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Abstract: This paper examines the deterrence properties of aggregate litigation and class actions, with an emphasis on positive value claims. In the multiple victim scenario with positive value claims, the probability that an individual victim will bring suit falls toward zero with geometric decay as the number of victims increases. The reason is that the incentive to free ride increases with the number of victims. Deterrence does not collapse but is degraded. Undercompliance is observed, which worsens as the number of victims increases. Compliance is never socially optimal, and the shortfall from optimality increases with the number of victims. These results, which continue to hold even if victims anticipate being joined in a single forum, suggest a more nuanced and potentially more robust justification for the class action than has hitherto been provided. Implications for collusive settlements of class action litigation are discussed.

JEL Classifications: K40, K41, K42, K22, D74

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1. Introduction

Rights without remedies have been viewed as anomalies in the law. As a result, the class action, permitting one or several litigants to sue on behalf of a large group of victims, developed as a means of providing a remedy in multiple-victim settings where individual incentives to sue are inadequate.

Class action lawsuits fall into two categories: those consisting of negative expected value claims, where the expected individual recovery is less than the claimant's cost of litigation (for example, consumer claims), and those consisting of positive expected value claims (for example, securities claims). For negative expected value claims, aggregation within the class action is necessary to create a suit with a positive expected value. This has been the fundamental justification for class actions (Coffee 2015).[1] For positive expected value claims, the social desirability of the class action is less clear because every claimant can profitably bring his own lawsuit.[2] To be sure, the literature has offered theories to justify positive claim class actions on social welfare grounds.[3] Still, despite the importance of the topic as evidenced by the passage of two federal statues regulating class actions,[4] the law and economics literature has given relatively little attention to the deterrence properties of aggregate litigation and class actions.[5]

This paper examines the deterrence properties of aggregate litigation and class actions,

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[1] Posner makes the same point in Eubank v. Pella Corp., 753 F.3d 718 (7th Cir. 2014) ("The device is especially important when each claim is too small to justify the expense of a separate suit, so that without a class action there would be no relief, however meritorious the claims.")

[2] Most discussions assume risk neutral agents who sue whenever the expected value of the claim is positive. If, instead, subjective preferences are taken into account, the welfare effects of both negative and positive value claim aggregation would be difficult to assess. Aggregation might benefit those who would prefer to sue but do not do so because of a lack of information on the existence of a potential claim, but might injure those who are informed but would prefer not to sue (Eisenberg and Miller, 2004, at 1529-30).

[3] See Spier (2002) and Bone (2003) on efficiency in reducing litigation costs and management of externalities in limited fund litigation. Rosenberg and Spier (2014) examine incentives to invest in litigation, and specifically the class action's ability to equalize investment incentives for plaintiffs and defendants. Che and Spier (2008) examine settlement pathologies in multiple plaintiff settings with a fixed cost of litigation shared among plaintiffs.

[4] The Class Action Fairness Act of 2005 and The Private Securities Litigation Reform Act of 1995.

[5] Among the relatively few exceptions are Bone (2003) and Ulen (2011). The formal economic analyses have tended to focus on ex post settlement incentives. Che and Spier (2008) examine the settlement process and discuss implications of their analysis for injurer incentive dilution. This paper's model, by contrast, focuses on ex ante incentive effects, and particularly the influence of litigation costs (Shavell, 1982; Hylton, 1990).

with an emphasis on positive value claims. Its core finding is that in the multiple victim scenario with positive value claims, the probability of individual suit goes to zero with geometric decay as the number of victims increases. This is due to strategic behavior, as the incentive to free ride (that is, wait for another litigant to first establish liability) increases with the number of victims. Deterrence does not collapse, as in the case of negative value claims, but is degraded.

Undercompliance is likely and becomes the norm as the number of victims increases. This is because free riding reduces aggregate liability below aggregate social harm. The difference can be made up only if the litigation cost burden on the defendant increases sufficiently with the number of victims. But the litigation cost burden threatened by any particular victim shrinks to zero in the limit because of free riding.

Compliance with the law is always less than socially optimal, and the shortfall from social optimality increases with the number of victims. This is a fundamental problem – again attributable to strategic behavior – that can be solved most effectively through the class action device. In theory, fee shifting could also solve the underdeterrence problem, but in reality it is unlikely that any fee shifting scheme could completely remove the incentive to free ride among victims.

The free riding result holds even if the first-filing victims anticipate joining in a single action. The reason is that although joinder reduces litigation costs, it does not eliminate the incentive to free ride and the resultant undercompliance. Counterintuitively, joinder can actually weaken deterrence under some conditions.

The core results of this paper suggest a more nuanced and potentially more robust justification for the class action.[6] In addition, the results have implications for the effectiveness of class action litigation. The problem of collusive "settlements," where the class action attorney terminates the action in exchange for a side payment from the defendant, appears to be governed by the same dynamics as the private litigation incentive. The incentive to free ride implies that the probability of any individual plaintiff choosing to monitor approaches zero as the class size expands, and further the probability of monitoring by any class member falls as the cost of monitoring rises relative to the individual payout.

I also examine the deterrence properties of litigation and class actions when the award

[6] To be sure, the literature examining settlement incentives in the multiple plaintiff setting offers important justifications for class actions (Spier, 2002, Che and Spier, 2008). The justifications implied in that literature follow from inefficiencies in the settlement process. In this paper, by contrast, the justification for class actions follows essentially from the problem of free riding in the decision to sue. In particular, because I find that settlement is precluded by positive transaction costs when the number of victims is large (because free riding depresses expected liability to the minimum of the settlement range), the findings here on ex ante incentives are independent of settlement pathologies.

is unequal to the harm, common in the consumer protection field where plaintiffs often seek statutory damages. Supra-compensatory damages can enhance welfare by removing the litigation cost hurdle that induces free riding, but can also result in excessive deterrence. Supra-compensatory damages class actions enhance welfare only if the award is less than the sum of the harm and the plaintiff's cost of litigation.

Lastly, I consider the model's implications for some issues in securities litigation, such as free riding among institutional investors, opting out, and the likely result of abolishing securities class actions. The model suggests a method of measuring the potential compliance value of class actions consisting of positive value claims.

Part 2 presents the basic model. Part 3 examines the effects of private litigation with multiple victims on incentives to comply with the law and on the social optimality of compliance. Part 3 illustrates the geometric decay of deterrence and also demonstrates that compliance is socially inadequate in the multiple victim private litigation setting. Part 4 considers the implications of permissive joinder of plaintiffs. Part 5 discusses extensions and implications of the basic model.

2. Basic Model

There are $n > 1$ victims. The injurer imposes a loss on each of v, and each faces a litigation cost $c_p > 0$. The injurer/defendant bears litigation cost $c_d > 0$. The injurer can take care, incurring a cost of $x > 0$. If the injurer does not take care, the probability of injury to each victim is $p > 0$. If the injurer does take care, the probability of injury to each victim is q, where $p > q$.

The injurer has sufficient assets to compensate all of the victims. Liability is strict, and the injury to each victim arises from a single transaction.[7] Thus, proof of liability by one victim/plaintiff establishes liability for any other victim.[8] Put in legal terms, there is one common issue of fact and law (did the injurer comply with the law?) that the court will consider to determine liability to all victims who sue.

Victims have "negative value claims" if $v \leq c_p$ (victims do not sue when indifferent)

[7] Strict liability is associated with many of the areas in which the availability of the class action has made litigation likely: for example, securities litigation (Section 10b5 securities fraud lawsuits), consumer fraud (e.g., Truth in Lending Act, Fair Debt Collection Practices Act, etc.), environmental litigation (e.g., Comprehensive Environmental Response, Compensation, and Liability Act (also known as Superfund)).

[8] In legal terms, this model assumes *offensive estoppel (issue preclusion)*: having been found guilty of the violation in one lawsuit, the defendant is precluded from relitigating liability in a later lawsuit arising from the same transaction. On offensive issue preclusion, see Parklane Hosiery Co. v. Shore, 439 U.S. 322 (1979). Che and Yi (1993) examine an asymmetric information model of litigation with issue preclusion, finding that the first plaintiff can extort a large settlement.

and positive value claims if $v > c_p$.[9] Equivalently, letting $\lambda = c_p/v$, claims are negative if $\lambda \geq 1$, and positive if $\lambda < 1$. Adopting a parallel notation for defendants, for simplicity of expression, let $\theta = c_d/v$.

