THE COST OF DELEGATED CONTROL: VICARIOUS LIABILITY, SECONDARY LIABILITY AND MANDATORY INSURANCE

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ABSTRACT

Vicarious liability, secondary liability and mandatory insurance are three systems to attain judgment-proof or disappearing injurers' precaution through the direct control of a second party (the vicariously liable principal, the secondary liable party, or the insurer). In this way, the legal system delegates control over some injurers to private entities. Such mechanisms generate monitoring costs. In this paper, we consider who bears the cost of such monitoring and the effect thereof on the equilibrium level of precautions under different liability rules. We use these findings to explain some of the patterns in the coupling of substantive standards of liability and legal regimes of delegated control.

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1. Introduction

Tort law is designed to induce potential injurers to take the socially optimal level of precaution. In some situations, the direct incentives created by the tort system are not sufficient and society may rely on various systems of delegated control: a private party is entrusted with the task of monitoring potential tortfeasors and enforcing the optimal level of injurer's precaution. Three such situations of delegated control are: vicarious liability (e.g., liability of employers for damages caused by employees, liability of parents for damages caused by children,[1] etc.), secondary liability (e.g., liability of the accountant for failure to detect fraud on the part of their clients,[2] liability of employers for damages caused by employees outside the scope of the employment,[3] etc.) and mandatory insurance[4]. These regimes can be viewed as instrumental to providing judgment-proof or disappearing[5] injurers with incentives to take optimal precaution by means of principals'[6] monitoring.[7]

The early contributions of Sykes (1981,1984 and 1988) and Kornhauser (1982) clarified the logic of vicarious and secondary liability and cabined the extent of their application. The subsequent literature has largely been focused on corporate liability and the vicarious liability

[1] See Eörsi (1975) and Le Gall (1976), respectively.
[2] See Kraakman (1984 and 1986) on "gatekeepers' liability" for a study of similar issues.
[3] See Sykes (1998) at 676.
[4] See Shavell (1987).
[5] The terms "judgment-proofness" and "disappearing defendant" have been used in the literature as synonyms, see Summers (1983) for the latter and Shavell (1986) for the former. Although the two terms describe different factual scenarios, we follow the established convention of collapsing the two possibilities into a single restriction for the model. More specifically, with the term "disappearing defendant (or agent)" we refer to the case in which it might be difficult for the victim to identify whom, among the principal's agents, caused the accident while it would be easy to identify the principal (Kornhauser, 1982, at 1370-1371). In these cases, it is conceivable that a system of delegated control be the result of a comparative advantage of the principal in identifying the injurer among his agents and collecting damages from him. For example, we could contemplate the emergence of a system of vicarious liability for a firm, given the fact that the firm may be better able than a third party victim to impose pecuniary liability on its employees. The problem is analogous to the issue of detection and enforcement error studied in other areas of tort law, as it concerns the dilution of incentives to take precaution. With the term "judgment-proofness" we instead refer to the case in which the agent's assets may be insufficient to compensate the victim's harm, or to other cases of limited or truncated liability (e.g., regimes of limited personal liability, liability of minors, etc.). Following the established convention and without loss of generality, both problems of disappearing and judgment-proof injurers will be captured in the model by the assumption that the injurer-agent's wealth, a, is lower than the harm, h.
[6] We shall refer to the injurer (e.g., the child, the employee, and the insured) as the *agent* and to the party that faces external liability for the accident (e.g., the parent, the employer, the accountant, and the insurer, respectively) as the *principal*. These terms are used for ease of exposition and do not necessarily carry the usual significance to them attributed by principal-agent theory.
[7] Another important function of vicarious liability is to enhance the efficient allocation of risk between the parties, Sykes (1981), when agents happen to be more risk averse than principals.

of firms or employers.[8] The main concern of these studies was the desirability of a vicarious liability rule in such environments. Thus far, the law and economics literature has devoted little attention to an important and quite general aspect of delegated control: the presence and possible effects of monitoring cost in the various regimes of vicarious and secondary liability.[9] In this paper, we assess just this issue.

In Section 2, we discuss the divergence between the optimal levels of precaution under personal liability and delegated control and the impact of different liability rules on the chosen levels of precaution in both scenarios. In Section 3, we compare monitoring and exposure to risk as alternative systems by which the principal can induce agents' precaution. This enables us to assess the difference between private and public incentives to delegate control. In Section 4, we present a formal model for vicarious and secondary liability in a contractual and non-contractual setting. In Section 5, we formally examine insurance contracts. In Section 6, we apply the findings of the two previous sections to investigate who bears the direct and indirect costs of delegated control under different liability rules. At that point, we will look at the effect of such cost allocation on the incentives to reduce the cost of monitoring. In Section 7 we provide some concluding remarks. In offering ideas for future analysis and extensions, we consider the value of our findings for the understanding of the liability rules adopted by contemporary legal systems for different cases of vicarious and secondary liability.

2. The Difficult Choice of Liability Rules for Delegated Control

Under personal liability, the optimal level of precaution is typically reached by balancing the marginal benefit of precaution (the reduction in the expected accident loss) with the marginal cost thereof. This yields the minimization of the total cost of accidents. We denote x^p as the level of precaution under personal liability. Under vicarious liability, however, the agent's precaution also includes the principal's monitoring expenditures. A reduction in the expected accident loss under vicarious liability has higher marginal costs, that is, the sum of both precaution cost and monitoring cost. We denote x^d as the level of precaution under delegated control. Given the presence of monitoring costs, the optimal level of precaution is lower under vicarious liability than under personal liability, $x^d < x^p$. Consequently, vicarious liability yields

[8] See Arlen (1994), Chapman (1992 and 1996), Choi (1998), Croley (1996), Fischel and Sykes (1996), Khanna (1996), Kraakman (1984a, 1984b and 1986), Parker (1996), Schwartz (1996), Shavell (1997).

