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Disappearing Defendants v. Judgment Proof
Injurers: Upgrading the Theory of Tort Law
Failures

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Abstract

Do injurers' insolvency and victims' reluctance to sue affect accident prevention in the same way? Are these circumstances less of a problem under the negligence rule than under strict liability? We argue, contrary to the literature, that the answer is, in most cases, negative and make three main points. First, the judgment proof problem and the disappearing defendant problem are shown to have different effects on injurers' behavior and hence yield dissimilar levels of social welfare. Second, when these two problems occur simultaneously they may have offsetting effects. Third, the negligence rule is superior to strict liability only under some conditions, which are not always satisfied when cause in fact is considered. In this case, we find that social welfare under negligence may actually be less than, the same as, or greater than under strict liability. Our model encompasses different precaution technologies as well as monetary vs. non-monetary precautions.

DISAPPEARING DEFENDANTS V. JUDGMENT PROOF INJURERS: UPGRADING THE THEORY OF TORT LAW FAILURES

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ABSTRACT

Do injurers' insolvency and victims' reluctance to sue affect accident prevention in the same way? Are these circumstances less of a problem under the negligence rule than under strict liability? We argue, contrary to the literature, that the answer is, in most cases, negative and make three main points. First, the judgment proof problem and the disappearing defendant problem are shown to have different effects on injurers' behavior and hence yield dissimilar levels of social welfare. Second, when these two problems occur simultaneously they may have offsetting effects. Third, the negligence rule is superior to strict liability only under some conditions, which are not always satisfied when cause in fact is considered. In this case, we find that social welfare under negligence may actually be less than, the same as, or greater than under strict liability. Our model encompasses different precaution technologies as well as monetary vs. non-monetary precautions.

Keywords: insolvency, judgment proof, strict liability, negligence, disappearing defendant
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1. Introduction

Liability rules serve the purpose of circumscribing the various negative effects of accidents by means of transferring the loss from where it fell – the victim – to another subject – the injurer. Such a transfer occurs only if two necessary conditions are satisfied. First, the injurer must be brought before the court and his legal responsibility must be proven.¹ Second, the injurer must pay an appropriate damage award to the victim.

If either of these two prerequisites is not met, the functioning of tort liability may be hampered and hence its purposes frustrated. Besides being a main source of concern for plaintiffs' lawyers, these issues have attracted the attention of legislatures,² legal scholars and, since the inception of the economic analysis of tort law, also economists. Literature on this subject has studied the effects of failures to meet such conditions on injurers' *ex ante* levels of precautions.

The initial posture taken by legal economists has been one of clustering these problems together. Early commentators³ noted that any incidence that permitted injurers to escape liability resulted in imperfect internalization of accidental losses and thus insufficient levels of accident prevention. More specifically, on the one hand, if injurers are not always brought to court, an externality results from the fact that victims will at times not be compensated. On the other hand, if injurers do not pay the appropriate damage award to victims, an externality arises

¹ It may be noticed that the vast majority of tort law cases are resolved out of court because the parties privately settle the controversy that arises from an accident. Nevertheless, this analysis applies also to these cases insofar as such composition occurs in the shadow of the law. Whether the parties really recur to legal action or use the threat of litigation in order to state their bargaining position is immaterial for our conclusions but might require careful application of the policy indications.

² For example, the Comprehensive Environmental Response, Compensation, and Liability Act addresses the effects of both the disappearing defendant and the judgment proof problem problems. This legislation established a compensation fund which provides funding for clean-up effort and compensation for claims that are not settled due to the injurer's limited liability or when the injurer cannot be identified or located, or is judgment proof. 42 U.S.C. § 9601-9675.

³ For the incipit of this literature see the works by Calabresi (1970), Brown (1973), Diamond (1974a and 1974b), Posner (1972), Shavell (1980), and Landes and Posner (1980). The effects of insolvency and lower apprehension rates on the injurers' incentives to take precaution were first analyzed by Summers (1983), Landes and Posner

from the fact that victims will be compensated insufficiently. In both cases, tortfeasors expect that they will not pay for the full consequences of their actions and hence they might reduce their levels of precaution.

This unitary approach is reflected in terminology. In fact, a single label is employed to refer to problems concerning both conditions mentioned above. The notion mostly used is that of ‘judgment proof injurer’.⁴ A competing though older label is ‘disappearing defendant’,⁵ which is in fact considered as a synonym of the former.

This paper re-examines these two notions and suggests that they should be distinguished from each other. In fact, circumstances that hinder the payment of damages have a more complex and indirect effect on behavior when compared to situations that prevent tortfeasors from being brought before the court. This paper proposes that injurers should be described as ‘disappearing’ if they are not brought before the court and as ‘judgment proof’ if they do not pay the appropriate damage award,⁶ along with illustrations of the differences between these two problems.

There is also an advantage in not using notions of insolvency or apprehension in a more general fashion as substitutes for judgment proofness and disappearance, as they do not exhaust the full reach of the concepts at issue. Judgment proofness may in fact derive from situations that have little to do with insolvency. A cap on the amount of damages that the injurer may be condemned to pay can be set by law or regulation, thus creating judgment proof injurers who are not in fact insolvent. Likewise, missed apprehension is not the only reason why

(1984), and Shavell (1986).

⁴ The concept of judgment proof injurer was introduced into the economic analysis of law by Shavell (1986) with reference to both insolvent injurers and unapprehended injurers.

⁵ Summers (1983), providing the first analysis of problems related to the fact that injurers may at times escape legal suit or liability, used the label of ‘disappearing defendant’ to refer to both situations. Summers (1983, p. 145) noticed that in both cases the injurer’s *ex ante* expectation to pay damages is curbed and hence his incentives to take precaution are diluted. He elaborated on this point by showing that the effects on behavior crucially depend on whether the injurer is subject to strict liability or to negligence. He principally argued that a negligence regime is less affected by disappearing defendant problems. This conclusion is also reached by Shavell (1986).

⁶ There is a path-dependence advantage in conserving the labels traditionally used in the literature, even if this requires a conceptual change, as their meanings in our analysis no longer coincide. Our choice is only motivated by an intuitive (almost onomatopoeic) link between the notion of missed apprehension and the idea of disappearance, on the one hand, and the ability to escape an order and the notion of being judgment proof.

defendants may disappear. An injurer can in fact be easily detected but subsequently not sued by the victim, or the causal relationship between his action and the victim's harm may be hard to establish in court. In proceeding with the analysis, the qualification of 'judgment proof injurer' and 'disappearing defendant' will be only employed with the meaning defined in this section.

