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Law and Economics of Obligations

by

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Law and Economics of Obligations

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Abstract

While various liability rules of tort law provide efficient incentives to invest, breach remedies of contract law are claimed to be distortive. Since, at least in Germany, obligations law provides general rules for both contractual and tort relationships such discrepancy seems puzzling. The paper identifies a saddle point property as the driving force behind most efficiency results and it establishes that fault rules of a general type generate this property. The model is then confronted with important legal rules of the German law of obligations. The alleged inefficiency of expectation damages turns out to rest, not on a failure of breach remedies, but on the binary nature of delivery choice as imposed by the traditional analysis of contract law.

JEL classification: K13, K12, D62

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1 Introduction

Contract, unjust enrichment and tort are the main subjects of the law of obligations. The economic analysis of tort law examines efficiency properties of liability rules. In the setting of the bilateral care level accident model, all liability rules except strict liability and no liability are known to be efficient.[1] Moreover, in sequential tort cases, the efficient solution may even emerge from backwards induction.

The economic analysis of contract law investigates various remedies for breach of contract. It is a common tenet that, in contrast to tort law, damage measures such as expectation or reliance damages typically fail to provide efficient incentives.[2] This discrepancy seems particularly puzzling because, in some countries at least, contract and tort law are subject of a general obligations law.

The German legal system, for example, codifies contract law as well as tort law in the second book of BGB[3] under the common headline of *law of obligations*. No doubt, similar legal constructions can be found in other countries as well.[4] For that reason, while the German law of obligations serves as guideline for the present paper, the findings might be of interest for other legal systems as well. In any case, the common feature is that the law provides standards of conduct which, if kept, exempt parties from having to compensate harmful effects. Such rules are referred to as *fault rules*.[5] In tort law, an injurer must be found *negligent* for the victim to be granted compensation for his losses from an accident (§ 823 BGB). The rules of contract law in general are rather intricate. In principle, the promisee is entitled to specific performance. But there are many deviations from this basic rule. The present paper considers cases of impossibility for which the standard of conduct is as follows. If it is impossible for the promisor to perform then the promisee is denied specific performance. Moreover, only if the promisor is *responsible* for such impossibility the promisee can claim

[1] For a proof, see textbooks such as Landes and Posner [1987] or Cooter and Ulen [2000]. Jain and Singh [2002] fully characterize efficient liability rules.

[2] See Shavell [1980a] and the textbooks.

[3] BGB: Bürgerliches Gesetzbuch (German Civil Code), version of 2 January 2002.

[4] In Switzerland, e.g., the corresponding law is even called "Obligationenrecht".

[5] See Cooter (1985).

damages (§§ 280, 283 BGB). Hence, the standard of conduct, in this case, is given by considerations of responsibility.

While the economic analysis of tort law has extensively explored standards of conduct in the above sense,[6] corresponding studies of contract typically do not take such standards into account. The present paper provides a unifying approach to the economic analysis of obligations and it explores the use of standards of conduct in general.

The care level accident model has both the victim and the injurer facing a one-dimensional and continuous choice of care levels. The normative goal consists of minimizing the sum of expected losses and costs of precautionary measures. Expected losses are assumed to be differentiable and convex functions of care levels. While this model provides many interesting insights, it does not readily fit real cases. Levels of care are not easily separated from other activity levels. In addition, more often than not, parties' decisions are better captured by discrete than continuous choice.

Therefore, the present paper introduces a more general *obligations model*. Parties are allowed to face a possibly multi-dimensional decision problem without restriction on whether choice is discrete or continuous and external effects are allowed to go in both directions. The only assumption imposed concerns the existence of a decision profile which maximizes social surplus. The traditional care level accident model as well as Cooter's (1985) model of precaution can be viewed as a special case of the more general obligations model. The extended model captures cases of tort and contract law and it allows to address unjust enrichment as well.

The traditional accident model is expressed in expected terms. The present paper, instead, models the stochastic environment explicitly. Harmful effects are assumed to arise from the interaction between parties' decisions and a move of nature. Nature is not behaving strategically but just follows some exogenously given stochastic rule, i.e. nature's decision is modelled as a random move. Modelling the stochastic environment explicitly allows to examine rules with a defense of violating the standard not being the cause-in-fact of the loss event and to discover interpretations of liability rules that differ from earlier treatments.

[6] For textbooks providing a rigorous analysis of tort law, the reader is referred to Shavell (1987) and Miceli (1997).

>From the perspective of economic analysis, the main contribution of the paper consists of identifying a certain saddle point property as the driving force behind most efficiency results. This property, while easy to check, has far-reaching consequences in terms of efficiency. The efficient solution is, not only, a Nash equilibrium of the game induced by the legal rule but, under sequential choice, even emerges as subgame perfect equilibrium outcome. If parties renegotiate this does not distort the first moving party's incentives and, well in line with the Coase theorem, restores efficiency off the equilibrium path as well. Moreover, since the Nash equilibrium generates the minmax payoffs for both players, games induced by legal rules, while not being zero sum, still share some of the nice properties of zero sum games.

Rules combining standards of conduct with granting damages to the opponent of the deviating party and possibly requiring to compensate unjust enrichment are generally referred to as fault rules by the present paper. Such fault rules are then shown to induce the above saddle point property. As a consequence, under fault rules, all the desirable properties of efficiency will hold.

The saddle point result also lends itself to interpretations of legal rules that would be consistent with economic efficiency. The following example will serve as an illustration of the approach. As mentioned before, a pure regime of expectation damages may lead to overreliance on part of the promisee.[7] Yet, German contract law combines expectation damages with a standard of conduct. Such a fault rule turns out to hold the potential for lowering the promisor's incentives to invest efficiently. However, if the seller is excused from specific performance, § 326 BGB grants relief from consideration to the promisee. In addition, if the promisor has partially fulfilled and only the remaining performance has become impossible then the promisee might be entitled to abate the price. It is not easy to interpret the abatement rule (§ 441 BGB) in the framework of an exactly specified model. For that reason, measures of abatement are approached from the opposite end by asking which conditions on the abatement rule would maintain the saddle point property. The present paper provides the answer to this question.