2.1. Litigation

Litigation is highly plausible in this scenario because of the transaction costs of settling numerous claims. Still, it is worthwhile to consider the precise sorts of costs that obstruct settlement.

First, note that if claims have negative value ($\lambda \geq 1$), no victim will sue, and the injurer will not take care, which is the traditional justification for class actions. For the remainder I assume that victims have positive claims.

Second, since the defendant's total trial cost $v+c_d$ exceeds the award v, the defendant would default unless there were significant costs incurred by doing so. I assume therefore that the defendant's cost of default is greater than c_d,[10] so that the defendant will not choose to default when a claim is filed in court.

Litigation results in this model – or, equivalently, settlement does not occur – because of the peculiar incentives of multiple victims and the transaction costs of settlement. The transaction costs consist of the costs of negotiation and "holding out" by victims.[11]

Consider the following sequence. In the first stage, the injurer decides whether to make a settlement offer simultaneously, and publicly observable, to all victims.[12] In the second stage, the victims decide simultaneously and noncooperatively whether to accept the offer, or to reject and hold out for more. If a victim accepts, the dispute between the accepting victim and injurer comes to an end. If a victim "holds out," he makes a counteroffer to the defendant. In the third stage, the victim's counteroffer is accepted by the defendant or the parties proceed to litigation. In the fourth stage, after having committed to litigation, the victim chooses either to "Sue" or to "Wait," where the former strategy involves suing immediately and the latter involves waiting to take advantage of legal precedent created by an earlier plaintiff. If the victim sues his payoff is $v - c_p$. If the victim waits and some other victim sues, the waiting victim

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[9] I assume the lawyer and victim act as a merged entity, so agency costs do not drive a wedge between the lawyer's and the victim's incentive to litigate.

[10] There are several plausible interpretations of the default cost. One is to treat v as the expected award after consideration of evidence from both parties on damages, where the default cost consists of an upward bias in v because of the absence of countervailing evidence in default. Another cost is to the reputation of a defendant who fails to respond to a court summons.

[11] Rave (2013) discusses the holdout problem as a factor driving litigation in the multiple victim setting.

[12] Che and Spier (2008) examine discriminating public offers in the multiple plaintiff setting. Daughety and Reinganum (1999) examine private offers. I assume offers are public and common to all.

receives v because he avoids the cost of proving liability. If all victims wait, their payoffs equal zero, because evidence has grown stale and no prior litigant has used the evidence to prove the defendant's violation. Transaction costs prevent victims from coordinating in advance.[13]

Examining pure strategies, there are multiple equilibria in the final period: specifically, any outcome in which one victim sues and the others wait. Considering (symmetric) mixed strategies, the victim chooses a probability of suit, a, that equalizes the payoff from suing, $v – c_p$, and that from waiting.[14] Since waiting has a positive reward only if some other victim sues, the payoff from waiting is $[1-(1-a)^{n-1}]v$. The equilibrium suit probability is therefore $a^* = 1 - \lambda^{\frac{1}{n-1}}$.

Given a^*, will the parties settle? The minimum settlement offer is $a^*(v – c_p) + (1- a^*)[1-(1- a^*)^{n-1}]v = v – c_p$. However, because some victims wait, the expected gain from settlement is small and disappearing with n.[15] *Thus, even minimal transaction costs preclude settlement in the large numbers case*. In the small numbers case, given the offer $v – c_p$, the victim has a weakly dominant strategy to hold out. The injurer could lessen this incentive by raising the offer, but the victims' tendency to wait constrains the scope for such an increase.[16] Modest transaction costs should be sufficient to eliminate the gain from settlement. Hence, injurers refuse to make offers in the first stage, resulting in litigation.

Proposition 1: *For multiple positive claim victims, the equilibrium probability of suit by a victim is* $a^* = 1 - \lambda^{\frac{1}{n-1}}$. *Thus, as the number of victims goes to infinity, each victim's probability of suing goes to zero.*

This is a version of the "bystander effect," which explains why the probability of a bystander coming to the aid of a person in distress falls as the number of bystanders

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[13] See Bone (2011), which also notes that the incentive to free ride will hinder any effort to communicate among victims to form the equivalent of a class lawsuit through voluntary joinder.

[14] Symmetry is easy to justify given that the victims are the same. Justifying mixed strategies is admittedly not as straightforward. With respect to individual incentives, it is plausible that a lawyer would have an incentive to randomize because a pure strategy of suing every time would induce the other lawyers to free ride, see Reinganum (2008). An alternative justification is the following selection argument: if all lawyers sue immediately, then some lawyers could gain by waiting, and thus there would be some percentage of "waiters" at which the expected profit advantage from waiting fully dissipates. Finally, the mixed strategy assumption generates simple and plausible comparative statics that are consistent with more complex pure strategy analyses of the public-good-provision problem at the base of this paper, see Bilodeau and Slivinski (1996).

[15] See appendix, part A.

[16] Id.

increases (Darley and Latane, 1968; Diekmann, 1985; Leshem and Tabbach, 2016). Here, the victim, deciding when to sue, focuses only on the payoff from suing immediately relative to that for waiting. For any given suit probability, the payoff from waiting increases with the number of victims. In the limit, this incentive to free ride causes the individual suit probability to go to zero.

2.2. Effect of Change in Award or Cost

As one would expect, the equilibrium individual suit probability is decreasing in the plaintiff's cost of litigation.[17] In addition, the larger is the plaintiff's litigation cost (provided it is less than the award), the smaller is the negative impact of its increase on the equilibrium suit probability.[18] This is intuitive given the existence of a limit where the plaintiff's cost is equal to the award, beyond which suits will not be brought. As the cost approaches the award, the sensitivity of the equilibrium suit probability to changes in the cost tapers off.

The equilibrium suit probability increases with the award.[19] This positive effect increases with the size of the award and decreases with the plaintiff's litigation cost. Not surprisingly in view of the free rider incentive, as the number of victims increases, the sensitivity of the equilibrium suit probability to changes in either the award or the litigation cost goes to zero.

2.3 Expected Liability

The question generated by the finding that the individual suit probability goes to zero is whether deterrence collapses in the same manner. If the injurer's expected liability decays as strongly as the individual suit probability then deterrence would inevitably collapse, and the justification for class actions in the positive value setting would be indistinguishable from that in the negative value setting. However, deterrence is a function of both the individual suit probability and the number of victims.

The injurer's expected liability is[20]

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[17] $\frac{\partial a^*}{\partial c_p} = \left(\frac{-1}{n-1}\right)\lambda^{\frac{1}{n-1}}\left(\frac{1}{c_p}\right) < 0$

[18] This is because

$$\frac{\partial^2 a^*}{\partial {c_p}^2} = \left(\frac{n-2}{(n-1)^2}\right)\lambda^{\frac{1}{n-1}}\left(\frac{1}{{c_p}^2}\right)$$

which is positive for $n > 2$, and zero for $n = 2$.

[19] $\frac{\partial a^*}{\partial v} = \left(\frac{1}{n-1}\right)\lambda^{\frac{1}{n-1}}\left(\frac{1}{v}\right) > 0$

[20] This answer can be arrived at intuitively, since the injurer avoids liability only in the outcome where everyone waits. The laborious route is as follows:

$$E(L) = \binom{n}{0} a^n \cdot (nv + nc_d) + \binom{n}{1} a^{n-1}(1-a)^1 \cdot (nv + (n-1)c_d) + \cdots + \binom{n}{n-1} a^1 (1-a)^{n-1} \cdot (nv + c_d) + (1-a)^n \cdot 0$$

$$E(L) = nv[1-(1-a^*)^n] + nc_d \cdot a^* \tag{1}$$

The first term reflects the discount on expected liability due to free riding and the second captures the total expected defense cost.

Substituting the equilibrium suit probability,

$$E(L) = nv\left[1-\lambda^{\frac{n}{n-1}}\right] + nc_d\left[1-\lambda^{\frac{1}{n-1}}\right].$$

As the number of victims increases,

$$E(L) \to nv(1-\lambda) = nv\left(1-c_p\right).$$

First, this is central to the argument of the previous part that litigation is plausible because of free riding. Second, even though the probability of litigation by an individual goes to zero as the victim pool increases, expected liability remains positive because it depends on the probability that at least one will sue, which falls but stabilizes at 1-λ.

