Optimism and Auditor Liability

Abstract

There is strong evidence that individuals are optimistic in the sense that they underrate the probability of a negative event occurring. This paper provides a positive theoretical analysis of how auditor optimism affects their incentives to take care under two liability rules: strict liability and a negligence rule. Under strict liability, auditors are held liable when they cause damages to investors. Under a negligence rule, auditors are held liable when they cause damages and in addition, act negligently, that is, fail to meet the standard of due care specified in legal and professional rules.

I find the following results. 1) If due care is sufficiently close to the efficient level, a negligence rule distorts auditors’ incentives less than strict liability. Under strict liability, optimism makes the auditor overestimate the chances of finding material mistakes and thus induces suboptimal care. In contrast, due care tends to be chosen regardless of the level of optimism. (2) If due care is too strict, the auditor will not exert due care but the same level of suboptimal care under either liability rule. (3) With increasing optimism and in the absence of punitive damages, strict liability becomes less preferable to a precise negligence rule. This statement also holds for vaguely defined standards of due care if due care is sufficiently strict or if auditor optimism is sufficiently high. (4) Punitive damages counteract suboptimal incentives generated by auditor optimism, especially under strict liability.

Keywords: auditor liability, optimism, (vague) negligence rule, strict liability, bounded rationality, punitive damages

JEL: M42, K13, D81
Optimism and Auditor Liability

1. Introduction

Optimism was first reported in the early twentieth century (Lund 1925, Cantril 1938), and has since been documented in nearly 200 studies (Jolls 1998). In general, individuals overestimate their performance in tasks requiring ability (DellaVigna 2009). Svenson (1981) showed that 93 percent of individuals rated their car driving skills as above the median. Individuals underestimate the probability of negative or undesirable events, such as hospitalisation (Weinstein 1980). Litigants and lawyers anticipate their trial prospects as being better than they objectively are (Korobkin and Ulen 2000). Optimistic CEOs are more likely than others to undertake a (value-destroying) merger (Malmendier and Tate 2008) and to bias earnings upward (Hribar and Yang 2010).

Evidence suggests that auditors are optimistic too. Auditors are experts, and expert judgments seem to be more prone to optimism (Griffin and Tversky 1992, Malmendier and Tate 2005). Auditors systematically overrate their ability to detect material errors in financial reports – regardless of auditor rank (Owhoso and Weickgenannt 2009); in addition, audit partners overrate the abilities of their audit team members (Messier, Owhoso and Rakovski 2008, Kennedy and Peecher 1997).\(^1\)

Based on Weinstein (1980), I define auditor optimism as the auditor underrating the probability of not detecting a material misstatement (negative event) occurring.\(^2\) This implies that the auditor overrates the probability of detecting material errors (Owhoso and Weickgenannt 2009). Optimism might induce auditors to engage in risky behaviour and to conduct ineffective audits (Owhoso and Weickgenannt

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\(^1\) Auditors are also subject to other forms of bounded rationality (Nelson and Kinney 1997, Zimbelman and Waller 1999, Peecher and Piercey 2008).

\(^2\) It is important to distinguish between optimism and risk attitude. Optimism addresses the underrating of probabilities of negative events occurring; that is, it addresses an individual’s beliefs. Risk attitude, on the other hand, determines the utility derived from the outcomes of such events. Hence, it is conceivable for an individual to be optimistic, but also risk-averse.
2009). They may systematically underestimate the risk of an audit engagement and/or overstate the effectiveness of the audit procedure and the level of care taken.

Given that auditors are optimistic, the question arises: does a negligence rule or strict liability better correct for distortions caused by optimism? This paper provides a positive theoretical analysis of this question.

With strict liability, auditors are held liable when they issue a clean audit report regardless of a material misstatement causing damages to investors. With a negligence rule, auditors are held liable if they issue an incorrect audit report and, additionally, if they act negligently, i.e. if they fail to meet the standard of due care specified by legal and professional rules such as the Generally Accepted Auditing Standards (GAAS). Such a standard of due care only exists under a negligence regime but not under strict liability. Under a precise negligence rule, due care is specifically defined. Thus, ex ante, the auditor clearly knows the minimum level of care necessary to avoid negligence. Under a vague negligence rule, due care is not defined precisely ex ante, and courts may find the auditor negligent ex post with some probability, even though they may have met the legal and professional standards (Schwartz 1998: 390). Thus, even when auditors exert due care, they cannot fully escape liability under vague negligence as they can under precise negligence.

The analysis’ results depend on three parameters: (a) the liability regime and the strictness of due care, (b) the existence of punitive damages and (c) the level of auditor optimism.

With regard to the liability regime, I find that if due care is sufficiently close to the efficient level, a negligence rule distorts auditor care less than strict liability. The reason for this is that under strict liability, optimism causes the auditor to overestimate the chances of finding material mistakes. Thus, they take suboptimal care. With a negligence rule there is a strong incentive to exert due care in order to avoid liability. If due care is efficiently defined, a negligence rule ensures efficient auditor care; optimism does not matter and a negligence rule is then preferable. If due care is lower or higher than the efficient level, the auditor will exert suboptimal or excessive care, respectively. Thus, there is a
social cost also under a negligence rule. Nevertheless, if due care is sufficiently close to the efficient level the welfare loss will be lower under a negligence rule than under strict liability.

Strictness of due care: If due care is too strict, it would be too costly to exert. As a consequence, a negligence rule provides the same level of suboptimal care as strict liability. If due care is too lenient, the auditor exerts this care level which might be even lower than the care level under strict liability. In such a case, strict liability would be preferable.

Auditor optimism: The more optimistic the auditor is the less care they exert under strict liability. Consequently, with increasing auditor optimism strict liability tends to become less preferable.

Punitive damages: While optimism induces the auditor to exert too little care, punitive damages have the opposite effect. Consequently, the auditor’s care level increases under strict liability. With a negligence rule, however, the auditor still tends to exert due care. Thus, punitive damages asymmetrically affect the auditor’s care level under the two liability regimes.

To sum up, under certain conditions auditor optimism decreases welfare less with a negligence regime than with a strict liability regime. However, as a word of caution, this does not necessarily imply that a negligence regime yields higher total welfare than a strict liability regime.

This paper contributes to the literature on auditor liability by incorporating a persistent phenomenon of bounded rationality. The literature assumes rationality in the sense of Expected Utility Theory (EUT), and focuses on other issues (e.g. Schwartz 1997, Willekens and Simunic 2007, Laux and Newman 2010). For instance, Narayanan (1994) shows that under a joint and several damages apportionment

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3 This literature focuses on the effect of performance-based audit fees (Radhakrishnan 1999). It compares several and joint liability and proportionate liability (Hillegeist,1999, Patterson and Wright 2003), and analyses how the possibility of settling a lawsuit affects auditor care in the first place (Boritz and Zhang 1997, Smith and Tidrick 1998, Zhang and Thoman 1999). Balachandran and Nagarajan (1987) address the issue of auditor liability insurance. Dye (1993) analyses the effect of limited liability due to auditors’ limited wealth, see also Quick (1996). The issue of vaguely defined standards of due care is addressed by Ewert (1999), Willekens et al. (1996) and Willekens and Simunic (2007). Liu and Wang (2006) analyse the effects of legal errors on audit effort and
rule, audit effort will be higher with a negligence rule than with strict liability if the probability of the auditor not being held liable under the negligence rule is sufficiently responsive to changes in auditor care. In my model, audit effort may also be higher under a negligence rule, albeit for a different reason. Due care represents a local optimum in the presence of auditor optimism while auditors’ incentives tend to become distorted under strict liability. Narayanan (1994) does not address auditor optimism; my paper does not deal with bilateral liability.

The paper also provides an argument for assessing punitive damages based on the auditor’s bounded rationality. The law and economics literature (e.g. Shavell 2007) find punitive damages desirable given that the liability enforcement system works imperfectly in the sense that an injurer (here: the auditor) is not always held responsible when causing harm, but only with some probability. If this probability is 50%, punitive damages should be double the actual damage. In a similar fashion, in our model punitive damages correct for the fact that an optimistic auditor underrates the event of a liability.

Only a few papers deviate from rationality according to Expected Utility Theory (EUT). Fischbacher and Stefani (2007) suggest a game-theoretical concept that deviates from the Nash equilibrium and is based on experimental evidence. Bigus (2012) addresses auditor ambiguity aversion with a vaguely defined negligence rule. However, I am unaware of any theoretical model that considers auditor optimism. In fact, theoretical papers that incorporate bounded rationality are quite rare in the accounting literature (Elitzur 2011).

I am able to show that, with auditor optimism and non-punitive damages, a precise negligence rule does relatively better than strict liability. I obtain a similar result with a vague negligence rule given that there is a sufficiently strict standard of due care or sufficiently strong auditor optimism. In contrast, the literature stresses the distortions of a vague negligence rule on auditors’ incentives (e.g. audit fees. Schwartz (1997) argues that shareholders may overinvest because if an investment fails they might be able to sue the auditor for compensation, and auditors may then exert excessive care. Pae and Yoo (2001) show that a stricter liability regime reduces the owner’s investment in the quality of the firm’s internal control system. Laux and Newman (2010) address the question of how the auditor’s liability exposure and litigation frictions affect the probability of client rejection.
Schwartz 1997, Willekens and Simunic 2007). In my model, a vague negligence rule generally induces the auditor to take more care thereby counterbalancing the suboptimal incentives induced by auditor optimism.

The paper is organised as follows. Section 2 incorporates optimism into a model of auditor liability considering strict liability, a precise negligence rule and a vague negligence rule. Section 3 provides a game-theoretical analysis, Section 4 derives empirical implications and Section 5 concludes.

2. Model

2.1 Assumptions and first-best solution

In the following, I investigate the effect of optimism in a model of auditor liability. Based on the findings of Svenson (1981), Weinstein (1980) and Malmendier and Tate (2008), I focus on optimism in the sense that individuals underrate the likelihood of a negative event. Figure 1 depicts the sequence of events.

