

UC Berkeley

Latin American and Caribbean Law and Economics Association (ALACDE) Annual Papers

Title

On Causal Apportioning and Efficiency in Tort Law

Permalink

<https://escholarship.org/uc/item/0gw2q5x3>

Authors

Acciarri, Hugo A.
Castellano, Andrea
Tohmé, Fernando

Publication Date

2008-03-24

On Causal Apportioning and Efficiency in Tort Law

Hugo A. Acciarri* Andrea Castellano* Fernando Tohmé*†

Abstract

Mainstream economic analysis of Tort Law takes for granted that efficiency cannot be reached by allocating liability according to causal apportioning. In this paper we will present some ways to escape from the full scope of this claim. We start by reviewing the standard conception of causality in the economic analysis of Tort Law, to show how some underlying assumptions influence the currently held view on the relation between causal apportioning and efficiency. Then, we revisit those assumptions to see how plausible they actually are. In the light of this discussion we introduce an alternative framework of causal reasoning in Tort Law. We will show how our model yields a way of allocating liability in terms of a causal apportioning rule. The outcomes obtained through this procedure are closer to efficiency than those prescribed by the mainstream.

1 Introduction

As science historians know too well, scientific disciplines have to face, at some stages, shocking realizations. The past century, for instance, amidst uncountable novelties, exhibited a surprising number of “pessimism-inducing” results in many areas. While seemingly coordinated in time, they were not related to each other, at least in principle. But all of them went against the accepted wisdom of past eras, in which it seemed that exactness and all-encompassing knowledge were attainable. Among these results the best known are Gödel and Turing’s theorems in meta-mathematics and Heisenberg’s uncertainty principle in quantum mechanics. On the other hand, Arrow’s and Sen’s theorems in economics challenged the previous wishful and soothing assumptions on the inner workings of human societies.

*Universidad Nacional del Sur, Bahía Blanca (Argentina). acciarri@satlink.com, acastell@uns.edu.ar

†CONICET (National Council of Research of Argentina). ftohme@criba.edu.ar

A similar kind of underlying pessimistic conclusions can be drawn in more modest instances. This is the case of the economic analysis of causation in Tort Law. In spite of the still scarce literature on the matter, the claim that *efficiency cannot be reached by allocating liability according to causal apportioning* is an already accepted fact in the field. As in the aforementioned cases, this conclusion is loaded with negative overtones. It is the purpose of this paper to discuss some ways to escape from the full scope of this claim.

In the next section we will review the standard analysis of causality in the economic analysis of Tort Law, in order to show how it influences the current view on the relation between causal apportioning and efficiency. In section 3, we will revisit the ideas of the mainstream to see how plausible they actually are. In the light of this discussion we will introduce an alternative framework of causal reasoning in Tort Law. In section 4, we will show that our alternative model leads to an alternative conception of efficiency in causal apportioning. We will prove, in particular, that there exist a way to allocate liability according to causal apportioning that leads to outcomes that are closer to efficiency than those prescribed by the mainstream. Moreover, we will sketch a kind of decision algorithm for this matter. Finally, we will briefly explore whether this procedure actually goes along with more traditional legal ideas as well as with current philosophical developments in the area.

2 The Standard View

It has been frequently claimed that mainstream Law & Economics disregards the role of causal relations in torts, at least in the usual sense of the traditional legal scholarship. The main reason of this failure seems to hinge on the normative core of the approach, aimed to seek efficiency. So, for Law & Economics the very idea of *cause* becomes reduced just to *efficient prevention*. This characterization of causation has been labeled **causal minimalism**.

Calabresi (1970) and later Landes and Posner (1983,1987) have stated that causation does not play a role in imposing liability. More precisely, for them causality does not play an independent role in the determination of liability and the causation of an injury should be always attributed to the injurer if she has the lower cost of avoidance. This position is summarized in the following claim: “when efficiency analysis is conducted to determine

liability, it can be fully pursued without reference to causation”.

Formal models of agents’ behavior in the face of an injury (Brown 1973, Shavell 1980) also postulate a symmetry among the roles of the injurer and the victim and the absence of any independent requirement of causation. These models have set the benchmark for subsequent economic analyses of Tort Law, in which the expected harm is seen as a function of the levels of care taken by both parties. The actions of either one (or both) agents raise the probability of harm and thus can be seen as causes of an expected harm.

Explicit characterizations of the causal relation involved in a tort have been given by Shavell (1980, 1987). He states that care (or lack of care) is a necessary cause of harm if, given some state of the world, a different level of care would have led to a different level of expected harm. For an action A to rise the probability of a harm relative to another action B , there must be a state of the world in which harm occurs **only if** A is taken, and not if the other action B is taken.