Holding fixed the number of victims, expected liability shrinks to zero as the ratio of the plaintiff's cost to the award gets closer to one. This cost-induced deterrence collapse occurs more rapidly as the number of victims increases.[21]

Expected liability increases as the award increases, both because of the direct effect and because of the indirect effect of increasing the probability of suit. Expected liability falls as the plaintiff's litigation cost increases, because of the effect on the probability of suit.

Given the obstacles to settlement noted earlier, why wouldn't the defendant pay off claims for full value by committing to a *claims resolution facility* (Ayres, 1990)? If the defendant could credibly commit not to defend claims, then the litigation cost

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$$= nv[1-(1-a)^n] + c_d\left[na^n + (n-1)\binom{n}{1}a^{n-1}(1-a) + (n-2)\binom{n}{2}a^{n-2}(1-a)^2 + \cdots + \binom{n}{n-1}a(1-a)^{n-1}\right]$$

$$= nv[1-(1-a)^n] + nc_d\left[a^n + \binom{n-1}{1}a^{n-1}(1-a) + \binom{n-1}{2}a^{n-2}(1-a)^2 + \cdots + \binom{n-1}{n-1}a(1-a)^{n-1}\right]$$

which is equal to the expression for expected liability in the text.

[21] This follows from

$$\frac{dE(L)}{d\lambda} = \left(\frac{-n}{n-1}\right)\left(\lambda^{\frac{1}{n-1}}\right)\lambda\left[nc_p + c_d\right] < 0,$$

which increases in absolute value with *n*.

barrier in the way of victims becoming plaintiffs would disappear. Since the threat of litigation deters claims by maintaining the plaintiff's litigation cost hurdle, a necessary and sufficient condition for litigation to be rational for the defendant is $nv > E(L)$.[22] Substituting the equilibrium suit probability, litigation is rational if

$$\lambda^{\frac{n}{n-1}} > \theta\left[1-\lambda^{\frac{1}{n-1}}\right] \tag{2}$$

which is plausible for small *n* and sure to hold for large *n*.

3. Compliance Incentives

Since deterrence does not collapse because of free riding, the remaining question is whether it is impaired. This part considers first the question of perfect compliance with the legal standard, and second the question of socially optimal compliance.

3.1 Perfect Compliance versus Socially Optimal Compliance

The equilibrium outcome is one of *perfect compliance* (or perfect deterrence, or first-best deterrence) if all injurers for whom

$$x < (p-q)nv \tag{3}$$

choose to take care. This standard, which compares the cost of compliance to the social harm to victims directly resulting from noncompliance, is exemplified by the Hand Formula in tort law and other fault-based tests throughout the law.

Given that litigation is costly, *socially optimal compliance* (or deterrence) occurs when, given a^*,

$$x < (p-q)n[v + a^*(c_p + c_d)] \tag{4}$$

In plain terms, compliance is socially optimal whenever the cost of compliance is less than the marginal social cost of failing to comply, taking into account the expected cost of litigation.

3.1.1 Perfect Compliance

An equilibrium of perfect compliance incentives holds when the social harm from noncompliance is the same as the expected liability from noncompliance:

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[22] This assumes that the claims resolution facility is costless and compensates in full. In reality, such facilities are not costless and do not compensate perfectly, which can distort compliance incentives (Ayres, 1990).

$$(p-q)\cdot nv=(p-q)\{nv[1-(1-a^{*})^{n}]+nc_{d}\cdot a^{*}\} \qquad (5)$$

Undercompliance results if marginal social harm (left side) is greater than marginal liability, and overcompliance if the inequality is reversed. This implies:

Proposition 2: *Undercompliance worsens with the number of victims and eventually becomes the norm as the number of victims gets large. If the injurer can commit to a claims resolution facility (and therefore threaten litigation only when it is rational because aggregate harm exceeds expected liability), then overcompliance is never an equilibrium.*

The proof of this is straightforward. Simplifying (5) and substituting the equilibrium suite probability, undercompliance results if condition (2) holds, and (2) holds more strongly as the number of victims increases.

Undercompliance is due to free riding, whose effect might be mitigated if the litigation cost burden on the defendant could make up for the dilution of liability. But given the vanishing likelihood of individual suit, the litigation cost burden cannot make up for the dilution due to free riding.

From (5), the frontier along which incentives align with the legal standard (perfect compliance) is

$$\frac{\lambda^{\frac{n}{n-1}}}{1-\lambda^{\frac{1}{n-1}}}=\theta$$

which is shown in the Figure 1 simulations below. The zone below the frontier is of undercompliance, and above the frontier, overcompliance. If the defendant can costlessly commit to a claims resolution facility, the overcompliance zone would instead represent perfect compliance. The simulations illustrate the rapid decay in compliance as the number of victims increases.

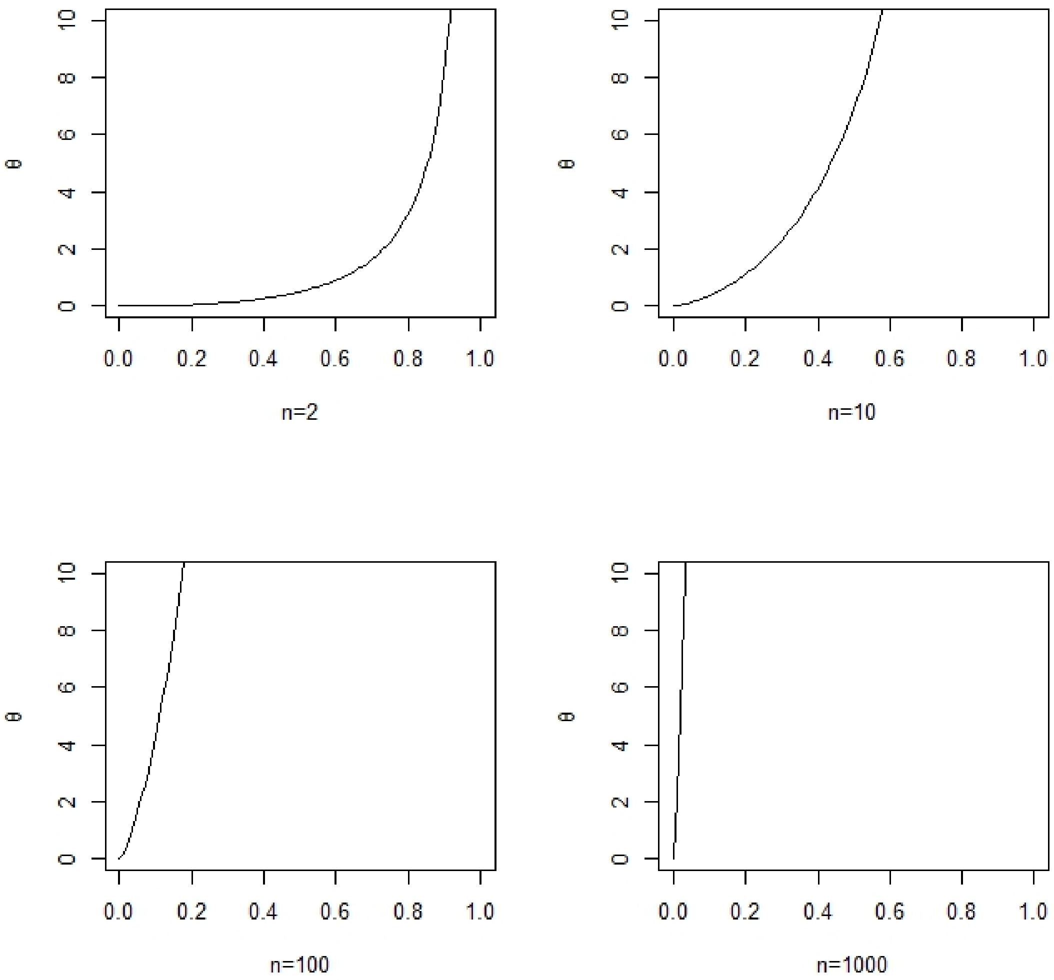

Figure 1: Compliance Effects of Litigation as the Number of Victims Increases

Notes: Horizontal axis: $0 < \lambda < 1$; vertical axis: $0 < \theta < 10$. Area below curve represents undercompliance zone, above represents overcompliance.

