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Drivers, Doctors, and Liability Externalities

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Abstract:

According to legal principles, a driver who negligently breaks a pedestrian's leg should pay the same damages as a doctor who negligently breaks a patient's leg. According to economic principles, however, the driver should pay more than the doctor. Drivers should pay more than doctors who inflict the same harm because of externalities in the underlying activites. *Non*-negligent drivers impose risk on others and liability law does not make them pay for it. When *liability externalities* are *negative* as with driving, socially efficient damages should increase beyond full compensation in order to discourage the activity. In contrast, doctors create benefits for patients that exceed their fees. When l*iability externalities* are *positive* as with doctoring, damages should decrease below full compensation in order to encourage the activity. In general, law should adjust damages up or down according to the externality associated with the underlying activity. Instead of case-by case adjustment, law should refine the menu of available damage measures and associate different measures with different activities. The menu should include a novel measure -- *disgorgement damages for accidents*.

Drivers, Doctors, and Liability Externalities

Robert Cooter and Ariel Porat[*]

Introduction

Driving a car and practicing medicine create the risk of accidentally harming others. Tort law, consequently, imposes liability on negligent drivers and negligent doctors. For identical injuries to victims, the liability of a negligent driver is the same in principle as the liability of a negligent doctor. To illustrate concretely, a driver who negligently breaks a pedestrian's leg pays the same damages in principle as a doctor who negligently breaks a patient's leg. This principle, unfortunately, overlooks an important difference. Each driver imposes risks on others without creating benefits for them. Non-negligent drivers impose risk on others and liability law does not make them pay for it. In general, the external effects of driving are harmful. In contrast, each doctor imposes risks on patients while creating benefits for them. Special features of medical markets cause doctors' fees to fall short of the benefits to patients, so doctoring has external effects that are positive. In general, the external effects of doctoring are beneficial. For identical injuries to victims, consequently, liability of a negligent driver should be higher than liability of a negligent doctor. To illustrate concretely, a driver who negligently breaks a pedestrian's leg should pay higher damages than a doctor who negligently breaks a patient's leg.

The competence of courts centers on the plaintiff's harm and the defendant's burden of care. These are social costs that courts routinely evaluate. We use the term "liability externalities" to refer externalities that courts can evaluate and take into account when setting damages. Other types of social costs should be evaluated by other organizations, not by courts. To illustrate, drivers cause pollution and congestion, but courts hearing cases concerning accidents should leave these externalities to policy makers.

Part I of this paper develops the general theory of liability externalities and Part II formalizes it. Part III discusses the important case where the injurer must choose between

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two acts, such as caesarian or natural delivery of a baby. This kind of situation changes the usual economic analysis of activity level. Part IV introduces the Disgorgement Damages for Accidents Principle. Part V discusses more examples and applications. A conclusion follows.

I.   Theory of Liability Externalities

According to the conventional economic analysis of law, a rule of strict liability with perfect compensation causes injurers to internalize the risk that they impose on others. Consequently, the precaution and activity level of injurers is efficient. In the case of driving, "precaution" refers to how carefully people drive, and "activity level" refers to the amount that people drive.

The conclusion is different, however, for a negligence rule. A negligence rule gives drivers an incentive to escape liability by satisfying the legal standard of care. Since careful drivers escape liability most of the time, they externalize most of the risk of harming others. Externalized risk makes them drive too much. Even careful drivers, however, internalize some of the risk of liability. Normally careful drivers occasionally lapse and harm others while driving negligently. Furthermore, in applying the duty of care, courts sometimes make mistakes and hold careful drivers liable. Since all drivers internalize some of the risk of harming others, higher damages will cause them to drive less. In particular, most drivers have insurance, so higher damages cause insurance premiums to increase. Higher insurance premiums cause people to buy fewer cars and drive them less. Increasing damages, consequently, will ameliorate the problem of excessive driving.

Like drivers, doctors are subject to a negligence rule. Careful doctors satisfy the legal standard and escape liability most of the time. Like drivers, normally careful drivers occasionally lapse and fall below the legal standard of care, and courts sometimes mistakenly find liability for careful doctors. Since normally careful doctors, are liable some of the time, changing damages will change their incentives. We focus on the incentives of doctors to choose one treatment rather than another. Fear of liability causes doctors to favor treatments that reduce their risk of liability instead of treatments that benefit patients the most ("defensive medicine"). Reducing liability of doctors has the

external benefit of reducing defensive medicine. For example, doctors apparently deliver too many babies by caesarian birth, where liability risk is relatively low, and they apparently deliver too few babies by natural birth, where liability risk is relatively high. If courts, regulators, and legislatures reduce the liability of doctors, the main beneficiaries will be the patients who receive more appropriate treatment at lower cost. Reducing the liability of doctors below full compensation of victims improves their incentives for choice of activity. The need to reduce damages for doctors is greatest when the rule of liability approaches strict liability, and the need is least when the rule of liability approaches a perfect negligence rule.

