Settlement versus Litigation in Environmental Damage Cases*

Running title: Settlement versus Litigation

by

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Abstract

Settlement versus Litigation in Environmental Damage Cases

Within a general framework, we address the normative question of under which conditions parties should settle out-of-court rather than litigate in the context of environmental damage cases. In contrast to the existing literature, parties in our framework are risk-adverse, can possess different assets and face different costs of litigations. We define the conditions under which bargaining can be ex-post efficient relative to a court action (for instance, in the context of an NRDA action). Moreover, we show how the presence of a group (multiple plaintiffs and defendants) strengthen or weaken the conditions which make the bargaining ex-post efficient.

Key words: Bargaining, Settlement, Negotiations, Bayesian Nash Equilibrium, NRDA

1 Introduction

In both North America and Europe, legislation exists to enable parties injured by releases of hazardous substances (e.g. oil, PCB's, arsenic, mercury) to claim compensation, or natural resource damages. In the USA, the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 (also known as Superfund) and the Oil Pollution Act of 1990 contain provisions allowing parties to sue for costs of restoring damaged natural resources (such as fisheries) or for diminution of use and non-use values due to pollution incidents (for example, lost recreational opportunities following an oil spill, or dis-utility due to impacts on wildlife).

Subsequent rule-making, primarily by the U.S. federal agencies that oversee many trustee relationships, defines and describes the Natural Resource Damage Assessment (NRDA) process for recovering economic damages. The superfund process is one where the U.S. Justice Department, representing the U.S. Environmental Protection Agency, may find liability on the part of an emitter of hazardous substances, and order clean-up, known as remediation. NRDA is rather different: in this context the trustees may go well beyond the order to pursue superfund remediation, and also seek compensatory damages. (see [17], [4] and [8]). The basic idea is that the party or parties responsible for injuries to the environment must restore welfare losses by monetary, or in-kind resource compensation[1].

[1] We note that in-kind resource compensation in lieu of money has been criticized for its embedded

There are several key features of NRDA including: (i) joint and several liability (ii) definition of trustees to include any and all responsible federal government agencies, state and local governments, and native American Indian tribes, and (iii) a rebuttable presumption. Feature (i) means that one defendant might involve several others, with liability being joint, or shared. This might be viewed as an advantage for the plaintiffs, because of the potential convenience in actual recovery of damages from parties sharing responsibility. Feature (ii) means that the negotiations and potential settlements are often not simply between two parties, and that the plaintiff may be made up of several players. Finally, feature (iii) means that if the plaintiffs pursue litigation in accordance with recommended procedures, it is most likely to be presumed that their damage claim is valid unless rebutted by the defendants.

In the European Union, damages to natural resources such as water supplies from pollution incidents may result in damage claims under a wide variety of national measures ([1] and [11]); whilst the draft EU Environmental Liability Directive (Com(2000) 66) will allow environmental groups to sue responsible parties for damages to biodiversity on the network of Natura 2000 sites ([7]).

Despite the existence if this legislation, experience in the USA and Europe shows that the legal process rarely goes to completion. Most claims for natural resource damages are settled out of court before litigation is completed, or has even commenced

assumptions (see [6]).

(see, for example, [4], [9] and [3]). Moreover, in some cases either the trial collapses (as for the Montrose Dioxin/PCB case, see [2]), or the plaintiff appears to have delayed moving forward on the case (the Leviathan Mine, California see [18]), or decided not to pursue it at this point in time (e.g. the Spokane River, Washington see [14]). The scope of the damages likely dictates whether either the plaintiff or the defendant will pursue primary scientific injury analysis and primary economic damage analysis. If either does, this will greatly increase the costs of the process over what it might cost if secondary analysis (e.g. literature reviews and benefits transfer) is used.

In this paper we use bargaining and mechanism design theory to identify conditions under which plaintiffs and defendants should settle out of court rather than litigate. As in [13] and [19], we assume two-sided incomplete information: in particular, we assume that the plaintiff has a better estimate of the penalty that can be imposed while the defendant has a better estimate of the probability of being found liable (see footnote 4). However, our framework extends the existing literature in a number of ways. First of all, parties are risk averse rather than risk neutral. Moreover, they posses different assets and face different litigation costs. Finally, we extend the analysis to the case of multiple plaintiffs and joint liability.