3.1.2 Socially Optimal Compliance

For compliance to be socially optimal, the marginal social cost from noncompliance, $(p-q)\cdot n[v+a^*(c_p+c_d)]$, must equal marginal liability, $(p-q)\{nv[1-(1-a^*)^n]+nc_d\cdot a^*\}$. Since the former is greater than the latter this result cannot hold. Thus:

Proposition 3: *Compliance is always less than socially optimal. This is because marginal liability is always less than the marginal social cost of noncompliance. The degree to which compliance falls short of social optimality increases with the number of victims*.

The reason is that the injurer does not expect to pay for all of the harms, given the incentive to wait on the part of victims, and also externalizes litigation costs to plaintiffs.[23] This is similar to the result that strict liability underdeters relative to the social optimum when litigation is costly (Hylton, 1990). However, the strict liability underdeterrence result is due to the fact that litigation costs erect a barrier to some victims by creating negative value claims. Here, litigation costs do not erect a barrier to any victim, because each has a positive claim. It is the strategic interactions among victims that generates social underdeterrence.

Underdeterence potentially could be solved by shifting the plaintiff's costs to the defendant. If such a shift were possible, then there would be no gain to a victim in playing the "wait" strategy. All victims would sue, and the marginal social harm from noncompliance would be equal to marginal liability.[24]

Calculating the welfare loss from socially suboptimal compliance would require information on the distribution of the compliance cost.[25] However, since the welfare loss increases with the wedge between marginal liability and marginal social cost, which is $(p\text{-}q)nc_p$, the loss due to free riding can be attributed generally to three factors: the productivity of care, the size of the victim pool, and the plaintiff's cost of litigation.

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[23] Proposition 3 is obviously true in the negative-value claim scenario, so there is no need to limit its scope to the positive-claim scenario.

[24] There is a separate issue as to whether suit should be barred in order to enhance social welfare. If expected litigation costs exceed the marginal deterrence benefit, then it may be optimal to bar litigation (Shavell, 1982).

[25] Let the distribution be $G(x)$ with corresponding density g; let $\underline{x}$ be the cutoff value equal to marginal liability, (5); and let $\overline{x}$ be the cutoff value equal to marginal social cost of noncompliance, (4). The welfare loss due to suboptimal compliance is

$$\int_{\underline{x}}^{\overline{x}} [(p-q)n[v+a^*(c_p+c_d)] - x]g(x)dx$$

3.2 Example: Two Victims

For two victims, *A* and *B*, the two pure strategy equilibria involve *A* suing and *B* waiting, or vice versa. For the mixed strategy, if *A* sues his payoff is $v - c_p$, and if he waits his payoff is av; thus $a^* = 1 - \lambda$. Perfect compliance equates expected harm and expected liability, $1 = [(1 - \lambda^2) + \theta(1 - \lambda)]$, or $\theta = \frac{\lambda^2}{1-\lambda}$. This is the curve in the upper left of Figure 1, showing the balance between over and undercompliance incentives for different parameter values.

4. Joinder of Plaintiffs

Federal Rules of Civil Procedure 20 provides that plaintiffs may join in one action if "(A) they assert any right to relief jointly, severally, or in the alternative with respect to or arising out of the same transaction, occurrence, or series of transactions or occurrences; and (B) any question of law or fact common to all plaintiffs will arise in the action."

Ex post (i.e., after suit is filed), permissive joinder advantages plaintiffs by reducing their joint litigation expenses.[26] Joinder also reduces defendant's expenses. These effects have complicated implications for incentives. First, from the defendant's perspective, joinder may not be desirable ex ante because it encourages the filing of lawsuits. It would seem that joinder should always be beneficial to plaintiffs ex ante, but it is not necessarily so. By reducing defendant's expenses, joinder may weaken deterrence, harming plaintiffs. When the number of victims is large, however, the joinder and non-joinder policies have similar implications for the probability that an individual victim will sue.

4.1 Probability of Suit with Joinder of Plaintiffs

Proposition 4: *Even with the prospect of joinder, the individual probability of suit approaches zero as the number of victims increases*.

Thus, the free rider incentive remains under joinder, and the probability of individual suit declines as the number of victims increases. The reason is that although joinder reduces the plaintiffs' litigation costs dramatically, it does not eliminate the incentive to wait to allow another victim to establish precedent. Even with permissive joinder of plaintiffs, the victim who waits to file after liability has been established by the first litigants gains. As long as there is an advantage to playing the "wait" strategy, deterrence is compromised. Next, I compare expected liability under joinder and non-joinder.

[26] Given the ex post advantage to plaintiffs, one could interpret the previous analysis of incentives under non-joinder as assuming that transaction costs prevent the plaintiffs from opting for joinder.

4.2 Expected Liability with Joinder of Plaintiffs

Comparing expected liability with joinder to the expectation where there is no joinder,[27]

$$E(L_j) = (1 - (1 - \hat{a})^n)(nv + c_d)$$

$$E(L_{nj}) = n[v(1 - (1 - a^*)^n) + a^* c_d]$$

where $\hat{a}$ is the equilibrium probability of suit given that plaintiffs join and a^* is the equilibrium probability of suit given that plaintiffs do not join. Looking at the two expressions, it is unclear whether joinder of plaintiffs advantages defendants by reducing expected liability – that is, whether $E(L_j) < E(L_{nj})$.

Just as in the non-joinder scenario examined previously, expected liability does not collapse in the joinder scenario as the number of victims increases, even though the probability of individual suit approaches zero. Substituting the equilibrium suit probability in the non-joinder scenario, non-joinder advantages defendants ex ante if

$$(1 - (1 - \hat{a})^n)(nv + c_d) > nv\left[1 - \lambda^{\frac{n}{n-1}}\right] + nc_d\left[1 - \lambda^{\frac{1}{n-1}}\right]$$

or equivalently,

$$\frac{\theta}{n+\theta} + \frac{\lambda^{\frac{n}{n-1}} - \theta\left[1 - \lambda^{\frac{1}{n-1}}\right]}{1 + \frac{\theta}{n}} > (1 - \hat{a})^n$$

which may or may not hold.[28] Thus, it is possible that joinder of plaintiffs could advantage injurers, and thereby reduce social welfare.

Next, I offer an illustration with two victims of the conflict between the ex ante and ex post joinder preferences of injurers. The illustration shows that the comparison between expected liability under joinder and non-joinder is generally ambiguous, depending on the ratio of the plaintiff's cost to the award and the ratio of the

[27] The derivation of $E(L_j)$ starts with the observation that $E(L_j) = \binom{n}{0}a^n \cdot (nv + c_d) + \binom{n}{1}a^{n-1}(1-a)^1 \cdot (nv + c_d) + \cdots + \binom{n}{n-1}a^1(1-a)^{n-1} \cdot (nv + c_d)$.

[28] As n goes to infinity, non-joinder advantages defendants (relative to joinder) if $\lambda > \lim_{n\to\infty}(1 - \hat{a})^n$, which may or may not hold, see appendix proposition 4.

defendant's cost to the award.

4.3 Example: Joinder with Two Victims

For two victims, expected liability under the joinder and non-joinder policies are $E(L_j) = (1-(1-\hat{a})^2)(2v+c_d)$ and $E(L_{nj}) = 2[v(1-(1-a^*)^2)+a^*c_d]$ respectively, where $\hat{a} = 2(1-\lambda)/(2-\lambda)$ and $a^* = 1 - \lambda$. The frontier of (λ, θ) values for which the defendant is indifferent ex ante regarding joinder and non-joinder is the boundary of the shaded region in Figure 2. Within the shaded region, non-joinder is optimal ex ante for the defendant.[29] In the white region, joinder is optimal ex ante for defendants, which could reduce welfare. The implication is that where the defendant's litigation costs are high relative to the plaintiff's, joinder of plaintiffs likely advantages defendants and can weaken compliance incentives relative to non-joinder.

