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LIABILITY OR NO LIABILITY?

PROMOTING SAFETY BY SHIFTING ACCIDENT LOSSES ONTO THIRD PARTIES

Abstract

In a recent article, Guerra et al.¹ considered the problem of liability for accidents caused by the activity of robots, proposing a novel liability regime, which they referred to as ‘manufacturer’s residual liability.’ Under this regime, injurers (robot operators) and victims are liable for accidents due to their negligence (hence, they are incentivised to act diligently), and third-party robot manufacturers bear all remaining accident losses, even when the accident is not caused by a defect or malfunction of the robot. In this article, I explore the possibility of extending this framework of liability to other tort scenarios. I refer to this broader application of the rule as ‘third-party residual liability.’ This rule incentivises third parties to make optimal safety investments in environments that are under their control, beyond the incentives obtainable under negligence or products liability law. Third-party residual liability rules will lead to a reduction in the price of safer goods and services offered by the third party, driving unsafe technologies out of the market. Further, thanks to the percolation effect of third-party residual liability, injurers and victims would also be incentivised to limit their activity levels in risky environments. The ideal application of this rule is to accident situations where the risk is affected not only by the behaviour of injurers and victims, but also by external factors that are controlled by a third party.

JEL CLASSIFICATION: K13, K32

SUMMARY

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¹ Alice Guerra and others, ‘Liability for Robots II: An Economic Analysis’ (2022) 18 Journal of Institutional Economics 553.

1 Introduction

In real life tort situations, several factors contribute to the probability of an accident occurring. From a law and economics perspective, traditional liability rules implicitly focus on two main factors: (i) the behaviour of prospective injurers, and (ii) the behaviour of prospective victims (hereinafter, I shall refer to prospective injurers and victims conjunctly as the ‘parties’). The relevant elements of the parties’ behaviour are their ‘levels of care’ (ie, the effort undertaken to carry out their activities in a careful manner) and their ‘activity levels’ (ie, how much activity the parties carry out, exposing themselves and others to the risk of an accident). This traditional framing of a tort problem omits to consider that, in the current age of safety technology, in several accident situations the probability of an accident is also affected—at times, greatly affected—by additional factors that are not under the control of the parties. For example, the risk of a car accident is affected not only by the parties’ behaviour, but also by the weather, the road conditions, or the quality of the safety technology adopted by the car manufacturer. Although there is not much that tort law can do to bring good weather to us, liability rules can create incentives for third parties who have control over other risk factors.

Let us continue our analysis focusing on a scenario where the risk of an accident arises from the interaction of three parties: an injurer (he), a victim (she), and a third-party (it) who controls external risk factors. By extending the analysis of Guerra et al.,² under my proposed rule, when an accident is not attributable to the negligence of injurers and/or victims, the third-party who has the control of the external risk factors would bear the accident loss³. I shall refer to this liability-shifting regime as ‘third-party residual liability.’ Third-party residual liability rules can activate incentives that outperform those of traditional products liability or third-party liability rules - shown below in the example of a no-fault tort occurring at a pool. Most notably, shifting residual liability on third parties can create incentives for third parties, without diluting the injurer’s and victim’s precaution incentives. Under a third-party residual liability rule, the third-party would bear the accident loss regardless of any negligence on its part (ie, on a strict liability basis) for accidents that are causally attributable to the environmental risks that are under

² *ibid.*

³ Alice Guerra and others, ‘Liability for Robots I: Legal Challenges’ (2022) 18 *Journal of Institutional Economics* 311; Alice Guerra and others (n 1) considered the legal and economic aspects of liability for robots. In their analysis, they considered a more specific scenario where the injurer was a robot ‘injurer’ (i.e. a human who utilised the robot to carry out an activity), causing harm to a victim. The injurer had some form of control over the robot—control which could be exercised in negligent manner. The ‘victim’ was the party who suffered the harm caused by a robot’s decisions. The ‘third party’ controlling the riskiness of the parties’ activities was the robot manufacturer (the authors considered a monolithic manufacturer, including those responsible for the development, programming, and production of the robot). Their analysis considered the application of a rule of ‘manufacturer residual liability,’ which imposed liability on robot manufacturers for the non-negligent accidents arising in the use of robots.