[9] Such a cost has been assumed either to be trivial – and thus vicarious liability has been justified – or to be prohibitive – so to render the application of vicarious liability less appealing. An exception is Kraakman (1984) at 867, though he does not elaborate as we do.

higher expected accident loss in a social optimum.[10]

Insurance contracts generate a similar situation, as the insurer is also vicariously liable for the insured party. The insured party's incentive to take precaution are dulled – the well-known moral-hazard problem – while the insurer tries to compensate such reduction in incentives through contract design and monitoring.[11] Once again, optimal accident prevention is reached at a higher total cost, given the additional contracting and monitoring costs. Mandatory insurance is somewhat analogous to secondary and vicarious liability: instead of delegating control over the agent to a specific subject, the legal system induces the agent to contract with an insurer, thus creating a vicariously liable principal.[12]

Therefore, in all cases of delegated control, monitoring costs increase the overall cost of accident precaution. The presence of higher overall precaution costs lowers the socially optimal standards of care. In this paper, we notice that the overall increase in the costs of accidents is the price that society pays for employing a delegated-control system, and ask the question of who should bear such a cost.

2.A. In Search of a First-Best: Strict Liability, Agent's Negligence and Principal's Negligence

Delegated control imposes higher overall costs of accident prevention. When personal liability is not feasible, and delegated control becomes necessary, lower standards of care may be socially desirable. Several questions arise at this point.

First, the reduction in optimal levels of care is due to the presence of monitoring costs – costs that are hardly ascertainable by a third party decision-maker. Strict liability standards would avoid the difficulties of setting optimal standards of care in the presence of monitoring costs. Yet, legal systems only occasionally utilize strict liability rules in conjunction with delegated control.

Second, under negligence, different liability standards might be necessary according to whether liability is personal or vicarious. However, the comparative study of legal rules of vicarious and secondary liability reveals that legal systems rarely modify or mitigate negligence standards to account for the presence of additional monitoring costs. Principals are held liable

[10] The superscript ^{d} stands for "delegated control", since it will be used for all the delegated-control systems that we examine in this paper.

[11] See Schwartz (1998).

[12] Shavell (1987) at 242 remarks that if insurers can observe the level of precaution taken by the insureds, requiring purchase of liability insurance solves the problem of underprecaution due to judgment-proofness. In this paper, we consider the costs of such observations.

if their agents fail to adopt the level of precautions that would be required under personal liability, without recognizing that the achievement of the same level of care imposes higher precaution costs under delegated control.

We consider three possible explanations of these interesting puzzles.

(1) Strict liability might lead to overprecaution when the cost of precaution is not internalised by the principal.

Delegated control systems can be distinguished in two categories. The first category encompasses situations in which the principal and the agent are parties to a contract, which explicitly specifies the level of precaution that the agent shall take. In this case, the price of the contract will reflect the contractually chosen level of precaution. The principal would internalize the cost of precaution and choose care and monitoring levels accordingly.

The second category of delegated-control relationships encompasses situations in which the principal and the agent are not parties to a contract[13] or where the contract fails to specify the level of precaution.[14] In these cases, the principal internalizes the full marginal benefits of precaution (the reduction in expected accident costs) but only a portion of the marginal costs (the monitoring costs). The core element here is that, absent a price mechanism to shift the cost of precaution from one party to the other, the principal would not bear the agent's cost of precaution and might enforce too high a level of precaution.

As will become clear through this paper, negligence rules are apt to solve the risk of overprecaution, as the principal is relieved of liability if he takes the due level of precaution, and has no incentive to force agents' precautions beyond such point.

(2) The same optimal level of precaution would exist under personal liability and delegated control when monitoring costs are not a function of the level of precaution.

The study of legal rules of vicarious and secondary liability reveals that legal systems rarely modify or mitigate negligence standards to account for the presence of monitoring costs. When negligence applies, liability is imposed on principals whose agents fail to adopt the applicable standard of care, without distinguishing between cases of personal and vicarious

[13] Consider for instance parental relationships.

[14] An example can be found in the liability of employers for damages caused by their employees outside the scope of the employment. Activities that fall outside the scope of the employment might also fall outside the scope of the employment contract, such that the applicable level of care would not be considered when setting the price of

liability. In doing so, the legal systems appear to ignore that the same level of care imposes higher precaution costs under delegated control.

A possible explanation of this apparent anomaly of the legal system is that identical optimal levels of precaution would obtain under personal liability and delegated control when monitoring costs are not a function of the level of precaution.

If monitoring imposes fixed costs that are not a function of the level of precaution, even though the total cost of precaution might be higher under delegated control, the marginal costs of precaution remains the same under the two systems. Thus the socially optimal level of precaution under delegated control would coincide with the negligence standard under personal liability $x^d = x^p$.

(3) The negligence standard is not allowed to depend on monitoring costs in order to create optimal incentives to reduce monitoring costs[15] *and avoid strategic under-investment in more efficient monitoring technology.*

In both the contractual setting and the non-contractual setting, the higher social cost due to delegated control mechanisms is due to the cost of monitoring borne by the principal. It is of interest to society to provide incentives to find ways to reduce such costs (e.g. developing monitoring technologies, surveillance, computerized controls, etc.), as lower monitoring costs might also yield higher levels of actual precaution and therefore reduce the social cost of accidents. Different liability regimes provide different incentives.

(a) *Strict Liability.* Under a rule of strict liability, principals bear all the relevant costs. Thus, they will enforce the level of precaution that is optimal under delegated control, x^d, and they maintain incentives to invest in technologies capable of reducing monitoring costs.