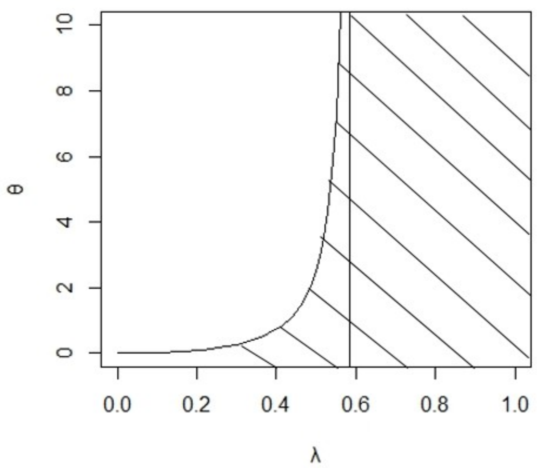

Figure 2: Ex ante versus ex post joinder incentives

4.3 Compliance under Joinder of Plaintiffs

Here I consider perfect compliance and socially optimal compliance under joinder. Recall that undercompliance worsens and becomes the norm as the number of victims increases in the non-joinder setting.

29 $E(L_j) > E(L_{nj})$ in the regions

$$0 < \lambda < 2 - \sqrt{2} \quad and \quad \theta < -\frac{(3-\lambda)\cdot\lambda^2}{\lambda^2 - 4\lambda + 2}$$

$$2 - \sqrt{2} < \lambda < 1 \quad and \quad \theta > -\frac{(3-\lambda)\cdot\lambda^2}{\lambda^2 - 4\lambda + 2}$$

Given that the boundary of the second region is to the right of $\lambda = 1$ for positive ϑ, Figure 2 provides a sufficient picture of the relevant region.

In the joinder setting, victims are more likely to bring suit, which could improve compliance. Under joinder, compliance is less than perfect if $nv > E(L_j)$, or

$$(1-\hat{a})^n > \frac{\theta}{n+\theta}$$

which holds as *n* gets large.[30] Thus, similar to Proposition 2, undercompliance worsens and becomes the norm as the number of victims increases. Although joinder of plaintiffs may improve deterrence in some small numbers settings, the free rider incentive eventually overwhelms the plaintiff cost-reduction effect. Again, if the injurer can commit to a claims resolution facility, overcompliance will not occur.

Consider the question of socially optimal compliance. It follows from the foregoing that social optimality is possible in the small numbers setting, but becomes less and less likely as the number of victims increases. The shortfall from optimality worsens with the number of victims.

5. Extensions

5.1 Limited Fund Litigation

The basic model (2.1) assumes that the defendant has sufficient funds to compensate all victims. In "limited fund" cases, by contrast, there are multiple victims against a defendant with a fund insufficient to compensate all of them (Spier, 2002; Miceli and Segerson, 2005). The standard presumption is that victims race to the courthouse, resulting in unequal levels of compensation (Bone, 2003).[31] If there is only enough to compensate $m < n$, and $k < m$ sue, then waiting could be advantageous if $v\text{-}c_p < (m\text{-}k)v/(n\text{-}k)$, though the standard race returns as *n* increases. This suggests, consistent with Miceli and Segerson, waiting (here, free riding) could occur in the limited fund setting,[32] especially if the fund size correlates with the number of victims. Products liability claims exhibit this trait because the fund for compensation is likely to correlate with the number of victims who purchase the product.[33]

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[30] The left hand side of the inequality does not go to zero (appendix, proposition 4), while the right hand side does go to zero.

[31] Spier (2002), in a careful examination of limited fund litigation, focuses on settlement incentives and finds that externalities among plaintiffs can result in socially inefficient litigation. For two plaintiffs, a race to the collect defendant's assets in settlement occurs only when the correlation between their claims is low. When the correlation is high, settlement is less likely in the Spier model.

[32] Miceli and Segerson (2005), examining tort suits for exposure, find that waiting can occur in equilibrium in the limited fund scenario, where the first wave of exposure suits does not threaten to wipe out the defendant's assets.

[33] Victims in these cases are similar to bank depositors whose withdrawals do not threaten the bank's

5.2 Class Actions and Social Optimality

The class action emerges naturally as a potential solution to the shortfall in deterrence. The class action solves the free riding problem by binding all of the victims into one litigation unit.[34]

One alternative to the class action is litigation cost shifting. If all of the litigation costs borne by victims are shifted to the injurer, then no victim will have an incentive to free ride on the litigation of other victims. However, it would be impossible to shift all of the costs borne by the plaintiff to the defendant. As long as plaintiffs bear some special costs in litigating early, the strategic incentive to wait will remain.

Another alternative to the class action would a memoryless court system in which late-filing victims/plaintiffs would be compelled to relitigate issues even against defendants who would rather settle. This would eliminate the free rider incentive, but it would be infeasible.

Consider the welfare potential of the class action. Although I have assumed all victims have positive claims, I relax this assumption here. Suppose the loss for each victim is the same and governed by the probability density $h(v)$. Since victims bring suit only when $v > c_p$, the marginal social harm from failing to comply is (assuming the class action is not available)

$$(p-q)\cdot n\{E(v)+a^*(c_p+c_d)[1-H(c_p)]\}$$

and marginal liability is

solvency even though its funds are limited, so that bank runs as in Diamond and Dybvig (1983) are unlikely. Breast implant litigation (e.g., Butler v. Mentor Corp. (In re Silicone Gel Breast Implant Prods. Liab. Litig.), MDL-926) and bone screw litigation (e.g., Fanning v. AcroMed Corporation , MDL–1014) provide illustrations.

[34] In theory, permissive joinder might mitigate the free rider problem if courts denied offensive estoppel to late-filing plaintiffs who played the "wait" strategy, as suggested in *Parklane Hosiery*, 439 U.S. at 330. However, this would not eliminate free riding. First, as a preliminary matter, *Parklane Hosiery* appears to deny offensive estoppel to the late-filing plaintiff only when he has waited for the purpose of having two bites at the apple, intending to bring his own claim if the first one fails. The plaintiff who waits simply to wait is not such an opportunistic plaintiff under the theory of *Parklane Hosiery*. Decisions after *Parklane Hosiery* have recognized exceptions to its suggested limit on offensive estoppel. Second, and more importantly, if the defendant knows the outcome of later litigation (i.e., that he will lose) he will settle the follow-on suits, which would induce free riding, whatever the rule on offensive estoppel.

$$(p-q)\{nE(v|v>c_p)[1-(1-a^*)^n]+nc_d\cdot a^*\}[1-H(c_p)].$$

Clearly, marginal social harm remains larger than marginal liability, as in the previous analysis that assumed positive value claims. Availability of the class action alters marginal liability to

$$(p-q)\{nE(v|v>\frac{c_p}{n})+c_d\}[1-H\left(\frac{c_p}{n}\right)]$$

and alters marginal social harm to

$$(p-q)\left\{nE(v)+(c_d+c_p)\cdot[1-H\left(\frac{c_p}{n}\right)]\right\}$$

While, under the class action device, marginal liability is still smaller than marginal social harm for any given number of victims, the ratio of the two approaches one as the number of victim increases. It should be clear that the positive claims scenario is a special case and conforms. This suggests that the class action is the only feasible solution to the welfare loss due to free riding.[35]

This argument also suggests a limitation. Free riding is likely where positive value plaintiffs are alike. Thus, a rule policing class actions for commonality, as in *Wal-Mart v. Dukes*, 564 U.S. 338 (2011), could serve to limit class actions to settings where the deterrence benefit is most probable.

5.2 The Monitoring Problem

An important weakness in the class action device is that a lawyer managing such a suit may have an incentive to take a side payment from the defendant to "settle" (i.e., terminate) the case for a small or trivial payout to the class (Koniak 1995, Macey and Miller 1991).[36] This problem is especially likely for negative-claim classes. For example, suppose the plaintiff's cost of litigation is $11 and each of 100 victims has suffered a loss of $10. No victim would sue on his own. The total class claim is $1000. Since the issues of fact and law are common within the class, the total class litigation cost is only $11. The lawyer, however, might choose to "settle" the case

[35] Awarding supra-compensatory (punitive) damages to the first group of litigants could be another way to blunt the free riding incentive. If the punitive component is at least as large as the cost of litigation, no victims would gain by waiting. However, since courts award punitive damages only in special cases of malicious or reckless conduct, this approach to correcting incentives would fail to blunt free riding in the general case.