We distinguish categories of accidents along two dimensions: (i) whether the injurer's precaution only curbs the probability of accidents or it mitigates the magnitude of the accident loss⁷ and (ii) whether or not the precaution expenditures made by the injurer reduce his exposure to liability.⁸ It will be shown that while the disappearing defendant problem has invariant effects on the injurer's incentives to take precaution, the consequences of the judgment proof problem differ depending on these circumstances.

Only in one case do judgment proof injurers and disappearing defendants take the same levels of precaution: when the injurer's precaution only affects the probability of the accidents and precaution expenditures do not reduce the injurer's liability. The conclusions of previous literature are based on this type of model and therefore yield to a unitary perspective on the two problems at issue.

Normally, when a defendant is both disappearing and judgment proof the outcome is worse than when only one of these two problems occurs. However, since at times the judgment proof problem may result in injurer's over-precaution, there are cases in which tort law failures have offsetting effects on each other and thus improve the outcome as compared with situations in which only judgment proofness or only the disappearing defendant problem materialize.

The next question that this paper addresses is whether the negligence rule may be less vulnerable to the judgment proof problem than strict liability. Law and economics literature on

⁷ Boyd and Ingberman (1994) first made this distinction in relation to judgment proofness; Dari-Mattiacci and De Geest (2005) further elaborated on it.

⁸ Monetary precaution expenditures, for example, reduce the injurer's assets that are available for victims' compensation, while non-monetary precautions do not have the same effect. Beard (1990) first proved that judgment proof injurers behave differently in these two situations and showed that if precaution expenditures do reduce the injurer's exposure to liability, judgment proofness may result in too much rather than too little precaution. See also Micheli and Segerson (2003) and Dari-Mattiacci and De Geest (2003) on this topic.

this topic unanimously answers in the positive.⁹ The reason behind this result is simple: compliance with the socially optimal level of precaution under the negligence rule is cheaper than under strict liability. In fact, when the injurer takes the optimal level of precaution, he pays damages to the victim under strict liability, while he does not do so under the negligence rule. Thus, the socially desirable level of precaution is comparatively more attractive under the negligence rule than under strict liability. This feature tends to counteract the effects of judgment proofness.

However, this model of negligence,¹⁰ on which previous studies on judgment proofness are based, does not account for the causation requirement. In reality, a negligent injurer may avoid liability by showing that his negligence did not cause the accident, in the sense that the accident would have occurred even if the injurer had been non-negligent.¹¹ This possibility reduces the cost of non-compliance and may thus erode the comparative advantage of the negligence rule. Consequently, as this paper shows, the conclusion that the negligence rule improves the judgment proof problem is only valid under the traditional model of negligence. This is not always true when cause in fact is taken into account.

It results that negligence with cause in fact does not improve the disappearing defendant problem, yielding the same result as strict liability. With regard to judgment proofness, the outcome depends again on the characteristics of the accident mentioned above: negligence with cause may in fact improve the problem, yield the same result as strict liability or even worsen the outcome depending on whether precaution curbs the magnitude or the probability of the accidental loss and on whether precaution expenditures reduce the injurer's exposure to liability.

⁹ Originated in Summers (1983) and Shavell (1986), this conclusion has never been challenged. Dari-Mattiacci and De Geest (2005) show that the traditional form of negligence is superior to strict liability also with precaution technologies different from that considered by Summers (1983) and Shavell (1986), but do not analyze cause in fact as we do in this study.

¹⁰ This version of the negligence rule was first described by Brown (1973) and successively endorsed in the mainstream law and economics literature. See for example Shavell (1987) and Landes and Posner (1987).

¹¹ This interpretation of the negligence was initially proposed by Grady (1983), who argued that such a model would be closer to the reality of tort law litigation than the traditional one. Kahan (1989) subsequently provided an economic formalization of the model. This rule is also known as the incremental damage rule and is discussed in Craswell and Calfee (1986).

The analysis is organized as follows. In section 2 we illustrate in what contexts these two problems may arise. In section 3, we present our formal analysis under strict liability and, in section 4, we extend the model to the two variants of the negligence rule. Section 5 concludes.

2. The sources of the problems

The disappearing defendant problem and the judgment proof problem may arise for various reasons. Understanding the circumstances in which these problems arise is important in order to correctly categorize the accidents that we will analyze in the subsequent sections.

The disappearing defendant problem infers that, at times, an injurer cannot be found. This may be due to the circumstances in which the accident occurs.¹² For example, in cases of environmental damage that is deemed ‘orphaned’ or where no responsible injurer can be identified, EU Member States are obliged to ensure that the damage is remedied. The Member States may impose fees or taxes on companies which are involved in activities that are likely to cause such damage. The same problem occurs in vicarious liability cases, where the victim may have difficulty in identifying which of the principal’s agents caused the injury. In this case, the principal has a comparative advantage in being able to identify the injurer among his agents and collecting damages from the injurer.¹³

A second reason why an injurer may disappear is that, even though he can be easily identified, there is no causal link between the injurer’s action and the harm caused. This is often due to the substantial amount of time that elapses between the injurer’s conduct and its harmful effects on victims. Moreover, the lapse of time may add to the difficulty of establishing causation. In the context of toxic tort cases, for example, a great deal of time elapses between

¹² Directive 2004/35/CE. The EU Member States’ ability to impose fees on companies likely to cause environmental damage is similar to the CERCLA (Superfund) legislation in the US. See footnote 17.

¹³ Law and economics literature has justified the employer’s vicarious liability for accidents caused by the employee on three grounds: (1) the victim’s inability to identify the injurer among all employees of a firm (discussed in the text accompanying this footnote); (2) the employee’s insolvency (which will be discussed below in the text; and (3) the employee’s risk-aversion (which will not be discussed here as it does not bear on the problems at issue). The first economic analyses of vicarious liability were provided by Sykes (1981) and Kornhauser (1982). For a recent analysis see also Dari-Mattiacci and Parisi (2003).

when victims are exposed to a toxic substance and when symptoms of illness or disease develop. This long latency period could in fact bar victims from recovering losses because injurers may not be found and causation becomes more difficult to prove.¹⁴

One important piece of legislation allows an injurer, namely an owner or operator of a facility, to be held liable without finding causation.¹⁵ The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, was enacted by the U.S. Congress to address liability for the release of hazardous waste and to establish a trust fund providing for environmental cleanup when no responsible party can be identified. It does not set a regulatory environmental standard, rather it is a pollution abatement program mostly funded by means of a ‘feedstock tax’¹⁶ and reimbursement liability.¹⁷

Likewise, the EU Directive on environmental liability with regard to the prevention and remedying of environmental damage establishes that, “if the operator cannot be identified, the competent EU authority may take remedial measures itself, as a means of last resort.”¹⁸

The disappearing defendant problem may also arise if the amount of time passing may exceed the applicable statute of limitations, thus effectively eliminating the opportunity for victims to recover damages for losses incurred. Under CERCLA, any action for natural resource damages must commence within 3 years after the later of the either (1) the date of the discovery of the loss or (2) the date on which regulations are promulgated under section

¹⁴ Miceli and Segerson (2001).

