ON THE SUPERIORITY OF LIABILITY RULES IN ENVIRONMENTAL LITIGATION

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ABSTRACT

A variety of contemporary external cost situations are characterized by the small number of affected parties involved. In resolving externality situations characterized by small numbers, much of the theoretical literature has addressed the relative merits of the collective authority using a property rule or imposing liability rules. While the consensus of previous analysis is that a clear-cut case for one approach or the other cannot be made, it is argued here that under plausible assumptions, liability rules will generally be superior on both efficiency and equity grounds.

INTRODUCTION

In a wide variety of externality situations, the number of individuals involved on both sides of the issue is small. Moreover, even when the number of individuals is large, resolution of the external cost situation may proceed as a small numbers case when affected parties select representatives to bargain on their behalf (e.g., neighborhood associations or class action law suits).

From society's point of view, the resolution of small numbers externality situations should consider both the allocative efficiency and distributive equity implications of proposed outcomes. That is, limited resources should be allocated in such a way as to maximize the net benefits generated by their use while care is taken that the incidence of these benefits and costs are distributed "fairly" among affected parties.

Much of the externality literature has addressed the relative merits of alternative control strategies. In particular, the theoretical discussion has

focused on the comparative desirability of *property rules* and *liability rules* in effectively internalizing external costs. Property rules give each party the right to block any deviation from the entitlement point without that party's consent, where the entitlement point specifies the initial distribution of property rights or the point from which bargaining will proceed. Liability rules assign to each party the right to compensation for any damages suffered as a result of the other party's movement away from the entitlement point. The compensation to be paid under a liability rule is determined by the courts.

Whether one rule is preferable to the other depends on the circumstances inherent in a particular externality situation and the goals of the courts. Coase [1], Turvey [2], and others [3–6], have demonstrated that when:

1. few parties are involved;
2. the technology of the externality is known;
3. transactions costs are low; and
4. property rights have been assigned;

either behavioral rule will result in the efficient level of activity. Thus, under these conditions, the choice between imposing a liability rule on the generator of external costs or allowing affected parties to negotiate an outcome to their mutual advantage is an equity consideration only since efficiency goals are served either way. Coase has argued that bargaining (i.e., use of a property rule) may frequently be preferrable with redistribution occurring, if necessary, through lump sum payments.

Unfortunately, once more realistic assumptions are added to the analysis, the choice between property and liability rules is no longer a matter of indifference on either efficiency or equity grounds. Polinsky has recently argued that lump sum transfers are frequently not a viable redistributive tool and that if parties bargain strategically[1] and the courts have preferences regarding the distribution of income between the parties, "the range of outcomes in which a liability rule is unambiguously preferable to a property rule may be arbitrarily small." [7, p. 235]

It is argued here that under the assumptions of Polinsky's analysis (small numbers case, perfect knowledge, strategic bargaining, and no lump sum transfers) the courts will generally prefer a well-specified liability rule since this enables the authority to limit the range of outcomes associated with the bargaining process. This additional characteristic of liability rules allows the courts to raise the level of social welfare associated with the worst possible outcome and increase the probability of attaining a bargaining agreement near

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[1] Strategic bargaining or behavior refers to each party's tendency to underestimate the other party's willingness to agree to its position. That is, the two parties may fail to bargain to the efficient level of output because one of the parties (a) tires of the process or (b) halts the bargaining due to wrongfully assuming the other party has little to gain by proceeding further. Thus, strategic behavior implies that transactions are not costless.

the first-best solution. In particular, it is shown that only when the courts place no value on either of these attributes will the choice between liability rules and property rules be a matter of indifference. Thus, in the vast majority of cases, the critical decision to be made by the collective authority involves a choice among alternative liability rules, not a choice between liability rules and property rules.

POLINSKY'S MODEL

Assume an externality situation involving two firms, an active injurer and a passive victim, where:

(a) q = output of the injurer

(b) $\pi(q)$ = total profits of the injurer

(c) q_m = output at which the injurers profits are maximized

(d) q^* = output at which joint profits are maximized (the efficient level)

(e) $\dfrac{\partial [\pi(q)]}{\partial q} > 0$ and $\dfrac{\partial^2 [\pi(q)]}{\partial q^2} < 0$

(f) $\delta(q)$ = total damages to the victim

(g) $\dfrac{\partial [\delta(q)]}{\partial q} > 0$ and $\dfrac{\partial^2 [\delta(q)]}{\partial q^2} > 0$

(h) $\bar{\pi}$ = fixed profits of the victim before damages

(i) $\bar{\pi} - \delta(q)$ = victims profits for every level of injurers output (q).