A game with imperfect information can be characterised by many equilibria (Bayesian Nash Equilibria). Moreover, these equilibria may differ when the bargaining procedure differs. Therefore, describing real-life bargaining procedures and deriving robust

results from the analysis of these models can be a daunting task. For this reason, we do not restrict our analysis to a particular bargaining procedure. Instead, our focus is on the efficiency of the out-of-court settlement. In particular, we establish conditions under which a bargaining outcome, rather than litigation, is *ex-post* efficient. That is to say, after all the information is revealed the players' payoffs associated with the bargaining outcome are Pareto efficient. We say that out-of-court settlements are ex-post efficient if there is at least one bargaining procedure with a Bayesian Nash Equilibrium (BNE) which generates an *ex-post* efficient outcome.

Our main conclusion is that out-of-court settlements can be ex-post efficient for parties engaged in natural resource damage disputes. This may explain why, though the environmentally concerned public may believe their trustees have "sold out" in a settlement agreement, settlement is the dominant outcome in NRDA cases in the U.S. Moreover, when multiple plaintiffs are involved, bargaining can be ex-post efficient for some of them (those characterised by high litigation costs and low levels of assets) but not for others. When similar plaintiffs coordinate, bargaining becomes less likely, in the sense that the conditions which make bargaining ex-post efficient are more restrictive. In other words, a group makes the party stronger. However, when there are multiple defendants (joint liability) settlements out of court become more likely.

In the next section we outline the model and characterise the conditions for an ex-post efficient outcome. In section 3, we discuss how these conditions are affected by

players' characteristics and the number of plaintiffs and defendants. The concluding remarks are in section 4.

2 The Model

In this section we assume that there is only a single plaintiff, P, and a single defendant, D (both these assumptions will be relaxed in section 3). Party D has injured party P and[2] both can bargain over the amount of compensation that D will offer P. The parties can either reach an agreement (settle) or litigate. If parties find an agreement, then D's compensation to P is c. Party i possesses asset a_i, which includes player i's lifetime income (with $i = D, P$). Then if P receives the compensation c from[3] D, his utility is $U(c + a_P)$ where $c + a_P$ is the total wealth, while D's utility is $U(-c + a_D)$. To simplify the notation we specify $U(x + a_i) \equiv U_i(x)$, where the subscript i (with $i = D, P$) indicates not only player i's utility but also its dependence on player i's assets. We assume that the utility function $U_i(x)$ is increasing and concave with respect to total wealth $x + a_i$. Moreover, the marginal utility with respect to x, $U_i'(x)$, is decreasing in a_i (e.g., $U_i(x) = \sqrt{x + a_i}$ [4]). In other words, rich parties are better

[2]To avoid any principle-agent problem, we assume that the trustees act in the best interest of the public.

[3]The compensation c is comparable to wealth, in other words it is the discounted value of any compensation. All the other costs and benefits are discounted values.

[4]Since a_i includes all the discounted future incomes, $x + a_i \geq 0$, even when $x < 0$, since at most a party can go bankrupt.

off, however, the increase in their utilities due to a given increase in consumption is smaller than the increase for poorer parties. Finally, we assume that parties are non-increasingly risk averse, that is, they do not worry more when they become richer (e.g., $U_i(x)$ is characterised by constant relative risk aversion). Note that whilst we focus on risk averse parties, the literature typically assumes risk neutrality (see, for instance, [16] and [19]). This, however, can be too restrictive: the results we show in this paper can be re-established if parties are risk neutral, however, in this case assets a_i do not play any role.

In litigation, we assume that both parties pay the litigation costs (this is called the America rule, since it is common in the USA)[5]. The total cost of litigation does not simply include the legal expenses of the trial (say f), but can also include other costs such as the loss of reputation and the cost of participating in the process[6]. For example, the Exxon Corporation was exposed by very high media coverage of the oil spill in Prince William Sound, and their related concern was very likely the impact on stock values by current future investors with some level of environmental concerns.