¹⁵ 42 U.S.C.A. § 9607(a)(1). Several courts explicitly have declined to read a causation requirement into section 9607(a). See *State of N.Y. v. Shore Realty Corp.*, 759 F.2d 1032, C.A.2 (N.Y.), 1985. *United States v. Cauffman*, No. CV 83-6318- KN(Bx), slip op. at 2-3 (C.D.Cal. Oct. 23, 1984) (citing other cases).

¹⁶ The feedstock tax is a special industry tax which is imposed on the sale of certain petroleum products, organic and inorganic chemicals.

¹⁷ Comprehensive Environmental Response, Compensation, and Liability Act of 1980, Pub.L. No. 96-510, 94 Stat. 2767 (codified as amended at 42 U.S.C. § 9601-9675 (759 F.2d 1032 1988 & Supp. II 1990)).

¹⁸ Directive 2004/35/CE, Article 6, para. 3. Where the CERCLA legislation does not require causation, the EU Directive does require that causation be found. The aim of the Directive is to establish a scheme of liability based on the ‘polluter pays’ principle. The ‘polluter-pays’ principle states that the operator who causes environmental damage or imminent threat of damage should bear the cost of necessary preventive or remedial measures. If a third party, such as a competent authority, should bear such cost, the authority can recover the incurred costs from the liable operator (para. 18 of the preliminary considerations to the Directive). In order for this liability scheme to be effective, there must be ‘one or more identifiable polluters, the damage should be concrete and quantifiable, and a causal link should be established between the damage and the identified polluter(s)’ (para. 13 of the preliminary

9651(c) of the legislation.¹⁹ In contrast, the EU Directive on environmental liability states that a 5-year statute of limitations for the recovery of clean-up costs runs from date of completion of measures or identification of liable party, whichever is later.²⁰

Even if the injurer is timely found and causation can be easily established, victims may simply be unwilling to sue because the value of the claim or their expected recovery is outweighed by a combination of factors: the cost of litigation might be too great, legal fees will be retained by the victim's attorney if the claim is successful, or the backlog of cases in the legal system may create a substantial delay for their own case.

With regard to the problem of judgment proofness, it is even more important to comprehend why and how the problem occurs. This approach allows for a proper categorization of the accident and a more accurate assessment of the effects of the judgment proof problem on the injurer's behavior. An obvious reason why the problem may occur is because the valuation of the harm caused to the victim exceeds the injurer's assets.²¹ Here, we must consider whether or not the injurer took monetary precaution. This will provide us with a better understanding of the assets that the injurer possesses.

The distinction between monetary and non-monetary precaution is essential to understanding the distinction between one-pocket and two-pocket models.²² Expenditures in monetary precaution will further reduce the injurer's assets, while non-monetary precaution leaves the injurer's assets unchanged. This means that when the injurer takes monetary precaution, not only does he reduce the expected accident loss, but he also reduces his exposure to liability. If the injurer takes monetary precaution and has limited assets, then the more the injurer spends in precaution, the less his assets become. This is considered a one-

considerations to the Directive).

¹⁹ 42 U.S.C.A. § 9613.

²⁰ Directive 2004/35/CE, Article 10.

²¹ The judgment proof problem has also provided one of the economic justifications for vicarious liability; see footnote 13.

²² This terminology has been introduced by Dari-Mattiaci and De Geest (2003). The two-pocket model refers to situations in which the injurer behaves as if he had two budgets: one to pay for precaution costs and the other to pay for damages. On the contrary, the one-pocket model refers to cases in which the injurer has one budget out of which both precaution expenditures and damage compensation are paid, thus the former reduces the amount of money available for the latter.

pocket situation. Monetary precaution by insolvent injurers may thus increase their incentives to take precaution in a way that will be analyzed in the next section.

On the contrary, if the injurer's precaution is non-monetary, the result is always a two-pocket model. In a different situation, if the injurer does take monetary precaution, but he is considered judgment proof because of a liability cap (as explained below), the cap does not change if the injurer takes more precaution, thus the result again is a two-pocket model.

Even when the injurer is solvent at the moment of his conduct, he may become insolvent before the harm materializes or the case is adjudicated. Time passing may also favor injurers' attempts to hide or voluntarily reduce their assets.²³ Referring to the toxic tort example used earlier (wherein causation could not be established for the disappearing defendant), the injurer in this case may be insolvent by the time that victims develop the symptoms of illness or disease.²⁴ In this sense, the injurer is judgment proof as opposed to a disappearing defendant.

Potential injurers may also have an incentive to become judgment proof, even if they have not committed any wrongdoing yet. For example, in legal malpractice insurance policies there is a liability cap. Lawyers often refrain from purchasing a second additional policy because most clients injured by malpractice are reluctant to pursue damages beyond the liability cap. In the event that a client tries to pursue damages above the cap, or if the client discovers that the lawyer has no malpractice insurance, the lawyer could make himself more judgment proof by retaining minimal assets and/or hiding or protecting his assets so that acquisition of the assets will become quite expensive for the client.²⁵

Often, a corporation is the injurer who is found to be judgment proof, as it has no assets to satisfy the victim's claim. Generally, a defendant (in this instance, a corporation) who renders itself judgment proof by selling all of its assets and distributing those proceeds of the sale, does not pass liabilities of those assets to the purchaser. There is an exception in some instances, known as the "trust fund" doctrine, recognized in most states, which enforces continued liability

²³ See Boyd and Ingberman (1999).

²⁴ Miceli and Segerson (2001).

