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Discussion Paper Series nr: 05-06

Soft Regulators, Tough Judges

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SOFT REGULATORS, TOUGH JUDGES

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April 2006

Abstract
When tort liability and regulation are jointly applicable, judges have a tendency to be more demanding than regulators. Liability standards are generally more stringent than regulatory ones: violation of a regulatory standard is normally considered negligence *per se* while compliance with regulation does not automatically relieve the injurer of tort liability. While under an imperfectly working tort liability system – i.e. a tort law system whose prevention function is undermined by judgment proof or disappearing defendants – injurers take too little precaution, it will still often be the case that only major violations (and not minor violations) are rewarding. Mathematically, this will occur when the injurer's expected expenses function exhibits two local minima, one at the socially optimal level of care and the other below that level. Regulation set below the optimal level can make the latter unfeasible, thereby enabling liability to induce socially optimal outcomes.

Keywords: insolvency, judgment proof problem, disappearing defendant, bankruptcy, regulation

JEL classification: K13, K32

Acknowledgements
This paper derives from research conducted when both of the authors worked at Utrecht University. We benefited from comments by Matej Marinč, the participants in the seminar at the University of Amsterdam and two anonymous referees on previous versions of this paper. M. Devlin Cooper, Barbara M. Mangan and Andrea Naylor provided valuable research and editorial assistance.

1. Introduction

When tort liability and regulation are jointly applicable, judges have a tendency to be more demanding than regulators. In the United States, a majority of the courts has adopted the rule that the unexcused[1] violation of a statutory standard is negligence *per se*, i.e. negligence in itself.[2] In other words, if a legislative body or regulatory authority defines a regulatory standard (which is aimed at the type of risk the victim suffered, and is specific enough),[3] then the non-compliance with the standard is considered to be sufficient for a finding of negligence. However, the converse does not hold.[4] Compliance with a regulatory norm does not relieve the injurer of liability. In general, statutes, ordinances and regulations are believed only to set the minimum standards of conduct.[5] Compliance with a legislative enactment or an administrative regulation does not prevent a finding of negligence if a reasonable person would have taken additional precautions.[6] Compliance may only play an indirect role: it can be evidence of reasonableness, that is, it may help to convince the court or jury that the injurer's precautionary measures were reasonable,[7] or that a product displayed a favorable risk-utility balance.[8] Such a compliance defense, however, is not conclusive. In most European legal systems, the outcome is similar. Injurers who violated a regulatory norm (e.g. a speed limit) are automatically found negligent (or 'at fault'), while injurers who complied with the regulatory standard are not necessarily relieved

[1] An excuse may for instance consist in an emergency or in physical circumstances beyond the injurer's control. See Restatement (Second) of Torts §288A. In general, these excuses also relieve the violator from criminal sanctions (Prosser and Keeton, 1984, p. 228).

[2] Prosser and Keeton (1984, p. 230); Harper, James and Gray (1986, §17.6); Shulman, James, Gray, and Gifford (2003, p. 243); see also Speiser, Krause and Gans (2003, §9.8 et seq.). In a minority of jurisdictions, violation of a criminal statute is regarded only as a rebuttable presumption of negligence, or just evidence of negligence. Some American courts attach less weight to municipal ordinances (and some also to norms of regulatory agencies) than to statutes in this respect. (Prosser and Keeton, 1984, p. 230-231).

[3] The Restatement (Second) of Torts §286 states that courts may adopt the requirements of a legislative enactment or administrative regulation as the standard of conduct if the statute is specific enough, and has been designed to protect against the type of harm (risk) the victim suffered. In addition, the victim should belong to the class of persons the statute intended to protect. The Restatement (Third) of Torts: Products Liability §4 states that '…a product's noncompliance with an applicable product safety statute or administrative regulation renders the product defective with respect to the risks sought to be reduced by the statute or regulation'.

[4] To illustrate, suppose that the regulatory standard is set at 40. When an accident occurs and it emerges that the injurer's precaution level was 39, he will be found negligent under the per se rule. Nevertheless, even if his precaution level was 40, he might still be found negligent, as the courts might require a higher due care level, for instance 50, i.e. they might not accept a compliance defense.

[5] Prosser and Keeton (1984, p. 233); Statsky (1994, p. 65); see also Speiser, Krause, and Gans (2003, §9.13).

[6] Restatement (Second) of Torts §288 C. Similar provisions can be found in the Restatement (Third) of Torts: Products Liability § 4 (stating that 'a product's compliance with an applicable product safety statute or administrative regulation …does not preclude as a matter of law a finding of product defect') and the National Traffic and Motor Vehicle Safety Act of 1966 (§30103.e of title 49, U.S. Code, stating explicitly that 'compliance with a motor vehicle safety standard … does not exempt a person from liability at common law').

[7] Harper, James and Gray (1986, §17.6); Prosser and Keeton on The Law of Torts (1984, p. 233).

[8] Viscusi (1988, p. 300-301).

of tort liability.[9]

This paper offers an explanation of this phenomenon by looking at the shape of the injurer's expected expenses function under a defective tort law system. When the functioning of tort law is affected by problems such as judgment proofness and disappearing defendants,[10] the injurer no longer takes optimal care. Under these conditions, it may occur that only major violations of the tort norm are rewarding, and not minor violations. Mathematically, this is the case when the injurer's expected expenses function under a defective tort law system exhibits two local minima: one at the socially optimal level of precaution and the other below that level. The injurer takes suboptimal precaution if the latter local minimum is also a global minimum, that is, if it brings lower total costs for the injurer than the other (socially efficient) local minimum.

In those cases, a regulatory norm that is set below the optimal care level is sufficient to remove the shortcomings of the tort law system and indirectly induce optimal care. If the injurer is prevented from taking such very low levels of precaution, he may find it convenient to comply with the negligence standard despite the judgment proof or the disappearing defendant problem. In essence, regulation prevents major violations and the tort law system minor violations.

To illustrate, consider figures 1 and 2 in section 2. The blackened line (including the dotted section) is the injurer's expected expenses function. Between the two local minima (at x^*, the optimal level, and at x_t, a suboptimal level of precaution from society's standpoint) the injurer chooses the one that entails lower total costs (x_t, in this case). It is sufficient to introduce a regulatory minimum norm set at x_r or x_R to prevent the injurer from taking too low care levels and inducing him to exert optimal care. Regulation, by keeping the injurer out of the dotted judgment proof zone, makes the zone in which x^* is the local minimum the only feasible set of options, working as an over-the-hill-tilting device.

