Insurance and Tort: Coordination Systems And Imperfect Liability Rules

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Abstract

Three methods compete, both across and within different legal systems, for coordinating insurance or like benefits (Social Security, employer provided benefits, etc.) and Tort liability awards: *Collateral Source Rule* (cumullation), collateral benefits offset (deduction), and subrogation of insurer or provider. It is known in the economics literature that the optimal insurance contract contains subrogatory provisions (Shavell 1987, Sykes 2001). In the presence of a liability system, however, it has been overlooked that subrogation and its alternatives, however, make sense only in a world in which liability rules don't operate perfectly. Under an imperfect strict liability regime, solely subrogation can induce optimal incentives for risk coverage. In addition, collateral offset reduces, compared to the other two, injurer's incentives to take care. Not very different is the outcome under an uncertain negligence rule incorporating causation. Under this regime, even subrogation is unable of inducing complete insurance coverage, albeit always higher than the benefits deduction rule. Finally, the paper also discusses in informal terms the apparently strong advantage of the collateral offset over subrogation, and points out at several factors that might seriously undermine this opinion. The paper casts doubts upon the trend favoring the elimination of the Collateral Source Rule and adoption of deduction systems, which has already been shown empirically to reduce deterrence (Rubin and Shepherd 2007).

1 Introduction

Risk-averse individuals facing the possibility of an adverse event that will determine losses in their wealth or income, would definitely prefer to be reimbursed for their losses -at least those pecuniary- if the accident prospect materializes. If insurance is readily available, either through the market or under a social insurance scheme, these individuals would be willing to transfer the risk to the insurer, and thus, obtain indemnity from a private or social insurer if the feared event takes place, against the payment of insurance *premia* or Social Security contributions.

At the same time, the legal system provides redress to the victims of some of these events, through the tort awards that the Law determines if an injurer is held legally liable for the damage caused. The question arising out of the co-existence of these two different institutional structures

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is how to coordinate the insurance benefits the insured will have received, had the accident taken place, with tort liability awards if there is a liable injurer. To achieve this coordination, three main options seem plausible. In fact, the three of them have been adopted by different legal systems in various fields and degrees.

The first one is to allow the insurer to seek reimbursement from a liable injurer of what has been paid to the insured. This can be implemented technically in a variety of ways: allowing a direct cause of action of the private or Social insurer against the injurer;[1] subrogating the insurer in the tort claim of the victim;[2] or compelling the insured to transfer her tort claim to the insurer, or, in some cases, assuming that that has been the case ;[3] other methods, such as a lien in favor of the injurer on the victim's tort award, or allowing his participation, side by side with the victim, in the civil liability claim. Throughout the paper we will refer to this option as insurance subrogation, but there are no substantial reasons why it would not equally apply to any other of the mentioned schemes. Even with respect to the strict subrogation, there are certain complexities that will be ignored, such as the sharing rules of insured and insurer in their actions against the responsible party. These rules are relevant when the liable injurer has only limited assets, a problem that will not be addressed here.

The second type of solution lets the victim of an accident who has received insurance or similar benefits to collect full damages from a liable injurer: In the computation of the damage award no reduction is made because of the benefits that have partially or totally eliminated the accident loss. This rule is traditionally called in the Anglo-American legal world *Collateral Source Rule*, because insurance or similar benefits are considered "collateral" with respect to the tort award.

The third is precisely the opposite of the one just exposed: The amount of the insurance or like benefits is deducted from the damage payment the injurer is liable for. We can call this option deduction, or collateral benefits set-off rule, following the American legal jargon. In continental Europe there is no widely accepted precise term for it, but it is usually considered under the heading of *compensatio lucri cum damno* in the calculation of damages.

It might be observed that the first option and the other two are not mutually exclusive in strictly logical terms. We could imagine the insurer being reimbursed for her payments and, at the same time, the victim being entitled to the full damage award payment. Or the insurer subrogated in the tort claim to the amount of the benefits paid, while the victim will retain her own claim but facing the collateral benefits offset. As for the first situation, even if theoretically possible, it is inconceivable in a legal system committed to the idea of avoiding liability in excess of damages. The second one is very much real: The question is that, in order to prevent double liability of the injurer, insurance subrogation must necessarily entail either (i) a bar of any tort claim by the victim herself if insurance coverage was full and thus, she was made whole or; (ii) a reduction of the award if coverage was only partial. And this implies that the collateral source offset is, as such, an essential part of the insurance subrogation scheme, and that the former only acquires existence and distinctiveness as independent rule precisely when it contradicts the latter, that is, when the benefits are deducted from the damage award and subrogation is at the same time excluded.

In this paper we will examine the effects of the three legal options just mentioned, both on the levels of insurance coverage to be purchased by potential victims and the amount of care or safety to be adopted by potential injurers.[4] As Danzon pointed out and Shavell demonstrated, it is in the best

[1]This is the case in the Spanish legal system concerning the medical expenses covered under Workers' Compensation or Social Security schemes: art. 127.3 *Ley General de la Seguridad Social*.

[2]This is probably the most widely used procedure across different systems: Par. 67 of the German *Versicherungsvertragsgesetz*, artt. 43 and 82 of the Spanish *Ley de Contrato de Seguro*; in the U.S., see Keeton & Widiss (1988, p. 219); in the U.K., see Birds (1988, p. 243).

[3]This is common in Germany when an employer provides coverage of medical expenses and lost wages resulting from a personal injury, apart from the cases in which this coverage is mandatory (as under Par. 1 of the *Lohnfortzahlungsgesetz*): see Larenz (1981, p. 537). The assignment of the cause of action against the injurer is also possible in Anglo-American Law, but is voluntary: Birds (1988, p. 249).

[4]See Levmore (1982, pp. 771-824) for an informal discussion of the same issues.

interest of potential victims to subscribe insurance policies containing subrogation provisions for their insurers, and that it leads to the Pareto-optimal outcome including the liability question into the problem.[5] Shavell, however, didn't examine in full the effects of the three different options under alternative liability regimes (as a matter of fact, he addressed the issue of liability in this respect only in passing), both on the decision to buy insurance and to take care. Consequently, he did not recognize the fact that the problem of insurance subrogation and its alternatives for coordinating Tort liability and insurance benefits appears as meaningless in a world in which liability rules operate ideally (as it is assumed in the basic standard economic modeling of accidents and accident Law).