[5]On the other hand, in Europe is more common the so-called English rule, where the loser of the trial bears both parties' litigation costs. Then, the winner of a trial has a greater incentive to litigate under the English rule, rather than the America rule, since he does not bear any costs. That litigation is more likely under the English rule has been proved first by [19].

[6]Similar costs can be faced also when parties attempt to settle out of court. However, in this case, such costs are smaller and therefore to simplify we assume them to equal zero.

We denote the total cost of litigation for party i, f_i with $i = D, P$. Moreover, if parties litigate then with probability θ, $\theta \in (0,1)$, D is judged to be responsible for the damages and his penalty is x, while with probability $1-\theta$, D does not pay any penalty. This probability includes not only the case in which D is not found liable, but also the case in which the trial collapses (and the plaintiff failed to pursue the case, although in this case the litigation costs are zero). Players' utilities under litigation are $L_D(x,\theta) = U_D(-\theta x - f_D)$ and $L_P(x,\theta) = U_P(\theta x - f_P)$.

To simplify the analysis we normalise players utility so that under litigation their utilities are zero. This implies that players' utilities from settlement become,

$$S_D = -L_D(x,\theta) + U_D(-c) \tag{1}$$

$$S_P = U_P(c) - L_P(x,\theta) \tag{2}$$

We assume that $S_i \geq 0$ for $i = D, P$ (i.e., $-\theta x - f_P \leq c \leq \theta x + f_D$). In other words, there are mutual gains from settlements. However, since a typical game to represent the problem of settlement versus litigation is characterised by imperfect information, these conditions alone cannot guarantee that parties should always settle. If the assumption of mutual gain is relaxed, [12] shows that, in the context of uncorrelated private values, bargaining cannot be ex-post efficient. It is intuitive that in our context with correlated private values, this result can be re-established. To simplify the analysis, we focus on the case in which there are gains from settlement and define the condition under which bargaining can be ex-post efficient.

In our framework, parties know different things. We assume that D knows that the probability of being found liable θ since he has a better knowledge of the pollution prevention actions he took. On the other hand, P has a better estimate of the damage and therefore the penalty x that can be imposed to the defendant[7] [8]. To model this we assume that θ is drawn from a continuous symmetric probability density function Θ, with support $[\underline{\theta}, \overline{\theta}]$. The defendant D knows the value that θ assumes while the plaintiff P knows only the probability density function Θ. Similarly, the penalty x (as a function of the damage) is drawn from a continuous symmetric probability density function X, with support $[\underline{x}, \overline{x}]$ while P knows the value x, the defendant D knows only the distribution X.

Since there is incomplete information, it is interesting to answer the question as to when parties should settle. In the next section, by using the revelation principle, we will show the necessary and sufficient conditions for an ex-post efficient settlement[9].

[7] In this context, the probability θ and the penalty x are correlated, since they both depend on the damage. In other words, parties have different valuations of the expected penalty (which depends on the damage). In many real-life examples, parties evaluate damages directly and, for strategic reasons, their estimates can be very different. For a discussion on the possible different ways of evaluating damages see [5].

[8] Large corporations especially, have outside or internal legal staff who would be aware of liability issues for the firm. In contrast, many trustees such as small state governments in the U.S. have very little knowledge of the NRDA process, including the legal, economic, or injury issues involved.

[9] The proof is based on [13]. Our analysis extend the results contained in [13] by assuming that

2.1 Characterisation of the Ex-post Efficient Outcome

In this section we will show that the bargaining outcome can be ex-post efficient if and only if there is an offer which is profitable both for D and P. That is to say,

Proposition 1 *The out-of-court agreement can be ex-post efficient, if and only if there is an offer o, which leaves P with a payoff not smaller than* $E_\theta(L_P(\overline{x},\theta))$ *and* $U_D(-o) \geq E_x(L_D(x,\underline{\theta}))$.