[36] In addition, a judge who must approve the settlement of a certified class may not have a strong incentive to reject a collusive settlement, given that any settlement reduces the court's workload (Helland and Klick, 2007).

for a side payment of $200, and an award to the class of only $20.

Indeed, the defendant and the plaintiff's lawyer can always maximize their joint utility by arranging a side payment to terminate the case – that is, a collusive settlement. Thus, if no one monitors the class lawyer, the lawyer's optimal strategy is to take a side payment from the defendant. More generally the probability of a side payment occurring is likely to be the complement of the probability of monitoring: *P*(*side payment*) = 1 – *P*(*monitoring*).

To prevent a collusive settlement, some member of the class must therefore monitor the lawyer. But any such monitor would incur costs to oversee the lawyer while receiving the same benefits as other class members. Class members would therefore free ride on the monitor.

The structure of the class action monitoring game is the same as that of the positive value litigation game analyzed in Part 2. Consider, for example, a class consisting of two victims/plaintiffs, with monitoring cost c_m.

		B's Choice	
		Monitor	Don't Monitor
A's Choice	Monitor	$v-\frac{c_p}{2}-\frac{c_m}{2}, v-\frac{c_p}{2}-\frac{c_m}{2}$	$v-\frac{c_p}{2}-c_m, v-\frac{c_p}{2}$
	Don't Monitor	$v-\frac{c_p}{2}, v-\frac{c_p}{2}-c_m$	0,0

More specifically, this structure is the same as in Proposition 4. For *n* plaintiffs, let

$$\sigma = \frac{c_m}{v-\frac{c_p}{n}}$$

which is the ratio of the cost of monitoring to the payoff to a class member.

Using the same argument as for Proposition 4, the equilibrium monitoring probability within the class, $\tilde{a}$, satisfies

$$\sigma[1-(1-\tilde{a})^n] = \tilde{a}[(1-\tilde{a})^{n-1}]n$$

As the number of plaintiffs within the class increases, the equilibrium probability of a class member choosing to monitor the class attorney approaches zero.[37] However, the equilibrium probability that monitoring occurs is the probability that at least one

[37] This follows from applying the argument in Proposition 4.

member of the class chooses to monitor. This does not fall to zero, but converges to a value less than one. Importantly, the probability of monitoring increases as the ratio of the cost of monitoring to the individual payoff from the class action, σ, decreases.[38]

If the claims are all negative value, the collapse of the class action (due to collusive settlement) that results because of the absence of monitoring would leave the plaintiffs with no other recourse. Their individual claims are worthless. If the claims are all positive value, the collapse of the class action does not deprive the victims of the alternative of pursuing their claims individually. But this returns us to Proposition 1: as the number of victims increases, the incentive to pursue individual positive-value claims falls to zero. A more general proposition emerges: as the number of victims expands, the probability of individual actions falls to zero, degrading deterrence, and the probability of an effective class action weakens, also degrading deterrence.[39]

Monitoring can be restored if the monitor receives an additional payment out of the class award to compensate him for the costs of monitoring.[40] However, if it is the class action lawyer who permits the monitor to receive the award, then incentives for monitoring remain poor. The class action lawyer has no incentive to fund an independent monitor. The lawyer would prefer to appoint a monitor who will give him maximal freedom to take a side payment if he deems such an action desirable.[41]

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[38] Letting $q = (1 - \tilde{\alpha})^n$, the equilibrium monitoring probability condition can be expressed as:

$$\sigma(1-q)(1-q^{\frac{1}{n}}) = nq^{\frac{n+1}{n}}$$

Since $dq/d\sigma > 0$, the probability that at least one plaintiff within the class monitors, $1-q$, falls as σ increases.

[39] The dilution of deterrence described here does not imply that class actions will not be observed. Such lawsuits will continue, but with many ending in collusive settlements. Because the per-victim payoff is lower for negative-claim classes than for positive-claim classes, monitoring is less likely in negative-claim classes. Unmonitored class actions are likely to serve a transfer rather than deterrence function.

[40] On the efficiency of rewards as a solution to the "volunteer's dilemma", see Leshem and Tabbach (2016).

[41] Macey and Miller (1991) propose an auction of the class action right, with the lowest bidder prevailing as appointed counsel, to solve the agency cost problem described here. While such an auction has an appealing simplicity, it would still generate some problems, as noted in Bebchuk (2002). The winning bidder may have erroneously underbid (winner's curse), or may be ill prepared or inadequately motivated to secure a large judgment. Moreover, the initial discovery and framing of a class action may require considerable effort on the part of an attorney. If the right is then auctioned off, after an attorney has developed the claim, it is unclear how the originating attorney will be compensated for his effort, and whether such compensation would be sufficient to encourage future development of claims. The Private Securities Litigation Reform Act of 1995 changed the law in

5.3 Damages Unequal to Harm

Another potential flaw in the class action device arises where the court award exceeds the harm. In some cases victims who have suffered no harm, or very little harm, can obtain statutory damages and pursue class action litigation (Johnston, 2017). Statutory damages provisions are often included in consumer protection statutes. In other cases, the victim pool includes individuals who suffered no harm (Brickman, 2008).

The deterrence implications of aggregate litigation with awards unequal to harm can be examined within the basic model set out previously. Consider the scenario of individual lawsuits. Let D be the damages award for each victim, $\tilde{\lambda} = \frac{c_p}{D} < 1$, and let $\pi = \frac{v}{D}$ be the ratio of the harm to the award. The free rider incentive remains in this scenario. However, the following deterrence result holds.

Proposition 5: *Compliance is socially optimal if and only if the award is equal to the sum of the plaintiff's harm and litigation cost* ($\tilde{\lambda} + \pi = 1$), *excessive if greater* ($\tilde{\lambda} + \pi < 1$), *and inadequate if less* ($\tilde{\lambda} + \pi > 1$).

Damages that precisely compensate for harm is the special case where $\pi = 1$, and compliance is socially inadequate as shown previously. Undercompensation of harm ($\pi > 1$) clearly results in inadequate compliance too. Since the no-harm case has $\pi = 0$, it follows that incentives to comply are socially excessive when there is no harm,[42] the opposite of the underdeterrence result established under the assumption that the award equals harm. The class action device only worsens the excessive compliance

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securities litigation to require federal judges to appoint lead plaintiffs – on the theory that a judge-appointed lead plaintiff would be more effective as a monitor than one chosen exclusively by the attorney (Choi, Fisch, Pritchard 2005). However, even a court-appointed monitor would be afflicted by the free riding incentive and therefore shirk. The empirical evidence indicates that among post-PSLRA lead plaintiffs, only public pension funds appear to achieve above average results (Choi, Fisch, Pritchard, 2005). This raises the question whether such funds are able to secure a greater private benefit from class action participation than other investors (Webber, 2010).

[42] Many of the class actions seeking disclosure or internal monitoring fall in the "no-harm" category, with a remedy that amounts to a positive award to the lawyers. In *In Re Subway Footlong Sandwich Mktg. & Sales Practices Litig*., No. 16-1652 (7th Cir. Aug. 25, 2017), the Seventh Circuit rejected a class action settlement awarding $525,000 to the attorneys. The lawsuit asserted Subway had harmed consumers by selling "Footlong Sandwiches" that sometimes fell short of 12 inches. The Seventh Circuit concluded that the lawsuit yielded no benefit to consumers, who had not been harmed by Subway's practices. For a skeptical analysis of disclosure class actions in merger litigation, see *In Re Trulia, Inc. Stockholder Litigation*, Del.Ch., 129 A.3d 884 (2016).

problem in the no-harm scenario.

When $\tilde{\lambda} + \pi = 1$, the real harm suffered by a prospective litigant is equal to the damages award, so that the award effectively removes the litigation cost hurdle that induces free riding. Generally, the class action can enhance welfare in the case where compliance is socially inadequate. Thus, even when the award exceeds harm, the class action may still be socially desirable if the excess amount is less than the plaintiff's litigation cost (Figure 3).