its control⁴. In this way, third parties would internalise the full benefit (and cost) of improving safety and reducing environmental risks. This distinguishes our rule of third-party residual liability from a rule imposing liability on a third party based on product defects, malfunctions, or other grounds of third-party liability based on negligence⁵. For example, traditional product liability uses the threat of liability to encourage manufacturers to produce well-functioning products that meet the quality standard needed to avoid product liability. However, with modern technology, there are several accidents that are not caused by any defect or malfunction, but are attributable to design limitations that could be corrected over time with additional investments in R&D. These design limitations cannot be legally construed as grounds for products liability, although further improvements in technology and additional investments in R&D might have avoided them. Such improvements are socially desirable but are not encouraged by existing legal rules. Rules of third-party residual liability would push incentives beyond the defect-avoidance threshold of products liability and lead to greater investments by third parties to reduce the environmental risks that are under their control: investments that may lead to the improvement of the safety of the goods and/or services that they produce, such as the quality of roads and the safety of environments that third parties control. For a related discussion regarding the sharing of liability among multiple tortfeasors, see Kornhauser and Resevz⁶.

		Injurer	
		<i>Negligent</i>	<i>Diligent</i>
Victim	<i>Negligent</i>	Share*	Victim
	<i>Diligent</i>	Injurer	Third-Party

Figure 1: Third-Party Residual Liability (*Under Comparative Negligence)

⁴ Hereinafter, I refer to the activities undertaken by the third parties as to include all activities that may affect the risks that are under their control, and which may affect the probability of an accident for other parties.

⁵ For example, a car manufacturer would face products liability if a defect in the car causes an accident. Such liability generally arises for defects causing ‘malfunctions.’ In the case of a car injuring a pedestrian, the driver’s (injurer’s) liability would arise when the product defect can be identified as the main cause of the harm to a victim. Product liability law would allow victims to sue manufacturers directly or would allow drivers to sue the car’s manufacturer in subrogation when they face direct liability under conventional tort law.

⁶ Lewis Kornhauser and Richard Resevz, ‘Sharing Damages Among Multiple Tortfeasors’ (1989) 98 *The Yale Law Journal* 831.

In Figure 1, I illustrate the allocation of liability under a rule of third-party residual liability when such rule is applied in conjunction with a comparative negligence rule. As shown by Guerra et al⁷, the choice of different allocations of the accident loss in cases of bilateral negligence—accident loss falling entirely on the injurer (under simple negligence), accident loss falling entirely on the victim (under contributory negligence), or accident loss shared between the parties (under comparative negligence)—does not affect the parties' care and activity-level incentives⁸. Therefore, in the following, I will conjunctly discuss the effects of third-party residual liability under all the variations of negligence liability.

2 The Functioning of Third-Party Residual Liability

2.1 The social objective

Let's denote the human injurer by I , the victim by V , and the third-party by T . Let x and w represent the injurer's care and activity levels, respectively, and y and z the victim's care and activity levels, respectively. The value of the activity is denoted by $V_I(w)$ for the injurer, and by $V_V(z)$ for the victim. Let r represent the third-party's investments to control the external risk affecting the probability of an accident (eg, the investment of a toll road company in maintaining roads in good conditions and with good lighting, a manufacturer's R&D investment for new safety technology to improve the safety of the external environment). The expected accident loss is represented by $L > 0$.

Following Singh⁹, Dari-Mattiacci et al.¹⁰, Carbonara et al.¹¹, and Guerra et al¹² I define the overall cost function (ie, the sum of expected accident costs and actual precaution

⁷ Alice Guerra and others (n 1).

