Efficiency of Liability Rules: A Reconsideration*

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Abstract

In the mainstream of law and economics the notion of negligence is defined as the failure to take at least the legally specified due care level. In the standard tort model, with this notion of negligence, the efficient liability rules are characterized by the condition of negligence liability which requires that if one party is negligent and the other nonnegligent then the entire accident loss must be borne by the negligent party.

This paper is concerned with the question of efficiency of liability rules when the notion of negligence is defined as failure to take some cost-justified precaution. The main result of the paper shows that there does not exist any liability rule which is efficient when negligence is identified by the existence of some cost-justified untaken precaution.

Keywords: Liability Rules, Efficient Liability Rules, Notion of Negligence, Untaken precaution, Negligence Rule.

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An important question that one can ask regarding any institution is whether its structure is such that when rational individuals act within its framework they are induced to act in ways so that the social outcome which comes about as a consequence of the totality of actions undertaken by the individuals is efficient. It is evident that, from the perspective of governance, particularly of governance with focus on the objective of economic development, the importance of efficient institutions, institutions with the characteristic of invariably yielding efficient outcomes from the interplay of actions undertaken by purposive individuals, cannot be overemphasized. In recent decades a large part of contemporary law has been analyzed to determine whether the relevant legal rules and procedures have this characteristic of always giving rise to efficient outcomes.

A central question in the economic analysis of tort law is how to apportion accident loss between victim and tortfeasor so that both parties involved in the harmful interaction are induced to take socially optimal levels of care. There is an extensive literature on the efficiency of liability rules, the rules for apportioning losses between victims and injurers. Considerations relating to efficiency of liability rules have occupied an important place in the law and economics literature right from its inception. The pioneering contribution by Calabresi (1961) analyzed the effect of liability rules on parties' behaviour. In his seminal contribution Coase (1960) looked at liability rules from the point of view of their implications for social costs. The rule of negligence was analyzed by Posner (1972) from the perspective of economic efficiency. The first formal analysis of liability rules was done by Brown (1973). His main results demonstrated the efficiency of the rule of negligence and the rule of strict liability with the defense of contributory negligence; and the inefficiency of strict liability and no liability. Formal treatment of some of the most important results of the vast literature on liability rules is contained in Landes and Posner (1987) and Shavell (1987). A complete characterization of efficient liability rules is contained in

Jain and Singh (2002).

In the literature dealing with the question of efficiency of liability rules, the problem has generally been considered within the framework of accidents resulting from interaction of two risk-neutral parties, the victim and the injurer. The social goal is taken to be the minimization of total social costs, which are defined to be the sum of costs of care taken by the two parties and expected accident loss. The probability of accident and the amount of loss in case of occurrence of accident are assumed to depend on the levels of care taken by the two parties. A liability rule determines the proportions in which the two parties are to bear the loss in case of occurrence of accident on the basis of whether and by what proportions the parties involved in the interaction were negligent. A liability rule is efficient iff it invariably induces both parties to behave in ways which result in socially optimal outcomes, i.e., outcomes under which total social costs are minimized. The central result regarding the efficiency question that has emerged is that a liability rule is efficient if and only if it satisfies the condition of negligence liability. The condition of negligence liability requires that in a two-party interaction if one party is nonnegligent and the other party is negligent then the entire loss, in case of occurrence of accident, must be borne by the negligent party. From the necessity and sufficiency of negligence liability for efficiency it follows that the rules of negligence, negligence with the defense of contributory negligence and strict liability with the defense of contributory negligence, among the commonly used liability rules, are efficient; the rules of strict liability and no liability are not.

In the mainstream of law and economics the notion of negligence is defined with respect to the legally specified due care level. If an individual's care level is found to be less than the legally specified level then the individual is adjudged to have been negligent. On the other hand if the care level is equal to or greater than the legally specified care level, the individual is adjudged to have been nonnegligent. The efficiency of liability rules, with few exceptions, has been discussed using this mainstream notion of negligence; coupled with the assumption that the courts specify the due care levels appropriately from the perspective of minimization of total social costs.

While in the law and economics literature it is common to conceptualize the notion of negligence as described above, it is by no means uncontroversial. In opposition to the mainstream view, it has been argued that the courts do not determine negligence as visualized in the law and economics literature. Rather, whether a party is adjudged to be negligent or not depends on whether the opposite party is able to show the existence of some cost-justified precaution which was not taken. That is to say, a party is deemed to be negligent iff it can be shown that the party could have averted some harm by taking care which would have cost less than the loss due to harm.[1] This paper is concerned with deriving the implications of this way of defining negligence for the efficiency of liability rules.