Parisi and Fon (2004)¹ make the following claim on the kind of causal inputs that can be found in torts:

*...As has been extensively debated in the literature, each party’s causal input should not be evaluated in isolation, since in some cases both inputs affect causation of an accident additively, while in other cases they do so multiplicatively, or a mix thereof.*²

Following the standard line of thought on causality, Parisi and Fon present a formal model of “comparative causation”. They postulate a rule in which liability is borne on the basis of parties’ respective causal contribution to the loss. They define the welfare functions of both parties, $w^i(z, x)$ and $w^v(u, y)$, where i is the injurer and v the victim. The first one represents the injurer’s expected income from undertaking an activity level z with a level of care x while $w^v(u, y)$ is the welfare function of the victim where u is her activity level and y her level of care. Increasing care is costly and leads to decreasing benefits. Moreover, it is assumed that both $w^i(\cdot, x)$ and $w^v(\cdot, y)$ are strictly concave in x and y , respectively.³

¹Summarizing the views of Landes and Posner (1983), Rizzo and Arnold (1980, 1986), Kaye and Aickin (1984), Wright (1985), and Kruskal (1986)

²There exists a class of cases in which the causal effects are just additive. Then, it becomes easy to apportion liability upon the amount of causation. Strassfeld (1992) notices that those additive cases help the courts to determine feasible shares of liabilities.

³That is, if $w^i(\cdot, x)$ and $w^v(\cdot, y)$ are continuous and twice differentiable, then $w_x^i, w_{xx}^i < 0$ and $w_y^v, w_{yy}^v < 0$.

In turn, let $l(x, y)$ be the expected loss per unit of activity, determined by the levels of care of both parties, and assume it is decreasing and strictly convex in each variable.⁴ Since the loss is proportional to the level of activity of both parties, the total loss is assumed to be $zul(x, y)$.

According to these different effects, Parisi and Fon derive the individual causal contributions to the accident, $c^i(z, x)$ and $c^v(u, y)$. They postulate that $c_z^i, c_u^v > 0$ while $c_x^i, c_y^v < 0$. This means that, on one hand, a decreasing level of activity of either party leads to a lower corresponding causal contribution to the resulting loss. On the other, an increase of care by an agent has the contrary effect on the expected damages.

They illustrate their claim with two kinds of cases, one in which causal inputs are *complements* and the other where they are *substitutes*. Causal complementarity is represented by a multiplicative causal relationship: the overall causation factor is given by the product of the causal inputs of both parties: $c_i(z, x)c_v(u, y)$. The case of causal substitutability, instead, is captured by means of an additive relationship: the overall causation factor is given by the sum of the causal inputs $c_i(z, x) + c_v(u, y)$. In both cases, the causation factor operates as a normalized index that is multiplied by the total damage. In each of these cases, parties do not fully internalize the effect of their actions, and have, therefore, incentives to engage in an excessive level of activity.

All in all, the aforementioned work clearly exhibits the standard point of view in the discipline: the imposition of liability on the basis of pure causal contributions is inconsistent with the goal of achieving efficiency. Moreover, the very interaction of causal relations is seen as an obstacle in the path towards the efficient allocation of liabilities. Accordingly, the solutions to that problem are based either on supposedly disregarding the real-world causal relations (Singh 2002)⁵ or on supplementing the rule of causal apportionment with non-causal ingredients.⁶

⁴If $l(x, y)$ is continuous and twice differentiable in x and y , then $l_x, l_y < 0$ and $l_{xx}, l_{yy} > 0$.

⁵ "...in these studies the term 'cause' does not have any meaning beyond economic (in)efficiency..."

⁶Negligence, for instance, as an autonomous rule.

3 Towards an Alternative Framework

As said above, Parisi and Fon’s model -as the literature generally does⁷- stems from an intuitive idea of causation, which is formally described by Shavell (1987)⁸ as follows:

Definition of necessary causation: *given the state of the world s , taking level of care x_1 is a necessary cause of losses $l(x_1, s)$ relative to taking level of care x_2 if $l(x_1, s) \neq l(x_2, s)$*

We will focus precisely on this starting point. As it has been said, Law & Economics has usually been called “minimalist” in relation to its approach to tort causation. In some sense, this adjective is used to mean that only a minimal trait is required by Law & Economics scholars to deem a factor as *causally eligible*, in order to satisfy efficiency. In general, the property of being a *necessary cause* is the only one required by the mainstream to qualify an action (or, in turn, and generally speaking, an event) as the cause of a certain harm.

Shavell’s characterization of necessary causation is, however, rather unorthodox. For one thing, it leaves room for ambiguity. The same formula $l(x_1, s) \neq l(x_2, s)$, with $l^1 = l(x_1, s)$ and $l^2 = l(x_2, s)$, might be understood as defining x_2 as a *sufficient* condition of l^2 as well as defining x_1 as a *necessary* condition of l^1 . To see this, consider the following example. Let x_1 be the event “greeting your neighbor” while x_2 is understood as “shooting your neighbor”. Then, l^1 implies a null loss (corresponding to a state of the world in which your neighbor keeps being alive) while l^2 involves a positive loss (all other things being equal, your neighbor is no longer alive). But then, it does not make much sense to see “greeting your neighbor” (x_1) as a necessary condition of the life-preservation of your neighbor. On the other hand, it is sensible to say that “shooting your neighbor” (x_2) is in general a sufficient condition for his death.