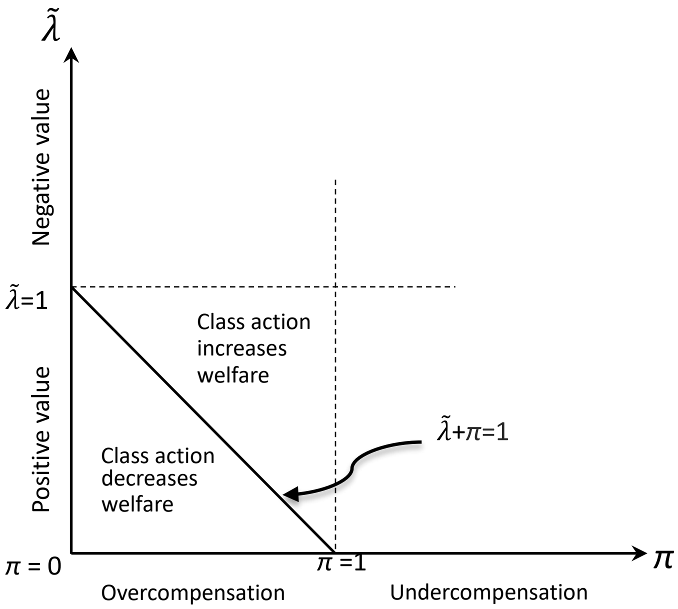

Figure 3: Class actions with awards unequal to harm

5.4 Application to Securities Litigation

Securities litigation is a straightforward application for this model because positive value securities claims (e.g., fraud) available to multiple victims are not unusual. Most shareholders would have negative value claims, but institutional investors are likely to have positive value claims. Moreover, free riding is potentially serious among institutional investors.[43] Webber (2015) describes incentives of institutional investors to assume lead plaintiff status in class actions:

> Fidelity, Vanguard, and TIAA-CREF are some of the largest institutional investors in the world, and undoubtedly have enough exposure to obtain lead-plaintiff appointments if they pursue them. But

[43] On free riding incentives among the major institutional investors (Blackrock, Vanguard, State Street Global Advisors), see Bebchuk and Hirst (2018).

> they don't. First, such funds are concerned about the cost of freeriding competitors, who are also likely to be class members….Hedge funds also avoid the lead-plaintiff role due to freeriding concerns. In addition, hedge funds tend to be secretive about their trading strategies and, thus, may be reluctant to subject themselves to the type of discovery that lead plaintiffs typically endure.

The same free riding would distort incentives of institutional investors to sue in the absence of the class action device. In view of the free riding incentive, this paper's results – specifically the geometric decay shown in Figure 1 – suggest that if the class action device were not available the likelihood of undercompliance with securities laws would worsen with the size of the claimant pool.

Take $E(L)/nv = 1 + \theta - (\lambda+\theta)\lambda^{1/(n-1)}$ as a simple measure of compliance efficiency. If $\lambda = \theta = ½$, then moving from three institutional investors to six reduces compliance efficiency from .79 to .62, that is, by 21 percent.

5.4.1 Positive Theory of Opting Out

Observers of class action litigation have noted that opting out of securities class actions by positive claimants has occurred more frequently, leaving the class consisting of negative claims (Coffee, 2015).[44] The positive claims are large institutional shareholders, with multimillion dollar anticipated awards. The decision to opt out typically occurs *after* a tentative settlement of the class action has been reached. The negative claim class left behind by opt-out litigants is vulnerable to the monitoring problem: no victim has an incentive to monitor, so the lawyer is likely to enter into a collusive settlement.

This model suggests that opting out reflects a type of symbiosis between positive and negative claim subclasses. Recall that, holding the cost of monitoring fixed, monitoring is more likely as the individual payoff increases. The entire combined class moves first, securing the outlines of a settlement through the monitoring of positive claimants, who then peel off to demand better terms. Their ability to demand better terms is facilitated by the negative claimants' credible threat to bring a class action.[45] If the class action were barred, the negative claims would never be credible, and the positive claimants would then each face the strategic game of choosing whether to sue immediately or wait for some other claimant to sue first –

[44] Che (1996) shows that the economics of opting out are potentially more complicated than the adverse selection account. Pure adverse selection, leading to positive value claims opting out, is observed in Che's model only when defendants have complete information on plaintiff claims.

[45] For example, the negative claims enhance the likelihood of satisfying the "superiority" requirement for certification – that is, that a class action be superior to other methods of suit, see Federal Rules of Civil Procedure 23(b)(3).

that is, the scenario of Proposition 1 – with the resultant shortfall in deterrence.

5.4.2 Additional Implications

If the class action were abolished in securities litigation, the positive claimants, institutional investors, might still be compelled to sue because of their fiduciary duty to clients (Webber, 2015). But each firm might defend a decision not to sue immediately on the ground that waiting could lead to a better return for clients than suing immediately. This implies that the decay process modeled here would be observed in spite of the fiduciary duty. Indeed, the fact that securities litigation is almost never seen anywhere in the world in the absence of a class action device is evidence in support of the hypothesis.

The basic model of this paper assumes that some degree of compliance with the law is socially desirable. In the securities field, this is admittedly an empirical question. If compliance is not socially desirable (e.g., no one is harmed), social welfare could be enhanced by prohibiting securities litigation, including class actions (Kraakman, Park, Shavell 1994). Even if some degree of compliance is socially desirable, if the cost of litigation is sufficiently high it may be socially preferable to prohibit litigation (Shavell, 1982). However, if such litigation enhances welfare up to a point, then its disuse or abandonment by victims obviously could be socially undesirable.

6. Conclusion

This paper shows that in the multiple victim scenario where the victims have positive expected value claims, the probability of an individual suit collapses with geometric decay as the number of victims increases. This is because of the incentive to free ride, which increases with the number of victims. In spite of this, the incentive to comply with the law does not collapse (as in the negative value claims scenario), though it is degraded. Undercompliance results, and becomes more severe as the number of victims increases. Compliance is always less than socially optimal. Permissive joinder of plaintiffs, even if it were possible in large numbers, cannot improve on these outcomes. These findings suggest that the class action device may be the only feasible solution to inefficient undercompliance in the multiple victim scenario. However, the very same strategic incentives that suggest that the class action may be socially preferable for deterrence purposes also suggest that class actions are inherently vulnerable to terminating in collusive settlements.

Appendix

A. *Scope for settlement*. Assume positive transaction costs. If $n(v - c_p) < E(L)$, then the injurer, given a choice to settle or litigate, would prefer to settle with each victim for $v - c_p$. This condition holds because

$$n(v - c_p) < E(L)$$

$$n(v - c_p) < nv\left(1 - \lambda^{\frac{n}{n-1}}\right) + nc_d\left(1 - \lambda^{\frac{1}{n-1}}\right)$$

$$0 < (\theta + \lambda)\left(1 - \lambda^{\frac{1}{n-1}}\right) \qquad \text{(A1)}$$

But the right hand side goes to zero as n approaches infinity, so $E(L)$ approaches $n(v - c_p)$, and the gain from settlement diminishes geometrically with the number of victims. Minimal transaction costs would therefore preclude settlement in the large numbers case, and unable to gain from settlement the injurer would not make an offer. Now consider the small numbers case. Given the offer $v - c_p$, the victim has a weakly dominant strategy to hold out for the settlement surplus. To reduce holdouts the injurer could raise the offer to $v - c_p + \delta$, at which holding out would no longer be weakly dominant for the victim. But the scope for such an offer is constrained – for example, if $n = 8$, $\lambda = \theta = ½$, the total surplus as a percentage of aggregate harm (A1) is only 9 percent. Second, transaction costs are likely to be substantial. Consider two victims and let P represent the probability of acceptance instead of holding out. If Z_δ represents the appropriable surplus from holding out given the common offer $v - c_p + \delta$, the proposed mixed strategy satisfies $v - c_p + \delta = P(v + Z_\delta) + (1 - P)(v - c_p)$, and $P = \frac{\delta}{v}(\frac{Z_\delta}{v} + \lambda)^{-1}$. Because of the high holdout probability, modest transaction costs should be sufficient to induce the injurer to forgo making the settlement offer.