An example of the above externality situation is illustrated in Figures 1 and 2. As the injurer increases output from q_z to q_m, profits from this activity rise as given by the area under the marginal profit curve in Figure 1. Simultaneously, this increase in output causes damages to be incurred by the victim as profits fall from $\bar{\pi}$ by the amount given by the area under the marginal damage curve. Net benefits or joint profits are maximized at an output level of q^* where the injurer's marginal profit exactly offsets the victim's marginal damage. Thus, efficiency goals are served when the level of the injurer's output is moved closer to q^*.

Distributive considerations inherent in this externality situation are illustrated in Figure 2. The profit frontier illustrates alternative combinations of injurer and victim profits achievable as the output of the injurer is varied from q_z to q_m. Note that there exists a one-to-one relationship between the level of the injurer's output in Figure 1 and points on the profit frontier of Figure 2. The sum of profits is maximized at a level of injurer output q^* corresponding to f^* on the profit frontier. This sum can be divided between the injurer and victim in a variety of ways. The transfer line shows all possible divisions of these profits.
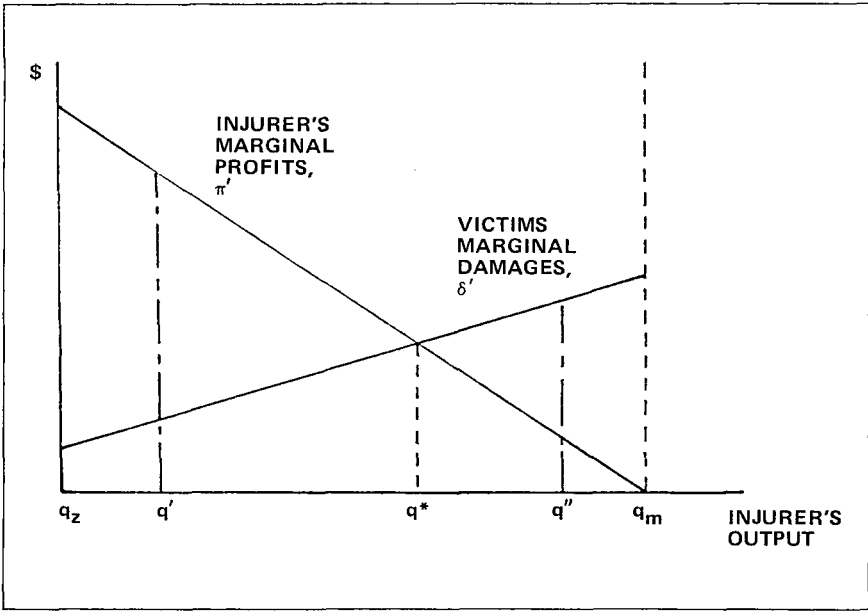
Figure 1.

In a Coasian world, q* would be realized through bargaining and then any distribution of profit on the transfer line could be achieved through lump-sum transfers. However, should lump-sum transfers not be within the jurisdiction of the courts, and should the parties bargain strategically, the choice of the liability or property rule will depend on the technology of the externality (shape of the profit frontier) and the courts distributional preferences (location of the first-best solution on the transfer line).

