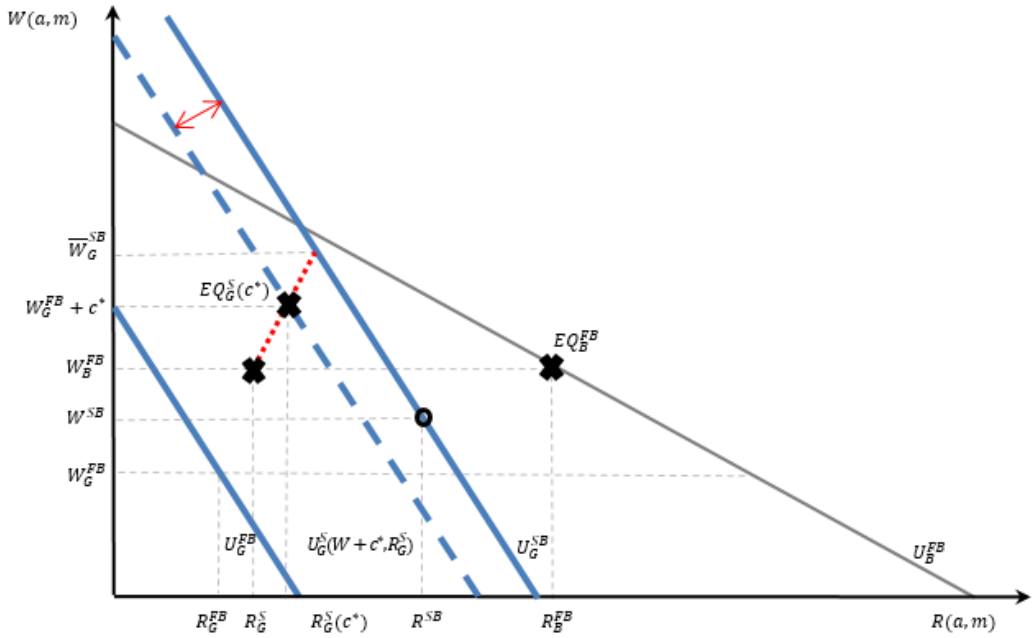


Figure 3 shows the utilities of the first best and second best solution as indifference curves on the W/R space graph where the investor's return R is depicted on the horizontal and the auditor's wage W on the vertical line. The bold blue lines show the indifference curves of the good type (U_G) and the gray lines the indifference curves of the bad type (U_B). Note that the utility is higher the closer it lies to the origin. The equilibrium of the first best scenario is on the indifference curve of the good type (bad type) where W_G^{FB} and R_G^{FB} (W_B^{FB} and R_B^{FB}) intersect. The second best equilibrium is where W^{SB} and R^{SB} intersect each type's indifference curve. The separating equilibrium is $(W_G^S(c), R_G^S(c))$ and (W_B^{FB}, R_B^{FB}). If the review costs are very low, $c \leq W_B^{FB} - W_G^{FB}$, the cheapest contract the good firm is able to propose in order to hinder the bad type from mimicking is $(W_G^S = W_B^{FB}, R_G^S)$. The rent for the auditor is then $w = W_B^{FB} - (W_G^{FB} + c)$ (Proposition 1 I a)). As c increases, the rent decreases until $c = W_B^{FB} - W_G^{FB}$ is fulfilled. If c increases further, also W_G^S increases proportionally ($W_G^S = W_G^{FB} + c$ for any arbitrary $c = c^* \geq W_B^{FB} - W_G^{FB}$). Hence, the red dotted line in the graph shows the possible equilibria dependent on c (Proposition 1 I b)). When the costs increase by too much, so that $U_G^S < U_G^{SB}$, the good firm chooses pooling on the asymmetric contract. The red double-arrowed line shows the gain in utility for the good type compared to the second best contract for specific costs c^*.

Contrary to the influence of τ on the second best utility, the separating utility, U_G^S, does not depend on the prior beliefs τ and only changes in auditor's wage and the lender's return, respectively. There are two effects on the audit wage, and consequently on the return, that needs to be considered. Firstly, the "type revelation effect": This is the direct effect on the audit effort in the annual audit, which decreases the audit wage in our first stage of the

backwards induction from W^{SB} to W_G^{FB}, since the auditor is able to channel his effort effectively on the good type from a^{SB} to a_G^{FB}. The "type revelation effect" is constant and independent of the review costs, c. The second effect, the "signaling effect", occurs because the review is essentially costly. This effect increases the audit wage from W^{SB} to $W_G^S(c)$ and increases strictly monotone in c. This "signaling effect" always dominates since we established earlier that the separating wage needs to be at least as high as the first best wage of the bad type, $W_G^S \geq W_B^{FB}$. It follows from this, that the lender's return always increases in review costs c and the utility always decreases (see also (1) and (6)). As a result, the separating utilities with respect to the level of the review costs are ordered in the following way: $U_G^S(\overline{W}_B, R_G^S) < U_G^S(W_G^{FB} + c, R_G^S) < U_G^S(W_B^{FB}, R_G^S)$ (even though the R_G^S level changes). $\bar{\tau}$ represents the cut-off value above which the good type is willing to separate from the bad type since separation brings him higher utility. $\bar{\tau}_1$ and $\bar{\tau}_2$ correspond to the cut-off values when the additional verification costs are low or moderate, respectively. Consequently, the cut-off levels of $\bar{\tau}$ are ordered in the following way: $\bar{\tau}_2 > \bar{\tau}_1$. This can also be seen from Figure 3. Proposition 3 and the above discussion lead to Corollary 1.

Corollary 1

The cut-off values $\bar{\tau}$, representing the prior beliefs about the firm's type, expressed in Proposition 2 have the following ordering $\bar{\tau}_2 > \bar{\tau}_1$.

6. MANDATORY VS. VOLUNTRY REVIEW OF FINANCIAL STATEMENTS

So far, we have explored the situation where the review of interim financial statements can be voluntarily applied for the purpose of providing timely and reliable information to the lender. We have shown that the good type would opt for a review to separate from the bad type as stated in Proposition 1 and 2, when the costs of this review are not too high and when there are relatively many bad firms on the market. However, now we additionally want to analyze how a regulatory requirement for mandatory reviews of interim (quarterly) financial statements, such as the SEC's Regulation S-X article 10, influences the player's utility.

When the verification of interim financial statements is mandatory, all firms are obliged to procure the service from the auditor during the year. Since all firms must comply with it, and the auditor is aware that both a good and a bad firm would request a verification of financial statements in order to get financing, he adjusts his audit fee accordingly. Therefore, he accepts the wage, which is not less than the weighted average of the wage he would accept for the good and for the bad type, increased by the interim review costs c. Therefore, this ex ante

wage that the auditor would be willing to accept must satisfy the following constraint, where M stands for mandatory verification:

$$W^M \geq \big((1-\tau)(1-p_G)+\tau(1-p_B)\big)\left(m^{SB}(1-a^{SB})sF+\frac{1}{2}dm^{SB}a^{SB\,2}\right)+c = W^{SB}+c$$

Since both types must contract with the auditor in advance and seek a review of financial statements, the auditor is ex-ante unsure of the types. We restrict our attention to this setting and assume the auditor contracts only once with the firm for both tasks. Therefore, he only accepts one total audit wage from both types. Now both types must pay this additional cost c, plus the weighted fee for the whole audit. To fully see the benefits and costs of a mandatory review, we compare the utilities of each type in the two settings, mandatory and voluntary interim review. We find that the usefulness of the mandatory verification is restricted to the case when the costs of this verification are very low. In all other cases when these costs are not low, it is more beneficial for both types to use the voluntary option of signaling their type by means of a review. The result is due to the ex-ante asymmetric information about the type that can be resolved with minimal costs. In our analysis we distinguish two major cases, depending on the voluntary choice of the good firm (voluntary separation or pooling) and compare the results to the mandatory setting. The results are summarized in Proposition 3 and depicted in Figure 4, as well as in Table 1.