⁸ Simple negligence rules are easier to administer because courts only need to evaluate the behaviour of injurers. Contributory negligence rules are generally used in products liability cases. Misuse of a product or a plaintiff's failure to follow clear instructions and/or warnings provided by the manufacturer are often construed as contributory negligence. Several jurisdictions in the U.S. have abandoned the contributory negligence rule in favour of comparative negligence rules in ordinary negligence cases (non-products liability), when bilateral negligence is established, since the former rule would bar victims from obtaining compensation even when the negligence of the tortfeasor is much more serious. Most civil law systems also utilise comparative negligence rules in apportioning damages in bilateral negligence cases. Alice Guerra and others (n 1) considered coupling with the robot's manufacturer residual liability: (a) simple negligence; (b) contributory negligence; and (c) comparative negligence. The only difference between the three rules is the way in which they allocate the accident loss when the injurer and victim are both negligent (top-left quadrant in Figure 1). Under all three rules, if the injurer is the only negligent party (bottom-left quadrant in Figure 1), the injurer bears the accident loss, and if the victim is the only negligent party (top-right quadrant in Figure 1), the victim bears the accident loss. Under all regimes, when both injurer and victim are diligent (bottom-right quadrant in Figure 1), the accident loss is shifted on the third party.

⁹ Ram Singh, 'On the Existence and Efficiency of Equilibria Under Liability Rules' [2006] NBER Working Paper Series 12625.

¹⁰ Giuseppe Dari-Mattiacci and Francesco Parisi, 'Loss-sharing Between Nonnegligent Parties' [2014] Journal of Theoretical and Institutional Economics 571.

¹¹ Emanuela Carbonara and Others, 'Sharing Residual Liability: The Cheapest Cost Avoider Revisited' (2016) 45 Journal of Legal Studies 173.

¹² Alice Guerra and others (n 1).



costs) as $L(x, y, w, z, r) + wx + zy + r$. The social optimization problem is thus $\text{Max } S = V_I(w) + V_V(z) - L(x, y, w, z, r) - wx - zy - r$. That is, the social objective is to maximise the value of the parties activities, $V_I(w)$ and $V_V(z)$, at the net of the expected accident costs, $L(x, y, w, z, r)$ and the precaution costs, wx , zy , and r . The injurer's and victim's socially efficient care levels, x^{**} and y^{**} , are identified by differentiating S with respect to the relevant control variables. Care levels are efficient when the marginal reduction in the expected accident loss equals the marginal cost of care, x and y . The parties' socially efficient activity levels, w^{**} and z^{**} are similarly identified by differentiating S with respect to the relevant variables. The optimality conditions will show that activity levels are socially efficient when the marginal benefit from an increase in activity level equals the marginal cost of the activity (the incremental expected accident cost caused by an increase in activity). The third-party's efficient investment in effort to increase the safety of the external environment, r^{**} , is similarly obtained by differentiating S with respect to r . The investment in r is socially efficient when the third-party's marginal cost from the research investments equals the social marginal benefit of the increased safety of the environment.

2.2 Injurer's and victim's incentives

To determine the actual incentives of the parties under a third-party residual liability rule, we can follow the derivation of the results in Guerra et al.¹³ to show that rules of third-party residual liability maintain optimal care incentives for injurers and victims. That is, even though in equilibrium the accident loss is shifted on a third-party, the injurer's and victim's incentives to undertake precautions remain unaltered.

Similarly, this can be verified by deriving the Nash strategies that injurers and victims would undertake to maximise their payoffs in Figure 1. As it can be seen, both parties' dominant strategies lead them to act diligently, notwithstanding the fact that neither of them bears the accident loss in equilibrium¹⁴. Additionally, as it will be discussed below, a rule of third-party residual liability creates optimal incentives for the third-party's effort to reduce the riskiness of the external environment (ie, rules of third-party residual liability will lead to the optimal supply of safety by third-parties).

¹³ Ibid.

¹⁴ Although not yet formally established in the literature, the dominance of optimal care incentives should be robust to role-uncertainty conditions (i.e. situations where parties take 'precautions' without knowing the role they will find themselves in—as injurers or victims—in the event of an accident, as in Barbara Luppi and others, 'Double-edged Torts' (2016) 46 *International Review of Law and Economics* 43.