(b) *Agent's Negligence.* Under a simple negligence rule, the solution depends on the determination of the negligence standard and its allocation. Two sub-cases should be distinguished. If the principal is strictly liable for the damages caused by his agents, but only if the agent were negligent, the agent's standard x^p is analogous to a strict liability standard, in that it imposes liability regardless of actual monitoring costs. Under this rule, the private and social incentives for research and development of new technology are perfectly aligned. The

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the contract.

[15] Note that this problem is analogous to the incentives for research and development under alternative liability rules.

benefits that accrue from an increase of the efficiency of principal's monitoring would be fully internalized by the principal. Conversely, under a negligence rule that utilizes the x^d standard, any new technology capable of reducing monitoring costs would in turn yield an increase in the threshold of liability. Here, the benefits from the new technology would be partially offset by the costs imposed on the principal, in terms of higher efforts necessary to avoid liability. Private and social incentives for research and development would thus diverge under this rule. This would lead to socially suboptimal efforts toward research and development of new monitoring technologies.

(c) *Principal's Negligence*. We now consider the case in which principals are only liable for damages caused by agents if their monitoring level was lower than the due level, that is, the negligence inquiry concerns the principal's monitoring behavior and only indirectly affects the level of agent's precaution triggered by such monitoring. If the standard of negligence is set such that the total social cost – comprising monitoring cost – is minimized, then a level of precaution equal to x^d will be enforced. Similar to a previous example, the indirect cost of delegated control is borne by victims, and the incentives to invest in new technologies that could reduce the monitoring cost are diluted.

2.B. Falling back on Second-Best Incentive Systems for Delegated Control

The preceding analysis suggests that the determination of optimal standards of due care in situations of delegated control should be sensitive to the presence of monitoring costs. Monitoring costs should be included in the calculation of the standard of negligence. Such a revised negligence standard would achieve the social optimum, given delegated control. Strict liability while correcting for the effect of positive monitoring costs, may be suboptimal because the cost of primary care is not always internalized by the principal (e.g., in non-contractual setting), and this may lead to excessive monitoring. These shortcomings of strict liability rules may lead to the adoption of negligence rules.

The foregoing arguments further provide a plausible explanation of why the application of negligence standards is not tailored on the monitoring costs. In reality, negligence standards do not generally distinguish between accidents that occur under a system of personal liability and those that occur in one of delegated control. The determination of due standards of care is unlikely to include the cost of principals' monitoring, and most legal systems enforce negligence standards to be set at x^p (e.g., liability of employers for the damages caused by their employees). Given the effect of monitoring costs, the adoption of negligence standards x^p

generally leads to second-best outcomes.

Negligence standards based on x^p are not always inefficient. This can be clearly seen in two groups of cases: (i) situations where the lack of consideration of monitoring costs imposes no social loss, because monitoring imposes a fixed costs, with no effect on the marginal cost of precaution; and (ii) situations where the social gain due to the creation of incentives for the principal to reduce the monitoring cost may overcome the social loss due to excessive precaution. As an example of the first group, we can think of the liability of parents for damages caused by children; while an example of the second group can be found in the liability of employers for damages caused by their employees within the scope of the employment.

3. The Domain of Delegated Control

In this Section, we discuss monitoring versus exposure to risk as alternative ways to provide agents with incentives to take efficient precaution, and consider the tension between private and social incentives to delegate control.

3.A. Monitoring versus Exposure to Risk

Principals have two instruments of control with which to incentivize their agents: monitoring and exposure to risk. In a principal-agent problem, if both parties are risk neutral, the transfer of all the risk to the agent generally achieves a first-best optimum, since it creates optimal incentives on the agent, and minimizes monitoring costs. The risk would only be transferred back to the principal in the presence of agent's risk-aversion, in order to obtain an optimal balance of incentives and risk-allocation benefits between the parties.

The analysis is different in the present case of delegated control. Delegated control becomes necessary because of the problems of judgment-proof or disappearing injurers. In the face of such problems (both captured by the assumed constraint $a<h$, the agent's wealth lower than the harm),[16] the first-best optimum is not obtainable and part of the risk is borne by the principal. The principal bears part of the risk, not to provide insurance benefits to a risk-averse agent, but to cope with the agent's limited capacity to cover the expected accident loss.

In the case of risk-neutral parties, the level of exposure to risk transferred back to the principal would never exceed the difference between the harm and the wealth of the agent, $h-a$. Monitoring would be substituted to exposure to risk only to the extent to which the latter is

unfeasible. In the presence of agent's risk aversion, the principal may rationally shield the agent from financial exposure even beyond *h-a*. By doing so, the principal would provide a partial insurance to the agent, while also fulfilling an important monitoring role. The principal-agent pair would capture the surplus from the reallocation of the risk, equal to the insurance premium that the agent would have been willing to pay in order to avoid full exposure of his assets.

Needless to say, such reallocation of risk would weaken the agent's precaution incentives and thus impose higher monitoring costs for the principal. The optimal balance would be found where the marginal benefits from risk-allocation equal the marginal costs of increased monitoring.

3.B. Private versus Social Incentives to Delegate Control

The presence of monitoring costs under delegated control increases the overall cost of accident precaution. At any given level of precaution, personal liability would impose a cost x, while delegated control would imposes a higher cost $x + m(x)$. This implies that, in all situations in which the principal-agent pair internalizes the total cost of accidents, the choice of delegated control would be privately sub-optimal. Given a choice between a system of personal liability and one of delegated control, rational parties would prefer to operate under a regime of personal liability, thus maximizing the net benefits from their risk-creating activities.

