Auditors' Liability under Prospect Theory

Jochen Bigus*

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Abstract

This paper analyzes unilateral auditors' liability assuming that the auditor has preferences according to *Prospect Theory*, thus, it considers loss aversion, risk-seeking behaviour with losses and weighting of probabilities. Compared to an Expected Utility maximizer the auditor has less incentives to take care under Prospect Theory when there is strict liability or negligence with a precise standard of due care. With a vague standard of due care results are mixed. With Prospect Theory, a negligence rule induces less distortions than a strict liability regime.

JEL-Classification: M 42, K 13

Keywords: Auditors' liability, Prospect Theory, vague standards of due care, economics of tort law

* Jochen Bigus, University of Osnabrück, Department of Management, Rolandstr.8, 49069 Osnabrück, Germany. Tel:++49-541-9692730, Fax: ++49-541-9692722, e-mail: jochen.bigus@uni-osnabrueck.de. For helpful comments I thank Fernando Gomez, Frank Westerhoff, Michael Wosnitza and seminar participants in Osnabrück and at the meeting of the European Association of Law And Economics in Ljubljana, September 2005.

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1. Introduction

The auditors' work is important since it reduces the information gap between top management and investors. Auditors check if the information given in the financial report is correct and in line with financial accounting standards. However, the auditors' effort is hardly observable. Thus, there should be incentives for auditors to exert sufficient care. In many countries, auditors can be held liable for damages of investors or of the firm.

This paper analyzes auditor's incentives to take care with a negligence rule and with strict liability assuming that an auditor has preferences according to *Prospect Theory* (Kahneman and Tversky, 1979). We incorporate three important elements of Prospect Theory: loss aversion, risk-seeking behaviour with losses and weighting of probabilities. Loss aversion means that a negative deviation to a certain reference point, a loss, counts more than a positive deviation (gain) even though in absolute terms they are the same. The probability weighting function takes into account that individuals overrate (very) small probabilities, but underrate (very) large ones. Those elements seem to describe empirical decision-making better than the standard approach in economics which is based on Expected Utility Theory (EU-model).

Surprisingly, even though there is a vast literature on the economics of tort law, new models of decision-making have hardly been incorporated yet (Shavell, 1987 and 2004). To our best knowledge, Behavioral Law and Economics has not addressed the link between Prospect Theory and tort law yet (Sunstein, 2000).[1] Apparently, only Eide (2005) investigates how Rank Dependent Expected Utility (RDEU) affects the economics of various liability rules. The RDEU-concept is mainly based on the work of Quiggin (1982), Yaari (1987) and Segal (1987), and changes probabilities of the EU-model into probability weights. Compared with Eide (2005), we also consider loss aversion and risk-seeking behaviour with losses. Moreover, Eide does neither explicitely address vague standards nor the important discontinuities of the probability weighting function suggested by the work of Kahneman and Tversky (1979).[2]

The same holds true for the literature on auditor's liability. The seminal papers by Dye (1993, 1995) analyse how limited liability distorts the auditor's incentives, however,

[1] In the most relevant book on Behavioural Law and Economics edited by Sunstein (2000) there is only a contribution on "Assessing punitive damages", written by Sunstein, Kahneman and Schkade.

[2] However, Eide (2005) analyzes also the case of bilateral accidents whereas we - as most of the literature on auditors' liability - stick to the unilateral case since the victims (shareholders) usually are not involved in wrongful financial reporting.

he does neither address strict liability nor vague standards of due care nor elements of bounded rationality. Other papers look at different issues such as strategic interactions between auditors, investors, and management - also under a vague standard of due care (Schwartz, 1998 and Ewert, 1999) and when settlement out of court is possible (Zhang and Thoman, 1999). Some studies investigate how the auditor's level of care is affected by joint and several or proportional liability (Hillegeist, 1999) or by performance based auditing fees (Radhakrishnan, 1999). Schwartz (1997) argues that a too strict liability regime might induce the shareholders to pursue projects with negative net present value (overinvestment). Schäfer (2004) demonstrates that auditor's liability should be stricter for audits in the primary market than for audits in the secondary market (e.g. for prospectus audits than for audits of financial reports of firms already listed) since the welfare loss is bigger on primary markets. Balanchandran and Nagarajan (1987) and Ewert, Feess and Nell (2000) address the issue of auditor liability insurance. Ganuza and Gomez (2005) investigate the problem when courts imposing duties or liabilities are unable to verify whether auditors have observed a wrong financial statement or not.