To depict our conclusions about of driving and doctoring, the line in Figure 1 represents optimal damages as a percentage of full compensation. For activities like driving in the standard tort model, incentives are optimal under a rule of strict liability when damages equal 100% of the victim's harm. For activities like driving, however, incentives are optimal under a negligence rule when damages exceed 100% of the victim's actual harm. Optimal damages increase under a negligence rule because careful drivers cause non-negligent harms, for which they are not held liable. Therefore a negligence rule creates negative externalities for driving that cause too much driving. Increasing liability above 100% could correct the distortion.

Figure 1: Drivers and Doctors

optimal damages as % of actual harm to victim
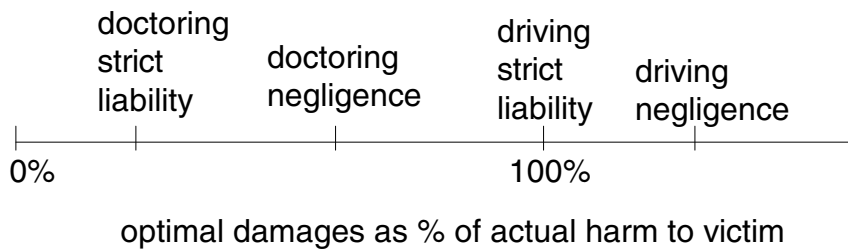
For activities like doctoring, in contrast, incentives are optimal under a rule of strict liability when damages are much less than 100% of the victim's actual harm. Careful doctors create some harms and a lot of benefits for which they are not fully paid. Under a rule of strict liability with full compensation, doctors internalize all the harms they create, but they externalize some of the benefits of their non-negligent acts. Consequently under such a rule, their activity level will be too low. Decreasing liability much below 100% could correct the distortion.

For activities like doctoring, a switch from strict liability to negligence increases the optimal damages, which still fall short of 100% of the victim's actual harm. Careful doctors sometimes lapse and courts sometimes make mistakes, so careful doctors are sometimes held liable under a negligence rule. Under a rule of negligence with full compensation, careful doctors internalize some of the non-negligent harm, and externalize benefits for which they are not paid. Consequently, under a rule of negligence with full compensation, the activity of doctors could be too low. Decreasing liability below 100% can correct the distortion.

Instead of increasing damages for drivers, a better solution to this problem in principle is to tax driving. In reality, however, driving taxes are not high enough anywhere in the world to internalize the risk of accidents. Practical political considerations preclude socially efficient driving taxes. Given deficient driving taxes, increasing the liability of drivers will improve the situation. Courts, regulators, and legislatures should respond by increasing the damages of liable drivers.

Similarly, Instead of decreasing damages for negligent doctors, a better solution in principle is to increase the fees paid to doctors for choosing risky treatments that benefit patients more. Structural impediments in medical markets preclude the possibility of eliminating defensive medicine in this way. Given imperfect fees, decreasing liability of doctors will improve the situation. Courts, regulators, and legislatures should respond by decreasing the damages of liable doctors below the level required for full compensation.

The term externality usually means costs and benefits conveyed to others thatmarket prices do not capture. When markets fail, liability law often improves the

situation by making injurers compensate victims. Sometimes, however, liability law leaves significant costs externalized. For example, tort liability leaves externalized much of the risk of non-negligent driving and part of the benefit of risky medical treatment. We adopt the phrase *liability externality* to mean costs and benefits conveyed to others that liability law does not internalize. When negligence rules leave benefits or costs externalized, adjusting damages can reduce the distortion. When liability externalities are negative, as with driving, damages should increase beyond full compensation. Conversely, when liability externalities are positive, as with doctoring, damages should decrease below full compensation. Given liability externalities, we propose to improve the activity level or choice of activity by adjusting damages.

Besides changing activity, the adjustment in damages also changes incentives for precaution. For example, increasing liability of drivers should cause drivers to take more precaution, and decreasing liability of doctors should cause doctors to take less precaution. The injurer's incentives to take precaution are optimal when compensation is full. We propose adjusting damages away from full compensation, which worsens the incentives for precaution.

Why do we favor adjusting damages to improve incentives for activity when the result is to worsen incentives for precaution? The reduction in social costs from improved activity is generally larger than the increase in social costs from changed precaution. On balance, responding to liability externalities by adjusting damages away from full compensation will reduce social costs.

The explanation for this fact is technical. Given full compensation, precaution is optimal under a negligence rule. A marginal change in precaution, consequently, causes no change in social costs. Unlike precaution, however, the activity is not optimal. Consequently, a marginal change in activity can reduce social costs. Thus a small change in damages causes a decrease in social costs due to improved activity that exceeds the increase in social costs due to worse precaution by the injurer.

How much should damages change in response to liability externalities? This question concerns the optimal extent of the change from full compensation, not its direction. The general answer is that damages should change until the gain from further

changes in activity equals the loss from further changes in precaution. To develop appropriate damage measures, this principle must be applied to categories of acts with liability externalities. Driving and doctoring are two examples of the many categories of activities where damages should be adjusted because of liability externalities.