Proof. We prove first the necessary and then the sufficient conditions for an ex-post efficient bargaining outcome. To conclude that out-of-court settlements are ex-post inefficient, it is necessary to show that for *any* bargaining mechanism *all* the BNE are ex-post inefficient. This latter task can be easily solved by using the revelation principle (a detailed analysis of the implications of this principle is included, among others in [10]). In other words, rather than focusing on all the possible procedures, we can focus on a subset of mechanisms. Indeed, this principle says that for any BNE of a bargaining game with asymmetric information, there is a *direct revelation procedure* (DRP) with two properties which implements the BNE. These two properties are *truth-implementability* and *individual-rationality,* defined below.

In our context a DRP is defined by two functions, α and β. If the plaintiff P announces the value x' for x with $x' \in [\underline{x},\overline{x}]$ and D announces the value θ' for θ with

parties are risk-averse, possess (possibly different) assets and face (possibly different) litigation costs.

$\theta' \in [\underline{\theta}, \overline{\theta}]$, then with probability $\alpha(x', \theta')$ players will agree to settle out-of-court and D will pay $\beta(x', \theta')$ to P, while with probability $1 - \alpha(x', \theta')$ players will litigate. A DRP is *truthfully-implementable* if and only if truth telling is an optimal strategy for each player. In other words, the expected gain from settlement, when P claims (the true value) x, $E_P(x)$, is not smaller than the expected gain when P claims $x\prime$. That is, for any x and $x' \in [\underline{x}, \overline{x}]$,

$$\begin{aligned} E_P(x) \equiv\ & E_\theta[\alpha(x,\theta)(U_P(\beta(x,\theta)) - L_P(x,\theta))] \geq \\ & E_\theta[\alpha(x',\theta)(U_P(\beta(x',\theta)) - L_P(x,\theta))] \end{aligned} \tag{3}$$

and similarly for D. For any θ and θ', with $\theta' \in [\underline{\theta}, \overline{\theta}]$,

$$\begin{aligned} E_D(\theta) \equiv\ & E_x[\alpha(x,\theta)(-L_D(x,\theta) + U_D(-\beta(x,\theta)))] \geq \\ & E_x[\alpha(x,\theta')(-L_D(x,\theta) + U_D(-\beta(x,\theta')))] \end{aligned} \tag{4}$$

where $E_D(\theta)$ is the expected gain from settlement when D claims the true value θ. Moreover, a truthfully-implementable DRP is *individually-rational* if and only if for any $x \in [\underline{x}, \overline{x}]$, $E_P(x)$, as defined in (3), is non negative and for any $\theta \in [\underline{\theta}, \overline{\theta}]$, $U_D(\theta)$, as defined in (4), is non-negative. Finally, a DRP is ex-post efficient if and only if when there are mutual gains, players settle out of court, otherwise, they do not. Since, $S_D \geq 0$ and $S_P \geq 0$, then for any $x \in [\underline{x}, \overline{x}]$ and $\theta \in [\underline{\theta}, \overline{\theta}]$, $\alpha(x, \theta) = 1$.

We now conclude the first part of the proof by using the revelation principle and focusing only on the DRP. Assume that there is no offer o which is profitable for

both P and D (i.e., the conditions specified in the proposition do not hold), then it is sufficient to show that there is no truthfully-implementable and individually-rational DRP which is also ex-post efficient. By contradiction, suppose that such a DRP exists, then by using the ex-post efficiency condition ($\alpha(x,\theta) = 1$), the truthfully-implementable conditions (3) and (4) can be written as follows,

$$E_\theta[U_P(\beta(x,\theta))] \geq E_\theta[U_P(\beta(x',\theta))] \tag{5}$$

$$E_x[U_D(-\beta(x,\theta))] \geq E_x[U_D(-\beta(x,\theta'))] \tag{6}$$

The expectation $E_\theta[U_P(\beta(x,\theta))]$ is independent from x while, $E_x[U_D(-\beta(x,\theta))]$ is independent from θ. Moreover, the individually-rational conditions imply,

$$E_\theta(U_P(\beta(x,\theta))) \geq E_\theta(L_P(x,\theta)) \tag{7}$$

$$E_x[L_D(x,\theta)] \leq E_x(U_D(-\beta(x,\theta))). \tag{8}$$

Taking the expectation E_x and E_θ in (7) and (8) respectively,

$$E_{x,\theta}[U_P(\beta(x,\theta))] \geq E_\theta(L_P(\overline{x},\theta)) \tag{9}$$

$$E_x[L_D(x,\underline{\theta})] \leq E_{x,\theta}[U_D(-\beta(x,\theta))] \tag{10}$$