²⁵ Cohen (1997).

for a brief time on former shareholders of a dissolved corporation for the corporation's debts.²⁶

However, the judgment proof problem may also occur when the injurer's insolvency is not at issue; instead, the law has placed limitations on the injurer's liability. The most common legal limitation is the liability or damage cap on the injurer. This generally occurs in instances of high-risk activities such as use of nuclear power, industrial activities, airlines, etc. Implicit in these types of activities is the potential for accidents resulting in a great amount of damage, so high that liable companies may not be able to adequately compensate for the damages.²⁷ Liability caps are used as a sort of immunity rule, reasoning that companies may fear that courts will prescribe liability even where no wrongdoing is present, or that companies will want to avoid absorbing the full costs associated with the activity, which may cause underproduction of the company's activity.²⁸ This issue is addressed in legislation relevant to the high-risk activities. In the case of oil pollution, liability is limited under the Oil Pollution Act of 1990: An onshore facility's liability is capped at \$350,000,000; total liability for tank vessels responsible under the Act is limited to the greater of \$1200 per gross ton, \$10,000,000 for vessels over 3000 tons, or \$2,000,000 for vessels under 3000 tons.²⁹

A second instance of such legal limitations occurs when the victim does not receive compensation for pain and suffering. Generally, compensation is not awarded for total losses; instead, victims receive compensation in form of pecuniary damages related to the injury, in addition to an award for pain and suffering arising from the loss. Research indicates that most victims with nonfatal injuries are not fully compensated for their losses suffered. In fact, where the injurer has a low liability the case is likely to be dropped, the injurer with high liability is more likely to settle his case, as shown by Galanter (1996). The same study indicates that while the seriously injured victims are generally under-compensated, awards to victims have been

²⁶ *Chaveriat v. Williams Pipe Line Co.*, 11 F.3d 1420, C.A.7 (Ill.), 1993, *Blankenship v. Demmler Mfg. Co.*, 89 Ill.App.3d 569, 44 Ill.Dec. 787, 789-90, 411 N.E.2d 1153, 1155-56 (1980); *In re RegO Co.*, 623 A.2d 92, 95 (Del.Ch.1992); see also Roe (1984).

²⁷ Innes (2004).

²⁸ Gillette (1996).

²⁹ 33 U.S.C.A. § 2701-2761. Section 2704 addresses limitations to liability, which is applicable to responsible parties as well as those third parties found liable under § 2703. Besides setting limits on liability for damages resulting from oil spills, The Oil Pollution Act of 1990 creates a fund to pay for damages resulting from oil spills.

increasing, even when adjusted for inflation. An earlier study by Viscusi (1991) found that 62.5% of the cases awarding damages for bodily injury included damages for pain and suffering, although the pain and suffering damages varied greatly.³⁰ While juries are instructed to award damages that will fully compensate victims or make them whole, people today have greater life expectancies and the price of medical care has increased dramatically, the combination of which gives rise to larger victim losses.³¹ Consequently, a jury may feel it necessary to award a higher damage award to appropriately compensate the victim; however, there is a tendency to over-compensate smaller losses and under-compensate larger losses. This is attributed to the fact that serious injuries and its full costs may be difficult to calculate, and often victims will settle with injurers before all of the accident's effects become known. In addition, those victims may be risk-averse and uncertain of their chances to recover full costs, and injurers aware of this may end up paying a much lower damage award.

Another manner in which the law limits liability is through limited compensation for bodily injuries. Often, individual states will create damage liability caps for actions arising from products liability, or even actions by victims against the state government and its employees. For example, under Florida state law, claims against certain government agencies are limited to \$100,000, per incident or occurrence, or if liability insurance is purchased, then up to the limits of insurance coverage, whichever is greater.³² As a result, numerous cases in Florida have been limited to this damage cap.³³ Thus, damage caps have a targeted effect of limiting the damage awards for those most seriously injured victims, as those victims will claim the greatest amount of damage. On the other end of the spectrum, the lower awards are unaffected by the

³⁰ See also Arlen (1999).

³¹ Galanter (1996).

³² West's F.S.A. § 768.28.

³³ *State, Dept. of Transp. v Knowles* (1980, Fla. App. D2) 388 So 2d 1045. See also *Trianon Park Condominium Asso. v Hialeah* (1982, Fla. App. D3) 423 So 2d 911, in which the court held that aggregate damage awards to 65 home owners could not exceed a statutory maximum of \$100,000 recoverable against a government defendant in actions arising from a single "incident or occurrence."

damages caps. This effectively defeats the goal of the award system, and also endangers the system's goal of deterring and preventing injury.³⁴

3. Analysis of strict liability

In this section, we will assess the effects that the disappearing defendant and the judgment proof problems have on social welfare and show that they are generally very different from each other. We first analyze these two problems in isolation and then evaluate their combined effects in a simple mathematical model. Our results are summarized in tale 1.

[Table 1]

We will consider accidents between an injurer and a passive victim, who are strangers to each other. Only the injurer is able to take precaution in order to reduce the expected harm to the victim. He is rational, utility maximizing and risk-neutral. Let x be the injurer's precaution cost and $l(x)$ the expected accident loss, with $l > 0$, $l' < 0$, $l'' > 0$. As it is usual, the objective of tort liability is taken to be the minimization of the total social cost of accidents, that is, the expected accident loss plus the precaution cost:³⁵

$$(1) \quad \min_x [l(x) + x]$$

Let x^* denote the unique level of precaution that minimizes (1) and hence solves $l' = -1$, and let it be positive. Here we analyze the injurer's behavior under strict liability; in the next section we will extend the analysis to the negligence rule. In both cases, courts are assumed to award perfectly compensatory damages to accident victims.

Under strict liability, the standard result is that a solvent injurer who faces liability for all of

³⁴ Galanter (1996) comments that "Optimum deterrence can be achieved only when injurers are required to bear the full cost of injuries in instances when courts have determined that further preventive measures should have been taken... the imposition of a cap removes the possibility of judicial achievement of optimum deterrence in cases of the most serious injuries."

³⁵ See Calabresi (1970), Brown (1973), and Shavell (1987) on this formulation of the social cost function.

the accidents he causes³⁶ takes the socially optimal level of precaution x^* , because he fully bears his precaution costs x and is obliged to pay damages to the victim equal to the harm $l(x)$. Thus the injurer's minimization problem is identical to (1).

