8-1-2013

Harm-Benefit Interactions

Oren Bar-Gill
NYU School of Law, bargill@nyu.edu

Ariel Porat
Tel Aviv University and University of Chicago - Law School, porata@post.tau.ac.il

Follow this and additional works at: http://lsr.nellco.org/nyu_lewp

Part of the Contracts Commons, Law and Economics Commons, Property Law and Real Estate Commons, and the Torts Commons

Recommended Citation
http://lsr.nellco.org/nyu_lewp/349

This Article is brought to you for free and open access by the New York University School of Law at NELLCO Legal Scholarship Repository. It has been accepted for inclusion in New York University Law and Economics Working Papers by an authorized administrator of NELLCO Legal Scholarship Repository. For more information, please contact tracythompson@nellco.org.
Harm-Benefit Interactions

Oren Bar-Gill and Ariel Porat*

Abstract

In the standard tort case, the injurer-victim interaction results in harm to the victim. In this paper, we identify and analyze a distinct category of cases – Harm-Benefit (“HB”) cases – in which the injurer-victim interaction, results simultaneously in harm to the victim and benefit to the injurer (or to others). Indeed, in these cases the injurer affirmatively prefers to encounter the victim. In HB cases, which are quite common, standard results about the relative efficiency of different liability rules do not apply. When the benefit to the injurer exceeds the harm to the victim, liability should be imposed, whereas if the harm is larger than the benefit the case for liability becomes much weaker. These conclusions imply, counterintuitively, that it may be more important to impose liability on the non-negligent injurer rather than on the negligent injurer. We study the incentive effects of different liability rules, as well as the restitution rule, in HB cases. Our analysis also sheds new light on the law of takings. And it applies in certain contractual settings. More generally, we take the standard tort model, which focuses on one consequence of the injurer-victim interaction – harm to the victim – and expand it to include other consequences. We focus on benefits, but our framework can also be used to study harms, beyond the harm suffered by the victim.

* Oren Bar-Gill is the Meltzer Professor of Law and Economics at the New York University School of Law. Ariel Porat is Alain Poher Professor of Law, Tel Aviv University, and Fischel-Neil Distinguished Visiting Professor of Law, University of Chicago Law School. For helpful comments and suggestions, we thank Ian Ayres, Omri Ben-Shahar, Yun-chien Chang, Giuseppe Dari-Mattiacci, Sharon Hannes, Assaf Jacob, Louis Kaplow, Gideon Parchomovsky, Ronen Perry, Avraham Tabbach and workshop and conference participants at Tel-Aviv University, the 2012 Annual Meeting of the American Law and Economics Association and the 2012 Annual Meeting of the Israeli Law and Economics Association. This paper also substantially benefitted from comments and suggestions by the Editor and two anonymous referees. Bar-Gill gratefully acknowledges the financial support of the D'Agostino/Greenberg Fund at NYU School of Law.
1. Introduction

1.1 Defining Harm-Benefit Interactions

Consider two examples:

Example 1: Navigating her ship in stormy waters, Ship-owner 1 collides with Ship 2, causing harm to Ship 2.

Example 2: To save her ship from drowning in stormy waters, Ship-owner 1 ties her ship (Ship 1) to a dock, causing harm to the dock.¹

Assume that the harm to the other ship in Example 1 and the harm to the dock in Example 2 are equal in magnitude. Further assume that the cost, to Ship-owner 1, of avoiding the harm – a cost that the injurer decided not to incur – is the same in both examples. Finally, assume that, in both examples, Ship-owner 1 is not negligent, as the harm caused is smaller than the cost of avoiding the harm. Should ship-owner 1 be liable for the harm caused?

In Example 1, which represents the standard tort case, the answer is ambiguous. Focusing on care level decisions, a negligence rule – implying no liability in Example 1 – is optimal. The now-classic economic analysis of tort law has shown that a negligence rule provides optimal incentives, to exercise care, for both the injurer and the victim. If the injurer, Ship-owner 1, was not negligent, then he need not pay damages. Indeed, a strict liability rule that forces a non-negligent injurer to pay damages is inferior to the negligence rule, as it removes any incentive for the victim to exercise care.² Matters become more complicated when activity level decisions are considered: Under a negligence rule, the victim will choose an optimal activity level, but the injurer will choose an excessively high activity level. Under a strict liability rule, the opposite is true: the injurer will choose an optimal activity level, and the victim will choose an excessively high activity level. (See Shavell, 1987)

This standard analysis does not apply in Example 2. In this example, the case for imposing liability on the non-negligent injurer becomes substantially stronger. Strict liability may be more efficient than negligence. Why is Example 2 different? What is so special about this example? The answer lies in the nature of the injurer-victim interaction. In the standard tort case, the injurer-victim interaction produces only harm (to the victim). In Example 2, the injurer-victim interaction produces simultaneously harm (to the victim) and benefit (to the injurer). It is the victim’s dock – the harmed dock – that saved the injurer’s ship. Example 2 is an example of what we call Harm-Benefit Interactions (or HB Interactions). As we argue below, standard analysis does not apply to HB interactions.

To be clear: In the standard tort case, the injurer gains utility from engaging in the activity that harms the victim. In Example 1, Ship-owner 1 gains utility from setting sail. But this benefit to the injurer is independent of the injurer-victim interaction. Ship-owner 1 does not need to collide with Ship 2 to enjoy this benefit. In fact, in Example 1, the injurer probably prefers that the victim not be present at all (or, at least, is indifferent to the victim’s presence). Not so in Example 2. There the injurer strongly prefers that the victim or, more specifically, the victim’s dock, be present. The prospect of an injurer-victim interaction increases the benefit, to the injurer, from engaging in her activity. Example 2 can be characterized as a forced rescue: the injurer “forced” the victim to rescue him; had the injurer not tied his ship to the victim’s dock, thereby damaging the dock, the ship would have drowned.

¹ Compare: Vincent v. Lake Erie Transportation Co., 124 N.W. 221 (Minn. 1910).
² These results obtain in the standard tort model under assumptions of perfect information. We retain these assumptions here. For the effects of imperfect information – see, e.g., Bar-Gill and Ben-Shahar (2003).
1.2 Optimal Liability in Harm-Benefit Interactions

Why does strict liability provide better incentives in HB interactions, as compared to the standard tort case? The main difference is that while imposing liability on the injurer distorts the victim’s incentives in the standard case, it can improve the victim’s incentives in the HB case. The intuition for this result is the following: In the standard case, the injurer-victim interaction results only in harm (H) to the victim. Optimal incentives require that the victim internalize the harm, namely, the victim needs to “feel” –H (i.e., minus H). No liability achieves such internalization, and induces the victim to optimally reduce his activity level and to invest appropriately in reducing the probability of an injurer-victim interaction. With liability, the victim externalizes the harm and his incentives are distorted.

In the HB case, the injurer-victim interaction results both in harm (H) to the victim and in benefit (B) to the injurer, for a net benefit of B – H. Optimal incentives require that the victim internalize both the harm and the benefit, namely, the victim needs to “feel” B – H. Standard liability rules do not achieve such perfect internalization. The question is whether liability does better, or worse, than no liability. We show that when the benefit (B) to the injurer is higher than the harm (H) to the victim, liability is unambiguously more efficient than no liability; as a result a rule of strict liability is superior to a negligence rule in these cases. When B > H, the net benefit from the injurer-victim interaction is positive and so it is optimal for the victim to increase his activity level and invest in increasing the probability of an interaction. Without liability, the victim “feels” –H and, thus, decreases, rather than increases, his activity level and invests in decreasing, rather than increasing, the probability of an interaction. With liability, the victim “feels” zero and, thus, while not increasing his activity level, as is optimal, at least does not decrease it; and while not investing in increasing the probability of an interaction, as is optimal, at least does not invest in decreasing this probability. For this reason, liability provides better incentives for the victim, as compared to no liability. And since liability provides first-best incentives for the injurer, it is clearly better to impose liability in HB cases, when B > H.