In fact, the characterization of necessary conditions can be presented more clearly in terms of formal logic than by algebraic conditions. The propositional formula $\neg q \rightarrow \neg p$ captures the idea that q is a necessary condition of p . In terms of truth valuations the meaning of this formula is that *the falseness of q guarantees the falseness of p* .⁹

⁷See Acciarri et al. (2001)

⁸Cf. pp. 119.

⁹As it is well known, this way of expressing these kinds of relations is not free from problems and criticisms. See the entry on *Necessary and Sufficient Conditions*, in **The**

On the other hand, the very notion of necessary condition in the field of Tort Law is, as in the general realm of causation, by itself ambiguous. Aware of that, philosophers and philosophers of law have introduced more refined notions, like the INUS (*insufficient but non-redundant part of an unnecessary but sufficient condition*)¹⁰ and, particularly, NESS (*necessary element of a sufficient set*)¹¹ conditions. By means of them, the role of individual events in the causation of torts can be more precisely described. Accordingly, we will assume from now on that the NESS category captures the essence of causality better than *necessary, but-for* and other somehow related conditions.

In fact, legal scholars like Wright (1985, 1988) strongly advocate for the practical use of the NESS test over the *but-for* one as the only guideline on how to detect “genuine” causality in the field. This notwithstanding, there does not exist a full consensus on the role of the NESS test and its relation with causal inquiries. Other scholars claim (against Wright’s proposition) either that the NESS test is only the first step in a complex procedure or that the usual stages in causal inquiries in Tort Law, namely the quests for the “actual” and the “proximate” causes of a harm, are just cover-ups for legal policy decisions on liability.

The re-examination of the usual examples in the Law & Economics literature can show clearly that the way in which the usual expressions (acts, omissions, events, etc.) are related to torts might also be captured by employing the notion of NESS conditions.¹² So, the NESS test, as the first step of a complex procedure, yields a semantical gain without any loss. That is, the search for causal allocations of liability can begin by checking whether or not a causal-candidate factor is a NESS condition, but then it has to move forward to the selection of those of them that also are efficient (Salvador-Coderch et al., 2004).

In formal terms, the NESS test can be re-interpreted as a preliminary procedure intended to find potential causal contributions to individual harms. However, only if, additionally, that contribution is consistent with

Stanford Encyclopedia of Philosophy,

<http://plato.stanford.edu/entries/necessary-sufficient/>.

¹⁰Mackie fathered the term, first suggested to him by Stove. See **The Cement of Universe**, pp. 62, note 5.

¹¹The so-called *NESS test* was originally suggested by Hart and Honoré (1985). See also Wright (1985).

¹²Indeed, every *but-for* condition must pass the NESS test, given that the scope of the former fully includes one of the latter.

our goal, a factor can be deemed a cause.

A digression is on point here. We do not agree with the usual viewpoints that either complain about or are satisfied with standard Law & Economics strategies for transforming the “proper”, “original” or “commonsense” meaning of *causality* in an unorthodox way. We assume, instead, that if the NESS requirement holds for some elements, almost any goal-oriented screening procedure among them should be legitimately regarded as an orthodox causal inquiry. We will not debate this proposition in detail in this paper. Nevertheless, we will present some examples of usual causal reasoning in order to illustrate the point.

Still, an additional challenge remains. Usual causal quests tend to choose *causes* in the sense of *picking some individual factors* (events, states, etcetera) *discarding others*. Whatever the method employed to make this choice, its result ends up being a *discrete* determination -any element that is a certified NESS condition will become deemed either a *cause* or a *no-cause* of a certain consequence. Then, we may conclude that seeing causal inputs as continuous variables stretches the meaning of causal relationships. Nevertheless, taking them to be so fits properly into the economic theory of torts.

Notice that we do not equate the fact of *being a causally eligible factor* of a certain harm with *making a quantifiable causal contribution* to the same outcome. Once selected the legal causes among the set of NESS conditions of a harm, we focus on the role of the selected elements to assess their liability on the basis of their causal influence (represented, at this stage, by real numbers).

To summarize, our procedure undergoes the following stages:

- **Stage 1:** find those potential causally influential factors that pass the NESS test for the harm. This describes a class \mathcal{C}^{NESS} .
- **Stage 2:** define the class of *legal causes* as $\mathcal{C}^C = \{c \in \mathcal{C}^{NESS} : c > 0\}$ (each $c \in \mathcal{C}^C$ is seen as a real variable).
- **Stage 3:** to each party responsible for a $c \in \mathcal{C}^C$ allocate a corresponding and proportional liability.

In the rest of the paper we will concentrate on the third stage of this procedure.