Are defective tort law systems in which the injurer's expected expenses function has the described shape (optimal care is a local minimum, and not a global minimum) mere theoretical curiosities, or frequently occurring situations? In section 2, we argue that they may be very relevant in practice, because of two frequently occurring sets of circumstances. First, a negligence rule will generally result in the optimal care level being a local minimum, because it relieves the injurer in a discontinuous way from paying damages when the due care point is

[9] For a comparative overview see von Bar (2003), p. 45-47. Under French and Belgian law, the unexcused violation of a statutory duty automatically constitutes 'faute' (note that in France and Belgium, the term 'per se negligence' is not used since the term 'negligence' has a narrower meaning: it includes only violations of precautionary norms defined by courts; an injurer committed a 'fault' either when he violated a legislative norm or acted negligently.). Under Italian and Dutch law the outcome is similar as in France and Belgium. However, in Germany and Portugal, such a violation is considered only as a rebuttable presumption of fault.

[10] We prefer to analytically separate these two problems. In Summers (1983) and Shavell (1984a, 1984b, and 1986) these terms are considered as synonyms. Our usage will be clarified in the text.

reached.[11] Second, when the injurer can also reduce the *magnitude* of the harm in the case of an accident (and not only the probability of the accident) by taking more precaution, a defective tort law system will often result in the described shape. The difference between these two causes is that a negligence rule can also create a local minimum around the optimal care level when the tort system is undermined by the disappearing defendant problem, while magnitude-reducing precaution creates such a local minimum only in cases of judgment proof problems.

The next question is where exactly the regulatory norm should be set. In section 3, we show that minimum regulation does not need to be set at a precise level of precaution, but can be set anywhere within a certain range. Therefore, the setting of minimum regulation requires less information than when regulation is used alone (although regulatory enforcement costs can be saved by choosing the lowest possible point). In addition, sometimes it is sufficient to regulate only some of the injurer's precautionary measures (those affecting the magnitude of the harm) to stop judgment proof problems from affecting the tort system.

In section 4, we argue that this minimum regulation does not need to be fully enforced (through a fines system) to be fully effective. The reason is that a part of the incentives to comply with the regulatory minimum norm are created by the tort system. Therefore, regulators can be 'soft' in two respects: by demanding less, and by not fully enforcing what they demand. In section 5, we conclude with some additional considerations. Further in the introduction, we relate our analysis to existing literature.

There is a substantial amount of economic and law-and-economics literature on the choice between regulation and tort liability, but most of this literature deals with different issues from the one discussed in this article. The purpose of this article is not to analyze when regulation is a superior instrument to tort law and vice versa (alternative use),[12] nor is it our primary[13] purpose to provide an additional justification for the joint use of regulation and tort law.[14]

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[11] In the analysis, we also account for the negligence rule with cause in fact.

[12] Early contributions on the alternative use of tort law and regulation are Wittman (1977) and Shavell (1984a). For more recent literature, see Innes (2004) and Boyer and Porrini (2004). A new strand of literature on this topic is emerging from Pistor and Xu (2003), emphasizing the role of different institutions in filling the gaps in incomplete laws. Glaeser, Johnson, and Shleifer (2001) evaluate judicial and regulatory enforcement of contract depending on the incentives of the enforcer. Our approach also differs from literature on the optimal standard of proof (for example, Rubinfeld and Sappington, 1987) as we do not focus on the degree of certainty with which facts need to be established, but on the levels of precaution required by different authorities in relation to the same activity.

[13] It should be noted that, at least indirectly, our results can be interpreted as an additional explanation for the joint use.

[14] A wide variety of justifications for the joint use of these instruments have been developed. Shavell (1984b) focuses on the case in which injurer's are insolvent and are not always sued by victims and regulators are poorly informed (Shavell's framework is close to ours, though the points we make are different). Schmitz' (2000) setting is similar to Shavell (1984b), but wealth varies among individuals. Hiriart, Martimort and Pouyet (2004) builds on and extends the analysis by Shavell (1984b). They allow for ex ante contracting between the injurer and the regulator and study how the injurer can be induced to reveal the information the regulator lacks. The regulator sets then ex ante first-best regulatory standard, while ex post liability only provides incentives to reveal information. Another justification for the

We seek to explain why – if they are jointly used – one standard is set higher than the other. Translated in legal terms, our purpose is to explain why, on the one hand, there is negligence *per se* and, on the other hand, the compliance defense is nonconclusive. Although no contribution has explicitly explained the combination of negligence per se and the nonconclusiveness of the compliance defense,[15] Shavell (1984b), Schmitz (2000) and Kolstad, Ulen and Johnson (1990) have indirectly explained the regulators' softness by making the related point that regulatory requirements should be lower when regulation is complemented by tort law than when regulation is used alone. This point is somewhat different from ours because it does not imply that the regulatory standard should always be lower than the liability standard. On the contrary, it results in liability standards being higher or lower than regulatory standards, even though on average regulation will be softer since it is set below the social optimum. In Shavell's (1984b) setting, tort law is undermined by disappearing and judgment proof defendants and regulators set a single standard for all injurers (due to information constraints), while tort law determines due care levels for each injurer individually.[16] In this framework, lowering the regulatory standard may be possible as the tort system will take up for some of the slack**,** that is, it will prevent some injurers from reducing their precaution levels. Schmitz (2000) reaches analogous conclusions in a setting in which the injurers' wealth varies. In both these contributions, tort law is aimed at controlling the behavior of rich injurers and regulation is aimed at controlling the behavior of poor injurers. Kolstad, Ulen and Johnson (1990) employ a framework in which liability standards are uncertain (which may result in underprecaution) while regulatory standards are certain. The authors argue that if the regulator set the standard at the optimal level, parties following this standard would still sometimes be sanctioned by the error-making tort system, and hence will take

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use of multiple instruments can be found in Laffont and Martimort (1999), who argue that splitting regulatory power among different agencies reduces the risk of capture. In Kolstad, Ulen and Johnson (1990), tort law is assumed to generate incentive problems because of uncertainty in the application of the negligence rule and regulation is used to repair such shortcoming. Burrows (1999) extends the analysis to the case in which also regulation is affected by uncertainty and also considers cases in which the regulatory standard may serve as a signal of the way in which the liability standard will be implemented. Che (1990) and Trebilcock and Winter (1997) consider multidimensional precaution, in which some precautionary measures are controlled by regulation and others by liability. In Trebilcock and Winter (1997) tort law takes care of the precautionary measures that are too costly to observe for the regulator.