When benefit is lower than harm (B < H), on the other hand, there is no clear priority for liability over no liability. In this case, it is optimal for the victim to “feel” B – H, which is now negative, decrease his activity level and invest in decreasing the probability of an injurer-victim interaction. Without liability, the victim “feels” –H and, thus, decreases his activity level by too much and invests too much in decreasing the probability of an interaction. With liability, the victim “feels” zero and, thus, does not decrease his activity level and does not invest in decreasing the probability of an interaction. Either distortion can be more detrimental to efficiency. Looking at the injurer’s incentives, liability is clearly better than no liability, as noted above. Overall, the efficiency ranking of liability versus no liability is ambiguous when B < H.

The conclusion that, in HB cases, liability is clearly better when B > H but not when B < H is counter-intuitive. To see why, consider, again, Example 2, and assume that the injurer can prevent the harm only by refraining from tying her ship to the victim’s dock. We call this the Avoidance-as-Precaution case. In this case, the cost of care equals the forgone benefit from the injurious interaction (B). Hence, liability is more efficient than no liability specifically when the injurer is non-negligent (B > H). This also implies that in such cases a rule of strict liability is unambiguously more efficient than a rule of negligence, since the difference between those two liability rules manifests itself only when B > H – the case in which liability is imposed under strict liability, but not under negligence (when B < H liability is imposed under both a strict liability rule and under a negligence rule).

We have thus far focused on the question whether liability should be imposed, implicitly assuming that liability is measured by the magnitude of the harm. But the measure of damages is a central question and a major focus of our analysis. HB cases lie at the intersection of tort law and the law of restitution. While tort law focuses on the harm component, restitution law focuses on the benefit component. We suggest
that, under certain circumstances, restitutionary damages in HB cases are superior to compensatory damages. In particular, they provide efficient incentives for the victim, albeit distort the injurer’s incentives.

1.3 Prevalence of Harm-Benefit Interactions

HB interactions are prevalent. Example 2, based on the famous Vincent case, shows that a subset of intentional tort cases are HB cases. There are many other examples of HB interactions. Any situation where one person or entity make their property available to another – in emergency situations or more generally – can be analyzed as an HB interaction. Consider a non-negligent driver who damages a guardrail, owned by the municipality, which prevented him from rolling down the hill and being severely injured. It would likely be efficient to impose liability on the non-negligent driver for the damage caused to the guardrail, since the expected benefit from installing a guardrail exceeds the expected damage to the guardrail. Or consider a facility or equipment owned by a charity. If a person non-negligently damages the facility or equipment, while using them for her own benefit, liability should be imposed for the harm caused, at least when the benefit exceeds the harm. In both cases, liability, in the absence of negligence, is efficient, because the injurer benefits from the interaction with the victim. Many other scenarios can be similarly analyzed: a person borrows his neighbor’s fire extinguisher to put out a fire. Or a person allows others to enjoy his garden. Some of these examples straddle the line between tort and contract; and, we argue, some contract cases can also be usefully analyzed as HB interactions.

Theft, or the tort of conversion, is another key example of an HB interaction – the thief benefits while the dispossessed owner is harmed. Our analysis provides a justification for imposing liability on the thief, especially in the “efficient theft” cases where \( B > H \). (We also show, counter-intuitively, that when \( B < H \) it might be inefficient to impose liability on the thief.) Like the case of theft, which can be viewed as a private taking, public takings are also examples of HB interactions. Our analysis sheds new light on the law of takings. We emphasize the distinction between takings where the taker would rather not have the taking victim present, and takings where the taker benefits from the presence of the victim – the HB case. Consider first the taking of a house in order to destroy it and construct a highway. The taker gains no benefit from the victim’s investment in the house; and would be just as well off, if not better off, had the victim, and his house, not been there at all. Next consider the taking of a truck in a time of emergency to be used for transporting rescue workers and equipment. The taker benefits from the presence of the victim, and his truck, and from the victim’s investment in maintaining the truck in good operating condition. Assume that both takings – of the house and of the truck – are efficient, as the benefit to the taker exceeds the harm to the victim. Liability is necessary in the truck case, which is an HB case, but not in the house case.

Restitution law provides further examples of HB interactions. We have already mentioned private takings cases, where the beneficiary takes the benefactor’s property for her own use without the benefactor’s consent. Restitution law imposes liability, with restitutionary damages, in these cases. Another category of HB cases, governed by the law of restitution are the rescue cases. Under certain circumstances, rescuers are entitled to reimbursement for the costs they incurred in rescuing another person without that person’s consent. Still, rescue cases are different from other HB cases in that the benefit is provided at the initiative of the benefactor. Since the rescuer, benevolent as he may be, is an intervener who conferred an unrequested benefit, the law is reluctant to impose liability on the beneficiary; and when liability is

---

3 See e.g., Olwell v. Nye & Nissen Co. 173 P. 2d 652 (Wash. 1946), where the defendant made use of the plaintiff’s property without the latter’s consent and the court ordered restitutinary damages.

4 When the benefit is to property or another economic interest, the law allows the benefactor to recover a reasonable charge for her beneficial actions. When the benefit is manifested in saving a person’s life or preventing bodily harm, the law allows such recovery only when the services granted were professional, as when a doctor provides first aid to an unconscious bystander. Restatement (Third) of Restitution & Unjust Enrichment §§ 20-21.
imposed, the remedy is not restitutionary damages, but rather compensatory damages – measured by the
cost of the rescue. Applying our framework, the reluctance to impose liability in rescue cases may reflect
an assessment that intervening rescuers often provide small benefits (B < H) that might be overestimated
by an imperfectly informed court.

The domain of our analysis is quite broad. First, it includes both intentional and accidental infliction of
harm. Second, it includes cases where the benefit from the injurer-victim interaction is enjoyed by third-
parties, in addition to cases, like Example 2, where the benefit is enjoyed by the injurer (see Section 4.1).
Third, it includes all cases where the victim can affect the probability of an interaction, or the magnitude
of the benefit from the interaction, even if the victim is not, strictly speaking, the source of the benefit.
More generally, our analysis extends the domain of the economic analysis of liability by incorporating
additional categories of externalities. The standard tort model focuses on one type of externality – harm
suffered by the victim. We add a second type of externality – benefit enjoyed by the injurer and third-
parties. The standard model implicitly assumes B = 0, while we allow for B > 0. Our analysis can also be
easily extended to cases where B < 0, namely, cases where the injurer-victim interaction results in
additional social harm, beyond the harm to the victim (see Section 4.2).

1.4 Related Literature

To the best of our knowledge, the unique features, and legal policy implications, of HB interactions have
not been fully identified and analyzed previously. Still, specific examples of cases that fall into our
general category of HB interactions have been studied in the literature. Landes and Posner (1981), in an
important early contribution, study intentional torts. They define intentional torts as cases in which the
injurer enjoys an affirmative benefit from committing the tort. Focusing on Vincent v. Lake Erie
Transportation Co., (which corresponds to our Example 2), Landes and Posner show that without liability
the victim will have insufficient incentives to invest in building docks, and thus favor strict liability in
such cases. Landes and Posner, however, do not systematically study what we have called HB
interactions, which include both intentional and accidental harms.