Take as given a certain type of harmful event. With a complete and perfect strict liability rule, being this in itself substantially equivalent, in this ideal world, to an insurance policy, potential victims will not pay the price of insurance in the market when they can enjoy it for free through the legal system. In cases governed by the negligence rule, there is, of course, plenty of room for the purchase of accident insurance by potential victims. But when this rule operates optimally as is assumed to do in the standard models, in equilibrium injurers always take optimal care and, consequently, are never held liable, and as a result, a victim or her insurer cannot expect to recover anything from injurers and therefore subrogation clauses or the other default options are not an issue.

The adequate framework in which to analyze the problem of connecting liability awards and insurance benefits is one where liability rules do not operate ideally, i. e. imperfect liability rules. We will use, however, the simplest possible imperfections under each rule, to allow the best grasp of the intuitions of the working of the three alternative regimes under imperfect functioning of liability.

Recently, Sykes (2001) has independently presented a related model intended to illuminate the issue of injurer's insolvency and how the optimal insurance contract containing subrogation provisions would allocate the reimbursement of insured and victim against the limitedly solvent injurer.[6] Sykes concentrates on optimal insurance subrogation clauses, allowing for non-pecuniary losses, unfair premiums and moral hazard of the insured, complications not considered in our model. His paper does not consider, however, the various liability rules in force nor the incentives for the injurer to take care.

There is also a policy concern behind this paper. Since the mid-seventies there has been a trend against the traditional Collateral Source Rule.[7] In the US, for instance, half the states have either abolished or modified, totally or partially, the existing rule in favor of the opposite regime of collateral benefits off-set under various forms. In the academic literature, proposals have been advanced, advocating the elimination of subrogation rights in medical malpractice[8] , in the workers compensation field[9] , or, more generally, in mandatory and social insurance.[10] The UK Law Commission even considered adopting the abolition of the right of subrogation as default rule in insurance contracts, although provisionally refrained from it, judging the step too radical—though not unsound. In general, these suggestions respond to the high administrative costs that subrogation entails, not only the certainly substantial, both private and publicly incurred, costs of the tort process, but also the greater costs of liability insurance- which many potential injurers might choose to purchase facing the prospect of considerable tort awards- over the ones of first-party accident insurance.

[5]Danzon (1984, pp. 517-532), Shavell (1987, pp. 235-255).

[6]Sykes (2001, p. 383).

[7]See Weiler (1991, p. 32 and notes) For the UK, see Law Commission, Consultation Paper No 147, Collateral Benefits (1997), and Lewis (1999, pp. 43-46).

[8]Weiler (1991, pp. 51-54).

[9]Epstein (1977, pp. 464-466); Epstein (1982, pp. 775-807); Larson (1982, pp. 483-540); Weiler (1989, pp. 825-847); Viscusi (1991, p. 186), disagrees absent conclusive evidence about the reform not affecting significantly incentives for safety.

[10]Danzon (1984); Harper, James & Gray (1986, p. 671).

The paper will be organized as follows: Section II will present the basic model and the well-known Pareto optimality conditions. Section III will consider the three alternatives with a risk-neutral injurer facing imperfect strict liability. Section IV examines a negligence rule with uncertainty in this same setting, and Section V briefly addresses the issue of administrative costs.

2 The Model

The basic assumptions of the model are as follows. Further assumptions will be made in later sections, but these will be held throughout the paper.

1.) A risk averse potential victim and a potential injurer face a positive ($0 < p < 1$) probability of an accident.

2.) The accident will determine a fixed loss $L > 0$ to the victim. The loss is monetary (we can think of a purely proprietary injury -loss of a good owned by the victim, or, alternatively, of a personal injury that determines only loss of wages or medical expenses with exclusion of nonpecuniary damages).

3.) The accident is unilateral, i.e. the probability (p) of its occurrence depends exclusively on the variable x, which represents the amount of care taken by the potential injurer. Additional units of care reduce the probability of the accident, but with diminishing effectiveness: p_x is decreasing and strictly convex.

4.) The victim has a *Von Neumann Morgenstern* utility function of wealth, v, which is increasing and strictly concave. The injurer has also a VN - M utility function of wealth, u.[11] Initial wealth for both agents is normalized to zero.

5.) There is fair insurance available, that is, with no overhead costs. So, the premium, a, will exactly equal the expected cost for the insurer: $a = p_x C$, where C is the nominal amount the victim receives in case of accident and is referred to as the level of coverage.

We will now briefly present a reminder of the well-known Diamond-Shavell optimality conditions for the insurance and liability problem.

Let me first consider the levels of insurance coverage and care that will be optimal from a social viewpoint. We will therefore make abstraction of the liability rules. These results are useful as a benchmark so that we can analyze how insurance subrogation and its alternatives in the setting of imperfect liability rules fail short in achieving fully socially efficient outcomes.[12]

The social welfare function is:

$$W = (1 - p_x)\, v\,(-a) + p_x v\,(C - L - a) + u\,(-x)$$

with the insurer's break even condition

$$a = p_x C.$$

If we plug this expression for a in W we get:

$$W = (1 - p_x)\, v\,(-p_x C) + p_x v\,(C - L - p_x C) + u\,(-x)$$

2.1 Pareto efficient level of insurance compensation

The socially optimal choice of insurance compensation is obtained from maximizing W with respect to C. Let $v'(y) = \partial v(y)/\partial y$. Then the F.O.C. on the social welfare function for C is:

$$\begin{aligned} 0 &= -(1 - p_x)\, v'\,(-a)\, p_x + p_x v'\,(C - L - a)\,(1 - p_x) \\ &\Rightarrow v'\,(-a) = v'\,(C - L - a) \end{aligned}$$

[11] We do not need to make at this point any further assumptions on the injurer's utility of wealth, because we will hold his wealth constant throughout this section.

[12] See Shavell (1982, p. 120), Shavell (1987, p. 215) and, on the insurance issue, Diamond (1977, p. 67).

Not surprisingly, because potential victims are risk averse and an accident will affect their marginal utility of income, an optimal insurance scheme will guarantee that they enjoy identical marginal utility of income in the absence or in the presence of an accident. Given this condition, and given that v is strictly concave, $v" < 0$, the only possible way in which the condition is satisfied, is the following one

$$C = L$$

The socially optimal level of coverage equals the level of losses, that is, optimality requires full coverage.