4 Revisiting the Canonical Framework

While the main focus of this paper is on the analysis of causal apportioning, this may be seen as a subsidiary issue of a broader subject matter: a general economic theory of causation in tort law. Although its full development exceeds the scope of this work, some of the main goals for such theory are the following:

- To provide an account of the general notions of causal reasoning.
- To elaborate a thorough view of its subject matter, adequate to the usual concepts of causal reasoning specific to the legal field. At least for the instances in which legal causal reasoning is seen as a particular case of general causal reasoning.
- To provide means to distinguish among all the events in the world, those that could be regarded either as legal causes or non-causes of harms.
- To yield analytical tools that assign liability on the basis of legal causes with the aim of achieving economic efficiency.
- To focus on causal apportioning, as a way to determine how to split liability, according to the purpose of the analysis, among the agents.

As it was shown above, usual criticisms from the legal camp point basically at the second item, blaming the standard economic analysis for giving a misrepresentation of the actual role of causal relations in Tort Law. Authors on the economic side, in turn, often implicitly, accept this contention assuming that causation has a different meaning than in the legal field (Singh, 2002).

On the other hand, the economic analysis of law faces a major problem in dealing with the third goal. By assuming that omissions could also be considered legal causes, Shavell's (1987) algebraic characterization of *necessary cause* as equal to *legal cause*, yields an almost infinite number of "legal causes" due to the omissions of many agents. Worse yet, in the usual analyses the legal causes are seen as given. Procedural positions (plaintiff, defendant) are equaled to substantial ones (victim, injurer) although no strict correspondence between both categories exists. Clearly, a plaintiff must be either a victim (of her defendant) or not and, correlatively, a defendant must be either an injurer (of her victim) or not. The causal issue,

precisely, plays a central part in this determination. It is easy to see that the defendant would be the injurer of her plaintiff if and only if she caused (in a legally relevant sense) a harm to her victim. Only recently (Salvador-Coderch et al., 2004) the mainstream theory has been refined in order to deal with this difficulty.

Finally, modern theoretical developments have also dealt with the fourth and fifth goals (Singh, 2002; Parisi and Fon, 2004). Nonetheless, up to some extent, and deliberately or not, they disregard some of the first three issues.

In the rest of this section we will sketch a theoretical framework aimed to accomplish the objectives enumerated above. Far from trying to prove here that our theoretical sketch captures every one of the goals, we will only suggest a seemingly coherence with them. Moreover, our focus will be on analyzing a simple procedure to deal at the same time with the third, fourth and fifth of those goals. We will suggest some simple features that could make a theory of causation in Tort Law *probably* consistent with our first and second goals and would encompass some modern developments intended to deal with the rest of them in a coherent apparatus. This framework may also show that some sort of apportioning of liability on the basis of causal contribution can yield allocations much closer to efficiency than it was usually believed possible. This can be done in ways less tributary of non-causal ingredients. Moreover, we will suggest that this is possible without any significant redefinition of traditional legal procedures and respecting the usual philosophical concepts on this matter. In addition, our formal procedure will apportion liability on causal basis by generating an efficient and unique Nash Equilibrium outcome. It will also apportion the loss in excess over the efficient outcome, between inefficient-behaving parties in a locally efficient way.

As it is well known, instead of the one-step approach that characterizes the standard economic strategy of relating a contributing factor to a harm, most legal systems apply a two-step approach.¹³ This procedure undergoes two conceptually distinguishable phases. The first one checks whether a

¹³The expression *two-step approach* is the usual name of a category generally assumed by mainstream European scholars. This kind of approach is said to be also a trend in American Law. See Schwartz(2000). The two-step approach described in this paper, however, differs from the one described by Salvador-Coderch et al. (2004). Nonetheless, both are complementary: while they emphasize on the scope of liability (an issue intentionally disregarded in this paper), we focus on the apportionment of liability.

candidate causal factor is a NESS condition of the harm.¹⁴ The procedure enters the second phase once the first one yields a positive answer. It only intends to verify whether the candidate factor, verifying a NESS condition, makes a positive contribution to the harm.

This kind of approach may also be employed to find causes and consequences in everyday life. However, exploring this possibility is far beyond the scope of this paper. Nonetheless, we will try to show that this kind of two-step approach, being closer to usual commonsense and legal purposes, might also be an analytical tool more consistent with the goal of detecting efficiency than the one usually employed by Law & Economics scholars

Let us start by exploring the essence of the first step. As suggested above, to avoid the ambiguity of natural language, we will rely, explicitly, on a procedure that checks whether or not a candidate factor is a NESS condition of a certain harm. We loosely conceive as “factors” many different entities, like states, (positive or negative ones) events, facts, etc., as to cover the various uses of the expression in legal matters. So, for instance, the state of *being alive* will be as much a NESS condition of the death of a person as the event of *shooting the victim*.

For our purposes, this first step does not define anything else but the quality or property of being a NESS condition. But this, as said, makes a factor a potentially causally eligible factor. As shown in the aforementioned example, *shooting the (would-be) victim* fulfills this requirement, so, we can claim that this event contributed, in this sense, to the death of the victim. Nonetheless, up to this point, we cannot claim that this or any other factor made a positive contribution, *in the usual quantitative sense of Law & Economics*, to the harm suffered by the victim. Each of these factors is individually necessary to complete a set of joint factors that is sufficient to bring about the harm, but no one of them has, so far, any quantifiable participation in the causation.