We derive the following results: (1) If we consider possible damage payments as losses, both risk-seeking and probability weighting might induce the auditor to take less care than in the EU-model. This holds for strict liability and for a negligence rule with a precise standard of due care. (2) A negligence rule might still induce efficient solutions, however, a strict liability rule will induce too little care. (3) Often, auditing standards are not precisely defined. With a vague standard, probability weighting mitigates the problem of overdeterrence that exists with the EU-model, but there might be an opposite second effect which induces the auditor to choose a care level where there is no liability for sure but which is too high. The overall outcome is not clear.

This paper assumes that auditors are not acting rationally in the sense of Expected Utility Theory. Empirical evidence suggests that individuals do not necessarily follow this concept of rationality. Still, one might argue that institutional actors, such as big auditing firms, may provide mechanisms to induce their agents to behave rationally and to learn over time. Yet, the evidence for this claim is mixed at best and shows that even institutional actors might be subject to bounded rationality (see e.g., Odean, 1998). Rabin (1998) points out that learning effects in reality are considerably more limited than economists usually assume.

To make the influence of different characteristics of Prospect Theory more transparent we will investigate the impact of each element on its own. Section 2 investigates the impact of loss aversion and risk-seeking behaviour with losses. Section 3 considers the probability weighting function first with a precise standard of due care, then with a vague standard. Section 4 concludes.

2. Loss aversion and risk-seeking with losses

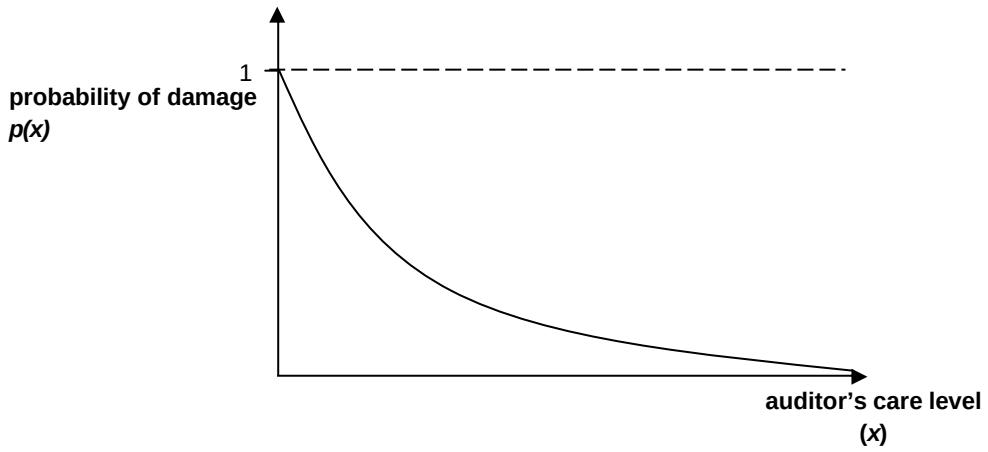
2.1 Assumptions and first-best-solution

We consider a firm listed at the stock market. With probability p ($0 < p < 1$), the firm's financial report is wrongful. If a risk-neutral auditor does not detect the mistake, risk-neutral shareholders will make wrong investment decisions that induce a social loss of D to the shareholders.[3] The auditor gets a flat fee[4] for his audit that meets his participation constraint. He is held liable for wrongful audits.[5] Liability is unlimited. With probability p, the auditor does not detect the mistake and shareholder's damage occurs. The probability of damage, p, depends on the auditor's level of care, x:

$$(1) \qquad p = p(x) = \frac{1}{1+x} \qquad \text{with } x = 0.$$

Following the literature (e.g., *Shavell*, 1987) we assume that the probability of damage decreases as the auditor's level of care increases, however, at diminishing rates.

Fig. 1: Probability of damage depending on the auditor's level of care



The auditor also bears direct costs for performing the audit. For simplicity, these costs equal the level of care, 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 expected damages. We first follow the law and economics literature and assume that the law-feasor is rational in the sense of Expected Utility Theory. The welfare gain is then reflected by:

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[3] To keep the analysis simple we assume there are no creditors.

[4] Contingent auditing fees are prohibited or not consistent with the professional code of conduct in most countries. Thus, many theoretical papers on auditors' liability employ this assumption, see Ewert (1999), p. 184.

[5] Following the law and economics literature (Shavell, 1987 and 2004) we assume that the shareholders will sue for sure which is quite plausible in the U.S. context.

(2) $Y = (1 - p(x))p\,D - x$.

Let us assume $Y > 0$. With the socially desirable level of care, $x = x^*$, marginal gains equal marginal costs of auditing. Thus,

(3) $Y'(x) = 0$ for $x = x^*$ with $x^* = \sqrt{p\,D} - 1$.[6]

Obviously, both a strict liability regime and a negligence rule defining the due standard of care to be x^* will induce an auditor to choose the efficient level of care if he decides on the basis of Expected Utility Theory.