Note that while $E_\theta(L_P(x,\theta))$ is increasing in θ and x, $E_x(-L_D(x,\theta))$ is decreasing in θ and x. Since U is concave, then there is a $\widetilde{\beta}$ such that,

$$U_P(\widetilde{\beta}(x,\theta)) \geq U_P[E_{x,\theta}(\beta(x,\theta))] \geq E_{x,\theta}[U_P(\beta(x,\theta))] \geq E_\theta(L_P(\overline{x},\theta)) \tag{11}$$

Moreover,

$$E_x[L_D(x,\underline{\theta})] \leq E_{x,\theta}[U_D(-\beta(x,\theta))] \leq U_D[E_{x,\theta}(-\beta(x,\theta))] \leq U_D(-\widetilde{\beta}(x,\theta)) \qquad (12)$$

In other words, there is an offer $\widetilde{\beta}(x,\theta)$, which leaves P with a payoff not smaller than $E_\theta(L_P(\overline{x},\theta))$, and this offer is profitable to D, which is a contradiction.

We now show that an out-of-court settlement can be ex-post efficient *if* the conditions specified in Proposition 1 hold. Consider a take-it-or-leave-it bargaining procedure, in which the defendant can make an out-of-court offer. If the offer is accepted players implement the agreement and the game ends, while if the offer is not accepted, the game ends and players' (normalised) payoffs are zero. Consider the following strategies. For any θ, D offers o such that P obtains $E_\theta(L_P(\overline{x},\theta))$, if he accepts; for any value of x, P accepts any offer at least equal to o and rejects any other offer. These are BNE as long as D gets something not smaller than he would get in litigation (that is zero), i.e., $E_x(L_D(x,\underline{\theta})) \leq U_D(-o)$. Moreover, this BNE is ex-post efficient. ■

Proposition 1 implies that there is always a profitable offer o if and only if

$$U^{-1}[E_\theta(U(\overline{x}\theta - f_P + a_P))] - a_P \leq a_D - U^{-1}[E_x(U(-x\underline{\theta} - f_D + a_D)] \qquad (13)$$

When players are risk neutral, it can be easily shown that Proposition 1 holds, in particular, the necessary and sufficient condition (13) becomes

$$\overline{x}(E_\theta\theta) - f_P \leq (E_x x)\underline{\theta} + f_D, \qquad (14)$$

as shown in [13].

3 Litigation or Settlement?

In the previous section we showed that when there is a single plaintiff, bargaining can be ex-post efficient if and only if there is an offer which is profitable both to D and P. That is to say,

$$U(o + a_P) \geq E_\theta(U(\overline{x}\theta - f_P + a_P)) \tag{15}$$

$$E_x(U(-x\underline{\theta} - f_D + a_D)) \leq U(-o + a_D) \tag{16}$$

When the litigation costs f_P and f_D are sufficiently high, inequalities (15) and (16) hold and parties should not litigate. Significant asymmetries in parties' litigation costs imply that either only (15) or only (16) holds. In other words, settlements cannot be ex-post efficient. In general bargaining is ex-post efficient when both parties' litigation costs are high. The intuition is that parties find it profitable to save the litigation costs by settling out of court. When parties are risk-neutral, the initial assets a_i with $i = 1, 2$ do not play any role in parties' decisions. In our framework however, we can show that assets matter. In particular, when D is rich (P poor), inequality (15) (respectively (16)) holds more strongly. Conversely, when D is poor (P rich) bargaining can become ex-post inefficient. This result is driven by the concavity of the utility function (see Appendix). The intuition behind this finding is the following. When party D is rich, he is more able to make an acceptable

offer to party P. On the other hand, when party P is poor, this offer is more easily acceptable, since the incentives to save on the litigation costs are higher. Moreover, the existence of an offer which is feasible for D and acceptable from P is affected by the expected penalty $x\theta$. Finally, if the maximum penalty $\overline{x}$ is sufficiently high and/or the minimum probability of being found liable $\underline{\theta}$ is low, settlements cannot be ex-post efficient.