Dari-Mattiacci (2004) considers the question of liability for pure economic loss. He observes that in pure
economic loss cases a benefit dimension commonly exists. Dari-Mattiacci extends the basic tort model to
account for this benefit. His analysis, however, focuses on the efficiency of excluding liability for pure
economic loss. And he does not systematically analyze the range of incentive problems arising in the
broad category of HB cases. Hylton (2012) studies the necessity defense. He considers the incentives of a
property owner to defend against an invader, focusing on cases where the owner’s defensive actions harm
the invader. Hylton asks whether the owner should be liable for such harm, and argues that the necessity
doctrine optimally blocks such liability. The invasion cases that Hylton studies are a type of private
takings and thus an example of an HB interaction. But Hylton focuses on liability that is imposed on the
owner, the victim in our framework, whereas we focus on liability that is imposed on the invader. While
studying a different set of legal rules, Hylton touches on some of the questions that we address.
Specifically, Hylton’s analysis of the owner’s incentive to defend relates to our analysis of the victim’s
incentives to reduce the probability of an HB interaction.

---

5 Id.
7 Consider a variation on Example 2 where, before Ship-owner 1 arrives, Ship-owner 2 ties her ship to the dock in a way that
blocks Ship-owner 1’s access to the dock. Ship-owner 1 could have tied her ship to the dock, thus saving her ship, if only Ship-
owner 2 tied her ship in a different way – a way that might, or might not, increase the probability that Ship 2 would be harmed. In
this example, while the benefit is provided by the dock, Ship-owner 2’s actions affect the probability that Ship-owner 1 will enjoy
the benefit. We thank Sharon Hannes for this point.
8 124 N.W. 221 (Minn. 1910).
In the takings context, Kaplow (1986) and others have argued against liability, focusing on the case where the taker destroys the victim’s asset. The takings literature, however, does not distinguish between a taker who destroys the victim’s asset and a taker who benefits from the victim’s investment in the asset. Liability, while providing inefficient incentives to the victim in the former case, may provide him with efficient incentives in the latter.

Prior work has studied the incentives of both injurers and victims, when wrongdoing by the injurer harms both the victim and the injurer herself (e.g., Arlen, 1990; Leong, 1989). Our analysis focuses on cases where the injurer enjoys a benefit, rather than suffers harm. Moreover, in the cases that we study this benefit to the injurer arises from the interaction with the victim and not from the injurer’s activity itself. Also related are papers that study the parties’ incentives, when wrongdoing by the injurer creates benefits to third parties (e.g., Porat, 2007; Dari-Mattiacci & Schaefer, 2007; Bishop, 1982; Rizzo, 1982). Unlike these papers, our focus is on benefits to the injurer herself. Our analysis further extends this literature by distinguishing benefits arising from the injurer-victim interaction from benefits, including benefits to third parties, that arise from the injurer’s activity itself, and by identifying the distinct characteristics of \( B > H \) cases versus \( B < H \) cases. Another strand in the literature considers benefit-producing interactions, exploring why the law generally does not compensate for benefits (see, e.g., Dari-Mattiacci, 2009; Porat, 2009a). These papers, however, do not consider interactions that generate both a harm and a benefit.

The economic literature on crime, and on the public enforcement of law more generally, has long recognized that perpetrator-victim interactions generate both a benefit to the perpetrator and a harm to the victim. (See, e.g., Polinsky and Shavell, 2000.). Moreover, the public enforcement of law literature has recognized the distinction between HB cases, like theft, where the benefit to the offender is inexorably linked to the harm suffered by the victim, and other cases, where this link is absent (see Mungan, 2011). And, the economic analysis of theft, an archetypal HB case, emphasized the importance of incentives to perpetrate and defend against theft (see, e.g., Tullock, 1967; McChesney, 1993), which correspond to some of the incentive effects that we study. In this literature, however, the standard consequence of a violation is a fine paid to the state (or a prison sentence levied on the perpetrator), rather than compensation paid to the victim. Accordingly, our analysis of liability rules in HB cases, while sharing common features with the analysis of crime and enforcement, differs from that analysis in important ways. For instance, the victim’s incentives to increase, rather than decrease, the probability of a (perpetrator-victim) interaction have not been studied in this literature.

Finally, the HB case is analogous to a joint-production scenario, where two (or more) parties influence, through their investments and other decisions, the value of a single good. In the HB case, two parties – the injurer and the victim – influence the magnitude of the net surplus \( B - H \). While joint production decisions have been studied in other contexts, harm-benefit interactions have received much less attention. More importantly, the incentive effects of liability rules have not been explored in the standard joint-production case, where questions of liability generally do not arise. (See, e.g., Shavell, 1979; Grossman and Hart, 1983.)

As we have argued above, HB interactions are prevalent. It is, therefore, not surprising that different subsets of HB interactions have been studied in the literature. One contribution of this paper is to identify common features that cut across these disparate strands of literature and call attention to the general category of HB cases. More important, our systemic analysis of HB interactions, fully accounting for multi-dimensional investment decisions (including bilateral precaution and activity level decisions), generates a series of new results and insights: First, we distinguish between cases where \( B > H \) and cases where \( B < H \) and show that liability, while clearly desirable in the former, might be inefficient in the latter (and we explain when liability is, and is not, efficient in \( B < H \) cases). Second, we find, counterintuitively, that in the Avoidance-as-Precaution case it is better to impose liability when the injurer is not negligent. Third, we call attention to the issue of countervailing distortions: ideally each party
should internalize both the harm and the benefit from an HB interaction. Under strict liability, the victim ignores both the harm and the benefit, leading to countervailing distortions. And the same is true for the injurer under a restitution rule. We show that such countervailing distortions can enhance efficiency. Finally, our broader view of HB interactions allows us to bring together tort law, the law of takings, contract law and the law of restitution, and to highlight the symmetry between the harm and benefit sides of the HB interaction.

The paper is organized as follows: Section 2 develops a formal model for analyzing Harm-Benefit interactions. We use this model to study the efficiency properties of different liability rules with respect to both precaution decisions and activity level decisions. Section 3 considers the special case of takings – both public takings and private takings. Section 4 concludes with a brief discussion of three extensions: benefits enjoyed by third-parties (rather than by the injurer), harms suffered by the injurer or by third parties (negative B cases), and contracts cases.

2. Model

We next examine the generalizability and robustness of the basic argument using a formal model. The model describes the general case of an injurer-victim interaction that is associated with both benefits and harms. The standard tort case can be viewed as a special case within this general model, where the benefit equals zero. We assume that high transaction costs preclude the possibility of any pre-interaction bargaining.

2.1 Framework of Analysis

There are two Parties: an Injurer, X, and a Victim, Y. Injurer chooses an activity level \( x_1 \), which generates a utility \( U(x_1) \). Similarly, Victim chooses an activity level \( y_1 \), which generates a utility \( V(y_1) \). Increasing one’s activity level is costly. Without loss of generality, we measure this cost by \( x_2 \) for Injurer and by \( y_2 \) for Victim. We assume \( U'(x_1) > 0, U''(x_1) < 0, V'(y_1) > 0 \) and \( V''(y_1) < 0 \). While we call \( x_1 \) and \( y_1 \) “activity levels,” they can also represent investments that increase the value of a party’s activity or asset. We pursue this alternative interpretation in Section 3, when we apply our model to takings. We assume that \( x_1 \) and \( y_1 \) are not verifiable and thus liability cannot be made conditional on these variables. This is the conventional assumption (at least when \( x_1 \) and \( y_1 \) represent activity levels).