However, will the auditor choose the efficient level of care if the auditor takes decision based on Prospect Theory? The answer to this question also depends on the characteristics of the liability regime. We start with a *negligence rule*, that is, the auditor is held liable if he does not perform an efficient standard of due care, thus, if he chooses care levels below x^*. With higher levels the auditor does not pay for damages. In many countries, such as the U.S. or Germany, there is a negligence rule for auditing services.

2.2 Loss Aversion

According to Kahneman and Tversky (1979, p. 277), human beings tend to consider the risk of losing money as a loss which is evaluated as a negative deviation with regard to a reference point. There is no such reference point in Expected Utility Theory. Under Prospect Theory, a negative deviation to the reference point, a loss counts more than a positive deviation (gain) even though in absolute terms they are the same. Often, people tend to weight a loss two to three times more than a gain that is comparable in absolute terms.[7] This is called loss aversion.

We assume that the reference situation is the one without the audit taking place. Thus, the auditor considers both the effort costs and the liability payment as a loss whereas the auditing fee is a gain. With loss aversion liability payments are weighted with a factor *?* (*?* > 1). Because the audit fee is not contingent, for the optimization problem only costs are relevant. Under a negligence rule with an efficient standard of due care the auditor's cost function is then reflected by:

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[6] Since we assume the level of care to be non-negative: $x = 0$, there is only a solution if $D > 1/p$. For convenience, we assume that this case holds. The second-order condition is met because of (1). For simplicity, we do not address the second-order conditions in the following. They are met, though.

[7] See, for instance, the evidence given by Tversky and Kahneman (1992), pp. 311f. based on an experiment. They suggest a factor of *?* = 2.25.

$$(4) \qquad C(x) = \begin{cases} l\,x + l\,\dfrac{1}{1+x}\,p\,D & ,\, x < x^* \\ l\,x & ,\, x \geq x^*. \end{cases}$$

Total costs are lowest with the efficient level x^*. With strict liability the auditor chooses x^* as well.

Result 1:

The definition of loss matters. If liability payments and effort costs are considered as a loss and auditors are loss averse, both a negligence rule and strict liability provide proper incentives - different to the case of risk aversion in Expected Utility. If only damage payments are considered as a loss, strict liability leads to excessive care - as with risk aversion under Expected Utility.

When injurers are risk averse in an Expected Utility framework they exert excessive care under strict liability which is not socially desirable (Shavell, 1982). The explanation is that effort costs are spent for sure whereas damage payments are uncertain. Since with risk aversion there is - other things being equal - a preference for smoothing net income in different states of nature injurers tend to spend more effort than would be efficient. With a negligence rule injurers choose the efficient level of care and they have a stronger incentive to do so since they avoid damage payments.

Yet, one might feel uncomfortable with the assumption that effort costs are considered as a loss. If *only* damages are considered as a loss we obtain a result similar to Expected Utility Theory. Under strict liability, a loss averse auditor exerts excessive care then:

$$(5) \qquad C(x) = x + l\,\frac{1}{1+x}\,p\,D \qquad \text{with} \quad \hat{x} = \sqrt{l\,p\,D} - 1 \;>\; x^* = \sqrt{p\,D} - 1,$$

where $\hat{x}$ denotes the auditor's optimal choice of effort. Still, we should keep in mind that with Prospect Theory the definition of loss matters.

Also the *size* of losses might matter, thus the parameter l might not be constant. There is some evidence showing that the degree of loss aversion is increasing with sufficiently large losses which jeopardize the individual's existence (**Sources**?). Thus, one could imagine $l = l(x)$ with $l'(x) < 0$ and $l''(x) > 0$). In the auditing setting we rather expect very large losses with "big" clients than with smaller ones and rather in legal frameworks where damage payments tend to be large, for instance, rather in the U.S. than in Germany. If there is some probability for large losses a strict liability rule will tend to induce even higher excessive care, even in the case where effort costs are considered as a loss. With a negligence rule, we still obtain the efficient solution.

Considering the issue of optimal risk-bearing, a negligence rule is also more preferable if auditors are more loss averse than the possible victims of a false audit, thus, the shareholders. Shareholders are supposed to be (almost) risk-neutral when they hold a well-diversified portfolio. With a negligence rule the auditor is able to transfer the risk of damages to the shareholders if he meets the legal standard whereas with a strict liability rule he is not able to do so. Still, we primarily look at the *incentive* effects of auditors' liability under Prospect Theory and not at the issue of optimal risk-sharing since this issue is not the focus of the paper.