As we said above, this first step may be common to any situation in which causes for something are sought. The next step, however, is less generally applied (and yields less neutral results) when other goals are pursued. If we were asked about the cause of a plane crash we could easily identify the gravity pull of Earth and the failure of a turbine, among others, as NESS conditions (and so, be considered potentially causally eligible factors). But we will rarely mention both conditions as causes in the same footing. As

¹⁴In legal terms this involves to check whether it fulfills *but-for*, *actual cause*, *cause in fact* or similar conditions.

an illustration of how gravity acts on objects, a plane crash shows what it can cause. But, instead, in an accident report the emphasis would be on the turbine failure as the cause of the plane crash.

The difference exhibited in these examples is not just a matter of information. What matters, when something is deemed as a cause of some event, is fundamentally the goal of the inquiry. Consequently, if we were pursuing the goal of allocating efficiently liabilities, we would select among the already selected factors in the way that best suits our efficiency-oriented inquiry. Once the choice is made, the resulting factors are the ones we will actually indict as *causes*.

At this point, a clash of intuitions seems to be involved in the procedure. On one hand, the choice of causally eligible factors described above is *discrete*. On the other, we seek to assign to each of those that will be actually chosen as causes a *proportion*. That is, treat them as *continuous variables*. In fact, there is no real contradiction. Both steps are clearly distinguishable and the differences between one and the other are neat. Again, the example with other causality-seeking fields is useful. Physicists analyzing complex real world phenomena select some potentially causing factors and then quantify the amount that each of them contributes to the overall behavior. In this case the same is true. Commonsense inquiries usually operate in a similar way. We can name a few factors (say, a strong wind or the lack of maintenance) as causes of an event (the collapse of an old wall), but will consider some as more important than the others. If we were asked, we would be willing to attribute “a higher proportion in the causation” to them.

To show with a little bit of formal notation how this two-step approach operates, let x, y and z be NESS conditions and then, causally eligible factors, of a harm $l(\cdot, s)$. Furthermore, assume that the legal decision maker picks x and y (and not z) as legal causal factors of $l(\cdot, s)$ in order to reach an efficient allocation. z , instead, is seen for this purpose as a non-causal-factor.

We discard the assumption that $l(\cdot, s)$ is null, running against the custom in the classic literature on Law & Economics. We, instead, go along more traditional views in the legal literature.¹⁵

We consider a state of the world and a combination of conditions that optimize the sum of causal contributions and the loss that arises from the harm $l(\cdot, s)$. In more formal terms, we consider, for a given state s , a combi-

¹⁵See Wright (1985, 1988). This is a way to deal with the traditional “backward approach”, allegedly neglected by mainstream Law & Economics.

nation of factors given by a vector associated to the injurer, X_i and another to the victim, X_v . Entries x_i, x_v capture the causal input of each agent implied in a single case and define an *optimal set* of causal inputs, while x_i^*, x_v^* are the single optimal entries in X_i and X_v , such that they yield $\min_{x_i, x_v} x_i + x_v + l(x_i, x_v, s)$.

Employing vectors enumerating the possible actions (and omissions) by the agents is a choice of representation intended to capture both the basis of causal reasoning as well as the usual way of running economic analyses in the field. “Causal inputs” represented in these vectors, then, involve all the dimensions of the influence of an agent on the consequent harms. So, we can associate a real number to each single action in order to denote the cost of lowering that influence. Hence $x_i, x_v \geq 0$. That cost encompasses the burden of the precaution (this term, in its usual sense) taken to perform the action and the cost of decreasing the level of activity to a certain point. Parisi and Fon (2004) against Landes and Posner (1987, pp. 70-71) and Gilles (1992), -who suggest that courts take into account activity levels in their assessment of negligence whenever it is feasible to do so-, claim that no threshold of “optimal activity level” is generally invoked by legal rules as a liability allocation mechanism, accounting for the difficulty of pinpointing a critical value separating efficient from inefficient activity levels. So, they claim, “*absent such critical threshold, no discontinuity in the parties’ expected liability can be created*”.

By the same token, no threshold of “optimal activity level” is required as an ingredient of negligence in our model. Instead, activity level is employed only as a component of causal inputs. Yet it remains the difficulty for the court to observe the actual level of activity. But this, rather unavoidable feature of reality is not an obstacle for our analysis: many dimensions of negligence are plainly unobservable (e.g., how focused was a driver on the road) and some straightforward manifestations of the level of activity, on the contrary, are clearly apparent (e.g., the quantity of liquid transported by a pipeline). So, in our model, the difficulty to observe activity levels in some actual cases as well as some dimensions of precaution is not a *formal* constraint. It would be so if the rule of negligence played any role and the “level of activity” were a feature excluded of the meaning of “negligence”. But this is only a contingent issue that will not be addressed at this stage.