3.1. *The disappearing defendant problem under strict liability*

If a solvent injurer faces liability only for a subset of the accidents he causes, he will not fully internalize the consequences of his actions. Let $0 < a < 1$ denote the probability that the injurer is held liable. His minimization problem is:

$$(2) \quad \min_x [al(x) + x]$$

He will therefore take a level of precaution $x_a < x^*$, which solves $l' = -1/a$. By the Implicit Function Theorem, it is also easy to see that x_a is monotonically increasing in a ; that is, the injurer takes more precaution when a approaches 1 and, vice versa, his precaution level drops when a decreases towards 0.

3.2. *The judgment proof problem under strict liability*

Let us now turn to the judgment proof problem. In this case, a further taxonomy of accidents is necessary in order to analyze the injurer's behavior. We will classify accident contexts along two dimensions: the precaution technology available to the injurer and the effects that his precaution expenditures have on his exposure to liability.

Concerning precaution technology, in order to assess the effects of judgment proofness on the injurer's precaution decisions, we need to separate the effect that the injurer's precaution has on the probability of the accident from the effect it has on the magnitude of the harm. For simplicity, we will consider two stereotypical situations: the *probability model*, in which the injurer's precaution only reduces the probability of the accident, while the magnitude is exogenous (consider for example airplane accidents); and the *magnitude model*, where the probability is exogenous and the injurer's precaution only reduces the magnitude of the harm

³⁶ For simplicity, the issue of causation under strict liability is not discussed. We will instead elaborate upon the

(as for example lifeboats and safety belts do).

Concerning instead the effects of the injurer's precaution on his exposure to liability, we consider two opposite cases: the *two-pocket* model, in which the injurer's precaution has no effect on his exposure to liability, and the *one-pocket model*, in which the injurer's precaution expenditures reduce the assets available for compensation.³⁷

A simple taxonomy of accidents in four different categories can be made along these two dimensions, as shown in table 1. The judgment proof problem has different effects on the injurer's precaution in each of these four cases, which we will individually revise.

3.2.1. The two-pocket probability model

In this model we have $l(x) = p(x)h$, where $p(x)$ is the probability of the accident³⁸ and is a function of the injurer's precaution and h is the magnitude of the harm and is exogenous. Let t be the injurer's assets (or the maximum amount of damages as capped by law), which are not affected by the injurer's precaution expenditures. This situation occurs when precaution is a non-monetary variable or the injurer's liability is capped by law. Therefore, the injurer's minimization problem is:

$$(3) \quad \min_x [p(x) \min\{h, t\} + x]$$

If $t \geq h$, the injurer will take x^* . If, however, $t < h$, the injurer will take $x_t < x^*$, which solves $p' = -1/t$, and is monotonically increasing in t . It is easy to see that this model is analogous to the disappearing defendant model. In fact, by simply setting $a = t/h \leq 1$, we can rewrite $p' = -1/t$ as $l' = -1/a$, from which the equivalence between the two problems is evident. Early literature on the judgment proof problem focused exclusively on this type of model; thus, it legitimately treated the judgment proof problem and the disappearing defendant problem as two manifestations of the same phenomenon. As we will see in the following subsections, however, the judgment proof problem may take very different forms. We will analyze three other

interaction of the negligence rule with the requirement of cause in fact in the next sections.

³⁷ See *supra* section 2.

³⁸ From the assumptions made on $l(x)$, the following follows $0 < p(x) < 1$, $p' < 0$, $p'' > 0$, and $h > 0$.

possible models, and thus argue that the two problems should be treated separately.

3.2.2. The one-pocket probability model

The first variation of the basic model to be considered is the case in which the injurer's expenditures on precaution reduce his exposures to liability. If, for instance, precaution is a monetary variable, the assets available for paying damages are $t - x$, instead of simply t as in the previous model. The injurer's minimization problem therefore becomes:

$$(4) \quad \min_x [p(x) \min\{h, t - x\} + x]$$

Under this model, when the injurer is insolvent he actually receives a precaution subsidy. In fact, a portion of the precaution expenditures he makes are refunded in terms of a smaller damage payment. An insolvent injurer pays $p(x)[t - x] + x$, which may also be written as $p(x)t + [1 - p(x)]x$. The latter expression shows that the injurer bears only a portion of the precaution costs, because in $p(x)$ cases (that is, when an accident occurs) this cost will be balanced by an equal reduction in liability. As a result, when the injurer's assets t are particularly low, the injurer will take less than socially optimal precaution. However, with larger assets, injurers actually take more than socially optimal precaution up to a certain threshold level of t , beyond which precaution drops to the optimal level.³⁹

3.2.3. The two-pocket magnitude model

In many accident contexts the injurer's precaution also reduces the magnitude of the accidental loss. In traffic accidents, for example, the speed of a motorist affects both the probability and the magnitude of harm to pedestrians. In this section and the following we will consider a stereotypical case, which is diametrically opposed to the probability model studied above. In a *magnitude model*, the injurer precaution only reduces the magnitude of the accidental loss $h(x)$, while the probability p is exogenous. Thus, we have $l(x) = ph(x)$.⁴⁰ Thus, the injurer's minimization problem becomes:

³⁹ Beard (1990). For a simple proof of these claims see Dari-Mattiaci and De Geest (2003).

$$(5) \quad \min_x [p \min\{h(x), t\} + x]$$

It is easy to see that the injurer's cost is either minimized by x^* , when t is sufficiently large, or by $x = 0$, when t is low.⁴¹ This binary outcome derives from the fact that the injurer is not insolvent at all levels of precaution, because the harm is determined by his precaution expenditures. Thus, he is insolvent only when his precaution is so low that the harm is greater than his assets. As a result, insolvency is actually determined by the injurer's precaution decisions.

The injurer makes an infra-marginal choice between being solvent and being insolvent. If solvent, his optimal precaution is clearly x^* , as he bears all costs as in the social optimum. If insolvent, his optimal precaution is $x = 0$, as he bears ex ante $pt + x$, and thus any precaution expenditure only increases his costs without reducing his exposure to liability.⁴² This choice depends in turn on the size of his assets.

3.2.4. The one-pocket magnitude model

In the one-pocket variant of this model, the injurer's minimization problem becomes:

$$(6) \quad \min_x [p \min\{h(x), t - x\} + x]$$

Contrary to the one-pocket probability model, however, the precaution subsidy is not sufficient to raise the level of precaution that an insolvent injurer takes. In fact, the precaution subsidy operates only with a probability p , the probability that an accident occurs. Thus the injurer only receives a partial refund of precaution. This is also true in the probability model, but there precaution reduces the probability of the accident, and so it has a positive value for the injurer. Instead, in the magnitude model, precaution is of no value for insolvent injurers, as the probability is exogenous. Thus, we have the same outcome as in the two-pocket magnitude

⁴⁰ From the assumptions made on $l(x)$, the following follows $0 < p < 1$, $h(x) > 0$, $h' < 0$, and $h'' > 0$.