The main result of the paper shows that if negligence is determined on the basis of cost-justified untaken precautions then there is no liability rule which is efficient. Thus the results on the efficiency of liability rules crucially depend on what constitutes negligence. If it turns out that the courts indeed determine negligence on the basis of cost-justified untaken precautions, and not on the basis of shortfall of actual care from some legally specified standard, there would be far-reaching implications for both positive and normative analysis of tort law.

The paper is divided in three sections. The first section sets out the framework of analysis and formalizes the notion of negligence determined on the basis of cost-justified untaken precautions. The next section contains the statement and the proof of the general impossibility theorem. The last section contains some concluding remarks on the implications of the general impossibility theorem from positive and normative perspectives.

1 Definitions and Assumptions

We consider accidents resulting from interaction of two parties, assumed to be strangers to each other, in which, to begin with, the entire loss falls on one party to be called the victim (plaintiff). The other party would be referred to as the injurer (defendant). We denote by $a \geq 0$ the index of the level of care taken by the victim; and by $b \geq 0$ the index of the level of care taken by the injurer.

Let

$A = \{a \mid a \geq 0$ is the index of some feasible level of care which can be taken by the victim$\}$, and

$B = \{b \mid b \geq 0$ is the index of some feasible level of care which can be taken by the injurer$\}$.

We assume:

$$0 \in A \ \wedge \ 0 \in B. \tag{A1}$$

We denote by $c(a)$ the cost to the victim of care level a and by $d(b)$ the cost to the injurer of care level b.

Let $C = \{c(a) \mid a \in A\}$, and $D = \{d(b) \mid b \in B\}$.

[1] This view has been most consistently, and cogently, articulated by Grady (1983, 1984, 1989).

We assume:

$c(0) = 0 \ \wedge \ d(0) = 0.$ (A2)

We also assume that c and d are strictly increasing functions of a and b respectively.

(A3)

In view of (A2) and (A3) it follows that:

$(\forall c \in C)(c \geq 0) \ \wedge \ (\forall d \in D)(d \geq 0).$

A consequence of (A3) is that c and d themselves can be taken as indices of levels of care of the two parties.

Let π denote the probability of occurrence of accident and $H \geq 0$ the loss in case of occurrence of accident. Both π and H will be assumed to be functions of c and d; $\pi = \pi(c, d), H = H(c, d)$. Let $L = \pi H$. L is thus the expected loss due to accident.

We assume:

$(\forall c, c' \in C)(\forall d, d' \in D)[[c > c' \ \rightarrow \ L(c, d) \leq L(c', d)] \ \wedge \ [d > d' \ \rightarrow \ L(c, d) \leq L(c, d')]].$

(A4)

In other words, it is assumed that a larger expenditure on care by either party, given the expenditure on care by the other party, results in lesser or equal expected accident loss.

Total social costs (TSC) are defined to be the sum of cost of care by the victim, cost of care by the injurer, and the expected loss due to accident; $TSC = c + d + L(c, d)$. Let $M = \{(c', d') \in C \times D \mid c' + d' + L(c', d') \text{ is minimum of } \{c + d + L(c, d) \mid c \in C \ \wedge \ d \in D\}\}$. Thus M is the set of all costs of care configurations (c', d') which are total social cost minimizing. It will be assumed that:

C, D and L are such that M is nonempty. (A5)

Corresponding to each $(c, d) \in C \times D$, we define:

$$C^u(c, d) = \{c^u \in C \mid c^u > c \wedge L(c, d) - L(c^u, d) > c^u - c\}$$
$$D^u(c, d) = \{d^u \in D \mid d^u > d \wedge L(c, d) - L(c, d^u) > d^u - d\}.$$

Thus, $C^u(c, d)$ is the set of all cost-justified untaken precautions at (c, d) which the victim could have taken; and $D^u(c, d)$ is the set of all cost-justified untaken precautions at (c, d) which the injurer could have taken.