II. Formalization

To increase the precision of preceding argument, we formalize our arguments. We begin by showing that damages should increase with negative liability externalities like driving and decrease with positive liability externalities like doctoring. Consider an activity that benefits the actor and other people, and also imposes risks on other people. Efficient incentives for the actor require him to internalize the benefits and costs of other people. To illustrate with notation, assume that the activity creates marginal benefits of b for other people and imposes the risk of harm h with probability p on them. Thus the net cost to others is $b-ph$. Efficient incentives require the injurer to bear the cost of $b-ph$ for engaging in the activity. A market transaction might give the actor the market price m. Liability law might require the actor to pay damages d with probability q. Thus the actors expected net payoff equals $m-qh$. To completely eliminate the externality, the actor's expected net payoff must equal the net social benefit of the activity to others: $m-qh=b-ph$.

To illustrate by automobile accidents, assume that injurer and victim are strangers who do not engage in a market transaction: $0=m$. Also assume that drivers do not convey benefits to their potential victims: $0=b$. To completely eliminate the externality, the actor's expected liability must equal the expected harm: $qd=ph$. For example, application of a rule of strict liability causes the probability of liability to equal the probability of an accident: $q=p$. Furthermore, liability for the full harm causes damages to equal the victim's actual harm: $d=h$. Thus strict liability of drivers for the full harm to victims causes them to internalize the externality.

In fact, however, drivers face a negligence rule, not a rule of strict liability. With a negligence rule, drivers expect to escape liability part of the time: $q<p$. To make drivers internalize the full cost of driving, the actor's expected liability must equal the expected harm: $qd=ph$. Since $q<p$, damages must increase above full compensation. Specifically, damages are optimal with respect to the amount of driving when $d=(p/q)h$.

To illustrate, if drivers expect to be liable 33% of the time, the damages should equal 300% of the actual harm.

This argument assumes that injurers and victims are strangers, as with most automobile accidents. In the case of medicine, however, the injurers and victims have a contractual relationship. The contract includes a price that may encompass some of the benefits and costs that the seller conveys to the buyer. Assume that the price of medical services is less than the marginal benefit: m<b. The unpriced benefit, which is thus given by b-m, can be called the *price externality*. With a negligence rule, doctors are liable for some, but not all, accidents: q<p. The unpriced risk, which is given by qd-pm, can be called the *liability externality*.

The total externality with respect to the choice of activity equals the sum of the price externality and the liability:

$$total\ externality\ = \underset{\substack{liability \\ externality}}{qd\ -\ ph}\ +\ \underset{\substack{price \\ externality}}{b-m}$$

To completely eliminate the externality with respect to the choice of activity, set the total externality equal to zero and solve the equation for optimal damages d*:

$$d* = \frac{1}{q}\left[\underset{\substack{expected \\ harm}}{ph}\ -\ \underset{benefit}{(b-m)}\right] \qquad\qquad (1)$$

(The notation b,q,d,p,and h should be interpreted as marginal values.1)

To illustrate the interpretation of equation 1, apply it to defective consumer products. Strict liability for consumer product injuries implies that p=q. When consumer products are sold in competitive markets, the buyer's benefit from consumption equals

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[1] Thus p denotes the change in the probability of an accident from a marginal increase in the activity. For drivers, p is the increase in the probability of an accident from a small increase in driving. For doctors, p is the increase in the probability of an accident from treating another patient.

the price: b=m. Thus equation 1 reduces to the proposition that optimal damages for activity level equal the actual harm to a consumer: d*=h.

> P1. Assume an activity with no price externality (b=m) that exposes strangers (m=0) to the risk of accidental harm (ph>0). To provide incentives for socially efficient activity, a rule of strict liability (p=q) should impose liability equal to full harm (d*=h).

As another illustration of equation 1, we apply it to driving. Driving usually involves stranger accidents: m=0. Assume that courts should proceed as if price externalities are nil: *b=m*. Also assume that careful drivers escape liability for accidents half of the time: $\frac{p}{q} = \frac{2}{1}$. Under these assumptions, equation 1 implies that liability for drivers should equal twice the actual harm: *L*=2H*. This example can be generalized as follows:

> P2. Assume an activity with no external benefits (b=0) that exposes strangers (m=0) to the risk of accidental harm (*ph>0*). To provide incentives for socially efficient activity, a negligence rule (*p>q>0*) should impose liability exceeding full compensation (*d*>h*).

As a final illustration, apply equation 1 to doctors. Assume that the harm caused by side effects from removing a diseased appendix equal 1000, which occurs with probability .02, In these circumstances, assume the doctor's probability of liability equals . 01.   Finally, assume that the value to the patient of having a diseased appendix removed is 15 more than the doctor gets paid for the operation: b-m.   Under these assumptions, equation 1 implies that the doctor's optimal liability equals 500.[2]

> P3. Assume an activity with external benefits (b>m≥0) that exposes people to the risk of accidental harm (*ph>0*). To provide incentives for socially efficient activity, a negligence rule (*p>q>0*) should impose less liability than full compensation (*d*<h*).