---insert Figure 1 about here---

I consider a firm with an incorrect financial report. If a risk-neutral auditor fails to detect the error, there will be a material misstatement in t=0 and risk-neutral investors will make faulty investment decisions that induce a loss of $D$ to investors in t=1. Correct audits allow investors to update beliefs in *ex-ante* unknown project types, which increases the investors’ net present value (Pae and Yoo 2001: 336). For simplicity, and in order to focus on the issue of optimism, I do not endogenise damages here.

The auditor earns a flat fee for the audit that meets their participation constraint. Following the basic accident model in Shavell (2007), I look at unilateral liability. The auditor’s liability is unlimited; the interest rate is zero. There is a probability of $p$ that the auditor will fail to detect the mistake and that damage to investors will occur. This probability depends on the auditor’s level of care, $x$:

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4 Contingent auditing fees are prohibited or inconsistent with the professional code of conduct in most countries.
(1) \[ p = p(x) = 1/(1 + x) \quad \text{with} \quad x \geq 0. \]

Following the literature (e.g. Shavell, 2007), I assume that the probability of damage decreases as the auditor’s level of care increases, albeit at diminishing rates. The auditor also bears the direct costs of performing the audit. For simplicity, these direct costs equal the level of care, \( c(x) = x \). Thus, the direct costs increase linearly with the level of care.

Auditing is socially efficient if the direct costs of care are lower than the reduction in investors’ expected losses (= damages). Damage compensation (penalty) is \( P \), which could be equal to investors’ losses \( D \), but also lower or higher than \( D \).\(^5\) Auditing reduces the social cost by:

(2) \[ Y = (1 - p(x))D - c(x) = (1 - p(x))D - x. \]

Let us assume that for some \( x > 0 \) we have \( Y > 0 \). With the socially desirable level of care, \( x = x^* \), marginal gains equal marginal costs of auditing. Thus,

(3) \[ Y'(x) = 0 \quad \text{for} \quad x = x^* \quad \text{with} \quad x^* = \sqrt{D} - 1. \(6\)

To make the problem interesting, I assume \( D \geq 1 \). If damage occurs, the investor’s decision to bring a lawsuit in \( t=2 \) will depend on the transaction costs \( T \) \( (T \geq 0) \) associated with litigation, such as lawyer and court fees. Without loss of generality, each party bears its own legal expenses (American rule).

The investors have two options in the event of damage occurring – they may or may not bring a lawsuit. The investors are unaware of the auditor’s level of care when the damage occurs in \( t=1 \). The auditor has to decide on the level of care to be taken before investors sue. Investors and the auditor choose their actions without observing the other party’s action. Otherwise, all parameters are common knowledge.

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\(^5\) For instance, \( P > D \) implies ‘punitive damages’. Usually, the literature assumes that damage compensation equals investor losses \( (P = D) \), e.g. Narayanan 1994, Pae and Yoo 2001, Hillegeist 2001.

\(^6\) The second-order condition is met due to (1).
2.2 Investors definitely bring a lawsuit: precise negligence versus strict liability

First, I analyse the case where investors definitely bring a lawsuit, maybe because transaction costs are zero ($T = 0$). I introduce the element of optimism by assuming that an optimistic auditor underrates the probability of not detecting a material misstatement; that is, an optimistic auditor overestimates the chances of finding material mistakes. The auditor underrates the probability of not detecting a material misstatement for any given level of care such that:

\[ p^o(x) < p(x) \quad \forall x \in (0, \infty). \]  

This condition can be met by assuming

\[ p^o(x) = \frac{p(x)}{\lambda} \quad \text{with} \quad 1 < \lambda \leq P \quad \forall x \in (0, \infty). \]

Note that $\lambda$ increases with the level of optimism. I assume that there is no underrating of certain events (Griffin and Tversky 1992): $p^o(x = 0) = p(x = 0) = 1$ and $p^o(x = \infty) = p(x = \infty) = 0$. Section 2.4 shows that this assumption is not crucial. There is an upper bound on $\lambda$ to make sure that individually optimal levels of care are non-negative.

There are two liability regimes (Shavell 2007). Under strict liability, an auditor is held liable whenever material mistakes and damage to investors occur. Under a precise negligence rule, the auditor is held liable when material mistakes and damage occur and, additionally, when the auditor acted negligently i.e. failed to meet due care as specified by legal and professional rules, such as Generally Accepted Auditing Standards (GAAS). I denote the standard of due care as $x^5$. The cost function of the optimistic auditor is ($x > 0$):

\[ C_{SL}(x) = c(x) + \frac{1}{\lambda (1 + x)} P \quad \text{with strict liability and} \]

\[ C_{SL}(x=0) = P \quad \text{under either liability regime. I do not explicitly mention the zero care level in the cost functions for the sake of simplicity but also because it never represents a local cost minimum when investors bring a lawsuit.} \]
(6.2) \[ C_{PN}(x) = \begin{cases} c(x) + P / (1 + x), & x < x^S \\ c(x), & x \geq x^S \end{cases} \] with a precise negligence rule.

Under strict liability there is always some probability of damage occurring and, thus, of paying damage compensation. This probability decreases with higher care \( x \). Under a negligence rule, there is no liability at all once the auditor exerts due care \( x^S \).

Note that due care can be defined efficiently \( x^S = x^* \), but need not be. Recall that the direct costs of care equal the level of care: \( c(x) = x \). The first derivatives of (6.1) and (6.2) with respect to \( x \) yield the auditor’s optimal levels of care under strict liability and precise negligence, \( \hat{x}_{SL} \) and \( \hat{x}_{PN} \), respectively:

\[
\begin{align*}
(7.1) \quad \hat{x}_{SL} &= \sqrt{P / \lambda} - 1 \\
(7.2) \quad \hat{x}_{PN} &= \begin{cases} x^S, & x^S \leq \hat{x}^S = 2\sqrt{P / \lambda} - 1 \\ \sqrt{P / \lambda} - 1 < x^S, & x^S > \hat{x}^S \end{cases}
\end{align*}
\]

From (7.1) we can infer that increasing optimism decreases auditor care under strict liability. Higher penalties \( P \) improve incentives to take care. The auditor will only exert efficient care if \( \hat{x}_{SL} = x^* = \sqrt{D} - 1 \), that is, \( P = \lambda D \) holds. With \( P > \lambda D \) there will be excessive care; with \( P < \lambda D \) suboptimal care. Both the optimism level and the size of penalties determine the auditor’s care level.

Under a negligence rule, the auditor will exert due care \( x^S \) if it is not too strict \( x^S \leq \hat{x}^S \), see (7.2)). As long as this condition holds, the auditor exerts due care – quite regardless of optimism and penalties. The intuition is that with due care the auditor does not have to pay damage compensation; only the direct audit cost matters. If due care is efficiently defined \( x^S = x^* \) the auditor will exert efficient care. With a lower standard \( x^S < x^* \), there will be suboptimal care; with a stricter standard there will be excessive care if \( x^* < x^S \).

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8 The second-order conditions are always met.
Only if due care is too strict and thus exceeds the threshold level \( \hat{x}_S \) (see (7.2)) would it be too costly to exert due care. Hence, the auditor chooses the same suboptimal care as under strict liability, \( \hat{x}_{PN} = \hat{x}_{SL} = \sqrt{P/\lambda} - 1 \), because the auditor’s cost of exerting \( \hat{x}_{PN} \) is lower than with due care:

\[
C(\hat{x}_{PN}) = 2\sqrt{P/\lambda} - 1 < C(\hat{x}_S \mid x^S > \hat{x}_S). \tag{8.1}
\]

When choosing \( \hat{x}_{PN} \), the auditor expects to pay damage compensation but direct audit costs are much lower than with due care.

In terms of preliminary results there are intuitively three driving forces: the standard of due care, the level of auditor optimism and the incidence of punitive damages:

- First, *ceteris paribus*, the closer due care is set to the efficient level the more favourable a negligence regime becomes. However, the auditor will also exert due care even when it is very low. As an extreme case, with \( x^S = 0 \), the auditor exerts zero care. If due care is sufficiently low, the auditor will exert less care under a negligence regime than under strict liability.

- Second, *ceteris paribus*, more optimism decreases the auditor’s care level under strict liability. Under a negligence regime, though, the auditor tends to stick to the level of due care given that it is not too strict. Thus, with higher levels of optimism, a negligence rule becomes more favourable.

- Third, *ceteris paribus*, punitive damages work against suboptimal incentives provided by optimism. Punitive damages increase auditor care under strict liability while there is no such effect under a negligence regime given that the standard is not too strict. The relative preference of the two liability regimes depends on whether punitive damages exist or not.

All forces work together. Thus, we need to perform a formal analysis of which conditions render which liability regime preferable, given that due care is not too strict (if it is too strict, \( x^S > \hat{x}_S \), both liability regimes induce the same suboptimal care). Social costs \( SC \) are defined as follows:

\[
SC_{SL} = c(\hat{x}_{SL}) + \frac{1}{1 + \hat{x}_{SL}}D = \sqrt{P/\lambda} - 1 + \frac{1}{\sqrt{P/\lambda}}D \quad \text{with strict liability and}
\]
(8.2) \( SC_{PN} = c\left(x^S\right) + \frac{1}{1 + x^S}D \) with a precise negligence rule.

Social welfare considers the direct audit costs and the damages investors are expected to incur, but not the expected damage compensation based on \( P \). We can infer from (8.1) and (8.2) that social costs are lower with precise negligence if due care is defined as follows:

(9) \( SC_{PN} < SC_{SL} \) if \( x^S \in \left(x_1, x_2^S\right) \)

(9.1) with \( x_1^S = \min\left(\sqrt{P / \lambda} - 1, \frac{D}{\sqrt{P / \lambda}} - 1\right) \) and \( x_2^S = \min\left(\max\left(\sqrt{P / \lambda} - 1, \frac{D}{\sqrt{P / \lambda}} - 1\right), \lambda^S\right) \).