[15] Shavell (1984b) offers an explanation for the fact that compliance with regulation is not conclusive, but does not explain the *per se* rule – on the contrary, he argues against it (Shavell, 1984a, p. 371-372, even suggesting that there is no *per se* rule under American law, mentioning emergency cases and cases with physical circumstances beyond the driver's control. It should be noted that in these cases the injurer would not be subject to sanctions under the regulatory system). Burrows' (1999) results dependent on the context; nevertheless, in the most realistic setting, point to the implementation of a stricter *per se* rule with compliance defense, reducing in fact the incentive function of the liability system to a mere enforcement of regulation-set standards. In a different context (the discussion on the tort crisis), Huber (1985) and Viscusi (1988) argue that compliance with the regulations should immunize an injurer from liability. Their underlying assumption is that regulation is a better instrument for determining optimal risk levels in society.

[16] It should be noted that, while in many cases regulatory norms are more general than tort law norms, this is not an inherent characteristic of these instruments since regulation can be specific, and tort norms can be general (for instance when due care levels are based on the precaution costs of an average person).

overprecaution. Therefore, to induce optimal precaution, regulatory standards should be lower when regulation is complemented by tort law than when regulation is used alone.[17]

In legal textbooks,[18] negligence per se is often justified on the grounds that courts should respect decisions made by representative bodies in a democratic society. This account does not explain why compliance with a regulatory standard does not relieve the injurer from tort liability (if courts cannot set safety standards lower than those of a legislative body because they have to respect the decisions of that body, why would they be entitled to replace these regulatory standards by their own, higher safety standards?). The nonconclusiveness of the compliance defense is often justified by arguing that in the absence of any explicit statements, courts may presume that it was the regulator's intention to set only minimum levels. Yet, this scholarship does not offer a satisfying explanation for why regulators would prefer to define minimum norms rather than maximum norms or, more simply, optimal norms.

2. Precaution under liability alone: local and global minima

In this section, we employ a framework in which the incentive effects of tort liability are undermined[19] by the *judgment proof problem* (due to insolvency or liability caps). In section 2.3 we will analyze whether our findings also hold for the *disappearing defendant problem* (injurers are not always successfully sued). We consider accidents that occur between two parties, who are strangers to each other: a victim (the party who is harmed) and an injurer (the other party). The injurer is rational, perfectly informed, utility-maximizing, and risk-neutral, and is the only party that can take precautions[20] in order to reduce the probability of the accident and the magnitude of the harm[21] – consider for example the effects of speed on the frequency and severity of traffic

[17] Schmitz (2000, p. 372) observes that Kolstad, Ulen and Johnson (1990) do not explain why tort law should be used at all, since the regulator can implement socially optimal standards.

[18] Prosser and Keeton (1984, p. 222), Harper, James and Gray (1986, §17.6). The argument goes back to Thayer (1913).

[19] We only consider the case in which judgment proof injurers take too little precaution (which is the most obvious outcome, for they internalize only a portion of the accident). Under some conditions, judgment proof injurers may take overprecaution, as shown by Beard (1990). See also Macminn (2002), Miceli and Segerson (2003) and Dari-Mattiacci and De Geest (forthcoming). Unless the injurer's wealth is so low that he is unable to pay for the precaution costs at the socially optimal level, our results also hold in this case, although they may quantitatively change.

[20] In the literature, accidents of this type are often referred to as unilateral-precaution accidents. Given this restriction, a further distinction between negligence rules (simple negligence, contributory negligence, comparative negligence) is irrelevant.

[21] In Dari-Mattiacci and De Geest (2005) we refer to this model as the *joint-probability-magnitude model* and make a distinction between this model and the *magnitude model* (where more precaution only reduces the magnitude of the harm, e.g. nuisance to neighbors), the *probability model* (where more precaution only reduces the probability of accidents, e.g. an aircraft crash) and the *separate-probability-magnitude model* (where injurers can take one precautionary measure to reduce the magnitude and another separate measure to reduce the probability). In the literature, the model usually employed is the *probability model*. In the formal analysis that follows, we will employ the *joint-probability-magnitude model* and the *separate-probability-magnitude model* (in section 3.2A.3.2), as they

accidents. If the injurer is found negligent, the court awards the victim perfectly compensatory damages. The injurer's assets are limited and exogenously determined, and therefore, may be less than the victim's harm. Let:[22]

x = the injurer's precaution cost, $x \geq 0$;

$p(x)$ = the probability of an accident, $0 < p(x) < 1$, $p' < 0$, $p'' > 0$;

$h(x)$ = the magnitude of the harm, $0 < h \leq h^{max}$, $h' \leq 0$, $h'' \geq 0$;

t = the injurer's assets (or the liability cap), $0 < t < h^{max}$.

We employ the standard social cost function:[23]

$$S(x) = p(x)h(x) + x \tag{1}$$

The socially optimal level of precaution that minimizes the sum of precaution costs and expected accident costs as in (1) will be denoted by x^*. Such level of precaution solves $S' = 0$ and is unique; for simplicity, let it also be positive. Depending on the liability rule in place, the injurer will face some or all of the social costs. In the next two subsections we will explore the shape of the injurer's expected expenses function and define the conditions under which it exhibits two local minima: one at the optimal level of precaution x^* and another at a lower level of precaution depending on the injurer's assets. If the latter is the global minimum, the injurer will take an insufficient level of precaution from society's standpoint. Next, we show how regulation can remedy this shortcoming by setting minimum requirements of care.

