Public-Good Nature of Environmental Conflicts: Individual and Collective Litigations

Sung-Hoon Park and Myunghoon Lee *

In environmental conflicts where private citizens sue a polluter, a private citizen's participation in the fight for environmental damages is characterized by the *public good* nature. We examine how the introduction of collective litigation and asymmetric reimbursement rule affects each citizen's choice between free-riding and participation in the collective litigation. Following a Stackelberg model, we assume that citizens move first and the firm follows, while each citizen has to state his environmental damages to the court in the process. Important findings are as follows: First, in the individual litigation, the hungriest citizen who most highly values environmental damages is the only one to participate. Second, in the collective litigation, all citizens participate, provided the total damages of the citizens' group are sufficiently larger than the damages of the hungriest citizen. Third, under certain conditions, introduction of the asymmetric reimbursement rule enhances the possibility that all citizens participate in the collective litigation.

Keywords: Collective litigation, Environmental conflicts, Individual litigation, Public goods, Asymmetric reimbursement

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* Research Fellow, Gyeonggi Research Institute, 179 Pajang-dong Jangan-gu, Suwon, Gyeonggi-do 440-290, Korea, (Tel) +82-31-250-3552, (E-mail) shpark123@gri.re.kr; Professor, Department of Economics, Korea University, Jochiwon-eup, Yeongi-gun, Chungnam 339-700, Korea, (Tel) +82-41-860-1514, (E-mail) lmh@korea.ac.kr, respectively.
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I. Introduction

Traditionally, the theory of environmental conflicts has examined the efficiency consequences of a citizen (or a representative of private citizens) and a firm competing over a private good.[1] In the real world, however, there are naturally more than one citizens who suffer from environmental damages while valuing the environmental damages in different magnitudes.

Baik (1993) and Baik *et al.* (2001) studied contests in which a number of groups compete with each other to win a group-specific public-good prize. They showed that only the hungriest player, who values the prize most dearly, of each group participates in the contest. Building on Baik (1993), Park and Shogren (2003) applied this concept of public-good prize to the environmental conflicts for the first time. Park and Shogren (2003) also analyzed, for the first time in the literature, whether the practice of asymmetric reimbursement rule can induce the less-hungry citizens to participate in the environmental conflicts. Under the asymmetric rule, the firm has to reimburse the citizens' legal expenditures while not being reciprocated in kind by the losing citizens.[2]

Baik (1993), Baik *et al.* (2001), and Park and Shogren (2003) assumed that all relevant information is common knowledge and that each player in every group tries to maximize his own expected payoff in the individual litigation.

Our research is different from the said three papers on account of the following.

First, we consider the Stackelberg equilibrium, in lieu of the Cournot equilibrium obtained in the previous papers, as a solution concept. In the Stackelberg model, each citizen first reveals his environmental damages to the court, that is, the citizens move first and the firm follows.[3] Accordingly, information on the size of

[1] See, for example, Baik and Shogren (1994), Heyes (1997), Hurley and Shogren (1997), Katz *et al.* (1990), Park and Lee (2007a), and Park and Lee (2007b).

[2] In this vein, the rule is perceived as an asymmetric modification of the classic British loser-pays system.

[3] Hurley and Shogren (1997) and Heyes (1997) emphasized that, in the real-world environmental conflicts, plaintiffs move first and defendants follow. Heyes (1997, p. 412) states that "under civil and criminal law the moving party states its case first, the defendant (in this case the polluting firm) then

damages become common knowledge.[4] It is because each citizen in the citizens' group has to inform the court of his environmental damages, and thus both all citizens and the firm get to know the environmental damages of each citizen as well as the total damages of the citizens' group.

Second, unlike the previous papers that stopped at proving the existence of free-riding, we proceed to examine on what conditions the citizens prefer participating in the collective litigation to free-riding.

Third, for the first time in the literature, we consider the asymmetric reimbursement rule as a device to promote citizens' participation in the collective litigation. The U.S. federal government attempted to promote public participation in the environmental conflicts by embodying the asymmetric rule in such laws as *Clean Air Act*, *Clean Water Act*, and *Endangered Species Act*. In this case, the citizens' suits are perceived not as a replacement of the legislative process but as "a means of providing realistic access to legislatures so that the theoretical processes of democracy can be made to work more effectively in practice" (Sax 1970).[5]

The following section develops the framework of analysis in the paper. Section III solves for the subgame-perfect Nash equilibrium (SPNE) in the individual litigation (*IL*, hereafter). In Section IV, the SPNE in the collective litigation (*CL*, hereafter) are derived considering, respectively, the no-reimbursement rule (*NR*, hereafter) and the asymmetric reimbursement rule (*AR*, hereafter). Finally, in Section V, we analyze the equilibrium consequences of *IL* and *CL* and offer our concluding remarks.