Consequently, the range of standards of due care that are preferable to strict liability is defined according to the degree of optimism:

(a) with minor optimism \((1 < \lambda \leq P / D)\), we have \( x^S \in \left(x_1^S = \frac{D}{\sqrt{P / \lambda}} - 1, x_2^S = \sqrt{P / \lambda} - 1\right) \),

(b) with medium optimism \((P / D < \lambda \leq 2P / D)\): \( x^S \in \left(x_1^S = \sqrt{P / \lambda} - 1, x_2^S = \frac{D}{\sqrt{P / \lambda}} - 1\right) \),

(c) with stronger optimism \((2P / D < \lambda)\): \( x^S \in \left(x_1^S = \sqrt{P / \lambda} - 1, x_2^S = \lambda^S = 2\sqrt{P / \lambda} - 1\right) \).

Note that case (a) necessarily requires that punitive damages exist \((P > D)\). In the absence of punitive damages \((P \leq D)\) only cases (b) and (c) exist.

Figure 2 assumes \( P = D \). In this case, increasing optimism reduces the auditor’s care level under strict liability. Under a negligence regime increasing optimism does not matter: unless due care is not too strict, the auditor still exerts due care. Thus, even inefficient due care might induce lower social cost than strict liability does. We can see how optimism affects the relative efficiency of the liability regimes by looking at the range of standards of due care in which a negligence rule induces lower social cost (see shaded area in Figure 2). With increasing optimism strict liability becomes less and less preferable. If due care is too strict (in Figure 2: North of \( x^S \)) it is too costly to exert and the auditor exerts the same suboptimal level of care under either liability regime; with increasing optimism this is more likely to happen \((\lambda^S = 2\sqrt{P / \lambda} - 1\) is decreasing with the optimism level \( \lambda \), see (7.2)).
It is noteworthy that without optimism strict liability would induce efficient care, whereas a negligence rule would only do so if due care is efficiently defined (in this case, we have $x^S_2 = x^S_1 = \sqrt{D} - 1 = x^*$).

I obtain similar qualitative results assuming too lenient penalties ($P < D$) as reflected by Figure 3.

Figures 2 and 3 reflect the case of non-punitive damages and indicate that a strict liability regime becomes less preferable with increasing optimism. This can also be shown formally. The range of standards of due care in which strict liability induces lower social cost than precise negligence is defined by \( \text{RANGE\_SL} \):

\[
(10.1) \quad R\text{ANGE\_SL} = \begin{cases} 
\left( x^S_2 - x^S_1 \right) + \left( x^S_1 - 0 \right) = 2\sqrt{P/\lambda} - \frac{D}{\sqrt{P/\lambda}} + \frac{P}{\lambda} - 1, & \text{if } \lambda < \frac{2P}{D}, \\
\left( x^S_1 - 0 \right) = \sqrt{P/\lambda} - 1, & \text{if } \lambda \geq \frac{2P}{D},
\end{cases}
\]

with \( \partial R\text{ANGE\_SL} / \partial \lambda < 0 \).

The range of standards in which precise negligence is relatively preferable is defined by \( \text{RANGE\_PN} \).

While this range decreases in optimism up to the point \( \lambda = 2P/D \), it decreases thereafter:

\[
(10.2) \quad R\text{ANGE\_PN} = \begin{cases} 
\left( x^S_2 - x^S_1 \right) = \frac{D}{\sqrt{P/\lambda}} - \sqrt{P/\lambda}, & \text{with } \partial R\text{ANGE\_PN} / \partial \lambda \bigg|_{\lambda < \frac{2P}{D}} > 0, \text{ if } \lambda < \frac{2P}{D}, \\
\left( x^S_1 - x^S \right) = \sqrt{P/\lambda}, & \text{with } \partial R\text{ANGE\_PN} / \partial \lambda \bigg|_{\lambda \geq \frac{2P}{D}} < 0, \text{ if } \lambda \geq \frac{2P}{D}.
\end{cases}
\]

In contrast, the range of standards in which neither regime is preferable increases with more optimism. This is because the threshold level of due care above which both liability regimes induce the same care (\( \lambda^* = \sqrt{P/\lambda} \)) decreases in \( \lambda \) (see (7.2)). In other words, with more optimism, it becomes more likely that both regimes will induce suboptimal care.

Figure 4 shows the scenario of punitive damages ($P > D$). With punitive damages, strict liability induces efficient care with a certain level of auditor optimism ($\lambda = P/D$). The reason for this is that
punitive damages tend to induce excessive care and counterbalance the suboptimal incentives generated by optimism. Thus, with minor optimism ($\lambda < P/D$), increasing optimism makes strict liability more efficient and makes precise negligence less preferable. The picture changes with medium or strong optimism ($\lambda > P/D$): here increasing optimism makes strict liability less efficient.

--insert Figure 4 about here--

**Result 1**

If investors definitely sue and in the absence of punitive damages ($P \leq D$), we get the following results:

(i) Increasing auditor optimism decreases the auditor’s level of care under strict liability (see (7.1)).

(ii) If the standard of due care is too strict such that $x^S > x^S = 2\sqrt{P/\lambda} - 1$, a negligence rule induces the same level of suboptimal care as strict liability (see (7.2)). With increasing optimism, this threshold level $x^S$ decreases.

(iii) If due care is in the range $x^S \in (x_1^S, x_2^S)$ as defined in (9.1), a precise negligence rule induces a higher level of care than strict liability and implies lower social costs.

(iv) With sufficiently lenient or sufficiently high standards of due care, that is, $0 \leq x^S < x_1^S$ and $x_2^S < x^S < \underline{x}^S$, respectively (see (9.1)), strict liability is preferable.

(v) Increasing optimism decreases the relative efficiency of strict liability (see (10.1)).

With punitive damages ($P > D$) and low levels of optimism, auditors’ care levels under strict liability increase with increasing optimism up to the level $\lambda = P/D$ and thus only the above results (ii), (iii) and (iv) prevail.●
The analysis suggests that punitive damages might be a regulatory option to correct for suboptimal incentives caused by optimism. In this sense, the paper provides a novel rationale for punitive damages based on the auditor’s bounded rationality discussed earlier. Punitive damages correct for the fact that an optimistic auditor underrates the event of a liability. In the model punitive damages should ideally be set to \( P = \lambda D \), which would induce efficient care under strict liability.

2.3 Investors definitely bring a lawsuit: vague negligence versus strict liability

As in my model, Schwartz (1998) assumes that a court will find negligence when the auditor does not meet the requirements of Generally Accepted Auditing Standards (GAAS). In a way, GAAS represents the standard of due care. In contrast to my basic model, Schwartz argues that this standard is not precise because courts may find the auditor negligent even if they have met GAAS. However, non-compliance with GAAS certainly implies negligence. Schwartz (1998) calls this a vague negligence rule, which might be more plausible than the precise rule analysed in Section 2.2. In what follows, I redo the analysis comparing a vague negligence regime with a strict liability regime where I specify vague negligence according to Schwartz (1998: 390).

Schwartz assumes that care levels below due care imply negligence. With care levels that meet or exceed due care, there is a probability lower than one that the court will find the auditor negligent, \( F(x \geq x^s) < 1 \). It seems plausible to assume that the probability of being held liable ex post, \( F(x) \), decreases with an increasing level of care, albeit at diminishing rates. To sum up, the ex-ante probability that the court will hold the auditor negligent ex post even though they met the requirements of GAAS is specified as

\[
F(x) = \begin{cases} 
1 
& 0 \leq x < x^s \\
1/(1+x) 
& x^s \leq x
\end{cases}
\]

Given (11), the auditor’s cost function reads as:
Vague negligence has two implications both of which are based on the fact that the auditor cannot be sure of avoiding liability when exerting due care $x^S$. First, the auditor is less likely to comply with strict standards of due care. Second, with sufficiently low standards of due care, the auditor might be inclined to exert the level $\overline{x}_{VN}$ exceeding due care.

Regarding the first implication, given that the standard of due care is quite strict there are weaker incentives to exert due care, since even with due care an auditor cannot be sure of avoiding liability. The condition for exerting due care is more restrictive than with (7.2):

$$C_{VN}(x) = \begin{cases} c(x) + p(x) \frac{P}{\lambda} = x + \frac{P}{\lambda(1+x)}, & 0 < x < x^S \\ c(x) + F(x) p(x) \frac{P}{\lambda} = x + \frac{1}{1+x} \frac{P}{\lambda(1+x)}, & x \geq x^S. \end{cases}$$

(12)

with $C_{VN}'(x) = \begin{cases} 1-P/\lambda(1+x)^2 = 0 & \text{with} \\ 1-2P/\lambda(1+x)^3 \end{cases} \quad \left\{ \begin{array}{l} \hat{x}_{VN} = \sqrt{P/\lambda} - 1 = \hat{x}_{SL}, \quad 0 < x < x^S \\ \overline{x}_{VN} = 2\sqrt{P/\lambda} - 1, \quad x \geq x^S. \end{array} \right.$

Vague negligence has two implications both of which are based on the fact that the auditor cannot be sure of avoiding liability when exerting due care $x^S$. First, the auditor is less likely to comply with strict standards of due care. Second, with sufficiently low standards of due care, the auditor might be inclined to exert the level $\overline{x}_{VN}$ exceeding due care.

