Optimal Successor Liability*

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Abstract

When a firm (buyer) acquires another firm's (seller's) assets, a tort liability that arises from the seller's past conduct is often transferred to the buyer through the doctrine of successor liability. If the buyer has as much information about the potential liability as the seller, the first best is achieved: all gains from acquisition are realized while the seller takes the efficient level of precaution. However, when the seller has more information about the potential liability than the buyer, there will be too little acquisition and the seller will take too little precaution. We argue that, in the presence of information asymmetry, the court should increase damages against the seller who misrepresents to the buyer and fails to sell while decreasing damages against the buyer who purchases the seller's assets.

1   Introduction

In many tort cases, there often is a substantial delay between a tort-feasor's activity and the occurrence or discovery of harm. Examples are easy to find. Cigarette smokers develop cancer after many years of usage. Workers exposed to asbestos become ill after a substantial latency period. Water pollution creates health problems to nearby residents long after the initial disposal. If the initial tort-feasor is still in existence when the victims discover harm, we can hold the initial actor accountable, thereby both compensating the victims and providing the right deterrence incentive against the tort-feasor. However, in an era of fluid corporate transactions, where companies are bought and sold on a daily basis, it often is unlikely that a company that makes a defective product or pollutes the environment is going to be around twenty or thirty years after its initial tortious conduct. The delay in

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harm discovery and the potential disappearance of the tort-feasor through a merger or an acquisition throws an additional layer of challenge to the legal system in achieving victim compensation and deterrence.

The solution adopted in American tort law is to allow the victims to recover from the company (buyer) that obtained control over the assets of the original tort-feasor (seller). The law makes a distinction based on how the buyer obtained control. If the ownership, e.g., seller's stock, has been transferred to the buyer through a statutory merger or a stock purchase, the law assumes that all liabilities will transfer to the buyer. On the other hand, even in cases where the buyer has only bought the seller's physical assets and has expressly, i.e., contractually, disavowed against future, contingent liability, if the tort claimants can show that the asset sale was a "de facto merger," the buyer is a "mere continuation" of the seller, or the transaction was made to intentionally escape liability, courts allow the victims to recover from the buyer based on the theory that the transaction is indistinguishable from a statutory merger or that the transaction was a fraud or a sham.

While imposing liability on a successor seems to punish an innocent buyer for a predecessor's wrongs for no apparent gain in efficiency, previous analysis has concluded that successor liability can compensate the victims and provide efficient deterrence against the predecessor without impeding efficient asset sales. The story goes like this: when a buyer possesses all relevant information about the future harm, acquisition price will adjust to reflect the buyer's information. Victims recover from the buyer and the buyer is not unjustly hurt since it has already been compensated through a lower acquisition price. The seller is optimally deterred, i.e., deterrence efficiency is achieved, since the seller does not want to sell its assets at a lower price and would want to take necessary precautions to avoid that outcome. Finally, since the acquisition price accurately reflects all relevant information, assets will be sold to the buyer only when the buyer places a higher value on the assets than the seller: transactional efficiency is achieved.

For the traditional argument to be valid, however, it is crucial that the acquisition price accurately reflects all relevant information about the future liability, and for the price to accurately reflect all relevant information, there must, at least, be a symmetry in the buyer's and the seller's information about the liability. If the seller is better informed about the liability than the buyer, it provides an incentive to the seller to act strategically and there is no guarantee that the price will reflect the seller's private information. Indeed, the seller has an incentive not to disclose material negative information since disclosure will depress the acquisition price. Buyer, accordingly, becomes more sceptical of the seller's claim of no liability. It is not difficult to imagine why the seller may be better informed than the buyer. After all, seller is the one who designed the defective product or polluted the environment. So, the question remains: if the seller is better informed of potential liability, can successor liability provide optimal deterrence incentive without undermining asset mobility?

This paper first shows that the answer is no. Asymmetric information creates two types of inefficiencies. First, not all acquisitions are consummated even when there are definite

gains from the acquisitions. Second, because the acquisition price becomes less sensitive to the seller's information, it fails to provide the efficient deterrence incentive to the seller. At the time of the acquisition, buyer faces an adverse selection problem. The seller with a negative information on future liability becomes less willing to disclose that information to the buyer and the buyer becomes less likely to buy the seller's assets when the seller claims that the assets are liability-free. In equilibrium, a higher-liability seller is more likely to sell its assets and realize a profit than a lower-liability seller and this, in turn, decreases a seller's incentive in reducing the size of the potential liability in the long run. Successor liability under-deters. In sum, the adverse selection problem at the time of the acquisition morphs into a moral hazard problem in the long run.

The paper also shows that although achieving the first best outcome through successor liability will be difficulty, if not impossible, the court can induce a better equilibrium by selectively adjusting the size of damages. We show that the optimal liability regime consists of two elements: (1) maximal punishment, i.e., punitive damages, against the seller who misrepresents to the buyer but fails to sell and (2) reduction of damages against the buyer who successfully acquires the seller's assets. First, if the seller knows that it will be imposed a higher damages in the future if the negotiation with the buyer fails due to lack of disclosure or misrepresentation, it becomes more willing to disclose and sell its assets to the buyer rather than risk not selling the company and paying higher damages in the future. Second, lowering damages against a successful buyer makes the buyer more willing to purchase the seller's assets and, by increasing the acquisition price in case the seller is aware of future liability, makes the seller less willing to lie. At the end of the day, the acquisition price better reflects the seller's private information regarding future liability and this effects both a higher asset mobility and a better deterrence against the seller.

The paper is organized as follows. The next section provides a simple, numerical example that demonstrates the main features of the optimal mechanism with minimal analytics. In the following section, we present the first best benchmark and, using a mechanism design approach, show that achieving the first best is not feasible. We, then, derive the optimal mechanism and show that maximally punishing the seller who misrepresents while reducing damages against the buyer constitute the second best. In the following section, we show how the optimal mechanism can be implemented by a court in a seller offer model. The final section concludes with suggestions for future research.