The paper also revisits traditional liability rules for the accident model which typically are expressed in terms of expected losses. While the present

[7] See, e.g., Shavell (1980a).

paper questions the interpretation behind these rules it still shows that they all generate the saddle point property needed to ensure all the nice properties of efficiency. In this sense, the findings of traditional tort law analysis can easily be recovered as a corollary of the present paper's general efficiency result.

Finally, the paper also revisits the alleged inefficiency induced by damage measures. The main finding is that such inefficiency may just be due to the assumed dichotomous performance choice. If the decision concerns some more continuous quantity or quality choice, expectation damages may well provide efficient incentives to invest, even if the contract is confined to specify, independent of nature's move, a constant delivery choice only. Edlin and Reichelstein [1996] have established similar results before.

The present paper explores the first best theory of obligations. Economists reading the paper will search in vain for fancy games of asymmetric information. Legal scholars, on the other side, will question the practical relevance of an approach which relies on courts being so well informed. Nevertheless, I strongly believe first best analysis to be an indispensable first step in understanding legal institutions. While actual law cannot be expected to design mechanisms that live up to the rigorous standard of modern economics of information, first best theory seems to be a more modest but reasonable vehicle to examine the economic logic behind the law.

The paper is organized as follows. Section 2 introduces the obligations model and it establishes the consequences of the saddle point property in terms of efficiency. Section 3 introduces the general class of fault rules. Fault rules are then shown to induce the saddle point property. Rules of last clear chances under sequential tort turn out to affect the solution, if at all, only off the equilibrium path. Section 4 lists the conditions of abatement rules that are consistent with the saddle point property. Section 5 explores the saddle point property of traditional liability rules. Section 6 relates inefficiencies of breach remedies to the findings of the present paper. Section 7 concludes.

2 The model of obligations

Extensive use of the following *obligations model* will be made throughout the paper. Two risk-neutral parties A and B are facing decisions $r \in R$ and $s \in S$, respectively. The parties may be injurer and victim in a tort case or promisor and promisee in a contractual relationship. The sets R and S of admissible choices, i.e. the strategy spaces are allowed to be multi-dimensional and to combine discrete and continuous choice. In the absence of any liability rule or contract, the expected net payoffs of the two parties depend on the parties' decisions and are denoted by $a(r, s)$ and $b(r, s)$. These payoff functions are referred to as *pre-law payoff functions*. The sum $w(r, s) = a(r, s) + b(r, s)$ of payoffs is referred to as *social surplus* because, by assumption, no further parties are affected by the decisions of parties A and B.

While, in a contractual relationship, all kind of payoffs can be protected by law, this is not the case in a tort relationship. Yet, since this distinction will not be the subject of the present paper, for all applications of tort law, I shall assume that the payoff functions express the monetary values of given property rights. Such values are protected by § 823 BGB.

The *efficient solution* $(r^*, s^*) \in R \times S$ maximizes social surplus, i.e. $(r^*, s^*) \in \arg\max_{r \in R, s \in S} w(r, s)$. Put differently, for any pair of decisions (r, s), it holds that

$$w(r, s) \leq w(r^*, s^*). \tag{1}$$

Legal rules affect payoffs. Let $\phi(r, s)$ and $\psi(r, s)$ denote party A and B's *post-law payoff functions*. The rules under consideration allow neither for fines to nor subsidies from an outside party such that post-law payoff functions still add up to social surplus, i.e. $\phi/r, s) + \psi(r, s) = w(r, s)$. A legal rule is called *efficient* if the efficient solution forms a Nash equilibrium of the game defined by the post-law payoff functions, i.e. if

$$\phi(r, s^*) \leq \phi(r^*, s^*) \text{ and } \psi(r^*, s) \leq \psi(r^*, s^*) \tag{2}$$

hold for all r and s.

Under *sequential choice*, party A is assumed to move first such that party B can observe A's choice before B must decide. The game is solved by backwards induction. Given A's choice r, B decides

$$s^B(r) \in \arg\max_{s \in S} \psi(r, s).$$

Anticipating B's best response, A decides

$$r^A \in \arg\max_{r \in R} \phi(r, s^B(r)).$$

The subgame perfect equilibrium outcome $(r^A, s^B(r^A))$ is efficient if

$$w(r^A, s^B(r^A)) = w(r^*, s^*).$$

In this case, along the equilibrium path, the outcome will be efficient. Off the equilibrium path, however, B's response may deviate from the *socially best response*

$$s^+(r) \in \arg\max_{s \in S} w(r, s), \tag{3}$$

i.e. $s^B(r) \neq s^+(r)$ may possibly occur for $r \neq r^*$. The corresponding *renegotiation surplus* is denoted by

$$n(r) = w(r, s^+(r)) - w(r, s^B(r)).$$

In such situations, well in line with the Coase-Theorem, parties may be expected to renegotiate to the socially best response. If they do, their post-renegotiation payoff functions $\phi^{reneg}(r)$ and $\psi^{reneg}(r)$ add up to $w(r, s^+(r))$. Moreover, since both parties could refuse to renegotiate, post-renegotiation payoff functions must satisfy the constraints

$$\phi^{reneg}(r) \geq \phi(r, s^B(r)) \text{ and } \psi^{reneg}(r) \geq \psi(r, s^B(r)). \tag{4}$$

If party A expects such renegotiations to occur, its incentives to decide are given as

$$r^{reneg} \in \arg\max_{r \in R} \phi^{reneg}(r).$$

Under sequential choice, it would be highly desirable that legal rules are not just efficient but that even the subgame perfect equilibrium outcome is efficient and that renegotiations off the equilibrium path do not distort the first moving party's decision. Interestingly enough, the following simple condition

$$\phi(r^*, s^*) \leq \phi(r^*, s) \text{ and } \psi(r^*, s^*) \leq \psi(r, s^*), \tag{5}$$

if it holds for all r and s, turns out to be sufficient for all these desirable properties to hold as the following proposition establishes. The condition requires that each party, when deciding efficiently, is never hurt by the other party's deviation from its efficient decision. For reasons which become clear along the proof of the proposition, condition (5) is referred to as the *saddle point property*.