Regarding the first implication, given that the standard of due care is quite strict there are weaker incentives to exert due care, since even with due care an auditor cannot be sure of avoiding liability. The condition for exerting due care is more restrictive than with (7.2):

$$C_{VN}(x^S) \leq C_{VN}(\hat{x}_{VN}) \Leftrightarrow x^S + \frac{P}{\lambda(1+x^S)^2} \leq 2\sqrt{P/\lambda} - 1.$$

(14)

Similar to $x^S$ in (7.2), I define $\overline{x}_{VN}^S$ as the standard of due care above which both vague negligence and strict liability induce the same level of suboptimal care. It is easy to infer from (14) that the threshold $\overline{x}_{VN}^S$ must be lower under vague negligence than under precise negligence; that is, $\overline{x}_{VN}^S = x^S - \Delta$ (see also Figures 5 and 6 below). The reason is that, even with due care, there is a likelihood of $1/(1+x^S)^2$ that the auditor has to pay damage compensation while with precise negligence there is a zero chance of doing so. Thus, it is more likely that the auditor will exert the same level of suboptimal care under both vague negligence and strict liability ($\hat{x}_{VN} = \hat{x}_{SL}$).

This first implication of a vague negligence regime does not hinge on the specification of $F(x)$ and concerns all scenarios regardless of whether there are punitive damages or not or whether there is high or low auditor optimism.
The second implication only materializes with sufficiently low standards of due care and also depends on whether there is low or high optimism (see for further details the analysis in the Appendix 1). If due care $x^S$ is sufficiently low, $x^S < \bar{x}_{VN}$ holds and the auditor will choose the higher level $\bar{x}_{VN}$ in order to reduce the probability of an adverse court ruling and of damage compensation.

Do we get similar results as with precise negligence? It depends. If due care is sufficiently high \( x^S \geq \bar{x}_{VN} \), only the first implication matters and qualitative results do not change; a vague negligence rule only implies lower social cost than strict liability if the auditor exerts due care and if due care is in the range \( x^S \in (x_1^S, x_{2VN}^S) \) where \( x_{2VN}^S = \min \left( \max \left( \sqrt{\frac{P}{\lambda}} - 1, \frac{D}{\sqrt{P/\lambda}} - 1 \right), \frac{\bar{x}_{VN}}{S} \right) \) and \( x_1^S \) is defined as in (9.1).

With sufficiently low standards of due care, the second implication matters as well, that is, the auditor prefers $\bar{x}_{VN}$ to due care because expected damage compensation payments are considerably lower.

Whether vague negligence or strict liability implies lower social costs no longer depends on due care but rather on whether there is high or low optimism and whether or not there are punitive damages (see Appendix 1). With high optimism \( \lambda > P/4 \), $\bar{x}_{VN}$ implies a higher care level than $\hat{x}_{SL}$ under strict liability. Social costs will be lower with vague negligence if $\bar{x}_{VN}$ is closer to the efficient level $x^*$, that is, if $\hat{x}_{SL} < \bar{x}_{VN} \leq x^*$. The condition $\bar{x}_{VN} < x^*$ is met if optimism is sufficiently high:

\[
(15.1) \quad \bar{x}_{VN} = \sqrt{2P/\lambda} - 1 \leq x^* = \sqrt{D} - 1 \iff \lambda \geq \frac{2P}{D^2}.
\]

If (15.1) does not hold but $\hat{x}_{SL} < x^* < \bar{x}_{VN}$ holds, social costs will be lower under vague negligence if damages are sufficiently high:

\[
(15.2) \quad SC_{VN}(\bar{x}_{VN}) < SC_{SL}(\hat{x}_{SL}) \iff \bar{x}_{VN} + \frac{D}{1+\bar{x}_{VN}} < \hat{x}_{SL} + \frac{D}{1+x_{SL}} \iff D > D_1 \text{ with } D_1 = \sqrt{2P/\lambda \cdot \sqrt{P/\lambda}}.
\]

Appendix 1 provides a more detailed analysis.
To sum up, due to the “new” optimum \( x_{VN} \), we need to qualify general statements (iii), (iv) and (v) of Result 1. Statements (iii) and (iv) hold in qualitative terms with sufficiently strict due care \( \left( x^s \geq x_{VN} \right) \).

With lower levels of due care \( (x^s < x_{VN}) \) and given that \( \lambda > P / 4 \) holds, vague negligence induces higher care and lower social costs than strict liability if there is sufficiently high optimism according to (15.1) or if condition (15.2) holds – regardless of the standard of due care. Statement (v) also needs to be qualified: increasing optimism decreases the relative efficiency of strict liability given that (15.1) or (15.2) hold.

Statements (1) and (2) still hold in qualitative terms: increasing auditor optimism decreases auditor care under strict liability, and with sufficiently strict due care both vague negligence and strict liability imply the same suboptimal level of care.

Overall, the analysis suggests that vague negligence might be preferable to strict liability in the presence of auditor optimism, while the literature illustrates that a vague negligence rule generally distorts auditors’ incentives (e.g. Willekens et al. 1996, Schwartz 1997, Willekens and Simunic 2007). The reason for this is that a vague negligence rule generally induces the auditor to take more care thereby counterbalancing the suboptimal incentives induced by auditor optimism.

2.4 Robustness

*General probability functions.* With general convex probability functions \( p(x) \) (with \( p'(x) < 0, p''(x) > 0 \)), I would be unable to precisely determine the range of standards of due care \( \left( x_2^S - x_2^S \right) \) for which a precise negligence rule does better than strict liability. However, it is assumed that qualitative results do not depend on the precise shape of the convex probability functions. If there are no punitive damages, more optimism decreases auditor care under strict liability. Thus, a negligence rule becomes preferable, even if due care is not efficiently defined.
With regard to vague negligence, other specifications of the probability function \( F(x) \) (with \( F'(x) < 0, F''(x) > 0 \)) will imply similar consequences as \( F(x) \) defined in (11) in the model. First, with high due care there is a stronger incentive to switch to the suboptimal level because the auditor might be held liable even when exerting due care, \( \hat{x}_{V^N} \). Second, with (very) low standards of due care, the auditor may still be inclined to choose a higher level of care similar to \( \hat{x}_{V^N} \) (with \( \hat{x}_{V^N} > x^\delta \)) if this lowers expected liability payments and total expected costs. Thus, for (very) low due care, it is possible that a vague negligence regime implies lower social costs than strict liability. Again, the intuition is that higher care \( x \) lowers both the probability of not detecting a material misstatement \( p(x) \) and the probability \( F(x) \) that the court will find the auditor negligent while with strict liability only \( p(x) \) is affected.

No underrating of certain events. Following Griffin and Tversky (1992), I assume that there is no underrating with certain events: \( p^\ast(x = 0) = p(x = 0) = 1 \). If \( p(x = 0) = 1 \), the expected damage compensation is higher than when \( p(x = 0) = 1/\lambda \) while the costs are the same. Since \( x = 0 \) was not optimal when solving the model assuming \( p(x = 0) = 1/\lambda \), it cannot be optimal when \( p(x = 0) = 1 \). Thus, the assumption that there is no underrating of certain events is not crucial.

2.5 Discussion of other assumptions

I assume that auditors face unlimited liability implying unlimited wealth. With limited wealth, the auditor’s incentives become distorted under strict liability (Dye, 1993). Under a negligence regime, a wealth-constrained auditor might still exert due care if there is sufficient wealth (Dye, 1993). Thus, assuming limited wealth would make a negligence rule more preferable.

The model focuses on unilateral liability. In reality, often both the firm’s management and the auditor are responsible for material errors in financial reports. The law and economics literature suggests that with bilateral liability negligence regimes usually induce more efficient incentives to take care than strict liability (Shavell 2007). However, this literature assumes rational actors in the sense of Expected
Utility Theory. I was unable to find literature dealing with bilateral liability assuming optimistic actors. This would be an interesting avenue for future research.

Term (1) assumes that the direct audit cost function is linear. I obtain the same qualitative results with a convex function of direct audit costs. With a concave function, there may be several local optima, making it difficult to define the social optimum clearly.

The model assumes a zero interest rate. A positive interest rate would not change qualitative results.

I assume the regulator not to be optimistic. I follow the literature, which tends to consider that the regulator acts rationally, recognises irrational behaviour and corrects for it (Hart 2009, pp. 439-441, Shleifer 2005, p. 446). In fact, Hart (2009) argues that the bounded rationality of agents can be seen as an important argument in favour of regulation. If the regulator were optimistic, there would be the problem of defining social welfare and efficient care.

Finally, the model assumes that auditors only have monetary incentives. In reality auditors will also follow ethical guidelines, which generally tend to mitigate distorted incentives to take care. I am unable to predict, though, if and how ethical goals will affect the relative efficiency of the liability regimes. This also depends on the way that ethical motives are modeled.

2.6 Different auditor types: reducing the efficient standard of due care might increase social welfare

The law and economics literature generally assumes that the regulator is able to learn from liability cases in the past and set a precise standard efficiently; that is \( x^S = x^* \) (Shavell 2007). I assume in this section that the regulator knows the efficient level and is not subject to optimism. Moreover, I follow the auditing literature and assume that damage compensation equals investor’s damages \( (P = D) \) (e.g. Narayanan 1994, Pae and Yoo 2001, Hillegeist 2001). In the USA, punitive damages \( (P > D) \) are ‘limited primarily to cases where parties acted with ill will, malice, or conscious disregard for others,
or where their behavior was outrageous or provoked indignation for some other reason’ (Shavell 2007: 150). I am unaware of any continental European countries where punitive damages are allowed.

Given the assumptions $x^S = x^*$, $P = D$ and auditor optimism ($\lambda > 1$), strict liability will induce suboptimal care ($\hat{x}_{SL} < x^*$). A precise negligence rule will induce efficient care if auditor optimism is not too high (see (7.2)):

$$C_{PN}(x^S = x^*) \leq C_{PN}(\hat{x}_{SL}) \Leftrightarrow \sqrt{D} - 1 \leq 2\sqrt{D/\lambda} - 1 \Leftrightarrow \lambda \leq \lambda = 4,$$

and suboptimal care $\hat{x}_{PN} = \hat{x}_{SL} < x^*$ with high optimism. Suppose there are two optimism levels: auditors are either mildly optimistic ($\lambda_L$ with $\lambda_L \leq \lambda = 4$) or highly optimistic ($\lambda_H$ with $\lambda_H > \lambda = 4$). Highly optimistic auditors will then exert suboptimal care. I assume that the proportion of highly optimistic auditors amounts to $\theta$ which is common knowledge.