II. The Framework of the Analysis

Consider contests in which a citizens' group attempts to win environmental damages by expending observable and irreversible effort against a polluting firm. The group consists of I risk-neutral citizens. Let us define x_c^i as the irreversible effort level spent by citizen $i(=1, 2, \cdots, I)$ in the group. Let X_c be the total effort level, or

chooses whether and how vigorously to defend itself."

[4] See Hurley and Shogren (1997, pp. 257-8).

[5] Also see Naysnerski and Tietenberg (1992), Settle *et al.* (2001), and Shavell (1982).

the summation of all citizens' effort levels in the group, *i.e.*, $X_c = \sum_{i=1}^{I} x_c^i$. Let us define x_f as the irreversible effort level spent by the firm. The firm is assumed risk-neutral.

Let $p_c(X_c, x_f)$ be the probability that the citizens' group wins the damages as shown in Baik and Shogren (1994) and Park and Shogren (2003). Likewise, let $p_f(X_c, x_f)$ be the probability that the firm wins the suit. The contest itself is modeled as a "lottery auction." In case both X_c and x_f are zero, it turns out that $p_c(0, 0) = p_f(0, 0) = 1/2$. Otherwise, the probability-of-winning functions for the group and the firm are expressed as $p_c = X_c/(X_c + x_f)$ and $p_f = x_f/(X_c + x_f)$, respectively.

Valuations for the environmental damages may differ across the individual citizens in the group. Before going to trial, each citizen in the group has to reveal his environmental damages to the court. Thus, all citizens' damages are publicized in the process. Let v_c^i represent the valuation of citizen *i*'s damages such that[6]

$$\sum_{i=1}^{I} v_c^i = V_c.$$

If the citizens' group wins V_c, the losing firm must pay V_c to the group while citizen i in the group receives v_c^i.

Let us now assume as follows:

***Assumption 1*:** $v_c^{h-1} > v_c^h > 0 \quad (h = 2, 3, \cdots, I)$.

Following the Stackelberg equilibrium as a solution concept, we also assume that the citizens in the group first choose their effort levels and then, after observing the citizens' effort levels, the firm chooses its effort level.

In *IL*, each citizen chooses his effort level independently. In *CL*, however, all citizens jointly choose the total effort level for the group.

III. SPNE in the Individual Litigation

Baik (1993) used the Cournot model to prove that only the hungriest player participates in the environmental conflicts. We follow the same proof procedures as in Baik (1993) and investigate whether the identical result is obtainable by using the Stackelberg

[6] See Park and Shogren (2003, p. 63).

model.

In *IL*, the expected payoff of citizen i and the expected loss of the firm are, respectively, as follows:

$$\begin{aligned}\pi^i_c &= p_c(v^i_c - x^i_c) + (1-p_c)(-x^i_c)\\ &= p_c v^i_c - x^i_c\end{aligned} \tag{1}$$

$$\begin{aligned}L_f &= p_c(V_c + x_f) + (1-p_c)(x_f)\\ &= p_c V_c + x_f\end{aligned} \tag{2}$$

Consider the firm's reaction to the group's action. We first minimize the firm's expected loss over its effort level. Let $\tilde{x}_f$ denote the best response of the firm. The first-order condition for this problem is:

$$\partial L_f/\partial x_f = -X_c V_c/(X_c + \tilde{x}_f)^2 + 1 = 0, \qquad \text{for } \tilde{x}_f > 0 \tag{3}$$

or

$$\partial L_f/\partial x_f = -X_c V_c/(X_c + \tilde{x}_f)^2 + 1 \geq 0, \qquad \text{for } \tilde{x}_f = 0 \tag{4}$$

Equation (3) implies that its marginal gross loss $\{X_c V_c/(X_c + \tilde{x}_f)^2\}$ must equal its marginal cost, 1, as the firm expends a positive effort level. Equation (4) implies that its marginal gross loss must not exceed its marginal cost as it chooses zero effort. The firm's expected loss function is strictly convex in its effort level. That is, a unique solution exists for the firm's minimization problem.