Proposition 3

Comparing mandatory and voluntary interim review of financial statements:

1) *A mandatory interim review compared to voluntarily signaling the type is beneficial to both firm types when the review costs are very low,* $c < (W_B^{FB} - W^{SB})$. *It holds that* $U_G^M(W^M, R_G^M) \geq U_G^S(W_B^{FB}, R_G^S)$ *and* $U_B^M(W^M, R_B^M) \geq U_B^{FB}(W_B^{FB}, R_B^{FB})$.
2) *A mandatory interim review compared to pooling on an asymmetric contract is beneficial only to the good type when the review costs not too high,* $c < (\overline{W}_G^{SB} - W^{SB})$. *It holds:* $U_G^M \geq U_G^{SB}$ *and* $U_B^M \leq U_B^{SB}$.
3) *A mandatory interim review is never beneficial to either of the types when the costs of verification are high.*
   a. *When* $c \geq (W_B^{FB} - W^{SB})$, *for separating equilibrium comparison* ($U_G^M \leq U_G^S$ *and* $U_B^M \leq U_B^{FB}$).
   b. *When* $c \geq (\overline{W}_G^{SB} - W^{SB})$, *for pooling equilibrium comparison* ($U_G^M \leq U_G^{SB}$ *and* $U_B^M \leq U_B^{SB}$).

Proof in the Appendix A. ■

The first setting, when the good firm would choose to separate using the review as a signaling mechanism for distinguishing its type, would happen when the prior beliefs are sufficiently pessimistic, $\tau > \bar{\tau}_t$, where $t \in \{1,2\}$, depending on the costs as set in Corollary 1 and Proposition 2, so that it is profitable to separate even with some separation costs. Assuming that separation is a better option for the good type, meaning that the good firm's utility with separation is higher than with pooling, $U_G^S(W_G^S, R_G^S) \geq U_G^{SB}(W^{SB}, R^{SB})$, we compare the utilities of the voluntary and the mandatory review. We can conclude that the voluntary verification can be a useful mechanism to signal the firm's type when the costs of this voluntary verification are not too high. This is mainly beneficial for the good type and can even yield rents for the auditor. In some situations when the review costs are very low, $c < (W_B^{FB} - W^{SB})$, a mandatory review can even further improve the good type's position. It can also improve the bad type's utility from the separating equilibrium at the same time. The reason for this is that the firms are able to keep the rents from signaling, which were grasped by the auditor, w, in the voluntary case, and divide them between themselves since the signaling condition (13) can be omitted. Hence, the resolved uncertainty benefits the firms and takes away the auditor's rents. However, with slightly higher costs, $c > (W_B^{FB} - W^{SB})$, allowing the good type to signal its type is more beneficial, not only to him but also to the bad type. Therefore, mandatory verification is not always the optimal solution. It is one of the solutions to reduce the information asymmetry, but it can be costly and inefficient.[18] In any case, the auditor breaks even on average, but gains on the good type ($W^{SB} - W_G^{FB}$) and loses on the bad type ($W^{SB} - W_B^{FB}$).

We are also interested in comparing the mandatory review to the case where there would be no demand for voluntary signaling with the review and where the firms would choose to be pooled in together. When the prior beliefs are optimistic, τ is sufficiently low or the review costs are sufficiently high (as stated in Proposition 3), there is little incentive for the good firm to signal its type to the lender and it is always beneficial to obtain the asymmetric equilibrium. It holds that $U_G^S(W_G^S, R_G^S) < U_G^{SB}(W^{SB}, R^{SB})$, because the separating wage with the lowest review costs is higher than the equivalent auditor's wage contract that brings the second best pooling utility. Therefore, the second setting examines mandatory review when pooling is a better option for the good type in the voluntary case. With the mandatory verification, the firms are forced to do the verification in settings where they would never do it voluntarily. Interestingly, lower review costs make it beneficial for the good type to have the mandated

[18] Note that some benefits on the investor's side cannot be picked up by our model, such as increased comparability of the firms and optimal portfolio considerations since we analyze a one-firm case in which the investor operates on a perfectly competitive market and is risk neutral.

verification instead of pooling, which he would choose in a voluntary setting. The bad type is worse off, because he loses the benefits of pooling due to the mandatory verification. Therefore, in the setting where these costs are not too high and where there are sufficiently many good firms on the market, there are benefits to mandating a review of financial statements. In all other cases, it is not advisable to introduce the mandatory verification and the players are better off if they individually choose to signal or not their type. All the cases are summarized in Table 1.

Figure 4: Voluntary vs. mandatory review with low costs, where $0 \leq c < (W_B^{FB} - W^{SB})$.

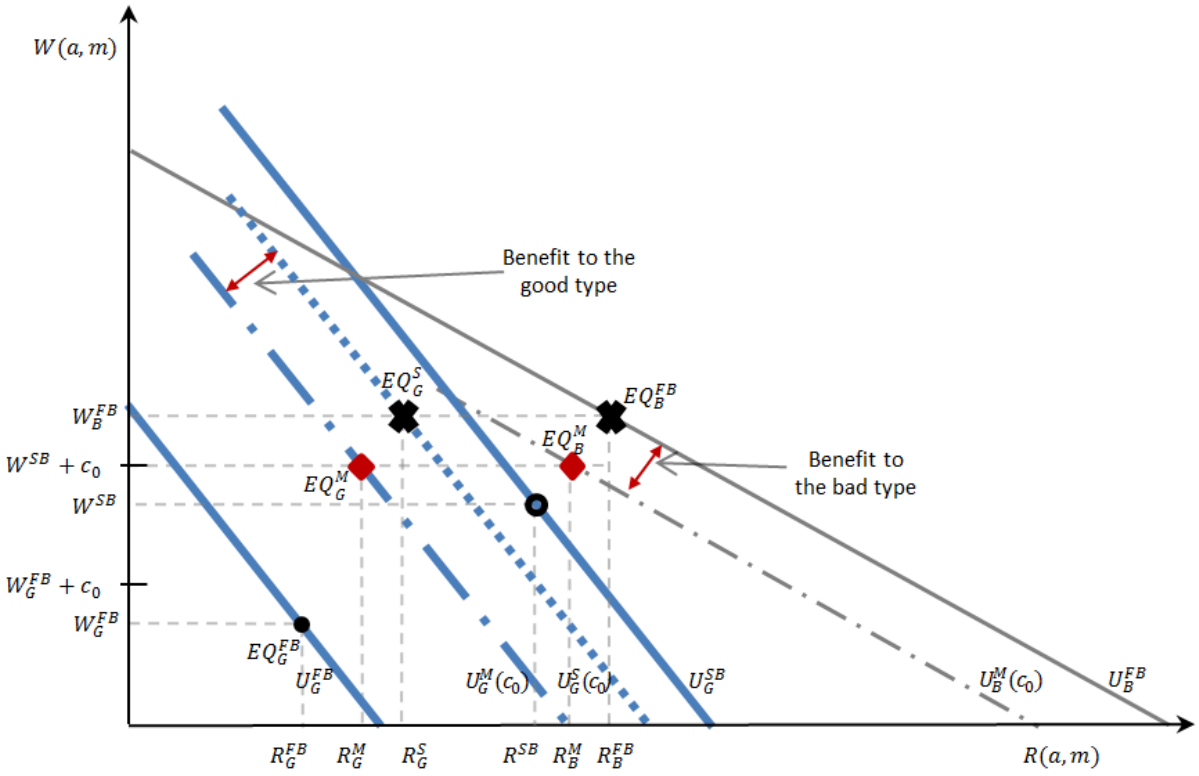


Figure 4 shows the case with very low review costs, $c < (W_B^{FB} - W^{SB})$. EQ_G^S *and* EQ_B^{FB} *show the equilibrium values under voluntary signaling with the interim review, given cost* c_o. *The equilibrium in the mandatory setting,* EQ_G^M *and* EQ_B^M, *shows an improvement for both firms. This benefit is taken from the auditor's rent, which is zero in expectation.*

7. EMPIRICAL IMPLICATIONS

In this section, we discuss empirical literature that is related to our model and consolidate the empirical findings with our results. Most recently, Bedard and Courteau (2015) study the benefits and costs of quarterly reviews. They analyze a sample of firms listed in the years 2004 and 2005 in Canada, where the review is voluntary. They find that audit fees are 18% higher if firms opt to have a review, but find no significant benefits, such as lower unexpected accruals. In contrast, other publications do observe increasing reporting quality when interim

financial statements are employed (Ettredge et al 1994, 2000a, b; Manry, Tiras and Wheatley 2003). This is in line with the following proposition.

Proposition 4

Financial Reporting Quality increases when the auditor is hired for the interim review.

In our model setup, financial reporting quality can be defined as the likelihood of an error-free report: $FRQ_i^n = 1 - [(1-\tau)(1-p_G) + \tau(1-p_B)]m_i^n(1-a_i^n)$. This is a convex function in τ which means in our context that it increases with decreasing information asymmetry or put differently, a higher likelihood that the type is known ($\tau \to 0, \tau \to 1$).[19]

Bedard and Courteau (2015) state that the lack of significant results on the benefits of an interim review might stem from the fact that the expected litigation is not strong enough in their Canadian setting and therefore the auditor is not sufficiently incentivized to work hard. While this is not directly an issue in our main analysis since the auditor is assumed to always work sufficiently hard in the review process, it relates to the setting, where the detection technology is not perfect (analysis in Appendix B). When we change the main setting to an imperfect detection technology, we also confirm that the auditor has to be properly incentivized for the interim reviews in order for the review to be advantageous for the good type firms. Krishnan and Zhang (2005) similarly find that auditors can reduce the probability of being held liable if they engage in an interim review—a finding that also corresponds to our robustness check in Appendix B, equation (B.4).