Back to the formalism, $l(x_i, x_v, s)$ represents the expected loss given x_i, x_v at state s . This state involves all the things that may not count as causally eligible factors as well as all those that may be such but are left aside in our selection.

Then, the choice of some vectors (for simplicity we will take only X_v and X_i ¹⁶) defines the agents who are seen as owning the legally relevant causal inputs and then, as authors of the harm. This choice is made uniquely on the basis of one entry in those vectors: the component of the optimal set.

To see how $l(x_i, x_v, s)$ reacts to variations in the efforts of the agents we can consider three cases:

- $l(x_i, x_v, s) = l(x_i^*, x_v^*, s)$.

As it will be shown, this case represents an efficient and unique Nash equilibrium. Moreover, this conclusion is independent of the liability rule applied, under the condition that the burden of the overall loss is imposed either on the injurer or on the victim. An immediate intuition arises from this statement: by definition, the injurer in this case is not negligent (having chosen x_i^*), so, under negligence, all the loss will fall on the victim, and the condition of efficiency will be fulfilled.

However, if the rule is pure strict liability, the analysis deserves a little more detailed attention. Let us assume that this rule simply means that *all the loss must be allocated on the legal cause/s of the harm*. Under the usual negligence rule, calling the conduct of the victim (for liability purposes) a causal factor of the harm is clearly irrelevant when the behavior of the injurer is not negligent. An additional complication arises under strict liability if we assume that both the victim's and the injurer's behaviors are the cause of the harm. If under this rule the only and sufficient requirement for allocating the loss is causality, we may think that both individuals should share the loss, in any proportion. In short, if we deem the behavior of the victim a cause of the harm, we can allocate *any* proportion of the loss on that agent.

However there is no need to proceed in this way. Usual legal constraints frequently free the victim from any causal attribution on her harm. In American Law the lack of the so called *proximate causation* is often used in this sense (to exclude, for instance, pedestrians from the causation of their harms in road accidents), and in European and Latin American liability systems a class of parallel tools fulfills the same role. The effect of those legal tools consists in negating *any* causal role, liability-wise, to some factors that may have passed the NESS test. So, being the conduct of the victim a non-

¹⁶Just in order to restrain the scope of this paper, we will not analyze the case of several injurers. That is the case in which the number of elements of the optimal set of single entries (belonging each of them to a different vector) exceeds two. Such cases involve a particular difficulty for our framework.

cause, all the liability will be allocated on the only remaining causal factor: the injurer’s behavior. Thus, the initial efficiency condition is fulfilled.

- $l(x_i, x_v, s) < l(x_i^*, x_v^*, s)$.

Keeping in mind the above considerations and the way to allocate liability (under the rules considered), this case is quite simple. It implies that at least one party has engaged in costs higher than the optimal ones. This is not rational, since the investment in diminishing a party’s causal input cannot be compensated by the resulting decreasing in the loss. So, there are no incentives to act in this way.

- $l(x_i, x_v, s) > l(x_i^*, x_v^*, s)$.

This case, in turn, is probably the most interesting. It arises every time the actual loss surpasses $l(x_i^*, x_v^*, s)$ and $x_i < x_i^*$, $x_v < x_v^*$ or both.¹⁷ When so, any procedure intended to assign any fraction of the loss larger than the savings from diminishing their causal input would be enough to induce any of the parties involved in the case to adopt her optimum value (x_i^* or x_v^*) (Singh, 2002). By definition, starting from $x_i^* + x_v^* + l(x_i^*, x_v^*, s)$, any decrease in x_v^* and/or in x_i^* brings about a larger increase in $l(x_i, x_v, s)$. This means that any less effort by any agent in lowering her causal influences turns to increase the loss more than proportionally to this reduction. So, in this case, there is always room for assigning a quantity equal to the parties’ savings out of the incremental loss over the optimum. Still, the excess of loss may not become exhausted. So, any division of the amount that remains after that assignation will be enough to generate the proper incentives to each party for adopting the optimal behavior.

However, an additional beneficial goal must be pursued, let say something close to the so called “corrective justice”. In the real world it would still exist a bundle of cases in which the parties will not adopt the proper conduct and where the need of imposing liability remains. Let us consider the following table, illustrating a simple case.

<i>Actual loss</i>	x_v	x_i
3*	1*	2*
10	0	2
15	1	1
20	0	0

¹⁷Being $l(\cdot, s)$ the *expected* loss, the actual loss might be larger than $l(\cdot, s)$, still in case of $x_i = x_i^*$ and $x_v = x_v^*$. This is why that constraint holds.

where n^* denotes the optimal value for any variable in the light of social cost. For simplicity's sake we assume here that the actual loss equals the expected loss.

