A NOTE ON OPTIMAL PUBLIC ENFORCEMENT WITH SETTLEMENTS AND LITIGATION COSTS

A. Mitchell Polinsky and Daniel L. Rubinfeld

ABSTRACT

This note reexamines the theory of optimal public enforcement when litigation costs are incurred if the defendant is prosecuted at trial, and when an out-of-court settlement is possible. Using a numerical example, it is shown that settlements and litigation costs can substantially alter the optimal system of public enforcement. It is also shown that failing to take these considerations into account can significantly lower the achievable level of social welfare.

I. INTRODUCTION

Economic analyses of optimal public enforcement examine the enforcement authority's choice of the probability of detection and the level of the penalty.[1]

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The authority's problem is to choose the probability and the penalty so as to maximize social welfare. Two implicit assumptions are made in these analyses: first, that all violators who are detected are prosecuted at trial; and second, that the prosecutor's and the defendant's litigation costs are zero.[2] Each of these assumptions is substantially contrary to fact.

The overwhelming majority of violators who are caught settle out of court. For example, over 90 percent of all criminal cases are disposed of in this way through the process of "plea bargaining;" similarly, most civil cases brought by administrative agencies are disposed of without resorting to trial.[3]

To some extent, the propensity to settle out of court is due to the high cost of litigating cases that go to trial. In private civil litigation, there is evidence that the parties' litigation costs can exceed the amount received by a successful plaintiff.[4] Litigation costs associated with public enforcement also are likely to be high, in part because of the high standard of proof that often must be met (as, for example, in criminal prosecutions).

The contribution of this note is to incorporate these two "real world" facts—settlements and litigation costs—into the model of optimal public enforcement, and to examine their implications for the choice of the probability of detection and the level of the penalty. A simple model of public enforcement with these features is presented in Section II. Some numerical calculations are then performed in Section III.[5]

II. THE MODEL[6]

Individuals are assumed to be risk neutral and identical, except for the private gain they obtain from engaging in an activity which imposes harm on others. If an individual undertakes the activity, he faces some probability of being caught. If he is caught and the case goes to trial, he will incur litigation costs and, with some probability, will be found liable and have to pay a fine. (The model easily could incorporate nonmonetary sanctions.) Alternatively, the individual may settle out of court. An individual will engage in the activity if his private gain exceeds his *expected payment*—the sum of the expected defense cost (i.e., the defense cost times the probability that he is caught and the case goes to trial), the expected fine (the fine times the probability that he is caught and loses at trial), and the expected out-of-court settlement (the settlement amount times the probability that he is caught and the case is settled out of court).

Both the probability of an out-of-court settlement and the amount of the settlement are assumed to be exogenous.[7] This assumption is made in order to focus on how these considerations affect the optimal probability of detection and the optimal level of the penalty.

The following notation will be used to describe the individual's problem more precisely:

g = gain to an individual from engaging in the activity,
$h(.)$ = probability density of gain among individuals,
g' = maximum possible gain,
p = probability that an individual who engages in the activity will be caught,
r = probability that an individual who is caught goes to trial,
q = probability that an individual who goes to trial is found liable,
f = fine collected from an individual who is found liable,
b = cost of defense if an individual goes to trial, and
s = settlement paid by an individual who settles out of court.

Given this notation, an individual will undertake the activity if

$$g > E(p,f), \tag{1}$$

where

$$E(p,f) = p[r(qf+b)+(1-r)s]. \tag{2}$$

In other words, an individual will engage in the harmful activity if his gain exceeds his expected payment, $E(.)$. His expected payment can be broken into three parts: the expected fine, $prqf$; the expected defense cost, prb; and the expected settlement, $p(1-r)s$.

Also, let:

$N(p,f)$ = number of individuals who engage in the activity,
e = external cost or harm from engaging in the activity, and
$n(p,f)$ = number of individuals who are caught ($= pN(p,f)$).

There are two types of costs borne by the public enforcement authority—detection costs and prosecution costs. Let:

$c(p,N)$ = cost to the enforcement authority of catching fraction p of those individuals who engage in the activity.

Detection costs are assumed to be increasing in both p and N ($c_1(.) > 0$, $c_2(.) > 0$). Thus, for example, if the number of violations is 1,000, it is more costly to catch 100 violators (with $p = .1$) than it is to catch 10 violators (with $p = .01$). And it is more expensive to catch 10 percent of 1 million violators than it is to catch 10 percent of 1,000 violators. Finally, let:

a = cost to the enforcement authority of prosecution.[8]

It is assumed that there is no cost to the enforcement authority of imposing fines.