In Krishnan and Zhang (2005), it is remarkable that only 5.7% of their US-sample actually disclose the auditor's review in their 10-Q filings. We mentioned earlier that the US regulatory environment mandates interim reviews. To be precise, reviews are only required to be *disclosed* when the firm refers to the review in its 10-Q filing. This constraint adds the flavor of a voluntary disclosure option to this requirement, due to the leeway regarding the question as to whether the firm chooses to refer to the review in the 10-Q or not. However, even if the firm chooses not to disclose the review, the auditor must still conduct a review in a non-written form. This alternative saves costs and keeps the auditor's other function of screening the interim report, in order to channel potential areas of misstatement intact. However, if the review is not accessible for financial statement users, the signaling function that we analyzed in the course of this study is undermined.

[19] This is true as long as the direct audit effort costs, d, are not too high which would deter effort too much in case a bad company is identified.

The result in Krishnan and Zhang (2005), that only 5.7% of their sample firms disclose interim reviews, does not necessarily indicate that our model is not representative of findings in the empirical literature. It rather addresses the fact that the economic parameters in the sample period 2000 and 2001 were rather optimistic which eliminates the necessity for separation in order to achieve favorable financing conditions. However, this is not true for the IT companies that were potentially involved in the "dotcom-bubble" around that time. Due to this economic slump, it can be expected that prior beliefs about IT companies were rather pessimistic during this period and good firms preferred to separate from the rest. Indeed, a robustness check in their study shows that IT companies, included in their variable "TECH", disclose interim reviews more often. This is in contrast to the authors' expectations and could be explained by our model predictions.

Lastly, we want to emphasize our results regarding the audit wage, W. The audit wage or audit fee is often used as a proxy for audit effort and, consequently, audit quality. Thereby a positive relationship between audit fees, audit effort and audit quality is commonly suggested. This can be questioned if we consider our base model, where we state in the discussion of Lemma 1 that the audit effort increases monotonically in the prior beliefs but for the audit wage, it depends on the parameter constellation, especially the relative importance of litigation and direct audit effort costs ($\frac{\partial a}{\partial \tau} > 0$, $\frac{\partial W}{\partial \tau}$, see Appendix A). Furthermore, additional insights with respect to this topic can be gained from the signaling model and Proposition 1. In the asymmetric information setting with only annual audits, the audit wage is pooled at W^{SB} since the auditor does not know the type of the firm. However, if he is hired by the good type for the additional review, the total audit wages become W_G^S for the good type and W_B^{FB} for the bad type. The consequences become most apparent if we compare the audit fees of the good and the bad firm types in the case of low review costs, i.e. Proposition 1 *I a)*. Then, the total audit fee for an audit of a bad type, who does not hire an auditor for the interim review, equals the good type's total audit fee including the review, which are both higher than the second best audit wage ($W^{SB} < W_G^S = W_B^{FB}$). However, the audit effort for the annual report differs for each type from the asymmetric setting, $a_G^{FB} < a^{SB} < a_B^{FB}$, due to the early channeling of audit effort to the areas which need the most diligence. Consequently, the relationship between audit fees and audit quality is likely to be non-monotonic in cases where signaling via the interim review is used.[20]

[20] Note that we do not quantify the effort of the review which increases audit quality in our main model. However, we present an extension in Appendix B where the auditor chooses review effort e.

Audit fee models generally control for variables, such as size and ROA, to address observable firm characteristics that affect audit fees that could otherwise bias the coefficients on the variables of interest. However, interim reviews are seldom considered, even though their occurrence could especially affect studies in an international context based on the country regulation. For example, Choi et al. (2009) analyze the effects of cross-listings on audit fees. They only distinguish countries based on their legal regimes (weak vs. strong) and based on a disclosure index (high vs. low). Neither of those variables is likely to reflect the differences between a mandatory and voluntary use of reviews. For example, Australia and UK are both in the higher percentile in terms of legal regimes and disclosure but Australia requires audit reviews while the UK does not. In addition, Choi et al.'s (2009) hypotheses are based on an analytical model with similar mechanism to our base model. Consequently, it is possible that extensions of both their model as well as their empirical analysis by including interim review regulation might have an effect on the overall results.

8. CONCLUSION

In this paper we address the costs and benefits of a (voluntary) interim review of financial reports. Since it is in the interest of the firm to obtain better financing conditions from the lenders, it is incentivized to disclose additional information about their performance prior to the loan initiation. This voluntary information can only be credible if it is verified by the firm's auditor. It follows that the additional interim review of financial statements is costly to the firm, but by acquiring it, the firm can secure a lower interest on the loan. Costly to the firm means that the firm must pay a higher audit wage due to the additional task, and therefore has fewer funds to invest into the project and must borrow more, which results in a higher face value of debt. On the other hand, the firm benefits by securing a lower interest rate on the loan. Depending on these countervailing forces, the good firm decides to additionally disclose the information through the auditor or not. We find that asking the auditor also for a review of interim financial statements, before issuing debt, can be a cheap and efficient way to signal its type. We argue that the demand for additional timely information is particularly present when the uncertainty about investing in a good firm is high, i.e. in economic crises. Naturally, this only works if the costs for the review are not too high. For low costs, we show that the auditor is even able to earn rents, although he is assumed to operate in a perfectly competitive market. This is due to the fact that the auditor cannot punish the bad firm after discovering his type. In the case where the investor's prior beliefs about the firm are already optimistic, separation is too costly to be beneficial. Besides the possibility to earn rents, the

auditor further benefits since he is able to isolate the areas of potential misstatement and channel his effort during the regular annual audit report.

We also address the discussion whether a review should be required by the regulator. We show that both types of firms can be better off in such a scenario when the review costs are very low and the good type would have voluntarily signaled his type. If the costs are higher, the good firm can still benefit compared to the pooling equilibrium, but the bad firm occurs costs. Nevertheless, there are benefits to this regulation that cannot be captured with our model, especially since we focus merely on the firm's side while lenders are assumed to operate in a perfectly competitive market and to be risk neutral. However, what we can say is that mandatory review erodes the benefits of signaling by means of voluntary review engagement. It takes away discretion from the firm to contribute to an efficient disclosure option. In terms of future research, it might still be interesting to employ a richer model that also captures the investor's potential benefits of a mandatory review of interim financial statements and compare those to the voluntary alternative.

There are additional insights regarding the auditor's wage structure which are particularly interesting to empiricists. In the empirical literature, audit fees are often used as proxy for audit quality in the sense that the higher the audit fees, the higher the audit quality. Apart from the fact that there simply is no consistent definition of audit quality, we show that this monotonic relationship can be disturbed when firms use audit fees as a signaling mechanism. Reduced audit fees vary substantially depending on the firm's signaling decision as well as the type of the firm and do not always reflect a reduction at the attestation level. Furthermore, our model predicts that signaling is present when the uncertainty about the repayment prospect is high or prior investors' beliefs are pessimistic. We interpret this as a situation of an economic crisis. It would be interesting to see empirically if signaling can be found particularly during crisis. Also, uncertainty about the repayment prospects could be higher in certain industries which could be identified empirically. We predict higher use of interim review from better firms in the industries, when there is a more significant difference between the firms, as well as in the markets where there are significantly many bad firms.

APPENDIX A

Economic Justification of Hiring an Auditor

An auditor has to enhance the value of the firm if he wants to be hired. This means, the first derivative of the firm's utility has to be positive. We derivate (9) w.r.t. a_i^n and rearrange:

$$\frac{dU_i^n}{da_i^n} = \frac{[(1-\tau)(1-p_G)+\tau(1-p_B)]}{[\tau p_B+(1-\tau)p_G]}[\underbrace{(m_i^n - \frac{dm_i^n}{da_i^n}(1-a_i^n))}_{>0}L \underbrace{-(dm_i^n a_i^n + \frac{d}{2}{a_i^n}^2 \frac{dm_i^n}{da_i^n})}_{<0}]$$

$$-(1-p_B)(\underbrace{\frac{dm_i^n}{da_i^n}(1-a_i^n) - m_i^n}_{<0})V) \underbrace{-km_i^n \frac{dm_i^n}{da_i^n}}_{>0} > 0$$

The overall effect is two-folded and considers the benefits and costs of hiring an auditor. When the auditor is not hired, then $a = 0$. By increasing a, the firm has the benefit that it reduces the return to the lender by giving up the decision rights more often, which serves like a commitment not to manipulate (first term). Opposing to this, the costs of auditing increase with every unit (second term). On the other hand, the probability of receiving the private benefit decreases (third term), but so does the costs of manipulation because the incentive to manipulate is lower (fourth term). If the value of the reduction in R, including the costs of auditing, is higher than the value of the private benefit, including the costs of manipulation, then the auditor has a positive effect on the overall firm value. However, auditing is a global business and hence, it can be observed that it is generally beneficial to the firms. In what follows we consider the annual audit to be beneficial to both the firm and the lender.