2.2 Pareto efficient level of care

To get the optimal level of care, we maximize W with respect to x. The F.O.C. for x where $a = p_x L$ and letting $p'_x = \partial p_x / \partial x$ is:

$$\begin{aligned} 0 = & - p'_x \left[v\left(-a\right) - v\left(C - L - a\right) \right] \\ & - p'_x L \left[\left(1 - p_x\right) v'\left(-a\right) + p_x v'\left(C - L - a\right) \right] \\ & - u'\left(-x\right) \end{aligned}$$

Using $C = L$ this simplifies to

$$\frac{u'\left(-x\right)}{v'\left(-a\right)} = -p'_x L$$

The left hand side is the marginal cost of taking care and the right hand side is the marginal benefit. But the cost is stated in terms of the quotient of the marginal utilities of injurer and victim. So, the higher the marginal utility of income of the injurer relative to the victim's, the lower the optimal level of care, and vice versa.

This condition implies entangling the problem of optimal care levels with income redistribution from low marginal utility of income individuals to high marginal utility individuals, through higher or lower levels of care and lower or higher accident probability and hence, insurance premiums.

We abstract from the redistribution dimension. We can assume that injurer and victim are drawn from populations of identical individuals, and that they share equally the sum of costs of coverage and insurance premia.[13]

Under this additional assumption we get the following optimal condition:

$$-p'_x L = 1$$

As expected, because we had implicitly assumed that the cost of each unit of care was 1 (of course, if unit costs of care were higher or lower, the condition would correspondingly change).

3 Strict liability regime

We will examine how the different options concerning subrogation affect the incentives for risk coverage by the potential victim and precaution taken by the potential risk-neutral injurer. As has been mentioned above, an ideal strict liability regime would make accident insurance superfluous: why should anyone want to pay premiums for coverage against losses caused by an external agent when this coverage is available for free through the legal system? The issue of subrogation of the insurer in the tort claim of the insured party would, therefore, not arise in this world.

[13] Needless to say, this does not mean that we believe that distributional matters are not at stake in the accident setting, nor even that liability rules should not be policy instruments to pursue distributional goals -although this highly debatable. It simply means that we try to focus on the strict efficiency consequences, without addressing the question of distribution.

But what would happen if the strict liability regime didn't work as the theory ordinarily assumes (i.e. perfectly). There is a variety of grounds that might cause the operation of the strict liability rule to be imperfect. By this we mean the possibility of the victim suffering a loss without complete repair payment by the injurer. Among these we can cite: (i) insufficient law enforcement so that some injurers are not identified and brought before Court (let's think of hit and run-type situations); (ii) difficulties in proving the causal linkage between the injurer's action and the victim's loss;[14] (iii) insufficient assets on the part of the injurer to make the victim whole if the accident occurs;[15] (iv) the damage payment does not amount to the actual losses incurred by the victim, either due to factual underestimation of damages by the Court or to the existence of a statutory cap on damages.

For the remainder of the paper we will make the following simplifying assumption: whatever the substantive reasons for the imperfection in the strict liability system, this imperfection will materialize in an exogenous probability q, $0 < q < 1$ that, given the occurrence of an accident, the injurer will face no damage payment and consequently, the victim will receive zero compensation through the tort system.[16] Given this eventuality of uncompensated loss, it is rational for a risk-averse potential victim to buy—at least some positive amount of—accident insurance. As the probability of receiving a Tort award if the accident materializes is positive, the issue of subrogation and its alternatives arises.

We will also assume throughout this and the following sections, that the injurer is risk-neutral, i.e. $u(y) = y$.

3.1 Collateral Source Rule

i) Faced with the prospect of an imperfect strict liability rule and the collateral source rule in the computation of damages, the situation for the victim if she suffers an accident is:

- with probability q, the insurance company compensates her directly: the victim receives C
- with probability $1 - q$, the insurance company pays compensation C and the injured party receives the tort damage payment D from the injurer which will be equal to L, assuming that the damage payment will be determined by the courts to exactly mirror the amount of losses suffered by the victim (that is the way in which the Tort system ideally operates).

The potential victim will have the following expected utility:

$$E[v] = (1 - p_x)\, v\,(-a) + qp_x v\,(C - L - a) + (1 - q)\, p_x v\,(D + C - L - a)$$

If we want to determine the (privately) optimal coverage for the potential victim we maximize this expected utility over the variable C (coverage), subject to the fair insurance constraint, $a = p_x C$.

Substituting the expression for a in $E[v]$, and after some cancellations and rearrangements, we get the following first order condition:

$$\begin{aligned} 0 = &- p_x\,(1 - p_x)\, v'\,(-a) + qp_x\,(1 - p_x)\, v'\,(C - L - a) \\ &+ (1 - q)\, p_x\,(1 - p_x)\, v'\,(D + C - L - a) \end{aligned}$$

[14] This proof is harder to provide, among others, the longer the time gap between harmful event and trial, and the larger the number of other possible intervening causes of the loss apart from the injurer's action. For instance, conclusive evidence of causation is much more difficult to establish in a pollution case, such as the presence of fish-killing pollutants in a river running in the vicinity of several chemical factories and a handful of domestic and industrial waste disposal sites, than in an ordinary automobile-pedestrian collision.

[15] From an economic perspective, see Shavell (1986, p. 45), and more recently, Ganuza and Gomez (2008, forthcoming).

[16] More complex ways of modeling the imperfection, for instance, introducing a random variable of law enforcement, or allowing for a variable loss, would not substantially alter the results, so we opt for the simplest path.

Using $D = L$, cancelling the $p_x(1-p_x)$ term and rearranging the resulting equation we obtain

$$v'(-a) = qv'(C-L-a) + (1-q)\,v'(C-a)$$

So she equates her marginal utility in the no-accident state with a lottery of the possible marginal utilities in the accident state. She is facing a gamble. The optimal amount of compensation will be partial compensation $0 < C^* < L$. The way to see this is to consider the gamble as a simple average: let $V_0' = v'(-a)$, $V_1' = v'(C-L-a)$ and $V_2' = v'(C-a)$. The first order condition says that $V_0' = qV_1' + (1-q)V_2'$, i.e. the LHS is the average of V_1' and V_2'.