Proposition 1 *If the saddle point property (5) holds, then the following claims are valid:*

1. *The efficient solution (r^*, s^*) is a Nash equilibrium.*
2. *All Nash equilibria are payoff equivalent, i.e. if (r^N, s^N) is another Nash equilibrium, then $\phi(r^N, s^N) = \phi(r^*, s^*)$ and $\psi(r^N, s^N) = \psi(r^*, s^*)$ must hold.*
3. *The efficient solution generates minmax-payments for both parties, i.e.*

$$\phi(r^*, s^*) = \min_{s \in S} \max_{r \in R} \phi(r, s) \text{ and } \psi(r^*, s^*) = \min_{r \in R} \max_{s \in S} \phi(r, s).$$

4. *Under sequential choice, the subgame perfect equilibrium outcome is efficient.*
5. *If, off the equilibrium path, inefficient decisions are renegotiated, the equilibrium outcome remains to be efficient.*

Proof. The proof is remarkably simple. Since $\phi(r, s^*) = w(r, s^*) - \psi(r, s^*)$ it follows from (1) and (5) that

$$\phi(r, s^*) \leq w(r^*, s^*) - \psi(r^*, s^*) = \phi(r^*, s^*)$$

and, by a similar argument, that $\psi(r^*, s) \leq \psi(r^*, s^*)$ must hold. Hence, claim 1 is established.

If (r^N, s^N) is another Nash equilibrium, then, since r^N is A's best response to s^N and as a consequence of the saddle point property (5),

$$\phi(r^N, s^N) \geq \phi(r^*, s^N) \geq \phi(r^*, s^*)$$

and, similarly,

$$\psi(r^N, s^N) \geq \psi(r^N, s^*) \geq \psi(r^*, s^*)$$

must hold. It follows that

$$w(r^N, s^N) = \phi(r^N, s^N) + \psi(r^N, s^N) \geq w(r^*, s^*).$$

Since the efficient solution maximizes social surplus, all the above inequalities must be binding. This establishes claim 2.

Condition (5) implies (2) and, hence, the efficient solution is a saddle point of both parties' post-law payoff functions. Claim 3 is known to follow from this fact (see, e.g. Karlin [1959, pp. 21 - 23]).

Since $s^B(r)$ is B's best response it follows from the saddle point property that

$$\psi(r, s^B(r)) \geq \psi(r, s^*) \geq \psi(r^*, s^*)$$

holds for all r, in particular for A's optimal choice r^A. Moreover, again by the saddle point property and by (1),

$$\begin{aligned} \phi(r, s^B(r)) &= w(r, s^B(r)) - \psi(r, s^B(r)) \leq w(r^*, s^*) - \psi(r^*, s^*) = \\ \phi(r^*, s^*) &\leq \phi(r^*, s^B(r^*)) \leq \phi(r^A, s^B(r^A)). \end{aligned}$$

Therefore,

$$\phi(r^A, s^B(r^A)) + \psi(r^A, s^B(r^A)) \geq \phi(r^*, s^*) + \psi(r^*, s^*) = w(r^*, s^*)$$

as was to be shown to establish claim 4.

By making use of the renegotiation constraint (4), claim 5 can be established by extending the argument for claim 4. ■

In spite of the fact that the games under consideration fail to be constant sum, the above proposition shows that most properties of zero sum games still hold under the saddle point property, with the following noteworthy exception. If a constant sum game has two Nash equilibria then combining the strategy of party A under the first equilibrium with B's strategy from the second equilibrium leads to yet a third Nash equilibrium. The saddle point property is not sufficient to extend this result to games that are not constant sum.

In the remaining part of the paper, many rules of obligations law are shown to induce post-law payoff functions which fulfill the saddle point property. It then follows from the above proposition that these rules have all the properties which are desirable from the economic point of view. In this sense, the proposition identifies the saddle point property as the driving force behind many of the efficiency results of the economic analysis of obligations law.

3 Fault rules

The law of obligations provides standards of conduct which, if kept, exempt parties from having to compensate harmful effects (see introduction). By the same token, if a party deviates from such a standard of conduct it must compensate the other party's losses arising from the deviation. Occasionally, a party's deviation may also cause a gain for the other party. Under additional conditions (see §§ 812, 818 BGB), the party benefitting from the deviation may have to compensate *unjust enrichment*. Rules of this type are referred to as fault rules. The main result of this section establishes that fault rules generate post-law payoff functions which satisfy the saddle point property.

The pre-law payoff functions of the obligations model, so far, have been expressed in expected terms. To capture details of fault rules, it proves crucial to model the stochastic environment explicitly. Therefore, a random move of nature $\omega \in \Omega$ is introduced which occurs after the parties have chosen their decisions r and s. Let $A(r, s, \omega)$ and $B(r, s, \omega)$ express their pre-law payoffs as functions of decisions and the random move of nature. Their pre-law payoff functions in expected terms can simply be recovered by making use of the expectation operator E, i.e.

$$a(r, s) = E\left[A(r, s, \omega)\right] \text{ and } b(r, s) = E\left[B(r, s, \omega)\right].$$

Fault rules rely on standards of conduct which, as usual in the economic analysis of law, are identified with the efficient decisions. If party B deviates by deciding $s \neq s^*$, it may depend on the random move of nature whether party A suffers or benefits from such a deviation. In the first case, A may claim damages amounting to $A(r, s^*, \omega) - A(r, s, \omega) > 0$ where r denotes A's actual decision. In the second case, A may possibly have to pay $A(r, s, \omega) - A(r, s^*, \omega) > 0$ as compensation for its unjust enrichment. More generally, legal rules may lead to intermediate cases where party A can claim damages $D_A(r, s, \omega)$ for which it holds that

$$A(r, s^*, \omega) - A(r, s, \omega) \leq D_A(r, s, \omega) \leq \max\left[A(r, s^*, \omega) - A(r, s, \omega), 0\right]. \quad (6)$$