⁴¹ The threshold level of the injurer's assets is $t = h(x^*) + x^* / p$. Note that the injurer may take no precaution at all even when his assets are large enough to pay compensatory damage if he takes optimal precaution; that is, when $t > h(x^*)$.

⁴² See Dari-Mattiacci and De Geest (2005) for a formal proof of this claim.

model: the injurer takes either $x = 0$, for low levels of t , or x^* , for higher levels of t .⁴³

[Figure 1]

3.3. *Disappearing defendant and judgment proofness combined*

So far, we have separately analyzed the two problems at issue. In reality however, they may occur together. As we would expect, when this happens the result is a further reduction of social welfare if compared with situations in which we have either of the two alone. However, there are cases in which they do counteract each other, thus improving social welfare.

As we have seen, in a one-pocket probability model the judgment proof problem may induce injurers to take excessive precaution. The disappearing defendant problem, instead, always reduces the level of precaution taken by injurers. Therefore, when they are jointly present, these two opposed forces will tend to rebalance the injurer's precaution and bring it closer to the social optimum.

3.3.1. Probability models

It is trivial to show that, in a two-pocket probability model, the effects of the disappearing defendant problem add to the effects of judgment proofness in lowering the level of precaution taken by the injurer. When the two problems are combined, the level of precaution taken by the injurer will be x_{at} which solves $p'(x) = I / at$, which is clearly lower than x_t (solving $p'(x) = I / t$) and x_a (solving $p'(x) = I / a$).

In a one-pocket probability model, however, the dilution of the injurer's incentives due to the disappearing defendant problem could mitigate the over-precaution problem generated by judgment proofness. Consider a potentially judgment proof injurer with assets equal to $t = h + x^*$. In such a situation, the injurer will take a level of precaution that is higher than the optimal level, that is $x^t > x^*$.⁴⁴ Let us now introduce a disappearing defendant problem, that is, a probability of apprehension of $a < 1$. The injurer now bears the following costs: $ap(x)[t - x] + x$.

⁴³ See Dari-Mattiacci and De Geest (2003) for a formal treatment of this claim.

⁴⁴ In fact, x_t solves $p'(x_t)(t - x_t) - p(x_t) + 1 = 0$. Evaluating this expression at x^* , we obtain $p'(x^*)(t - x^*) - p(x^*) + 1 = p'(x^*)h - p(x^*) + 1 < 0$. Thus we have $x_t > x^*$.

His level of precaution will thus be x_{at} , which solves:

$$(7) \quad p'(x) = -\frac{\frac{1}{a} - p(x)}{t - x} < -\frac{1 - p(x)}{t - x}$$

Since $p'(x) = -[1 - p(x)]/[t - x]$ is solved by $x_t > x^*$, then the above inequality yields that x_{at} is lower than x_t . We further need to establish whether x_{at} is greater or less than x^* . The derivative of the injurer's cost evaluated at x^* yields $ap'(x^*)[t - x^*] - ap(x^*) + 1$ and is negative if x_{at} is greater than x^* and negative otherwise. After substituting $t = h + x^*$ (as we assumed above) and $p'(x^*)h = -1$ (from the definition of x^*), we have $x_{at} \leq x^*$ if the following condition is satisfied and $x_{at} > x^*$ otherwise.

$$(8) \quad a \geq \frac{1}{1 + p(x^*)}$$

Thus, if the apprehension rate is sufficiently high, the disappearing defendant problem unambiguously improves the judgment proof problem, as it reduces the (excessive) level of precaution taken by the injurer without resulting in under-precaution. When the equality in (8) is satisfied, we obtain the socially optimal level of precaution. Nevertheless, even when a lower apprehension rate results in some level of under-precaution, it might still be true that the social welfare is higher than under the judgment proof problem alone.

Conversely, it is easy to see that this situation also yields higher social welfare than the disappearing defendant problem alone. In this case, while the disappearing defendant problem unambiguously results in under-precaution, the judgment proof problem may in fact raise the injurer's level of precaution to a level that is closer to the social optimum in a similar way as we have seen above.

3.3.2. Magnitude models

In magnitude models, instead, the two problems combined definitively lower social welfare. Consider the case in which a potentially judgment proof injurer has just enough assets to take

optimal precaution. That is, assume that $t = h(x^*) + x^* / p$.⁴⁵ Let us now introduce a disappearing defendant problem, that is, the probability of apprehension is $a < 1$. The optimal level of precaution for a solvent injurer becomes x_{at} , such that $aph'(x_{at}) + 1 = 0$. Re-writing the initial condition as $pt = ph(x^*) + x^*$, it is easy to show that the following (in)equalities hold:

$$(9) \quad pt = ph(x^*) + x^* \Rightarrow apt = a(ph(x^*) + x^*) < a(ph(x_{at}) + x_{at}) < aph(x_{at}) + x_{at}$$

As a result, the cost of taking no precaution at all, apt , is lower than the cost $ap(x_{at}) + x_{at}$ of taking the higher level of precaution x_{at} . Therefore, we can conclude that a potentially judgment proof injurer, who would otherwise take optimal precaution, will instead take no precaution at all due to the disappearing defendant problem. Such level of precaution is lower than the level of precaution that the injurer would take under the judgment proof problem alone, but also than the level that the injurer would take under the disappearing defendant problem alone, which is lower than optimal but generally positive, as we have seen in the previous section. It is easy to see that the same would occur in a one-pocket magnitude model.

4. Analysis of negligence

In this section, we will discuss the effects of tort law failures when the injurer is subject to liability for negligence. Since its incipit, the literature has traditionally prized the superiority of the negligence rule over strict liability as the appropriate liability rule for judgment proof injurers and disappearing defendants. The logic of this argument is simple: the negligence rule makes compliance with the optimal level of precaution cheaper, because non-negligent injurers do not compensate victims for harm. However, as it has been shown,⁴⁶ this result may be easily challenged when the requirement of cause in fact is introduced into the model.