If $C = L$ then $V_1' = V_0'$ but $V_2' < V_1'$ (as $L - a > -a$) so that the equality cannot hold (the RHS, $qV_0' + (1-q)V_2'$, is smaller than the LHS, V_0'). Similarly, if we let $C = 0$ then $V_0' = V_2'$ but $V_1' > V_0'$ (as $-L - a < -a$) so that the RHS is greater than the LHS. The solution is a C^* that lies somewhere in between $C = 0$ and $C = L$.

The intuitive explanation for less than full insurance coverage lies on the possibility of overcompensation for the victim if the injurer actually pays damages and the corresponding willingness to transfer some of her wealth to the no-accident state through savings in the insurance premium.

ii) There is also the problem of the injurer's incentives to take care. In the presence of both the imperfect strict liability and the collateral source rules, the potential injurer faces a tort damage payment D with probability $p_x(1-q)$. If she behaves rationally she will minimize over x her costs of care plus expected liability costs $(x + p_x(1-q)D)$.

The injurer's incentives to take care are obtained by differentiating his direct cost of care plus the expected tort payment and setting it equal to zero with $D = L$. The resulting condition is:

$$\begin{aligned} 0 &= 1 + p_x'(1-q)L \\ 1 &= -p_x'(1-q)L \end{aligned}$$

And this, given that $p_x' < 0$ and $p_x'' > 0$, implies that x^* will be below the socially optimal level of care. This dilution in the incentives to take precautionary measures, of course, comes as no surprise under the assumption of the reduced likelihood for the injurer of being hold liable, and therefore, to pay for the losses if the accident takes place. Nevertheless, in an imperfect world where q is the probability that the injurer cannot be identified, this solution would be the best possible one, the imperfect society's optimum.

3.2 Collateral benefits offset

i) If the courts use as their damage computation rule the opposite of the collateral rule, that is, a rule of insurance benefits offset, the potential victim faces the following:

- with probability q, the insurance company compensates her directly: the victim receives C
- with probability $1-q$, the insurance company pays compensation C and the injured party receives a tort damage payment from the injurer D which is her loss net of the insurance compensation she receives from the insurer, i.e. $D = L - C$ (assuming the policy is not affected by the benefit offset rule per se, just by the non subrogation that it entails).

The expected utility of the injured party is

$$\begin{aligned} E[v] &= (1-p_x)\,v(-a) + qp_x v(C-L-a) + (1-q)\,p_x v(C-L-a+(L-C)) \\ &\Leftrightarrow (1-p_x)\,v(-a) + qp_x v(C-L-a) + (1-q)\,p_x v(-a) \\ &\Leftrightarrow (1-qp_x)\,v(-a) + qp_x v(C-L-a) \end{aligned}$$

Assuming that the premium is fair, $a = p_x C$, and Maximizing $E[v]$ over C subject to the insurer's break even constraint, we get the condition for the victim's (privately) optimal coverage. Keeping in mind that D = L, after some cancellations and arrangements

$$\begin{aligned} 0 &= -p_x (1 - qp_x) v' (-a) \\ &\quad + qp_x (1 - p_x) v' (C - L - a) \\ v' (-a) &= \frac{q(1 - p_x)}{1 - qp_x} v' (C - L - a) \end{aligned}$$

Let C^*, solve this equation, then because the factor multiplying $v' (C - L - a)$, $\frac{q - qp_x}{1 - qp_x}$ is less than one then $v' (-a) > v' (C^* - L - a)$, so that $C^* < L$ (as $v"() < 0$).

Intuitively, the victim is paying actuarially fair insurance for an event that occurs with probability p_x while she receives an effective payment with probability qp_x. This is because when the injurer is found liable the victim will always receive a total payment equal to L independently of her insurance coverage. Thus, from the point of view of the victim, she is paying insurance for coverage when the injurer is not found liable, while the price covers payments both when the injurer is not found liable and when he is. The resulting price is unfair and hence she buys less than she would if the price were fair, that is, less than full coverage. As the effectiveness of the judicial system improves (the probability of the injurer being found liable increases), the probability of receiving an *effective* payment from the insurance company falls while the price of insurance stays the same, so that the victim's incentives to buy insurance fall. In the limit, as the effectiveness of the judicial system becomes perfect, the incentives to buy insurance disappear.

It is clear, anyhow, that the collateral offset rule induces a non (socially) optimal result. The reason for this lies in the fact that the benefits of buying more coverage don't accrue solely to the victim but also to the injurer, due to the benefit offset rule, although the costs are borne, through the payment of the premiums, exclusively by the insured.

ii) Given C^*, the potential injurer faces liability costs of $(L - C^*)$ with probability $p_x (1 - q)$, so she will minimize: $x + p_x (1 - q) (L - C^*)$, which results in the condition

$$\begin{aligned} 0 &= 1 + p'_x (1 - q) (L - C^*) \\ 1 &= -p'_x (1 - q) (L - C^*) \end{aligned}$$

which, in turn, implies a lower level of care, not only than the socially optimal but also than the (lower) imperfect society's optimal level induced by the collateral source rule.

3.3 Insurance benefits subrogation

i) Even if the insurance contract that links the potential victim with her insurer does not contain any insurance subrogation clauses, Courts might be able to create a rule or to apply one imposed by legislation, allowing insurers to recover from a liable defendant precisely those amounts which they had already paid to accident victims under the policies.

Assuming that both parties can anticipate this outcome, they will take it into account in the calculus of insurance premiums and potential victims will include it in the expected utility maximization program. If insurers can, accordingly, costlessly obtain reimbursement of the insurance payments made, the risk they are actually assuming through the policy is not $p_x C$ but $a = p_x C - (1 - q) p_x C = qp_x C$.

The situation faced by the potential victim is:

- with probability q, the insurance company compensates her directly: the victim receives C
- with probability $1 - q$, the insurance company pays compensation C, the injured party receives a tort damage payment net of insurance compensation from the injurer of $D = L - C$ and the

insurance company can recover from the injurer the compensation paid to the insured, which is equal to C.[17]

The expected utility of the injured party is

$$\begin{aligned}&(1-p_x)\,v(-a)+qp_x v(C-L-a)+(1-q)\,p_x v(C-L-a+(L-C))\\&\Leftrightarrow(1-qp_x)\,v(-a)+qp_x v(C-L-a)\end{aligned}$$

In other words, the situation in which the insurer pays the insured whenever the accident takes place and then recovers this amount from the injurer in the case the latter is found liable, is very similar to the situation in which the insurer pays the sum covered only when the victim cannot get a tort payment from the injurer.[18] Then, the optimal compensation is

$$\begin{aligned}0=&-qp_x(1-qp_x)\,v'(-a)\\&+qp_x(1-qp_x)\,v'(C-L-a)\\v'(-a)=&\,v'(C-L-a)\end{aligned}$$

The optimal amount of compensation is the socially optimal level, full insurance: $C=L$. The intuition behind this result is very similar as that for the collateral benefits rule: the insurance payments are effective only when the injurer is not found liable. The main difference is that the price of insurance only includes payments made when the injurer is not found liable so that from the point of view of the victim the insurance contract is fairly priced and the optimal insurance coverage is full coverage.