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[2] By assumption, *H=1000, p=.02, q=.01, and a-m=15.* Thus equation 2 reduces to

$$L* = \frac{1}{q}(pH - a + m = \frac{1}{.01}(.02 \times 1000 - 15) = 500.$$

If, contrary to P3, the damages owed by a negligent doctor equals the patient's harm, doctors will be discouraged from engaging in their profession. They will, for example, retire too early or work too few hours.

III. Choosing Between Two Acts

The economic analysis of law usually distinguishes the level of activity and the care with which it is done. In this framework, a negligence rule assigns liability for deficient care and it does not assign liability for excessive activity. Our analysis so far has followed this approach. Sometimes, however, doing nothing is not an option. Instead of doing nothing, the alternative to one activity may be another activity.

Such situations often arise in medicine. To illustrate, a doctor may face a choice between delivering a baby by caesarian or natural birth. Not delivering a baby is not an option. Dichotomous choice does not quite fit the usual economic model. To see why, contrast delivering a baby to driving. A driver can decide to stop and cease imposing risk on others. The baseline for driving is not driving, which imposes no risk on others. The standard economic analysis implicitly assumed that the alternative to a small increase in the activity is doing nothing, which has no social benefits or costs. In the case of babies, however, doctors cannot stop delivering. The baseline for delivering a baby by one method is delivering the baby by another method.

In situations like delivering a baby, an actor may be held liable for choosing the wrong activity. For example, when natural birth injures the baby, the doctor may be held liable for not choosing caesarian delivery. On the other hand, when a mother suffers pain from the caesarian operation, or delivering babies in the future become more risky for her because of the caesarian operation, the doctor is very unlikely to be held liable for not choosing natural delivery. The doctor who delivers by caesarian can defend himself by saying that he exercised his professional judgment in the best interest of the mother and child. Proving the damages could also be an impossible mission. The asymmetry in probability of doctor's liability for the baby's injury and the mother pain causes too many caesarian deliveries.

We have explained the distortion caused by differences in the probability of liability for making the wrong choice. In medical procedures, a slightly different cause can produce the same result. Instead of liability for choosing the wrong activity, the actor

may be found negligent in carrying out the chosen activity. For example, a lapse by the doctor in delivering by natural birth may be easier for the court to detect than a lapse in performing a caesarian. When the probability of detecting a lapse is higher in one activity than another, the result is often defensive medicine.

When differences in the probability of liability distort dichotomous choices, an adjustment in damages can correct the distortion. In Part II we explained how to adjust damages by applying the internalization principle found in equation 1. Instead of internalizing social values, another approach is easier to apply when an actor must choose between two acts. The alternative approach, which we now explain, gives the right incentives to the actor to choose between the two activities.

Externality Equalization

An alternative to the "internalization principle" is what we call the "externality equalization principle." To explain the externality equalization principle, we begin with a numerical example.

> **Example 1: No Externality**.
> A doctor must choose between delivering a baby by natural birth or C-section. The two procedures are equally burdensome for the doctor. For natural birth, the expected harm to baby and mother sum to 20 and the expected benefit equals 100. For C-section, the expected harm is 30 and the expected benefit is 100. The doctor recognizes that natural birth is better than C-section for the patient and child by 10. If the doctor is paid for all 100 of the benefit that he creates, and if the doctor bears liability for any harm that materializes (20 and 30 respectively), he internalizes both risks and benefits and will decide for a natural birth delivery.

In Example 1, liability and prices work together to internalize values. Now consider this modification of Example 1 where liability law does not internalize risk and prices do not correct the problem of liability law.

> **Example 1': Externalized Risk.**
> The same facts about burdens, benefits, and risks apply as in Example 1, except for the facts about doctor's liability. In Example 1, the doctor pays 100% of the time for the harm that materializes. In Example 1', the doctor pays 100% of the time for the harm that materializes from natural birth, and the doctor pays 50% of the time for the harm that materializes from C-section. Thus doctor's expected liability from C-section equals 15, and doctor's expected liability from natural birth equals 20. Doctor,

consequently, prefers C-section even though natural birth is better for patients.

To correct the distortion in Example 1', courts could apply the internalization principle and increase doctor's liability for C-section to 200% of the actual harm. The increase in damages from 100% to 200% exactly offsets the decrease in probability of liability from 100% to 50%. Increasing liability for C-sections may encourage doctors to take too high precautions after they chose C-section, in order to avoid liability for lapses or courts' errors. We discuss this issue later.