Notice the convention that, if $D_A < 0$ this means that A must pay $-D_A$ to B. For reasons of symmetry, party B may claim damages $D_B(r, s, \omega)$ which, depending on the details of the legal rule, are in the range

$$B(r^*, s, \omega) - B(r, s, \omega) \leq D_B(r, s, \omega) \leq \max\left[B(r^*, s, \omega) - B(r, s, \omega), 0\right]. \quad (7)$$

I refer to damage rules satisfying (6) and (7) generally as *fault rules.* Fault rules induce post-law payoff functions

$$\phi(r,s) = a(r,s) + E\left[D_A(r,s,\omega)\right] - E\left[D_B(r,s,\omega)\right]$$

and

$$\psi(r,s) = b(r,s) + E\left[D_B(r,s,\omega)\right] - E\left[D_A(r,s,\omega)\right]$$

for party A and B, respectively.

Notice if party B's pre-law payoff function $B = B(s,\omega)$ does not depend on party A's decision r, then $D_B \equiv 0$. Similarly, a party can never claim damages if the other party keeps to the standard of conduct, i.e.

$$D_A(r,s^*,\omega) = 0 \text{ and } D_B(r^*,s,\omega) = 0.$$

Proposition 2 *Under fault rules in the above sense, the post law payoff functions satisfy the saddle point property.*

Proof. The proof is straightforward. For party A, it holds that

$$\begin{aligned} \phi(r^*,s) &= a(r^*,s) + E\left[D_A(r^*,s,\omega)\right] \geq \\ a(r^*,s) + \left[a(r^*,s^*) - a(r^*,s)\right] &= a(r^*,s^*) = \phi(r^*,s^*) \end{aligned}$$

which is the saddle point property for A's payoff function. For reasons of symmetry, the saddle point property also holds for the other party. ■

Under fault rules, the saddle point property holds and, hence, proposition 1 applies. In this sense, no further legal rule would be needed to ensure that the subgame perfect equilibrium outcome is efficient. Nevertheless, there exist further rules for cases of sequential tort. In fact, imagine that party B is the victim of an obligation. Since B is assumed to move last, the rule of last clear chance might apply (see § 254 II BGB). This rule, while not needed to ensure efficiency along the equilibrium path, may still improve efficiency off the equilibrium path as the following proposition establishes.

If A has deviated from its standard of conduct, i.e. if it has decided $r \neq r^*$, it is B's duty to limit (social) losses by choosing the socially best response $s^+(r)$ (see (3)). If A had kept its standard of conduct, B's maximum payoff would amount to $B(r^*,s^*,\omega)$. Therefore, under a rule of last clear chance, B could claim damages amounting to

$$D_B^L(r,\omega) = \max\left[B(r^*,s^*,\omega) - B(r,s^+(r),\omega), 0\right]$$

only. In the same spirit, party A could claim damages

$$D_A^L(r,s,\omega) = \max\left[A(r,s^+(r),\omega) - A(r,s,\omega), 0\right]$$

only for B not making use of its last chance in a socially best way, i.e. for deciding $s \neq s^+(r)$. The post-law payoff functions of B and A are then

$$\psi^L(r,s) = b(r,s) + E\left[D_B^L(r,\omega)\right] - E\left[D_A^L(r,s,\omega)\right]$$

and $\phi^L(r,s) = w(r,s) - \psi^L(r,s)$, respectively.

Proposition 3 *Under a rule of last clear chance in the above sense, the second moving party has the incentive to choose, on and off the equilibrium path, the socially best response. Anticipating this response, the first moving party still has efficient incentives to invest.*

Proof. Since $D_A^L(r,s^+(r),\omega) = 0$, it holds for B's payoff that

$$\begin{aligned} \psi^L(r,s) &\leq b(r,s) + E\left[D_B^L(r,\omega)\right] - \left[A(r,s^+(r),\omega) - A(r,s,\omega)\right] \\ &= w(r,s) + E\left[D_B^L(r,\omega)\right] - a(r,s^+(r)) \\ &\leq w(r,s^+(r)) + E\left[D_B^L(r,\omega)\right] - a(r,s^+(r)) = \psi^L(r,s^+(r)) \end{aligned}$$

which establishes the first part of the proposition.

As for the second part, it follows that

$$\begin{aligned} \phi^L(r,s^+(r)) &= a(r,s^+(r)) - E\left[D_B^L(r,\omega)\right] \leq \\ a(r,s^+(r)) + b(r,s^+(r)) - b(r^*,s^*) &\leq w(r^*,s^*) - b(r^*,s^* = \phi^L(r^*,s^*). \end{aligned}$$

Therefore, since s^* is B's best response to r^*, it follows that the efficient decision r^* maximizes A's expected payoff indeed. ■

Notice, while the efficient solution still emerges as a subgame perfect equilibrium outcome, the saddle point property may be lost under the above rule of last clear chance.

4 Impossibility and abatement

In this section, a subclass of the general obligations model is considered which allows to capture obligations where, due to insufficient investments and/or the move of nature, it may become impossible for the promisor to perform. If, say, party B as the promisor fails to perform then party A as the promisee is entitled to expectation damages but only if B is ruled *responsible* for the impossibility to perform. In this sense, § 283 BGB defines a standard of conduct which holds for obligations in general, not just for contractual obligations.