Delegated control becomes socially optimal in the presence of judgment-proof or disappearing defendants, since in such cases the injurer would not face the usual precaution incentives. But, while delegated control may be socially optimal in these situates, the choice of delegated control is simply not privately optimal. Solvent injurers would never strategically choose delegated control, since such arrangement would unduly increase the overall cost of accident precaution.

In the following Section, we shall furnish the reader with some formal considerations on the difficulties of designing optimal liability rules for vicarious and secondary liability.

4. A Model of Vicarious and Secondary Liability

In this Section, we present a formal model for vicarious and secondary liability in a contractual and non-contractual setting. We employ a simple model in order to describe the monitoring decision of a party (the principal), who is vicariously liable for accident losses caused by

[16] See footnote 5 for a precise definition of the two situations.

another party (a judgment-proof or disappearing agent).[17] We assume that parties are risk-neutral, rational and utility maximizing.

Derivatives are denoted by subscripts. Let:

x = agent's level of precaution, $x=[0, \infty)$;

$m(x)$ = principal's monitoring expenditure, $m=[0, \infty)$; $m_x>0$; $m_{xx}>0$;[18]

$p(x)$ = probability of an accident occurring, $p=[0,1]$; $p_x<0$; $p_{xx}>0$;

h = harm (exogenous), $h>0$;[19]

a = agent's wealth, $a<h$;[20]

w = principal's payment to the agent in a contractual setting.

The probability of the accident is a function of the agent's level of precaution only; the principal and the victim cannot reduce it by taking precaution on their own.[21] The principal can induce the agent to take a certain level of precaution either by simply conditioning the agent's payment to that level, or by enforcing it directly by means of monitoring the agent's level of

[17] We do not discuss here whether vicarious liability is preferable to personal liability. We only examine those situations in which this is the case. This question has been the main concern of the literature on vicarious liability. See also footnote 5 for a precise definition of the concepts of judgment-proof and disappearing defendant as they are used in this paper.

[18] The causal relationship between x and m is the opposite as a matter of fact. Monitoring encourages precaution and not the other way around. However, writing $m(x)$ simplifies the model and does not alter the substance of our reasoning at all. The principal decides how much precaution he wants the agent to take, and invests in monitoring so that that level of precaution will result. It is simply another way of looking at the same relationship. The positive second derivative depicts the diminishing returns (in terms of precaution) of the investment in monitoring. In addition to that, it would be easy to include in the model, without changing our conclusions, some costs borne by the agent in order to make his effort more easily observable by the principal.

[19] We are implicitly assuming that the injurer cannot reduce the magnitude of the harm by means of precaution. This solution simplifies the model but adumbrate an oversimplification of reality. Injurers can in fact frequently reduce both the magnitude and the probability of the accident – as for example in car accidents. In any case, however, a limit on injurers' liability tends to reduce (and at times annihilate) the incentives to take precaution also in models in which the magnitude of the harm is endogenous (see Dari Mattiacci and De Geest, 2001). The model presented in this paper could be adjusted in order to encompass such complications but the main results would not change.

[20] We do not consider $a \geq h$ for the reason that in such a case the agent is not judgment-proof and vicarious liability is not a necessary device to induce optimal precaution: personal liability would provide the agent with perfect incentives. In addition to agents' limited wealth, a second reason could dilute incentives to enhance precaution: the tendency of victims not to sue or the difficulty in individuating the responsible one among the many agents of a single principal. In the latter case a could be interpreted as the fraction of the harm that the agent expect the bear given the probability lower than one of not being sued. Our results would not change also in this case. See also footnote 5.

[21] Relaxing the assumption that the victim cannot take precaution would require a slightly more complex analysis but would not alter the main results of our analysis. Relaxing the assumption that the principal cannot take any other precaution than monitoring the agent would lead to a discussion of the principal personal liability for accident

precaution and sanctioning only non-compliance. Given the magnitude of the sanction, the monitoring cost increases with the level of precaution that the principal enforces at an increasing rate. We assume certainty in the principal's enforcement: given a combination of monitoring and sanctions, the required level of the agent's precaution results; as the agent always complies, sanctions are never applied and we do not consider them into the model.[22]

The propositions formulated in this section will be referred in general to delegated control. This section proves them under vicarious and secondary liability both in a contractual and in a non-contractual setting. In section 5, it will be shown that they are also applicable to the case of mandatory insurance.

4.A.I. Social Optimum

Proposition 1. The optimal level of precaution under delegated control is lower than the optimal level of precaution under personal liability.

When liability is vicarious, secondary or deriving from an insurance coverage, the reduction in the expected accident loss involves not only the agent's precaution cost (as under personal liability) but also the principal's monitoring cost, and hence the same level of precaution will be attained at a higher marginal cost.

If liability is personal, the socially optimal level of precaution, x^p, minimizes the sum of the precaution cost and the expected accident loss.

(1) $$\min_x \left[x + p(x)h\right].$$

As Exp. (1) is convex,[23] from the first order condition we have:

(2) $$p_x(x^p) = -\frac{1}{h}.$$

If liability is vicarious, secondary or deriving from an insurance coverage, the socially optimal level of precaution, x^d, minimizes the sum of the precaution cost, the expected accident loss and the monitoring cost.

(3) $$\min_x \left[x + p(x)h + m(x)\right].$$

As Exp. (3) is convex,[24] from the first order condition we have:

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that is not within the scope of this paper.

[22] Polinsky and Shavell (1993) at 251-253 refer to this situation as a negligence rule on the agent compliance and recommend this solution. This assumption can be relaxed without undermining the results of the analysis.

(4) $$p_x\left(x^d\right) = -\frac{1+m_x\left(x^d\right)}{h}.$$

$p_x(x^d)$ in Eq. (4) is clearly less than $p_x(x^p)$ in Eq. (2)[25]. As $p_{xx}>0$, it follows that $x^d<x^p$: the optimal level of precaution under delegated control is lower than the optimal level of precaution under personal liability.