Let us deal, then, with the worst scenario (always in terms of social cost), that is, the fourth row. It shows an increasing in $l(\cdot, s)$, i.e. of actual loss, over the optimum, of 17, and a reduction (saving of effort) of 1, for the victim, and 2 for the injurer. It is easy to conclude that, out of the additional 17, assigning any amount larger than 1, for the victim and larger than 2 for the injurer, will be enough to induce an optimum behavior. We could, for instance, assign 10 to the victim and 7 to the injurer and our goal (inducing the desirable Nash equilibrium) would be attained. Nonetheless fairness contentions could be raised against this hypothetical allocation. It can be argued that any kind of apportioning divorced from the relative effort by every party can be deemed unfair, and so, it violates the criterion of “corrective justice” that underlies almost every legal system.

However, this simple framework also allows us to explore some tools in order to overcome that sort of criticisms. Moreover, at this point it is possible to pursue (and to meet) additional goals, and even deal with at least some variants of “corrective justice”. Namely, we can fulfill the standard Kaldor-Hicks criterion inducing the desired Nash equilibrium and at the same time locally verify additional efficiency criteria.

To do so we can simply apply the *CG*-procedure of Aumann and Maschler (1985) on the difference on $l(\cdot, s)$. Denote by Δl the difference $l(x_i, x_v, s) - l(x_i^*, x_v^*, s)$, and $\Delta x_k = x_k - x_k^*$, for $k = i, v$. Then, the apportionment of causal attribution to an actual $l(x_i, x_v, s)$ is denoted as θ_i for the injurer and θ_v for the victim. The rule prescribes that these values should be:

$$\theta_i = \frac{[\Delta l - (\Delta l - \Delta x_i)^+ - (\Delta l - \Delta x_v)^+]}{2} + (\Delta l - \Delta x_v)^+$$

$$\theta_v = \frac{[\Delta l - (\Delta l - \Delta x_i)^+ - (\Delta l - \Delta x_v)^+]}{2} + (\Delta l - \Delta x_i)^+$$

where the operator $(\cdot)^+$ is such that $(k)^+ = \max(0, k)$. That is, for each argument, it yields either its absolute value (if the argument is non-negative) or zero.

It can be easily checked out that $\theta_i + \theta_v = \Delta l$. That is, it shares the liability of the total losses between both parties, in proportion of their contribution. In this sense, the shares can be deemed as **fair**, since the split depends on the degrees of causation. Furthermore, this division is **efficient**:

Proposition *The allocation $\langle \theta_i, \theta_v \rangle$ yields an efficient apportionment of the losses due to deviations from $\langle x_i^*, x_v^* \rangle$.*

Proof: *Immediate from the fact that the CG-rule yields the nucleolus of the corresponding allocation game. The nucleolus, in turn, yields the unique outcome in the core of the game, i.e. an efficient assignment of dues to both parties.*

That is, efficient allocations of causal attribution can be reached by following this rule, once the causes have been detected by the two-step procedure. This result, even if originally thought as a solution for how to allocate **goods**, works all the same in the attribution of shares in an overall loss. Being this allocation in the nucleolus, it minimizes the advantages of any party over the other, and being in the core it achieves this efficiently.¹⁸

5 Concluding Remarks

Some final observations might be significant at this point. First, we are far from claiming that actual liability systems, as they are in the real world, will lead unconditionally to efficiency by taking into account the causal influences on the harms. Rather, we tried to show that theoretical relations between abstract concepts hidden in the characterization of the usual legal tools may lead to efficiency in this area, identifying the requirements for that goal. More specifically, we suggest that the contradiction between an efficient allocation of liability on the basis of causal apportioning and efficiency in general is not as stark as claimed. At least, that there is not such a contradiction on the level of theoretical relations, for any kind of allocation. While Aumann and Maschler's CG-principle is intended for just two parties, a variety of methods of fair division have been designed for n -person contexts, all of them yielding efficient allocations (Brams and Taylor, 1996).

Additionally, we have shown that the basis on which mainstream Law & Economics stated the issue leads to two problematic consequences. First, the deviation from some usual cornerstone notions of philosophy and traditional legal scholarship. Second, in spite of doing so, it does not provide any

¹⁸Here *efficiency* covers all the meanings in Economics: an element in the core of an allocation game is Pareto-optimal, verifies the Hicks-Kaldor condition and verifies Shapley's axiom of efficiency (See Mas-Collel et al., 1995).

gain in terms of the achieving efficiency, the main normative goal of Law & Economics.

By introducing an alternative framework we intended to overcome both weaknesses in a single stroke. On the one hand, at a theoretical level, our strategy succeeds in providing an acceptable procedure for allocating liability on the basis of causal apportioning, applicable even to the hard cases of causal complements and causal substitutes, that have shown to be the source of inefficiencies in the mainstream framework.

On the other, our set of assumptions seems to go along with the toolbox of traditional legal scholarship and with the current philosophical conceptual framework on causality. The application of the NESS test, the two-step approach and even the treatment of causal apportioning goes in this way. By means of the first step, the “factual” aspect of the causal judgment (the most universal one) is fulfilled. The second step, in turn, fulfills another universal characteristic of any causal inquiry, which consist in filtering the rough material provided by the first step. The result of this step, however, is far from being neutral. It is, instead, goal-oriented, and this is the reason for why we do not face an endless listing of factors every time we ask for the cause of everyday or more complex events. Therefore, if our goal is to achieve efficiency, our screening among the NESS conditions of an event would in the end select those that will allow to allocate liability in an efficient form. At this stage confronting “legal policy reasons” with “causal determinations” probably makes little sense.