We define:

$$
\begin{aligned}
\hat{c}(c,d) &= \sup C^u(c,d) \quad \text{if } C^u(c,d) \neq \emptyset \\
&= c \quad \text{if } C^u(c,d) = \emptyset
\end{aligned}
$$

and

$$
\begin{aligned}
\hat{d}(c,d) &= \sup D^u(c,d) \quad \text{if } D^u(c,d) \neq \emptyset \\
&= d \quad \text{if } D^u(c,d) = \emptyset
\end{aligned}
$$

Let I denote the closed unit interval $[0,1]$[2]. Given C, D, π and H, we define functions p and q as follows:

$$
\begin{aligned}
p : C \times D \mapsto I \text{ by: } \quad p(c,d) &= \tfrac{c}{\hat{c}(c,d)} \quad \text{if } \hat{c}(c,d) \neq 0 \\
&= 1 \quad \text{if } \hat{c}(c,d) = 0 \\
q : C \times D \mapsto I \text{ by: } \quad q(c,d) &= \tfrac{d}{\hat{d}(c,d)} \quad \text{if } \hat{d}(c,d) \neq 0 \\
&= 1 \quad \text{if } \hat{d}(c,d) = 0
\end{aligned}
$$

p and q would be interpreted as proportions of nonnegligence of the victim and the injurer respectively. $(1-p)$ and $(1-q)$ consequently would denote the proportions of negligence of the victim and the injurer respectively.[3]

A liability rule is a rule which specifies the proportions in which the two parties are to bear the loss in case of occurrence of accident as a function of proportions of nonnegligence of the two parties. Formally, a liability rule is a function f from I^2 to I^2, $f : I^2 \mapsto I^2$, such that: $f(p,q) = (x,y)$, where $x + y = 1$.

Let C, D, π and H be given. If accident takes place and loss of $H(c,d)$ materializes, then $x[p(c,d), q(c,d)]H(c,d)$ will be borne by the victim and $y[p(c,d), q(c,d)]H(c,d)$ by the injurer. As, to begin with, in case of occurrence of accident, the entire loss falls upon the victim, $y[p(c,d), q(c,d)]H(c,d)$ represents the liability payment by the injurer to the victim. The expected costs of the victim and the injurer, to be denoted by EC_1 and EC_2 respectively, therefore, are $[c + x[p(c,d), q(c,d)]L(c,d)]$ and $[d + y[p(c,d), q(c,d)]L(c,d)]$ respectively. Both parties are assumed to prefer smaller expected costs to larger expected costs and be indifferent between alternatives with equal expected costs.

[2] In addition to denoting the set $\{x \mid 0 \leq x \leq 1\}$ by $[0,1]$, we denote by $[0,1)$ the set $\{x \mid 0 \leq x < 1\}$.

[3] To define proportions of negligence and nonnegligence the way they have been defined here seems to be an appropriate way to do so in a framework where negligence is determined on the basis of existence of some cost-justified untaken precaution. It should, however, be noted that there are other plausible ways of defining proportions of negligence and nonnegligence. For the impossibility result of this paper, the particular way in which proportions of negligence and nonnegligence have been defined here, is not crucial.

Let f be a liability rule. An application of f consists of specification of C, D, π and H satisfying (A1) - (A5). The class of all applications satisfying (A1) - (A5) will be denoted by $\mathcal{A}$.

f is defined to be efficient for a given application $< C, D, \pi, H >$ satisfying (A1) - (A5) iff $(\forall(\overline{c}, \overline{d}) \in C \times D)[(\overline{c}, \overline{d})$ is a Nash equilibrium $\rightarrow (\overline{c}, \overline{d}) \in M]$ and $(\exists(\overline{c}, \overline{d}) \in C \times D)[(\overline{c}, \overline{d})$ is a Nash equilibrium].[4] In other words, a liability rule is efficient for a given application $< C, D, \pi, H >$ satisfying (A1) - (A5) iff (i) every pure-strategy Nash equilibrium is total social cost minimizing, and (ii) there exists at least one pure-strategy Nash equilibrium. f is defined to be efficient with respect to a class of applications iff it is efficient for every application belonging to the class.

The following example illustrates some of the above ideas.