Under a precise negligence rule, the regulator is able to increase the level of care of highly optimistic auditors by reducing due care to $x^{S*}_{adj}$, as defined in (17):

$$C_{PN}(x^S_{adj}) = C_{PN}(\hat{x}_{PN}) \quad \text{given that} \quad \hat{x}_{PN} < x^{S*}_{adj} < x^*.$$

Since $x^*$ is the efficient level, the regulator might want to reduce due care as little as possible. Thus, the optimal level would be $x^{S*}_{adj} = 2\sqrt{D/\lambda_H} - 1$ because then the cost with the adjusted care level equals the cost with the suboptimal care level, $C_{PN}(x^{S*}_{adj}) = C_{PN}(\hat{x}_{PN})$. Further, the adjusted care level exceeds the suboptimal level: $\hat{x}_{PN} = \sqrt{D/\lambda_H} - 1 < x^{S*}_{adj}$.

Slightly optimistic auditors will then exert a lower level of care, $x^{S*}_{adj} < x^*$. Reducing due care towards $x^{S*}_{adj}$ is beneficial when the proportion of highly optimistic auditors is sufficiently high; that is, if the following holds:

$$\theta \left[ Y(x^{S*}_{adj}) - Y(\hat{x}_{PN}) \right] > (1 - \theta) \left[ Y(x^*) - Y(x^{S*}_{adj}) \right] \Leftrightarrow \theta > \theta^* = \frac{Y(x^*) - Y(x^{S*}_{adj})}{Y(x^*) - Y(\hat{x}_{PN})}.$$
\( Y(\hat{x}_{PN}), Y(\hat{x}_{adj}) \) and \( Y(x^*) \) reflect the welfare gain (= reduction in social cost) from auditing with the respective level of care. Note that \( 0 < \theta^* < 1 \) since \( Y(\hat{x}_{PN}) < Y(\hat{x}_{adj}) < Y(x^*) \). Since \( \hat{x}_{PN} = \hat{x}_{SL} \), social costs under precise negligence are also lower than under strict liability.

The finding that reducing the efficient standard might increase social welfare may be surprising at first glance, but it is in line with a similar result in Dye (1993). In his model, the auditor is rational but has limited wealth, which induces suboptimal care. Dye shows that decreasing due care may then induce the auditor to exert greater care.

The upper part of Figure 7 demonstrates the case where the highly optimistic auditor’s perceived total costs are lower with the suboptimal level \( \hat{x}_{PN} \) than with the efficient level \( x^* \). The adjusted standard \( x^S_{adj} \) implies even lower total costs such that the auditor is willing to switch to \( x^S_{adj} \) (bottom part of Figure 7). The optimistic auditor will then still exert suboptimal care, albeit at a lower level.

--Insert Figure 7 about here --

Given that punitive damages are allowed \( (P > D) \), reducing due care to below \( x^* \) is only possible if \( P < \lambda_{HD} \) holds. With \( P \geq \lambda_{HD} \), all auditors will meet the efficient level of due care. Thus, if the legislator is able to define due care efficiently and there is a precise negligence rule, an appropriate increase in damage compensation (punitive damages) would induce all auditors to meet this efficient standard.

Given that the regulator is unable to assess due care efficiently, we revert to the analysis of Section 2.2. The reduced standard \( x^S_{adj} \) will induce lower social costs with precise negligence than with strict liability if \( x^S_{adj} \in \left( x^S_1, x^S_2 \right) \).

---

9 Note that the adjusted care level in Figure 7 implies lower cost than the suboptimal care level, but is not optimal.
3  Game-theoretical analysis

Do the qualitative results remain when we assume that investors bear the transaction costs \( T (T > 0) \) of bringing a lawsuit? If so, investors may not always sue the auditor; instead, they will make the decision to sue dependent on the auditor’s expected actions. The auditor in turn will decide on the level of care dependent on the investor’s decision to bring a lawsuit. This calls for a game-theoretical analysis. In the following, I compare a precise negligence rule with strict liability. The qualitative results are similar when comparing a vague negligence rule with strict liability (see Appendix 3).

I assume the American Rule, implying that the auditor does not reimburse the investors’ transaction costs if the trial was lost (American Rule10).11 There are three cases:

- **Case 1:** Investor transaction costs are high \( (T > P) \),
- **Case 2a:** Low transaction costs \( (T < P) \) and strict standard of due care \( (x^S > x^S) \), see (7.2) such that the auditor chooses \( \tilde{x}_{PN} \left(x_{PN} < x^S\right) \) under a negligence regime,
- **Case 2b:** Low transaction costs \( (T < P) \) and due care is not strict \( (x^S \leq x^S) \) such that the auditor chooses \( x^S \) under a negligence regime.

**Case 1:**

---

10 This assumption is not crucial to the results. Assuming the British rule would only complicate the analysis. Investors would then have stronger incentives to bring a lawsuit (Smith and Tidrick 1998).

11 In what follows, I allow for Nash equilibria in mixed strategies. I assume that their equilibrium probabilities are *not* subject to optimism. Were I to do so, inconsistencies would occur. Equilibrium probabilities are meant to make the other player indifferent to pure strategies. Let us call the equilibrium probabilities \( \mu^* \) and \( \sigma^* \) for the rational auditor and investor, respectively. The optimistic auditor applies the perceived probability \( \mu^{op*} \) which will only meet the indifference condition with rational investors if \( \mu^{*op} = \mu^* \) is valid. This condition only holds for a pure auditor strategy; that is, \( \mu^* = 1 \) or \( \mu^* = 0 \). I was unable to find game-theoretical literature that addresses this issue. A well-known monograph on behavioural game theory by Camerer (2003) mentions the limits of mixed-strategy equilibria (Chapter 3) but does not address this point; nor does Binmore (2007).
With $T > P$, transaction costs exceed damage compensation such that investors will not bring a lawsuit and the auditor will exert zero care, then inducing a damage probability of $p(x = 0) = 1$. This holds for both precise negligence and strict liability. The social cost is $Y(x^*) - Y(\hat{x} = 0)$ for either regime.

**Case 2a:**

With low transaction costs ($T \leq P$), investors always bring a lawsuit under strict liability once damage occurs. Under strict liability, damage compensation is tied to the event of damage occurring, the probability being $p(\hat{x}_{sl})$. The analysis in Section 2.2 shows that the auditor’s level of care is then $\hat{x}_{sl} = \sqrt{P / \lambda} - 1$. From an ex-ante perspective, the social cost is $p(\hat{x}_{sl})T + Y(x^*) - Y(\hat{x}_{sl})$.

With $T \leq P$ and precise negligence, the auditor will choose the same level as with strict liability because due care is too strict ($\hat{x}_{ps} = \hat{x}_{sl} = \sqrt{P / \lambda} - 1 < x^3$). Investors will anticipate and sue once damage occurs because the court will inevitably find negligence. Thus, there is no difference to strict liability.

**Case 2b:**

With regard to strict liability, the results are the same as in case 2a. However, under the negligence regime, the results change. If due care is not too strict ($x^S \leq \hat{x}_{sl}$), the investors can no longer be sure of receiving damage compensation, because the auditor may have exerted due care. However, not bringing a lawsuit is not an advisable strategy either because then the auditor would exert zero care. Thus, we have a Nash equilibrium in mixed strategies. Given that damage occurs, the probability that investors will sue is

\begin{equation}
\sigma^* = \frac{x^3}{P}
\end{equation}

and the auditor performs due care $x^S$ with probability

\begin{equation}
\mu^* = 1 - \frac{T}{P},
\end{equation}
and zero care with probability $1 - \mu^*$ (see Appendix 2). Auditors are more likely to exert due care if investors’ transaction costs $T$ decrease or if damage compensation $P$ increases.

The question remains as to whether social costs are lower under precise negligence or under strict liability. Compared to the case where investors definitely bring a lawsuit because of $T = 0$, both strict liability and precise negligence now imply higher costs. Given that $0 < T \leq P$, strict liability implies the same level of care and the same damage probability as with $T = 0$, the only difference being that investors bear transaction costs $T$.

Under precise negligence and $T = 0$, the auditor will exert due care $x^S$. With $0 < T \leq P$, the auditor will perform due care with probability $\mu^*$, but zero care with probability $1 - \mu^*$. Hence, with probability $1 - \mu^*$ direct audit costs are lower than with scenario $T = 0$, although damage probability is then 1.

There are also transaction costs involved. Investors will sue with probability $\sigma^*$ when damage occurs. Damage occurs if the auditor exerts zero care (with probability $(1 - \mu^*)$); with probability $\mu^*$ the auditor exerts due care with a damage probability of $p(x^S)$. Overall, the ex-ante probability of damage occurring is $\mu^* \cdot p(x^S) + (1 - \mu^*)$. Hence, compared to the scenario $T = 0$, the additional social costs add up to $(1 - \mu^*) \left[ (1 - p(x^S)) D - x^S \right] + \sigma^* \left[ \mu^* \cdot p(x^S) + (1 - \mu^*) \right] T$.

The additional social costs compared to the $T = 0$ scenario are lower with precise negligence than with strict liability if the following holds:  

$$
(1 - \mu^*) \left[ (1 - p(x^S)) D - x^S \right] + \sigma^* \left[ \mu^* \cdot p(x^S) + (1 - \mu^*) \right] T < p(\tilde{x}_{SL}) T \quad \Leftrightarrow \quad D \leq \frac{p(\tilde{x}_{SL}) P}{1 - p(x^S)} + x^S \left( \frac{1 - T}{P} \right),
$$

when inserting (19) and (20).