The activities of X and Y may result in an interaction between the two parties that occurs with a probability \( p \). This interaction results in a harm, \( H \), to party Y and a benefit, \( B \), to party X. The variables \( p, H \) and \( B \) are each a function of the parties’ activity levels, \( x_1 \) and \( y_1 \). We therefore write the harm and benefit functions as: \( H(x_1, y_1) \) and \( B(x_1, y_1) \). As for the probability of an interaction, we allow the two parties to affect this probability also through direct investments. Party X can invest \( x_2^+ \geq 0 \) in increasing the probability of an interaction, or she can invest \( x_2^- \leq 0 \) in reducing the probability of an interaction. Similarly, Party Y can invest \( y_2^+ \geq 0 \) in increasing the probability of an interaction, or she can invest \( y_2^- \leq 0 \) in reducing the probability of an interaction. \( x_2 \) and \( y_2 \) can be thought of as a precaution investments.) Let \( x_2 = (x_2^+, x_2^-) \) and \( y_2 = (y_2^+, y_2^-) \). The probability of an injurer-victim interaction is: \( p(x_1, y_1; x_2, y_2) \). We assume that the cross-derivatives between the different variables in \( p(\cdot) \) are all zero (compare: Shavell, 1987).

The investments, \( x_2 \) and \( y_2 \), are assumed to be verifiable and, therefore, liability can, in theory, be made conditional on these dimensions of the parties’ behavior. The analysis below considers the basic negligence rule, which conditions liability on the injurer’s investment in reducing the probability of an interaction, \( x_2^- \). We do not consider more complex liability rules – specifically, rules with contributory or comparative negligence defenses – that condition liability also on the victim’s investment in reducing the
probability of an interaction, \( y_2^+ \). And we do not consider rules that condition liability on investments in increasing the probability of an interaction, \( x_2^+ \) and \( y_2^+ \); while one could devise such rules in theory, we don’t see them in practice.

The special, Avoidance-as-Precaution case, where the only thing the injurer can do to reduce the expected harm, and benefit, from an interaction is to avoid the interaction altogether, and where such avoidance does not entail affirmative cost, is captured, in this framework, by assuming that \( p(x_0, y_1; x_2, y_2) \big|_{x_2^+} = 0 \) and allowing the injurer to unilaterally choose, without incurring any affirmative costs, whether or not the interaction will take place. We treat this case separately in the analysis that follows.

It may be helpful to map the decision variables defined above onto Example 2, from the Introduction, i.e., the Vincent example. The ship-owner decides how often to set sail (\( x_1 \)). The ship-owner also decides whether to install an advanced weather monitoring system that would help her avoid storms and the need to moor her ship on the dock (\( x_2 \)). In the Avoidance-as-Precaution case, the ship-owner can reduce the probability of an interaction only by not using the dock and subjecting her ship to the fury of the storm. As for the dock-owner, he decides how many docks to build and how long each dock will be (\( y_1 \)). The dock-owner also decides whether to install a fence (or other barrier) around his dock(s) or to hire someone to patrol the dock(s) or to hire someone to patrol the dock(s) and untie unauthorized ships (\( y_2 \)).

We focus initially on investments that increase or decrease the probability of an interaction, ignoring investments, by the two parties, that affect the magnitude of the harm, \( H \), and the benefit, \( B \). We, therefore, assume that the magnitudes of the harm and the benefit are exogenously given values, i.e., \( H(x_1, y_1) = H \) and \( B(x_1, y_1) = B \). We discuss the implications of endogenous harms and benefits in Section 2.4. Moreover, endogenous harms and benefits become the focus of the analysis, when we apply our model to the takings context, in Section 3.

In this framework, the social objective function is:

\[
[U(x_1) - x_1 - x_2] + [V(y_1) - y_1 - y_2] + p(x_1, y_1; x_2, y_2) \cdot [-H + B].
\]

In this formulation of the social objective function, and in similar formulations below, we are guilty of a slight abuse of notation: When subtracting the investment \( x_2 \), we mean to subtract either \( x_2^+ \) or \( x_2^- \); the injurer will choose either a positive \( x_2^+ \) (and \( x_2^- = 0 \)) or a positive \( x_2^- \) (and \( x_2^+ = 0 \)), depending on the context. The same applies to \( y_2 \).

2.2 Benchmark: The Standard Tort Case

In the standard tort model, victims do not benefit their injurers. This means that there is no \( B \). The social objective function is:

\[
[U(x_1) - x_1 - x_2] + [V(y_1) - y_1 - y_2] + p(x_1, y_1; x_2, y_2) \cdot [-H]
\]

In the standard tort case, the injurer’s optimal activity level satisfies the FOC: \( U'(x_1) + \frac{\partial p}{\partial x_1} \cdot [-H] = 1 \), and the victim’s optimal activity level satisfies the FOC: \( V'(y_1) + \frac{\partial p}{\partial y_1} \cdot [-H] = 1 \). Since the injurer-

\footnote{An alternative approach to modeling activity levels and precaution investments would assume (1) that raising the activity level does not entail a direct cost, and (2) that precaution costs are incurred per-unit of activity. The social objective functions would thus be: \( U(x_1) + V(y_1) - x_1 - x_2 - y_1 - y_2 + p(x_1, y_1; x_2, y_2) \cdot [-H + B] \). We chose to treat activity levels and precaution investments as we did, mainly because this approach is more convenient technically. The two approaches are substantively similar, and our main results can be derived under the alternative approach as well.}
victim interaction imposes a social harm, $H$, optimal activity levels are lower than the optimal activity levels in the absence of the injurer-victim interaction (these activity levels satisfy $U'(x_1) = 1$ and $V'(y_1) = 1$). Similarly, it is never socially optimal to invest in increasing the probability of an interaction between the injurer and the victim, i.e., in the social optimum $x_2^+ = 0$ and $y_2^+ = 0$. Optimal investments in decreasing the probability of an interaction, $x_2^-$ and $y_2^-$, solve the following FOCs: $\frac{dp}{dx_2} \cdot [-H] = 1$ and $\frac{dp}{dy_2} \cdot [-H] = 1$.

The incentive effects of different legal rules, in the standard tort case, are well-understood: A No Liability rule provides optimal incentives for the victim – to reduce his activity level and to invest in reducing the probability of an interaction, but no incentive for the injurer – to reduce her activity level or to invest in reducing the probability of an interaction. Conversely, a Strict Liability rule provides optimal incentives for the injurer – to reduce her activity level and to invest in reducing the probability of an interaction, but no incentive for the victim – to reduce his activity level or to invest in reducing the probability of an interaction. A Negligence rule that sets the Due Care Standard (DCS) for the injurer at the socially optimal level induces the injurer to invest optimally – to avoid being found negligent, but provides inadequate incentives for the injurer to reduce her activity level. The victim bears the harm, under a Negligence rule (because the injurer meets the DCS and thus avoids being found negligent), and thus optimally reduces his activity level and optimally invests in reducing the probability of an interaction.\(^\text{10}\)

The outcomes are summarized in Table 1:

<table>
<thead>
<tr>
<th></th>
<th>No Liability</th>
<th>Strict Liability</th>
<th>Negligence</th>
</tr>
</thead>
<tbody>
<tr>
<td>X Activity Level</td>
<td>Too High</td>
<td>Optimal</td>
<td>Too High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Zero instead of decrease</td>
<td>Optimal</td>
</tr>
<tr>
<td>X Investment</td>
<td></td>
<td>Optimal</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>No Liability</th>
<th>Strict Liability</th>
<th>Negligence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y Activity Level</td>
<td>Optimal</td>
<td>Too High</td>
<td>Optimal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Zero instead of decrease</td>
<td>Optimal</td>
</tr>
<tr>
<td>Y Investment</td>
<td>Optimal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Standard Tort Model - Outcomes

The relative efficiency of the three rules is described in the following proposition.