2.3 Loss Aversion and Risk-seeking

Prospect Theory suggests a value function $V(y)$ which is concave with gains relative to the reference point - implying risk aversion - and convex with losses - implying risk seeking (Tversky and Kahneman, 1992):

$$(6) \qquad V_l^d = \begin{cases} y^d & , y \geq 0, \\ -l\,(-y^d) & , y < 0, \end{cases} \qquad \text{with } l > 1 \text{ and } 0 \leq d \leq 1.$$

Loss aversion is still reflected by the parameter l. Moreover, the value function reflects diminishing sensitivity via the parameter d.[8] So far we assumed $d = 1$. The smaller the d, the more risk averse the auditor is in the gain domain and the more risk seeking in the loss domain.

The auditor aims at minimizing losses (costs), that is, with strict liability he tries to minimize:

$$(6.1) \quad C(x) = l\,x^d + l\frac{1}{1+x}pD^d.$$

With $d = 1$, marginal expected benefits (lower expected damages) equal marginal costs (higher care level) at the individual optimum $x = \hat{x}$. It holds $V''(y) = 0$. Note that with $d = 1$, the marginal utility of one unit loss less is constant and independent from the level of losses: $V'(y = \hat{x}) = V'(y = D) = l$.

With $d < 1$, in (6) $V''(y) > 0$ holds for the loss domain ($y < 0$). Since damages are expected to exceed the cost of care, $D > x$, (else taking care would not pay at all), it holds: $V'(y = \hat{x}) > V'(y = D)$. Hence, the marginal costs with $x = \hat{x}$ exceed the marginal benefits then. The new optimum is to be found with a lower cost level:

[8] In fact, Tversky and Kahneman (1992) did not require the exponent for gains and losses to be the same. However, they found identical exponents of 0.88 in an estimation based on an experimental study.

$$(7) \qquad C'(x) = d\,l\,x^{d-1} - l\,\frac{p\,D^d}{(1+x)^2} = 0\,,$$

which is solved for $x = \hat{\hat{x}}$, where $\hat{\hat{x}} < \hat{x}$. Thus, with strict liability we expect too little care when there is risk-seeking behaviour ($d < 1$). With a negligence rule, there is less incentive to choose the efficient level x^* (and go for $\hat{\hat{x}}$ instead), since meeting the due standard of care would eliminate risk. The risk-seeking auditor - other things being equal - might have a preference for uncertain damage payments than for spending effort costs for sure. Still, an efficient solution is possible.

Result 2:

If auditors are risk-seeking with losses, they have an incentive to "gamble", that is, they tend to spend too little care under strict liability and possibly even under a negligence rule.

If *only* damage payments are considered as a loss but not direct auditing costs, there is a countervailing effect since due to $l > 1$ there is an incentive to avoid damage payments by higher effort.

That was the formal analysis. But we should also address the question whether risk-seeking with losses is a plausible assumption in the auditing setting. The empirical evidence is mainly based on investment decisions showing that investors hesitate to sell securities in the "loss domain", that is, when the market price is below the initial purchase price. Investors even hesitate to sell when the market price is expected to decrease further because they *hope* that eventually prices will go up again. So far, we do not have evidence directly related to the auditing setting. Yet, we can imagine that auditors may testify a financial report knowing that it is wrong and that possibly they will have to pay damage payments. On the other hand, else they will lose the client for sure. Thus, it is imaginable that they go for the risky alternative (testifying) even though the expected value might be lower hoping that the financial market does not detect the wrong-doing.

3. Probability weighting

3.1 Probability weighting with precise standards

To separate the effect of probability weighting we abstain from loss aversion and risk-seeking, instead we assume risk-neutrality. Prospect Theory suggests that individuals do not directly consider the probability of a state of nature occuring (p_j). Rather, they

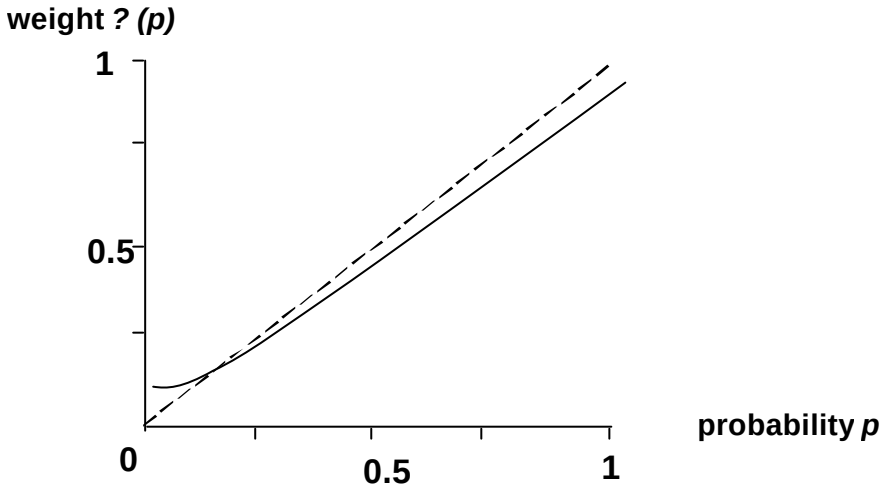
perceive a different weight according to a weighting function $?(p_j)$.[9] Based on robust empirical evidence, Kahneman and Tversky (1979: 280-284) attach the following characteristics to the weighting function:[10]