2.3 Third parties' incentives

Under a third-party residual liability rule, third parties will have incentives to invest optimally to mitigate the risks that are under their control. This result does not hinge upon the observability of the third parties' behaviour by prospective injurers or victims. Nor is it needed for consumers to be willing to pay a premium for safer goods or services offered by the third parties, as required in Hay and Spier¹⁵. Instead, competitive market forces will cause the safest goods or services to be in greater demand, if only because they will be offered at the lowest price. This follows from the fact that, under this rule, the total cost of the third parties' goods or services captures the expected residual liability that they face. Third parties will minimise total production costs, optimally balancing the marginal investments in r with the marginal reduction in their expected liability. Third parties will be investing in development, maintenance, and post-production improvements (eg. recalls, replacements, upgrades, etc.) to reduce the level of environmental risk faced by parties who utilise their goods or services (hence, to reduce their expected residual liability). Under third-party residual liability, third parties would make their production decisions accounting for the net present value of their future liability, rather than looking solely at the bare development and production costs that they would face in the absence of residual liability. This induces third parties to invest in safety, until they reach the socially optimal level of r^{**} as defined above¹⁶. By doing so, third parties who have better safety technology will also be able to offer their goods or services more affordably. When third parties face residual liability, they fully internalise the benefits of safety of their services or products. Once the good or service is supplied, and is in the hands of the injurer, the third party is unable to influence the risk of injury. Non-negligent accidents impose a cost of liability on the third party. The expected cost of future non-negligent accidents becomes part of the third party's cost of production. When determining their optimal total investment in quality and technology—which includes the ex-ante investments in R&D for safety, and the ex-post cost of updates, and maintenance plans to maintain or improve safety—third parties will balance the cost of these safety investments and reduction in their expected liability. The resulting choices will determine the price of their product in a competitive market¹⁷.

¹⁵ Bruce Hay and Kathryn E Spier, 'Third-party Liability for Harms Caused by Consumer to Others' (2005) 95 American Economic Review 1700.

¹⁶ Making the third party internalise the full cost of the harm causes the price of the good or service to reflect its dangerousness, whereby more dangerous third-party's goods or services would be more expensive, and safer third-party goods or services would be less expensive. Similar to what was pointed out by Alice Guerra and others (n 1) in the context of market for robots, third parties would compete on price to sell their goods or services and by doing so they would compete on safety, producing and maintaining optimal levels of safety, minimising price. Even if injurers are not held liable for the non-negligent harm by their activity, competitive market forces would lead to the supply and demand of safer third-party goods or services, regardless of whether injurers are informed—or even care about safety as a social value—when making their purchasing decisions.

¹⁷ Alice Guerra and others (n 1).



The fact that safer third-party goods or services will be less expensive would encourage consumers to acquire them, even in the absence of full information about safety on their part. The result of these supply and demand effects will generate prices that reveal the riskiness of third-party's goods and services and will lead (even uninformed) parties toward safer environments¹⁸. This risk-revelation mechanism will be particularly desirable in our context because the opportunities and costs of developing safer technologies are not easily verifiable in court, and the alternative means of incentivizing safety through regulation and negligence rules would be hard to implement at the policy level. Regulators have no direct information to determine what would be the socially optimal advancement in safety technology and further it would be difficult to adopt safety standards, given the opacity of the relevant information for regulators. It would be equally difficult for courts to establish standards of "due safety development" and use them as benchmarks of liability, holding third parties responsible for not having optimally invested in safety development. Investment decisions in R&D are best delegated to third parties, who have direct information about the costs and benefits of safety development.

Under a rule of third-party residual liability, a gradual—and allocatively efficient—spread of safety technology will be obtained, with safer technology introduced in environments that are most exposed to the risk caused by the third party. For example, as pointed out by Guerra et al.¹⁹, when the third parties are suppliers of goods that are used by prospective injurers, residual liability rules create optimal incentives for such third parties to provide upgrades of technology and safety solutions to individuals who already acquired their goods. Third-party manufacturers will initially invest in providing free upgrades or replacements to high-activity-level prospective injurers, and later to others. Adopting safer technology reduces the expected accident cost of carrying out an activity and injurers with high activity levels would benefit more from operating in safer environments or adopting safer third-party goods or services. Allocative efficiency will result and will lead to advances in safety technology that will be optimally allocated: newer and safer environments and products will first be made available and accessed by those who would use (and benefit from) them the most.