The Exxon Valdez oil spill case is consistent with the theory explained above: when D has a very deep pocket can be easily settle out of court. In the United States experience most NRDA cases have been pursued by trustees when there is at least one defendant with a deep pocket likely to be found liable, possibly as one of a group of multiple defendants with many of them having relatively small assets. Poor plaintiffs, and most state governments are poor in comparison to corporate giants such as General Electric, ARCO and Exxon, cannot hope to recover even their case costs if the plaintiff's perceived ability to pay is extremely low. Most of the "poorest" state economies in the U.S have seen very little going on in term of in NRDA, since the plaintiffs did not have the minimum budget required to pursue to case[10].

[10] In recent years the practise of changing to "resource to resource" compensation may have reduced legal costs for plaintiffs but also the size of the damage awarded.

3.1 Multiple Plaintiffs and Defendants

In many cases of environmental damages, more than one plaintiff is involved. For instance, in the Nestucca oil spill case two large players on the plaintiff's side were the state of Washington and the Canadian province of British Columbia (see [15]). Multiple defendants can also be involved (for instance, Attrasco and BP were just two of the defendants in the "American Trader" oil spill in the Pacific Ocean in 1990: [3]). In this section, we focus first on the case of multiple plaintiffs (when there is a single defendant), we then extend the analysis to the case of multiple defendants[11].

Let us assume that there are n plaintiffs (with $n > 1$). Moreover, the plaintiffs may behave in two possible ways: they either coordinate or act independently[12]. Suppose first that the plaintiffs behave independently from each other. Indeed, although the plaintiffs represent the harmed party (the public), they may be concerned about different aspects of the case. For instance, in the case of river pollution, a Native American Indian tribe may be concerned mainly with the injured fish, while the trustees for the U.S. federal agencies may be more worried about the polluted water.

Each plaintiff is characterised by (possibly) different expected utility values

$$E_\theta(U_{P_i}(\overline{x}^i\theta - f_{P_i})) \tag{17}$$

since they may possess not only (total) different litigation costs, f_{P_i}, and different

[11] A related paper is [20], which analyse a bargaining game with two plaintiffs and one defendant.

[12] These are two extreme cases. In many real-life examples, there are many intermediate cases.

assets, a_{P_i}, which affect their utility U_{P_i}, but also different valuations of the maximum value of the penalty $\overline{x}^i$ (which is now related to part of the total damage), with $i = 1, ..., n$. To simplify the notation we assume that the probability of being found liable θ, is unchanged, since it depends on the entire damage.

When plaintiff i attempts to settle with D, bargaining can be ex-post efficient if and only if conditions (18) and (19) below hold,

$$U(o^i + a_{P_i}) \geq E_\theta(U(\overline{x}^i\theta - f_{P_i} + a_{P_i})) \tag{18}$$

$$E_{x^i}(U(-x^i\underline{\theta} - f_D + a_D)) \leq U(-o^i + a_D) \tag{19}$$

where o^i is the offer made by D to plaintiff i with $i = 1, ..., n$. The offer o^i to plaintiff i can be more generous than the offer o^j ($o^i > o^j$), with $i, j = 1, ..., n$ and $i \neq j$, even if plaintiffs i and j have the same valuations of the maximum penalty ($\overline{x}^i = \overline{x}^j$). Indeed, when plaintiff i is tougher than j, in the sense that is richer or his litigation costs are smaller, bargaining can be ex-post efficient but the tougher plaintiff obtains a better deal. This is consistent with outcomes observed in several NRDA cases in the U.S. involving multiple plaintiffs. For example, in the above-mentioned Nestucca oil spill case, the Province of British Columbia more vigorously pursued trial than their co-plaintiff, the State of Washington. Both still settled, though interestingly, by holding out British Columbia got more than Washington did, even though the plaintiff's estimated damages did not imply a different settlement.