To capture impossibility, the present section introduces the *event technology* which has the impossibility to perform arising from the interaction between parties' decisions and a random move of nature $\omega \in \Omega$. In order to simplify, I assume that the promisee's decision, while affecting the size of the loss from non-performance, does not foster the incidence of the loss event itself. Taking this simplification into account, the event technology is defined as a map

$$e : S \times \Omega \to \{0, 1\}$$

where $e(s, \omega) = 1$ means that performance becomes impossible if the injurer has decided s and the true state of nature is ω and $e(s, \omega) = 0$, otherwise. In case of a loss event, the victim suffers a loss amounting to $\Delta(r, \omega) \geq 0$. This loss possibly depends on the victim's decision and the true state of nature.[8] The pre-law payoff functions are assumed to be of the following structure:

$$A = A(r, s, \omega) = H(r, \omega) - e(s, \omega)\Delta(r, \omega) - T$$

and

$$B = B(s, \omega) = K(s, \omega) + T$$

where, in case of a contractual obligation, T denotes the price which party A has agreed to pay to B. For illustration, imagine a buyer-seller relationship. Then $H(r, \omega)$ would be A's net benefit from reliances under performance and $-K(s, \omega)$ would be B's costs of precautionary investments and of performance if performance remains possible. Since A's decision does not enter B's pre-law payoff function, B can never claim damages from A. For simplicity, compensation of unjust enrichment is also ruled out. Hence A may claim damages amounting exactly to

$$\begin{aligned} D_A(r, s, \omega) &= \max\left[A(r, s^*, \omega) - A(r, s, \omega), 0\right] = \\ &\quad \max\left[e(s, \omega) - e(s^*, \omega), 0\right] \Delta(r, \omega). \end{aligned} \tag{8}$$

[8] For more general cases, the reader is referred to the next section.

Notice, such damages are positive only if the loss event has occurred for the single reason that A has deviated from the standard of conduct, i.e. only if

$$e(s, \omega) = 1 > e(s^*, \omega) = 0.$$

If B has deviated from the standard of conduct but the loss event would neither have been avoided by sticking to it, i.e.

$$e(s, \omega) = 1 = e(s^*, \omega), \tag{9}$$

then the promisor's deviation was not cause-in-fact of the loss event and, due to § 283 BGB, A could not claim damages, well in line with (8). The above legal rule induces post-law payoff functions

$$\Phi(r, s, \omega) = A(r, s, \omega) + D_A(r, s, \omega)$$

and

$$\Psi(r, s, \omega) = B(s, \omega) - D_A(r, s, \omega).$$

It immediately follows from proposition 2 that the payoff functions expressed in expected terms $\phi(r, s) = E[\Phi(r, s, \omega)]$ and $\psi(r, s) = E[\Psi(r, s, \omega)]$ satisfy the saddle point property, ensuring all the efficiency consequences of proposition 1. In this sense, § 283 BGB, while making use of expectation damages, prevents the promisee from overreliance because, at the same time, it relies on a standard of conduct.[9]

So far, I have assumed that the promisee has to pay the price if the promisor is not responsible for the impossibility to perform, i.e. in case (9). Such a rule would correspond to *periculum est emptoris* which, however, does not apply under current German law. In fact, it is § 326 BGB which rules that if, due to impossibility, the promisee is denied specific performance then the promisor is also not entitled to the price T which was specified in the original contract. Moreover, if the promisor has partially fulfilled then § 441 BGB might apply which allows the promisee to abate the price. The meaning of the abatement rule remains ambiguous if confronted with an exact model.

[9] Cooter (1985) argues that the common law tradition also has a solution to the problem of overreliance which is different form a fault rule, namely liquidated damages which do not depend on the promisee's reliances. Moreover, when damages are not liquidated in the contract, various legal doctrines are available that achieve the same as liquidation of damages.

In the following, instead, it is investigated what conditions of an abatement rule would preserve the saddle point property which just has been shown to hold under *periculum est emptoris.*

Let $M(r,s,\omega)$ denote the abatement of the price such that the post-law payoffs induced by the rule of abatement amount to

$$\Phi^a(r,s,\omega) = \Phi(r,s,\omega) + e(s,\omega)e(s^*,\omega)M(r,s,\omega)$$

and

$$\Psi^a(r,s,\omega) = \Psi(r,s,\omega) - e(s,\omega)e(s^*,\omega)M(r,s,\omega).$$

The following three conditions will prove sufficient to preserve the saddle point property:

If (9) holds then, for all s and ω,

$$M(r^*,s^*,\omega) \leq M(r^*,s,\omega) \tag{10}$$

whereas if $e(s^*,\omega) = 1$ then, for all r and ω,

$$M(r,s^*,\omega) \leq M(r^*,s^*,\omega). \tag{11}$$

Finally, for all ω,

$$M(r^*,s^*,\omega) \leq \Delta(r^*,\omega). \tag{12}$$

The first two properties correspond to a restricted form of a saddle point property. If the promisee has invested efficiently the promisor cannot diminish the abatement of the price, not even by overinvestment. Similarly, if the promisor keeps the standard of conduct the promisee cannot raise the abatement of the price, not even by overreliance. The last property, finally, requires that, at efficient decisions, the abatement of the price is bounded from above by the actual loss due to impossibility.

Proposition 4 *If the rule of abatement satisfies conditions (10) - (12) then the post-law payoff functions $E[\Phi^a(r,s,\omega)]$ and $E[\Psi^a(r,s,\omega)]$ still exhibit the saddle point property.*

Proof. It is easily seen that

$$\begin{aligned} & \Phi^a(r^*,s,\omega) - \Phi^a(r^*,s^*,\omega) \\ = \; & [e(s^*,\omega) - e(s,\omega)]\,\Delta(r^*,\omega) + \max[e(s,\omega) - e(s^*,\omega), 0]\,\Delta(r^*,\omega) + \\ & e(s^*,\omega)\,[e(s,\omega)M(r^*,s,\omega) - M(r^*,s^*,\omega)] \end{aligned}$$

must hold for all s and ω. By distinguishing four cases according to whether $e(s,\omega) = 0/1$ and $e(s^*,\omega) = 0/1$, it can be shown that

$$\Phi^a(r^*, s, \omega) - \Phi^a(r^*, s^*, \omega) \geq 0$$

holds for all ω and hence, independent of the stochastic rule behind nature's move, the saddle point property holds for A's payoff function. Since

$$\Psi^a(r, s^*, \omega) - \Psi^a(r^*, s^*, \omega) = -e(s^*, \omega)\left[M(r, s^*, \omega) - M(r^*, s^*, \omega)\right] \geq 0$$

as follows from (11), the saddle point property also holds for B's payoff function. The proposition is established. ■