B. *Proofs*

Proposition 3: Subtracting marginal liability (5) from marginal social cost (4),

$$(p - q)\{n[v + a^*(c_p + c_d)] - nv[1 - (1 - a^*)^n] - nc_d \cdot a^*\}$$

$$(p - q)[na^*c_p + nv(1 - a^*)^n]$$

Substituting the equilibrium suit probability

$$(p - q)\left[n\left(1 - \lambda^{\frac{1}{n-1}}\right)c_p + nv\lambda^{\frac{n}{n-1}}\right]$$

$$(p - q)nc_p. \blacksquare$$

Proposition 4: If a victim chooses to sue, under joinder, his payoff is:

$$\binom{n-1}{0} a^{n-1}(1-a)^0\left(v-\frac{1}{n}c_p\right)+\binom{n-1}{1} a^{n-2}(1-a)^1\left(v-\frac{1}{n-1}c_p\right)+\cdots+\binom{n-1}{n-1} a^0(1-a)^{n-1}\left(v-c_p\right)$$

If he chooses to wait he gets $v[1-(1-a)^{n-1}]$. Equating the two

$$v-c_p\frac{1}{an}\left[\binom{n}{0} a^n(1-a)^0+\binom{n}{1} a^{n-1}(1-a)^1+\cdots+\binom{n}{n-1} a^1(1-a)^{n-1}+(1-\mathrm{a})^n-(1-\mathrm{a})^n\right]=v[1-(1-a)^{n-1}]$$

$$v-c_p\frac{1}{an}(1-(1-a)^n)=v(1-(1-a)^{n-1})$$

The equilibrium strategy $\hat{a}$ therefore satisfies

$$\lambda=\frac{\hat{a}n(1-\hat{a})^{n-1}}{1-(1-\hat{a})^n}$$

where $\hat{a}(n, \lambda) < 1$. For the case where $n = 2$, $\hat{a} = 2(1-\lambda)/(2-\lambda)$. The equilibrium condition implies that $\hat{a}n$ cannot go to zero or to infinity as n increases. The solution for λ implies $\frac{\lambda}{\lambda+\lim_{n\to\infty}\hat{a}n}=\lim_{n\to\infty}(1-\hat{a})^n<1$. Rewriting the solution:

$$\left(\frac{\lambda}{n}\right)[1-(1-\hat{a})^n]=\hat{a}(1-\hat{a})^{n-1}$$

Given the foregoing, this final expression implies that $\hat{a}$ goes to zero.■

Proposition 5: Marginal liability exceeds marginal social cost if:

$$(p-q)\{n[\pi D+a^*(c_p+c_d)]<nD[1-(1-a^*)^n]-nc_d\cdot a^*\}$$

which is equivalent to $\tilde{\lambda}+\pi<1$. ■

References

Ian Ayres, Optimal Pooling in Claims Resolution Facilities, 53 Law and Cntemporary Problems 159-174 (1990)

Lucian Arye Bebchuk, The Questionable Case for Using Auctions to Select Lead Counsel, 80 Wash. U. L.Q. 889, 890 (2002).

Lucian Arye Bebchuk and Scott Hirst, Index Funds and the Future of Corporate Governance: Theory, Evidence, and Policy, working paper (2018)

Marc Bilodeau and Al Slivinski, Toilet Cleaning and Department Chairing: Volunteering a Public Service, 59 Journal of Public Economics 299-308 (1996).

Robert G. Bone, Civil Procedure: The Economics of Civil Procedure, Foundation Press (2003).

Robert G. Bone, Class Action, in Procedural Law and Economics (Sanchirico, C.W., ed., Edward Elgar (2011).

Lester Brickman, The Use of Litigation Screenings in Mass Torts: A Formula for Fraud, 61 SMU L. Rev. 1221 (2008)

Lester Brickman, Disparities Between Asbestosis and Silicosis Claims Generated by Litigation Screenings and Clinical Studies, 29 Cardozo L. Rev. 513 (2007).

Yeon Koo Che, Equilibrium Formation of Class Action Suits, 62 Journal of Public Economics 339-361 (1996)

Yeon Koo Che and Kathryn E. Spier, Exploiting Plaintiffs through Settlement: Divide and Conquer, 164 J Institutional & Theoretical Economics 4 (2008)

Yeon Koo Che and Jong Goo Yi, The Role of Precedents in Repeated Litigation, 9 J Law, Econ. & Org. 399 (1993)

Stephen J. Choi, Jill E. Fisch, and Adam C. Pritchard, Do Institutions Matter? The Impact of the Lead Plaintiff Provision of the Private Securities Litigation Reform Act, 83 Wash U L Q 869 (2005).

John C. Coffee, Jr Entrepreneurial Litigation: Its Rise, Fall, and Future. (Harvard University Press 2015).

John M. Darley and B. Latane, Bystander Intervention in Emergencies: Diffusion of Responsibility, 8 Journal of Personality and Social Psychology 377-383 (1968).

Andrew F. Daughety and Jennifer F. Reinganum, Hush Money, 30 RAND Journal of Economics, 661-78 (1999).

Douglas W. Diamond and Philip H. Dybvig, Bank Runs, Deposit Insurance, and Liquidity, 91 Journal of Political Economy, 401-419 (1983)

Andreas Diekmann, Volunteer's Dilemma, 29 Journal of Conflict Resolution 611-18 (1985).

Theodore Eisenberg and Geoffrey Miller, The Role of Opt-Outs and Objectors in Class Action Litigation: Theoretical and Empirical Issues, 57 Vand. L. Rev. 1529 (2004)

Henry J. Friendly, Federal Jurisdiction: A General View 120 (1973).

Eric Helland and Jonathan Klick, The Effect of Judicial Expedience on Attorney Fees in Class Actions, 36 J. Legal Stud. 171 - 187 (2007)

Keith N. Hylton, The Influence of Litigation Costs on Deterrence Under Strict Liability and Under Negligence, 10 International Review of Law and Economics, 161-171 (1990).

Jason Scott Johnston, High Cost, Little Compensation, No Harm to Deter: New Evidence On Class Actions Under Federal Consumer Protection Statutes, 2017 Colum. Bus. L. Rev. 1 - 91 (2017).

Susan P. Koniak, Feasting While the Widow Weeps: Georgine v. Amchem Products, Inc., 80 Cornell L. Rev. 1045 - 1158 (1995)

Reinier Kraakman, Hyun Park and Steven Shavell, When are Shareholder Suits in Shareholder Interests? 82 Georgetown L. J. 1733 (1994).

Shmuel Leshem and Avraham Tabbach, Solving the Volunteer's Dilemma: The Efficiency of Rewards Versus Punishments, 18 Am. Law Econ Rev 1-32 (2016).

Jonathan R. Macey and Geoffrey Miller, The Plaintiff's Attorney's Role in Class Action and Derivatives Litigation: Economic Analysis and Recommendations for Reform 58 U Chi L Rev 1. (1991).

Thomas J. Miceli and Kathleen Segerson, Do Exposure Suits Produce a “Race to File”? An Economic Analysis of a Tort for Risk, 36 RAND Journal of Economics 613-627 (2005).

Miller, Geoffrey P., Class Actions, in Newman, Peter (ed.), New Palgrave Dictionary of Economics and the Law I, London: Macmillan Press, pp. 257–62 (1998).

D. Theodore Rave, Governing the Anticommons in Aggregate Litigation, 66 Vanderbilt Law Review 1183 (2013).

Jennifer Reinganum, Comment: Exploiting Plaintiffs through Settlement: Divide and Conquer, 164 J Institutional & Theoretical Economics 24 (2008)

David Rosenberg and Kathryn E. Spier, Incentives to Invest in Litigation and the Superiority of the Class Action, 6 J. Legal Analysis 305-365 (2014).

Shavell, Steven, The Social Versus the Private Incentive to Bring Suit in a Costly Legal System, 11 J. Legal Stud. 333 (1982)

Kathryn E. Spier, Settlement with Multiple Plaintiffs: The Role of Insolvency, 18 Journal of Law, Economics, & Organization, 295-323, (2002).

Thomas Ulen, An Introduction to the Law and Economics of Class Action Litigation, 32 Eur. J. L. & Econ 185 (2011)

David H. Webber, Shareholder Litigation Without Class Actions, 57 Arizona Law Review 201 (2015).

David H. Webber, Is "Pay-To-Play" Driving Public Pension Fund Activism in Securities Class Actions?: An Empirical Study, 90 Boston University Law Review 2031–81 (2010).