**Proposition 1:** In the Standard Tort Model (when $B = 0$) -

(a) With respect to party X’s incentives – in terms of both activity levels and investment levels – Strict Liability is superior to Negligence, which is superior to No Liability.

(b) With respect to party Y’s incentives – in terms of both activity levels and investment levels – No Liability and Negligence are superior to Strict Liability.

(c) Negligence is superior to No Liability in terms of overall efficiency.

2.3 When Victims Benefit Their Injurers: The HB Case

We focus on decisions – by X and Y – that directly affect the likelihood of Harm and Benefit, i.e., on the choice of activity levels $x_1$ and $y_1$, and on investment decisions $x_2$ and $y_2$. These decisions depend on

---

\(^{10}\) A rule of strict liability with a defense of contributory negligence is symmetrical to the simple negligence rule and, therefore, we do not explicitly analyze this rule.
what part of the net benefit \([-H + B]\) each party enjoys/bears, as determined by the legal rule. We distinguish between two cases: (1) \(B > H\), and (2) \(B < H\). We will show that, counterintuitively, liability is more desirable when the benefit exceeds the harm (in Case 1) and less desirable when the harm exceeds the benefit (in Case 2).

2.3.1 Case 1: \(B > H\)

In this case, the interaction produces a net gain. Since higher activity levels – higher \(x_1\) and \(y_1\) – increase the probability of an interaction, the parties should increase their activity levels. Specifically, the injurer’s optimal activity level satisfies the FOC: \(U'(x_1) + \frac{\partial p}{\partial x_1} \cdot [-H + B] = 1\). Since \(-H + B > 0\), the optimal activity level is higher than the optimal activity level in the absence of the harm-benefit interaction (which satisfies \(U'(x_1) = 1\)). Similarly, the victim’s optimal activity level satisfies the FOC: \(V'(y_1) + \frac{\partial p}{\partial y_1} \cdot [-H + B] = 1\). Again, since \(-H + B > 0\), the optimal activity level is higher than the optimal activity level in the absence of the harm-benefit interaction (which satisfies \(V'(y_1) = 1\)).

In addition to adjusting their activity levels, the parties can directly invest in either increasing the probability of an interaction – investments \(x_2^+\) and \(y_2^+\) – or in decreasing the probability of an interaction – investments \(x_2^-\) and \(y_2^-\). Since the interaction produces a net gain, the parties should invest in increasing the probability of an interaction, and not in decreasing the probability of an interaction. Formally, optimal investment levels for the injurer are: \(x_2^- = 0\) and \(x_2^+ > 0\), where the first best level of \(x_2^+\) satisfies the FOC: \(\frac{\partial p}{\partial x_2^+} \cdot [-H + B] = 1\). And optimal investment levels for the victim are: \(y_2^- = 0\) and \(y_2^+ > 0\), where the first best level of \(y_2^+\) satisfies the FOC: \(\frac{\partial p}{\partial y_2^+} \cdot [-H + B] = 1\).

Socially optimal incentives would result if both the injurer and the victim internalize both the benefit (\(B\)) and the harm (\(-H\)), but such perfect internalization is not achieved under existing law. Different liability rules allocate harms and benefits between the two parties. Under a No Liability rule, the injurer enjoys the benefit but does not bear the harm, while the victim bears the harm but does not enjoy the benefit. Under Strict Liability, the injurer internalizes both the harm and the benefit, and the victim internalizes neither the harm nor the benefit. Under a Restitution rule, the victim internalizes both the harm and the benefit, and the injurer internalizes neither the harm nor the benefit. A Negligence rule, in Case 1, is equivalent to No Liability. Since \(B > H\), the injurer should not invest in reducing the probability of an interaction. The DCS would thus be zero, and the injurer would never be held liable. Accordingly, the allocation of the harm and the benefit under Negligence is identical to the allocation under No Liability.

Table 2 summarizes the allocation of harms and benefits under different liability rules, as well as the social optimum benchmark of perfect internalization.

<table>
<thead>
<tr>
<th></th>
<th>Social Optimum</th>
<th>No Liability</th>
<th>Strict Liability</th>
<th>Restitution</th>
<th>Negligence</th>
</tr>
</thead>
<tbody>
<tr>
<td>(X)</td>
<td>(-H + B)</td>
<td>(B)</td>
<td>(-H + B)</td>
<td>(0)</td>
<td>(B)</td>
</tr>
<tr>
<td>(Y)</td>
<td>(-H + B)</td>
<td>(-H)</td>
<td>(0)</td>
<td>(-H + B)</td>
<td>(-H)</td>
</tr>
</tbody>
</table>

Table 2: Allocation of Harms and Benefits

From the allocations of harms and benefits, as described in Table 2, we can infer the activity levels and investments under the different liability rules:
Table 3: Outcomes – Case 1

As we can see, different rules lead to distortions that vary in both type and magnitude. The ability to rank the different rules, in terms of overall efficiency is, therefore, limited. Still, we can say the following –

**Proposition 2:** In Case 1, when \( B > H \) –

(a) With respect to party X’s incentives – in terms of both activity levels and investment levels: Strict Liability is superior to both Restitution and No Liability/Negligence. Restitution is superior to No Liability/Negligence iff no incentive to change activity levels or to invest in increasing the probability of an interaction is better than the excessively high activity level and the excessively high investment in increasing the probability of an interaction induced by No Liability/Negligence.

(b) With respect to party Y’s incentives – in terms of both activity levels and investment levels: Restitution is superior to Strict Liability, which is superior to No Liability/Negligence.

(c) Strict Liability is superior to No Liability/Negligence in terms of overall efficiency.

Remark – Countervailing Distortions:

1. **Strict Liability:** Under Strict liability, there are countervailing distortions – Y internalize neither the harm nor the benefit. In Case 1, the benefit exceeds the harm, hence Y should increase his activity level and invest a positive amount in increasing the probability of an interaction. Rather, Y does not alter his activity level and invests zero in increasing the probability of an interaction. The measure of the aggregate distortion equals the difference between the countervailing distortions: \( B - H \). Under No Liability and Negligence there is a single distortion – Y internalizes the harm, but not the benefit. As a result, Y feels a loss of \( H \) instead of the (net) social gain, \( B - H \), and accordingly decreases, rather than increases, his activity level, and invests in reducing the probability of an interaction instead of investing in increasing this probability. The measure of the distortion is \( H \). Since \( B > B - H \), Strict Liability provides Y with better incentives than No Liability or Negligence. Two countervailing distortions are better than a single distortion.

2. **Restitution:** Under Restitution, X is subject to countervailing distortions (similar to those affecting Y under Strict Liability). The measure of the aggregate distortion is: \( B - H \). Under No Liability and Negligence there is a single distortion – X feels \( B \) instead of \( B - H \) and so the measure of the distortion is \( H \). Restitution provides X with better incentives than No Liability or Negligence, when two countervailing distortions are better than a single distortion. (While our measures of the different distortions do not translate directly into social costs, it is informative to compare the distortion under Restitution, \( B - H \), to the distortion under No Liability and Negligence, \( H \). The distortion under Restitution is smaller iff \( B < 2 \cdot H \).)
Remark – Avoidance-as-Precaution: What happens when the only thing the injurer can do to reduce the expected harm from an interaction is to avoid the interaction altogether, at a cost of forgoing the benefit, $B$, and such avoidance does not entail affirmative costs, beyond the forgone benefit?