5 Liability rules revisited

This section revisits the traditional accident model which has extensively been explored in the economic analysis of tort law and which corresponds to a subclass of the model studied in the previous section. Both parties are assumed to choose a continuous care level $r, s \in R = S = [0, \infty)$ which captures precautionary measures in monetary terms. Raising care levels lowers expected losses. It is assumed that productive decisions and precautionary measures are fully separable from each other. The care level model expresses the precautionary part of the problem while the productive part remains unconsidered. This is the reason why the model does not readily fit real cases.[10]

Expressed as a subcase of the general obligations model, the injurer's and the victim's expected pre-law payoffs amount to

$$a = a(r) = -r \text{ and } b(r, s) = -s - d(r, s)$$

where $d(r, s)$ denotes the expected loss to the victim. Higher investments by the injurer, in particular, lead to lower expected losses, i.e. if $r < r'$ then $d(r, s) \geq d(r', s)$. By making use of an event technology

$$e : R \times S \times \Omega \to \{0, 1\},$$

[10] Shavell (1980b), to be sure, has considered a model including the choice of both activity and care levels. While Shavell deals with a second best problem where the standards cannot be conditioned on the activity levels, the present paper concentrates on the more elementary first best approach.

again, the stochastic environment can be modelled explicitly. Notice, to allow for richer applications, the victim's decision may now affect the occurrence of the loss event as well. The loss in case of an accident $\Delta(r,s,\omega)$ is also allowed to depend on both decisions. The expected loss amounts to $d(r,s) = E[e(r,s,\omega)\Delta(r,s,\omega)]$ and the pre-law payoff functions are

$$A = A(r) = -r \text{ and } B = B(r,s,\omega) = -s - e(r,s,\omega)\Delta(r,s,\omega).$$

Since the injurer A's payoff function does not depend on victim B's decision, A can never claim damages from B. Party B, however, may claim damages from A. What amount exactly could B claim under actual law? If the injurer keeps to the standard of conduct r^* then the victim could not claim any damages, i.e. $D_B(r^*,s,\omega) = 0$. If the injurer deviates but the victim decides efficiently, i.e. if $r \neq r^*$ but $s = s^*$ then two cases must be distinguished. Either the injurer's deviation is causal for the accident ($e(r,s^*,\omega) = 1 > e(r^*,s^*,\omega) = 0$). Then the victim may recover full losses, i.e. $D_B(r,s^*,\omega) = \Delta(r,s^*,\omega)$. Or the injurer's deviation is not causal for the accident ($e(r,s^*,\omega) = e(r^*,s^*,\omega) = 1$). Then the victim, according to the *difference principle*, may claim damages amounting to

$$D_B(r,s^*,\omega) = \max\left[\Delta(r,s^*,\omega) - \Delta(r^*,s^*,\omega), 0\right]$$

only. This difference principle rests on § 249 BGB which generally defines the size of expectation damages.[11]

Proposition 5 *Under the above difference principle, the post-law payoff functions satisfy the saddle point property.*

Proof. It follows from the above definitions that

$$D_B(r^*,s,\omega) = 0 = \max\left[B(r^*,s,\omega) - B(r^*,s,\omega), 0\right]$$

and

$$D_B(r,s^*,\omega) = \max\left[B(r^*,s^*,\omega) - B(r,s^*,\omega), 0\right]$$

and, hence, the difference principle leads to a fault rule in the sense of proposition 2. Therefore, the claim of the present proposition immediately follows from that proposition. ■

[11] I am grateful to Hans-Bernd Schäfer who has drawn my attention to the legal source of the difference principle.

Notice, the above interpretation, while in the same spirit, still differs from Kahan's [1989] rule. In fact, Kahan takes party with the tradition to express liability rules in terms of expected losses. His rule would lead to post-law payoff functions

$$\phi^K(r,s) = -r - \max\left[d(r,s) - d(r^*,s), 0\right]$$

and

$$\psi^K(r,s) = -s - d(r,s) + \max\left[d(r,s) - d(r^*,s), 0\right].$$

Yet, as I have shown, modelling the stochastic environment explicitly leads to an interpretation of the legal rule which, in general, cannot be expressed in terms of expected losses only. Nevertheless, the post-law payoff functions induced by Kahan's interpretation would also satisfy the saddle point property. The proof can easily be adapted from that of proposition 2 and, for that reason, is omitted.

Liability rules as investigated in traditional tort law analysis also exhibit the saddle point property as I now want to show. Under such rules, post-law payoffs amount to

$$\phi^t(r,s) = -r - \lambda(r,s)d(r,s)$$

and

$$\psi^t(r,s) = -s - \left[1 - \lambda(r,s)\right] d(r,s)$$

where $0 \leq \lambda(r,s) \leq 1$ denotes the share of the expected loss which the injurer must compensate. The following two conditions on the liability rule turn out to be sufficient to ensure the saddle point property.

If the injurer keeps to the standard of conduct then the injurer is not liable, i.e., for all s,

$$\lambda(r^*,s) = 0 \tag{13}$$

whereas if the injurer underinvests but the victim invests efficiently then the injurer must compensate full losses, i.e. if $r < r^*$ but $s = s^*$ then

$$\lambda(r,s^*) = 1. \tag{14}$$

Notice that the negligence rule, the negligence rule with a defense of contributory negligence, strict liability with a defense of contributory negligence and comparative negligence, all fulfill the two conditions and, hence, they all induce post-law payoff functions that satisfy the saddle point property as the following proposition establishes.

Proposition 6 *Under traditional liability rules satisfying conditions (13) and (14), post-law payoff functions ϕ^t and ψ^t satisfy the saddle point property.*

Proof. Notice, first, that

$$\phi^t(r^*, s) - \phi^t(r^*, s^*) = -\lambda(r^*, s)d(r^*, s) + \lambda(r^*, s^*)d(r^*, s^*) = 0$$

as follows from (13). Therefore, the efficient solution is a saddle point of the injurer's post-law payoff function.