Attainable First-Best Solution

If the first-best solution is on or between t_z and t_m of the transfer line (Figure 2), a liability rule in which the injurer's marginal liability equals the victim's actual marginal damages is preferred to the property rule. Every point on the $t_z f*$ segment can be attained by selecting an entitlement point between q_z and q* and requiring the injurer to pay the marginal damages to the sufferer. Similarly, every point on the $t_m f*$ segment can be achieved by selecting an entitlement point between q* and q_m and letting the victim select the injurer's output level then compensating the injurer for profits lost due to a movement away from that entitlement point (the "reverse liability rule"). For example, assume entitlement point q' (Figure 1) was selected by the courts. The injurer's and victim's profits which are realized at q' correspond to a point f' on the profit frontier. Under a marginal liability equals marginal damages liability rule, a
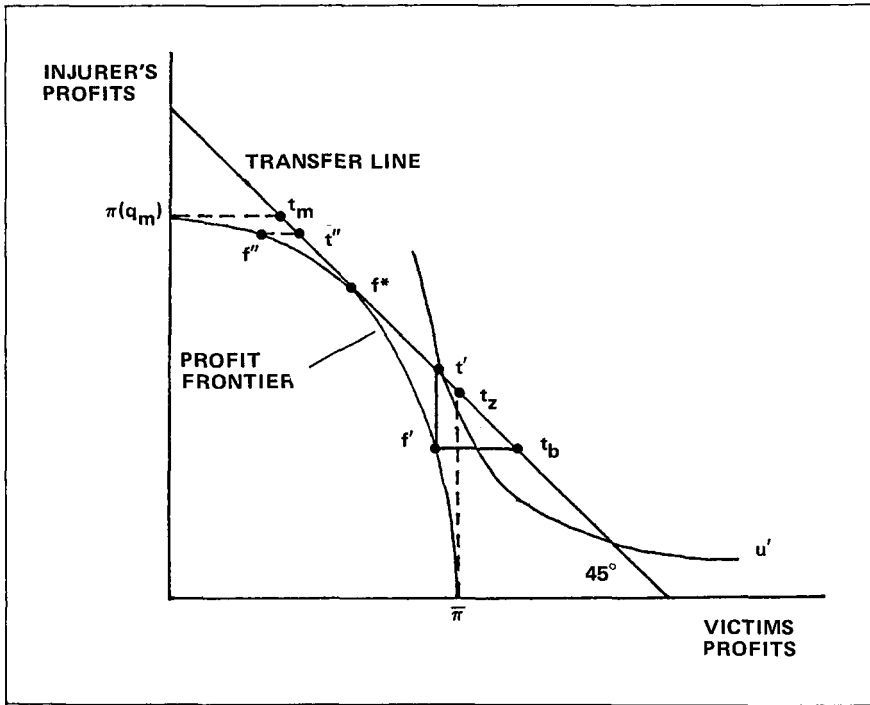
Figure 2.

profit-maximizing injurer would be induced to produce at q*. All the gains (i.e., the difference between marginal profit and marginal damage) from the injurers change in production (q' to q*) would go to the injurer and profit allocation t' on the transfer line would be realized. Similarly, the entitlement point q'' (and the reverse liability rule) would result in an initial profit distribution of f'' and an after-compensation distribution of t''.

Every profit combination on the transfer line between t_z and t_m could conceivably be attained using an undercompensation liability rule (marginal liability less than marginal damages), an overcompensation liability rule (marginal liability greater than marginal damages but less than marginal profits) or the property rule. However, because of the strategic bargaining inherent in the overcompensation and property rules, the probability of bargaining to any specific first-best solution along $t_m t_z$ is very low. Therefore, the over-compensation liability and property rules realistically cannot be expected to attain a first-best solution on the $t_z t_m$ segment of the transfer line. Because of equity considerations, the courts are unlikely to adopt an undercompensation liability rule when the same first-best solution can be achieved with a compensation equals damages ruling.

Nonattainable First-Best Solutions

If the first-best solution is on the transfer line outside of the $t_z t_m$ segment, Polinsky argues that the property rule may be preferred to a marginal liability-equals-marginal damages rule if the parties bargaining skills are not too unequal and if they do not bargain too strategically. For example, assume the entitlement point is q' and the corresponding point on the profit frontier is f' (Figures 1 and 2). Should the courts adopt a liability rule with the liability equal to actual damages, profit distribution t' and social welfare level U' would result (Figure 2). However, using the property rule, the potential outcomes of the bargaining process would be $f't't_b$ (all pareto superior moves from f'). If the bargaining process were amicable, $q*$ in Figure 1 would be attained and the final distribution of profits would be somewhere on the transfer line segment $t't_b$. The exact location, of course, would depend on how the gains from trade were divided. Alternatively, strategic behavior would result in a final solution in the interior of triangle $f't't_b$, yet all potential solutions in $f't't_b$ above U' are preferred to the outcome (t') achieved by the marginal liability-equals-marginal damages rule.