The traditional model of negligence simply assumes that negligent injurers pay their precaution costs plus damage compensation to the victim, while non-negligent injurers only pay their precaution costs. Assuming that the standard of negligence is set at the socially optimal

⁴⁵ In this case the injurer is in fact indifferent between taking x^* and bearing $ph(x^*) + x^*$, and taking $x = 0$ and bearing pt .

level, the minimization problem of a (solvent and non-disappearing) injurer is:

$$(10) \quad \min_x \begin{cases} l(x) + x & \text{if } x < x^* \\ x & \text{if } x \geq x^* \end{cases}$$

The traditional conclusion being that the injurer will take x^* . Nevertheless, the functioning of negligence in the courts may be different. Injurers, in fact, may claim that their negligence did not cause the accident, in the sense that the accident would have occurred even if they had been non-negligent. Therefore, a negligent injurer does not always pay damages to the victim (or he does not pay for the entire harm), as he is exonerated from paying damages that would have occurred anyway. His minimization problem thus becomes:

$$(11) \quad \min_x \begin{cases} l(x) - l(x^*) + x & \text{if } x < x^* \\ x & \text{if } x \geq x^* \end{cases}$$

Also in this case it is easy to show that the injurer takes x^* . Although the performance of these two rules is identical under ideal conditions, it diverges when tort law failures are considered. Hereafter we will analyze the performance of these two variants of the negligence rule in the face of tort law failures. Our results are summarized in table 2.

[Table 2]

4.1. *The disappearing defendant problem under negligence*

As we will see the disappearing defendant problem takes two very different forms under the two versions of the negligence rule. While negligence without cause in fact mitigates the problem, if compared to strict liability, negligence with cause in fact does not, yielding the same outcome as a strict liability rule.

Under negligence without cause in fact, the injurers faces the following minimization problem:

$$(12) \quad \min_x \begin{cases} al(x) + x & \text{if } x < x^* \\ x & \text{if } x \geq x^* \end{cases}$$

⁴⁶ Dari-Mattiacci (2004).

It is easy to see that, although the first expression in (12) is minimized by $x_a < x^*$ as soon as $a < 1$ (a situation that yields suboptimal precaution under strict liability), the injurer will still find it advantageous to take x^* if $x^* \leq al(x_a) + x_a$. Therefore there exists a threshold level of a (given by the former expression) above which the negligence rule yields socially optimal precaution, while strict liability would have induced the injurer to take too little precaution.

Under negligence with cause in fact, the conclusion reached above does not hold true. In fact, the injurer's problem is:

$$(13) \quad \min_x \begin{cases} a[l(x) - l(x^*)] + x & \text{if } x < x^* \\ x & \text{if } x \geq x^* \end{cases}$$

The first condition in (13) is again minimized by x_a , but the condition for the injurer to take x^* becomes: $x^* \leq a[l(x_a) - l(x^*)] + x_a$, which may be rewritten as $al(x^*) + x^* \leq al(x_a) + x_a$, which can never be satisfied by definition of x_a . Therefore, the injurer will always take x_a under negligence with cause in fact as he does under strict liability.

4.2. The judgment proof problem under negligence

The performance of the negligence rule in the face of the judgment proof problem is quite different. While the negligence rule without cause in fact unambiguously improves the judgment proof problem as it does for the disappearing defendant problem, the negligence rule with cause in fact is not quite as undesirable as before. In fact there is a wide range of circumstances in which the two versions of the negligence rule may yield the same outcome.

4.2.1. The two-pocket probability model

Under negligence without cause in fact, the injurer faces the following minimization problem:

$$(14) \quad \min_x \begin{cases} p(x) \min\{h, t\} + x & \text{if } x < x^* \\ x & \text{if } x \geq x^* \end{cases}$$

The first expression in (14) is minimized by $x_t < x^*$ as soon as $t < h$. However, the injurer will still find it advantageous to take x^* if $x^* \leq p(x_t)t + x_t$. Therefore, there exists a threshold level of t above which the negligence rule yields socially optimal precaution, while strict liability would have induced the injurer to take too little precaution.

Under negligence with cause in fact, the injurer's problem is:

$$(15) \quad \min_x \begin{cases} [p(x) - p(x^*)] \min\{h, t\} + x & \text{if } x < x^* \\ x & \text{if } x \geq x^* \end{cases}$$

The first condition in (15) is again minimized by x_t if $t < h$, but, as before, the condition for the injurer to take x^* becomes: $x^* \leq [p(x_t) - p(x^*)]t + x_t$, which may be rewritten as $p(x^*)t + x^* \leq p(x_t)t + x_t$, which can never be satisfied by definition of x_t . Therefore, the injurer will always take x_t as under strict liability. As we have concluded under strict liability, the two-pocket probability model corresponds to the disappearing defendant model and the same results are reached. The results will be different in the following models.

4.2.2. The one-pocket probability model

Under negligence without cause in fact, the injurer faces the following minimization problem:

$$(16) \quad \min_x \begin{cases} p(x) \min\{h, t - x\} + x & \text{if } x < x^* \\ x & \text{if } x \geq x^* \end{cases}$$

As soon as t is below a certain threshold level,⁴⁷ the first expression in (16) is minimized by x_t , if $t < h + x$, which may be greater or less than x^* . It is easy to see that if x_t is greater than x^* the injurer will take x^* , because he does not pay damages to the victim and hence has no incentives to increase his level of precaution above x^* . If x_t is less than x^* , then the injurer will still take x^* if $x^* \leq p(x_t)[t - x_t] + x_t$, while it always takes x_t under strict liability. Thus, also in this case, the negligence rule without cause in fact improves the judgment proof problem.

Under the negligence rule with cause in fact, the injurer's problem is:

$$(17) \quad \min_x \begin{cases} [p(x) - p(x^*)] \min\{h, t - x\} + x & \text{if } x < x^* \\ x & \text{if } x \geq x^* \end{cases}$$

The first condition in (17) is minimized by $x_c < x_t$ ⁴⁸ if $t < h + x$ and, as before, if x_c is greater

⁴⁷ See section 3.2.2.

⁴⁸ Consider that x_c solves $p'[t - x] - p(x) + p(x^*) + 1 = 0$. Evaluating the latter at x_t we have $p'(x_t)[t - x_t] - p(x_t) + p(x^*) + 1 = p(x^*) > 0$, which implies $x_c < x_t$. Evaluating the same expression at x^* we have $p'[t - x^*] + 1 \geq 0$ if $t \leq h +$

than or equal to x^* , then the injurer takes x^* . If, on the contrary, x_c is less than x^* , then the injurer would take x^* only if $x^* \leq [p(x_c) - p(x^*)][t - x_c] + x_c$, which can never be the case.⁴⁹ Thus negligence with cause in fact can only correct over-precaution but not under-precaution. It is further interesting to notice that, in the case of under-precaution, since x_c is less than x_t , the negligence rule with cause in fact results in a worse outcome compared to that of strict liability.