Similarly, it holds that

$$\begin{aligned}\psi^t(r, s^*) - \psi^t(r^*, s^*) &= -\left[1 - \lambda(r, s^*)\right] d(r, s^*) + \left[1 - \lambda(r^*, s^*)\right] d(r^*, s^*) \\ &= -\left[1 - \lambda(r, s^*)\right] d(r, s^*) + d(r^*, s^*)\end{aligned}$$

as follows from (13) again. If $r < r^*$ then $\psi^t(r, s^*) - \psi^t(r^*, s^*) = d(r^*, s^*) \geq 0$ as follows from (14) whereas, if $r^* < r$, then $\psi^t(r, s^*) - \psi^t(r^*, s^*) \geq d(r^*, s^*) - d(r, s^*) \geq 0$ as follows from the assumption that the expected loss is a decreasing function of precautionary investments. Therefore, the efficient solution is a saddle point of the victim's post-law payoff function as well and, hence, the proposition is established. ■

To deal with tort under sequential moves, Wittman (1981) has investigated the rule of *strict marginal cost liability.*[12] Without going into details, I simply mention that his rule if applied to the obligations model would give rise to expected post-law payoff amounting to

$$\psi^W(r, s) = w(r, s) - w(r, s^+(r)) + m \tag{15}$$

for party B where m is a constant not affecting incentives. Under strict marginal cost liability, the second moving party B responds by the socially best response and the first moving party A has efficient investments as a dominant strategy. Therefore, the efficient solution emerges as subgame perfect equilibrium outcome under strict marginal cost liability as well. Notice, however, that the efficient solution would not be a saddle point of B's post-law payoff function. In this sense, it differs qualitatively from traditional liability rules. Marginal cost liability has been dismissed as not being used in practice.

[12] See also Miceli (1997).

6 Are expectation damages inefficient?

It is a common tenet of the economic analysis of contract law that expectation damages induce overreliance (see Shavell (1980a), Rogerson (1984) and the textbooks on law and economics). The present paper, in contrast, has shown that fault rules, in general, have very nice efficiency properties. To illuminate the issue, the present section identifies the potential source of inefficiency.

Inefficiency results make use of a model with the following time structure. First, party A as the promisee decides on reliances $r \in R$. Second, there is a random move $\omega \in \Omega$ of nature before, third, party B as the promisor decides on $y \in Y$. The pre-law payoff functions, reflecting this time structure, are denoted by $A(r, \omega, y)$ and $B(\omega, y)$, social surplus by $W(r, \omega, y) = A(r, \omega, y) + B(\omega, y)$, respectively. As usual, reliances are assumed not to enter the promisor's pre-law payoff function and, hence, B can never claim damages from A but, of course, A may possibly claim damages from B.

To be sure, the present time structure differs from the one imposed in earlier sections. But this in itself is not the source of inefficiency. In fact, let r^* and $y^*(\omega)$ denote the efficient solution. Since B decides after the move of nature, its efficient decision must be state contingent. By definition, for any r of A and any state contingent decision $y(\omega)$ it holds that

$$E\left[W(r, \omega, y(\omega))\right] \leq E\left[W(r^*, \omega, y^*(\omega))\right].$$

As before, damages claimed by the promisee are governed by the *fault rule* if they are within the range

$$A(r, \omega, y^*(\omega)) - A(r, \omega, y) \leq D_A(r, \omega, y) \leq \max\left[A(r, \omega, y^*(\omega)) - A(r, \omega, y), 0\right].$$

Such damages induce post-law payoff functions $\Phi(r, \omega, y) = W(r, \omega, y) - \Psi(r, \omega, y)$ and

$$\Psi(r, \omega, y) = B(\omega, y) + T - D_A(r, \omega, y)$$

for A and B, respectively. It then follows from proposition 2 that the efficient solution is a saddle point of both post-law payoff functions. Therefore, by proposition 1, the subgame perfect equilibrium outcome will be efficient. In this sense, contract law generates efficient incentives if it has to complete an incomplete contract specifying the appropriate state contingent decision $y^*(\omega)$ and if expectation damages are granted in case of deviations.

The literature on inefficiency of expectation damages is more demanding. It deals with contracts that are not state-contingent. Such contracts just specify a price T and a constant decision $y^c \in Y$. Fault rules based on such contracts grant damages $D_A^c(r, \omega, y)$ to A in the range

$$A(r, \omega, y^c) - A(r, \omega, y) \leq D_A^c(r, \omega, y) \leq \max\left[A(r, \omega, y^c) - A(r, \omega, y), 0\right]. \quad (16)$$

Party A and B's payoffs amount to $\Phi^c(r, \omega, y) = W(r, \omega, y) - \Psi^c(r, \omega, y)$ and

$$\Psi^c(r, \omega, y) = B(\omega, y) + T - D_A^c(r, \omega, y),$$

respectively.

Shavell (1980a) and Rogerson (1984) deal with a setting of continuous reliance decision but binary delivery choice, i.e. $R = [0, \infty)$ and $Y = \{0, 1\}$. For illustration, suppose the promisee A is a buyer with utility $v(r, \omega)$ under performance such that A's pre-law payoff function has the form

$$A(r, \omega, y) = v(r, \omega)y - r$$

whereas B, as the seller, has payoff function $B(\omega, y) = -c(\omega)y$ where $c(\omega)$ denotes cost of performance in state ω of nature. In this setting, a contract specifying $y^c = 0$ would lead to the same outcome as if the parties had signed no contract at all. Therefore the literature concentrates on the only other constant contract available under binary choice, namely the contract specifying performance $y^c = 1$ for all moves of nature. For such contracts, (16) fully specifies damages as

$$D_A^c(r, \omega, y) = A(r, \omega, y^c) - A(r, \omega, y). \quad (17)$$

The buyer's incentives to invest under such contracts are given by

$$r^c = r^c(y^c = 1) \in \arg\max_r E\left[v(r, \omega)\right] - r$$

and, hence, they are excessive. Notice, however, with no contract or, equivalently, with a contract specifying $y^c = 0$, there would exist no incentives to invest at all. To summarize, in a setting of binary choice, obviously, two decisions y_L and y_H must exist such that the promisee's incentives to invest under contracts specifying one of these decisions satisfy

$$r^c(y_L) \leq r^* \leq r^c(y_H). \quad (18)$$

This result allows for substantial generalization as the following proposition establishes.