We derive the firm's reaction function, $R_f(X_c)$, for the case of a positive effort level, by solving Equation (3) above.

$$R_f(X_c) = -X_c + (X_c V_c)^{1/2} \tag{5}$$

Next, given the other citizens' effort levels, citizen i selects x^i_c to maximize his expected payoff subject to the firm's reaction function, $R_f(X_c)$.

$$\begin{aligned}&\max\ \pi^i_c = p_c v^i_c - x^i_c\\ &\text{s.t. } R_f(X_c) = -X_c + (X_c V_c)^{1/2}\end{aligned} \tag{6}$$

Let $\tilde{x}^i_c$ denote the best response of citizen i. The first-order condition is:

$$\partial\pi_c^i/\partial x_c^i = v_c^i/2(X_cV_c)^{1/2} - 1 = 0, \qquad \text{for } \tilde{x}_c^i > 0 \tag{7}$$

or

$$\partial\pi_c^i/\partial x_c^i = v_c^i/2(X_cV_c)^{1/2} - 1 \leq 0, \qquad \text{for } \tilde{x}_c^i = 0 \tag{8}$$

Equation (7) implies that citizen *i*'s marginal gross payoff $\{v_c^i/2(X_cV_c)^{1/2}\}$ must equal his marginal cost, 1, as he expends a positive effort level. Equation (8) implies that his marginal gross payoff must not exceed his marginal cost as he chooses zero effort.

Citizen *i*'s expected payoff function is strictly concave in his effort level. That is, a unique solution exists for citizen *i*'s maximization problem.

Using Equations (7) and (8), we obtain Lemma 1.

Lemma 1: *In IL,* $\{\tilde{x}_c^{h-1} \geq \tilde{x}_c^h\}$ *holds, for* $h=2,\cdots, I$.

Proof: Equations (7) and (8) show that each citizen's marginal cost equals 1. The second-order condition shows that citizen *i*'s marginal gross payoff $\{v_c^i/2(X_cV_c)^{1/2}\}$ is monotonously decreasing in the effort level of citizen *i*. In addition, by the first-order condition, we know that $\{v_c^{h-1}/2(X_cV_c)^{1/2} > v_c^h/2(X_cV_c)^{1/2}\}$ results if $\{v_c^{h-1} > v_c^h\}$ holds. Therefore, if $\{\tilde{x}_c^{h-1} > 0\}$ holds, then $\{\tilde{x}_c^{h-1} > \tilde{x}_c^h\}$ should hold. And, if $\{\tilde{x}_c^{h-1} = 0\}$ holds, then $\{\tilde{x}_c^h = 0\}$ should hold.

Using Lemma 1, we derive SPNE in *IL*. Let x_c^{i*} and X_c^* denote, respectively, the effort level of citizen *i* and the group's total effort level, at equilibrium. Lemma 2 summarizes our results.

Lemma 2: *At SPNE in IL, the total effort level of the citizens' group equals the effort level of the hungriest citizen, who most highly values the environmental damages. That is,* $X_c^* = x_c^{1*} \geq 0$.

Proof: Suppose $\{X_c^* > x_c^{1*}\}$. Then, by Lemma 1, $\{X_c^* > x_c^{1*} \geq x_c^{h*}\}$ holds for $h=2,\cdots, I$. Thus, $\{x_c^{1*} \geq x_c^{h*}\}$ should hold. Consider $\{x_c^{1*} > x_c^{h*} > 0\}$. Looking at Assumption 1 and the first-order condition (7), we know $\{v_c^1/2(X_cV_c)^{1/2} - 1 = 0\}$ and $\{v_c^h/2(X_cV_c)^{1/2} - 1 < 0\}$. Therefore, by Equation (8), $\{x_c^{h*} = 0\}$ should hold, which contradicts $\{x_c^{h*} > x_c^{h*} > 0\}$. This results in the following two findings: (a) $\{x_c^{1*}>0\}$ implies $\{x_c^{h*}=0\}$, while, by Lemma 1, $\{x_c^{1*}=0\}$ implies $\{x_c^{h*}=0\}$; (b) $\{X_c^*=\sum_{i=1}^{I}x_c^{i*}\}$ holds in SPNE. By combining (a) and (b) above, we find that $\{X_c^*=x_c^{1*}\geq 0\}$ holds in SPNE.

Using Equations (5) and (7), we obtain SPNE in *IL* as in Proposition 1.