Example 1

Let liability rule f be the negligence rule defined by: $(\forall p \in [0,1])(\forall q \in [0,1))[f(p,q) = (0,1)] \wedge (\forall p \in [0,1])[f(p,1) = (1,0)]$.
Consider an application of f such that:
$C = D = \{0, 1, 2\}$;
For $(c, d) \in C \times D$, let $L(c, d)$ be as given in the following array:

		d		
		0	1	2
	0	10.0	7.0	5.5
c	1	7.0	4.0	2.5
	2	5.5	2.5	1.0

Here $(2, 2)$ is the unique TSC-minimizing configuration of costs of care.
For $(c, d) \in C \times D$, we have $C^u(c, d)$ as given in the following array:

		d		
		0	1	2
	0	$\{1,2\}$	$\{1,2\}$	$\{1,2\}$
c	1	$\{2\}$	$\{2\}$	$\{2\}$
	2	$\emptyset$	$\emptyset$	$\emptyset$

And the following array gives $D^u(c, d)$ for $(c, d) \in C \times D$:

[4] Throughout this paper we consider only pure-strategy Nash equilibria.

		d		
		0	1	2
	0	$\{1,2\}$	$\{2\}$	$\emptyset$
c	1	$\{1,2\}$	$\{2\}$	$\emptyset$
	2	$\{1,2\}$	$\{2\}$	$\emptyset$

Therefore, we obtain:
$(\forall(c,d) \in C \times D)[\hat{c}(c,d) = 2 \ \wedge \ \hat{d}(c,d) = 2]$.

The following array gives, for $(c,d) \in C \times D$, $EC(c,d) = (EC_1(c,d), EC_2(c,d))$:

		d		
		0	1	2
	0	$(0,10)$	$(0,8)$	$(5.5,2)$
c	1	$(1,7)$	$(1,5)$	$(3.5,2)$
	2	$(2,5.5)$	$(2,3.5)$	$(3,2)$

Therefore $(2,2)$ is the only pure-strategy Nash equilibrium. Thus f is efficient for this application.

Now, we define a condition on liability rules.

Condition of Negligence Liability (NL): A liability rule f satisfies the condition of negligence liability iff $[[\forall p \in [0,1)][f(p,1) = (1,0)] \ \wedge \ [\forall q \in [0,1)][f(1,q) = (0,1)]]$.
In other words, a liability rule satisfies the condition of negligence liability iff its structure is such that (i) whenever the injurer is nonnegligent and the victim is negligent, the entire loss in case of accident is borne by the victim, and (ii) whenever the victim is nonnegligent and the injurer is negligent, the entire loss in case of an accident is borne by the injurer.

2 Negligence as Cost-Justified Untaken Precaution and Efficient Liability Rules: The General Impossibility Theorem

Proposition 1 *If a liability rule f is efficient for every application belonging to $\mathcal{A}$ then it satisfies the condition of negligence liability.*

Proof: Let f be any liability rule violating condition NL. As condition NL is violated, we must have:

$[\exists p \in [0,1)][f(p,1) \neq (1,0)] \ \vee \ [\exists q \in [0,1)][f(1,q) \neq (0,1)]$.

Suppose $[\exists q \in [0,1)][f(1,q) \neq (0,1)]$ holds.

Suppose for $q_0 \in [0,1)$ we have:

$f(1,q_0) = (x_{q_0}, y_{q_0}), y_{q_0} \neq 1$.

Let t be a positive number. As $y_{q_0} \in [0,1)$, we have $y_{q_0}t < t$. Choose a positive number r such that $y_{q_0}t < r < t$.

As $q_0 \neq 1, (1-q_0) \neq 0$. Let $d_0 = \frac{r}{1-q_0}$

Let $0 < \epsilon$ and $0 < c_0$.

Now let C and D be specified as follows:

$C = \{0, c_0\}, D = \{0, q_0d_0, d_0\}$.

For $(c,d) \in C \times D$, let $L(c,d)$ be as given in the following array:

		d		
		0	q_0d_0	d_0
c	0	$t + q_0d_0 + c_0 + \epsilon$	$t + c_0 + \epsilon$	$c_0 + \epsilon$
	c_0	$t + q_0d_0$	t	0

It should be noted that the above specification of C, D and L is consistent with (A1)-(A5). Furthermore, the specification of L is done in such a way that no inconsistency would arise even if $q_0 = 0$.

As $\epsilon > 0$ and $t > r = (1-q_0)d_0$, it follows that (c_0, d_0) is the unique total social cost minimizing configuration.