2.1. Two local minima generated by the negligence rule

A reason why the injurer's expected expenses function may exhibit two local minima is the negligence rule.[24] Under the negligence rule, the injurer pays damages to the victim only if his precaution was lower than the standard of negligence. Assuming that the standard of negligence is set at the socially optimal level x^*, the injurer's minimization problem is:

$$\min_x \begin{cases} p(x)\min\{h(x),t\} + x & if \quad x < x^* \\ x & if \quad x \geq x^* \end{cases} \tag{2}$$

The first line in (2) represents the cost that the injurer bears if he does not comply with due care,

encompass the former two. The distinction between precaution that reduces the magnitude of the harm (self-insurance) and precaution that reduces the probability of an accident (self-protection) is known in the insurance literature; see Ehrlich and Becker (1972). Boyd and Ingbermann (1994) first introduced this distinction in relation to the judgment proof problem.

[22] All functions are assumed continuously differentiable to any desired order.

[23] We construct the social cost as the sum of expected accident loss and precaution costs. See Calabresi (1970) and Brown (1973).

[24] This point has been discussed in Summers (1983) and Shavell (1986) but not in connection with regulation.

while the second line depict the injurer's costs when he complies with due care. If negligent (first line in (2)), the injurer minimizes his costs as follows:

$$\min_x\left[p(x)\min\{h(x),t\}+x\right] \Leftrightarrow \min\{\min_x[p(x)h(x)+x],\min_x[p(x)t+x]\}$$

which may be rewritten as:

$$\min\{p(x^*)h(x^*)+x^*,\, p(x_t)t+x_t\}$$

Where x^* is the socially optimal level of precaution, and x_t is the level of precaution that solves $p't + 1 = 0$. It is easy to show that the negligence rule always generates an expected expenses function with two local minima: one at x^* and one at x_t, as depicted in figure 1.[25] Which one of these two points is the global minimum depends on t.

If the injurer complies with the negligence standard – second line in (2) – his costs are clearly minimized by x^*. Thus, x^* yields the global minimum and he will prefer to comply with rather than to violate the negligence standard if his compliance costs are lower than (or equal to) the cost of violating it: $x^* \leq p(x_t)t + x_t$.[26] From the latter expression, we can derive a threshold level of the injurer's assets below which the injurer violates the negligence standard (and takes $x_t < x^*$, which increases in t)[27] and above which he complies (and takes x^*):

$$t^{n1} = \frac{x^* - x_t}{p(x_t)} \tag{3}$$

The blackened line in figure 1 (including the dotted portion) depicts the pattern of the injurer's expected expenses as a function of his level of precaution.

[FIGURE 1]

Figure 1 depicts a case when the injurer's assets are lower than t^{n1} and shows that the global minimum is at x_t and hence the injurer will take a socially inefficient level of precaution. We will return to this case in section 3 to show that a regulatory intervention can improve caretaking.

[25] This is true as long as $0 < t < h^{max}$, as specified in our assumption. In other words, the injurer's assets must be positive but lower than the maximum harm that can possibly result from an accident. If the latter assumption is not satisfied, x^* may be the only local minimum and hence, necessarily, the global minimum.

[26] It follows from the Envelop Theorem that the right-hand side increases monotonically in t, and thus there exists a level of t at which the equality in (3) holds. For large levels of t (when $p(x^*)h(x^*) + x^* < p(x_t)t + x_t$) the cost of violating x^* is $p(x)h(x) + x$ rather than $p(x_t)t + x_t$. However, the former expression is minimized by x^* and hence the injurer will take x^*. Therefore, the expression in the text is correct also in this case.

[27] This result can be easily verified by direct application of the Implicit Function Theorem on $p'(x_t)t + 1 = 0$.

2.2. Two local minima generated by magnitude-reducing precaution

When the liability rule in place is strict liability or when a negligence rule is coupled with a requirement of cause in fact (Grady, 1983, and Kahan, 1989),[28] the results of the previous section do not apply. In these cases, the presence of two local minima in the injurer's expected expenses function can be due to the fact that the injurer's precaution does not only curb the probability of accidents but it also reduces the magnitude of the harm.[29] In this section, we focus on strict liability, although the results are applicable to the negligence rule with cause in fact after slight modifications of the model. Under strict liability, the injurer's minimization problem is:

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

which may be rewritten as:

$$\min\{p(x^*)h(x^*)+x^*, p(x_t)t+x_t\}$$

From the former expression (represented in figure 2), it is evident that the injurer's expected expenses function exhibits two local minima in correspondence to x^* and x_t, as long as the two curves intersect at some point between these two values.[30] This is only true, however, as long as $h' < 0$, that is, if the injurer has some (however small) influence on the magnitude of the harm. If $h' = 0$, our model is reduced to a traditional pure *probability model*.[31] In this case, if $t < h$, the two curves in the figure do not intersect, but asymptotically approach each other to the right of the figure as x grows. Thus, the only local (and global) minimum is x_t, with no room for the improvements proposed in this analysis. If $t \geq h$, the global minimum is x^* and no intervention is needed.

[FIGURE 2]

Assuming that the injurer does have control over the magnitude of the harm, when we have $p(x^*)h(x^*) + x^* > p(x_t)t + x_t$, the global minimum is given by x_t. In this case, the injurer's costs are minimized by x_t, and hence this is the level of precaution that the injurer takes under strict liability alone. We will show in section 3 that regulation can improve caretaking.

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[28] The requirement of cause in fact removes the discontinuity in the injurer's expected expenses function on which the results of the previous section are based.

[29] Most models of judgment proofness only consider probability-precaution and assume that the magnitude of the harm is exogenously determined. See note 21 above for a review of the literature.

[30] This is the case as if $h(x_t) < t < h(x^*)$. As it will be clear in the following, if t is less than or equal to the lower bound, regulation is not necessary; if t is greater than or equal to the upper bound, minimum regulation is not effective.

[31] See note 21.

2.3. Disappearing defendants

In the previous sections, we assumed that the incentives provided by tort law are undermined by the judgment proof problem (a limit on the amount of damages injurers pay). Do our findings also hold for the disappearing defendant problem (the fact that injurers may not always be successfully sued)?

Although these two problems are sometimes considered analogous in the literature,[32] they are analytically distinct in this context. In fact, the judgment proof problem affects the maximum magnitude of damages an injurer actually pays per accident, while the disappearing defendant problem proportionally reduces the probability of paying such damages. Let $0 < a < 1$ denote the probability that an injurer is successfully sued. This probability may be lower than 1 if, for instance, the injurer is difficult to identify or evidence is hard to find or decays with time.