Alternatively, courts could correct the distortion in Example 1' by applying the externality equalization principle, whose aim is to achieve the *same* magnitude of externality for both procedures. Instead of eliminating externalities, the aim is to equalize them. In Example 1', the court faces the problem that the probability of liability for harm caused by C-section has fallen from 100% to 50%. To achieve the same magnitude of liability externality for natural birth, the court could reduce damages for harms caused by natural birth from 100% to 25% of the harm (expected liability 5, externality of 15) and at the same time impose liability of 100% of the harm for C sections (expected liability 15, externality of 15). After this change in damages, the doctor's incentives are socially efficient. Specifically, the doctor prefers natural birth with expected liability of 5, rather than C-section with expected liability of 15.

In Example 1', liability law externalizes values. Now consider a case where the market price externalizes value.

Example 1": Externalized Benefits.
A doctor must choose between delivering a baby by natural birth or C-section. The two procedures are equally burdensome for the doctor. For both procedures, the expected harm to baby and mother sum to 20, and doctor is liable for any harm that materializes. The doctor is paid 90 for C-section and it creates benefits of 90 for patients. The doctor is also paid 90 for natural birth and it creates benefits of 100 for patients. Thus the doctor is indifferent between the two procedures, although the social benefits of natural birth are higher by 10.

To correct the distortion in Example 1", courts could apply the internalization principle and decrease doctor's expected liability for natural birth by 10. That would happen if courts impose liability for natural birth at a level of 50% (resulting in a

decrease in the expected liability from 20 to 10). The decrease in doctor's expected liability for natural birth by 10 offsets the price externality of 10. Consequently, doctor internalizes the social value of the two procedures and prefers the one with higher social value. Specifically, he prefers natural birth because it saves 10 in liability costs. Alternatively, instead of eliminating the externality, courts could correct the distortion by applying the externality equalization principle. To equalize the externality, courts can increase doctor's expected liability for C-section by 10. That would happen if courts impose liability for C-section at a level of 150% (resulting in an increase in the expected liability from 20 to 30). After this increase, doctor externalizes the same amount of social value for the two procedures, so he prefers the one with higher social value. Specifically, he prefers in this example natural birth because it saves 10 in liability costs.

Now we will formalize the externality equalization principle. We modify our notation to fit circumstances where the only alternative to an act is another act. Assume that the actor must choose between two activities with different externalities:

$$E_1 = q_1 d_1 - p_1 h_1 + b_1 - m_1$$
$$E_2 = q_2 d_2 - p_2 h_2 + b_2 - m_2$$

$$\underset{\substack{\textit{liability} \\ \textit{externality}}}{} \quad \underset{\substack{\textit{price} \\ \textit{externality}}}{}$$

One way to provide socially efficient incentives is to apply equation 1 to each activity and eliminate the externality. Another way is to equalize the externality: $E_1 = E_2$. Rearranging the terms in this equation gives this formula for externality equalization:

$$\underset{\textit{liability}}{q_1 d_1 - q_2 d_2} = \underset{\textit{externality}}{[m_1 - (b_1 - p_1 h_1)]} - \underset{\textit{externality}}{[m_2 - (b_2 - p_2 h_2)]}$$

The left side of the equation indicates the difference in expected liability for the two acts. The right side of the equation indicates the difference in externality for the two acts. Thus the equation means that equalizing externalities for two acts requires equating their difference in expected liability and the difference in externality. The preceding examples are applications of this formula.

Consider the difference in information required to apply the internalization principle in equation (2) and the externality equalization principle in equation (3). To apply the internalization principle to two acts, the courts must know the absolute value of the externality for each of them. To apply the externality equalization principle to two acts, the court must know the difference in externality between them. Since the later requires less information, it is easier to apply. To illustrate, if the courts know the probability and extent of doctor's liability when C-section harms a patient, and if courts also know the probability and extent of doctor's liability when natural birth causes the same harm to a patient, then courts have enough information to apply the externality equalization principle. To apply the internalization principle, in contrast, the courts also need to know the true extent of the social harm from an accident.

We have used Examples 1, 1', and 1" to explain the difference between internalizing and equalizing externalities. When social costs are internalized, actor has efficient incentives to choose between alternative activities. A person also has efficient incentives to decide whether or not to become an actor who faces such alternatives. For example, internalizing externalities for obstetricians who deliver babies give doctors efficient incentives to choose between obstetrics and other medical specialties.

In this respect, internalization differs from equalization. When social costs of two alternatives are equalized, actors have efficient incentives to choose between them. When social costs are equalized but not internalized, however, a person does not have efficient incentives to become an actor who faces this alternative. For example, if liability externalities are equal and positive for natural birth and C-section, an obstetrician has socially efficient incentives to choose between the two procedures, but a doctor has socially insufficient incentives to specialize in obstetrics. Moreover, increasing or decreasing liability for negligence within an activity may give insufficient incentives for precautions. For example, doctors who are liable for 50% of damages for natural birth would tend to take too little precautions after they chose natural birth.

In the next section we propose a way to ameliorate those problems for activities like doctoring with positive externalities. While externality equalization results in damages that give incentives to make the socially efficient choice of activities, lower damages will also produce this result. Lower damages have the advantage of encouraging

more people to become actors who make the choice in question, such as obstetricians. Moreover, lower damages would not necessarily result in taking too little precautions.