¹⁸ In many products liability models, the belief that safer products will develop in the market rests on two fundamental assumptions: (i) that consumers are willing to pay a premium for safer products, and (ii) that product safety is perfectly observable to consumers when making their purchasing decisions, see Alan Mitchell Polinsky, 'Strict Liability vs. Negligence in a Market Setting' (1980) 70 *American Economic Review* 363; Hay and Spier (n 15). In a world of fast-evolving safety technology, neither of these assumptions is likely to hold. First, in the three-party scenario we consider, injurers are only interested in avoiding liability, which they can do by adopting due care in their activity. They would not be willing to pay a premium to operate in a safer environment, because any such investment in safety would reduce the risk of accidents, not their expected liability. Second, the safety of the environment or technology controlled by third parties is not observable by prospective injurers or victims prior to engaging in their activities (e.g. specific shortfalls in the maintenance of toll roads or level of advancement of the safety technology used by sporting facilities is only learned over time, through experience and use). These factors are unknown to the users, just as they may be unknown to the third party before the risk materialises.

¹⁹ Alice Guerra and others (n 1).

3 Percolation Effects of Third Party Residual Liability

3.1 Third parties' incentives to monitor the care levels of injurers and victims

Under a negligence regime, victims have the burden of proving the negligence of their injurers to obtain compensation. Compensation is a powerful motivation for prospective victims to collect and produce evidence of the injurer's negligence. Third-party residual liability rules may reduce the efforts of the victim to prove the negligence of the injurer. A victim can bring an action and obtain compensation, even if she fails to prove the injurer's negligence: in the absence of proof of the injurer's negligence, the victim would still be able to obtain compensation from the third party.

However, fortunately the victim's reduced incentives to prove the injurer's negligence do not undermine the injurer's incentives to invest in optimal precautions. Third-party residual liability rules shift evidentiary incentives from plaintiffs to third-party defendants. The threat of residual liability incentivises third parties to monitor the activities of prospective injurers and victims that operate in their environments, because proving the negligence of injurers and/or victims would shield the third party from residual liability. Third parties will anticipate the victims' reliance on their residual liability to obtain compensation and will thus be incentivised to invest resources and to produce evidence to show that the accident was caused by the injurer's (or the victim's) negligence²⁰. This would allow them to avoid liability in case of accidents attributable to the parties' negligent behaviour. In our running examples, the company that manages a toll road would have incentives to install video cameras or other evidence technology to determine if any accident was caused by the parties' negligence. Likewise, the owner of a sports facility would have incentives to monitor the users' activities. In this way, the victim's reduced litigation efforts may be (often, more than fully) offset by the third-party's efforts to establish the injurer's negligence.

In several circumstances third parties may have a comparative advantage over parties in documenting and proving the parties' violation of duties of due care. In these cases, shifting litigation incentives from victims to third parties would thus increase the probability that negligent injurers may face liability, thereby reinforcing their primary incentives to adopt due care²¹.

²⁰ When the third-party's residual liability operates under rules of contributory or comparative negligence (as in Figure 1), third parties would have incentives to also monitor victims' care levels, since under this rule the finding of victims' negligence would equally shield third parties from liability.

²¹ When such comparative advantage in obtaining evidence is not present, an inversion of legal presumptions, shifting the burden of proof on defendants would change the analysis above. See Alice Guerra and others (n 1). Possibly, creating legal presumptions of negligence (and contributory negligence) on injurers (and victims) would be a way to overcome the dilution of evidentiary incentives that third-party residual liability rules may create. For a related analysis of the incentives to invest in private evidence under alternative presumption and discovery rules, see Alice Guerra and Francesco Parisi, 'Investing in Private Evidence: The Effect of Adversarial Discovery' (2021) 13 *Journal of Legal Analysis* 657; Francesco Parisi and Giampaolo Frezza, 'Burdens of Proof in Establishing Negligence: A Comparative Law and Economics Analysis' (2023) 9 *Italian Law Journal*, forthcoming.



Under our legal regime, we should therefore expect third parties to adopt evidence technology (eg, to install video cameras or speed detectors on toll roads, or to incorporate other evidence technologies into their third-party goods or services), to produce evidence showing that any given accident was caused by the parties' negligence and should not fall under their blanket residual liability coverage. As pointed out by Guerra and Parisi²², and Parisi and Frezza²³, exposure to such evidence technology will, in turn, strengthen the injurers' (and victims') incentives to adopt due care in environments controlled by the third party.