Under the negligence rule, the problem is essentially the same as with judgment proofness. The injurer's cost function is now as follows:

$$\min_x \begin{cases} ap(x)h(x) + x & if \quad x < x^* \\ x & if \quad x \geq x^* \end{cases} \tag{5}$$

The first line in (5) is minimized by $x_a < x^*$, which solves $p'h(x) + p(x)h' = -1/a$, whenever $a < 1$. Thus the injurer will take x^* if $x^* \leq ap(x_a)h(x_a) + x_a$. Also in this case it is easy to show that the negligence rule generates an expected expenses function with two local minima: one at x^* and one at x_a. The pattern of the injurer's cost is analogous to the one depicted in figure 1. Which of these two local minima will be the global minimum depends on the magnitude of the disappearing defendant problem, that is, on how small a is. Therefore, the analysis of minimum regulation that we will perform in the following also applies to the disappearing defendant problem under the negligence rule.

On the contrary, under strict liability minimum regulation cannot remove the disappearing defendant problem because the injurer's expected expenses function only exhibits one local (and global) minimum at x_a. In fact, the injurer's minimization problem under strict liability is:

$$\min_x [ap(x)h(x) + x] \tag{6}$$

Notice that (6) – the disappearing defendant problem – is typically different from (4) – the judgment proof problem. The case of the disappearing defendant is analytically analogous to the specific case of judgment proofness only when the injurer's precaution reduces the probability of the accident, while having no effect on the magnitude of the loss. We have shown, however, that

minimum regulation is ineffective in such a setting. The same result is valid for the negligence rule with cause in fact.

3. Precaution under liability and regulation: setting a minimum regulatory standard

As shown in the previous section, under plausible circumstances, the injurer's expected expenses function exhibits two local minima. When this is the case, it is possible that the socially optimal level of precaution x^* is only a local minimum, while the inefficient level of precaution (x_t or x_a) is the global minimum; that is, it can be the case that this inefficient level of precaution yields less costs for the injurer than x^*. A regulatory standard can improve caretaking by making the choice of x_t (or x_a) unfeasible. The function of regulation is to prevent the injurer from taking those levels of precaution that yield an expected cost lower than the cost at x^*. This way, even if the regulatory standard x_r (or x_R) is lower than x^*, as in figures 1 and 2, it is sufficient to tilt the injurer's precaution over the hill and enable tort liability to do the rest. As a result, the injurer will take socially efficient precaution.

3.1. The level of the regulatory standard

In this section we show that such minimum regulation does not need to be set at a precise level of precaution, but can be set anywhere within a certain range. Therefore, the setting of minimum regulation requires less information than when regulation is used alone (although further enforcement costs are saved by setting it at the lowest possible and still effective point). We will focus on negligence, but the same logic applies to the other rules considered.[33]

As figure 1 shows, if the injurer is prevented from taking those low levels of precaution that lie on the dotted section of the curve to the left of x_r, he will take x^*. Note that such dotted section does not cover the whole area in which the injurer is judgment proof, but only the part that triggers the lowest costs. Formally, a level of x_r such that $x_t < x_r < x^*$[34] and $x^* = p(x_r)t + x_r$ guarantees that we have $x^* \leq p(x) \min\{h(x), t\} + x$ for any $x \geq x_r$.[35] Thus, once the option of taking $x < x_r$ is precluded, the injurer's cost will be lower at x^* then at any other feasible (that is, greater than or equal to x_r) level of precaution. Hence he will take x^*.

Consequently, a regulator can set a minimum regulatory standard at r anywhere between x_r

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[32] See note 10.
[33] The actual levels of the regulatory standard will be higher under strict liability than under negligence.
[34] That $x_r > x_t$ is obvious. That $x_r < x^*$ follows directly from the arguments brought in the text accompanying this note.
[35] If $h(x) \leq t$, the former inequality is always satisfied by definition of x^*. If $h(x) > t$, the inequality is satisfied because $p(x)t + x$ is increasing in x to the right of x_t.

and x^*. Moreover, since x_r is monotonically decreasing in t,[36] the range of $r \in [x_r, x^*]$ widens as t increases. This range gives an indication of the freedom regulators enjoy in setting regulatory standards. Such freedom may be relevant when regulators lack precise information on either of the two boundaries, as they may alternatively choose to set regulatory standards closer to one or the other, depending on the information available.

It is also worth noting that, by combining negligence with regulation, the first best level of precaution can be attained even though the regulatory standard is set below the socially optimal level of precaution. This result differs from previous literature, which settles with second-best outcomes.[37]

3.2. The scope of the regulatory standard

So far, we have assumed that the injurer could only take one precautionary measure, which at the same time curbs the probability of an accident and abates the magnitude of the resulting harm. In many circumstances, however, the injurer may take different precautionary measures that control probability and magnitude separately (for instance, radars only reduce the probability of a shipwreck, while lifeboats only mitigate the magnitude of the harm to passengers in the case of a shipwreck).[38] The question we ask in this section is whether or not regulation should target both of these precautionary measures. In fact, we will show that this may not be necessary. To be more precise, when the injurer can separately affect the probability of the accident and the magnitude of the harm, if his assets are above a certain threshold, minimum regulation of only the magnitude precaution is sufficient to remove the judgment proof problem. Below that threshold, both magnitude precaution and probability precaution need to be regulated. To prove this claim more formally, let us modify the previous model as follows:

s = the injurer's probability-precaution cost;

z = the injurer's magnitude-precaution cost;

$p(s)$ = the probability of an accident occurring, $0 < p < 1$, $p' < 0$, $p'' > 0$;

$h(z)$ = the magnitude of the harm, $h > 0$, $h' \leq 0$, $h'' \geq 0$.

The social cost in this case is to be written as follows:

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[36] We know that x_r is such that $p(x_r)t + x_r = x^*$. Therefore we can write $d\,(p(x_r)t + x_r) = d\,x^* = 0$. From this we have $p't\,d\,x_r + p(x_r)\,d\,t + d\,x_r = 0$, which yields $d\,x_r / d\,t = -\,p(x_r) / (p't + 1)$. Since x_r necessarily lies to the right of x_t, then $p't + 1 > 0$, and $d\,x_r / d\,t < 0$. As t approaches t^{n1}, x_r approaches x_t.