1. X’s investment decision: The Avoidance-as-Precaution scenario is unique in that the injurer’s investment decision is binary, rather than continuous; the injurer chooses either to seek the interaction or to avoid it. In Case 1, the interaction produces a net gain, and, therefore, it is efficient for the injurer to seek the interaction, not to avoid it. Both No Liability and Strict Liability provide optimal incentives in this regard. Restitution leaves the injurer indifferent between avoiding the interaction or not.

2. Y’s investment decisions: Under Strict Liability, No Liability and, perhaps, Restitution, X will seek an interaction, and Y’s investment decisions will be as described in Table 3. If, under Restitution, X decides to avoid the efficient interaction, then Y will invest neither in increasing or decreasing the probability of an interaction.

3. Activity levels: Under Strict Liability, No Liability and, perhaps, Restitution, X will seek an interaction, and the activity level decisions of both X and Y will be as described in Table 3. If, under Restitution, X decides to avoid the efficient interaction, then both X and Y’s activity levels will be too low.

4. Redefining Negligence: With Avoidance-as-Precaution, Negligence needs to be redefined such that the injurer will be considered negligent iff $B < R$. This means that in Case 1, when $B > H$, an injurer will never be considered negligent. The new definition of Negligence does not change our previous observation: the Negligence rule is equivalent, in Case 1, to No Liability.

2.3.2 Case 2: $B < H$

In this case, the interaction produces a net loss. The activity-level FOCs are identical to those stated in Sec. 2.3.1, only now $-H + B < 0$. This implies that optimal activity levels are lower than the optimal activity levels in the absence of the harm-benefit interaction. In terms of investments, since the interaction produces a net loss, the parties should invest in reducing the probability of an interaction, and not in increasing the probability of an interaction. Formally, optimal investment levels for the injurer are: $x_2^+ = 0$ and $x_2^- > 0$, where the first best level of $x_2^-$ satisfies the FOC: $\frac{\partial p}{\partial x_2^-} \cdot [-H + B] = 1$. And optimal investment levels for the victim are: $y_2^+ = 0$ and $y_2^- > 0$, where the first best level of $y_2^-$ satisfies the FOC: $\frac{\partial p}{\partial y_2^-} \cdot [-H + B] = 1$.

The allocation of harms and benefits between the two parties, under different liability rules, was summarized in Table 2 above. From these allocations, we can infer the activity levels and investments under the different liability rules (bearing in mind that now $-H + B < 0$):

<table>
<thead>
<tr>
<th></th>
<th>No Liability</th>
<th>Strict Liability</th>
<th>Restitution</th>
<th>Negligence</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>Too High</td>
<td>Optimal</td>
<td>Too High</td>
<td>Too High</td>
</tr>
<tr>
<td></td>
<td>Activity Level</td>
<td>Investment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increase instead of decrease</td>
<td>Optimal</td>
<td>Zero instead of decrease</td>
<td>Optimal</td>
</tr>
<tr>
<td>Y</td>
<td>Too Low</td>
<td>Too High</td>
<td>Optimal</td>
<td>Too Low</td>
</tr>
<tr>
<td></td>
<td>Activity Level</td>
<td>Investment</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Decrease too much</td>
<td>Zero instead of decrease</td>
<td>Optimal</td>
<td>Decrease too much</td>
</tr>
</tbody>
</table>

Table 4: Outcomes – Case 2
The Negligence rule operates differently in Case 2: We assume that the court sets a DCS on the $x_2$ dimension. If the court sets the DCS optimally, considering the benefit from the injurer-victim interaction, as well as the harm (as implied by the FOC above), then the injurer will invest optimally in reducing the probability of an interaction. The non-negligent injurer will not be subject to liability and will, therefore, choose an excessively high activity level. Since the injurer is non-negligent, the victim bears the loss and obtains a negative payoff, $-H$. As compared to the (net) social welfare effect of the interaction, $-H + B$, the victim’s payoff is too negative. This means that the victim will reduce his activity level by too much (the activity level will be too low); and invest too much in decreasing the probability of an interaction.

Again, different rules lead to distortions that vary in both type and magnitude and our ability to rank the different rules, in terms of overall efficiency is limited. Still, we can say the following –

**Proposition 3:** In Case 2, when $B < H$ -

(a) With respect to party X’s incentives –
   i. In terms of activity levels: Strict Liability is superior to Restitution, which is superior to No Liability and Negligence.
   ii. In terms of investment levels: Strict Liability and Negligence are superior to Restitution, which is superior to No Liability.

(b) With respect to party Y’s incentives – in terms of both activity levels and investment levels: Restitution is superior to the other three rules. Strict Liability is superior to No Liability and Negligence (both of which provide identical incentives to Y) iff no incentive to change activity levels or to invest in reducing the probability of an interaction is better than the excessively low activity level and the excessively high investment in reducing the probability of an interaction induced by No Liability and Negligence.

(c) Restitution is superior to No Liability in terms of overall efficiency.

Remark – Countervailing Distortions:

1. Strict Liability: Under Strict liability there are countervailing distortions, as in Case 1. The difference is that, in Case 2, Y should reduce his activity level and invest a positive amount in reducing the probability of an interaction. Rather, Y does nothing. The measure of the aggregate distortion equals the difference between the countervailing distortions: $H - B$ (as compared to $B - H$ in Case 1). Under No Liability and Negligence, Y feels a loss of $H$ instead of the (net) social loss, $H - B$, and accordingly reduces his activity level by too much and invests too much in reducing the probability of an interaction. The measure of the distortion is $B (= H - (H - B))$. Strict Liability provides Y with better incentives than No Liability and Negligence, when two countervailing distortions are better than a single distortion. (While our measures of the different distortions do not translate directly into social costs, it is informative to compare the distortion under Strict Liability, $H - B$, to the distortion under No Liability and Negligence, $B$. The distortion under Strict Liability is smaller if $B > H/2$.)

2. Restitution: Under Restitution, X is subject to countervailing distortions. The measure of the aggregate distortion is: $H - B$. Under No Liability there is a single distortion – X feels $B$ instead of $B - H$ and so the measure of the distortion is $H (= B - (B - H))$. Since $H > H - B$, Restitution provides X with better incentives than No Liability. Two countervailing distortions are better than a single distortion.

Remark – Avoidance-as-Precaution:

1. X’s investment decision: In Case 2, the interaction produces a net loss, and, therefore, it is efficient for the injurer to avoid it. (Note that the injurer can avoid the interaction without incurring affirmative cost, beyond the forgone benefit. If the injurer does not avoid the
interaction, the victim can reduce the probability of an interaction, but only after incurring an affirmative cost; the forgone benefit would also add to the social cost.) Under Strict Liability, the injurer will efficiently avoid the interaction. Under No Liability, the injurer will inefficiently seek the interaction. And Restitution leaves the injurer indifferent between seeking the interaction and avoiding it.

2. Y’s investment decisions: Under Strict Liability, X will avoid the interaction, and so Y will invest neither in increasing or decreasing the probability of an interaction, as is efficient. Under No Liability, the injurer will seek the interaction, and Y will invest excessively in reducing the probability of an interaction. Y’s investment under Restitution will depend on what X does: If X avoids an interaction, then Y will invest neither in increasing nor in decreasing the probability of an interaction. If X seeks an interaction, then Y will invest excessively in reducing the probability of an interaction.