(a) The weighting function increases monotonically with the probability p. It holds $?(p=1) = 1$ and $?(p=0) = 0$. The weighting function is not continuous in $p=0$ and $p=1$.[11]

(b) Small probabilities are overestimated, big ones are underestimated: $?(p) > p$ and $?(p) < p$, respectively.

Figure 2 shows the weighting function and its relation to the (original) probabilities.

Fig. 2: Probability weighting function $?(p)$ according to Prospect Theory



According to the weighting function, small probabilities are overestimated, big ones are underestimated. Thus, in the continuous part the weighting function increases at *lower* rates than the original probability. Note the discontinuities with $p = 0$ and $p = 1$. This is due to a so-called *certainty effect*: there is a "jump" in perceived probability if events certainly will happen or certainly will not.

We approximate the weighting function by the following function:[12]

[9] Allais (1953), pp. 508, 513 already mentions this idea.

[10] The weighting function has some additional features that, apparently, do not directly affect auditor's liability: (a) subcertainty for complementary events: $?(p) + ?(1-p) < 1$, (b) subadditivity for small probabilities: $?(r \cdot p) > r \cdot ?(p)$ for $r \in (0,1)$ and (c) subproportionality: $\frac{w(p \cdot q)}{w(p)} < \frac{w(r \cdot p \cdot q)}{w(r \cdot p)}$, for $r, q \in (0,1)$.

[11] See Kahneman and Tversky (1979), p. 282.

$$(8)\qquad w(p)=\begin{cases}0 & ,p=0\\ b\,p+a & ,0<p<1\\ 1 & ,p=1.\end{cases}\qquad \text{with } 0<a<1,\ 0<ß<1 \text{ and } a<(1-b).^{13}$$

What does this mean for auditor's liability? We have to consider discontinuities for p = 0 and p = 1, that is, for x = 8 and x = 0, respectively, in case of strict liability, and for x = x* and x = 0, respectively, in case of a negligence rule with an efficient standard of due care. With a **negligence rule**, the auditor's cost function is reflected by:

$$(9)\qquad C(x)=\begin{cases}p\,D & ,x=0\\ x+\left(\dfrac{b}{1+x}+a\right)p\,D & ,0<x<x^*\\ x & ,x\geq x^*.\end{cases}$$

Zero effort (x = 0) cannot be optimal, since a marginal increase in effort will reduce the weighted probability considerably (there is a discontinuity!). In contrast to the standard tort model without probability weighting there are now two local minima due to the discontinuity for x = x*, which implies a damage probability of p = 0. The global cost minimum is located at $x=\hat{x}=\sqrt{bp\,D}-1 < x^*$, if holds:

$$(10)\qquad C(x=\hat{x})=2\sqrt{bp\,D}-1+ap\,D < C(x=x^*)=x^*=\sqrt{p\,D}-1$$

$$\text{or if}\quad b<\hat{b}=\frac{(\sqrt{p\,D}-ap\,D)^2}{4p\,D},$$

that is, if the slope of the probability weighting function is sufficiently small. With **strict liability**, the cost function equals $C(x) = x+\left(b/(1+x)+a\right)p\,D$ and the auditor chooses the individual optimum $\hat{x}$ which implies underdeterrence. Note that with strict liability there is no discontinuity since there is always a small probability to be held liable. As opposed to a negligence rule, there is only one local cost minimum.

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[12] Tversky and Kahneman (1992), p. 309, suggest the following approximation for the weighting function: $?(p) = \dfrac{p^g}{(p^g+(1-p)^g)^{1/g}}$, for $0<g\leq 1$. However, the formal analysis becomes messy with this function, we will not end up with clearer results. Thus, we suggest the approximation given in (8).

[13] This condition makes sure that $w(p) < 1$ holds, if p ? 1. Based on the evidence provided by Tversky and Kahneman (1992) and their approximation for the weighting function and for g (see footnote above), we can imagine values between 0.02 - 0.1 for a, and values between 0.5 - 0.9 for $ß$ (note, however, that the "original" weighting function is *not* linear).