12 This condition is necessary and sufficient.
Expected transaction costs tend to be higher with strict liability. Compared to the zero transaction costs scenario and given that due care is not too strict \((x^S \leq x^S)\), precise negligence becomes even more favourable than strict liability if damages \(D\) are sufficiently low. The intuition is that, with the negligence rule, the auditor will exert zero care with probability \((1-\mu^*)\). The social cost related to zero care is relatively negligible with low damages. With damages higher than those defined in (21), the relative benefit of a precise negligence rule declines, and may even disappear.

Another issue in a game-theoretical context is investor optimism, which I have ignored so far. However, there is evidence that litigants (here: investors) and their lawyers systematically anticipate their trial prospects as being better than they objectively are (Korobkin and Ulen 2000). Investors also demonstrate optimism in financial markets (DellaVigna 2009). Investor optimism does not matter if investors are sure whether or not there will be damage compensation. Investor optimism matters with a vague negligence rule if they overestimate the probability that the court will find the auditor negligent, \(F(x)\), by a factor \(\gamma\) with \(\gamma > 1\) and \(\gamma F(x) < 1\). As a consequence, optimistic investors are then more likely to bring a lawsuit, i.e. if \(T < \gamma F(x)D\), and, thus, auditors are less likely to exert zero care.

4 Empirical implications

It would be impossible to test whether a country’s level of auditor optimism correlates with whether there is a negligence rule or a strict liability rule in auditor liability. I am unaware of any country-level measure of auditor optimism. However, studies on an individual level would be feasible. Since optimism seems to be positively correlated to expert status (Griffin and Tversky 1992, Malmendier and Tate 2005), care levels should be lower with experts, controlling for other factors determining the level of care such as career concerns, structure of compensation and individual work efficiency. Expertise could be measured by auditor rank, auditor tenure or specialised knowledge.

Some studies suggest that men are more likely to be overconfident than women, and that men perform less well concerning investment decisions (e.g. Barber and Odean 2001, Biais et al. 2005). These
studies are related to the overestimation of the precision of one’s own information, but do not address
the underestimation of negative events occurring. Still, it might be worth investigating whether female
auditors take more care than male auditors, other things being equal.

In an experimental setting, I expect optimistic auditors to almost never exert efficient care under strict
liability. However, they are likely to exert due care under a negligence rule if due care is sufficiently
close to the efficient care level.

5 Conclusion

This paper incorporates a widespread phenomenon of bounded rationality into a unilateral auditor
liability model, namely optimism. Optimism implies that the auditor underrates the probability of an
undesirable event occurring, such as not detecting a material error in an audited financial statement.

If auditors are optimistic, they tend to exert less care. With increasing optimism, auditors exert less
and less care under strict liability. A precise negligence rule is relatively more efficient than strict
liability if due care is sufficiently close to the efficient level. If due care is too lenient, strict liability is
preferable. If due care is too strict, both negligence regimes and strict liability will induce the same
level of suboptimal care. With increasing optimism and in the absence of punitive damages, a precise
negligence rule becomes increasingly preferable to strict liability because it implies lower social cost.
Qualitative results are similar with vague negligence if the standard of due care is sufficiently strict or
if there is sufficiently strong auditor optimism. These statements do not necessarily imply that a
negligence regime generally yields higher total welfare than a strict liability regime, because the model
omits important factors necessary for such an assessment (e.g., bilateral liability).

Future research could usefully address other persistent phenomena of biased individual decision-
making. Further, we need to explore how optimism affects incentives to take care in bilateral liability
cases. Most importantly, there is a need for empirical research into the model’s propositions and the
factors that influence the level of auditor optimism.
Appendix 1: Vague negligence versus strict liability

1. Vague negligence versus strict liability with non-punitive damages

In order to reduce complexity, I first assume non-punitive damages ($P \leq D$). Based on the relation between the two interior optima $\hat{x}_{VN}$ and $x_{VN}$ in (13), there are two cases to distinguish between: low optimism ($\lambda \leq P / 4$) implying $x_{VN} \leq \hat{x}_{VN}$ and high optimism ($\lambda > P / 4$) implying $\hat{x}_{VN} < x_{VN}$.

1.1 Non-punitive damages and low optimism

With low optimism there is $\lambda \leq P / 4$ implying $x_{VN} \leq \hat{x}_{VN}$. Depending on the strictness of the standard of due care $x^S$, there are three subcases to be analysed:

(a) $x^S < x_{VN} < \hat{x}_{VN}$ (lenient standard of due care),
(b) $x_{VN} \leq x^S \leq \hat{x}_{VN}$ (medium standard of due care),
(c) $x_{VN} < \hat{x}_{VN} < x^S$ (strict standard of due care).

Subcase (a), lenient standard of due care. With subcase (a), optimum $\hat{x}_{VN}$ is not relevant because it is outside the range $0 < x < x^S$ for which it is defined. Consequently, $x_{VN}$ is the global cost minimum in this subcase. With strict liability, the global cost minimum would be $\hat{x}_{SL}$, where $\hat{x}_{SL} = \hat{x}_{VN} > x_{VN}$. Thus, the auditor takes more care under strict liability. Neither local cost minimum is efficient, $x_{VN} < \hat{x}_{SL} < x^*$. Hence, since $\hat{x}_{SL}$ is closer to the efficient level, social costs – defined as the sum of direct audit costs and expected damages to investors – are lower with strict liability: $SC(x_{VN}) > SC(\hat{x}_{SL}) > SC(x^*)$.

Subcase (b), medium standard of due care. With subcase (b), neither the local cost minimum $\hat{x}_{VN}$ nor the local cost minimum $x_{VN}$ are relevant because they are outside their respective range of definition. The global cost minimum is $x^S$. The social costs with vague negligence and strict liability are defined as in (8.1) and (8.2). It can be deduced from (9) that vague negligence does better than strict liability if:
(a1) \( SC_{VN} < SC_{SL} \) that is, if \( x^S \in (x_1^S, x_2^S) \),

where \( x_1^S \) and \( x_2^S \) are defined as in (9.1).

**Subcase (c), strict standard of due care.** With subcase (c), the local cost minimum \( \tau_{VN} \) is not relevant because it is outside the range of definition. The global cost minimum is \( x^S \) if the auditor’s costs are lower with it, and \( \hat{x}_{VN} \) otherwise. With vague negligence there is a weaker incentive to exert due care since an auditor cannot be sure of avoiding liability. The condition for exerting due care is more restrictive than with (7.2):

\[
C_{VN}(x^S) \leq C_{VN}(\hat{x}_{VN}) \iff x^S + \frac{P}{\lambda(1 + x^S)^2} \leq 2\sqrt{P/\lambda} - 1.
\]

I define \( \chi^S_{VN} \) as the standard of due care above which both vague negligence and strict liability induce the same level of suboptimal care. It is easy to infer from (14) that the threshold \( \chi^S_{VN} \) must be lower under vague negligence than under precise negligence; that is, \( \chi^S_{VN} = \chi^S - \Delta \) (see also Figures 5 and 6 below).

To sum up, with non-punitive damages and low optimism, a vague negligence rule only implies lower social cost than strict liability if the auditor exerts due care and if due care is in the range \( x^S \in (x_1^S, x_2^J_{VN}) \),

where \( x_2^J_{VN} = \frac{D}{\sqrt{P/\lambda}} - 1 \) with medium due care and \( x_2^S_{VN} = \chi^S_{VN} \) with strict due care.

### 1.2 Non-punitive damages and high optimism

With high optimism, we have \( \lambda > P / 4 \) implying \( \hat{x}_{VN} < \tau_{VN} \). Depending on the strictness of the standard of due care \( \hat{x} \), there are again three subcases to be analysed:

(a) \( x^S < \hat{x}_{VN} < \tau_{VN} \) (lenient standard of due care),

(b) \( \hat{x}_{VN} \leq x^S \leq \tau_{VN} \) (medium standard of due care),
(c) \( \hat{x}_{VN} < x^r < x^s \) (strict standard of due care).

**Subcase (a), lenient standard of due care.** With subcase (a), again the local optimum \( \hat{x}_{VN} \) is not relevant because it is outside the range \( 0 < x < x^s \) for which it is defined. \( x_{VN} \) is the global cost minimum. Note that the auditor will exert \( x_{VN} \) even if due care is (much) lower and might be even close to zero. The intuition is that meeting due care does not necessarily preclude liability under a vague negligence rule. Hence, the auditor prefers to exert the higher level \( x_{vn} \). With strict liability, the cost minimum is \( \hat{x}_{SL} \), where \( \hat{x}_{sl} = \hat{x}_{VN} < x_{VN} \). Thus, the auditor now takes more care under vague negligence. Social costs will be lower with vague negligence if \( x_{VN} \) is closer to the efficient level \( x^* \), \( \hat{x}_{SL} < x_{VN} \leq x^* \). The condition \( x_{VN} \leq x^* \) is met if optimism is sufficiently high:

\[
(15.1) \quad x_{VN} = \sqrt{2P/\lambda} - 1 \leq x^* = \sqrt{D} - 1 \Leftrightarrow \lambda \geq \frac{2P}{D}.
\]

If (15.1) does not hold but \( \hat{x}_{SL} < x^* < x_{VN} \) holds, social costs will be lower under vague negligence if damages are sufficiently high:

\[
(15.2) \quad SC_{VN}(x_{VN}) < SC_{SL}(\hat{x}_{SL}) \Leftrightarrow x_{VN} + \frac{D}{1+x_{VN}} < \hat{x}_{SL} + \frac{D}{1+\hat{x}_{SL}} \Leftrightarrow D > D_1 \text{ with } D_1 = \sqrt{2P/\lambda} \cdot \sqrt{P/\lambda}.
\]

**Subcase (b), medium standard of due care.** With subcase (b), there are two local cost minima, \( \hat{x}_{VN} \) and \( x_{VN} \). However, it can be shown that the auditor will prefer \( x_{VN} \) because the costs are then lower. The intuition is as follows: with \( \lambda \) slightly exceeding \( P/4 \), the direct audit costs are slightly higher with \( x_{VN} \) than with \( \hat{x}_{VN} \), while expected damage compensation payments are significantly lower with \( x_{VN} \) because damages occur with lower probability and the court is less likely to find negligence. For increasing \( \lambda \), direct audit costs increase more with \( x_{VN} \) than with \( \hat{x}_{VN} \), but expected damage compensation payments decrease even more strongly with \( x_{VN} \). As a net effect, the auditor prefers \( x_{VN} \). Again, note that the auditor will not exert

\[13 \text{ Costs are lower with } x_{VN} \text{ if } C_{VN}(x_{VN}) < C_{VN}(\hat{x}_{VN}). \text{ This condition holds if } \lambda < \frac{P}{4(3/4)} = P/0.7119. \text{ (5) assumes } \lambda \leq P; \text{ thus the condition is met.} \]
due care even if due care would be close to zero. Compared to strict liability, we get the same results as in subcase (a): Social costs will be lower with vague negligence if \( \hat{x}_{SL} < x^* \leq \hat{x}_{VN} \). Given that \( \hat{x}_{SL} < x^* < \hat{x}_{VN} \) holds, social costs will be lower with vague negligence if (15.2) holds.