The following array gives $C^u(c,d)$ for $(c,d) \in C \times D$:

		d		
		0	q_0d_0	d_0
c	0	$\{c_0\}$	$\{c_0\}$	$\{c_0\}$
	c_0	$\emptyset$	$\emptyset$	$\emptyset$

And the following array $D^u(c,d)$ for $(c,d) \in C \times D$:

		d		
		0	q_0d_0	d_0
c	0	$\{d_0\}$	$\{d_0\}$	$\emptyset$
	c_0	$\{d_0\}$	$\{d_0\}$	$\emptyset$

Therefore, we obtain:
$(\forall(c,d) \in C \times D)[\hat{c}(c,d) = c_0 \ \wedge \ \hat{d}(c,d) = d_0]$.

Now, expected costs of the injurer at $(c_0, q_0 d_0) = EC_2(c_0, q_0 d_0)$
$= q_0 d_0 + y_{q_0} L(c_0, q_0 d_0)$
$= q_0 d_0 + y_{q_0} t$

$EC_2(c_0, d_0)$
$= d_0$

$EC_2(c_0, d_0) - EC_2(c_0, q_0 d_0)$
$= d_0 - q_0 d_0 - y_{q_0} t$
$= (r - y_{q_0} t)$
> 0.

This establishes that (c_0, d_0) is not a Nash equilibrium. Thus f is not efficient for the application under consideration. Consequently, it is not the case that f is efficient for every application belonging to $\mathcal{A}$. In case $[\exists p \in [0,1)][f(p,1) \neq (1,0)]$ holds, an analogous argument shows that it is not the case that f is an efficient liability rule for every application belonging to $\mathcal{A}$.

Thus it follows that if f is efficient for every application belonging to $\mathcal{A}$ then it must satisfy condition NL; establishing the proposition.

Proposition 2 *If a liability rule f is efficient for every application belonging to $\mathcal{A}$ then it violates the condition of negligence liability.*

Proof: Let f be any liability rule satisfying condition NL.
Let $f(1,1) = (x^*, y^*)$.
First suppose that $x^* > 0$.
Let t be a positive integer such that: $\frac{1}{t} < x^*$.[5]
Choose positive numbers $c_0, d_0, \theta_1, \theta_2, L_0, \epsilon_1, \epsilon_2, \epsilon_3, \epsilon_4, \epsilon_5$ such that:
(i) $\epsilon_3 < \epsilon_2$
(ii) $\epsilon_4 < \epsilon_1$
(iii) $\epsilon_1 < \epsilon_4 + \epsilon_5$

[5]It should be noted that as $x^* \in (0,1]$, it follows that $t > 1$.

(iv) $\epsilon_2 < \epsilon_3 + \epsilon_5$
(v) $\epsilon_3 + \epsilon_4 + \epsilon_5 < \epsilon_1 + \epsilon_2$
(vi) $\epsilon_1 - \epsilon_4 < \theta_1$
(vii) $\epsilon_2 - \epsilon_3 < \theta_2$
(viii) $L_0 > t\epsilon$, where ϵ is any number greater than max $\{\epsilon_1, \epsilon_2, \epsilon_3, \epsilon_4, \epsilon_5\}$.[6]

Now consider the following application belonging to $\mathcal{A}$:
$C = \{0, c_0, c_0 + \epsilon_1\}, D = \{0, d_0, d_0 + \epsilon_2\}$
For $(c, d) \in C \times D$, let $L(c, d)$ be as given in the following array:

		d		
		0	d_0	$d_0 + \epsilon_2$
	0	$c_0 + d_0 + \theta_1 + \theta_2 + L_0$	$c_0 + \theta_1 + L_0$	$c_0 + \theta_1 + L_0 - \epsilon_3$
c	c_0	$d_0 + \theta_2 + L_0$	L_0	$L_0 - \epsilon_3$
	$c_0 + \epsilon_1$	$d_0 + \theta_2 + L_0 - \epsilon_4$	$L_0 - \epsilon_4$	$L_0 - \epsilon_3 - \epsilon_4 - \epsilon_5$

(c_0, d_0) is the unique total social cost minimizing configuration.