Proposition 1: *At SPNE in IL, equilibrium solutions are as follows:*
The effort level of citizen 1: $x_c^{1*}=(v_c^1)^2/4V_c$
The effort level of citizen h: $x_c^{h*}=0$, *for* $h=2,\cdots, I$
The effort level of the firm: $x_f^*=v_c^1(2V_c-v_c^1)/4V_c$
The combined effort level of all litigants (citizens and the firm): $T^*=v_c^1/2$
The probability of winning for the citizens' group: $p_c^*(X_c^*, x_f^*)=v_c^1/2V_c$
The expected payoff for citizen 1: $\pi_c^{1*}=(v_c^1)^2/4V_c$
The expected payoff for citizen h: $\pi_c^{h*}=v_c^1v_c^h/2V_c$, *for* $h=2,\cdots, I$
The expected loss of the firm: $L_f^*=v_c^1(4V_c-v_c^1)/4V_c$

IV. SPNE in the Collective Litigation

In Section IV, we first consider *CL-NR* and then move onto *CL-AR*. Our *CL* models are characterized as follows: (i) the citizens' group is treated as a single entity competing with the firm to win V_c; (ii) the total effort level of the citizens' group is allocated to each citizen in accordance with the proportion of his damages, *i.e.*, $\{(v_c^i/V_v)X_c=x_c^i\}$; and (iii) in *CL-AR*, the losing firm has to reimburse the citizens for their legal expenditures.

If citizen *i*'s expected payoff in *CL* exceeds that in *IL*, he prefers participating in the collective litigation. If this prevails for all citizens, then free-riding vanishes.

A. Collective Litigation with No-Reimbursement

Let us consider the case of *CL-NR*. The total expected payoff for the citizens' group is:

$$\bar{\pi}_c=\sum_{i=1}^{I}(p_cv_c^i-x_c^i)=p_cV_c-X_c \tag{9}$$

The expected loss of the firm in *CL-NR* is equivalent to that in *IL* as discussed in Section III. That is, $\{L_f=p_cV_c+x_f\}$ holds. *CL-NR* solution requires that the group selects X_c to maximize the total expected payoff subject to the firm's reaction function, $R_f(X_c)=-X_c+(X_cV_c)^{1/2}$.

$$\max\ \bar{\pi}_c=p_cV_c-X_c$$
$$\text{s.t. } R_f(X_c)=-X_c+(X_cV_c)^{1/2} \qquad (10)$$

Let $\hat{X}_c$ denote the best response of the citizens' group. The first-order condition for this problem is:

$$\partial\bar{\pi}_c/\partial X_c=V_c/2(X_cV_c)^{1/2}-1=0, \qquad \text{for } \hat{X}_c>0 \qquad (11)$$

or

$$\partial\bar{\pi}_c/\partial X_c=V_c/2(X_cV_c)^{1/2}-1\leq 0, \qquad \text{for } \hat{X}_c=0 \qquad (12)$$

The total expected payoff function is strictly concave in the group's total effort level. That is, a unique solution exists for the group's maximization problem.

We assume, as described earlier, that citizen i's effort level is determined in accordance with the sharing rule $\{(v_c^i/V_v)X_c=x_c^i\}$. Using Equations (5), (11), and (12), we obtain SPNE as the citizens' group chooses a positive value for $\hat{X}_c$. The following proposition summarizes the results.

Proposition 2: *At SPNE in CL-NR, equilibrium solutions are as follows:*
The effort level of citizen i: $x_c^{i**}=v_c^i/4$, *for* $i=1, 2, \cdots, I$
The total effort level of the citizens' group: $X_c^{**}=V_c/4$
The effort level of the firm: $x_f^{**}=V_c/4$
The combined effort level of all litigants: $T^{**}=V_c/2$
The probability of winning for the group: $p_c^{**}(X_c^{**}, x_f^{**})=1/2$
The expected payoff for citizen i: $\pi_c^{i**}=v_c^i/4$, *for* $i=1, 2, \cdots, I$
The expected loss of the firm: $L_f^{**}=3V_c/4$

B. Collective Litigation with Asymmetric Reimbursement

We now consider the case of *CL-AR*. The goal of *AR* is to promote citizen suits by reducing the financial risks of these "private attorney generals" by repaying their costs for discovery, investigation, court costs, and support staff if they win (Baik and Shogren 1994).

Let us consider the reimbursement ratio β, while assuming $\{0<\beta<1\}$.[7] In case the citizens' group wins the environmental damages, the firm has to reimburse βX_c while citizen i receives βx_c^i.