Interestingly, the amount of the litigation fee, F, does not have an influence on the firm value. The reason for this is that the firm serves as an intermediary in this case. At the same time, it pays the auditor a higher fee for the risk, which lowers firm value because it is costly, but it also reduces the return to lenders by the same amount, which is a benefit to the firm. Ergo, both factors cancel each other out.

Proof of Lemma 1

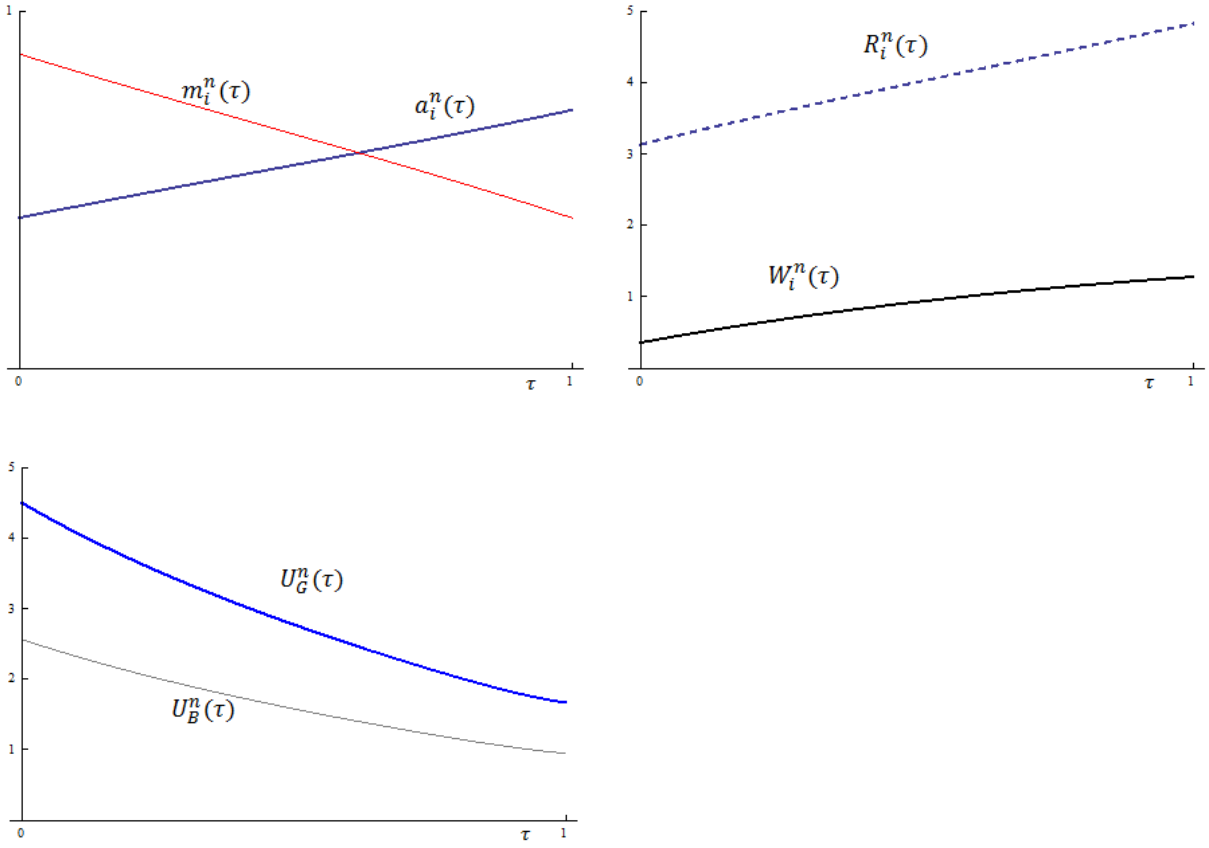
In equilibrium, all conjectures are true for all players, $\hat{a}_i^n = a_i^n$ and $\hat{m}_i^n = m_i^n$. This leads to the following equilibrium values.

$$a_i^n = \frac{Pr(b)\left(1-\frac{sF}{d}\right)+Pr(g)\frac{k}{V}+\sqrt{(Pr(b)\left(1-\frac{sF}{d}\right)+Pr(g)\frac{k}{V})^2-4\,Pr(b)^2\frac{sF}{d}}}{2\,Pr(b)} \tag{A.1}$$

$$m_i^n = \frac{V}{k}(1 - \frac{Pr(b)\left(1-\frac{sF}{d}\right)+Pr(g)\frac{k}{V}+\sqrt{\left(Pr(b)\left(1-\frac{sF}{d}\right)+Pr(g)\frac{k}{V}\right)^2-4\,Pr(b)^2\frac{sF}{d}}}{2\,Pr(b)}) \tag{A.2}$$

The ordering with respect to τ becomes clear by observing the following graphs.

Figure A.1: Equilibrium values of a, m, R, W, U dependent on the prior beliefs, τ



These are graphs of the variables of Lemma 1 dependent on τ. The first one illustrates the auditor's effort a, the bold blue line, and the manager's manipulation, m, the thin red line. Audit effort increases in τ ($\frac{\partial a}{\partial \tau} > 0$) and manipulation decreases in τ ($\frac{\partial m}{\partial \tau} < 0$). The second graph shows the return to the lender, R, the dashed blue line, and the audit wage, the black line. The return increases in τ ($\frac{\partial R}{\partial \tau} > 0$). The main driver for the latter inference is the assumption $p_G \gg p_B$ which can be seen in the denominator of the optimal return of (6).

$$R_i^n = \frac{I - A + W_i^n - [(1-\tau)(1-p_G) + \tau(1-p_B)](\hat{m}_i^n(1-\hat{a}_i^n)sF + (1-\hat{m}_i^n(1-\hat{a}_i^n))L)}{\pi[\tau p_B + (1-\tau)p_G]} \tag{6}$$

The graph about the audit wage increases in τ ($\frac{\partial W}{\partial \tau} > 0$). This is only the case under a specific parameter constellation, which we assume for convenience in Lemma 1. This can be seen best from the first order condition with respect to the prior beliefs, τ. The audit wage can be rearranged to

$$W_i^n(a_i^n) = [(1-\tau)(1-p_G) + \tau(1-p_G)]\left[(1-a_i^n)^2 \frac{V}{k} sF + \frac{1}{2} d\left(a_i^{n2} - a_i^{n3}\right)\right]$$

$$\frac{dW_i^n}{d\tau} = \overbrace{(p_G - p_B)\left[(1-a_i^n)^2 \frac{V}{k} sF + \frac{1}{2} d\left(a_i^{n2} - a_i^{n3}\right)\right]}^{>0}$$

$$+[(1-\tau)(1-p_G)+\tau(1-p_G)]\underbrace{\left[-\frac{\partial a_i^n}{\partial \tau}2(1-a_i^n)\frac{V}{k}sF+\frac{1}{2}d\frac{\partial a_i^n}{\partial \tau}\left(2a_i^n-3a_i^{n2}\right)\right]}_{>0\ if\ sF<d}$$

The term in the first line of the derivative is always positive. The second part depends largely on the relation between sF and d as discussed in the main analysis. If there is a higher relative importance of expected litigation compared to direct effort costs, lower sF and/or higher d, the second term becomes positive (Remember: $\frac{\partial a_i^n}{\partial \tau} > 0$). The reason for this is firstly, the direct comparison of the parameters $sF < d$, and secondly, the auditors choice of a. Lower litigation and higher direct costs discourage the auditor to work, which is why a is lower and the $2a_i^n - 3a_i^{n2}$ is positive ($2a_i^n - 3a_i^{n2} > 0$ for $a < \bar{a} = 2/3$). Only then, the monotonic relationship which is implied in Lemma 1 in our paper, and by the empirical literature in general, holds. On the other hand, the sign of the derivative turns around if litigation becomes relatively more important than the direct costs and the arguments reverse.