2 An Illustrative Example

There are two firms: B and S. Firm S manufactures and sells widgets that can cause harm to its consumers. The size of the aggregate harm is either $0 or $100. Without this (potential) liability, firm S's assets are worth $200 to S. With the potential liability, the assets are worth either $100 or $200. Before manufacturing the product, S can invest in improving the safety features of the product that would reduce the probability of harm to

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the consumers. Suppose the cost of this investment is $25, and the investment will reduce the probability of harm from 60% to 20%. From the social welfare perspective, since the cost of investment is only $25, the expected benefit ($(0.4)(\$100) = \$40$) outweighs the cost by $15, so A should spend $25 to make the product safer.

After S has manufactured and sold the widgets, although S becomes aware of whether the consumers will, in fact, suffer $100 of harm in the future or not, the consumers have not, i.e., there is a delay in the realization of harm and the legal action. In the meantime, firm B appears as a potential suitor for S's assets. B values S's assets at $300 without any liability. To keep the bargaining process simple, suppose S makes a take-it-or-leave-it offer to B and B can only either accept or reject S's offer. After the transaction, consumers become aware of the harm and bring a successful legal action against the survivor, either against S if S has not sold its assets, or against B under the doctrine of successor liability. Consistent with the tort law's imposition of liability on defective products that are "unreasonably dangerous," we assume that the liability is strict. We also assume that if B buys S, S distributes the acquisition consideration to its dispersed shareholders and subsequently dissolves, so that it is prohibitively costly for the consumers to bring an action against the former shareholders of S.

When B is also aware of the potential liability, S's offer will reflect the information so as to achieve both efficient transfer and optimal deterrence. Suppose consumers suffer no harm, and both B and S are aware of this. At the time of the acquisition, B will offer (slightly less than) $300 to B and B will accept. On the other hand, if both expect $100 of harm to the consumers, S will offer (slightly less than) $200 to B and, again, B will accept. In both cases, we achieve efficient transfer. At the same time, when making the investment decision, S takes into account this future bargaining outcome. If S were not to make the investment, S's expected profit is $(0.6)(\$200) + (0.4)(\$300) = \$220$. If S invests in safety, its expected profit is $(0.2)(\$200) + (0.8)(\$300) - \$25 = \$245$. Since $245 is higher than $220, S decides to make the investment, which is efficient. With symmetric information, we achieve both transactional and deterrence efficiency.

Suppose, instead, when B approaches S, though S knows whether there will be a $100 harm and whether it has invested in safety, B does not. B's reservation values are either $300 or $200, and these are also S's offers. If S has no liability, she would not want to offer $200 to B, since that's already her reservation value: she would only offer $300. If S has $100 liability, she can either be truthful and offer $200 or misrepresent and offer $300. B knows that only S with liability will offer $200: B will always accept the $200 offer. Suppose B accepts the $300 offer with probability q. Then, to make the seller (with liability) truthful, we need $q(\$300) + (1 - q)(\$100) \leq \$200$. The left hand side is the seller's expected return when she pretends no liability and the right hand side is the sure return the seller can get by telling the buyer the truth. The maximum q that satisfies this inequality is 50%. In equilibrium, if there is liability, S offers $200 and B always accepts, and if there is no liability, S offer $300 and B accepts with 50% probability. S's expected profit when there is liability,

therefore, is $200, while S's expected profit in case of no liability is $250 = (0.5)($300) + (0.5)($200). In the long run, if S were to invest in safety technology, its expected return is (0.2)($200) + (0.8){(0.5)($300) + (0.5)($200)} − $25 = $215. If S were not to make the investment, its expected return is (0.5)($200) + (0.5){(0.5)($300) + (0.5)($200)} = $220. Not investing in safety is better for S, and we achieve neither transactional nor deterrence efficiency.

At the crux of the problem lies the S's incentive to lie or to claim that there is no liability. There are (at least) two ways of mitigating this incentive. First, punish S for misrepresentation, and second, reduce the extra return S could have gotten from lying. The first works as a stick and the second as a carrot. To see this, suppose the court, at the time of tort litigation, imposes $200 of damages ($100 of which is punitive) against S to misrepresented to B in the past. Also, if the suit is brought against B, who has purchased S's assets, the court reduces damages to $95, instead of $100. At the time of bargaining, B's reservation values are now $300 or $205, which also are S's potential offers. As before, suppose B accepts $205 offer with certainty and accepts $300 offer with probability q. If S has no liability, she still offers $300. For S with liability, if she were to offer $300 and claim no liability, her expected return is $q($300) + (1 − q)($0)$, which represents the court's imposition of $100 punitive damages against the seller in case she misrepresents but fails to sell. If she reveals her information, her return is $205. For separation, we need $q($300) \le 205. The maximum q that satisfies this inequality is about 68.3%.

What about the deterrence incentive? If S were to invest in safety, her long-run expected return is $(0.2)($205) + (0.8){(0.683)($300) + (0.317)($200)} − $25 = 230.6$. If S were not to invest, her long-run expected return is $(0.6)($205) + (0.4){(0.683)($300) + (0.317)($200)} = 230.3$. Now, S has enough incentive to invest in safety. Although the damages adjustment was not able to implement the first best, compared to the case with no adjustment, we have achieved a much higher transactional efficiency (from 50% acquisition failure in case of no liability to 31.7% failure) and have provided optimal deterrence incentive to the seller. In the next section, we expand this result to a more general environment. Although we are able to achieve the deterrence efficiency in this example, that will not generally be true in a more complex environment: optimal damages schedule will have to endure both transactional and deterrence efficiencies. On the other hand, we show that the basic structure of (1) punishing the seller for misrepresentation and (2) reducing the damages against the buyer remains in tact.