[37] An exception is Hiriart, Martimort and Pouyet (2004); see above note 14. Ganuza and Gomez (2004) demonstrate that the performance of the negligence rule could be improved by lowering the negligence standard. Considering again figure 1, it is clear that a negligence standard set at x^* induces the injurer to take x_t, while a negligence standard set at x_d, such that $x_d = p(x_t)t + x_t < x^*$, induces the injurer would take $x_d > x_t$ Lowering the negligence standard improves caretaking by the injurer, but, contrary to working with minimum regulation, does not induce first-best outcomes.

[38] In Dari-Mattiacci and De Geest (2005), we refer to this model as *separate-probability-magnitude model*.

$$S(s,z) = p(s)h(z) + s + z \tag{7}$$

Let s^* and z^* denote the unique (and positive, we assume) levels of precautions that minimize (7).[39] Again, we focus on negligence, but the same qualitative results apply to the other rules, although there may be quantitative differences.[40] The injurer's minimization problem under negligence is:

$$\min_{s,z}\begin{cases} p(s)\min\{h(z),t\} + s + z & if \quad s < s^* \text{ or } z < z^* \\ s + z & if \quad s \geq s^* \text{ and } z \geq z^* \end{cases} \tag{8}$$

As we have done for (2), the first line in (8) may be rewritten as:

$$\min\{p(s^*)h(z^*) + s^* + z^*, p(s_t)t + s_t\}$$

where s_t is the level of probability precaution that solves $p't + 1 = 0$. It is obvious that when the injurer is insolvent, that is, when $h(z) > t$, his optimal level of z is equal to zero. For this reason, z disappears from the optimal cost of the insolvent injurer, as depicted in the right-hand portion of the expression above. The injurer will comply with the negligence standard if $s^* + z^* \leq p(s_t)t + s_t$, from which we can derive a threshold level of the injurer's assets below which the injurer violates the negligence standard (and takes $s_t < s^*$, and $z_t = 0$) and above which he complies (and takes s^* and z^*):

$$t^{n2} = \frac{s^* + z^* - s_t}{p(s_t)} \tag{9}$$

Now, let us consider a certain level $0 \leq z_r \leq z^*$ of the magnitude precaution z. It results that z_r such that $s^* + z^* = p(s_t)t + s_t + z_r$ guarantees $s^* + z^* \leq p(s)\min\{h(z), t\} + s + z$, for any $z \geq z_r$ and any s.[41] That is, it guarantees that the injurer, if prevented from taking $z < z_r$, will take socially optimal precaution with respect to both s and z.

Such a $z_r \leq z^*$only exists if t is above a certain threshold level $t\wedge$, which is such that $p(s_t)t\wedge + s_t = s^*$.[42] From this it follows that, when the injurer can control probability and magnitude of accidental losses by using two different precautionary measures, regulation does not necessarily

[39] We assume that the product $p(s)h(z)$ is a strictly convex function of s and z.

[40] For example, under strict liability, the threshold level of t that will be described later in the text will be higher.

[41] If $h(z) \leq t$, the inequality in the text is always guaranteed by definition of s^* and z^*. If $h(z) > t$, the inequality holds because $p(s)t + s + z$ is increasing in s to the right of s_t, and it is linearly increasing in z.

[42] $z_r \leq z^*$ implies $z^* - z_r \geq 0$. Using $s^* + z^* = p(s_t)t + s_t + z_r$, we have $z^* - z_r = p(s_t)t + s_t - s^* \geq 0$ or $p(s_t)t + s_t \geq s^*$. Since by the Envelop Theorem we have that the left-hand side of the latter inequality is monotonically increasing in t, then there exist a threshold level of t above which the condition is satisfied and below which it is not. It is easy to show that $t\wedge < t^{n2}$.

need to target both of them in order to address the judgment proof problem. If the injurer is sufficiently wealthy (his assets are above t^), regulation can only target magnitude precaution and impose a regulatory standard which may lie anywhere in the range $r_z \in [z_r, z^*]$. On the contrary, if the injurer's assets are below t^, standards need to be set with respect to both precautionary measures in the ranges $r_s \in [s_r, s^*]$ and $r_z \in [z_r, z^*]$.[43]

4. Enforcement of minimum regulatory standards

In the previous sections, we have argued that regulators may be soft in the sense that they apply standards that are lower than the liability standards (and than the socially optimal level of precaution) or only regulate some precautionary measures. In this section, we show that they may be soft in a third way: they may under-enforce such a standard. Normally, to create effective incentives to comply with a certain norm, the expected regulatory fine must at least be equal to the cost of compliance. By under-enforcement we mean that the expected regulatory fine is lower than the cost of compliance. Lowering enforcement may be desirable because it saves costs for the regulatory agency in addition to those already saved by lowering the standard.[44]

This is possible because there is a second incentive mechanism at work: tort liability. To induce injurers to take a level of precaution at least equal to r, the total expected fine should be $\varphi(x) = r - x$ when there is regulation alone. However, tort law creates an additional expected sanction for the negligent injurer which equals $p(x)t$. Therefore, the expected regulatory fine can be reduced to $\varphi(x) = r - x - p(x)t$, as depicted in figure 3. That is, the expected fine can be set at a lower level that would be optimal if regulation was used on its own.

5. Concluding remarks and extensions

In this article, we show that, when regulation and liability are used together, regulators can be softer than courts in three ways: they can apply lower standards, they can regulate only some of the precautionary measures and they can under-enforce the standards they set. Nevertheless, minimum regulation is capable of removing the judgment proof and (under more restrictive circumstances) the disappearing defendant problems affecting tort law, leaving then the provision of efficient incentives to take precaution to the liability system. In essence, the philosophy of minimum regulation is to ensure that potential injurers are unable to escape responsibility for the

[43] If this is the case, two levels exist $s_t \le s_r \le s^*$ and $0 \le z_r \le z^*$ such that $s^* + z^* = p(s_r)t + s_r + z_r$, which guarantee $s^* + z^* \le p(s)\min\{h(z), t\} + s + z$, for any $s \ge s_r$ and any $z \ge z_r$. It is easy to see that s_r and z_r can be set such that $s_r \le s^*$ and $z_r \le z^*$ as long as $s^* + z^* \ge s_r + z_r$. In fact, using $s^* + z^* = p(s_r)t + s_r + z_r$, we have $(s^* + z^*) - (s_r + z_r) = p(s_r)t > 0$.