The next section concerns the lowest level of damages that still gives the actor incentives to make the right choices.

IV. Disgorgement Damages for Accidents

A. Introducing the Disgorgement Damages for Accidents Rule

Under the prevailing rule of negligence the injurer is liable for the full harm that he negligently causes. This is "the Compensatory Damages Rule." Compensatory damages give the injurer an incentive to take precautions that cost him less than the expected harm he reduces by taking them.

However, a lower liability could also provide efficient incentives to the injurer. To illustrate, assume that by taking precautions that cost 17 the injurer could eliminate the expected harm of 20, but nevertheless the injurer took no precautions. Assume also that the expected harm is the product of the harm of 200 multiplied by 1/10 which is the probability of the infliction of that harm by the negligent injurer. Under the Compensatory Damages Rule the injurer will take the precautions that cost him 17, in order to avoid the expected harm of 20. But liability measured by the precautions, and not by the harm, could be enough for providing efficient incentives to the injurer. Thus, if the injurer faced liability of 170 (or 171) (instead of 200) he would take precautions of 17 and eliminate the expected harm of 20. We call this rule "the Precautionary Damages Rule", but we do not discuss it in this paper.

Occasionally, liability of less than 170 will be enough. To illustrate, assume that in our example the injurer actually took precautions that cost 15 instead of precautions that cost 17. Assume first that by taking precautions that cost 15 the injurer did not reduce the expected harm at all (The Binary Precaution Case). Liability of 20 (or 21) (instead of 200) is sufficient for providing the injurer with efficient incentives in this case. Since this liability rule is aimed at creating an *ex ante* threat on the injurer in the magnitude of the costs of precautions he saved by not taking adequate precautions, we call this rule "the Disgorgement Damages for Accidents Rule" ("DDA").

The DDA is applicable not only to binary precautions cases but also to continuous precautions cases. To illustrate, assume now that by taking precautions of 15 the injurer reduced the expected harm from 20 to 4. In particular, assume that after taking precautions that cost 15, the harm is still 200, but the probability of inflicting it is reduced from 1/10 to 1/50. Under the Compensatory Damages Rule if the harm is inflicted the injurer will be liable for 200, what makes his expected liability after he takes precautions of 15, to be 4. In contrast, under the DDA liability will amount to 100 (or 101) only. Under this rule the injurer, after taking precautions of 15, faces expected liability of 2 (or a bit more) and this is sufficient for providing him with efficient incentives to take precautions of 17 instead of 15.

In order to apply the DDA the court should divide the precautions the injurer saved by not meeting the standard of care by the probability of inflicting the harm by the injurer. To illustrate, if the injurer took precautions that cost 15 instead of precautions that cost 17, and if after taking those precautions the probability of harm is 1/10, under the DDA liability should amount to 20.

B. The DDA in Context

The law of restitution allows the disgorgement of ill-gotten profits. Disgorgement of profits is a desirable rule for a plaintiff because sometimes the plaintiff can get higher amount of damages under the disgorgement rule than under the compensatory damages rule, and when this is not the case he can always choose to recover under the compensatory rule. Thus it adds a remedy, not substitute one for another.

Disgorgement is a better remedy than compensatory damages if the goal of the law is deterrence. In order to deter the defendant from committing a wrong the law should deprive him of all the profits he makes out of his wrongdoing. Imposing liability for the harm would not always deter the wrongdoer. Firstly, sometimes damage is hard to prove or detect while proving or detecting the amount of profits is easier; secondly, sometimes profits are higher than damages, so the injurer who is required to fully compensate the plaintiff will still find it profitable to commit the wrong.

If the goal of the law is efficiency, or *optimal* -- rather than *full* -- deterrence, disgorgement is considered to be inefficient because efficiency requires internalization of harms, which motivates the creation of risks, their benefits are higher than their costs. Still, even if the goal of the law is efficiency, when harms are hard to proof or detect, disgorgement could be a superior remedy to compensatory damages.

The DDA that we propose in this article differs in three important respects from the prevailing disgorgement rule applied by courts.

First, the prevailing disgorgement rule applies to cases of intentional harms and the like, but not to accidental harms. The rule we propose applied also to accidental harms. For example if A uses the property of B without B's consent, the court could award B the profits A reaped from the misuse. But if instead A saved money when he refrained from replacing the old brakes of his car, and consequently hit B, these savings will not be awarded to A. The main reason for this is that in accidental harm cases, no plaintiff will sue for disgorgement instead of compensatory damages, because the savings would typically be very low comparing to the harm suffered (and recovery for both profits and harms amounts to double recovery which courts would not allow). Another reason is that in accidental harm cases a plaintiff who sues for disgorgement encounters a doctrinal (or conceptual) difficulty: in order to succeed in a disgorgement suit the plaintiff is required to convince the court that the profits or savings he sues for were made by the defendant *at the plaintiff's expense*. In the misuse of property case B would encounter no significant difficulties in showing that A's profits were made at his expense, while in the car's brakes example showing that would be much more problematic. In particular, the savings – so the argument goes – were not made only at the plaintiff's expense, but at the expense of all potential victims who were exposed to the risk of being hit by A due to his failure to replace his old brakes. Therefore, the plaintiff is entitled if at all only to the relative savings made at his expense. Examining the extent to which this last argument is convincing or not is beyond the scope of this Article. But it certainly could be a reason why we don't find accidental harms cases where courts award disgorgement of profits.