In summary, the choice between the property rule and liability rule depends on the location of the distributional preferences of the courts and the technology of the externality. The liability rule will dominate the property rule if the first-best solution is on the $t_z t_m$ segment of the transfer line. However, the length of this segment may be very short or long depending on the technology of the externality. The remaining outcomes on the transfer lines not attainable by any liability rule are defined by the sets of potential property rule outcomes when the entitlement points are zero output (q_z) and profit-maximizing output (q_m) for the injurer. Therefore, Polinsky concludes that, "When the first-best solution is not attainable, there is not a general case for liability rules or property rules." [7, p. 243] In the following two sections it is demonstrated that a "limited" liability rule (the injurer liable for damages over a limited range of output) is generally preferred to any property rule if the objective of the court is to increase the probability of attaining an agreement near the first-best solution.

ALTERNATIVE POLICIES FOR THE COURTS: CASE OF UNKNOWN BARGAINING SKILLS

Consider a small numbers externality situation where:

1. the parties bargain strategically;
2. the collective authority has complete information about the technology of the externality;
3. lump-sum transfers are not available to redistribute income between the parties;

4. nothing is known of the two parties' bargaining skills (all potential solutions are equally likely); and

5. the first-best solution does not lie on the portion of the transfer line achievable by a liability rule.

Under these circumstances, the collective authority has five principal policy alternatives to consider. Each of these alternatives are illustrated in Figures 3 and 4.

Policy 1: Set Marginal Liability Equal to Marginal Damage and Let q_z be the Entitlement Point (ML = MD)

Under this liability rule, the injurer would increase production from q_z to q^* and the victim would be exactly compensated for the resulting damage. The entire "gains from trade" would accrue to the injurer while the victim's profits would remain unchanged. This corresponds to point t_z on the transfer line, resulting in a level of social welfare associated with indifference curve U_0.

Policy 2: Establish a Property Rule with Entitlement Point q_z (PR)

This property rule policy establishes a feasible set of outcomes given by $t_z f_z t_b$. Assuming a uniform probability distribution for outcomes in this space[2] the collective authority has a probability of exceeding the welfare outcome of Policy 1 (ML = MD) equal to the ratio of the area bounded by $t_z t_a$ on the transfer line and the U_0 indifference curve to the area $t_z f_z t_b$. The actual outcome will depend on how strategically the parties bargain and how the gains from trade are divided, and will result in a level of social welfare between that associated with the first-best solution (say U^*) and the level associated with f_z (say U_2).

Policy 3: Set Marginal Liability Greater than Marginal Damage and Let q_z be the Entitlement Point (ML > MD)

Setting the marginal liability schedule above the marginal damage schedule reduces the feasible set of outcomes. For example, setting marginal liability equal to L' in Figure 3 would result in reducing the set of feasible outcomes to the points above L' in triangle $t_z f_z t_b$ of Figure 4. By reducing the feasible set to $t_z f_z t_a$, this liability rule increases the probability of exceeding U_0, the welfare level achieved by Policy 1 (ML = MD), compared to the probability of exceeding U_0 associated with Policy 2 (PR). However, the level of welfare associated with the actual outcome realized in $t_z f_z t_a$ may still vary from U_2 to U^*. In this respect, it is certainly true that a general case cannot be made for the superiority