[44] Since lower standard entail lower compliance costs, for the same magnitude of the fine, lower standard also imply

negative externalities they cause. Holding them responsible is a task for tort liability. Below, we use some considerations about issues bearing on our analysis and on possible extensions.

5.1. Applicability to contracts

Although our analysis only considers tort law, minimum regulation is a concept with a wider applicability. For instance, the incentives of contract law are also undermined by potential insolvency. Some forms of market regulation (like prudential regulation for banks, or consumer safety regulation) clearly have an insolvency preventing function as well.

5.2. An example of a defective tort system in which the optimal care level is no local minimum

We have based our analysis on the fact that the shape of the injurer's expected expenses function under negligence or strict liability may only make major violations rewarding. Preventing such major violations is the task of minimum regulatory standards, which consequently enable tort liability to provide effective incentives to take socially optimal care. However, there may be situations in which, for reasons not considered in this analysis, minor violations are the attractive ones. For example, it may make sense for a firm to only slightly violate a standard of care imposed by liability hoping that the harm spread across a large number of victims will be small enough for each individual to go unnoticed or to be lower than the cost of bringing a lawsuit. Firms may in this case be careful with major violations, which not only increase the expected amount of damages but also the probability of being brought to court.

5.3. Negligence per se

The negligence *per se* rule means that the violation of regulatory standards is a sufficient condition for a finding of negligence, which does not need to be proven any further. We have supported this rule on the grounds that, given that the optimal regulatory standard combined with liability should be lower than the liability standard, violation of the former logically implies violation of the latter. As a result, making a finding of negligence easier may be a good way to reduce the cost of bringing a liability suit. In addition, if the violation of the regulatory standard triggers both the regulatory sanction and (if an accident occurs) the payment of damages, enforcement of the regulatory standard is less expensive than without tort liability as the apprehension rate can be further lowered. However, when the regulatory standard would be set at a uniform level for a whole population of injurers it may well be optimal for most but simply too

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lower probability of apprehension and hence less costs for the regulatory agency.

high for some. In this event, the case for the *per se* rule is weakened, as it may not be the case that some over-deterrence be the reasonable price to pay for the application of a simple and rather inexpensive rule.

It is important, however, to distinguish the type of regulation this paper analyzes from other types of regulation. The compliance defense should indeed not be conclusive for the former, while this may not be the case for other types of regulation. In different settings than ours, it may well be the case that regulation is a superior instrument to managing risks in society (as Huber, 1985, and Viscusi, 1988, suggested). Current legal doctrines insufficiently distinguish between the two. It is possible that the overexpansion of tort law is partly caused by an insufficiently refined doctrinal distinction between these fundamentally different regulatory types.

5.4. Comparison between strict liability and negligence

In the previous sections, we have shown that the judgment proof problem may be removed by a minimum regulatory standard lying anywhere within a defined range of the injurer's precaution. The upper limit of the range is always the socially optimal level of precaution x^*, while the lower limit depends on the liability rule.

The lower bound of the regulatory range is lower under the negligence rule than under strict liability[45] – this can be noted by comparing figures 1 and 2. Moreover, while we have shown that under the negligence rule we can always find an appropriate regulatory standard that eliminates the judgment proof problem, under strict liability this is only possible if two restrictive conditions are satisfied: the injurer must be able to reduce the magnitude of the harm by taking precaution, and thus be solvent at the optimal level of precaution.

Therefore, our analysis yields that, if there is a choice over the liability rule to be complemented with regulation, the negligence rule enjoys a broader applicability and, at the same time, provides a broader range for the setting of the regulatory standard, which thus can be set at a lower level.

In addition, it is also worth noting that minimum regulation will be needed less often under negligence than under strict liability. In fact, the critical threshold of the injurer's assets, below which the injurer takes an inefficient level of precaution is lower under negligence. This implies that there are some levels of the injurer's assets for which the negligence rule alone yields the socially optimal outcome, while strict liability alone would not and hence needs to be complemented by regulation.[46] However, consider that the requirement of cause in fact is taken

[45] Under negligence the lower bound is $x_r = x^* - p(x_r)t$, which is clearly smaller than $x_R = x^* - p(x_R)t + p(x^*)h(x^*)$ under strict liability. The same can be easily shown for the other cases considered in the analysis.

[46] On the desirability of negligence over strict liability when there is a judgment proof problem, see also Summers

into account, the performance of the negligence rule approaches that of strict liability, as emphasized in the text.

5.5. Heterogeneous injurers

In the model, injurers were assumed homogenous in terms of precaution costs, expected harm, and wealth. What happens if injurers are heterogeneous (obviously, if regulation could be tailor-made, the analysis would remain unchanged)? If the injurer's wealth varies, the lowest possible regulatory standard (x_r or x_R) that induces optimal precaution varies as well. If in addition x^* varies among injurers (for instance because precaution costs or expected harm vary), also the upper end of the range within which regulation induces socially optimal levels of precaution will vary. As a result, it may be the case that there is no general minimum regulatory standard that will induce *all* injurers to take the first best levels of precaution. Still, given the fact that for each individual injurer there is a range at which regulation induces optimal behavior (thanks to the over-the-hill-tilting effect created by the defective tort law system), regulation can be set so that *a positive fraction* (more than 1) of the injurers will be induced to take optimal precaution. Moreover, this over-the-hill-tilting effect will in general result in a lower regulatory standard being optimal than when regulation is used alone due to the additional incentives provided by tort law.