Result 3:

(1) The wrong estimation of probabilities decreases the *marginal* benefits of taking care, thus the auditor may have less incentives to take care and may choose the suboptimal level $\hat{x}$ if (10) holds. Note that without probability weighting ($b = 1, a = 0$) the auditor would always choose the efficient level x^*. (2) Whereas a negligence rule not always causes underdeterrence, strict liability does. Without probability weighting, strict liability would induce an efficient care level.

Due to the weighting function *perceived* probabilities decrease at lower rates than real probabilities as the care level increases. Thus, perceived expected damages also decrease at lower rates. The marginal costs of taking care are not affected by the weighting function, they are certain (it holds $?(p=1) = 1$). Thus, with a negligence rule the individually optimal level is lower than in the case without the weighting function.

It is worth noticing that strict liability generally induces too little care if injurers decide according to Prospect Theory. Thus, many scenarios in which strict liability is regarded to be preferable to a negligence regime have to be reconsidered, for instance scenarios, where the risk of an activity or of a product is substantial but difficult to assess and if potential injurers can much better reduce risk than users (Shavell, 2004: 219).

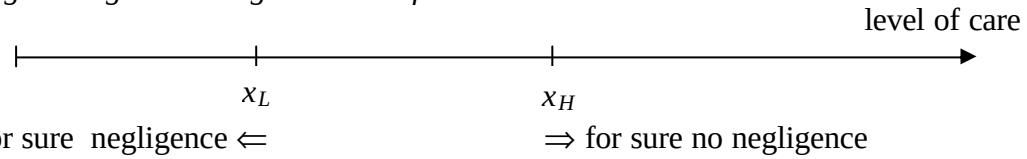
3.2 Probability weighting with a vague standard

We still abstain from loss aversion and risk-seeking, additionally, we assume that there is no weighting with regard to the probability that a damage occurs (p). We do so to single out the effect of probability weighting on a vague standard level of due care.

With a precise standard the auditor's knows exactly ex ante when he crosses the sharp line between liability and no liability. However, in reality this line often is not very clear, it is rather fuzzy. Often, a court decides *ex post* whether the auditor has met the standard level of due care.[14] Figure 3 illustrates the zone of care levels where it is not clear ex ante whether the auditor meets the due level or not.

[14] See Crasswell and Calfee (1986), Schwartz (1998), Ewert (1999) and Schäfer (2004)) for an analysis of vague standards of due care, however, related to other subjects.

Fig. 3: Vague auditing standard of due care



If the auditing level does not exceed x_L, the auditor knows *ex ante* that he will be held liable for sure. With a care level of at least x_H, he certainly will not be held liable. In the range in-between, $x_L < x < x_H$, the auditor does not know for sure ex ante how the court will decide ex post. We can capture this uncertainty by a probability function $F = F(x)$ with the following characteristics:

$$(11) \qquad F(x) = \begin{cases} 1 & , x \le x_L \\ \dfrac{x_H - x}{x_H - x_L} & , x_L < x < x_H \\ 0 & , x \ge x_H . \end{cases} \quad \text{with } \frac{dF(x)}{dx} < 0 \text{ for } x_L < x < x_H.$$

The derivative in (19) demonstrates, that, if the level of care (x) increases not only the probability of a damage occurring, $p(x)$, increases, but *also* the probability of being held liable ex post. For the following analysis, let us assume that the efficient level of care is in the range $x_L < x^* = \sqrt{pD} - 1 < x_H$.[15]

Now let us consider the probability weighting function $w(F)$ defined like $w(p)$ in (8). The total (perceived) expected auditor's costs amount then to:

$$(12) \qquad C(x) = \begin{cases} x + \dfrac{1}{1+x} pD & , 0 \le x \le x_L \\ x + \left[b \dfrac{x_H - x}{x_H - x_L} + a \right] \dfrac{1}{1+x} pD & , x_L < x < x_H \\ x & , x \ge x_H . \end{cases}$$

Note that with $b = 1$ and $a = 0$, there is no probability weighting as under Expected Utility Theory.

Result 4:

(1) Under Expected Utility Theory, vague standards lead to excessive levels of care (overdeterrence). (2) Probability weighting according to Prospect Theory reduces the marginal benefits from higher care levels and thus, tends to reduce overdeterrence and (3) might even induce an efficient level of care.

[15] This assumption seems to be plausible if courts generally try to find the efficient level of due care, however, due to a lack of information they might assign a lower or higher level ex post.