3   The Model

There are four players, one buyer, one seller, one potential tort victim, all risk neutral, and a mechanism-designer. There are four periods in the model and there is no time discount. In the first period ($t = 1$), the seller decides on a level of precaution, $e \in [0, \overline{e}]$, at cost $\psi(e)$. In a products liability example, for instance, the effort can be thought of as the seller's

costly investment in the safety design of its product. We assume that $\psi' > 0$, $\psi'' > 0$, $\psi'(0) = 0$, and $\psi'(\overline{e}) = +\infty$. The level of effort determines the probability (or likelihood), $p(e)$, of an accident which imposes a damage of d (> 0) onto the victim. Letting D be the liability random variable, we set $\Pr(D = d) = p(e)$ and $\Pr(D = 0) = 1 - p(e)$. We assume that a higher level of precaution by the seller decreases the probability of the accident at a decreasing rate: $p' < 0$ and $p'' > 0$. For an interior solution, we also assume that $p'(0) < 0$ and $0 < p(0) \leq 1$.

In the second period ($t = 2$), only the seller learns whether there will be an accident in the future or not, i.e., whether $D = 0$ or $D = d$. In the third period ($t = 3$), buyer appears with probability one. The mechanism designer then determines, based on a report from the seller, whether or not the assets should be transferred to the buyer, how much the seller should be paid in case of transfer, and what the future damages, that the buyer or the seller will be liable for, should be. The buyer values the company at $v_b - D$ while the seller values at $v_s - D$. We assume that $v_b - v_s > 0$, so that there is a definite gains from the merger and that the buyer will not bankrupt due to the liability, i.e., $v_b > d$. In the fourth period ($t = 4$), the accident is discovered and the victim costlessly recovers damages, set by the mechanism designer in $t = 3$, from the surviving corporation.

3.1 The First Best

Assuming that the victim is wholly compensated, the first best requires the seller's assets to be sold to the buyer with probability one and the seller to make precautionary investment to maximize the expected social welfare, which is $v_b - p(e)d - \psi(e)$. Note that we have v_b instead of v_s to reflect the fact that the buyer should always purchase the seller's assets. The maximization yields $p'(e^*)d + \psi'(e^*) = 0$, where e^* denotes the first best level of precaution. With the assumed signs on the second order derivatives, the second order condition is satisfied: $p''(e^*) + \psi''(e^*) > 0$. The first order condition implicitly defines the first best level of precaution, e^*, as a function of the size of the harm, i.e., $e^*(d)$, and it is easy to see that as the harm gets larger, so must the first best level of precaution, i.e., $e^{*\prime}(d) > 0$. We will refer back to this relationship, in slightly different forms, in the latter parts of the paper.

If the buyer and the seller are symmetrically informed, it is easy to see how successor liability leads to the first best outcome with private bargaining. Suppose, at $t = 3$, the buyer is also aware of the realization of D and the seller makes a take-it-or-leave-it offer to the buyer. The buyer's reservation values are $v_b - d$ if $D = d$ and v_b if $D = 0$. In both cases, the seller will make an offer equal to (or slightly less than) the buyer's reservation value and the buyer will always accept. Given this $t = 3$ acquisition outcome, at $t = 1$, the seller maximizes her expected profit of $E(\pi_s) = p(e)(v_b - d) + (1 - p(e))v_b - \psi(e)$. In words, she rationally expects that if there is future liability, she will sell the assets to the buyer at $v_b - d$, and if there is no liability, she will sell at v_b. Maximizing the expression

with respect to e and setting it equal to zero yields $p'(e)d + \psi'(e) = 0$. We see that this first order condition is identical to the one that maximizes the social welfare. With symmetric information, therefore, the acquisition price reflects all relevant information regarding future liability and we achieve both transactional and deterrence efficiencies.

3.2 Mechanism Design Problem

Reinstating the asymmetric information assumption, at $t = 3$, there are two types of sellers. Let's call the seller with $D = 0$ the "high" type and the seller with $D = d$, the "low" type. If we let θ to denote the seller's type, θ can take on two values: $\theta \in \{h, l\}$. Relying on the Revelation Principle, we restrict our attention to an mechanism that uses types as messages and that gives the seller an incentive to report her true type. The mechanism designer, therefore, asks the seller for her type, and based on her report ($\widetilde{\theta}$) and the observed type in $t = 4$, the designer imposes the probability of acquisition, $q(\widetilde{\theta})$, amount of transfer paid to the seller in case of acquisition, $t(\widetilde{\theta})$, and ex post damages after the types are revealed, $d(\theta, \widetilde{\theta})$. In $d(\theta, \widetilde{\theta})$, the first θ represents the seller's true type that gets revealed at $t = 4$ and $\widetilde{\theta}$ stands for the seller's report to the mechanism designer at $t = 3$. The mechanism can be represented as $\Gamma = (q(\widetilde{\theta}), t(\widetilde{\theta}), d(\theta, \widetilde{\theta}))$. We assume that $0 \le q(\widetilde{\theta}) \le 1$, $0 \le t(\widetilde{\theta}) \le v_b$ and $0 \le d(\theta, \widetilde{\theta}) \le v_s$. The first imposes natural bounds on the probabilities while the last two constraints are limited liability (LL), or budget-balancing, conditions. The mechanism designer cannot allow the seller to receive more than what the buyer places on the seller's assets and cannot impose damages that is larger than the seller's value on the assets. Although we can also impose $v_s \le t(h)$ and $v_s - d \le t(l)$, these restrictions turn out not to be important.