As an illustrative example of third-party residual liability, consider the case of a swimming pool or sporting facility. Here, a third party, the facility operator, controls an environment in which accidents may occur. Under a traditional tort regime, it is typical for the actions of only the injurer and victim to be considered. Under a traditional tort law and products liability regime, the swimming pool or sporting facility operators are incentivised to ensure that there are no unsafe areas on their premises that could cause an accident to occur, such as a faulty diving board, dangerous blind corners, or obstructed safety exits. However, when liability is extended through third-party residual liability, the operators would internalise the costs of all accident risk factors in circumstances where neither the injurer nor the victim acted negligently. The facilities operators would invest in the development of safety and monitoring procedures beyond those that would be incentivised by standard liability rules. A third-party residual liability rule would incentivise the facility operators to mitigate the environmental risks while monitoring the injurer's and victim's activities on their premises.

3.2 Correcting injurer's and victim's moral hazard through third-party residual liability

As suggested above, in situations where third parties control the safety of the environment in which prospective injurers and victims operate, an optimal liability regime might be one where the third party is the sole residual bearer of the accident loss. The logic is two-fold. First, when third parties face residual liability, they have optimal incentives to innovate and improve the safety of the environment under their control. This is especially important considering that the safety level of the environment is often undetectable by the users. Second, as well-known in the literature, negligence rules cannot incentivise non-verifiable precautions because non-verifiable precautions are undetectable by courts in determining negligence. However, incentives for 'non-verifiable precautions' can be created through the allocation of residual liability²⁴. In our three-party scenario with injurers, victims, and third parties, by allocating the residual liability

²² Alice Guerra and Francesco Parisi (n 21).

²³ Francesco Parisi and Giampaolo Frezza (n 21).

²⁴ Giuseppe Dari-Mattiacci and Francesco Parisi, 'The Economics of Tort Law' in J.G. Backhaus (eds), *The Elgar Companion to Law and Economics* (Edward Elgar Publishing 2005).

to third parties, our rule would create optimal incentives for third parties' 'non-verifiable' R&D investments, leading to safer third-party goods or services²⁵.

Because residual liability can only be placed on one party, as per Shavell's theorem²⁶, it may seem that we cannot simultaneously incentivise third parties to produce safer environments and at the same time encourage injurers and victims to mitigate their activity levels. In the absence of a price relationship between the parties, neither injurers nor victims internalise the risk caused by their non-negligent activities, with a resulting excessive activity level for both parties. This misalignment of incentives occurs because injurers (and victims) derive benefits from their activities and use third-party goods and services, disregarding the fact that their activities—albeit diligently carried out—increase the probability of accidents, with a resulting externality on the third party who bears residual liability. Most readers will recognise this problem as a three-party incarnation of Shavell's²⁷ activity-level theorem²⁸.

From a policy point of view, in the absence of a price mechanism a difficult choice would thus arise: should residual liability be allocated on injurers to incentivise them to undertake optimal activity levels, or should residual liability be allocated on third parties to incentivise them to optimally control the risks and the non-verifiable safety investments that they undertake? Fortunately, as notably pointed out by Guerra et al.²⁹, these two policy objectives are not necessarily mutually exclusive. Market mechanisms are likely to emerge and cause a percolation of the third-party's residual liability, into the injurers' (and their prospective victims') objective functions. For example, with current technology, third parties can keep track of the injurer's activity level (eg, toll roads can keep track of a car's usage of the road; manufacturers can verify the level of usage of their product, swimming pool and sports facilities operators can monitor the access and activity levels of users, etc.). In a competitive market, third parties would have strong incentives to develop a price mechanism to transfer the cost of the risk created by the activities of injurers and victims back to them. This pricing mechanism will induce parties to internalise the cost of the expected residual liability that they create on third parties, and in turn reduce their activities to socially optimal levels. As a simple illustration, a fee can be charged by the third party to the injurer based on his activity level (eg, a toll road company can charge a per-mile fee to cars; a third-party manufacturer can charge a maintenance or leasing fee based on usage, sports facilities could charge per-hour access

²⁵ In the standard tort model, residual liability should be imposed on the party whose non-verifiable precautions most effectively reduce the cost of accidents, see Emanuela Carbonara and others (n 11).