[2] Since bargaining skills and the extent of strategic behavior are unknown, all outcomes in the feasible set will be considered equally likely (i.e., uniform probability distribution).
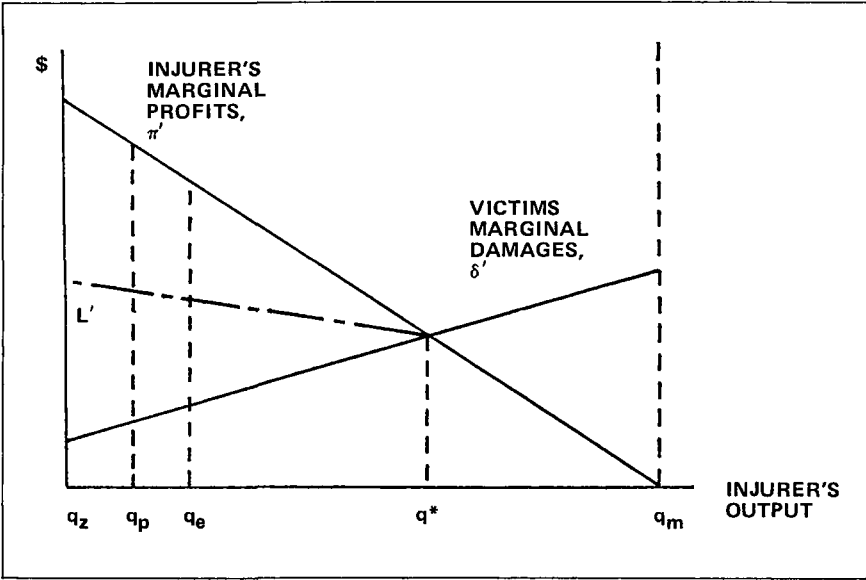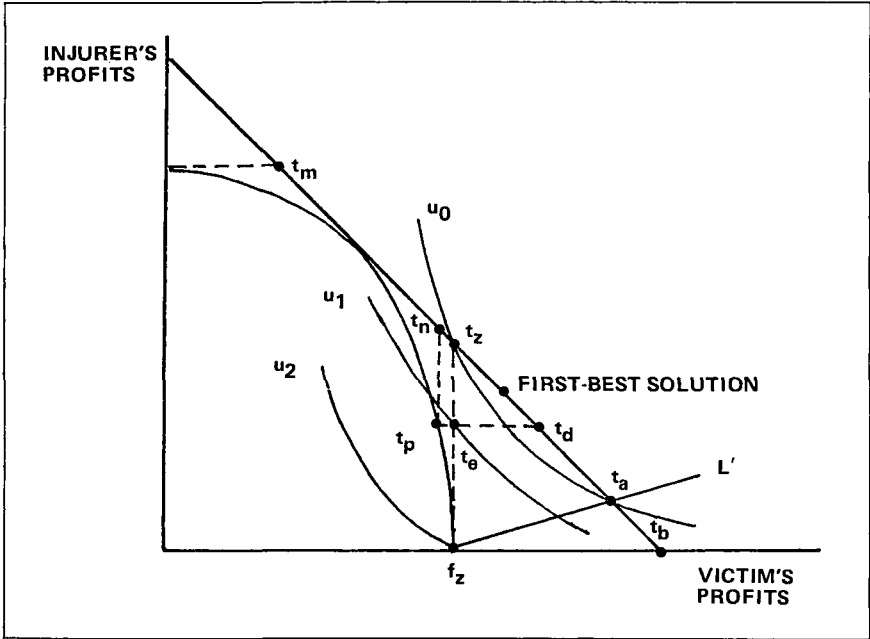
Figure 3.

Figure 4.

of these types of liability rules over property rules. As a practical matter, however, the collective authority may well prefer Policy 3 to Policy 2 since the probability of exceeding U_0 is greater even though the range of possible welfare level outcomes has not been narrowed. As noted by Polinsky, imposition of this type of liability has the potentially desirable characteristics of restricting the scope for bargaining and reversing the roles of the parties with respect to threats.

Policy 4: Establish a Property Rule with Entitlement Point q_p (PR')

An intermediate entitlement point such as q_p reduces the set of attainable outcomes to the triangle $t_n t_p t_d$. By selecting an interior entitlement point, the probability of exceeding utility level U_0 is increased and the level of social welfare associated with the "worst case" is raised. Moreover, by starting the bargaining process at an entitlement point closer to q^*, the courts have improved the parties' chances of bargaining to an output nearer q^* before cooperation is halted by strategic behavior. The principal disadvantage with Policy 4 is that the victim may actually be made worse off. Under Policies 1, 2, and 3 (ML = MD, PR, and ML > MD, respectively), the victim's profit can never fall below f_z.

Policy 5: Set the Marginal Liability Equal to Marginal Damage for Level of Injurer's Output between q_z and Entitlement Point q_e; the Property Rule Guides Negotiations for Any Movement Beyond q_e ("Limited" Liability Rule — LL)

Under this "limited" rule, the injurer would increase production from q_z to q_e and reimburse the victim for damages incurred. This has the effect of moving the entitlement point from f_z to t_e in Figure 4. The feasible set of profit combinations remaining for moving production between q_e and q^* consists of points in area $t_z t_e t_d$.