**Subcase (c), strict standard of due care.** With subcase (c), the local cost minimum \( \bar{x}_{VN} \) is not relevant because it is outside the range of definition. The local cost minima are \( x^S \) and \( \hat{x}_{VN} \). Thus, the analysis is very similar to the low optimism subcase (c) above: a vague negligence rule only implies lower social cost than strict liability if the auditor exerts due care and if due care is in the range \( x^S \in (x^S_1, x^S_2, x^V_2) \).

To sum up, with non-punitive damages and high optimism we have the interesting result that the auditor chooses \( \bar{x}_{VN} \) in subcases (a) and (b) even if due care would be much lower. The intuition is that exerting due care does not ensure protection from liability under vague negligence. Thus, the auditor exerts more care. If (15.1) or (15.2) hold, a vague negligence rule implies lower social costs than strict liability regardless of the standard of due care. Figure 5 reflects the scenario where (15.1) holds in the range \( \lambda > P/4 \).

---insert Figure 5 about here---

2. Vague negligence versus strict liability with punitive damages

Given that there are punitive damages (\( P > D \)), the analyses on subcases (b) and (c) with low optimism and on subcase (c) with high optimism are very similar to Sections 1.1 and 1.2, respectively, in this Appendix. See Table 1 below. With regard to the other subcases, there are more scenarios to be considered: in some vague negligence implies lower social costs; in others strict liability does so. See Table 1 below.

---

14 For both figures, \( \hat{x}_{SL} < \bar{x}_{VN} \leq x^* \) holds in the range \( \lambda > P/4 \). The efficient level of care is \( x^* = 2 \). Considering the top figure, with \( \lambda = P/4 = 2.25 \): \( \hat{x}_{SL} = \bar{x}_{VN} = 1 \) / for \( \lambda = 3 \): \( \hat{x}_{SL} = 0.73, \bar{x}_{VN} = 0.82 \) / for \( \lambda = 4 \): \( \hat{x}_{SL} = 0.5, \bar{x}_{VN} = 0.65 \). Considering the bottom figure, with \( \lambda = P/4 = 1 \): \( \hat{x}_{SL} = \bar{x}_{VN} = 1 \) / for \( \lambda = 2 \): \( \hat{x}_{SL} = 0.41, \bar{x}_{VN} = 0.58 \) / for \( \lambda = 3 \): \( \hat{x}_{SL} = 0.15, \bar{x}_{VN} = 0.39 \) / for \( \lambda = 4 \): \( \hat{x}_{SL} = 0, \bar{x}_{VN} = 0.26 \).
There is an additional interesting finding under vague negligence if \( \lambda \leq P / 4 \), \( x^s < x^s_1 \), \( \lambda < P / D \) and \( \lambda \leq \frac{2P}{D} \) hold. With \( \lambda \leq P / 4 \) and \( x^s < x^s_1 \), the auditor exerts less care under vague negligence than under strict liability: \( \bar{x}_{VN} < (\hat{x}_{VN} = \hat{x}_{SL} \). Given that \( \lambda < P / D \) also holds, \( \hat{x}_{SL} \) implies excessive care. Thus, \( \bar{x}_{VN} \) will be closer to the efficient level if \( x^* \leq \bar{x}_{VN} < \hat{x}_{SL} \) holds. If so, vague negligence implies lower social costs than strict liability. \( x^* \leq \bar{x}_{VN} \) holds if

\[
(a2) \quad x^* = \sqrt{D} - 1 \leq \bar{x}_{VN} = \sqrt{2P / \lambda} - 1 \iff \lambda \leq \frac{2P}{D}.
\]

The intuition that vague negligence is preferable under the conditions given again refers to the fact that the auditor exerts more than due care. Figure 6 illustrates the consequences of this effect: for sufficiently low levels of optimism \( (1 \leq \lambda \leq \frac{2P}{D}) \) vague negligence is preferable to strict liability. It also shows that condition (15.1) is met in the range \( \lambda > P / 4 \) implying that vague negligence then implies lower social costs.\(^{15}\)

---insert Figure 6 about here---

3. Vague negligence versus strict liability: summary

To sum up, we obtain qualitative findings similar to Result 1. There are two main differences to mention, though. First, the threshold level of due care which induces the auditor to exert suboptimal care under both negligence and strict liability is lower with vague negligence (\( x^S_{VN} < x^S \), see (7.2) and (14)). Second, with sufficiently low standards of due care and \( \lambda > P / 4 \), the auditor exerts the care level \( \bar{x}_{VN} \) but not due care, implying that they will exert more care under vague negligence than under strict liability. Social costs are lower with vague negligence if auditor optimism or damages are sufficiently high.

\(^{15}\) Again, \( \hat{x}_{SL} < \bar{x}_{VN} \leq x^* \) holds in the range \( \lambda > P / 4 \). The efficient level of care is \( x^* = 2 \). With \( \lambda = P / 4 = 4 \):

\[
\hat{x}_{SL} = \bar{x}_{VN} = 1 \quad \text{for} \; \lambda = 5; \; \hat{x}_{SL} = 0.78, \; \bar{x}_{VN} = 0.86 \quad \text{for} \; \lambda = 6; \; \hat{x}_{SL} = 0.63, \; \bar{x}_{VN} = 0.75.
\]
Table 1: Cases under vague negligence

<table>
<thead>
<tr>
<th>Possible global optima with vague negligence (VN) (in brackets: optima under precise negligence)</th>
<th>Optimum under strict liability (SL)</th>
<th>$P \leq D$</th>
<th>$P &gt; D$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\hat{x}_v \leq x_s$</td>
<td>$\bar{x}_V (x_s)$</td>
<td>$\hat{x}_s$</td>
<td>no punitive damages</td>
</tr>
<tr>
<td>$x_s &lt; \bar{x}_V \leq \hat{x}_v$</td>
<td>$\bar{x}_V (x_s)$</td>
<td>$\hat{x}_s$</td>
<td>if $x^* \leq \bar{x}_V &lt; \hat{x}_v \Rightarrow \hat{x}_s \approx \frac{\lambda}{\rho} \Rightarrow VN &gt; SL$ (15.1)</td>
</tr>
<tr>
<td>$(\bar{x}_V \leq) x_s \leq \hat{x}_v$</td>
<td>$\bar{x}_V (x_s)$</td>
<td>$\hat{x}_s$</td>
<td>if $x^* \leq \bar{x}_V &lt; \hat{x}_v \Rightarrow VN &gt; SL$ (15.2)</td>
</tr>
<tr>
<td>$(\bar{x}_V \leq) \hat{x}_V &lt; x_s$</td>
<td>$\bar{x}_V \hat{x}_V (x_s)$</td>
<td>$\hat{x}_s$</td>
<td>if $x^* \leq \bar{x}_V &lt; \hat{x}_v \Rightarrow VN &gt; SL$ (15.2)</td>
</tr>
<tr>
<td>$x_s &lt; (\bar{x}_V \leq) x_s$</td>
<td>$\bar{x}_V (x_s)$</td>
<td>$\hat{x}_s$</td>
<td>if $x^* \leq \bar{x}_V &lt; \hat{x}_v \Rightarrow VN &gt; SL$ (15.2)</td>
</tr>
</tbody>
</table>

$\hat{x}_v = \hat{x}_s$: interior optima under vague negligence / strict liability defined in (14) / (7.1)

$x^S$: due care

$x^*$: efficient level of care defined in (3)

$x^S \in \left(x^1_S, x^2_S, x^V_N\right)$: range of standards of due care where vague negligence is preferable to strict liability regime, see (9.1) and analysis in Section 2.3.