The total expected payoff for the group now becomes:

$$\bar{\pi}_c=\sum_{i=1}^{I}(p_c(v_c^i+\beta x_c^i)-x_c^i)=p_c(V_c+\beta X_c)-X_c \tag{13}$$

The expected loss of the firm is expressed as:

$$L_f=p_c(V_c+\beta X_c)-x_f \tag{14}$$

The firm minimizes its expected loss. Assuming that the firm spends a non-zero effort level, standard calculation gives the first-order condition $\{-X_c(V_c+\beta X_c)/(X_c+\tilde{x}_f)^2+1=0\}$. The second-order condition is found met. By solving this equation we derive the firm's reaction function, $R_f(X_c)$.

$$R_f(X_c)=-X_c+(X_c(V_c+\beta X_c))^{1/2} \tag{15}$$

Subject to $R_f(X_c)$, the citizens' group now selects X_c to maximize the group's total expected payoff.

$$\begin{aligned}&\max\ \bar{\pi}_c=p_c(V_c+\beta X_c)-X_c\\&\text{s.t. } R_f(X_c)=-X_c+(X_c(V_c+\beta X_c))^{1/2}\end{aligned} \tag{16}$$

Let $\check{X}_c$ denote the best response of the citizens' group. The first-order condition for this problem is:

$$\partial\bar{\pi}_c/\partial X_c=(V_c+2\beta X_c)/2(X_c(V_c+\beta X_c))^{1/2}-1=0, \qquad \text{for } \check{X}_c>0 \tag{17}$$

or

$$\partial\bar{\pi}_c/\partial X_c=(V_c+2\beta X_c)/2(X_c(V_c+\beta X_c))^{1/2}-1\leq 0, \qquad \text{for } \check{X}_c=0 \tag{18}$$

The total expected payoff function is strictly concave in the group's

[7] "If $\beta=0$, the model collapses to Tullock (1980)'s traditional model of a rent-seeking contest where reimbursement is nonexistent. As β approaches unity, reparations approach complete reimbursement of effort." See Baik and Shogren (1994, p. 3).

total effort level. That is, a unique solution exists for the group's maximization problem.

As in IV-*A*, we assume that citizen *i*'s effort level is determined in accordance with the sharing rule $\{(v_c^i/V_v)X_c=x_c^i\}$. Using Equations (13), (14), (15), and (16), we obtain SPNE as the citizens' group chooses a positive value for $\check{X}_c$. The following proposition summarizes the results.

Proposition 3: *At SPNE in CL-AR, equilibrium solutions are as follows:*
The effort level of citizen i: $x_c^{i***}=(1-\sqrt{1-\beta})v_c^i/2\beta\sqrt{1-\beta}$, *for* $i=1, 2, \cdots, I$
The total effort level of the citizens' group: $X_c^{***}=(1-\sqrt{1-\beta})V_c/2\beta\sqrt{1-\beta}$
The effort level of the firm: $x_f^{***}=(1-\sqrt{1-\beta})V_c/2\beta$
The combined effort level of all litigants: $T^{***}=V_c/2\sqrt{1-\beta}$
The probability of winning for the group: $p_c^{***}(X_c^{***}, x_f^{***})=1/(1+\sqrt{1-\beta})$
The expected payoff for citizen i: $\pi_c^{i***}=(1-\sqrt{1-\beta})v_c^i/2\beta$, *for* $i=1, 2, \cdots, I$
The expected loss of the firm: $L_f^{***}=(-1+2\beta+\sqrt{1-\beta})V_c/2\beta\sqrt{1-\beta}$

V. Discussion and Conclusion

Employing the Stackelberg model, we assumed that each citizen first reveals his environmental damages to the court and the firm follows. As evident in Proposition 1 for *IL*, we arrived at the same conclusion as with the Cournot model of the previous studies. That is, citizens' participation in the conflicts is characterized by the *public good* nature while free-riding prevails except for the hungriest player. This phenomenon, due to the assumption $\{V_c>v_c^1\}$, gives rise to the result that the citizens' group is the underdog with less than 50% chance of winning the suit.[8]

Comparing Proposition 1 with Proposition 2, we observe the following. First, due to the assumption $\{V_c>v_c^1\}$, the expected payoff for citizen 1 in *CL-NR* $\{\pi_c^{1**}=v_c^1/4\}$ surpasses that in *IL* $\{\pi_c^{1*}=(v_c^1)^2/4V_c\}$. Second, with the proviso that $\{V_c>2v_c^1\}$ holds, the expected payoff for the other citizens in *CL-NR* $\{\pi_c^{h**}=v_c^h/4\}$ is larger than that in *IL* $\{\pi_c^{h*}=v_c^1v_c^h/2V_c\}$.