To set up the program, we must first consider the seller's incentive to tell the truth at $t = 3$. Suppose the seller is of high type ($\theta = h$). If she were to be truthfully reveal her type ($\widetilde{\theta} = h$), the mechanism allows her the expected profit of $q(h)t(h) + (1 - q(h))(v_s - d(h, h))$. Her assets are transferred to the buyer with probability $q(h)$, and in case of transfer, she receives $t(h)$. In case the assets are not transferred, which happens with probability $1 - q(h)$, she will realize the value of her assets (v_s) minus whatever damages the mechanism imposes on her ($d(h, h)$), which depends on her report and her true type that gets revealed at $t = 4$. If she were to lie ($\widetilde{\theta} = l$), her expected profit is $q(l)t(l) + (1 - q(l))(v_s - d(h, l))$. For truthful revelation, therefore, we need

$$q(h)t(h) + (1 - q(h))(v_s - d(h, h)) \ge q(l)t(l) + (1 - q(l))(v_s - d(h, l)) \tag{TR1}$$

Similarly, for the low type ($\theta = l$), truthful revelation requires

$$q(l)t(l) + (1 - q(l))(v_s - d(l, l)) \ge q(h)t(h) + (1 - q(h))(v_s - d(l, h)) \tag{TR2}$$

Next, the program should also consider the seller's incentive to invest in safety at $t = 1$. Assuming that there is truthful revelation at $t = 3$, the seller's expected profit, at $t = 1$, is

$$p(e)\{q(l)t(l) + (1 - q(l))(v_s - d(l, l))\} + (1 - p(e))\{q(h)t(h) + (1 - q(h))(v_s - d(h, h))\} - \psi(e)$$

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The first set of terms denotes the seller's expected profit in case of $D = d$ and the second set of terms denotes the seller's expected profit in case of $D = 0$. The last term is the seller's cost of precaution. Seller maximizes this expected profit, producing the first order condition of

$$p'(e)\{q(l)t(l) + (1 - q(l))(v_s - d(l,l)) - q(h)t(h) - (1 - q(h))(v_s - d(h,h))\} = \psi'(e) \quad \text{(P)}$$

which implicitly determines the seller's level of precaution. The equilibrium social welfare, where e is determined by the constraint P, is

$$p(e)\{q(l)v_b + (1 - q(l))v_s - d\} + (1 - p(e))\{q(h)v_b + (1 - q(h))v_s\} - \psi(e) \quad \text{(SW)}$$

Note that the welfare is independent of the transfers, $t(\widetilde{\theta})$, or the actual damages imposed on the seller (or the buyer), $d(\theta, \widetilde{\theta})$, since these represent transfers from one party to another. They do, however, play an important role in providing incentives to the seller to be truthful (TR's) and to take more precaution (P).

Now, we can state the full problem. The mechanism designer wants to maximize the equilibrium social welfare (SW) subject to (1) two truthful revelation constraints ($TR1$ and $TR2$), (2) precaution incentive constraint (P), and (3) probability and limited liability constraints (LL's). In other words, the problem is to

$$\underset{(q(\widetilde{\theta}),t(\widetilde{\theta}),d(\theta,\widetilde{\theta}))}{Max} \ p(e)\{q(l)v_b + (1 - q(l))v_s - d\} + (1 - p(e))\{q(h)v_b + (1 - q(h))v_s\} - \psi(e)$$

$$\text{subject to}$$

$$q(h)t(h) + (1 - q(h))(v_s - d(h,h)) \geq q(l)t(l) + (1 - q(l))(v_s - d(h,l))$$

$$q(l)t(l) + (1 - q(l))(v_s - d(l,l)) \geq q(h)t(h) + (1 - q(h))(v_s - d(l,h))$$

$$p'(e)\{q(l)t(l) + (1 - q(l))(v_s - d(l,l)) - q(h)t(h) - (1 - q(h))(v_s - d(h,h))\} = \psi'(e)$$

$$0 \leq q(\widetilde{\theta}) \leq 1$$

$$0 \leq t(\widetilde{\theta}) \leq v_b$$

$$0 \leq d(\theta, \widetilde{\theta}) \leq v_s$$

Before searching for the optimal mechanism, we must first examine whether implementing the first best is feasible. Recall that the first best entails the asset transfer with probability one ($q(h) = q(l) = 1$) and inducing the seller to take e^* amount of precaution. The following lemma proves that there is no mechanism that achieves the first best. Furthermore, the only way to achieve transactional efficiency is by giving up deterrence efficiency, and although achieving deterrence efficiency is possible, it will result in transactional inefficiency.

Lemma 1 *There does not exist a mechanism* $\Gamma = (q(\widetilde{\theta}), t(\widetilde{\theta}), d(\theta, \widetilde{\theta}))$ *that satisfies the constraints ($TR1$, $TR2$, P, and LL's) and achieves, in equilibrium, $e = e^*$ and $q(h) = q(l) = 1$.*

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Proof. Suppose there exists a first best solution. From the transactional efficiency, $q(h) = q(l) = 1$, the precaution incentive constraint (P) becomes

$$p'(e)\{t(h) - t(l)\} + \psi'(e) = 0$$

Also, the truthful revelation constraints ($TR1$ and $TR2$) become $t(h) \geq t(l)$ and $t(l) \geq t(h)$, which imply that, the first best solution must set $t(h) = t(l)$. In that case, however, the precaution incentive (P) becomes

$$p'(e) \cdot 0 + \psi'(e) = 0$$

and the only solution to this equation is $e = 0$. In other words, the seller takes zero precaution.