4.A.II. Contractual Settings[26]

The principal and the agent are parties to a contract; they may be, for example, employer and employee respectively. The agent has limited wealth, a, and is judgment proof whatever payment he receives from the principal, $a+w<h$[27]. The principal is instead solvent. The contract is Pareto optimal; therefore, it maximizes one party's utility, given the utility of the other party. Let the agent's utility be $\tilde{w}$, and let the principal maximize his utility by minimizing the payment to the agent plus his expected liability. Let w_n denote the payment in the case of no accident, and w_h the payment in the case of an accident occurring. The principal sets

(5) $$\min_{w_n, w_h, x}\left[\left(1-p(x)\right)w_n + p(x)\left(w_h + h\right) + m(x)\right],$$

subject to the constraint of constant agent's utility:

(6) $$a + \left(1-p(x)\right)w_n + p(x)w_h - x = \tilde{w}.$$[28]

Substituting Eq. (6) in Exp. (5), we obtain:

(7) $$\min_x\left[\tilde{w} - a + x + p(x)h + m(x)\right] \qquad \text{or} \qquad \min_x\left[x + p(x)h + m(x)\right]$$

Exp. (7), the principal's minimization problem, is the same as in Exp. (3), the social cost minimization problem in the presence of vicarious liability; therefore, the principal will enforce x^d and bear $m(x^d)$ monitoring costs.

Proposition 2. If the principal bears the agent's precaution cost, strict liability on both the principal and the agent achieves the delegated-control optimum.

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[23] First order condition: $1+p_xh=0$. Second order condition $p_{xx}h>0$.

[24] First order condition: $1+p_xh+m_x=0$. Second order condition $p_{xx}h+m_{xx}>0$.

[25] h and m_x are both greater than zero.

[26] The first part of this section closely follows Shavell (1987) at 182-185, except for the introduction of positive monitoring costs.

[27] See Shavell (1987) at 182, Sykes (1981).

[28] Although in theory the principal could in many cases recover part of his liability expenditures from the agent, in practice indemnification actions as unlikely to take place. We therefore assume them away and consider the principal as the only party subject to tort liability. See on this point Schwartz (1996).

In a contractual setting, the principal bears the agent's precaution costs, as he has to compensate the agent for his effort. Strict liability on the principal implies principal's liability regardless of his level of monitoring, $m(x)$. Strict liability on the agent implies that the principal is liable regardless of the agent's level of precaution, x. The proof of Proposition 2 immediately follows from the fact that the principal bears exactly the social cost, Exp. (7).

Remark. The monitoring costs are likely to be zero for the first range on x. If the agent's assets plus the payment he receives if the accident does not occur are greater than zero, he will take some precaution also if the principal does not monitor.[29] In such a case, the agent will choose his level of precaution by maximizing the left-hand side of Eq. (6). The first order condition yields:

$$(8) \qquad p_x(x^a) = -\frac{1}{w_n - w_h},$$

where x^a is the level of the agent's precaution that the principal can attain without monitoring. The principal can at most offer a contract in which $w_h=-a$, that is the agent pays his total assets to the principal when an accident occurs: his assets are fully exposed to the risk of accidents. However, we have assumed at the beginning that $w_n+a<h$; therefore, the level of precaution chosen by the agent is lower than the optimal level of precaution under personal liability, $x^a<x^p$.

The monitoring cost is, hence, zero for $x=[0,x^a]$, and starts rising to the right of the interval.[30] By investing in monitoring, the principal can attain a level of precaution falling between x^a and x^p. The assumptions made assure the convexity of the principal's minimization problem between those two limits. Therefore, the conclusions reached supra do not change.

Proposition 3. If the principal bears the agent's precaution cost, strict liability on the principal and duty-based liability on the agent might (but not always) yield the personal-liability social optimum if the standard of negligence for agent's conduct is set at x^p (at times x^d results). If the negligence standard is set at x^d, the delegated-control optimum always results.

[29] Shavell (1987) at 185.

[30] Hence, $m_x(x)=0$, $m_{xx}(x)=0$ for $x£x^a$; $m_x(x)>0$, $m_{xx}(x)>0$, otherwise.

Let x^p be the standard of negligence for the agent's conduct. After adapting Exp. (7), the principal's minimization problem becomes:

$$(9) \qquad \min_x \begin{cases} x + m(x) & if \quad x \geq x^p \\ x + p(x)h + m(x) & if \quad x < x^p \end{cases}.$$

The principal will choose x^p [31] if

$$(10) \qquad x^p + m(x^p) < x + p(x)h + m(x) \quad \text{for} \quad x < x^p,$$

and x^d otherwise.[32]

On the contrary, if the standard of agent's negligence is set at x^d, as determined by Proposition 1, the outcome will always be the delegated-control optimal level of precaution, x^d. The reason is that x^d is the level of precaution that minimizes the second Exp. in (9), thus no other level of precaution would further reduce the cost for the principal. A formal proof can be easily derived.

Proposition 4. If the principal bears the agent's precaution cost, duty-based liability on the principal achieves the delegated-control optimum even if the standard of agent's negligence is set at x^p.

Let us assume that the standard of principal's negligence is set at $m^d=m(x^d)$[33]. The principal's minimization problem is:

$$(11) \qquad \min_x \begin{cases} x + m(x) & if \quad x \geq x^d \\ x + p(x)h + m(x) & if \quad x < x^d \end{cases}.$$

As $m(x^p)>m(x^d)$, the principal will choose $m(x^d)$: any higher level of monitoring would only increase the monitoring cost and thus the precaution cost without decreasing principal's

[31] The principal will not choose $x>x^p$ as the first expression in (9) is increasing in x.