If both direct costs and litigation are similarly important, $\frac{dW_i^n}{d\tau} > 0$ for $a < \bar{a} = 2/3$ and , $\frac{dW_i^n}{d\tau} < 0$ for $a > \bar{a} = 2/3$. There exists a cutoff value of $\bar{\tau}_W$, where $\frac{dW_i^n}{d\tau} = 0$ and the sign changes from positive to negative. The cutoff $\bar{\tau}_W$ depends on the other parameters as well, such as the manager's incentives with respect to V and k.

The third graph depicts the resulting utilities and shows that they decrease in τ ($\frac{\partial U}{\partial \tau} < 0$). Thereby, U_G^n, the bold blue line, is always larger than U_B^n, the thin gray line. This is mainly driven by the lower return to the lender in case of the good type. It also shows that a bad firm benefits from uncertainty, $U_B^{SB} > U_B^{FB}$, and the good firm suffers from uncertainty, $U_G^{SB} < U_G^{FB}$, since the graph descends.

Proof of Proposition 1: The Signaling Equilibrium

To obtain $\bar{W}_{i\bar{}}$ we solve the following equations for the variable in question:

$$\bar{U}_G(\bar{W}_G, \bar{R}_G^S) = U_G^B(W_B^{FB}, R_B^{FB}) \text{ and}$$
$$\bar{U}_B(\bar{W}_B, \bar{R}_G^S) = U_B^{FB}(W_B^{FB}, R_B^{FB}), \text{ respectively.}$$

This results in $\bar{W}_i = W_B^{FB} + \pi p_i \Delta R^{FB}$, where $\Delta R^{FB} = R_B^{FB} - \bar{R}_G^S$.

In both expressions, the maximum wage that the respective type is willing to pay to the auditor for the given separating return, R_G^S, consists of the wage that a bad type has to pay plus the difference of the returns in the signaling scenario ($\Delta R^{FB} = R_B^{FB} - R_G^S$). By comparing the

maximal wages it can easily be seen that $\bar{W}_B < \bar{W}_G$ since $p_B < p_G$. This means that the good type is prepared to pay more in order to separate from the bad type than the bad type is prepared to pay to mimic the good type. This relation is due to the success probabilities of good outcomes for the two types (p_G and p_B) and it makes separating possible.

Proof of Proposition 2: Signaling vs. joint asymmetric contract

The good type seeks to separate whenever $U_G^S \geq U_G^{SB}$ with

$$U_G^{SB} = p_G(\pi(X - R_G^{SB}) + V) + (1 - p_G)\left(m^{SB}(1 - a^{SB})V - \frac{1}{2}k{m^{SB}}^2\right) \text{ and}$$
$$U_G^S = p_G(\pi(X - R_G^S) + V) + (1 - p_G)\left(m_G^{FB}(1 - a_G^{FB})V - \frac{1}{2}k{m_G^{FB}}^2\right).$$

There are several cases that need to be examined dependent on the additional costs *c* and prior beliefs τ. In examining the cases, we follow the same cost classification as we did with the Proposition 1.

a) When the verification costs are low, $c < (W_B^{FB} - W_G^{FB})$, there is the possibility to separate with the auditor's review. Separation is preferred to pooling with the bad type when the following inequality holds: $U_G^S(W_B^{FB}, R_G^S) \geq U_G^{SB}(W^{SB}, R^{SB})$. Which is true whenever $\bar{W}_G^{SB} > W_B^{FB}$. $\bar{W}_G^{SB}$characterizes the total auditor wage from the contract $(\bar{W}_G^{SB}, \bar{R}_G^{SB})$ that results in the same utility for the good type as the second best contract (W^{SB}, R^{SB}).

$$\bar{W}_G^{SB} = W^{SB} + \pi p_G \Delta R^{SB}, \text{ where } \Delta R^{SB} = R^{SB} - \bar{R}_G^{SB}.$$

$\bar{W}_G^{SB} > W_B^{FB}$holds when there are sufficiently many bad types on the market, or when τ is high enough, $\tau \geq \bar{\tau}_1$. The threshold $\bar{\tau}_1$ shows where the utility of separating by paying $W_G^{SR} = W_B^{FB}$ equals the utility from pooling: $U_G^S(W_B^{FB}, R_G^S) = U_G^{SB}(W^{SB}, R^{SB})$, rearranging yields

$$W_B^{FB} - W^{SB}(\bar{\tau}_1) = \pi(R^{SB}(\bar{\tau}_1) - R_G^S) \qquad \text{(A.4)}$$

The threshold $\bar{\tau}_1$ is the value of τ that satisfies this equation.

b) When the verification costs are moderate, $(W_B^{FB} - W_G^{FB}) \leq c < (\bar{W}_B - W_G^{FB})$, there is a possibility to separate with the auditor's review. Separation is preferred to pooling with the bad type when the good type's utility with separating is higher than his utility with pooling, or formally when the following inequality holds: $U_G^S(W_G^{FB} + c, R_G^S) \geq U_G^{SB}(W^{SB}, R^{SB})$, which is true whenever $\bar{W}_G^{SB} > W_B^{FB}$. Therefore, separation of types always exists when there are comparably many bad types on the market, or when τ is high enough, $\tau \geq \bar{\tau}_2$. The threshold $\bar{\tau}_2$ shows where the utility of separating by paying

$W_G^{FB} + c$ equals the utility from pooling: $U_G^S(W_G^{FB} + c, R_G^S) = U_G^{SB}(W^{SB}, R^{SB})$. The threshold $\bar{\tau}_2$ is the value of τ that satisfies this equation.

$$W_G^{FB} + c - W^{SB}(\bar{\tau}_2) = \pi(R^{SB}(\bar{\tau}_2) - R_G^S) \quad \text{(A.5)}$$

c) To complete the discussion, we also observe the pooling preference of the good firm. The good type prefers to be pooled in with the bad type and proposes the second best asymmetric contract whenever his utility with separation is lower than his utility with the asymmetric contract, or formally: $U_G^S(W_G^S, R_G^S) < U_G^{SB}(W^{SB}, R^{SB})$. This is true in the following cases:

   i. When the verification costs are extremely high $c > (\overline{W}_G^{SB} - W_G^{FB})$.

   ii. When $W_B^{FB} > \overline{W}_G^{SB}$ it always holds that $U_G^S < U_G^{SB}$. There will always be pooling with the bad type. This is true when the prior beliefs are sufficiently optimistic $\tau < \bar{\tau}_1$.

Proof of Corollary 1

Since equation (A.4), and (A.5) only differ in the signaling wages which can be ranked $\overline{W}_B > W_G^{FB} + c > W_B^{FB}$, it is apparent that the same ranking also exists for the cut-off values $\bar{\tau}_2 > \bar{\tau}_1$.

Proof of Proposition 3

We distinguish two major cases, depending on the voluntary choice of the good firm, and compare their results to the mandatory setting. The first setting compares mandatory review effects with voluntary separation of the good firm through a review and the second setting compares the mandatory review effects with the effects of voluntary pooling on an asymmetric contract.

I. Mandatory Reviews when Separation is Optimal in the Voluntary Setting

The good firm would separate using the review as a signaling mechanism when there are sufficiently many bad firms on the market, $\tau > \bar{\tau}_t$ (where $\tau \in \{1,2\}$, depending on the costs as set in Corollary 1 and Proposition 2). When separation is a better option for the good type, $U_G^S(W_G^S, R_G^S) \geq U_G^{SB}(W^{SB}, R^{SB})$, then the following two cases can be distinguished:

A. If the costs of review are low, $0 \leq c < (W_B^{FB} - W^{SB})$, then there is an overall benefit to both types for mandating the additional review of financial statements. The good type receives higher utility with a mandatory review, formally, $U_G^M(W^M, R_G^M) \geq U_G^{SR}(W_B^{FB}, R_G^{SR})$. Even the bad type receives higher utility, $U_B^M(W^M, R_B^M) \geq U_B^{FB}(W_B^{FB}, R_B^{FB})$. The utilities are higher since with these very low costs

c, the total auditor's wage paid under mandatory review is lower than the auditor's wage paid in case of voluntary review, $W^M = W^{SB} + c < W_B^{FB}$. The setting is displayed in Figure 4 and the costs are characterized as c_0.