3. Activity levels: Under Strict Liability, anticipating her efficient decision to avoid the interaction, X chooses an optimal activity level. Y also anticipates X’s decision to avoid the interaction and chooses an optimal activity level. Under No Liability, X will inefficiently seek the interaction and, since she does not feel the implications of this decision, X will choose an excessively high activity level, as in Table 4. Y’s activity level will also be as specified in Table 4. Results for the Restitution rule depend on whether X decides to avoid the interaction or seek it. If the former, then X and Y’s activity level decisions will be optimal. If the latter, then X’s activity level will be too high, as in Table 4, and Y’s activity level will too low, again as in Table 4.

4. Redefining Negligence: In Case 2, when \( B < H \), an injurer who seeks the interaction will always be considered negligent. Accordingly, the injurer will avoid the interaction, as is efficient. As a result, the injurer will also choose an optimal activity level; and the victim will choose an optimal activity level and invest zero in reducing the probability of an interaction, which is optimal (given that the interaction will be avoided anyway).

2.3.3 Comparison

Comparing Proposition 2 (and specifically Proposition 2(c)) and Proposition 3, we see that imposing liability on the injurer (under a Strict Liability rule) is efficient in Case 1, where \( B > H \), but not necessarily in Case 2, where \( B < H \). In the Avoidance-as-Precaution case, it is efficient to impose liability both when \( B > H \) and when \( B < H \) (see Remark to Proposition 3). Our conclusion is, therefore, that strict liability is unambiguously superior to negligence in this case: When \( B > H \) and liability is efficient, a strict liability rule imposes liability, while a negligence rule does not; and when \( B < H \), liability – which is still efficient – is imposed under both rules. Moreover, as a practical matter, it is hard to imagine that courts would not impose liability when harm exceeds benefit \( B < H \), so the only real question is what to do when benefit exceeds harm \( B > H \); and, as explained above, strict liability is superior in these cases.

2.4 Endogenous Harms and Benefits

We have thus far assumed that the magnitudes of the harm \( H \) and the benefit \( B \) are exogenously determined and focused on the effects of the parties’ activity level and investment decisions on the probability of an interaction. But, of course, in many cases the parties can also invest in reducing the harm and increasing the benefit from an interaction. The framework developed above can be extended to study endogenous harms and benefits.

In a nutshell: Under Strict Liability, X will optimally invest in reducing \( H \) and in increasing \( B \), while Y will inefficiently choose not to invest at all. Under No Liability, X will optimally invest in increasing \( B \), but will not invest in reducing \( H \). Y, on the other hand, will optimally invest in reducing \( H \), but will not invest in increasing \( B \). Under Restitution, Y will optimally invest in reducing \( H \) and in increasing \( B \), while
X will inefficiently choose not to invest at all. Under Negligence, when the DCS incorporates both investments in reducing the probability of an interaction and investments in reducing the harm, X would optimally invest in both reducing $H$ (to avoid being found negligent) and in increasing $B$. Since X will choose not to be negligent, there will be no liability and Y will internalize the harm. As a result, Y will optimally invest in reducing $H$. Y will not invest in increasing $B$.

Importantly, the parties’ investments – in reducing $H$ and in increasing $B$ – can reverse the $B,H$ ordering. Specifically, if absent such investments, we were in Case 2, with $B < H$, the parties’ investments can move us to Case 1, where $B > H$. Finally, when parties can substantially affect the magnitudes of harms and benefits, the efficiency rankings of the different rules, as stated in Propositions 2 and 3, would need to be qualified. For example, the advantage of Strict Liability, as compared to No Liability and to Negligence, when $B > H$, may disappear, if the victim can substantially reduce $H$ (and would have no incentive to do so under Strict Liability).

3. Takings

A subset of takings cases – both public takings and private takings – are an important category of HB cases: The taker enjoys a benefit, which is a function of the harm incurred by the victim of the taking. Our analysis (below) focuses on public takings, but the results apply with equal force to private takings.

The government sometimes condemns people’s assets for public use. The question then is whether it should compensate the owner of the asset (“the victim”) for the value of the asset, which typically corresponds to his harm. Takings law mandates such compensation. Compensation for takings provides incentives for the government to use its taking powers efficiently, namely, only when benefits exceed costs. At the same time compensation might distort the incentives of the victim to invest efficiently in the asset. Focusing on cases where the taken asset is destroyed, the literature noted that, if the victim is fully compensated for his harm, he would ignore the possibility that his asset would be taken and invest excessively in increasing the asset’s value (see, e.g., Fischel and Shapiro, 1988; Kaplow, 1986; Cooter, 1985). The takings literature has also recognized that without compensation victims might inefficiently invest in reducing the probability of a taking (see, e.g., Blum, Rubinfeld and Shapiro, 1984).

The analysis of a public taking as an HB interaction sheds new light on the law of takings. It reveals that liability for takings – the duty to compensate the takings victim – should depend on whether the taker derives a benefit from the victim’s investments in the condemned asset.

We apply the model developed in Section 2 to the takings context. As noted above, while the general analysis in Section 2 focused on the endogenous probability of a harm-benefit interaction, the takings analysis focuses on the endogenous magnitudes of the harms and benefits involved.

In the takings context, the interaction between party X, the taker, and party Y, the victim, results in a transfer of the asset from Y to X. Party Y loses the utility from the asset that is being taken. In other words, the main component of the harm to Y is the lost value of the asset to Y: $H(x_1,y_1) = V(y_1)$, where $y_1$ represents Y’s investment in the asset. While Y loses the asset, X gains the asset. What proves critical is whether the taker, X, will use the asset for the same purpose that Y used it, or for an entirely different purpose (or for a related, though still different purpose). To study these questions, we define the following benefit function: $B(x_1,y_1) = \bar{U} + \alpha \cdot V(y_1)$. When $\alpha = 0$, $B = \bar{U}$. In this case, the benefit to X is not a function of the value of the asset to Y, which means that X will use the asset for an entirely different purpose. The utility, to X, from this different purpose is denoted $\bar{U}$. When $\alpha = 1$, $B = \bar{U} + V(y_1)$. In this case, the value of the asset to Y fully enters into X’s benefit function, which means that X will use the asset for the same purpose that Y used it. Of course, there are also intermediate cases, where $0 < \alpha < 1$. 


Finally, it is possible that X will use the asset for the same purpose as Y, but extract greater benefit. In this case, $\alpha > 1$. We emphasize that the relevant factor is whether, and to what extent, X benefits from Y’s investment in the asset. We use “purpose” as a proxy – for expositional convenience.

Following the takings literature, we ask how different legal rules affect Y’s investment in increasing the value of the asset that can potentially be taken ($y_1$). To focus on this investment decision, we assume that the probability of a taking – of this type of harm-benefit interaction – is exogenously given, i.e., $p(x_1, y_1; x_2, y_2) = p$, and thus ignore any investments in reducing (or increasing) the probability of an interaction $(x_2, y_2)$. We also ignore any utility enjoyed by X that is unrelated to the taking. The social objective function is:

$$[V(y_1) - y_1] + p \cdot \left[ -V(y_1) + \left( \bar{U} + \alpha \cdot V(y_1) \right) \right]$$

In the absence of a taking, the asset is used by Y and social welfare is $V(y_1) - y_1$. With probability, $p$, the asset is taken by X. This means that Y’s utility from using the asset is deducted from the social welfare function, $-V(y_1)$; and X’s utility from using the asset, $\bar{U} + \alpha \cdot V(y_1)$, is added to the social welfare function. The optimal investment level solves: $[1 + p \cdot (-1 + \alpha)] \cdot V(y_1) = 1$.