Although this is sufficient for the proof, it is instructive to examine what would happen if we were to attempt to achieve the deterrence efficiency. Inducing optimal precaution requires

$$q(l)t(l) + (1 - q(l))(v_s - d(l, l)) - q(h)t(h) - (1 - q(h))(v_s - d(h, h)) = d$$

From the TR's, we should set $d(h, l) = d(l, h) = v_s$, since increasing $d(h, l)$ and $d(l, h)$ can only help us by relaxing those constraints. Then, the constraints become

$$q(h)t(h) + (1 - q(h))(v_s - d(h, h)) \geq q(l)t(l)$$
$$q(l)t(l) + (1 - q(l))(v_s - d(l, l)) \geq q(h)t(h)$$

When we simplify the constraints with

$$q(l)t(l) + (1 - q(l))(v_s - d(l, l)) - q(h)t(h) - (1 - q(h))(v_s - d(h, h)) = d$$

we get

$$d + (1 - q(l))(v_s - d(l, l)) \geq 0$$
$$(1 - q(h))(v_s - d(h, h)) - d \geq 0$$

From the constraints, we see that while setting $q(l) = 1$ is feasible, if we set $q(h) = 1$, we violate the second constraint. Hence, achieving deterrence efficiency requires some transactional inefficiency. ∎

The reason the first best cannot be achieved is easy to understand. Suppose both types of seller know that, in equilibrium, their assets will be sold with probability one, i.e., $q(h) = q(l) = 1$, which is required for transactional efficiency. Then, there is no point in allowing different amounts of transfer ($t(h) \neq t(l)$) based on the seller's report, because both types will simply pretend to be the type that allows a higher transfer. Furthermore, in the long run, since both types sell their assets with probability one and both get the same amount of transfer, there is no point to trying to become a better type by incurring a higher precaution cost. Complete pooling results and the seller takes no precaution. The second part of the proof shows that if we want to achieve deterrence efficiency, we must give up hope on achieving transactional efficiency.

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3.3 Optimal Mechanism

It seems clear that, unless we want to give up on giving any precaution incentive to the seller, the optimal mechanism must entail some transactional inefficiency that serves as a stick mechanism against the seller. Given that the seller may not be able to sell her assets and be responsible for the harm, if it later turns out that she lied previously, the mechanism can impose a harsh punishment on the seller. Conversely, if the designer finds out that the seller has been truthful, the seller can be rewarded for her honesty. So, the key to separating both types is the carrot and stick incentives that rely on transactional inefficiency. The following proposition also shows that, in the second best equilibrium, we must endure both transactional and deterrence inefficiencies.

Proposition 1 *The optimal mechanism satisfies*

$$q(l) = 1$$

$$q(h) = \frac{t(l)}{t(h)} = \frac{v_b - d}{v_b} + \frac{(1 - p(e))(v_b - v_s)}{p'(e)e'(q(h))v_b} < 1$$

$$d(l, h) = d(h, l) = v_s$$

$$d(h, h) = 0$$

where $e'(q(h)) = \frac{p'(e)v_s}{p''(e)(1-q(h))v_s + \psi''(e)}$.

Although the absolute levels of $t(l)$, $t(h)$, and $d(l,l)$ are indeterminate, the gap in acquisition prices, $t(h) - t(l)$, must be smaller than the size of the harm, d. Finally, in equilibrium, there are both transactional and deterrence inefficiencies.

Proof. Rather than tediously solving the problem using a long Lagrangian, we provide a more intuitive proof. Let us concentrate on the three "main" constraints: truthful revelation constraints and precaution constraint. First, from the truthful revelation constraints, increasing $d(l, h)$ and $d(h, l)$ only helps relax the constraints. Therefore, we set $d(l, h) = d(h, l) = v_s$. We also see that decreasing $d(h, h)$ helps the TR constraints while strengthening the precaution constraint. Hence, we let $d(h, h) = 0$. The constraints simplify to

$$q(h)t(h) + (1 - q(h))v_s \geq q(l)t(l)$$

$$q(l)t(l) + (1 - q(l))(v_s - d(l, l)) \geq q(h)t(h)$$

$$p'(e)\{q(l)t(l) + (1 - q(l))(v_s - d(l, l)) - q(h)t(h) - (1 - q(h))(v_s - d(h, h))\} + \psi'(e) = 0$$

Second, in equilibrium, we cannot have both TR constraints bind. Suppose not. Then,

$$q(h)t(h) + (1 - q(h))v_s = q(l)t(l)$$

$$q(l)t(l) + (1 - q(l))(v_s - d(l, l)) = q(h)t(h)$$

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and this implies

$$q(h)t(h) + (1 - q(h))v_s = q(l)t(l) = q(h)t(h) - (1 - q(l))(v_s - d(l,l))$$

which is a contradiction. Furthermore, we cannot have only the $TR1$ binding. If this were so, we would have

$$q(h)t(h) + (1 - q(h))v_s = q(l)t(l)$$
$$q(l)t(l) + (1 - q(l))(v_s - d(l,l)) > q(h)t(h)$$

The precaution constraint becomes

$$-p'(e)\{(1 - q(l))(v_s - d(l,l))\} + \psi'(e) = 0$$

which implies that the seller will take zero precaution, which is clearly suboptimal. Therefore, in equilibrium, we must have

$$q(h)t(h) + (1 - q(h))v_s > q(l)t(l)$$
$$q(l)t(l) + (1 - q(l))(v_s - d(l,l)) = q(h)t(h)$$

Third, ignoring the non-binding constraint, the mechanism design problem becomes

$$\underset{(q(\tilde{\theta}),t(\tilde{\theta}),d(\theta,\tilde{\theta}))}{Max} p(e)\{q(l)v_b + (1 - q(l))v_s - d\} + (1 - p(e))\{q(h)v_b + (1 - q(h))v_s\} - \psi(e)$$

subject to

$$q(l)t(l) + (1 - q(l))(v_s - d(l,l)) = q(h)t(h)$$
$$p'(e)(1 - q(h))v_s + \psi'(e) = 0$$

We want to set $q(l)$ and $q(h)$ as close to 1 as possible and $(1-q(h))v_s$ as close to d as possible. From the problem, we cannot have $q(h) = 1$, since otherwise, we will have $p'(e)0 + \psi'(e) = 0$. On the other hand, we can easily set $q(l) = 1$ by adjusting $t(l)$ and $d(l,l)$. Hence, $q(l) = 1$ at optimum, which implies that $t(l) = q(h)t(h)$, or $q(h) = \frac{t(l)}{t(h)}$. Setting $(1 - q(h))v_s$ as close to d as possible now implies setting $q(h)$ as close to $\frac{v_s - d}{v_s}$ as possible.