B. If the review costs are higher, $c \geq (W_B^{FB} - W^{SB})$, then mandating a review is not beneficial for the good type, $U_G^M(W^M, R_G^M) \leq U_G^S(W_G^S, R_G^S)$. This holds since the auditor's wage that the good firm must pay for the mandatory review is always higher than the one it would have to pay for the voluntary review, $W^M = W^{SB} + c \geq W_B^{FB}$ for moderate costs $(W_B^{FB} - W^{SB}) \leq c < (W_B^{FB} - W_G^{FB})$ and $W^M = W^{SB} + c \geq W_G^{FB} + c > \bar{W}_B$, for higher costs. The bad type also loses with the mandatory review, $U_B^M(W^M, R_B^M) \leq U_B^{FB}(W_B^{FB}, R_B^{FB})$, since it always holds for the bad type that $W^M = W^{SB} + c \geq W_B^{FB}$.

II. Mandatory Reviews when Pooling is Optimal in the Voluntary Setting

When there are many good firms on the market, τ is sufficiently low or review costs are sufficiently high (as stated in Proposition 2), there is little incentive for the good firm to signal its type to the financier and there would be no demand for voluntary signaling with a review. It holds that $U_G^S(W_G^S, R_G^S) < U_G^{SB}(W^{SB}, R^{SB}) = \bar{U}_G^{SB}(\bar{W}_G^{SB}, \bar{R}_G^{SB})$, because even the separating wage with the lowest costs of verification is higher than the equivalent auditor's wage contract that brings the second best pooling utility, $W_B^{FB} \geq \bar{W}_G^{SB}$. The following two cases can be distinguished:

A. If the review costs c are small enough, $0 \leq c < (\bar{W}_G^{SB} - W^{SB})$, the mandatory review is beneficial for the good type, $U_G^M(W^M, R_G^M) > U_G^{SB}(W^{SB}, R^{SB}) = \bar{U}_G^{SB}(\bar{W}_G^{SB}, \bar{R}_G^{SB})$. This holds since $\bar{W}_G^{SB} > W^M = W^{SB} + c$. The bad type is worse off due to costly mandatory review that shows his type, compared to the second best case, but he might still be better off than with his own first best case. Each type receives some portion of the auditor's rents that were present in the voluntary signaling review. $U_B^{SB}(W^{SB}, R^{SB}) > U_B^M(W^M, R_B^M) \geq U_B^{FB}(W_B^{FB}, R_B^{FB})$. This holds since $W^{SB} < W^M < W_B^{FB}$ and $R^{SB} < R_B^M < R_B^{FB}$. The auditor breaks even.

B. If the costs c of a mandatory review are higher, $c \geq (\bar{W}_G^{SB} - W^{SB})$, mandatory review is never beneficial for any of the types. For the bad type the situation is as in the case with low costs and for the good type the following holds $U_G^M(W^M, R_G^M) < U_G^{SB}(W^{SB}, R^{SB}) = U_G^{SB}(\bar{W}_G^{SB}, \bar{R}_G^{SB})$, since $\bar{W}_G^{SB} < W^M = W^{SB} + c$. The auditor once again breaks even.

Table 1: BENEFITS OF MANDATORY REVIEW COMPARED TO VOLUNTARY (SEPARATING OR POOLING) EQUILIBRIUM.

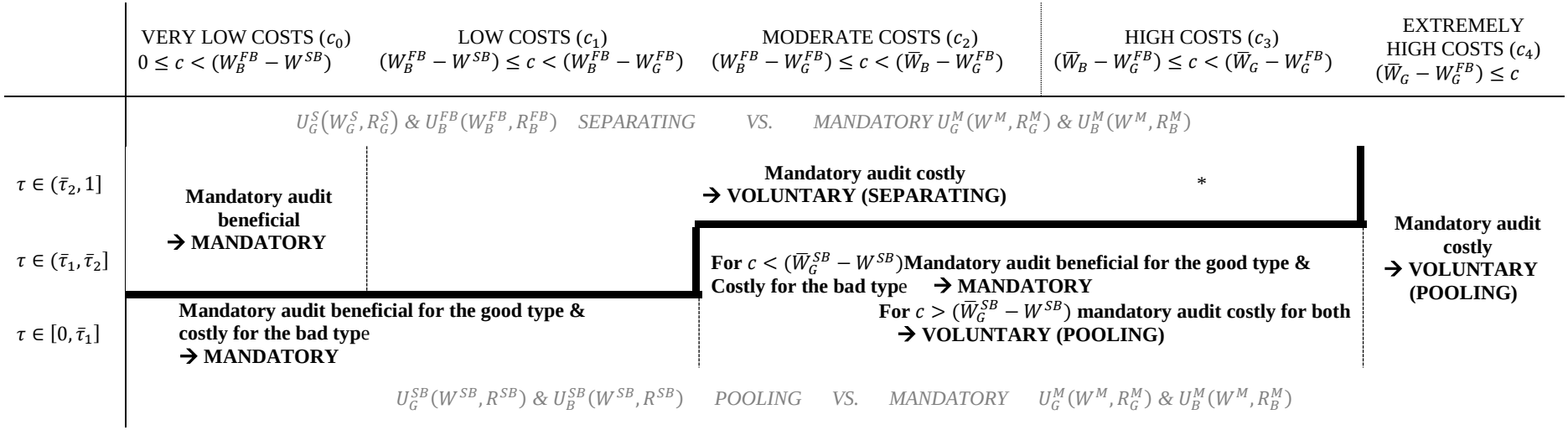


Table 1 compares the equilibrium values under voluntary review of financial statements to the mandatory review. The figure shows when the mandatory review is beneficial to the firms and when it is more costly than the choice made under the voluntary review option. We consider several cases which depend on how high the costs for the review, c, are and what the market expectation, τ, is. The lowest costs are represented in the far left column and increasing, pessimistic prior beliefs are represented with high τ in the first row and decreasing. The thick black line divides the separating and pooling equilibria when there is a regime not requiring a review. Therefore, if the parameters are in the upper left side, the voluntary choice of a good firm would be to separate from the bad type. In this case, mandatory review is beneficial when the costs c are very low, otherwise a voluntary review is better. The lower right corner shows the parameters where the voluntary choice of a good firm would be to pool together with the bad firm on an asymmetric contract without the review. However, this pooling equilibrium is only beneficial to the good firm in case of very high costs c. In all other cases, when the costs c are not very high it would actually be beneficial for the good firm to have a mandatory review of financial statements.

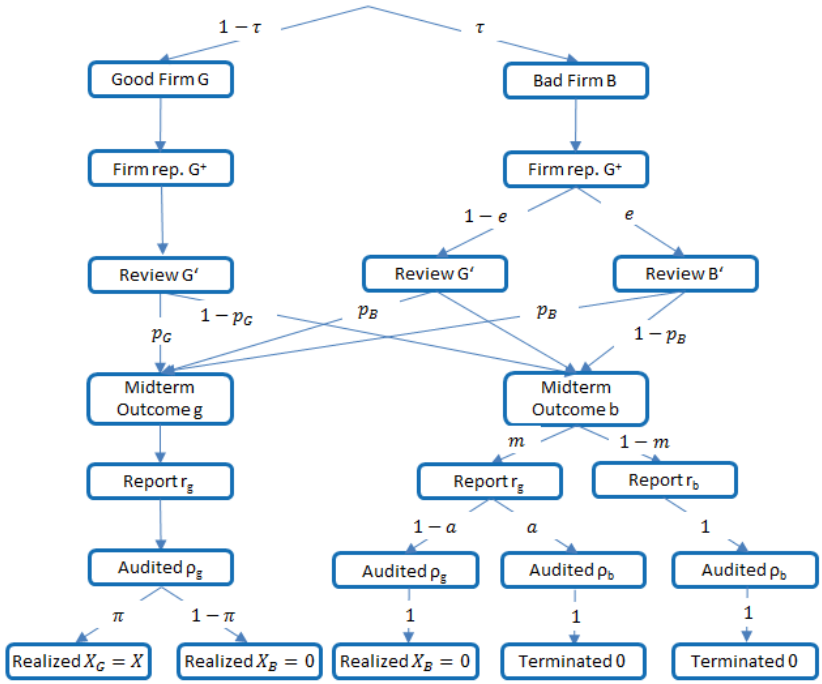
**With high costs, separating by review is not the optimal choice, but it is still better than the mandatory review or the pooling equilibrium. The best choice would be to separate by overpaying the auditor for the regular audit.*

APPENDIX B

Imperfect Audit Technology

In the main analysis, we use the assumption that the auditor can perfectly identify and confirm the firm's type in the review of interim financial statements in order to increase tractability of our results. We want to show in this section that dropping this assumption leads to the same conclusions. The quality of the statement the auditor is able to make in a review is limited to negative assurance, which means that no evidence for an inaccurate representation of the information in the financial statement has been found.[21]

Figure B.1: Extended Game tree



Manager	$X - R + V - W$	$V - W$	$V - W$	$-W$	$-W$
Lender	$R - I$	$-I$	$sF - I$	$L - I$	$L - I$
Auditor	W	W	$W - sF$	W	W

Our starting point in the analysis is that the interim financial statement is not credible as it is and needs the additional verification from the auditor. Furthermore, it is not in the interest of the firm to provide information that might lead to a negative belief of lenders about the firm's type. Thus, a good type has no incentive to be viewed as bad and a bad type would rather not disclose than reveal its type in order to be pooled with the good type. In this sense,

[21] Contrary to this, positive assurance is a much stronger statement which means that the representation is, indeed, fairly.

both types try to appear as good as possible and issue a good interim financial report, G^+.[22] Figure B.1 shows the extended game tree.