Social welfare equals the sum of the gains to individuals who engage in the activity less the harm they cause, less the cost of catching them, and less the private and public costs associated with trials:

$$W = \int_{E(p,f)}^{g'} gh(g)dg - eN(p,f) - c(p,N(p,f)) - n(p,f)r(a+b). \qquad (3)$$

The problem of the enforcement authority is to maximize social welfare, W, through the choice of the fine, f, and the probability of detection, p. The optimal values of the variables will be indicated by asterisks.

Since an individual cannot pay more than his wealth, the maximum effective fine equals the individual's wealth less his cost of defense. If individuals are risk neutral and fines are socially costless to impose (as is assumed here), it is well known that the optimal fine equals the maximum fine; thus,

$$f^* = y - b, \qquad (4)$$

where,

y = initial wealth of individuals.

The reason for this result is simple. If the fine were less than $y-b$, the fine could be raised and the probability of detection lowered so as to keep the expected payment of violators, E(.), the same. Social welfare would rise because the cost of catching individuals would fall.

Given that $f^* = y-b$, the optimal probability of detection is determined by maximizing social welfare (3) with respect to p. Assuming an interior solution, the resulting first-order condition can be written as:[9]

$$[e-E(.)][-dN(.)/dp] = \{c_1(.)-c_2(.)[-dN(.)/dp]\} + [dn(.)/dp]r(a+b). \qquad (5)$$

The left-hand side of (5) is the marginal benefit of raising the probability of detection, which equals the reduction in the number of individuals engaging in the activity, $-dN(.)/dp$, times the harm caused by each net of their gains, $e-E(.)$.[10] The right-hand side is the marginal cost of raising the probability, which has two elements—detection costs and litigation costs. The terms in braces represent the effects on detection costs. The first term, $c_1(.)$, is the direct cost of raising the probability of detection, holding constant the number of individuals engaging in the activity. The second term in braces represents the savings in detection costs due to a reduction in the number of individuals who undertake the activity. The final term is the effect on litigation costs associated with the change in the number of violators who are caught.[11]

It is easy to see that settlements and litigation costs affect the optimal system of public enforcement. Since $f^* = y-b$, the optimal fine falls as the defendant's litigation costs rise.

The effects of settlements and litigation costs on the optimal probability are less obvious because a number of terms in the first-order condition, (5), are affected. Everything else equal, the possibility of a settlement lowers the expected payment, E(.), of an individual who engages in the harmful activity, assuming that the settlement amount will be less than his expected payout at trial (including his litigation costs). Thus, settlements will tend to increase the number of individuals engaging in the harmful activity, N(.), and the number who are caught, n(.). The possibility of settlement also will have the effect of decreasing average litigation costs, r(a + b). Similarly, an increase in the litigation costs of the defendant will increase the expected payment of someone who engages in the harmful activity, which will reduce the number of individuals who choose to do so. Also, an increase in the prosecutor's litigation costs will have a direct effect on average litigation costs.

When all of these factors are taken into account, it is not clear whether settlements and litigation costs will tend to increase or decrease the optimal probability of detection, or by how much.

III. AN EXAMPLE

Although the preceding discussion shows that the optimal system of public enforcement depends on the likelihood that a case will be settled and on the costs of litigation if the case is tried, it does not indicate how important these considerations are. In this section, calculations of the optimal probability of detection and optimal fine are performed using a special case of the more general model. It will be shown that the fact that most cases are settled and that there are substantial litigation costs can significantly change the optimal system of public enforcement. The importance of taking these considerations into account will be measured by comparing the level of social welfare achieved under optimal public enforcement to the level of social welfare that would result if the probability and fine were set under the incorrect assumption that all cases are litigated and that litigation costs are zero.

It will be assumed in this section that the probability density of gains, h(.), is uniform between 0 and g′, and that the cost of detection function, c(p,N), is given by $c_1p + c_2N$, where c_1 and c_2 are positive constants.[12] Given these assumptions, it is not difficult to show that the optimal probability of detection is:

$$p = \frac{(1/g')[(dE(.)/dp)\,(e + c_2)] - [c_1 + r(a+b)]}{(1/g')(dE(.)/dp)[(dE(.)/dp) - 2r(a+b)]}, \qquad (6)$$

where

$$dE(.)/dp = rqy + (1-r)s + rb(1-q). \qquad (7)$$

Calculations were made using plausible values for the parameters given in equations (6) and (7). Specifically, let:

y (wealth)	= \$20,000,
g' (maximum gain)	= \$12,000,
e (harm)	= \$ 5,000,
q (probability of liability at trial)	= 0.5,
c_1 (marginal cost of p)[13]	= \$2,000,
c_2 (marginal cost of N)	= \$500,
r (probability of trial)	= 0.3.