With No Liability, Y’s objective function is: $V(y_1) - p \cdot V(y_1) - y_1$. The FOC is: $[1 + p \cdot (-1)] \cdot V'(y_1) = 1$, which means that: (a) If $\alpha > 0$, Y’s investment will be too low, and the measure of the distortion is: $p \cdot \alpha$. (b) If $\alpha = 0$, Y’s investment will be optimal. With Liability, Y’s objective function is: $V(y_1) - y_1$. The FOC is: $V'(y_1) = 1$, which means that: (a) If $\alpha < 1$, then Y’s investment will be too high, and the measure of the distortion is: $p \cdot (1 - \alpha)$. (b) If $\alpha > 1$, then Y’s investment will be too low, and the measure of the distortion is: $p \cdot (\alpha - 1)$. (c) If $\alpha = 1$, then Y’s investment will be optimal.

This analysis is summarized in Table 5:

<table>
<thead>
<tr>
<th>$\alpha$</th>
<th>No Liability</th>
<th>Liability</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha = 0$</td>
<td>Optimal [0]</td>
<td>Too High $[p \cdot (1 - \alpha)]$</td>
</tr>
<tr>
<td>$0 &lt; \alpha &lt; 1$</td>
<td>Too Low $[p \cdot \alpha]$</td>
<td>Too High $[p \cdot (1 - \alpha)]$</td>
</tr>
<tr>
<td>$\alpha = 1$</td>
<td>Too Low $[p \cdot \alpha]$</td>
<td>Optimal [0]</td>
</tr>
<tr>
<td>$\alpha &gt; 1$</td>
<td>Too Low $[p \cdot \alpha]$</td>
<td>Too Low $[p \cdot (\alpha - 1)]$</td>
</tr>
</tbody>
</table>

Table 5: Investment Levels

We can now state the following proposition –

**Proposition 4:** In the Takings case, when we consider Y’s investment in increasing the value of the asset, then -

(a) No Liability is better, when $\alpha$ is small, i.e., when the taker will use the asset for a different purpose, and

(b) Liability is better, when $\alpha$ is large, i.e., when the taker will use the asset for a similar purpose.

Remark – Restitution: Under a Restitution rule, Y’s objective function is identical to the social objective function, which means that Y’s investment in increasing the value of the asset will be socially optimal.
Remark – Taker’s Incentives: We have thus far focused on the incentives of the takings-victim, Y, to invest in increasing the value of the asset. What about the incentives of the taker, X, to take the asset? To answer this question, we can apply results from the general analysis in Section 2 above. Note that a taking corresponds to the injurer-victim interaction, and the taker’s incentives to take correspond to the injurer’s incentives to increase the probability of an interaction. As explained in Section 2, with respect to X’s incentives, Liability is superior to No Liability and to Restitution.

Remark – Liability with Lump-Sum Compensation: The preceding analysis assumed, following the economic literature on takings, that, with Liability, compensation equals the true value of the asset, as influenced by the victim’s investment. But, in fact, compensation, under Takings Law, is only partially sensitive to the victim’s investment. The condemnee often gets compensation for the “highest and best use” of the property, evaluated from an objective perspective. Specific investments by the victim have only limited influence on the amount of compensation under this formula. (See Chang, forthcoming, ch. 3). In essence, this rule provides for lump-sum compensation. Incentives to invest under Liability with lump-sum compensation are identical to those under No Liability. Accordingly, our analysis suggests that the lump-sum compensation rule is efficient when investments do not affect the value of the asset to the government, but leads to underinvestment when investments increase the value of the asset to the government.

4. Concluding Remarks

We conclude by briefly discussing three extensions.

4.1 Benefits to Third Parties

The analysis of the victims’ incentives does not change when the benefits from the injurious interaction are enjoyed by third parties rather than by the injurer. The identity of the beneficiary does, however, change the analysis of the injurer’s incentives. In particular, in the HB case, when the benefit is enjoyed by the injurer, liability makes the injurer internalizes all the harms and benefits created by her behavior. On the other hand, when benefits are enjoyed by third parties, these benefits are not internalized by the injurer. Thus, if the entire B goes to third parties, then with liability the injurer feels –H, while ideally she should feel B – H. Consequently, liability for the entire harm provides the injurer with incentives to take excessive care and to choose an insufficiently low activity level.

Examples of benefits to third parties created by the injurer-victim interaction are ample. The rule against liability for pure economic loss is often justified by the existence of third-party benefits. (See, e.g., Bishop, 1982; Rizzo, 1982; Dari-Mattiacci, 2004; Dari-Mattiacci & Schaefer, 2007). Thus, if a nuisance created by the injurer causes a nearby restaurant to lose customers, there will generally be another restaurant who gains customers, and the latter’s gains could offset the former’s losses. As in our basic HB case, the presence of the first restaurant, in the vicinity of the nuisance, is critical for the creation of the third-party benefits (as the presence of the dock was critical for the creation of the benefit to the injurer in Example 2). Another example: A doctor uses a new treatment, which harms the patient. But the information and experience gained by the doctor benefit future patients. This benefit to future patients theoretically should count in analyzing both the injurer’s and victim’s incentives.

In other cases, the victim’s loss prevents harm to third parties, thus benefiting the third parties. Reconsider Example 2, but now assume that, in the absence of a dock to hold the ship during the storm, the ship would have collided into other ships causing them harm. In such cases, the injurer should feel –H (the harm to the dock), rather than B – H, since the B (the third-party harm that is prevented) is not a
benefit created by the injurer. The victim, however, should feel $B - H$, because that is the net social benefit caused by its presence.

4.2 Harms to the Injurer and to Third Parties

The standard tort model (implicitly) assumes $B = 0$. We relaxed this assumption. In doing so, we focused on cases where $B > 0$. But there are also cases where $B < 0$. The negative $B$ corresponds to harm that is suffered by the injurer or by third parties. Indeed, while the standard tort model focuses on harm to the victim, it is not uncommon for the injurer-victim interaction to inflict harm also on the injurer and on third parties. Consider a road accident where car A collides into car B. In addition to the damage to car B, the collision between the two vehicles will commonly result in harm to car A (the injurer’s car), and possibly also to bystanders and other car drivers, or passengers. Ideally, both the driver of car A (the injurer) and the driver of car B (the victim) should “feel” the entire harm, including the harm caused to the other party and to all third parties. Our framework can be readily extended to cover negative $B$ cases.

4.3 Contracts

The HB tort cases have parallels in contracts. The most direct parallels are the so-called inadvertent breach cases, where both the promisor-injurer and the promisee-victim can invest in reducing the probability of breach. (See Bebchuk and P’ng, 1999). Consider the following example: Contractor undertakes to build a house for Owner. Contractor breaches the contract, because he failed to obtain the necessary building permits from the municipality. Owner, if she exerted effort, could have helped Contractor obtain the permits, but failed to do so. As a result of the breach, Owner suffers harm, $H$, and rescinds the contract. Following the rescission, Contractor enters into a substitute contract with another owner, earning a benefit, $B$. (The contractor could not have performed both contracts.)

The inadvertent breach cases are structurally very similar to the tort cases. Accordingly, our analysis applies directly. Under contract law, the promisor’s liability is typically strict, which provides the promisor with efficient incentives, but at the same time provides inefficient incentives for the promisee, who is fully compensated (Cooter and Porat, 2002; Porat, 2009b). Our analysis of the HB case, in Section 2, highlights the implications of the relative magnitudes of the harm and the benefit for the efficiency of the strict liability rule. It should be noted that, in contracts (as opposed to torts), the parties can specify the allocation of benefits and harms. Our analysis would thus serve to guide parties as they draft their contracts or lawmakers when setting default rules.
References