In accordance with the concept of negative assurance, the auditor is able to identify material modification, i.e. a bad firm is truly bad, with probability e, and he updates his beliefs. The variable e also represents the auditor's effort in the review process and the parameter $z > 1$ characterizes the technology of the review. Better review technology is less costly to the auditor, which is represented by lower z. Auditor exerts review effort ex ante and states that nothing fraudulent came to his attention and confirms G' with probability $\tau(1-e)+(1-\tau)$ from an ex ante perspective. We look at voluntary review setting where the good firm makes the decision whether to hire an auditor and make his verified interim financial report public in order to signal its type (Superscript Se is used for imperfect technology e). The probabilities are as follows:

$$Pr(G|G') = \frac{(1-\tau)}{(1-\tau)+\tau(1-e)}, \qquad Pr(B|B') = 1, \qquad Pr(B|G') = \frac{\tau(1-e)}{(1-\tau)+\tau(1-e)},$$

$$Pr\left(b\middle|r_g, G'\right) = \frac{\hat{m}_{G'}^{Se}[(1-\tau)(1-p_G)+\tau(1-e)(1-p_B)]}{\hat{m}_{G'}^{Se}[\tau(1-e)(1-p_B)+(1-\tau)(1-p_G)]+\tau(1-e)p_B+(1-\tau)p_G}$$

$$Pr\left(b\middle|r_g, B'\right) = \frac{\hat{m}_{B'}^{Se}(1-p_B)}{\hat{m}_{B'}^{Se}(1-p_B)+p_B}, \qquad Pr(G') = \tau(1-e)+(1-\tau), \qquad Pr(B') = \tau e$$

Similar to the main analysis, we apply backward induction and start with stage 5.

Stage 5 – Optimal Annual Audit Effort a

When the auditor chooses the optimal audit effort, a, he observes whether the firm had an interim review or not. But even if there was a review, it could still be a bad type since the review is not perfect and it is possible that a bad firm has a good review. This is reflected in the probability $Pr\left(b\middle|r_g, G'\right)$. Different to that, without a review, the firm is certainly bad. The auditor's incentive constraint regarding the audit effort, a_i is as follows:

$$arg\,max_{a_{B'}^{Se}}\, W_{B'}^{Se} - Pr\left(b\middle|r_g, B'\right)(1-a_{B'}^{Se})sF - \frac{1}{2}d{a_{B'}^{Se}}^2 \tag{B.1}$$

$$arg\,max_{a_{G'}^{Se}}\, W_{G}^{Se} - Pr\left(b\middle|r_g, G'\right)(1-a_{G'}^{Se})sF - \frac{1}{2}d{a_{G'}^{Se}}^2 \tag{B.2}$$

The auditor chooses his annual audit effort, a, based on his incentive constraints, (B.1) when he expects the bad type (B') and (B.2) when he expects the good type (G'). Thereby, (B.1) is the exact same constraint as in (2) from the bad type's first best case. Condition (B.2)

[22] This coincides with the general understanding that interim financial reports can be prone to false representation. However, note that there are no costs for falsely issuing a good interim financial statement.

is influenced by the review effort. As before, the auditor needs to be compensated for the risk of expected litigation, which he updates after the review according to Bayes, and his direct effort costs.

$$a_B^{Se} = a_B^{FB}$$

$$a_G^{Se} = \frac{\hat{m}_{G'}^{Se}[(1-\tau)(1-p_G)+\tau(1-e)(1-p_B)]}{\hat{m}_{G'}^{Se}[\tau(1-e)(1-p_B)+(1-\tau)(1-p_G)]+\tau(1-e)p_B+(1-\tau)p_G}\frac{sF}{d}$$

The annual audit effort is determined by solving the incentive constraints (B.1) and (B.2) for a. In case, the firm does not issue a review or is discovered as a bad type in the review, everyone knows that this is a bad type and the audit effort for those firms is equivalent to the first best solution for the bad type ((B.2) or (2)). However, since there is no direct punishment for a faulty review, there is also no incentive for a bad type to be honest. Hence, he would always try to appear as a good type in the review. In the sense, the manager severely manipulates the interim statements in this setting, which confirms a common intuition in the literature (Joon and Krishnan 2005) and explains why interim statements are not credible without the auditor's verification. The auditor knows this, updates his beliefs given the review effort, and adjusts his audit effort according to (B.2) for which is true that $a_G^{FB} < a_G^{Se} < a^{SB}$. This is easy to see since a_G^{Se} approaches $a_G^{FB}(a^{SB})$ when $e \to 1$ ($e \to 0$). Thus, since e is monotone, it is also true that $\frac{\partial a_G^{Se}}{\partial e} < 0$. If the auditor does not exert any review effort, there is no additional information on the type and the model continues in the second best case. In conclusion, the consequence from dropping the perfect technology assumption is that the actual audit effort is between the first best and second best solution. Thus, perfect technology, which results in the first best audit effort, only intensifies the effect but does not change the statements from the main analysis qualitatively.

Stage 4 – Optimal firm manipulation m

In what follows, we determine the optimal manipulation, m, based on the firm's incentive constraint:

$$arg\,max_{m_{i'}}\, m_{i'}^{Se}(1-\hat{a}_{i'}^{Se})V - \frac{1}{2}km_{i'}^{Se\_c^2} \tag{B.3}$$

$$m_{i'}^{Se} = \frac{(1-\hat{a}_{i'}^{Se})V}{k}$$

The firm's decision rule for the manipulation from (B.3) is still unchanged. However, a bad type which is not discovered as such in the review applies the same manipulation as a good type since the auditor bases the audit effort on what he has done in the review. Hence,

$m_{B(G')}^{Se} = m_{G(G')}^{Se} = m_{G'}^{Se}$ and $m_{B'}^{Se} = m_B^{FB}$. The bad type who does not issue a review or is discovered as a bad type uses his first best manipulation, given his conjecture about the audit effort, where $m_B^{FB} < m^{SB} < m_{G'}^{Se} < m_G^{FB}$. In Consequence, similarly to the level of audit quality, a quantitative, but not qualitative, change from perfect to imperfect technology can be observed.

Stage 3 – Optimal Lender's Return

$$R_B^{Se} = \frac{I - A + W_B^{Se} - (1-p_B)(\hat{m}_B^{FB}(1-\hat{a}_B^{FB})sF + (1-\hat{m}_B^{FB}(1-\hat{a}_B^{FB}))L)}{p_B\pi}$$

$$R_{G'}^{Se} = \frac{I - A + W_{G'}^{Se} - (\frac{(1-p_G)(1-\tau)+\tau(1-e)(1-p_B)}{(1-\tau)+\tau(1-e)})(\hat{m}_{G'}^{Se}(1-\hat{a}_{G'}^{Se})sF + (1-\hat{m}_{G'}^{Se}(1-a_{G'}^{Se}))L)}{\pi(\frac{p_G(1-\tau)+\tau(1-e)p_B}{(1-\tau)+\tau(1-e)})}$$

Similar to the main analysis, the optimal returns result from the lender's participation constraints. As a result from the review, the lender observes the auditor's report about the firm's type and interprets it as a signal by the good type. He conjectures the types and hence, demands a return similar to the first best for the bad type and he updates his beliefs for the good type and adjusts according to the audit wage, W_i^{Se}, which incorporates the increased effort of the review and the firm's choice of manipulation, m, as well as the auditor's choice of audit quality, a. The audit wage itself will be determined in stage 1.