Now, the problem simplifies to

$$\underset{q(h)}{Max}\ p(e)\{v_b - d\} + (1 - p(e))\{q(h)v_b + (1 - q(h))v_s\} - \psi(e)$$

subject to

$$t(l) = q(h)t(h)$$
$$p'(e)(1 - q(h))v_s + \psi'(e) = 0$$

From $p'(e)(1 - q(h))v_s + \psi'(e) = 0$, we can let e as a function of $q(h)$. By totally differentiating the equation and simplifying, we get

$$e'(q(h)) = \frac{p'(e)v_s}{p''(e)(1 - q(h))v_s + \psi''(e)}$$

which is negative since $p'(e) < 0$, $p''(e) > 0$, and $\psi'(e) > 0$. If we maximize the objective function with respect to $q(h)$, the first order condition is

$$p'(e)e'(q(h))(v_b - d) - p'(e)e'(q(h))(q(h)v_b + (1 - q(h))v_s)$$
$$+ (1 - p(e))(v_b - v_s) - \psi'(e)e'(q(h)) = 0$$

If we substitute $p'(e)(1 - q(h))v_s + \psi'(e) = 0$ into the first order condition and simplify,

$$p'(e)e'(q(h)) \{v_b(1 - q(h)) - d\} + (1 - p(e))(v_b - v_s) = 0$$

Since $p'(e) < 0$, $e'(q(h)) < 0$ and $(1 - p(e))(v_b - v_s) > 0$, we must have

$$v_b(1 - q(h)) - d < 0 \Leftrightarrow (1 - q(h)) < \frac{d}{v_b} \Leftrightarrow \frac{v_b - d}{v_b} < q(h) = \frac{t(l)}{t(h)}$$

Since $\frac{v_s - d}{v_s} < \frac{v_b - d}{v_b}$, we must have under-precaution in equilibrium.

Finally, from $p'(e)e'(q(h)) \{v_b(1 - q(h)) - d\} + (1 - p(e))(v_b - v_s) = 0$, we get

$$q(h) = \frac{v_b - d}{v_b} + \frac{(1 - p(e))(v_b - v_s)}{p'(e)e'(q(h))v_b} = \frac{t(l)}{t(h)}$$

which implicitly defines optimal $q(h)$. Therefore, optimal mechanism is given by

$$q(l) = 1$$
$$q(h) = \frac{v_b - d}{v_b} + \frac{(1 - p(e))(v_b - v_s)}{p'(e)e'(q(h))v_b} = \frac{t(l)}{t(h)}$$
$$d(l, h) = d(h, l) = v_s$$
$$d(h, h) = 0$$

Since $d(l, l)$ is never imposed in equilibrium, optimal $d(l, l)$ is indeterminate. ∎

The optimal mechanism renders some intuitive results. Foremost, since achieving truthful revelation is important, regardless of the level of transactions, punishing liars to the fullest extent is a good idea: $d(l, h) = d(h, l) = v_s$. The system should impose a harsh penalty for the seller's misrepresentation (to the buyer). Second, for the sake of providing better precaution incentive, we do not want to impose damages on the seller when there is no harm: $d(h, h) = 0$. Third, since the seller's incentive is usually to pretend that there is no liability, rather than the other way around, not allowing asset transfer for the seller who discloses the liability would be inefficient: $q(l) = 1$.

To understand the expression on $q(h)$, let us focus on the low type seller, who knows that there will be an harm of d in the future, for the moment. If she were to be truthful, her assets will be sold for sure at price $t(l)$. If she were to pretend to be the high type,

her assets will be transferred with probability $q(h)$, in which case she will get $t(h)$, and in case of no transfer, she will be imposed the maximum fine, i.e., she receives nothing. This provides us the truthful revelation constraint of $t(l) \geq q(h)t(h)$. However, since we want to increase $q(h)$ as much as we can, ceteris paribus, this constraint must be satisfied with equality: $q(h) = \frac{t(l)}{t(h)}$. Finally, $q(h)$ serves two, conflicting roles. Increasing $q(h)$ will improve the transactional efficiency, but will create a larger deterrence inefficiency, since the low type is more likely to get away from lying. Decreasing $q(h)$ will create an opposite problem. The optimal $q(h)$ makes an efficient trade-off.

At the center of the problem lies the low type seller's incentive to pretend that there is no future harm. There are, at least, two ways of mitigating this problem. First, impose maximum punishment on the seller if the truth is revealed later ($d(l, h) = v_s$), which would happen only when there is some transactional inefficiency. At the same time, however, the higher acquisition price in case of no liability tempts the low type seller to pretend no liability. Hence, another way to induce truthful revelation is by minimizing this source of temptation, i.e., by reducing the acquisition price gap, $t(h) - t(l)$. In the case with no information asymmetry, the gap is exactly equal to the size of the harm, $t(h) - t(l) = d$, which implies that $\frac{v_b - d}{v_b} \geq \frac{t(l)}{t(h)} \geq \frac{v_s - d}{v_s}$. In the optimal mechanism, the gap is smaller: $\frac{t(l)}{t(h)} > \frac{v_b - d}{v_b} > \frac{v_s - d}{v_s}$.