The second difference between the DDA and the disgorgement rule applied by courts is that the DDA is an ex ante disgorgement rule while the prevailing rule is an ex post one. Thus, the prevailing disgorgement rule extracts the profits the defendant actually made. If in the example of the misuse of the property, the profits A made out of the misuse are $100, that would also be the amount of damages the court would award to B under the prevailing disgorgement rule. In contrast, under DDA, if replacing brakes cost $100, the court should award damages at the amount of $100 divided by the probability of inflicting harm because of the failure to replace brakes. Thus, if that probability is, say, .001, the court should award under DDA damages at the amount of $100,000. Under DDA A's profits from not replacing his brakes are forfeited *ex ante*: even though A gains only $100 dollars from his failure to replace the brakes he pays much more than the profits he actually made out of his failure.

The third difference between the DDA and the one applied by courts relates to the identity of the party who has the power to choose between compensation and disgorgement. Under the prevailing rule it is the plaintiff, not the defendant, who has the power to choose between compensatory damages and disgorgement. Obviously the plaintiff will always choose the higher measure between the two. To illustrate, if in the misuse of property case the profits of A are $50 and the proven harm of B is $100, the plaintiff will sue for the harm he suffered and be awarded $100. In contrast, under DDA, the defendant has the power to choose between compensation and disgorgement: by proving his savings from not taking precautions as well as the probability of inflicting harm because of that failure, he could escape the compensatory damages rule, and pay a lower amount of damages. To illustrate, if in the failure to replace brakes case A proves that his savings were $100 and the probability of the harm is .001, and if the harm actually inflicted on B is $1M, under our rule liability would be $100,000 and not $1M.

To summarize, the DDA that we propose applies to accidents, it appropriates the profits of the wrongdoer from an *ex ante* perspective, and it is evoked by defendants in order to reduce their liability. Thus, our rule efficiently deters wrongdoing, albeit the wrongdoer does not internalize the entire costs of the harm that he caused. This rule is

especially attractive from an efficiency perspective, when the activity that generates the harm creates positive externalities.

C. Applying the DDA and the Information Problem

In order to implement the DDA courts need information about:

a. the precautions that the injurer should have taken ("optimal precautions");

b. the precautions that the injurer actually took ("actual precautions"); and

c. the probability of inflicting harm due to the failure to take the optimal precautions.

This information is different from the information needed to implement the compensatory damages rule. Under the compensatory damages rule courts need to know *accurately* only the magnitude of the harm and also whether that harm is causally related to the negligent behavior. True, in order to determine whether the injurer was negligent – a determination which is a precondition to imposing liability under a negligence rule – courts need information also about optimal precautions, actual precautions as well as about the expected damages. But they don't need *accurate* information about those three factors -- or accurate figures -- since they just need to know whether by taking more precautions than those actually taken the injurer could have reduced the expected damages by more or less than the costs of taking those additional precautions.

Could courts acquire accurate information about optimal precautions, actual precautions and the probability of the harm? One way to trigger supplying information to courts with respect to these three factors is by shifting the burden of proof to the defendant, as we propose. Thus, the default rule could be the compensatory damages rule (or the precautionary damages rule), that applies as long as the defendant does not provide sufficient information for applying the DDA. In particular, after the court determines that the defendant negligently caused the litigated harm, it will impose liability for the entire harm (or precautionary damages), unless the defendant shows that he took some precautions, at a magnitude that he can prove in a satisfactory manner, as well as the probability of inflicting harm given the fact that those precautions were not taken. Shifting the burden of proof is justified because typically the defendant has better information with respect to the precaution actually taken, than the court or the plaintiff.

The following example illustrates how the DDA could work in the real world, in a medical malpractice suit.

Example 2. The CT Case.   Patient arrives into the hospital with a severe headache. Doctor examines him and decides on a certain medical procedure that costs 15. Optimally, Doctor should administer a CT exam that costs 17. Eventually, Patient is diagnosed with a tumor in his brain, which cannot be recovered. Had the CT exam be taken on time, the harm would have been prevented. Patient suffers harm of 200. The probability of misdiagnosis of tumors to people coming to hospital with severe headaches with no procedures taken is 1/10. Taking the procedure actually taken by Doctor reduces the probability of misdiagnosis to 1/50. CT exam reduces the probability of misdiagnosis to zero.