The exact outcome obtained in this set will depend again on how strategically the parties bargain and also on how successful the injurer is in extorting excess compensation from the victim. The result of imposing this limited liability rule is to further increase the probability of obtaining a welfare level outcome greater than U_0, compared to either Policy 2, 3, or 4. Moreover, the range of welfare outcomes has been narrowed to at worst U_1 and at best U^*. That is, by adopting this liability rule, the collective authority has been guaranteed a level of social welfare U_1 and has increased the probability of exceeding U_0, the level guaranteed by Policy 1.

A comparison of Policy 2 (PR) and Policy 5 (LL) reveals that the first is just a special case of the latter. Use of a limited liability schedule allows the entitlement point to be changed from f_z to any point on line segment $f_z t_z$. As this point varies from f_z to t_z, the welfare level associated with the worst possible outcome increases from U_2 to U_0, and the probability of achieving an outcome

superior to that which results from Policy 1 (ML = MD) also rises.[3] By selecting a particular specification for the liability schedule, the collective authority can choose that combination of range and probability best suited to the externality situation under consideration.

A comparison of Policy 3 (ML > MD) and Policy 5 (LL) shows that the later can be expected to provide more latitude for choice than the former. Policy 5 can vary both the probability of exceeding U_0 and the range of welfare level outcomes, while Policy 3 is restricted to altering the set of feasible outcomes. Finally, the limited liability rule is preferred to the property rule with an interior entitlement point (Policy 4) because:

1. the possibility that the victim's profits fall below f_z is eliminated;
2. the welfare level associated with the worst possible outcome has been increased; and
3. the probability of achieving a welfare level greater than U_0 has been increased.

ALTERNATIVE POLICIES FOR THE COURTS: CASE OF UNEQUAL BARGAINING SKILLS

Again consider a small numbers externality case with strategic bargaining, complete information, no lump sum transfers, and the first-best solution is not attainable with a liability rule. Now, however, assume that all potential solutions are not equally likely due to disparities in the parties' bargaining skills. For example, let f_z (Figure 5a) represent the profit distribution resulting from the initial entitlement point (victim has the property rights). Should the injurer be the superior negotiator, the outcomes in triangle $f_z t_z t_w$ (Figure 5a) will be more likely than those of triangles $f_z t_w t_x$ and $f_z t_x t_y$ and the more unequal the negotiation between injurer and victim, the more acute angle $f_z t_z t_w$ becomes. Conversely, if the victim is the superior bargainer, the probability of attaining an outcome in region $f_z t_x t_y$ is greater than that for $f_z t_x t_w$ or $f_z t_z t_w$. A bargaining solution in the central region ($f_z t_x t_w$) is likely if the negotiating abilities of the two parties are somewhat equal. Whether the courts should select a property or "limited" liability rule (Policy 5) under conditions of unequal bargaining skills is contingent upon the location of the first-best solution on the $t_z t_y$ segment and which party is more astute at bargaining.

First-Best Solution is Between t_z and t_w

The attainment of a first-best solution on or near the $t_z t_w$ line segment is highly unlikely if the victim is the superior negotiator or even if the victim and

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[3] For example, if t_e is the point from which bargaining proceeds, the welfare level associated with the worst possible outcome is U_1 and the probability of exceeding welfare level U_0 is equal to the ratio of the area "above" U_0 in triangle $t_e t_z t_d$ to the area of triangle $t_e t_z t_d$.

the injurer possess approximately equal bargaining skills. Moreover, strategic bargaining may preclude the attainment of an outcome near $t_z t_w$ even if the injurer has superior bargaining skills. However, a "limited" liability rule with marginal liability equal to marginal damages between q_z and q_e (Figure 1) and a property rule thereafter (Policy 5, Section III) will reduce the set of possible outcomes to triangle $f_e t_z t_w$ (Figure 5a). Now, regardless of the bargaining skills of the two parties, a solution will be attained near the selected first-best solution. For example, in Figure 5b (an enlargement of area $f_z t_z t_y$) $f_e t_z t_c$ bounds the probable outcomes if the injurer is the superior negotiator, triangle $f_e t_d t_w$ represent the likely outcomes when the victim possesses superior bargaining skills, and if the two parties possess equal negotiating abilities, the most likely outcomes are contained in triangle $f_e t_c t_d$. Thus, the "limited" liability rule is unambiguously preferred to a property rule if the first-best solution is on the segment $t_z t_w$ and if the goals of the courts are to raise the level of welfare associated with the worst possible outcome and increase the probability of attaining an agreement near the first-best solution.