Subrogation induces potential victims to purchase coverage to make them whole if the accident occurs and the judicial system fails. The combination of insurance and Tort achieves the socially optimal insurance coverage.

ii) As for the injurers incentives to take care, given the previous result $C=L$, and that there is no difference for the injurer - defendant in paying $D=L=C$ to the victim or to her insurer, so the problem just duplicates that in part 1.) of this section:

$$1=-p_x'(1-q)\,L$$

To summarize the findings in this section: given the (standard) restrictive assumptions of the model, under an imperfect strict liability regime—which in any case determines a lower level of care than the socially optimal—both the collateral source and the collateral benefits offset rules induce inefficient bearing of risk on the part of the victim. Given the social limitations to make the injurer liable, only the collateral benefits offset rule induces the potential injurer to take a suboptimal level of care. Insurance subrogation, on the contrary, induces optimal insurance coverage, albeit finds herself incapable of overcoming the dilution in incentives to take care caused by the imperfect functioning of the strict liability regime.

4 Negligence regime

As has been already shown in Section I, an ideal negligence rule makes it unnecessary to address the matter of insurance subrogation. But there is also a variety of reasons that allow for imperfections in the operation of the negligence regime, and hence, for actual findings of negligence against injurers.

[17] Remember that double liability has to be avoided, so the damage award to the victim is necessarily $L-C$, or equivalently, $D-C$.

[18] This idea was first expressed by Shavell (1987, p. 255).

In this modified set of circumstances the decision about the coordination between insurance or insurance-like benefits perceivable by the victim and the damage award payable by the injurer has a role to play.

We will not discuss the multiplicity of factors that can explain why in fact some people are found negligent. These range from differences in costs of care or effectiveness of precautions across potential injurers—given that the standard of care is unique for all individuals—to court errors in setting the level of due care, to potential injurers' misconceptions about what is the legally required standard of precaution, or to injurer's optimistic beliefs about law enforcement, and so forth.[19]

In the following exposition we will solely undertake the treatment of one of these potential sources of imperfection of the negligence rule: the courts' inadequate ability to monitor and ascertain the level of care actually adopted by the injurer-defendant, x, and thus, to compare it with the level of due care, (x^d); we will further assume that courts are capable of unmistakably fixing the legally required amount of care and do so at the social optimal level, x^d, where x^d solves $1 = -p'_{x^d}L$.

More specifically, let's imagine the imperfection in the negligence system as consisting in the fact that courts always make mistakes while assessing the degree of precaution. These mistakes can be represented by a non-trivial random variable M with mean zero. That is, mistakes can be either negative (courts will perceive injurers' care as lower than it in fact was), or positive (courts will evaluate injurers' care higher than it really was), and errors are symmetrically distributed.

We will also assume that the greater the level of precaution chosen by the injurer, the smaller the imperfection in the assessment of the actual level of care will be, and correspondingly, the lower the uncertainty over liability. In particular, we assume that the uncertainty is inversely proportional to the degree of care. More specifically, given the chosen level of care x, M has a distribution on the interval $[-k, k]$, where $k > 0$, with a single-peaked, symmetric density function $f(m)$, $m \in [-k, k]$, and the courts observe $x + \frac{M}{x}$.

Consequently, the probability of the injurer being found negligent is

$$Pr\{x + M/x < x^d\} = \begin{cases} 0 & \text{if} \quad x(x^d - x) \leq -k \\ \displaystyle\int_{-k}^{x(x^d-x)} f(m)dm & \text{if} \quad x(x^d - x) \in [-k, k] \\ 1 & \text{if} \quad x(x^d - x) \geq k \end{cases}$$

Let $\pi_x = Pr\{x + M < x^d\}$ denote this probability.

Before we go into the effects of our three opposite rules, however, we must decide the question of which analytical model of the negligence rule will be used.

Two alternative approaches compete in the law and economics literature. One could be labeled as the "standard"[20] and conceives negligence as stating that, whenever the injurer's level of care—mistakenly perceived by the courts, in our imperfect setting—falls short of due level of care, the entire amount of the loss suffered by the victim is shifted to the injurer. In the particular case under examination, this means that the injurer's expected liability would be

$$\pi_x p_x L$$

The second has been advocated mainly by Grady and Kahan[21], and diverges from the previous conception in that the injurer is held liable not for the whole extension of the loss incurred by the victim, but just for the damages that would not have occurred had the injurer's level of precaution not been lower than the legal standard of care. This implies that the victim, despite the injurer's negligence, would have to bear the expected loss evaluated at the due care level, $p_{x^d}L$—which by

[19] See Grady (1988, p. 293).

[20] This approach is also dominant among the models introducing uncertainty within the negligence system: Calfee & Craswell (1984, pp. 965-974), Craswell & Calfee (1986, p. 279), Shavell (1987, p. 86).

[21] Grady (1983); Kahan (1989, p. 427).

assumption is the optimal quantity of accident costs.[22] In our case of interest, the injurer faces an expected liability of

$$\pi_x p_x \left(L - p_{x^d} L\right)$$

In this section we will use the second understanding of the negligence rule and let $L^d = L - p_{x^d} L$ denote the maximum damage payment that the injurer is liable for. A thorough justification of this choice is much beyond the scope of this paper. Nevertheless, it seems possible to find, at least tentatively, several grounds for this choice.

The modified version of the negligence model appears to incorporate the minimum of legal notions and requirements of causation that are common features of both Anglo-American and Roman-German systems.[23] Moreover, the standard model reduces the negligence rule to a mere combination of the no liability and strict liability rules. The standard of care, in this view, exhausts its function in operating as a threshold, a switch from absence of liability to strict liability, without a normative substance of its own. A third, and possibly in this setting, important reason to incorporate causal conditions in this section, is that, without them, the results regarding the choice of the level of coverage under an imperfect negligence regime would exactly mirror those under the imperfect strict liability rule. The modified negligence rule, although not substantially inducing divergent outcomes, provokes a significant qualitative difference.