Moreover, the conditions (18) and (19) can hold for some i but not necessarily

for all i. In this possible scenario, some plaintiffs should litigate with the defendant, while others should settle out of court. For instance, when the penalty $\overline{x}^1$ is similar to $\overline{x}^2$, but plaintiff P_1 is poorer than P_2 or his litigation costs are higher, then bargaining can be an ex-post efficient outcome for P_1 and D, but will not be for P_2 and D.

Although often in NRDA plaintiffs are different and they pursue damages separately, in some cases plaintiffs agree in advance that one of the parties' attorneys will be the lead council. Coordination between the members of party P can be modelled in different ways. However, since our focus is not on a particular bargaining game, but on the normative question of when parties should litigate or settle out-of court, we simply discuss how coordination can affect the results shown above.

When multiple plaintiffs decide to coordinate, the penalty they may receive is not necessarily the highest penalty requested by a single plaintiff. Often this will be larger, since the penalty includes other damages which this plaintiff did not consider[13]. Let the maximum penalty of party P be $\overline{x}^P$, when plaintiffs coordinate. To simplify, assume that plaintiffs are equally liable for litigation costs and share equally any damages awarded[14]. Then, bargaining can be ex-post efficient if and only if conditions

[13] When there are valuation problems, this can be even smaller, since a plaintiff can be convinced by the group that some of the damages it includes cannot be easily proved.

[14] In the early settlements in the late 1980's and early 1990's, monies were sometimes used to provide for or enhance similar activities to ones that were diminished, and even to pursue other NRDA cases. It was possible for a state trustee to receive one sum and a federal trustee to receive

(20) and (21) below hold,

$$\sum_{i=1}^{n} U(\frac{o}{n} + f(a_{Pi})) \geq E_\theta \left[\sum_{i=1}^{n} U(\frac{\overline{x}^P}{n}\theta - f_i + a_{P_i})) \right] \tag{20}$$

$$E_x(U(-x\underline{\theta} - f_D + a_D)) \leq U(-o + a_D) \tag{21}$$

where the rhs of (20) is the combined expected utility of the plaintiffs. The rhs is affected by a number of factors. Apart from the maximum penalty ($\overline{x}^P$), the costs of litigation for a plaintiff are not necessarily the same as in (17). The legal costs are now shared equally between plaintiffs, although, there are some individual costs relating to individual plaintiffs which are unchanged. Finally, the assets of each single plaintiff affect the utility that he obtains from litigation.

To show the effects of party multiplicity on the efficiency of bargaining, let's assume that the plaintiffs are identical in terms of assets, litigation costs and evaluation of the damage, in other words, the group is homogeneous. Then, condition (20) becomes as follows,

$$nU\left(\frac{o}{n} + a_P\right) \geq E_\theta \left[nU\left(\frac{\overline{x}^P\theta - f_P}{n} + a_P\right)\right] \tag{22}$$

That is to say,

$$U\left(o + na_P\right) \geq E_\theta \left(\overline{x}^P\theta - f_P + na_P\right) \tag{23}$$

quite a different sum (see the negotiated settlement on the Clark Fork Basin for example). Today, all sums received by plaintiffs in connection with a case are used toward restoration activities and recovery of fees spent to pursue the cases.

This implies that when there are n plaintiffs, it is as if party P is n times as rich. As shown in the Appendix, the fact that party P is richer implies that bargaining is less likely to be ex-post efficient (i.e., the conditions in Proposition 1 are either very restrictive or they cannot hold). In other words, plaintiffs which act independently are more likely to settle out of court, while, when they behave as a single group they are more likely to litigate.

This analysis can be easily extended to the case in which plaintiffs are heterogeneous. Indeed, a possible scenario in this case is that there are two types of plaintiffs, some are poor/with high litigation costs and prefer settlement to litigation, while the others, richer/with lower litigation costs, prefer litigation. When these plaintiffs behave as one, there are two important effects. On one side, as pointed out for the homogeneous group, the group tends to be stronger, since it is as if party P is richer. However, on the other hand the degree of heterogeneity of the groups, that is, the proportion of the softest (poor/with high litigation costs) to the toughest (rich/with lower litigation cost) will weaken the previous effect. Therefore, the resulting effect on the ex-post efficiency condition for the group depends on these two contrasting forces. A conclusion that can be drawn from this analysis is that a poor plaintiff should individually bargain with the defendant, but when acting in a group, should litigate if the coordination makes the party P tough.