First-Best Solution is Between t_w and t_x

As the first-best solution moves "down" the transfer line toward t_y the "limited" liability rule becomes less versatile in its ability to increase the probability of an acceptable outcome. If the desired profit distribution is between t_w and t_x, the "limited" liability rule will only increase the likelihood of attaining an outcome near the first-best solution if the victim is the superior bargainer. For example, $f_z t_x t_y$ (Figure 5c) bound the most probable outcomes should the victim be the better negotiator and the entitlement point be q_z (corresponding to f_z on profit frontier). By utilizing the "limited" liability rule and a bargaining point of f_e', the courts can eliminate undesirable outcomes and shift the set of probable outcomes "up" such that most of the $t_w t_z$ segment and the first-best solution are members of that set. Thus, the probability of achieving an outcome near the first-best solution is greatly increased. However, if the two parties are equal in bargaining skills or the injurer is the better negotiator, the most likely outcomes of a "limited" liability rule (with bargaining starting at f_e') are in the triangles $f_e' t_i t_j$ and $f_e' t_z t_i$ respectively (Figure 5c). Therefore, the adoption of a "limited" liability rule would only serve to isolate the most probable outcomes further from the desired distribution.

The First-Best Solution is Between t_x and t_y

When the social welfare maximum is on the $t_x t_y$ line segment, a property rule is generally preferable to a "limited" liability rule. However, as Polinsky noted, if the courts desire that the victim receive a large share of the joint profits, "a liability rule with liability greater than actual damages may be preferred to a property rule because it restricts the scope for bargaining and reverses the roles of the parties with respect to threats." [7, p. 243]
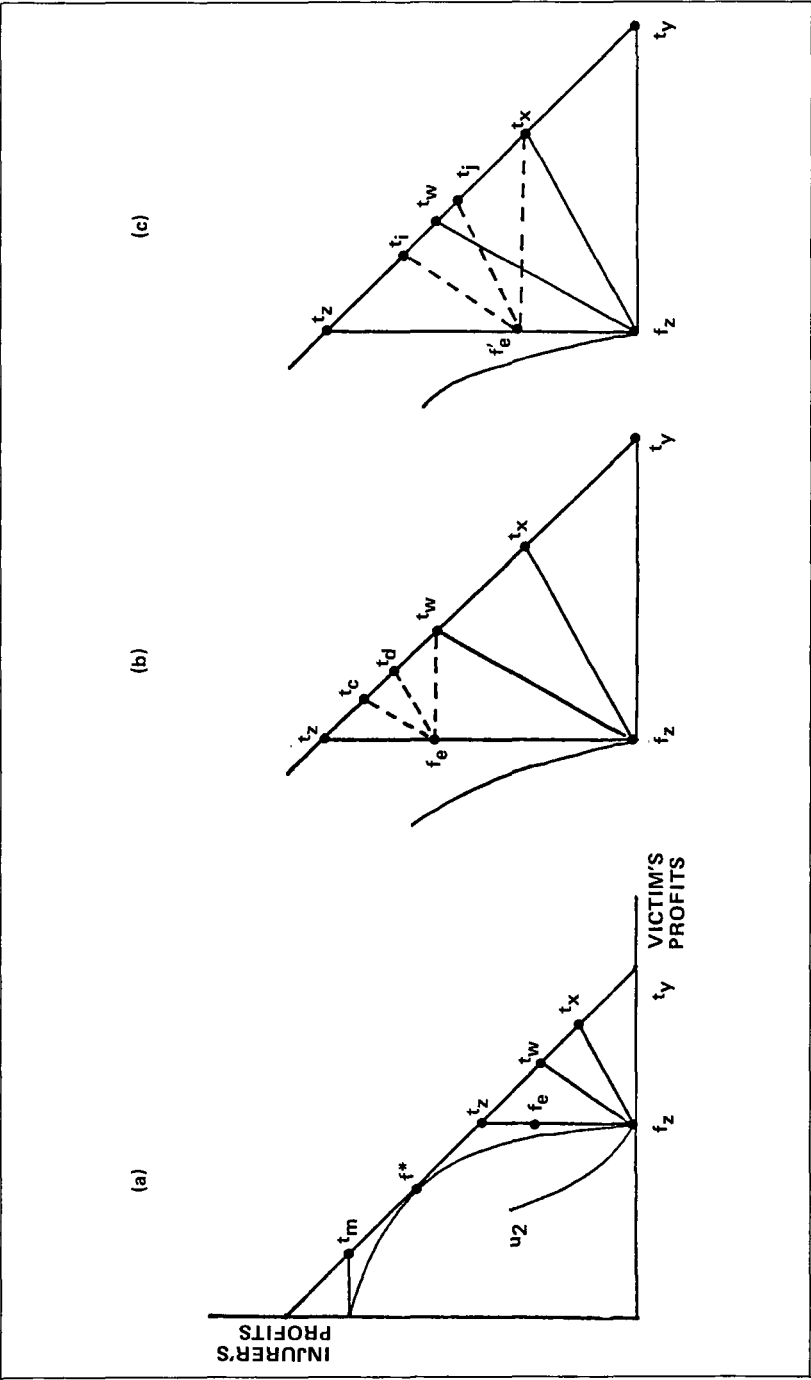
Figure 5.