The results with the standard approach to negligence, however, will be briefly summarized at the end of the section.

4.1 Collateral source rule

i) In the presence of both an imperfect negligence regime as already described, and the collateral source rule, the situation for the victim when he suffers an accident is:

- with probability π_x, the insurance company compensates her directly: the victim receives C
- with probability $1 - \pi_x$, the insurance company pays compensation C and the injured party receives a tort damage payment from the injurer of $D \left(= L^d = L - p_{x^d} L\right)$.

The potential victim will have the following expected utility:

$$E[v] = (1 - p_x)\, v\left(-a\right) + \pi_x p_x v\left(C - L - a\right) + \left(1 - \pi_x\right) p_x v\left(L^d + C - L - a\right)$$

As $L^d = L(1 - p_{x^d})$,

$$E[v] = (1 - p_x)\, v\left(-a\right) + \pi_x p_x v\left(C - L - a\right) + \left(1 - \pi_x\right) p_x v\left(C - p_{x^d} L - a\right)$$

Maximizing with respect to C subject to the fair insurance constraint we obtain

$$\begin{aligned} 0 = &- p_x \left(1 - p_x\right) v'\left(-a\right) + \pi_x p_x \left(1 - p_x\right) v'\left(C - L - a\right) \\ &+ \left(1 - \pi_x\right) p_x \left(1 - p_x\right) v'\left(C - p_{x^d} L - a\right) \end{aligned}$$

Which simplifies to

$$v'\left(-a\right) = \pi_x v'\left(C - L - a\right) + \left(1 - \pi_x\right) v'\left(C - p_{x^d} L - a\right)$$

[22] Of course, the fraction the victim bears is zero when $p_{x^d} L = 0$. In this case, both versions of the negligence rule become totally undistinguishable.

[23] This minimum causal inquiry is based on the *but for* test, necessary condition or *conditio sine qua non*, as is more familiar to the continental legal tradition. Needless to say, this test doesn't exhaust the causal requirements for tort liability, but it can be considered as the lowest common denominator regarding causation in the major legal systems.

As in the strict liability case, this shows that the victim is facing a gamble because of the possibility of cumulating the insurance benefit and the damage award, only in the negligence regime, the damage award is limited so there is always a residual loss that can be protected using insurance coverage. Thus, she will purchase partial insurance but more than in the strict liability case: $p_{x^d}L < C^* < L$.

ii) The injurer is confronted with the following costs

$$x + p_x \pi_x L^d$$

Minimizing over x yields the condition

$$0 = 1 + p'_x \pi_x L^d + p_x \pi'_x L^d$$

From this condition one can see that there are several effects that enter into the injurer's problem. The liability rule puts an upper limit on tort payments below the total victim's loss. This lowers the penalty from low care and enhances the incentives for reducing the level of care. Then, the imperfections in the judicial application of the law have two effects: first, the possibility that the injurer is found to have exercised the appropriate level of care (even if it is not true) enhances the effect of the liability rule of reducing the incentives for care; but second, the effect of increased care in reducing the probability of being found negligent enhances the incentives for care possibly even beyond the optimal level. The net effect could lead to over- or underprovision of care.

To see how these two forces interact consider the choice of $x = x^d$. Recall that x^d is assumed to have been set at the socially optimal level, i.e. using the condition

$$-p'_{x^d} L = 1$$

If we consider $x = x^d$ then the RHS would be equal to

$$1 - \pi_x \frac{L^d}{L} + p_x \pi'_x L^d$$

The forces that lead to underprovision of care enter into the second term, $\pi_x L^d / L$. In the optimal welfare problem this term is equal to one. The two forces are: one, the liability rule that lowers tort payments $\left(L^d/L < 1\right)$ and two, the possibility of not being found liable even if exercising the right level of care ($\pi_x < 1$). The third term reflects the effect of increased care in reducing the probability of being found liable. To analyze this further recall the definition of π_x and take the derivative with respect to x:

$$\frac{\partial}{\partial x}\pi_x = \frac{\partial}{\partial x}\int_{-k}^{x(x^d - x)} f(m)dm = f(x(x^d - x))(x^d - 2x),$$

As $f(m) \geq 0$, the sign of π'_x is negative (it is positive only if $2x < x^d$), i.e. at $x = x^d$ more care always reduces the probability of being found liable because too little care was taken (this is because the judicial system makes both positive and negative errors when establishing the level of care taken). The net effect depends on the relative values of the parameters ($f(m)$, L^d, etc).

4.2 Collateral benefits offset

i) In this case the situation for the victim when she suffers an accident is:

- with probability π_x, the insurance company pays C
- with probability $1 - \pi_x$, the insurance company pays C and the injured party receives a tort damage payment from the injurer of D, which is equal to L^d net of insurance payments C. Note that $D \geq 0$ so that if $C \geq L^d$ then the injurer does not have to pay anything: $D = \max\left\{0, L^d - C\right\}$.

The potential victim will have the following expected utility:

$$E[v] = (1-p_x)\,v(-a) + \pi_x p_x v(C-L-a) + (1-\pi_x)\,p_x v(D+C-L-a)$$

This can also be expressed as

$$E[v] = \begin{cases} (1-p_x)\,v(-a) + \pi_x p_x v(C-L-a) + (1-\pi_x)\,p_x v(C-L-a) & if \quad C \geq L^d \\ (1-p_x)\,v(-a) + \pi_x p_x v(C-L-a) + (1-\pi_x)\,p_x v(-p_x L-a) & if \quad C \leq L^d \end{cases}$$

In order to maximize over C, we obtain the following derivative of $E[v]$ (after dividing by p_x)

$$\begin{cases} -(1-p_x)\,v'(-a) + (1-p_x)\,v'(C-L-a) & if \quad C \geq L^d \\ -\left[(1-p_x)\,v'(-a) + (1-\pi_x)\,p_x v'(-p_x L-a)\right] + \pi_x(1-p_x)\,v'(C-L-a) & if \quad C \leq L^d \end{cases}$$