Stage 2 – Optimal Review Effort e

The following equation displays the auditor's incentive constraint for review effort, e:

$$arg\,max_e\, W_G^{Se} - \frac{1}{2}ze^2 - [(1-\tau)(1-p_G) + \tau(1-e)(1-p_B)]\left(\hat{m}_{G'}^{Se}(1-a_{G'}^{Se})sF + \hat{m}_{G'}^{Se}\frac{1}{2}da_{G'}^{Se\,2}\right) - \tau e(1-p_B)\left(\hat{m}_B^{FB}(1-a_B^{FB})sF + \hat{m}_B^{FB}\frac{1}{2}da_B^{FB\,2}\right) \quad \text{(B.4)}$$

The auditor knows that all types, who ask for an interim review, claim to be good ex-ante and therefore he must exert effort to find out the type. He decides on the effort based on his costs and benefits from exerting it. The auditor is to be incentivized for the review effort in the same way as for the audit effort. In this context, it is possible to evaluate a common empirical intuition, which was pointed out in section seven. The auditor exerts review effort to decrease his exposure to litigation. The expected litigation from (B.4) can be expressed as

$$EL = (1-\tau)(1-p_G)\hat{m}_{G'}^{Se}(1-a_{G'}^{Se})sF + [\tau(1-e)\hat{m}_{G'}^{Se}(1-a_{G'}^{Se}) + \tau e\hat{m}_B^{FB}(1-a_B^{FB})](1-p_B)sF$$

In order to see how the term develops with increased review effort, the expression $\hat{m}_i^n(1-a_i^n)$ is important. This expression increases in τ ($\frac{\partial \hat{m}_i^n(1-a_i^n)}{\partial \tau} > 0$) which means that $[\hat{m}_{G'}^{Se}(1-a_{G'}^{Se}) > \hat{m}_B^{FB}(1-a_B^{FB})]$. Consequently, an increase in review effort shifts probability mass from the first part of the square brackets to the second part and the expected litigation decreases.[23]

Due to the complexity of the expressions, we only display the optimal solution in a general manner. Therefore, the optimal level of review effort is e^* that solves the first order condition:

$$\frac{\partial U_A}{\partial e} = \tau(1-p_B)\left(sF\left(\hat{m}_{G'}^{Se}(1-a_{G'}^{Se}) - \hat{m}_B^{FB}(1-a_B^{FB})\right) + \frac{1}{2}d\left(\hat{m}_{G'}^{Se}{a_{G'}^{Se}}^2 - \hat{m}_B^{FB}{a_B^{FB}}^2\right)\right)$$

$$-\tau\big((1-\tau)(1-p_G)+\tau(1-e)(1-p_B)\big)\left(\frac{\partial \hat{m}_{G'}^{Se}}{\partial e}(sF(1-a_{G'}^{Se}) + \frac{1}{2}d{a_{G'}^{Se}}^2) - \hat{m}_{G'}^{Se}\frac{\partial a_{G'}^{Se}}{\partial e}(sF - d a_{G'}^{Se})\right)$$

$$-ze = 0$$

It is obvious to see that the direct effect of review effort on the auditor's utility is positive as long as the direct effort costs, z, are not too high.[24] The remaining effects are not that self-explanatory. To prove that it is indeed a local maximum, we check the sufficient condition that the second derivative needs to be smaller than zero. Due to lengthy expressions, we do not provide them here (the whole proof is attainable by the authors upon request). Table B.1 provides an example of parameters that fulfill the optimization criteria.

Stage 1 – Optimal Audit Fee W

From the participation constraints we know that

$$W_{G'}^{Se} \geq [(1-\tau)(1-p_G)+\tau(1-e)(1-p_B)]\left(\hat{m}_{G'}^{Se}(1-a_{G'}^{Se})sF + \hat{m}_{G'}^{Se}\frac{1}{2}d{a_{G'}^{Se}}^2\right)$$
$$+\tau e(1-p_B)\left(\hat{m}_B^{FB}(1-a_B^{FB})sF + \hat{m}_B^{FB}\frac{1}{2}d{a_B^{FB}}^2\right) + \frac{1}{2}ze^2$$

In the mandatory setting there will only be one total audit wage including the review and the audit for both types.

The resulting utility has the same form as in all previous sections:

$$\max_{R_{G'}^{Se}, W_{G'}^{Se}, m_{G'}^{Se}} U_G^{Se} = p_G(\pi(X - R_{G'}^{Se}) + V) + (1-p_G)\left(m_{G'}^{Se}(1-a_{G'}^{Se})V - \frac{1}{2}k{m_{G'}^{Se}}^2\right)$$

[23] Proof upon request.

[24] Note that it seems reasonable to assume that both cost factors, d and z, are either high or low simultaneously since an auditor with a good audit technology is also likely to have a good review technology.

It should be noted that utility of the good type depends on the actual type of the firm, G, and on the interim review, G'.

Signaling Game

The signaling game works in the same manner as before. The incentive constraints that each type should choose their own contract, are as follows:

$$U_G^{Se}(W_G^{Se}, R_G^{Se}) \geq U_G^{B\_FB}(W_B^{FB}, R_B^{FB}) \qquad \text{(B.5)}$$
$$U_B^{FB}(W_B^{FB}, R_B^{FB}) \geq U_B^{Se}(W_G^{Se}, R_G^{Se}),$$

which is analogous to (13). Also the logic from the main analysis can be applied in this section in order to make the signaling work. The only necessary task is to prove that a manager would indeed consider an interim review as a signal. He does so whenever the utility from the review is better than without it, hence: $U_G^{Se} \geq U_G^{SB}$.

In the signaling model of section 5, the types are revealed and the game continues with the results from the first best case, if the signaling is effective. In this section, there are two participation constraints for the auditor, one for the annual audit where he picks a and one for the interim review where he picks e. Both constraints have to be fulfilled from an ex-ante perspective to make the auditor participate and ensure that he does not lose from the engagement in expectation, since even if the firm issues a good review, it could still be bad. It depends on the review costs which constraint is binding. If the costs are low enough so that it follows: $W_G^{Se} \leq W_B^{FB}$, the auditor earns extra rents $w = W_B^{FB} - W_G^{Se}$ and only the constraint for the annual audit effort is binding. The minimal total audit wage that the good type offers to the auditor for the audit and the review is:

$$W_G^{Se} = \frac{p_G}{p_B} W_B^{FB} + \frac{p_G - p_B}{p_B}(I - A) + (1 - p_G)\left[m_G^{FB}(1 - a_G^{FB})sF + \left(1 - m_G^{FB}(1 - a_G^{FB})\right)L\right]$$
$$- \frac{p_G}{p_B}(1 - p_B)\left[m_B^{FB}(1 - a_B^{FB})sF + \left(1 - m_B^{FB}(1 - a_B^{FB})\right)L\right.$$
$$\left. - \left(m_G^{FB}(1 - a_G^{FB}) - m_B^{FB}(1 - a_B^{FB})\right)V + \frac{k}{2}(m_G^{FB} - m_B^{FB})\right]$$

The signaling wage which includes the review and the audit has to be higher than the bad type's first best audit wage in order for the signaling to be efficient. In that case the type is revealed and the rest of the results resemble the first best case for each of the types. The optimal solutions are very lengthy and complex and therefore we present the following example to show that a voluntary review does, in fact, have all the predicted features, such as

lower return to the lender, possible rents for the auditor, as well as higher utility for the good type. The results are presented in the following table.

Table B.1: Comparison of second best scenario and the application of a voluntary review given certain parameter choices

	Second Best Scenario	**Good Type applies Voluntary Review**	
Stage 5	$a^{SB} = 0.1716$	$a_G^{Se} = 0.1698$	$\tau = 0.8$, $p_G = 0.8$, $p_B = 0.2$, $\pi = 0.9$, $X = 20$, $I = 6$, $L = 4.5$, $V = 1$, $A = 1$, $s = 0.5$, $F = 4$, $k = 6$, $d = 2$, $z = 0.1$
Stage 4	$m^{SB} = 0.1381$	$m_G^{Se} = 0.1384$	
Stage 3	$R^{SB} = 7.2535$	$R_G^{Se} = 7.2442$	
Stage 2	$e = 0$	$e^* = 0.0384$	
Stage 1	$W^{SB} = 0.1396$	$W_G^{Se} = 0.1430$	
Utilities	$U_G^{SB} = 9.9889$	$U_G^{Se} = 9.9957$, $w = 0.0034$	

Table B.1 shows the case were signaling is the better option since $U_G^{Se} > U_G^{SB}$, and the review costs, z, are low enough for the auditor to earn rents ($w > 0$). In conclusion, Appendix B shows that the changes from dropping the assumption of the auditor's perfect review technique are only quantitative in nature but allow for the same inferences. However, some further factors need to be considered, such as the relationship between the audit incentives arising from litigation risk and direct costs, which limit the generalizability of signaling by interim review compared to the main analysis.

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