We obtain $C^u(c, d)$, $(c, d) \in C \times D$, as given in the following array:

		d		
		0	d_0	$d_0 + \epsilon_2$
	0	$\{c_0, c_0 + \epsilon_1\}$	$\{c_0, c_0 + \epsilon_1\}$	$\{c_0, c_0 + \epsilon_1\}$
c	c_0	$\emptyset$	$\emptyset$	$\{c_0 + \epsilon_1\}$
	$c_0 + \epsilon_1$	$\emptyset$	$\emptyset$	$\emptyset$

And $D^u(c, d)$, $(c, d) \in C \times D$, as given in the following array:

		d		
		0	d_0	$d_0 + \epsilon_2$
	0	$\{d_0, d_0 + \epsilon_2\}$	$\emptyset$	$\emptyset$
c	c_0	$\{d_0, d_0 + \epsilon_2\}$	$\emptyset$	$\emptyset$
	$c_0 + \epsilon_1$	$\{d_0, d_0 + \epsilon_2\}$	$\{d_0 + \epsilon_2\}$	$\emptyset$

Therefore, we obtain $\hat{c}(c, d)$, $(c, d) \in C \times D$, as given in the following array:

[6] This can always be done. $\epsilon_1 = \epsilon_2 = 4, \epsilon_3 = \epsilon_4 = 2, \epsilon_5 = 3, \theta_1 = \theta_2 = 3, \epsilon = 5$, provides a simple example.

		d		
		0	d_0	$d_0 + \epsilon_2$
	0	$c_0 + \epsilon_1$	$c_0 + \epsilon_1$	$c_0 + \epsilon_1$
c	c_0	c_0	c_0	$c_0 + \epsilon_1$
	$c_0 + \epsilon_1$	$c_0 + \epsilon_1$	$c_0 + \epsilon_1$	$c_0 + \epsilon_1$

And $\hat{d}(c, d)$, $(c, d) \in C \times D$, as given in the following array:

		d		
		0	d_0	$d_0 + \epsilon_2$
	0	$d_0 + \epsilon_2$	d_0	$d_0 + \epsilon_2$
c	c_0	$d_0 + \epsilon_2$	d_0	$d_0 + \epsilon_2$
	$c_0 + \epsilon_1$	$d_0 + \epsilon_2$	$d_0 + \epsilon_2$	$d_0 + \epsilon_2$

Now, expected costs of the victim at $(c_0, d_0) = EC_1(c_0, d_0)$
$= c_0 + x^* L(c_0, d_0)$
$= c_0 + x^* L_0$

$EC_1(c_0 + \epsilon_1, d_0)$
$= c_0 + \epsilon_1 + x(1, \frac{d_0}{d_0+\epsilon_2})L(c_0 + \epsilon_1, d_0)$
$= c_0 + \epsilon_1$
as $x(1, \frac{d_0}{d_0+\epsilon_2}) = 0$ by condition NL.

$EC_1(c_0, d_0) - EC_1(c_0 + \epsilon_1, d_0)$
$= c_0 + x^* L_0 - c_0 - \epsilon_1$
$= x^* L_0 - \epsilon_1$
Now,
$x^* > \frac{1}{t} \wedge L_0 > t\epsilon \wedge t > 0 \wedge \epsilon > 0 \rightarrow x^* L_0 > \epsilon$
$\rightarrow x^* L_0 > \epsilon_1$
$\rightarrow x^* L_0 - \epsilon_1 > 0.$

Therefore it follows that (c_0, d_0) is not a Nash equilibrium. Thus f is not efficient for the application under consideration. Consequently, it is not the case that f is an efficient liability rule for every application belonging to $\mathcal{A}$. By an analogous argument it can be shown that if $y^* > 0$ then it is not the case that f is an efficient rule for every application belonging to $\mathcal{A}$.

As we must have $(x^* > 0 \vee y^* > 0)$, it follows that it is not the case that f is efficient for every application belonging to $\mathcal{A}$.

This establishes that if f is efficient for every application belonging to $\mathcal{A}$ then it must violate condition NL.

Theorem 1 *There is no liability rule which is efficient for every application belonging to $\mathcal{A}$.*

Proof: Follows immediately from Propositions 1 and 2.

An implication of the above general impossibility theorem is that it is not the case that the negligence rule is efficient for every application belonging to $\mathcal{A}$. The following example shows the inefficiency of negligence rule for a particular application.