We know that there is a value of C such that the first condition is equal to zero, namely $C = L$. As for the second condition, as $C \leq L^d$ we know that

$$v'(-a) < v'(-p_x L-a) < v'(C-L-a)$$

We can look at the upper bound for the value of the term in square brackets:

$$\begin{aligned}(1-p_x)\,v'(-a) + (1-\pi_x)\,p_x v'(-p_x L-a) &\leq (1-p_x)\,v'(-p_x L-a) + (1-\pi_x)\,p_x v'(-p_x L-a) \\ &= (1-\pi_x p_x)\,v'(-p_x L-a)\end{aligned}$$

This bound is above the minimum value of $\pi_x(1-p_x)\,v'(C-L-a)$ which is attained when $C = L^d$ and is equal to $\pi_x(1-p_x)\,v'(-p_x L-a)$. Thus, it could be that a second solution is possible, one such that $C \in \left(0, L^d\right)$. Nevertheless, if such a solution exists it would be a local maximum as the utility obtained from $C = L$ is necessarily higher (by the concavity of v).

In conclusion, the potential victim will buy full insurance. Recall from the discussion of the collateral benefits offset regime in case of strict liability, that the victim is *de facto* subsidizing the injurer's tort payments. The reduced tort payments implied by the current liability rules exacerbates this effect at low levels of coverage: the victim is subsidizing the injurer and on top of that she is left with a residual risk. At high levels of coverage the reduced tort payments combined with the collateral offset rule imply that the victim receives no payments from the injurer. Thus she must rely exclusively on insurance. As insurance has an actuarially fair premium it is optimal to buy full coverage.

ii) Given that the victim is purchasing full insurance, the injurer faces no *de facto* liabilities and hence he must minimize the direct costs, i.e. x. Thus it is optimal to take no care at all.

4.3 Insurance benefits subrogation

i) This case is similar to that of collateral benefits offset only now the insurance company can recover insurance payments from a liable defendant and this affects the insurance premium. The victim when she suffers an accident faces:

- with probability π_x, the insurance company compensates her directly: the victim receives C
- with probability $1-\pi_x$, the insurance company pays compensation C and the injured party receives tort damage payment from injurer of D, which is equal to L^d net of insurance payments C. Note that $D \geq 0$ so that if $C \geq L^d$ then the injurer does not have to pay anything: $D = \max\left\{0, L^d - C\right\}$.

The insurance company can recover C if $C \leq L^d$ and L^d if $C > L^d$ from the injurer.

The potential victim will have the same expected utility as in the collateral benefits offset regime only the risk premium a varies, i.e.:

$$E[v] = (1-p_x)\, v\,(-a) + \pi_x p_x v\,(C-L-a) + (1-\pi_x)\, p_x v\,(D+C-L-a)$$

This can also be expressed as

$$E\,[v] = \begin{cases} (1-p_x)\, v\,(-a) + \pi_x p_x v\,(C-L-a) + (1-\pi_x)\, p_x v\,(C-L-a) & if \quad C \geq L^d \\ (1-p_x)\, v\,(-a) + \pi_x p_x v\,(C-L-a) + (1-\pi_x)\, p_x v\,(-p_x L-a) & if \quad C \leq L^d \end{cases}$$

In this regime, the fair insurance premium is not $p_x C$, but

$$a = \begin{cases} p_x \pi_x C + (1-\pi_x)\, \frac{L^d}{C} C & if \quad C \geq L^d \\ p_x \pi_x C & if \quad C \leq L^d \end{cases}$$

Given this new constraint, the F.O.C. is described by the conditions

$$\begin{cases} -\pi_x\,(1-p_x)\, v'\,(-a) + (1-\pi_x p_x)\, v'\,(C-L-a) & if \quad C \geq L^d \\ -\pi_x\,(1-p_x)\, v'\,(-a) + \pi_x\,(1-\pi_x p_x)\, v'\,(C-L-a) - (1-\pi_x)\, \pi_x p_x v'\,(-p_x L-a) & if \quad C \leq L^d \end{cases}$$

The first condition can be rewritten as

$$-\pi_x\,(1-p_x)\,[v'\,(-a) - v'\,(C-L-a)] + (1-\pi_x)\, v'\,(C-L-a)$$

As $v' > 0$ and $[v'\,(-a) - v'\,(C-L-a)] < 0$ for $C \leq L$ then this condition is strictly positive for $C \in [L^d, L]$ and the victim insures fully (and would like to overinsure if it were possible).

The second condition can also be simplified to:

$$-\left[(1-p_x)\, v'\,(-a) + (1-\pi_x)\, p_x v'\,(-p_x L-a)\right] + (1-\pi_x p_x)\, v'\,(C-L-a)$$

Again we look for an upper bound for the term in square brackets:

$$\begin{aligned}(1-p_x)\, v'\,(-a) + (1-\pi_x)\, p_x v'\,(-p_x L-a) &< (1-p_x)\, v'\,(-p_x L-a) + (1-\pi_x)\, p_x v'\,(-p_x L-a) \\ &= (1-\pi_x p_x)\, v'\,(-p_x L-a)\end{aligned}$$

As $v'\,(-p_x L-a)$ is the lower bound for $v'\,(C-L-a)$ for $C \in \left[0, L^d\right]$ then

$$(1-\pi_x p_x)\, v'\,(C-L-a) \geq (1-\pi_x p_x)\, v'\,(-p_x L-a)$$

So that

$$-\left[(1-p_x)\, v'\,(-a) + (1-\pi_x)\, p_x v'\,(-p_x L-a)\right] + (1-\pi_x p_x)\, v'\,(C-L-a) > 0.$$

Thus there is no optimal C in $\left[0, L^d\right]$ and the only solution is $C = L$. The logic is very similar to that for the collateral benefits offset regime, only in the current regime the insurance company recovers part of its costs from the injurer which is reflected in lower insurance premia which in turn increases the incentives of the potential victim to buy insurance. The natural conclusion that follows from this is that the potential victim buys full coverage and would like to overinsure if allowed to.

ii) As the injurer-defendant pays the insurance company but its liability is limited then his problem is to minimize

$$x + \pi_x p_x L^d$$

which is the same problem as in the collateral source rule regime with identical conclusions.

A necessary qualification of these results is that they are dependent on the use of the causation-incorporating negligence rule.