Lemma 3 summarizes the above results.

Lemma 3: *In CL-NR,* (*i*) *the citizen who most suffers from the*

[8] Define the favourite as the player with greater than a 50% of winning and the underdog as the player with less than a 50% of winning (Dixit 1987).

environmental damages always prefers CL-NR to IL. (ii) the other citizens participate in CL, if $\{V_c > 2v_c^1\}$ *holds. (iii) The citizens' probability of winning is* $1/2$*, if* $\{V_c > 2v_c^1\}$ *holds. In short, if* $\{V_c > 2v_c^1\}$ *holds, CL-NR encourages all citizens to participate in the collective litigation while fixing the citizens' probability of winning at* $1/2$.

Lemma 3 indicates that, as the collective litigation is instituted, all citizens are to participate in the environmental conflicts with the proviso that the total damages of the citizens' group are sufficiently larger than the damages of the hungriest citizen.

Let us now compare Propositions 1, 2, and 3 with each other, to obtain the following implications.

First, the expected payoff of citizen 1 in *CL-AR* $\{\pi_c^{1***} = (1 - \sqrt{1-\beta})v_c^1/2\beta\}$ is always larger than that in *CL-NR* $\{\pi_c^{1**} = v_c^1/4\}$ and that in *IL* $\{\pi_c^{1*} = (v_c^1)^2/4V_c\}$.

Second, if $\{V_c > \beta v_c^1/(1-\sqrt{1-\beta})\}$ holds, due to the assumption $\{0 < \beta < 1\}$, the other citizens' expected payoff in *CL-AR* is larger than that in *CL-NR* and that in *IL*. This is because citizen h's expected payoff in *CL-AR* $\{\pi_c^{h***} = (1-\sqrt{1-\beta})v_c^h/2\beta\}$ is larger (i) than that in *CL-NR* $\{\pi_c^{h**} = v_c^h/4\}$, if $\{0 < \beta < 1\}$ holds; and (ii) than that in *IL* $\{\pi_c^{h*} = v_c^1 v_c^h/2V_c\}$, if $\{V_c > /\beta v_c^1/(1-\sqrt{1-\beta})\}$ holds.

Third, the aforementioned condition $\{V_c > /\beta v_c^1/(1-\sqrt{1-\beta})\}$ develops to be satisfied as β approaches unity. It is due to the assumption $\{V_c > v_c^1\}$ and the consideration of $\{\lim_{\beta\to 1}(\beta v_c^1/(1-\sqrt{1-\beta})) = v_c^1\}$. Consequently, as β approaches unity, all citizens in the group come to prefer *CL-AR* to *CL-NR* and *IL*. That is, as β approaches unity, employment of *AR* succeeds in persuading all citizens from free-riding to participation in the collective litigation.

Fourth, the group's probability of winning in *CL-AR* $\{p_c^{***}(X_c^{***}, x_f^{***}) = 1/(1+\sqrt{1-\beta})\}$ is higher than that in *CL-NR* $\{p_c^{**}(X_c^{**}, x_f^{**}) = 1/2\}$, which is higher than that in *IL* $\{p_c^{*}(X_c^{*}, x_f^{*}) = v_c^1/2V_c\}$.

Fifth, if $\{V_c > 2v_c^1\}$ holds and thus all citizens participate in *CL*, the combined effort level of all litigants in *CL-AR* $\{T^{***} = V_c/2\sqrt{1-\beta}\}$ is larger than that in *CL-NR* $\{T^{**} = V_c/2\}$, which is larger than that in *IL* $\{T^{*} = v_c^1/2\}$.

The contribution of this paper lies, most importantly, in providing policy implications with regard to *AR*. Before *AR* is incorporated, satisfaction of $\{V_c > 2v_c^1\}$ is a prerequisite for all citizens to participate in the collective litigation. Once *AR* is coupled with collective litigation, however, citizens' incentives are markedly strengthened to eschew free-riding and to pursue litigation. As the reimbursement ratio (β) approaches unity, *AR* comes to recruit all citizens to the collective litigation with no more provisory clauses, while keeping the group's probability of winning above the levels attainable with *IL* or *CL-NR*.

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