While it is likely that fewer than 30 percent of all cases go to trial, this choice of r reflects the fact that a large number of cases are settled just prior to trial, after substantial expenditures by both prosecutor and defendant.

In addition, let:

a (prosecutor's costs)	= \$2,500,
b (defendant's costs)	= \$2,500.

As noted in the introduction, there is evidence that the combined litigation costs of the parties may exceed the victim's damages. The implicit assumption here is that these values are equal.

For the reasons given in Section II, the optimal fine is set such that the fine plus the defendant's cost of litigation equals his income. Thus,

f^* (optimal fine) $= y - b = \$17{,}500.$

The settlement amount is assumed to be midway between the prosecutor's expected winnings at trial net of his litigation costs, and the defendant's expected loss at trial including his litigation costs. Thus,

s (settlement amount) $= qf + .5(b-a) = \$8{,}750.$

Finally, from (6),

p^* (optimal probability) $= .17.$

Now suppose that the probability and fine are set under the mistaken assumptions that all cases go to trial and that litigation costs are zero. In other words, suppose one were to choose p and f to maximize social welfare assuming $r = 1$ and $a = b = 0$. This would lead to a fine of \$20,000 (although in fact the injurer would not be able to pay this much) and a probability of .31, nearly double the optimal probability of .17. In addition, actual social welfare (using the true values of r, a, and b) would fall by more than 9 percent. Thus, failing to take into account the possibility of settlement and the presence of litigation costs can have a substantial effect on the determination of the optimal system of public enforcement and on the achievable level of social welfare.

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NOTES

1. See, for example, Becker (1968).
2. Although some analyses of the court system do consider settlements and litigation costs, these studies are not concerned with optimal public enforcement. See, for example, Landes (1971) and Reinganum (1988). One partial exception is Chu (1988), which is discussed in note 5.
3. See, for example, Grossman and Katz (1983) and Posner (1970).
4. For example (although perhaps an extreme one), a study of asbestos litigation found that \$1.71 is spent by the parties in litigation costs for every \$1.00 received by the plaintiff. See Kakalik et al. (1983).
5. There are two papers that complement the analysis presented here. One, by Fenn and Veljanovski (1988), focuses on explaining why, given prosecution costs, a regulatory authority would accept a violator's promise to voluntarily comply with the authority's regulations in the future. The other, by Chu (1988), derives the implications of possible post-offense compromise between the victim and the injurer for the optimal sanction, assuming the probability of detection is exogenous.
6. The model in this section is a generalization of the model used in Polinsky and Shavell (1984).
7. In models which focus on other issues, both of these assumptions have been relaxed. See, for example, Bebchuk (1984) and the references cited therein.
8. This cost includes both the cost to the prosecutor's office and the court costs associated with a trial. The model does not distinguish between these two institutions.
9. This derivation uses the fact that $h(E(.))[dE(.)/dp] = dH(E(.))/dp = -dN(.)/dp$, where $H(.)$ is the cumulative distribution of $h(.)$.
10. The individuals who are deterred by the increased probability of detection are those who were previously indifferent between engaging in the activity or not; their gains equal the expected payment, $E(.)$.
11. Note that, depending on the sign of the right-hand side of (5), the expected payment, $E(.)$, may be greater than, equal to, or less than the harm caused, e. Thus, an optimal system of public enforcement may be characterized by "overdeterrence," in the sense that some individuals who are deterred from engaging in the activity would have received gains greater than the harm they would have caused (if $e < E(.)$); or there may be "underdeterrence," in the sense that some individuals who engage in the activity obtain gains less than the harm they cause. These points were recognized by

Friedman (1981), although his model of public enforcement did not include settlements and litigation costs.

12. A linear cost function allows for a simple closed-form solution for the optimal p. Such a cost function can be justified on the grounds that it represents a first-order approximation to a more realistic multiplicative cost function.

13. Note that these values of c_1 and c_2 imply that if all individuals were violators (N = 1), it would take one-eighth of the wealth of society ($2,500/$20,000) to catch all of them (p = 1).

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