With respect to the actual scope of our analysis, it is clear that it is to improve the theoretical understanding of the problem of allocating liability on causal grounds. However, since the real world is far from being so neat as required in our exercise, there are many aspects of the problem that remain unsolved. Even so, we think we suggested potential headways towards a better understanding to the problem and opened venues for further research.

6 References

Acciarri, H., Castellano, A. and Barbero, A. (2001): Daños, Instituciones e Incentivos. Hacia un Modelo Unificado de Responsabilidad Civil Contractual y Extracontractual, *Anales de la XXXVI Reunión Anual de la Asociación Argentina Economía Política*,
http://www.aaep.org.ar/espa/anales/resumen_01/acciarri_barbero_castellano.htm.

Aumann, R. and Maschler, M. (1985): Game Theoretic Analysis of a Bankruptcy Problem from the Talmud, *Journal of Economic Theory* **36**: 195-213.

Ben-Shahar, O. (2000): Causation and Forseeability, in B. Bouckaert and G. De Geest (eds.) **Encyclopedia of Law and Economics**, vol. **2**: 644-668, Elgar Publishing, Cheltenham, UK.

Brams, S. and Taylor, A. (1996): **Fair Division: from Cake Cutting to Dispute Resolution**, Cambridge University Press, NY.

Brown, J. P. (1973): Toward an Economic Theory of Liability, *Journal of Legal Studies* **2**: 323-350.

Calabresi, G. (1970): **The Costs of Accidents. A Legal and Economic Analysis**, Yale University Press, New Haven. CT.

Kaye, D. and Aickin, M. (1984): A Comment on Causal Apportionment, *Journal of Legal Studies* **13**: 191-208.

Kruskal, W. (1986): Terms of Reference: Singular Confusion about Multiple Causation, *Journal of Legal Studies* **15**: 427-436.

Landes, W. and Posner, R. (1983): Causation in Tort Law: an Economic Approach, *Journal of Legal Studies* **12**: 109-134.

Landes, W. And Posner, R. (1987): **The Economic Structure of Tort Law**, Harvard University Press, Cambridge, MA.

Mas-Collel, A., Whinston, M. and Green, J. (1995): **Microeconomic Theory**, Oxford University Press, NY.

Mill, J. S. (2006, original: 1843): A System of Logic, in **Collected Works of John Stuart Mill: A System of Logic, Ratiocinative and Inductive**, Liberty Fund, NY.

Parisi, F. and Fon, V. (2004): Comparative Causation, *American Law and Economics Review* **6**: 345-368.

Rizzo, M. and Arnold, F. (1980): Causal Apportionment in Tort Law: an Economic Theory, *Columbia Law Review* **80**: 1399-1429.

Rizzo, M. and Arnold, F. (1986): Causal Apportionment: Reply to the Critics, *Journal of Legal Studies* **15**: 219-226.

Salvador-Coderch, P., Garoupa, N. and Gómez Liguerra, C. (2004): Scope of Liability, the Vanishing Distinction between Negligence and Strict Liability, *Latin American and Caribbean Law and Economics Association Annual Papers*, paper **6**, <http://repositories.cdlib.org/bple/alacde/6>.

Schwartz, G. T. (2000): Causation Under US Law, in J. Spier, J. **Unification of Tort Law**, p. 123, Kluwer Law, The Hague.

Shavell, S. (1980): Strict Liability versus Negligence, *Journal of Legal Studies* **9**: 1-25.

Shavell, S. (1987): **Economic Analysis of Accident Law**, Harvard University Press, Cambridge, MA.

Singh, R. (2002): Causation, Economic Efficiency and the Law of Torts, *Centre for Development Economics, Delhi School of Economics* working paper **102**, <http://www.cdedse.org/pdf/work102.pdf>.

Spier, J. (ed.) (2000): **Unification of Tort Law**, Kluwer Law, The Hague.

Strassfeld, R. (1992): Causal Comparisons, *Fordham Law Review* **60**: 913-951.

Wright, R. (1985): Actual Causation vs. Probabilistic Linkage: the Bane of Economic Analysis, *Journal of Legal Studies* **14**: 435-456.

Wright, R. (1988): Causation, Responsibility, Risk, Probability, Naked Statistics and Proof: Pruning the Bramble Bush by Clarifying the Concepts, *Iowa Law Review* **73**: 1001- 1077.

Young, R., Faure, M., Fenn, P. and Willis, J. (2007): Multiple Tortfeasors: an Economic Analysis, *Review of Law & Economics* **3**: article 7, <http://www.bepress.com/rle/vol13/iss1/art7>.