Proposition 7 *Suppose investment decisions are continuous, i.e.* $R = [0, \infty)$, *and the promisee's pre-law payoff function is concave, i.e.* $A_{rr}(r, \omega, y) \leq 0$. *If the promisee can claim damages according to (17) then there must exist constant choices* y_L *and* y_H *such that contracts specifying these constant choices lead to underreliance and overreliance, respectively, i.e. (18) must hold. Since the promisor's best response is equal to the socially best response, neither off nor on the equilibrium path, there is scope for renegotiations.*

Proof. The promisor's post-law payoff amounts to

$$\Psi^c(r, \omega, y) = B(\omega, y) + T - D^c_A(r, s, \omega) = W(r, \omega, y) - A(r, \omega, y^c)$$

and, hence, its decision coincides with the socially best response. The last claim of the proposition is settled.

Efficient investments, under the assumptions of the proposition, can be derived from first order condition

$$\begin{aligned} E\left[W_r(r^*, \omega, y^*(\omega))\right] &= E\left[A_r(r^*, \omega, y^*(\omega)) + B_r(\omega, y^*(\omega))\right] = \\ E\left[A_r(r^*, \omega, y^*(\omega))\right] &\leq 0, \quad = 0 \text{ if } r^* > 0. \end{aligned}$$

Notice, for

$$y_L \in \arg\min_{\omega} A_r(r^*, \omega, y^*(\omega)) \text{ and } y_H \in \arg\max_{\omega} A_r(r^*, \omega, y^*(\omega)),$$

it holds that

$$E\left[A_r(r^*, \omega, y_L)\right] \leq E\left[A_r(r^*, \omega, y^*(\omega))\right] \leq E\left[A_r(r^*, \omega, y_H)\right].$$

Since the promisee's post-law payoff amounts to

$$\Phi^c(r, \omega, y) = A(r, \omega, y) - T + D^c_A(r, \omega, y) = A(r, \omega, y^c) - T$$

it follows that the promisee underinvests and overinvests if the contract has specified the constant choice $y^c = y_L$ and $y^c = y_H$, respectively. The proposition is established. ■

If the delivery choice is continuous then, under the premises of the above proposition, an intermediate constant value $y^* \in Y$ can be found which, if specified in the contract, provides efficient incentives to invest. Since the promisor decides in favor of the socially best response, the subgame perfect equilibrium outcome must be efficient. In other words, the parties have a simple contract with a fixed delivery choice at their disposal such that fault rule (17) induces the efficient outcome.

Under additional assumptions, Edlin and Reichelstein [1996] have shown that a similar result also holds for rules granting expectation damages

$$D_A^e(r, \omega, y) = \max\left[A(r, \omega, y^c) - A(r, \omega, y), 0\right]$$

without compensation of enrichment. While their analysis is quite sophisticated, the above proposition captures the main point in a rather simple way. In any case, inefficiency of expectation damages as traditionally established in a setting of binary choice is due to the fact that, if randomization is excluded, intermediate choices fail to exist.

7 Concluding remarks

The overwhelming bulk of formal papers dealing with the law of obligations has been developed in the United States which is a common law country. Even scholars writing about law and economics in the civil law tradition usually rely on these models when discussing issues of the economic analysis of law.[13] No doubt, many insights gained from models introduced in the common law tradition are of relevance for civil law countries as well. Yet, when confronting such models with actual law, the fit is not always one-to-one. For that reason, the present paper attempts to improve the fit by modifying the traditional common law models appropriately. It introduces a general model of obligations which captures cases of tort, contract and unjust enrichment.

By the way, it may even capture cases of nuisance law which are not part of obligations law.[14] In fact, according to § 906 BGB, the harmful effect will not be compensated if party B's activities are ruled *customary in place* and the effect is considered *not-essential*. Moreover, if the activities do violate this standard of conduct, then party A is granted compensation beyond the

[13] For an early treatment of tort law, e.g., see Adams (1985). For the leading text book on the economic analysis of the German Civil Code, see Schäfer and Ott (2000).

[14] For a further analysis of § 906 BGB, the reader is referred to Schweizer (2003).

reasonable level only, well in line with general fault rules as investigated by the present paper.[15]

The obligations model is used to examine a few basic provisions of German obligations law. Obviously, it is contract law where differences between the two traditions are most pronounced. German contract law introduces a great variety of rules, most of which have yet to be made the subject of formal economic analysis. The paper emphasizes those cases of contract law where, due to impossibility, the promisor fails to perform as specified in the contract. In principle, the promisee would then be entitled to expectation damages. But the solution still differs from a regime of pure expectation damages because the promisee is granted such remedy only if the promisor is found responsible for the impossibility to perform.

Fault rules in general are shown to exhibit very nice properties as far as economic efficiency is concerned. In principle, remedies for breach of contract can also be captured as fault rules and, as a consequence, should also be efficient. In fact, for the appropriately specified delivery choice, expectation damages turn out to provide efficient incentives to invest. Yet, if breach of contract occurs after nature's move, then the saddle point property would only hold for a delivery choice that is state-contingent. While the saddle point property may be violated under constant delivery choices, the efficient solution may still emerge as a subgame perfect equilibrium outcome for some constant delivery choice. For the appropriate delivery choice to exist, however, the choice set should be continuous. In this sense, the inefficiency of expectation damages rests on the binary character of choice as imposed by the traditional analysis of contract law.

No doubt, confronting economic models with actual law is a useful exercise. While the present paper, hopefully, is considered by the reader to belong to this category, the many rules of German contract law leave more of such exercises for future research.

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[15] See Neue Juristische Wochenzeitschrift NJW-RR, 1291, 1988 Heft 21.

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