Although the optimal gap depends on the underlying relationship between the probability and precaution, it is proportional to the relative difference in the buyer's and the seller's values, $\frac{(v_b - v_s)}{v_b}$, and the likelihood of no harm, $(1 - p(e))$. The larger the difference in values, the smaller the gap should be, and when the harm becomes less likely, the gap should also shrink. This is not surprising. Less likely harm implies that the deterrence efficiency becomes relatively less important while the larger synergy from the acquisition indicates relative importance of transactional efficiency. When either or both are true, decreasing the gap would encourage more asset acquisitions at the cost of reduced deterrence incentive. On the other hand, when precaution has a large effect on reducing the probability of harm, i.e., $p'(e)$ and/or $e'(q(h))$ large, deterrence becomes more important and the gap should increase.

4   Application to Seller Offer Model

Although it is unlikely that there exists a mechanism designer that intervenes at the time of the acquisition and selectively adjusts the damages based on the seller's report, the optimal mechanism derived in the previous section has important policy implications for designing the successor liability regime. To demonstrate this, we adopt a simple seller offer model with ex post damages adjustment by court. Suppose at $t = 3$, the seller, who is aware of the future liability, makes a take-it-or-leave-it offer to the buyer. The seller can either tell the truth to the buyer or misrepresent. In either case, her claim will be reflected in the

offer price. The buyer can either accept or reject the offer. If the buyer accepts, the assets transfer at the offer price, whereas if the buyer rejects, the seller remains independent.

The court will hear the tort case only when the harm is discovered, so there are three different damages measures the court can consider. If the buyer acquires the assets, the court can impose damages of d_b on the buyer when the harm is discovered and the suit is brought. Against the seller, there are two measures of damages. If the seller misrepresents to the buyer, i.e., pretends that there is no liability, and the buyer rejects the offer, court can impose the damages of d_{s1} against the seller when the harm is discovered. On the other hand, if the seller is truthful of future harm but the buyer does not buy, court can impose the damages of d_{s2} on the seller. As before, we assume that $d_b \leq v_b$ and $d_{s1}, d_{s2} \leq v_s$.

Depending on the damages, buyer's reservation values are v_b or $v_b - d_b$, and since the seller has all the bargaining power, these also are the seller's offers. Offering any price in between the two is strictly dominated by either or both. We look for a truthful separating equilibrium, where the low type seller offers $v_b - d_b$ (and reveals that there is liability) and the high type seller offers v_b. Suppose, in equilibrium, the buyer accepts the offer of v_b with probability r and the offer of $v_b - d_b$ with probability q. While there are many separating equilibria, the following proposition relies on the most efficient equilibrium.

Proposition 2 *To achieve the second best transactional and deterrence efficiency, the court should set $d_{s1} = v_s$ and $d_b = d + \frac{(1-p(e))(v_b - v_s)}{p'(e)e'(d_b)v_b} < d$, where $e'(d_b) = -\frac{p'(e)\frac{v_s}{v_b}}{p''(e)\frac{d_b}{v_b}v_s + \psi''(e)}$. With the optimal damages, the equilibrium acceptance rates are $q = 1$ and $r = \frac{v_b - d_b}{v_b}$.*

Proof. Consider the seller with value v_s, the high type. If she offers v_b, her expected profit is given by $E(\pi_s|v_b) = rv_b + (1-r)v_s$. Similarly, $E(\pi_s|v_b - d_b) = q(v_b - d_b) + (1-q)v_s$. For the low type seller, $E(\pi_s|v_b) = rv_b + (1-r)(v_s - d_{s1})$ and $E(\pi_s|v_b - d_b) = q(v_b - d_b) + (1-q)(v_s - d_{s2})$. To get the separation, we need

$$rv_b + (1-r)v_s \geq q(v_b - d_b) + (1-q)v_s$$
$$q(v_b - d_b) + (1-q)(v_s - d_{s2}) \geq rv_b + (1-r)(v_s - d_{s1})$$

which simplify to

$$r \geq \frac{q(v_b - v_s - d_b)}{v_b - v_s}$$
$$r \leq \frac{q(v_b - v_s + d_{s2} - d_b) + d_{s1} - d_{s2}}{v_b - v_s + d_{s1}}$$

Although there are many different equilibria, in the most efficient equilibrium, we must have $q = 1$, which implies that $r = \frac{v_b - v_s - d_b + d_{s1}}{v_b - v_s + d_{s1}}$.

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To find the optimal damages, first, since $\frac{dr}{dd_{s1}} > 0$, increasing d_{s1} raises the probability of asset transfer. Therefore, we should set $d_{s1} = v_s$, which implies that $r = \frac{v_b - d_b}{v_b}$. The seller's expected profit, at $t = 1$, is

$$E(\pi_s) = p(e)(v_s - d_b) + (1 - p(e)) \left(\frac{v_b - d_b}{v_b} v_s + \frac{d_b}{v_b} v_s \right) - \psi(e)$$

The seller will, therefore, choose e that satisfies

$$p'(e) \frac{d_b}{v_b} v_s + \psi'(e) = 0$$

where e, which is implicitly defined, is a function of d_b. When we totally differentiate the equality with respect to d_b,

$$p''(e)e'(d_b) \frac{d_b}{v_b} v_s + p'(e) \frac{v_s}{v_b} + \psi''(e)e'(d_b) = 0$$

which implies that

$$e'(d_b) = -\frac{p'(e) \frac{v_s}{v_b}}{p''(e) \frac{d_b}{v_b} v_s + \psi''(e)}$$

This expression is positive since $p'(e) < 0$, $p''(e) > 0$ and $\psi''(e) > 0$.