Proof: Ad (1): The first derivative with respect to *x* yields:

$$(13)\qquad C'(x)=\begin{cases}1-\dfrac{p\,D}{(1+x)^2} & ,0\le x\le x_L\\[2ex] 1-\left[\,b\,\dfrac{p\,D(1+x_H)}{(x_H-x_L)(1+x)^2}+a\,\dfrac{p\,D}{(1+x)^2}\right] & ,x_L<x<x_H\\[2ex] 1 & ,x\ge x_H.\end{cases}$$

Which level of care does induce minimum costs? Since the efficient level of care (x^*) exceeds x_L, the individual optimum lies in the range $x_L < x$. The optimum is $x = \hat{x}=\sqrt{bp\,D\dfrac{(1+x_H)}{(x_H-x_L)}+ap\,D}-1$, if $\hat{x}<x_H$, else it is x_H. Under Expected Utility (EU), $b=1$ and $a=0$, thus $\hat{x}^{EU}=\sqrt{p\,D\dfrac{(1+x_H)}{(x_H-x_L)}}-1$, where $\hat{x}^{EU}$ exceeds the efficient level $x^*=\sqrt{p\,D}-1$, because of $x_H>0$, $x_L>0$ and $(1+x_H)>(x_H-x_L)$. Thus, there is overdeterrence with a vague standard under Expected Utility Theory (see Shavell (2004): 224-227)

Ad (2): Due to lower marginal perceived benefits from taking care, the local optimum in the range $x_L<x<x_H$ is smaller: $\hat{x}<\hat{x}^{EU}$, since $bp\,D\dfrac{(1+x_H)}{(x_H-x_L)}+ap\,D<p\,D\dfrac{(1+x_H)}{(x_H-x_L)}$ implies $a<(1-b)\dfrac{(1+x_H)}{x_H-x_L}$ which is valid due to the assumption $a<(1-b)$ and because of $(1+x_H)>(x_H-x_L)$.

Ad (3): An efficient solution under a vague standard is possible if holds (assuming $\hat{x}<x_H$): $\hat{x}=\sqrt{bp\,D\dfrac{(1+x_H)}{(x_H-x_L)}+ap\,D}=x^*=\sqrt{p\,D}-1 \quad\Leftrightarrow a=(1-b)\dfrac{(1+x_H)}{x_H-x_L}$, which might be fulfilled due to $a<(1-b)$ and $(1+x_H)>(x_H-x_L)$. Underdeterrence is possible, too, though.

With a vague standard, in principle, an auditor has stronger incentives to take care, since a higher level of care reduces both the probability of a damage occurring and, in addition, the probability that the auditor will be held liable by the court ex post. Thus, the standard literature (Shavell, 1987) concludes that vague standards may induce overdeterrence in general. With the probability weighting function, this result may not hold: overdeterrence is still possible (though at lower extent), but too little care and even efficient outcomes are possible. The reason is: with the probability weighting function the *perceived* marginal benefits from additional care - the lower probability of

being held liable - are undervalued, thus tending to induce lower care levels than under Expected Utility Theory.

Even though perceived marginal benefits are lower with the probability weighting, still, it is possible that auditors might choose a *higher* effort level than under Expected Utility Theory. This case is likely to occur when the local optimum $\hat{x}$ is sufficiently close to x_H, such that $F(x=\hat{x})$ is quite small and such that this small probabilities is overestimated: $w(F(x=\hat{x})) > F(x=\hat{x})$. Certainty is not overestimated: $w(F(x=x_H)) = F(x=x_H) = 0$. In this case, perceived total costs with the local optimum $\hat{x}$ are likely to be larger with the probability weighting function than without (considering the local optimum $\hat{x}^{EU}$). Since total costs with the corner optimum x_H are the same in either case, there is a stronger incentive to go for x_H implying overdeterrence. It is obvious when we look at the extreme case, where $\hat{x} = \hat{x}^{EU}$ holds, but where both are very close to x_H.

$$(14) \qquad \lim_{\hat{x}\to x_H} C(x=\hat{x}) = \hat{x} + a\frac{1}{1+\hat{x}}pD; \qquad \lim_{\hat{x}^{EU}\to x_H} C(x=\hat{x}^{EU}) = \hat{x}^{EU}.$$

The term $apD/(1+\hat{x})$ denotes the *perceived* "fixed costs" of uncertainty since very small probabilities are overestimated. There are no such costs with x_H, where there is certainty, thus there is an incentive to go for x_H. There are no such costs with Expected Utility Theory either.

Note that a similar argument also holds for the case where the standard of due care is precise. Because the probability of a damage occurring is very small for care levels close to x^*, they are overestimated $w(p(x)) > p(x)$ and thus, there is an even stronger incentive to go for the efficient level x^*.[16] With strict liability there is no such "certainty effect".