$\lambda$: auditor’s level of optimism ($\leq$, $\leq$): to be interpreted as “outside the range of definition”

$\Rightarrow$, $\Rightarrow$, $\Rightarrow$: preferable to / equal to / inferior to

$D$: damages

$P$: auditor’s penalty (damage compensation)

$SC$: social cost

$SL$: strict liability regime

$VN$: vague negligence regime
Appendix 2: Proof of (19) and (20), precise negligence, equilibrium in mixed strategies:

Given that investors sue, an optimistic auditor will choose due care ($S^x$). Given there is no lawsuit, the auditor will exert zero care ($0 \equiv \hat{PN}x$). Note that with zero care the probability of damage is 1. Certain events are not underrated. The equilibrium probabilities are not subject to auditor optimism. If investors sue with probability $\sigma$ and the auditor chooses a high level of care $x^S$ with the probability $\mu$, the investors’ and auditor’s expected payoff equal:

(a3) \[ Y_{Inv} = \sigma [(1-\mu)(-T+D)] - (1-\sigma)D = -D + \sigma [(1-\mu)P-T] \]

(a4) \[ Y_{Aud} = -\mu x^S - (1-\mu)\left[\sigma(0+p(\hat{x}_{PN}=0)P)+(1-\sigma)\cdot0\right] = -\mu x^S - (1-\mu)\sigma P \]

First derivatives yield:

(a5) \[ \frac{\partial Y_{Inv}}{\partial \sigma} = (1-\mu)P-T = 0 \quad \text{if} \quad \mu = \mu^* = 1-T/P, \]

(a6) \[ \frac{\partial Y_{Aud}}{\partial \mu} = -x^S + \sigma P = 0 \quad \text{if} \quad \sigma = \sigma^* = x^S / P. \]

The auditor’s equilibrium probability of exerting due care is reflected by $\mu^*$. The investors’ equilibrium probability to sue is reflected by $\sigma^*$.■

Appendix 3: Game-theoretical analysis: vague negligence versus strict liability

Under a vague negligence rule, investors will receive damage compensation with probability $F(x)$ even if the auditor has met the auditing standards. This makes investors more willing to sue. Similar to the scenario of precise negligence, there are three cases:

- Case 1: Investor transaction costs are high ($T > P$),
- Case 2a: Low transaction costs ($T < P$) and strict standard of due care ($x^S \geq x_{YN}^S$, see (14)) such that the auditor chooses $\hat{x}_{YN} \left(\hat{x}_{YN} < x^S\right)$ under a vague negligence regime,
Case 2b: Low transaction costs ($T < P$) and due care is not strict ($x^S < \hat{S}_{VN}$) such that the auditor chooses $x^S$ or $\bar{x}_{VN} (\bar{x}_{VN} > x^S)$ under a vague negligence regime.

Case 1: With high transaction costs, there is no lawsuit and the auditor exerts zero care with both vague negligence and strict liability.

Case 2a: If transaction costs do not exceed the expected damage compensation given that the auditor exerts “high” care, investors will bring a lawsuit and the auditor will then exert $\bar{x}_{VN} = \bar{x}_{SL}$ under vague negligence and strict liability. The only difference compared to the analysis in Section 2.3 is that, with both vague negligence and strict liability, investors will bear positive transaction costs $T$.

Case 2b: With due care not defined too strictly, a Nash equilibrium in pure strategies exists if $T \leq F(\bar{x}_{VN})P$ or $T \leq F(x^S)P$ holds. Investors will bring a lawsuit and the auditor will then exert $\bar{x}_{VN}$ or $x^S$ depending on the cases analysed in Section 2.3.

However, if investor transaction costs are lower than $P$ – which is the expected damage compensation given a zero care level – but exceed the expected damage compensation given that the auditor exceeds a “high” level care, there will only be a Nash equilibrium in mixed strategies. The condition is $F(\bar{x}_{VN})P < T < P$ and $F(x^S)P < T < P$, respectively. Both subcases are solved in the same fashion. In the following, I focus on the latter case. Given that $F(x^S)P < T < P$, investors will sue with probability

(a7) \[ \sigma^* = \frac{x^S}{P[1 - F(x^S)P(x^S)/\lambda]} \]

and the auditor will perform due care $x^S$ with probability

(a8) \[ \mu^* = \frac{1 - T/P}{1 - F(x^S)}, \]

and zero care with probability $1 - \mu^*$. 
Proof: With subcase (2b), given that investors sue, the auditor will exert due care $(x^s)$. In contrast to precise negligence, auditors will still pay damages with a probability of $F(x^s)p(x^s)$ if they exert due care. Given that there is no lawsuit, the auditor will exert zero care ($\hat{x}_{VN} = 0$) and pay damages. If investors sue with probability $\sigma$ and the auditor chooses a high level of care with probability $\mu$, the investors’ and auditor’s expected payoffs equal:

\begin{align*}
(a9) \quad Y_{Inv} &= \sigma \left[ -T - D + F(x^s)P + (1-\mu)(-T-D+P) \right] - (1-\sigma)D \\
&= -D + \sigma \left[ (1-\mu)\left(1-F(x^s)\right) \right] P - T,
\end{align*}

\begin{align*}
(a10) \quad Y_{Aud} &= -\mu \left[ x^s + \sigma F(x^s) p(x^s) \frac{P}{\lambda} \right] - (1-\mu)\sigma P.
\end{align*}

First derivatives yield:

\begin{align*}
(a11) \quad \frac{\partial Y_{Inv}}{\partial \sigma} &= \left[ 1-\mu \left(1-F(x^s)\right) \right] P - T = 0 \quad \text{if} \quad \mu = \mu_{VN}^* = \frac{1-T/P}{1-F(x^s)}.
\end{align*}

\begin{align*}
(a12) \quad \frac{\partial Y_{Aud}}{\partial \mu} &= -x^s + \left[ 1-F(x^s) p(x^s) / \lambda \right] \sigma P = 0 \quad \text{if} \quad \sigma = \sigma_{VN}^* = \frac{x^s}{P \left[1-F(x^s) p(x^s) / \lambda \right]}.
\end{align*}

Compared to the case of precise negligence, investors are more likely to bring a lawsuit because they may get damage compensation even though the auditor has exerted due care. Consequently, the auditor is less likely to perform zero care under vague negligence.

In contrast to the case of vague negligence with $T = 0$, there are positive transaction costs which are incurred whenever damage occurs. Ex ante, the probability of damage occurring is $\mu_{VN}^* p(x^s) + (1-\mu_{VN}^*)$. The auditor exerts zero care with probability $(1-\mu_{VN}^*)$. To sum up, the additional costs compared to the $T = 0$ scenario are lower with precise negligence than with strict liability if the following holds:

\begin{align*}
(a13) \quad (1-\mu_{VN}^*) \left[ \left(1-p(x^s)\right)D - x^s \right] + \sigma_{VN}^* \left[ \mu_{VN}^* \cdot p(x^s) + (1-\mu_{VN}^*) \right] T < p(\hat{x}_{SL})T.
\end{align*}
References


Figure 1: Sequence of events

\[
\begin{array}{ccc}
t = 0 & t = 1 & t = 2 \\
\text{auditor chooses} & \text{damage occurs to} & \text{investors bring a} \\
\text{level of care } x & \text{investors with} & \text{law suit or not} \\
(\text{not observable}) & \text{probability } p(x) & \\
\end{array}
\]

Figure 2: Relative efficiency of strict liability and precise negligence depending on the level of optimism

\[(P = D, \text{penalty} = \text{damages})\]

Notation: \(\lambda\): level of auditor optimism, \(x^S\): standard of due care under a precise negligence rule, \(x^*\): efficient level of care representing the social optimum, \(x^{\text{M}}\): marginal standard where auditor chooses the same (suboptimal) level of care as with strict liability (see 7.2), \(x^{\text{P}}\): auditor’s optimal level of care with a precise negligence rule given that investors sue, \(x_1^S\), \(x_2^S\): lower and upper bound of standards of due care for which a negligence rule implies higher social welfare than strict liability (see (9) and (9.1)). \(D\): investors’ damage with an error in the financial statement, \(P\): damage compensation. In this graph, I assume \(D = P = 9\). North of \(x^S\) the auditor exerts the same level of care under strict liability and precise negligence. The shaded area indicates situations in which a negligence regime is preferable to strict liability.
Figure 3: Relative efficiency of strict liability and precise negligence depending on the level of optimism ($P < D$, too lenient penalties)

Notation: See Figure 2. In this graph, I assume $D = 9$ and $P = 4$. North of $x^S$, the auditor exerts the same level of care under strict liability and precise negligence. The shaded area indicates situations in which a negligence regime is preferable to strict liability.

Figure 4: Relative efficiency of strict liability and precise negligence depending on the level of optimism ($P > D$, punitive damages)

Notation: See Figure 2. In this graph, I assume $D = 9$ and $P = 16$. North of $x^S$, the auditor exerts the same level of care under strict liability and precise negligence. The shaded area indicates situations in which a negligence regime is preferable to strict liability.
Figure 5: Relative efficiency of strict liability and *vague* negligence depending on the level of optimism, (Numerical simulation: in the top $P = D$; in the bottom lenient penalties, $P < D$)

Notation: See Figure 2. In the top graph, I assume $D = 9$ and $P = 9$; in the bottom graph it is $D = 9$ and $P = 4$. North of $\Delta_{VN}^S$ the auditor exerts the same level of care under strict liability and vague negligence. The shaded areas indicate situations in which a negligence regime is preferable to strict liability.
Figure 6: Relative efficiency of strict liability and vague negligence depending on the level of optimism (Numerical simulation: \( P > D \), punitive damages)

Notation: See Figure 2. In this graph, I assumed \( D = 9 \) and \( P = 16 \). North of \( \Sigma_{VN}^S \) the auditor exerts the same level of care under strict liability and vague negligence. The shaded area indicates situations in which a negligence regime is preferable to strict liability.
Figure 7: Increasing the level of care of optimistic auditors by decreasing the standard of due care

The auditor’s total perceived costs are reflected by the thick solid line. The upper graph shows that the auditor chooses suboptimal level $\hat{x}_{PN}$ if due care is efficiently defined ($x^S = x^*$). The graph below shows that a reduction in due care ($x_{adj} < x^*$) actually increases the auditor’s level of care from $\hat{x}_{PN}$ to $x^S_{adj}$.

Notation: $x$: auditor’s level of care, $x^*$: efficient level of care, $\hat{x}_{PN}$: auditor’s optimal level of care with a precise negligence rule given that investors sue, $x^S_{adj}$: reduced level of due care, $C(x)$: auditor’s total expected costs associated with level of care $x$, $D$: investors’ damage with an error in the financial statement, $p(x)$ / $p^p(x)$: probability/perceived probability of damage depending on the level of care chosen by the rational auditor/optimistic auditor. In order to reduce clutter, in the graph I omit the index for precise negligence, that is, $C_{PN}(.) = C(.)$. 

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