With the equilibrium precaution, the expected social welfare is

$$p(e)(v_b - d) + (1 - p(e)) \left(\frac{v_b - d_b}{v_b} v_s + \frac{d_b}{v_b} v_s \right) - \psi(e)$$

Maximizing with respect to d_b yields

$$p'(e)e'(d_b) \left(d_b - d - \frac{d_b}{v_b} v_s \right) - (1 - p(e)) \left(\frac{v_b - v_s}{v_b} \right) - \psi'(e)e'(d_b) = 0$$

Simplifying with $p'(e) \frac{d_b}{v_b} v_s + \psi'(e) = 0$ yields

$$d_b = d + \frac{(1 - p(e))(v_b - v_s)}{p'(e)e'(d_b)v_b}$$

Since $e'(d_b) > 0$, $d_b < d$. ∎

Consistent with the optimal mechanism, if the seller misrepresents to the buyer (i.e., pretends no liability) and the harm is discovered later, in case the seller has failed to sell its assets to the buyer, the court should impose a maximal punishment, i.e., punitive damages against the seller: $d_{s1} = v_s$. On the other hand, the court should be more lenient toward the buyer. When the assets are transferred to the buyer and the harm is discovered later, the court should set the damages below the actual harm: $d_b < d$. The objective is not the

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leniency toward the "hapless" buyer per se, but is to reduce the incentive for the seller to lie, because reducing the damages against the buyer reduces the acquisition price gap. While the precise amount of reduction depends on numerous factors, the larger the (potential) merger gains $(\frac{v_b - v_s}{v_b})$ and the smaller the likelihood of harm $(p(e))$, the larger the reduction. On the other hand, when it becomes easier for the seller to have fixed the potential problem, $|p'(e)|$ large, the smaller the reduction.

5 Conclusion

In order for any successor liability regime to achieve optimal asset mobility and optimal deterrence, it must ensure that the privately-negotiated pricing mechanism work relatively well. If the acquisition prices fail to reflect all relevant information regarding future liability, the regime achieves neither. The paper has shown that one critical source of such failure is asymmetric information between a seller and a buyer. When a seller has more information than a buyer, the seller has an incentive to hide such information and the buyer becomes less willing to buy the seller's assets. Because the price fails to fully reflect the seller's information, it cannot provide the right deterrence incentive to the seller in the long run, either. We have suggested that, while achieving the first best is not feasible, the court can, by selectively adjusting damages against the seller and the buyer, better induce the seller to reveal her private information. Optimal successor liability regime should consist of (1) maximal punishment against the seller who misrepresents to the buyer but fails to sell and (2) reduction of damages against the buyer who purchases the seller's assets.

Many real-world concerns remain: the model, that relies on a simple, two-liability assumption, needs a generalization. Some concerns are easy to address. If reduced damages against a buyer creates an incentive for a seller and a buyer to transfer the assets to escape liability, the optimal reduction should be smaller. If the probability that a buyer will appear to purchase a seller's assets is smaller, so long as the court can identify whether the seller has misrepresented to a buyer in the past, the reduction in probability should not matter. If, on the other hand, it is difficult for a court to identify past misrepresentation, while punishing the seller for misrepresentation will still hold, such punishment strategy becomes less effective. In such light, one might consider increasing damages against a seller whether or not there was a misrepresentation in the past, although the increase in damages should be smaller. On the other hand, other concerns, such as piecemeal asset sales to multiple buyers at multiple prices, buyer's potential bankruptcy, and joint and several liability in conjunction with successor liability pose more serious challenges in designing an optimal liability regime and remain to be answered in future research.

References

[1] Arness, J., Sutin, A. and Plotkin, T. (1989), "Preventing Successor Liability for Defective Products: Safeguards for Acquiring Corporations," *Washington University Law Quarterly* 67, 353.

[2] Blumberg, P. (1996), "The Continuity of the Enterprise Doctrine: Corporate Successorship in United States Law," *Florida Journal of International Law* 10, 365.

[3] Cremer, J. and McLean, R. (1985), "Optimal Selling Strategies Under Uncertainty For a Discriminating Monopolist When Demands are Interdependent," *Econometrica* 53, 345.

[4] Cremer, J. and McLean, R. (1988), "Full Extraction of the Surplus in Bayesian and Dominant Strategy Auctions," *Econometrica* 56, 1247.

[5] Fudenberg, D. and Tirole, J. (1991), *Game Theory*, MIT Press, Cambridge, Massachusetts.

[6] Gilson, R. and Black, B. (1995), *The Law and Finance of Corporate Acquisitions*, 2nd edition, Foundation Press, Westbury, New York.

[7] Green, M. (1993), "Successors and CERCLA: The Imperfect Analogy to Products Liability and an Alternate Proposal," *Northwestern University Law Review* 87, 897.

[8] Green, M. (1986), "Successor Liability: Supermajority of Statutory Reform to Protect Products Liability Claimants," *Cornell Law Review* 72, 17.

[9] Kraakman, R. (1984), "Corporate Liability Strategies and the Costs of Legal Controls," *Yale Law Journal* 93, 857.

[10] Mas-Colell, A., Whinston, M., and Green, J. (1995), *Microeconomic Theory*, Oxford University Press, New York, New York.

[11] Phillips, J. (1989), "Successor Corporation Products Liability–Six or more Characters in Search of an Author," *Washington University Law Quarterly* 67, 335.

[12] Phillips, J. (1982), "Product Line Continuity and Successor Corporation Liability," *NYU Law Review* 58, 906.

[13] Roe, M. (1984), "Mergers, Acquisitions, and Tort: A Comment on the Problem of Successor Corporate Liability," *Vanderbilt Law Review* 70, 1559.

[14] Schwartz, A. (1985), "Products Liability, Corporate Structure and Bankruptcy: Toxic Substances and the Remote Risk Relationship," *Journal of Legal Studies* 14, 689.