Ambiguity aversion. Empirical evidence indicates that people dislike *ambiguity* which is very close to the concept of vagueness (Camerer and Weber, 1992). Ambiguity is an intermediate state of ignorance, in which no distributions can be ruled out, and risk, in which all but one distribution is ruled out (Eide, 2005). Ellsberg (1961) was the first to show that individuals dislike ambiguity in general. There is especially aversion to ambiguity for events where a high loss may occur with low probability (Einhorn and Hogart, 1989) like typically with audits. The auditor's decision with a vague standard fits the concept of ambiguity since damage payments do not only depend on the probability of damage but also on a second order probability function $F(x)$ (Camerer

[16] However, if the precise due level of care is lower or higher than the efficient level of care, the "certainty effect" will even worsen the resulting problems of underdeterrence and overdeterrence, respectively. We should rather expect the case of overdeterrence because the Law and Economics literature suggests to install a quite high level of due care if the lawfeasor does not know the efficient level of care (Shavell, 1987).

and Weber, 1992). Taking ambiguity aversion into account, there is an *additional* incentive to go for decisions which yield a certain outcome, that is, to go for x_H. In contrast to the issue of the probability function this holds not only for local optima $\hat{x}$ that are sufficiently close to x_H, but for all $\hat{x}$ in the range $\hat{x} \in (x_L, x_H)$, since then we have a second-order probability distribution. Again, note that such considerations are not important for strict liability since there is no certainty not to pay damages.

Result 5:

The probability weighting function of Prospect Theory implies that very small probabilities are overweighted and also expected damages. Due to this "certainty effect" auditors might be more willing than under Expected Utility Theory to choose x_H under a negligence rule, implying overdeterrence. With ambiguity aversion, there is an additional incentive to choose x_H since certainty eliminates the cost of ambiguity aversion. With strict liability, there is no certainty effect.

4. Conclusion

We investigated the impact of three important elements of Prospect Theory on auditor's choice of care levels with different auditor liability regimes.

Loss Aversion: The definition of loss matters. If liability payments and effort costs are considered as a loss and auditors are loss averse, both a negligence rule and strict liability induce efficient care - different to the case of risk aversion in Expected Utility Theory where there is overdeterrence with strict liability and an efficient solution with negligence. We obtain similar results to Expected Utility Theory, though, if only damage payments are considered as a loss. Overdeterrence becomes more severe if the degree of loss aversion increases, for instance, with large damage payments threatening the auditor's existence. We might expect large damage payments rather in the U.S. than in Continental Europe and rather for large clients than for small ones. The possibility of large losses may additionally favour a negligence rule which provides a sort of "insurance function" once the due standard of care is met.

Risk-seeking behaviour with losses: If auditors are risk-seeking with losses, they have an incentive to "gamble", that is, they tend to spend too little care under strict liability and possibly even under a negligence rule. A negligence rule is preferable.

Probability weighting: (1) With a *precise* standard of due care we obtain the following results: (a) The wrong estimation of probabilities decreases the *marginal* benefits of taking care, thus, the auditor may choose too little care whereas without probability weighting the auditor chooses efficient care. (b) Whereas a negligence rule not always

causes underdeterrence with probability weighting, strict liability does. Again, a negligence rule is preferable. (2) With a *vague* standard of due care, we have excessive care under Expected Utility Theory (overdeterrence). Probability weighting according to Prospect Theory tends to reduce overdeterrence and might even induce efficient care. Still, a corner solution with even more excessive care is possible, if the benefits from moving from a local optimum with "almost certainly no damages" to a local optimum with "certainly no damages" are perceived to be sufficiently big.

To sum up: First, compared to Expected Utility Theory the elements of Prospect Theory rather tend to weaken the incentives of auditors to work hard which is not desirable given a precise standard of due care. With a vague standard of due care and with strict liability results are more mixed. Second, if there is a precise standard of due care, a negligence rule is preferable to a strict liability regime because distortions are less likely to occur. Still, we cannot conclude that a negligence rule strictly outperforms a strict liability regime in the setting we analyzed. The problem is that the distortions with a strict liability regime might compensate each other: loss aversion induces overdeterrence, but risk-seeking behaviour with losses and probability weighting induces underdeterrence.

Future research may extend our model and may analyse the simultaneous impact of all elements of Prospect Theory. Future research may address the case of bilateral liability as well and may also include interactions between the shareholder's decision to sue and the auditor's effort. Further, there is need to investigate the consequences of Prospect Theory for optimal risk-sharing. A more advanced model might also be able to incorporate ambiguity aversion.

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