²⁶ Steven Shavell, 'Strict Liability versus Negligence' (1980) 9 *Journal of Legal Studies* 1.

²⁷ *Ibid.*

²⁸ Shavell's theorem holds that only the bearer of residual liability is incentivised to undertake precautions that are not incentivised by the negligence standard. This is because the party who does not bear residual liability only wants to avoid liability by showing that he adopted due care, whereas the bearer of residual liability wants to avoid causing harm tout court. For a more extensive explanation and discussion of this theorem, see 'Shavell's Activity Level Theorem' in Francesco Parisi, *The Language of Law and Economics: A Dictionary* (Cambridge University Press 2013).

²⁹ Alice Guerra and others (n 1).



fees, etc.). The third party will set the fee equal to the cost of the expected incremental liability generated by the injurer's activity level. As a result, the injurer will internalise the risk created by his (non-negligent) activity and will choose an activity level that aligns with the socially optimal level w^{**} , as defined above³⁰. In the context of a swimming pool or sports facility operator, for example, a pricing mechanism would likely be adopted to induce users to internalise the cost of expected residual liability they may create on the facility operator. This pricing mechanism could be in the form of an added entrance fee to use the pool or sports facility, or possibly a fee based on time spent on the operators' premises. This percolation will lead to injurers and victims to perform at socially optimal levels of activity.

Additionally, as pointed out by Guerra et al.³¹ if prospective injurers and victims are contractually related (eg, the injurer is using a toll road to offer a limousine service to the victim), the cost of the service would increase to reflect the extra fees charged by the third party to the injurer. Through these price adjustments, incentives would percolate from the third-party supplier of the service to prospective injurers, and from prospective injurers down to prospective victims, aligning the incentives of all parties (i.e. the toll road company would make optimal safety investments, r^{**} , and the limousine driver and his passenger would mitigate their activity levels, w^{**} and z^{**} , in response to the higher fees being charged).

4 Conclusions

To the extent that we want the assignment of residual liability to affect the incentives of as many parties as possible, it would be desirable assigning residual liability to the party who can more easily affect the incentives of others (e.g. if a third party can more easily affect the incentives of injurers and victims, compared to injurers and victims affecting the incentives of third parties, a third-party residual liability rule would be preferable). In three-party incentive-alignment problems, it may often be the case that the allocation of residual liability on third parties may be preferable to alternative allocations. If injurers or victims were assigned residual liability, the inverse percolation of incentives toward the third-party would not be equally practical. Contractual and market mechanisms can be more easily imagined transmitting residual liability incentives from third parties to injurers and victims, although they may also potentially be constructed to transmit incentives upstream from injurers and victims to third parties. The percolation effect of residual liability on activity levels will not undermine the third-party's incentives to produce safer third-party goods or services. Even when third parties can transfer the cost

³⁰ Several mechanisms could be implemented to transmit incentives from third parties to injurers through the price system. In a competitive market, we expect pricing mechanisms to shift the expected cost of non-negligent accidents associated with higher activity levels to injurers. In this way, the residual liability incentives faced by the third parties would percolate downstream to the injurers, leading them to undertake optimal activity levels.

³¹ Alice Guerra and others (n 1).

of their expected residual liability back to injurers (eg, charging user fees equal to the residual liability associated with the parties' activity levels), their incentives to invest in safety would remain in place. Newer, safer third-party goods or services would in fact be cheaper and more attractive in the marketplace. Their higher level of safety would entail lower activity level externalities: the percolation effect of third parties' residual liability on users would be of lesser magnitude and would contribute to the financial attractiveness of the safer third parties' goods or services. This would thus be a contributing force that incentivises third parties to optimally reduce the risks that are under their control.

As a final note, third-party residual liability regimes are a second-best solution to our three-party incentive problem, and our analysis relied on the implicit assumption that third parties' investments in safety are more important factors in preventing accidents, compared to the parties' activity levels. In the absence of price mechanisms connecting all parties, there will always be some misaligned incentives, and the optimal allocation of the residual liability turns on the empirical question of which is the most important and cost-effective in reducing the risk of accidents.