Since Doctor was negligent he should compensate patient. Under the DDA Doctor can prove that his negligent is manifested in a savings of 2. Since the probability of harm, when Doctors saves 2 (by taking the cheap procedure instead of the more expensive CT exam) is 1/50, court should impose on Doctor liability of 100.

D. The DDA and Choosing Between Two Acts

To understand the application of the DDA to the "Choosing Between Two Acts" situations, return to our numerical examples from the previous section. Recall that in Examples 1, 1', and 1", social net benefits are higher for delivery by natural birth rather than C-section.   Assume, however, that the doctor in Example 1' chose the wrong procedure and delivered a baby by C-section, and the baby was harmed. Consider the savings in cost that the doctor expected by choosing the wrong procedure. According to Example 1', the doctor who performs C-section expects to pay damages in 50% of the cases of harm. If damages equal 100% of the harm, then doctor's expected liability from C-section equals 15 (while expected harm is 30). In contrast, the doctor who delivers by natural birth expects to pay damages in 100% of the cases of harm, and his expected liability equals 20. Thus the doctor expects to gain 5 from performing the wrong procedure (20 minus 15). Thus expected liability of 5 from C-section would cause doctor to disgorge the expected gain from choosing the wrong procedure. To have *expected* liability of 5, the actual damages in case of liability from C-section should be 33% of the harm (expected liability of 5, instead of 15). Under the DDA as applicable to Example 1'

the doctor gains nothing from choosing C-section, and he is indifferent between the two procedures: his self interest in choosing C-section is neutralized by the DDA.

As the parallel of internalization is equalization of externalities, the DDA also has a parallel: instead of disgorging the actor's benefit from choosing the act which is better for him, keep always the difference between the expected liabilities of the two acts, at the magnitude of the savings of the actor from choosing the act that is less costly to him. To illustrate, keep the difference in expected liabilities in Example 1' as 5 (Disgorgement II").

The following table summarizes the differences between the 4 liability rules, applying to Example 1': Internalization; equalization; DDA ("Disgorgement I"); Disgorgement II.

Example 1'

	Expected Damages	Expected Liability (full compensation)	Internaliza-tion	Equalizat-ion	Disgorgement I	Disgorgement II
Natural Birth	20	20	20	X	0	Y
C-section	30	15	30	X+10	5	Y+5

We turn now to Example 1''. Recall that in Example 1", the doctor is indifferent between natural birth and C-section because he gets paid the same for either one, even though the patient expects to benefit more by 10 from natural delivery than C-section. If the doctor chooses the wrong procedure and delivers the baby by C-section, then the externality equalization principle requires expected liability to be higher by 10 for the same injury caused by C-section rather than natural delivery. In contrast, the DDA requires the doctor who chose the wrong procedure to pay damages of 0. The doctor

should pay damages of 0 because he did not expect to gain anything from the choice that he made in Example 1". (His mistake in choosing the wrong procedure was obviously not motivated by self-interest.) To make the doctor prefer natural birth in Example 1," the court can increase damages by any small amount, say 1, for the wrong act, or decrease damages by any small amount for the right act.

The contrast between externality equalization and DDA in Example 1' and 1" illustrates a general principle: externality equalization damages are at least as great as disgorgement damages. The reason for this fact is that disgorgement damages make the actor indifferent between doing the optimal act and the wrong act, whereas external equalizing damages make the actor prefer the optimal act instead of the wrong act.

We formulate the disgorgement principle in our notation. Assume that the actor took the primary act and he ought to have taken the alternative act. Disgorgement damages L_{dg} equate the actor's expected net benefit from the two acts:

$$\underset{primary\ act}{(b+m-qL_{dg})} \ = \ \underset{alternative\ act}{(b_o+m_o-q_oL_o)} \tag{4}.$$

By using equations (3) and (4) it is straightforward to prove that externality-equalizing damages are at least as large as disgorgement damages: $L_{ee} \geq L_{dg}$.[3]

As we have shown, disgorgement damages are the minimum damages sufficient to make self-interested actors choose the optimal activity. Consequently, disgorgement damages are desirable for activities like doctoring with positive externalities. Choosing disgorgement damages protects patients from abuse and also gives an incentive to people to become doctors like obstetricians who risk liability. For activities with positive externalities, disgorgement damages are best because they provide socially efficient incentives for choice of activity and also the strongest incentives to participate in the activity. Moreover, as we have showed above, both measures would typically produce efficient incentives for actors to take the appropriate level of precautions.

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[3] Equation (3) defines externality equalizing damages. Equation (4) defines disgorgement damages. Add these two equation together and rearrange terms to obtain this equation:
$$qL_{ee} - qL_{dg} = (b_o + a_o - p_oL_o) - (b + a - pL).$$
The right hand side of this equation is the difference in net social benefits of the two acts. By assumption, the net social benefit of the alternative action exceeds the net social benefit of the primary action, so the right side of this equation is non-negative, which implies that $L_{ee} > L_{dg}$.