[32] This follows from Proposition 2. Note that if the negligence rule were applied in the causal corrected way examined by Grady (1983) and Kahan (1989) – where the negligent injurer pays only the damages that would not have occurred had he taken the due level of precaution – $x^p>x^d$ could never result. To prove this point it is sufficient to prove that $x+p(x)h-p(x^p)h+m(x)$, which the injurer bears if $x<x^p$, is minimized by x^d. The proof is intuitive as the first order condition is $1+m_x+p_xh=0$, which is the same as Exp. (4), and therefore yields x^d.

[33] Note that the standard of principal's negligence can be expressed indifferently in terms of m or x. If expressed in terms of m, the standard states the level of the principal's monitoring expensed required to fulfill the negligence criterion. Likewise, since any given monitoring level triggers a certain level of agent's precaution, the principal's due level of monitoring can be expressed in terms of the level of precaution x that his monitoring induces the agent to take. Therefore saying that the principal should attain a level of agent's precaution equal to x^d and saying that the principal should spend m^d in monitoring are equivalent statements, given that by hypothesis $m^d=m(x^d)$. We shall use the former as it simplifies the notation in the analysis.

expected liability, which is already equal to zero; hence, even if the standard of agent's negligence is set at x^p, x^d will result. Any other lower levels of monitoring would also imply a higher cost, as the second Exp. in (11) is minimized by x^d.

4.A.III. Non-Contractual Settings

The concern here is with the monitoring decision of a principal who is not in a contractual relationship with the tortfeasor (we shall continue calling him the agent). Parents and supervisors are in this situation.

Proposition 5. If the principal only partially bears the agent's precaution cost, strict liability on both the principal and the agent yields overprecaution and over-monitoring if compared to the delegated-control optimum. The level of taken precaution might instead be higher or lower than the personal-liability optimum.

When the parties are not in a contractual relationship, the principal might not internalize the agent's precaution cost perfectly, since he does not have to compensate the agent for his effort. He can use authority over the agent and require a certain level of precaution, without having to pay for it.

For the sake of generality, let $b<1$ denote the portion of x that the principal internalizes.

$$\min_x \left[bx + p(x)h + m(x)\right]. \tag{12}$$

As Exp. (12) is convex,[34] from the first order condition we have:

$$p_x\left(x^r\right) = -\frac{b + m_x\left(x^r\right)}{h}, \tag{13}$$

where x^r is the level of monitoring that minimizes Exp. (12). As $b<1$, $p_x(x^r)$ in Eq. (13) is clearly greater than $p_x(x^d)$ in Eq. (4). As $p_{xx}>0$, it follows that $x^r>x^d$, and hence $m(x^r)>m(x^d)$. If the principal does not bear the agent's precaution costs fully, he will spend more on monitoring and induce a higher level of the agent's precaution than in the delegated-control optimum. Nevertheless, x^r might happen to be either lower or higher than x^p, the personal-liability optimum, as it can be easily verified by confronting Eq. (2) and Eq. (13) – where $b+m_x$ might be either higher or lower than 1.

[34] First order condition: $b+p_xh+m_x=0$. Second order condition: $p_{xx}h+m_{xx}>0$.

Proposition 6. If the principal only partially bears the agent's precaution cost, duty-based liability on the principal achieves the delegated-control optimum.

The level of precaution enforced by principals in a non-contractual setting as described in Proposition 5 can be altered by introducing a negligence standard concerning the principal's monitoring level. If the standard of negligence is set at $m^d=m(x^d)$, the principal's minimization problem is:

$$(14) \qquad \min_x \begin{cases} bx+m(x) & \text{if} \quad x \geq x^d \\ bx+p(x)h+m(x) & \text{if} \quad x < x^d \end{cases}.$$

As $b<1$, then $x^r>x^d$, and the principal will choose x^d: any higher level of precaution would only increase the cost of monitoring without decreasing the expected liability, which is already equal to zero.

5. A Model of Mandatory Insurance

We will now examine the case in which the law requires a judgment-proof party – the insured-injurer – to purchase liability insurance from an insurer. In the case of an accident, the insurer will bear the accident loss, according to the liability rule to which the insured is subject. In addition to what already specified let:

p = insurance premium, insured's payment to the insurer in exchange for the insurance coverage;

e = portion of the harm that the insured bear in the case of an accident, clearly $e£a$, thus $e<h$.

The social costs can be described again as in section 4.A.I. The insurer offers a contract to the insured. The contract is Pareto optimal; therefore, it maximizes the insurer's utility, given the utility of the insured. Let the insured's utility be $\tilde{w}$, and let the insurer maximize his utility by maximizing the insurance premium minus his expected liability and his monitoring costs.

If the insurance coverage is complete, the insured bears no risk. However, as the insured's level of precaution x is costly observable, it might be advantageous for the insured to

bear some risk, in order to lower the cost of monitoring and hence the premium.[35]

The insurer maximizes the payments he receives from the insured minus his exposure to liability and his monitoring costs:[36]

(15) $$\max_{p,x}\left[p - p(x)(h-e) - m(x)\right],$$

subject to the constraint of constant insured's utility:

(16) $$a - p - p(x)e - x = \tilde{w}.$$

Substituting Eq. (16) in Exp. (15), we obtain:

(17) $$\max_{x}\left[a - \tilde{w} - x - p(x)h - m(x)\right] \qquad \text{or} \qquad \min_{x}\left[x + p(x)h + m(x)\right].$$

Exp. (17), the principal's minimization problem, is the same as in Exp. (7), the principal's minimization problem in the presence of vicarious liability in a contractual setting; therefore, the same analysis is applicable as in section 4.A.II. A similar remark can be made. In the absence of monitoring the agent minimizes the left hand side of Eq. (16), and takes a level of precaution x^a that satisfies the first order condition:

(18) $$p_x(x^a) = -\frac{1}{e}.$$

Therefore, the insurer can offer at most a contract in which $e=a$ in order to obtain the maximum effect from the insured's exposure to risk and save on monitoring costs. Since $a<h$, x^a will be an inefficient level of precaution and any higher level of precaution will have to be induced through monitoring.