Suppose that instead of considering that the liability rule sets a maximum tort payment of L^d, we use the standard liability rule. Then, the outcomes with the use of the standard negligence model can be sketched in the following way: (i) the incentives for insurance coverage would be identical to the imperfect strict liability case examined in Section 3. This comes as no surprise, as from the point of view of potential victims, a standard negligence regime with findings of negligence is equivalent to an imperfect strict liability rule;[24] (ii) The effects on the choice of level of care by the potential injurer are indeterminate: she might take too little or too much care with respect to the social optimum, although it is plausible, as previous studies on uncertainty have shown, that the injurer would tend to choose an excessive level of care in both the collateral source rule and the insurance benefits subrogation regimes.[25] However, under insurance benefits offset, the level of care would be zero and the probability of accidents is maximized.

5 Administrative costs

The choice among the three alternative regimes of coordinating insurance and similar kinds of benefits, and tort awards is not just a matter of theory, but requires to balance, in the actual functioning of legal systems, the benefits and costs of the options involved. In the previous sections, deterrence and insurance effects have been considered, and now we will turn to administration costs. As we are not aware of any defense of the traditional collateral source rule over insurance subrogation on administrative costs grounds, we will concentrate the discussion in this Section on the choice between a subrogation rule and a collateral benefits off-set rule, both as default rules in contractual settings, and as mandatory rules in non-contractual ones such as Workers' Compensation or Social Security systems.

Insurance subrogation (either as contractual provision or as default rule), is criticized as entailing substantial transaction and administrative costs. It is obvious that the processing of subrogation rights by insurance companies is costly. Moreover, the claims against liable injurers or their liability insurers (more on these in a while), might well end up in Court, entailing costs both to the litigating parties and to the public.

The apparent stronghold of collateral benefits offset lies, on the contrary, in the so-proclaimed significant savings in transaction and administrative costs. It can be argued that the cost-reducing properties of this rule would be twofold. First, it eliminates the costs connected with the dealing of claims by insurers. Second, as the expected judgement against a liable injurer or liability insurer is reduced by the amount of any insurance benefits received by the victim, the incentive to sue, other things being equal, diminishes and, correspondingly, so do the costs associated with trial.[26] When the benefits paid to the victim equal the loss incurred by her, the expected damage award is zero and the possibility of going to Court disappears.

The results presented in the previous Sections of this paper raise doubts about the weight of these arguments and may serve, to some extent, to undermine the faith in the administrative cost advantage of the collateral set-off rule, or, at least, the importance of this advantage. First, it is very unlikely that dispersed victims will be able to handle their rights to Tort compensation more cost-effectively than insurance companies their subrogation rights: the latter are professional and repeated players, have internal counsel and can avoid duplication efforts with centralization. And given imperfect liability rules, a potential victim considering her optimal behavior under the rule of benefits off-set will often not opt for full insurance coverage. This implies that she would retain the expectation of a damage award against the injurer. So the number of cases in which the victim

[24] Shavell (1987, p. 84), stresses the strict liability component of the findings of negligence.

[25] See Craswell & Calfee (1986, p. 282), and Shavell (1987, pp. 94-96).

[26] Danzon (1986, pp. 57-72), presents evidence about the effects of the offset rule as inducing reductions in the frequency and amount of claims in the medical malpractice area.

has a legal right to a damage award is no lower than the ones in which there is a subrogation claim under the insurance subrogation rule.

In areas of compulsory or social insurance, however, things might turn out to be more complicated. The State could impose a mandatory level of coverage, which theoretically, could be set at the socially optimal amount (i.e., perfect coverage). the combination of this and collateral benefits set-off provides both optimal bearing of risk and a dramatic sink in transaction and litigation costs. The drawback, obviously, is represented by the dilution of incentives to take care by potential injurers.

The preference for this scheme purely in terms of its administrative convenience may be, however, more disputed than it appears. Even if we disregard the costs of regulatory standard-setting and enforcement, there are still notable obstacles to surmount. As litigation costs are concerned, the outcome appears relatively indeterminate. If, to cover the dilution of incentives for care, society needs to rely more on civil and criminal penalties instead of Tort damages to the victim,[27] or payments to subrogated insurers, simply shifts litigation and its related costs from private parties on both sides, to the Government, on one side, and potential injurers violators of regulatory requirements, on the other. In other words, it simply substitutes administrative or criminal litigation for civil litigation. And to answer which one is more likely and/or costly, other things being equal, is very difficult on a theoretical basis and would require an empirical assessment of legal and factual data for the different jurisdictions.

A second property of benefits offset that is commonly underlined is that it does away with the Tort system and Courts as being the forum in which accident and liability insurers solve their differences. As it happens, however, the presence of liability insurers instead of liable injurers as addressees of subrogation claims, serves arguably the goal of diminishing administration costs: Insurance companies are experienced negotiators and have continuous reciprocal relations, so they are better suited to dispose of claims in the most cost-effective way.[28] As a matter of fact, certain arrangements have emerged whose purpose consists precisely in dealing with subrogation claims without incurring high administration and litigation costs. We are referring to the so-called *Schadensteilungsabkommen* and *Regressverzichtabkommen*, between German liability insurance companies, on the one side, and accident and medical insurers and Social Security bodies, on the other. The former type of agreement implies that the party entitled to subrogation can obtain a specified share of the benefits paid to the victim (hence why they are called damage sharing agreements) from the liability insurer of the presumed injurer without detailed proof of causation or fault, provided only that the damage was consequence of the risk covered in the liability insurance policy. The latter type contains the *selling* for a lump sum to a liability insurer of all the subrogation rights that might arise against her within the contract period .

All the factors presented in this Section lead to the impression that the presumed administration and transaction costs advantage favoring the collateral benefits offset rule are substantially less clear as might be generally supposed, and thus, undermines the main argument in pro of the more or less general adoption of this rule. To this one should add the shortcomings of the set-off regime in terms of adequate risk coverage and, more importantly, in terms of deterrence. In fact, empirical studies (Rubin and Shepherd 2007) seem to show that the move away from the Collateral Source Rule and the advances of various forms of set-off regimes have had an statistically significant effect on the number of non-motor vehicle accidental deaths, thus giving support to the dilution of incentives effect identified in this paper.

[27]This substitution raises the problem of inefficient risk-bearing on the part of risk-averse potential violators given that criminal penalties are not insurable, and civil ones might be only limitedly insurable.

[28]Levmore (1982, p. 829).

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