Example 2

Consider the following application of the negligence rule:
$C = D = \{0, 1, 5\}$.
For $(c, d) \in C \times D$, let $L(c, d)$ be as given in the following array:

		d		
		0	1	5
	0	18	14	12
c	1	14	10	8
	5	12	8	3

Here $(1, 1)$ is the unique TSC-minimizing configuration of costs of care.
For $(c, d) \in C \times D$, we have $C^u(c, d)$ as given in the following array:

		d		
		0	1	5
	0	$\{1, 5\}$	$\{1, 5\}$	$\{1, 5\}$
c	1	$\emptyset$	$\emptyset$	$\{5\}$
	5	$\emptyset$	$\emptyset$	$\emptyset$

And the following array gives $D^u(c, d)$ for $(c, d) \in C \times D$:

		d		
		0	1	5
	0	$\{1, 5\}$	$\emptyset$	$\emptyset$
c	1	$\{1, 5\}$	$\emptyset$	$\emptyset$
	5	$\{1, 5\}$	$\{5\}$	$\emptyset$

Therefore, the following array gives $\hat{c}(c,d)$ for $(c,d) \in C \times D$:

		d 0	1	5
	0	5	5	5
c	1	1	1	5
	5	5	5	5

And the following array $\hat{d}(c,d)$ for $(c,d) \in C \times D$:

		d 0	1	5
	0	5	1	5
c	1	5	1	5
	5	5	5	5

The following array gives, for $(c,d) \in C \times D$, $EC(c,d) = (EC_1(c,d), EC_2(c,d))$:

		d 0	1	5
	0	$(0,18)$	$(14,1)$	$(12,5)$
c	1	$(1,14)$	$(11,1)$	$(9,5)$
	5	$(5,12)$	$(5,9)$	$(8,5)$

Therefore $(5,5)$ is the only pure-strategy Nash equilibrium. Thus the negligence rule is inefficient for this application.

3 Concluding Remarks

The economic analysis of common law carried out in the last four and a half decades, starting from the pioneering contributions of Calabresi and Coase, has shown that common law is by and large efficient. This has resulted in economic efficiency being perceived as an idea capable of providing a unified positive theory of law. In this connection it is rather important to note that in order for an idea to constitute an explanation for an institution it is not sufficient to demonstrate that the institution in question embodies the idea; it also needs to be shown that there is no other institution which can be an embodiment of the idea. Merely showing that the institution embodies the idea, at best, can constitute a partial explanation for the institution. For a complete theory one would need a set of ideas which can completely characterize the institution for which a theory is to be provided. Thus, viewing of economic efficiency as a unifying explanation for law is, strictly speaking, not warranted on the basis of the findings of economic analysis; from the findings one can only claim a partial explanatory role for efficiency. The significance of the results of this paper lies in the fact that if the courts in fact determine negligence on the basis of existence of some cost-justified untaken precaution then even the status of economic efficiency as that of providing a partial explanatory role in the context of legal institutions would become questionable.

In the contemporary discourse on rules and institutions, the desirability of having efficient rules and institutions is taken for granted. If in reality the courts decide question of negligence on the basis of shortfall of actual care from the due care level then most liability rules used in practice are efficient; and consequently do not need to be replaced by other rules if the sole consideration in the selecting of the rules is economic efficiency. On the other hand, if the courts in fact decide question of negligence on the basis of the existence of some cost-justified untaken precaution then exclusive or even predominant preoccupation with efficiency would suggest need for reform. To bring in efficiency one would either have to have a procedure for determining negligence which is more conducive from the efficiency perspective or alternatively design rules different from liability rules which in conjunction with negligence as failure to take cost-justified untaken precautions would achieve efficient outcomes.

If one wants to accommodate efficiency considerations within the framework of negligence as failure to take cost-justified precautions to the extent possible, one possible way to proceed would be to first define a quasi-ordering over the set of all liability rules $\mathcal{L}$ and then consider the maximal elements of $\mathcal{L}$ with respect to the quasi-ordering as follows: Let f be a liability rule and let $\mathcal{A}_f^i \subseteq \mathcal{A}$ denote the set of applications for which f is inefficient. Define a binary relation R over the set of all liability rules by: $[(\forall f, g \in \mathcal{L})[fRg \leftrightarrow \mathcal{A}_f^i \subseteq \mathcal{A}_g^i]]$. It is clear that R is reflexive and transitive, i.e., is a quasi-ordering. Let $\mathcal{L}_m$ denote the set of maximal elements of $\mathcal{L}$ with respect to R. If one wants to retain the framework of negligence as failure to take cost-justified precautions and has no requirement other than efficiency then at first glance it would seem that the choice of a liability rule must be made from $\mathcal{L}_m$ only.

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