6. Who Bears the Cost of Delegated Control?

If control over people's conduct is exercised by means of public enforcement of the law, society in general will bear this cost, mainly through taxes. If control is delegated to a private party, the cost is borne by different individuals, depending on the liability rule in force. Let us first define more precisely the cost of delegated control as the sum of a *direct cost* – the cost

[35] See Shavell (1979) on the issue of identifying the optimal insurance coverage when moral hazard is present. Shavell (1979) also analyzes the possibility of making costly observations of the precaution level, but considers the cost of the observation as independent from the level of precaution. To the contrary, we assume that the resources expended on monitoring result in increasing levels of precaution.

[36] As already noted in footnote 18 it is plausible that some of the monitoring costs be borne by the insured – as for example the cost of providing the insurer with detailed information on the precautionary measures taken or to be taken. Although these costs could be easily included in our model without altering our conclusions, for the sake of simplicity we do not explicitly account for them.

of monitoring – and an *indirect cost* – the increased accident loss due to more expensive precaution. Put differently, under personal liability the minimum social cost is given by $x^p + p(x^p)h$, while under delegated-control systems it is $x^d + p(x^d)h + m(x^d)$, where $m(x^d)$ is the direct cost and the difference $p(x^d)h - p(x^p)h$ is a positive – since $x^d<x^p$ – indirect cost. It is noteworthy that there is also a gain due to the fact that the precaution expenditure is lower, $x^d<x^p$, and hence some precaution costs are saved. However, such a gain can never offset the increase in expected accident loss, as the increase in the expected accident loss is greater than the reduction in precaution cost.[37]

The direct cost is borne by the principal-agent pair in a contractual setting, while in a non-contractual setting is borne by the principal alone. In both cases, if the principal is a producer, the direct cost of control might increase the price of goods and be partially borne by consumers. The indirect cost of delegated control might be externalized on victims depending on the legal rule in force.

As we have noticed in the introduction, the choice of the liability rule in the case of delegated control rests on three orders of considerations:

1. Whether the relationship between principal and agent is contractual or non-contractual in nature. In non-contractual settings there is a risk of overprecaution due to the fact that the principal does not bear the agent's costs of precaution. This occurs only under the strict liability rule.

2. Whether the cost of monitoring is fixed or variable with the level of required precaution. If the cost of monitoring is fixed, the socially optimal level of precaution under delegated control would coincide with the negligence standard under personal liability $x^d = x^p$.

3. Whether incentives to reduce the monitoring costs should be provided to the injurer.

The first two elements are rather self-evident, while the third requires some further elaboration, provided in the next subsection.

6.A. Incentives to Reduce the Monitoring Cost and Incentives to Take Precaution under Alternative Liability Rules

Different liability rules provide different incentives to take precaution and to invest in research and development of better monitoring procedures.

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[37] In fact, by hypothesis x^p minimizes $p(x)h+x$, hence $p(x^d)h+x^d > p(x^p)h+x^p$, whose rearranging yields $p(x^d)h-p(x^p)h > x^p-x^d$.

6.A.I. Strict Liability.

Under a rule of strict liability, principals in a contractual setting bear the full social cost of their agents' activity. Thus, they will enforce the level of precaution that is optimal under delegated control, x^d. Principals are also the residual bearers of the accident loss under strict liability, maintaining incentives to invest in reducing monitoring costs as much as possible.

On the contrary, principals in a non-contractual setting will enforce a higher level of precaution than the optimal level under delegated control, as they do not bear the agents' cost of precaution. This effect might at times bring the resulting level of precaution closer to x^p than to x^d, and the resulting level of precaution might even exceed x^p. Nevertheless, principals would still maintain incentives to reduce monitoring costs. Under strict liability, in both situations, principals (and, through the contract, agents) bear both the direct and the indirect costs of delegated control.

If the monitoring cost is fixed, the risk of overprecaution is even more serious, as the principal will enforce $x^r > x^d = x^p$, and the resulting level of precaution will always be greater even than the socially optimal level of precaution under personal liability.

6.A.II. Agent's Negligence.

Under a simple negligence rule the solution depends on the determination of the negligence standard and on its allocation. Let us start from the case in which the principal is strictly liable for the damages caused by his agents, but only if the agent was negligent. For reasons clarified in the formal analysis,[38] the principal will likely enforce the level of precaution defined in the negligence standard both in a contractual and in a non-contractual setting.

Thus, if the standard of negligence is set at x^d, the indirect cost of delegated control is externalized on victims, as they are the residual bearer of a higher expected accident loss than under personal liability. If the standard of negligence is set at x^p then such a cost is not externalized on victims, and is actually borne by the principal-agent pair in the form of higher levels of precaution and monitoring. However, incentives to reduce monitoring costs are provided only by a negligence standard set at x^p, since in this case monitoring is not included in the determination of negligence, and the principal would reduce some expenses if he could attain agents' compliance at lower monitoring costs.[39]

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[38] We have notice in section 4.A.II that a negligence standard on the agent's level of precaution set at x^p will at times result anyway in x^d. Nevertheless, also in such cases, as the agent would be found to have been negligent – since $x^d < x^p$ – the accident loss will be compensated, and therefore, the indirect cost will not be externalized to the victim.