4.2.3. The two-pocket magnitude model

In the two-pocket magnitude model, the difference between the two variants of the negligence rule disappears. Under the negligence rule without cause in fact the injurer's problem is:

$$(18) \quad \min_x \begin{cases} p \min\{h(x), t\} + x & \text{if } x < x^* \\ x & \text{if } x \geq x^* \end{cases}$$

If $t < h(x^*) + x^* / p$, the first expression in (18) is minimized by $x = 0$, which is the level of precaution that the injurer would take under strict liability. However, here the injurer still takes x^* if $x^* \leq pt$. Thus, the threshold level of t is lower than under strict liability, as it is $t = x^* / p$.

Thus the problem improves.

Under negligence with cause in fact, we have:

$$(19) \quad \min_x \begin{cases} p \min\{h(x) - h(x^*), t\} + x & \text{if } x < x^* \\ x & \text{if } x \geq x^* \end{cases}$$

It is easy to show that we can reach exactly the same conclusions as under negligence without cause in fact, thus the two versions of the negligence rule improve the judgment proof problem in the same way.

4.2.4. The two-pocket magnitude model

Under the negligence rule without cause in fact we have:

x^* , which implies $x_c \leq x^*$. On the contrary, we have $p[t - x^*] + 1 < 0$ if $t > h + x^*$, which implies $x_c > x^*$.

⁴⁹ The following inequality necessarily holds $x^* \leq [p(x_c) - p(x^*)][t - x_c] + x_c < [p(x_t) - p(x^*)][t - x_t] + x_t$ (by definition of x_c), which implies $x^* + p(x^*)[t - x_t] < p(x_t)[t - x_t] + x_t$, which in turn can never hold true by definition of x_t .

$$(20) \quad \min_x \begin{cases} p \min\{h(x), t-x\} + x & \text{if } x < x^* \\ x & \text{if } x \geq x^* \end{cases}$$

while under negligence with cause in fact we have:

$$(21) \quad \min_x \begin{cases} p \min\{h(x) - h(x^*), t-x\} + x & \text{if } x < x^* \\ x & \text{if } x \geq x^* \end{cases}$$

Both of these two models yield the same outcome as above. Thus, also in this case the negligence rule improves the judgment proof problem irrespective of the causation requirement.

5. Conclusions

In this paper we have studied the effects of tort law failures on the behavior of injurers and, thus, of social welfare. The illustrative taxonomy provided in the previous sections shows three main results: First, the effects of the disappearing defendant problem (injurers are not successfully sued) are different from those of the judgment proof problem (injurers pay under-compensatory damages to victims). Previous literature suggested to the contrary that these two problems had identical effects on social welfare because it based its conclusions on a specific type of model. By using a more general and realistic formulation, we are able to challenge this result. Second, there are cases in which judgment proofness yields over-precaution and thus the coinciding presence of a disappearing defendant problem may actually improve the outcome and vice versa. Third, we have disproved the other fundamental conclusion that negligence is always less vulnerable to these two problems than strict liability. This result is valid under the traditional model of negligence but is not valid when cause in fact is considered.

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FIGURES

Judgment proof injurer		
Probability models	<i>Two-pocket</i>	Under-precaution
	<i>One-pocket</i>	Under-precaution <i>or</i> over-precaution
Magnitude models	<i>Two-pocket</i>	No precaution <i>or</i> optimal precaution
	<i>One-pocket</i>	No precaution <i>or</i> optimal precaution
Disappearing defendant		Under-precaution

TABLE 1: *The effects of tort law failures under strict liability*

Judgment proof injurer		Without cause in fact	With cause in fact
Probability models	<i>Two-pocket</i>	√	no
	<i>One-pocket</i>	√	corrects over-precaution but worsens under-precaution
Magnitude models	<i>Two-pocket</i>	√	√
	<i>One-pocket</i>	√	√
Disappearing defendant		√	no

TABLE 2: *Whether the negligence rule improves the problem compared to strict liability*

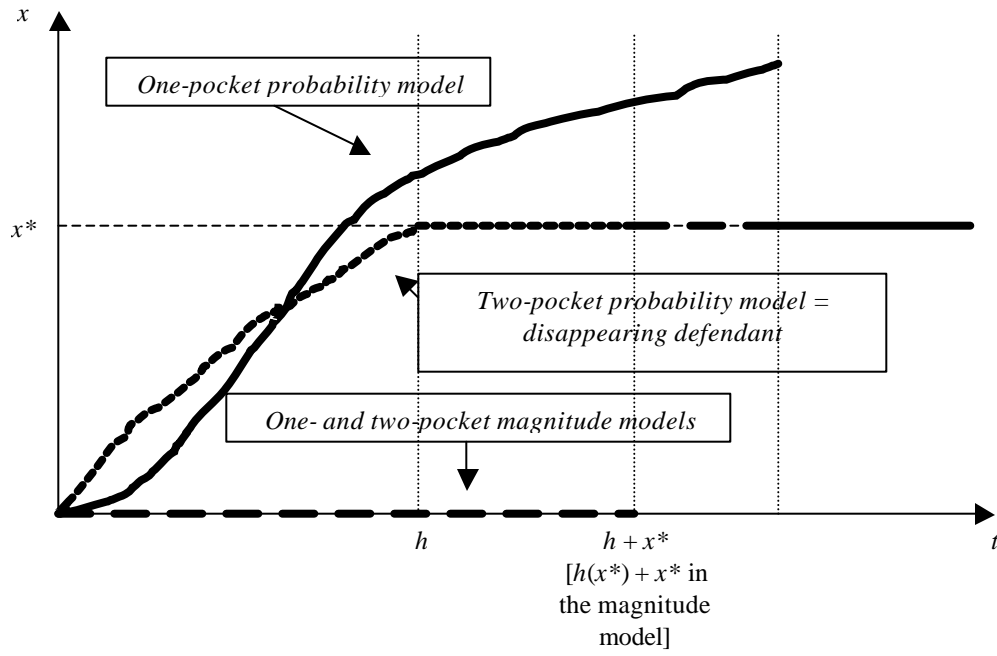


FIGURE 1: Effects of the level of assets t on the injurer's precaution x in the different models of judgment proofness and in the model of disappearing defendant under strict liability