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Figures

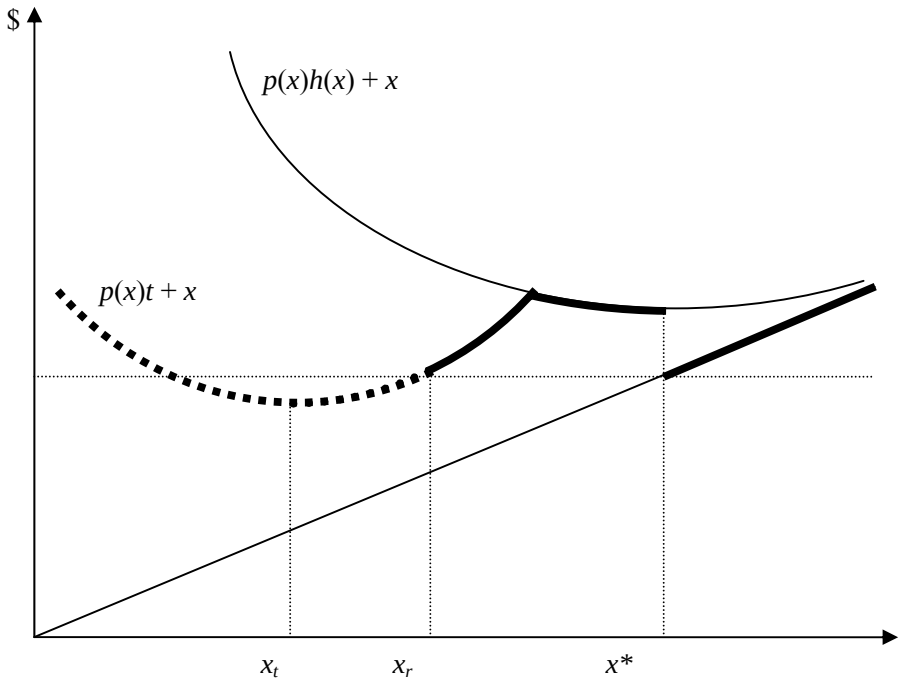

FIGURE 1: *Negligence and regulation combined* ($t < t^{st1}$)

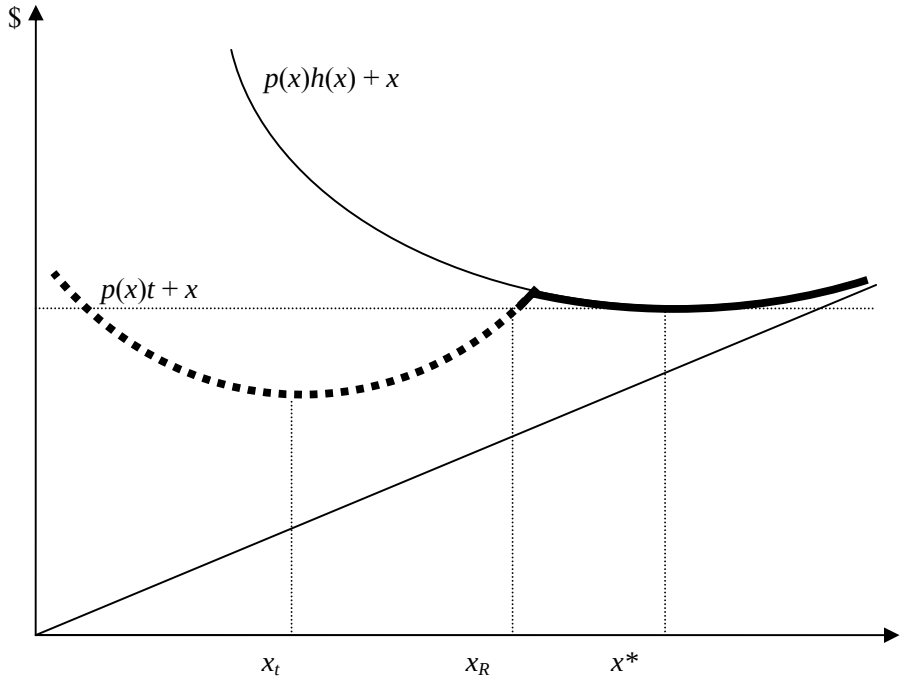

FIGURE 2: *strict liability and regulation combined* ($t < t^{n1}$)

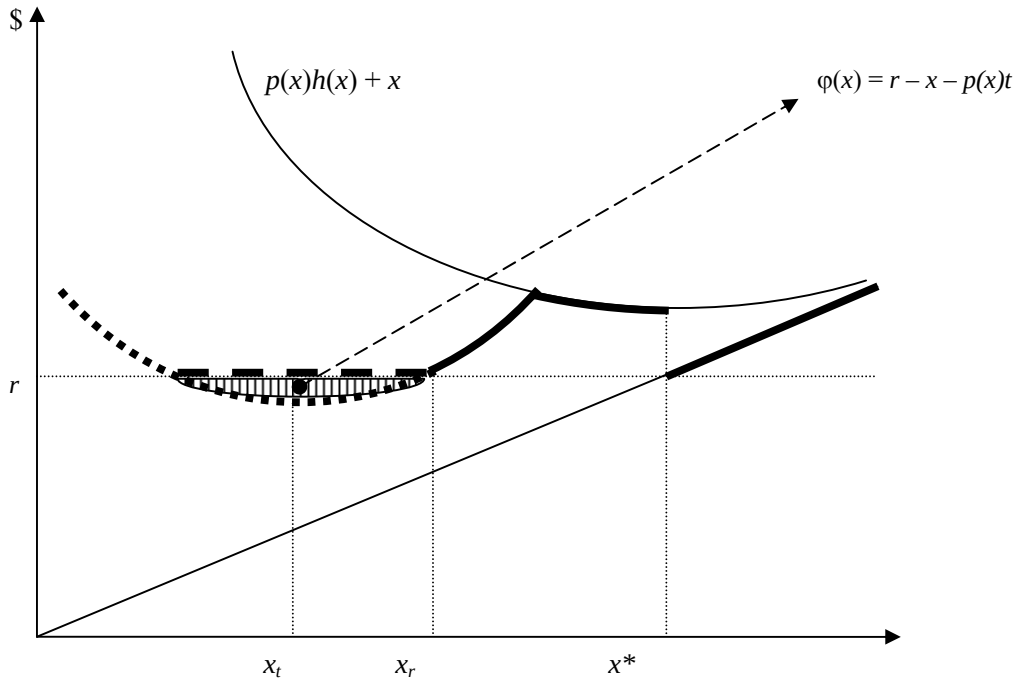

FIGURE 3: *Under-enforced minimum regulation is effective*