[39] Note that this problem is analogous to the incentives for research and development under alternative liability

On the contrary, x^d is explicitly set to include the cost of monitoring, so that a reduction in monitoring costs might trigger a higher level of precaution, which would dilute the incentives to invest in such a reduction. In reality, negligence standard on agents' level of precaution are unlikely to contain the cost of principals' monitoring, so we would expect negligence standards to be set at x^p.

In non-contractual settings, negligence serves also a second purpose: it counteracts the principal's incentives to require excessive levels of precaution.

If the cost of monitoring if fixed, the setting of the negligence standard becomes unproblematic, as $x^d=x^p$, and the incentive to reduce that cost do not depend on it. Nevertheless, the negligence rule still maintains the advantage of counteracting the incentives to require excessive precaution.

6.A.III. Principal's Negligence.

We will now consider the case in which principals are only liable for damages caused by agents if their monitoring level was lower than the standard of negligence. Thus, the negligence standard directly concerns monitoring and indirectly concerns the levels of precaution attained through monitoring. If the standard of negligence is set such that the total social cost – inclusive of monitoring costs – is minimized, then a level of precaution equal to x^d will be enforced. As we have already explained, the indirect cost of delegated control is externalized on victims, and the incentives to reduce the monitoring cost are diluted.

Such a negligence standard does not provide incentives to reduce the monitoring cost but still maintains the advantage of counteracting the incentives to require overprecaution, that would be present under strict liability in non-contractual settings. If the monitoring cost is fixed, the former shortcoming disappears, but the advantage over strict liability in non-contractual settings remains.

7. Conclusion: Rethinking Delegated Control

This paper provides a new interpretation of different forms of delegated control, previously

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rules. The standard x^p is analogous to a strict liability standard, in that it imposes liability regardless of actual monitoring costs. Thus, the benefit of research towards new technology that would increase the efficiency of principal's monitoring would be fully internalized under this rule. Conversely, under a x^d standard, any new technology capable of reducing monitoring costs would in turn yield an increase in the threshold of liability. Thus, the benefits from the new technology would be partially offset by the costs imposed on the principal, in terms of higher efforts necessary to avoid liability. This would lead to suboptimal efforts toward research and development of new technologies.

analyzed, but never directly compared to one another. We consider vicarious liability, secondary liability and mandatory insurance as mechanisms to overcome the under-precaution problem that might arise with judgment-proof or disappearing injurers. This allowed us to compare the structure and incentive properties of alternative legal instruments.

Legal systems shift liability on a second party in order to provide that party with incentives to monitor the injurer. Nevertheless, since monitoring is expensive, precaution is attained at a higher marginal cost under delegated control and hence the socially optimal level of precaution is lower. Legal systems do not seem to lower the due levels of precaution required under the negligence rule in the presence of delegated control, and therefore generally enforce a prima facie inefficient (because too high) level of precaution. As a result, the additional cost of delegated control is usually paid by the injurer and his principal both in terms of monitoring costs and higher precaution costs; on the contrary, victims bear no additional cost.

We have shown that the allocation of the cost of delegated control to the injurer and his principal induces inefficient precaution but produces incentives to reduce monitoring costs. On the contrary, where this cost externalized on victims through lower levels of due care, precaution would be efficient but incentives to reduce the monitoring cost would be severely diluted. Whether efficient precaution or efficient monitoring technology is desirable is an empirical question.

Liability rules further seem to be instrumental to preventing overprecaution problems that might otherwise arise in non-contractual settings where the principal does not bear the agent's precaution cost. We have noticed that the risk of overprecaution only arises in the presence of strict liability.

The aforementioned analytical implements might amount to powerful tools to unveil the economic rationale of actual liability regimes in future comparative research. Some tentative conclusions can already be determined.

In many legal systems, the liability of parents and supervisors is governed by a negligence rule that allows parents (supervisors) to escape liability by proving that the level of monitoring taken did, in fact, conform to the due level.[40] Such a rule yields efficient precaution under delegated control but does not provide incentives to reduce monitoring cost. In this particular case, the monitoring techniques of parents (supervisors) is not particularly suited for technological improvements in whose research parents (supervisors) should invest resources,

[40] See le Gall, 1976.

and the monitoring cost might at times be fixed, and hence may not affect the marginal cost of precaution. Therefore, in the trade-off between efficient precaution and efficient monitoring technology, the former seems to prevail. In addition, the parent-child (supervisor-supervisee) relationship is non-contractual and may suffer from the overprecaution problem considered in our analysis. A negligence rule, as opposed to strict liability, may induce the socially optimal level of precaution.

On the contrary, employers are in a contractual relationship with their employees – hence the risk of overprecaution disappears – and the incentives to reduce the cost of monitoring are certainly not unimportant, as they pertain not only to the monitoring technology but also, more generally, to the organization of the firm. For these reasons, it is sensible to impose the cost of delegated control on the injurer and his principal through a rule of strict liability or of negligence where the due-care level is set at the normal personal-liability level.

Mandatory insurance certainly deals with the class of contractual settings as well. In addition, incentives to reduce the monitoring costs are important for the technological development of the insurance industry and plausibly variable with the required level of precaution. The former arguments explain why the insurer in not relieved of liability even if he appropriately monitored the insured.

Of some interest is the fact that employers are sometimes liable for damages caused by their employees outside the scope of the employment, but only if their monitoring level was lower than a due level, a situation that resembles the liability of parents. These cases of employers' liability seem to be outside the organization of the firm and therefore the incentives to reduce the cost of monitoring lose their importance. In addition, a rule of negligence (as opposed to strict liability) shields from the overprecaution problem mentioned above, which might arise if, for some reason, the parties do not negotiate over the level of the employer's precaution.[41]

[41] See Sykes (1988) for a different explanation and Eörsi (1975) for a comparative overview.

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