A similar reasoning applies when there are multiple defendants and a unique

plaintiffs. However, the incentives now work in the opposite direction. To show this, let's assume that there is a homogeneous group of defendants (i.e., with the same assets and litigation costs). When the defendants share the penalty and the legal costs of litigations equally, inequality (16), defining the necessary and sufficient condition for ex-post efficient bargaining, becomes,

$$E_x\left[\sum_{i=1}^{n} U_{D_i}(-\frac{x}{n}\underline{\theta} - f_{D_i}))\right] \leq U(-o + a_D) \tag{24}$$

This inequality holds more strongly when party D is a group. It is as if D is richer and in this case bargaining becomes ex-post efficient. Therefore, a possible scenario is that there are individual defendants who should litigate when acting independently, but who should settle out of court when acting cooperatively with the other defendants.

Finally, when there are both multiple plaintiffs and multiple defendants all the effects specified above are at work, and since these can be in contrast, the assessment of whether bargaining should be more or less likely depends on the specific form of the utility function and the characteristics of the individual parties in the group.

4 Conclusions

In a very general framework we discussed the normative question of under which conditions parties should settle out-of-court rather than litigate for enviromental damages. We showed that out-of-court bargaining can be ex-post efficient. Moreover, when there are many similar plaintiffs (defendants), such bargaining becomes less

(more) likely. Finally, group heterogeneity affects the results in different directions (depending on the specific differences within a group). In general, if an individual plaintiff is poor he has a strong incentive to negotiate an agreement out of court. However, this incentive may be weakened or even reversed when the plaintiff operates within a group, depending on the composition of the group. Conversely, a rich defendant tends to settle and this incentive is strengthened when the defendant act cooperatively in a group.

This analysis not only help explain why some parties do not go to trial, but also why for a single damage case, some parties settle, while some others do not. In many real-life examples, heterogeneous groups are often involved. In our framework we set out the different forces which make bargaining ex-post efficient. Future research may investigate the strategic interactions among different parties when out-of-court negotiations are attempted.

Appendix

To show the effects of assets on the ex-post efficient conditions, we re-write (15) and (16) as follows,

$$o \geq U^{-1}[E_\theta(U(\overline{x}\theta - f_P + a_P))] - a_P \tag{25}$$

$$o \leq a_D - U^{-1}[E_x(U(-x\underline{\theta} - f_D + a_D)] \tag{26}$$

We now show that the rhs of (25) is smaller when P is poor ($a_P = 0$), i.e.,

$$U^{-1}[E_\theta(U(\overline{x}\theta - f_P + a_P))] - a_P \geq U^{-1}[E_\theta(U(\overline{x}\theta - f_P))] \tag{27}$$

Note, that from this result, it follows that the rhs of (26) is higher when a_D increases. We therefore focus only on P. Condition (27) can also be written as,

$$U^{-1}[E_\theta(U(\overline{x}\theta - f_P + a_P))] \geq U^{-1}[E_\theta(U(\overline{x}\theta - f_P))] + a_P \tag{28}$$

Condition (28) says that the certainty equivalent, C, to obtain the expected value $E_\theta U(y_\theta + a_P)$ where $y_\theta = \overline{x}\theta - f_P$, is not smaller than the certainty equivalent for $E_\theta U(y_\theta)$ plus a_P. That is,

$$CE_\theta U(y_\theta + a_P) \geq CE_\theta U(y_\theta) + a_P \tag{29}$$

This is always satisfied when U is increasing, concave and exhibits non-increasingly risk aversion. In conclusion, when P is poorer, the inequality (15) can hold more strongly. With a similar reasoning it is possible to show that when D is richer, inequality (16) holds more strongly.

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