SUMMARY AND CONCLUSION

In the preceding two sections, the relative desirability of property and liability rules was compared when bargaining skills of the victim and injurer were both unknown and known. A summary of these comparisons is given in Table 1 for various distributional outcomes that might be desired by the courts.

When the first-best solution is attainable (i.e., an outcome along the $t_m t_z$ segment of the transfer line is desired), a liability rule of marginal liability equal to marginal damage is unambiguously preferred to any property rule specification regardless of bargaining skills. In addition to distributive outcomes in this segment of the transfer line, "limited" liability rules are preferred to property rules for outcomes proximate to the $t_m t_z$ segment (i.e., outcomes along the $t_z t_w$ segment of the transfer line) since the set of potential negotiated outcomes is restricted to points near the first-best solution. Thus, regardless of relative bargaining skills, the probability of realizing the desired distributive outcome is enhanced.

As the distributional preferences of the courts increasingly favor the victim (i.e., segment $t_w t_x$), the role of bargaining skills becomes more significant in choosing between property and liability rules. When bargaining skills are unknown or the victim is the superior negotiator, "limited" liability rules are again preferred because the scope of negotiated outcomes can be favorably restricted. However, should bargaining skills be equal or the injurer be the superior bargainer, property rules become preferable since the expected result of the negotiation process will be near the first-best solution. Finally, when it is desired that "most" of the gains from trade accrue to the victim (i.e., segment $t_x t_y$), a property rule is preferred only in the case of the victim having superior

Table 1. The Choice Between Property Rules and Liability Rules

Location of First-Best Solution on the Transfer Line	Bargaining Skills of the Parties			
	Unknown	Injurer Superior to Victim	Injurer Equal to Victim	Injurer Inferior to Victim
$t_m t_z$	ML = MD	ML = MD	ML = MD	ML = MD
$t_z t_w$	LL	LL	LL	LL
$t_w t_x$	LL	PR	PR	LL
$t_x t_y$	ML > MD	ML > MD	ML > MD	PR

NOTE: where ML = Marginal Liability; MD = Marginal Damage; LL = "Limited" Liability Rule; and PR = Property Rule.

bargaining skills. When bargaining skills are unknown, equal, or favor the injurer, a liability rule of marginal liability greater than marginal damage becomes preferrable since the scope of bargaining is restricted and the victim's position in the negotiation process is strengthened.

It is concluded that when the courts have information on the technology of the externality, resolution of most small numbers externality situations will require specification of an appropriate liability rule. While use of a property rule is appealing since it reduces the burden on the courts to simply clarifying the existing distribution of property rights, the results of this analysis suggest that both efficiency and equity goals are better served when a well-specified liability rule is imposed on the generator of the external costs. In practice, policy is further complicated when imperfect information and sizable transaction costs characterized external cost situations. Both an incomplete understanding of the interdependency of profits and the increased expense of determining optimal liability schedules weaken the case against property rules. Under these conditions, the challenge facing the collective authority in resolving small numbers externality cases becomes one of evaluating the potential benefits of imposing optimal liability schedules *vis-a-vis* the increased information and transaction costs incurred.

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