Re-Examination of the Efficiency of the Joint and Several Liability System

Yoshiyuki WADA*
Department of Economics, Shiga University

This note shows that both strict liability and negligence rules under the joint and several liability system have appealing characteristics beyond the traditional results given in the literature. Strict liability rules can achieve an efficient incentive effect instead of balancing the budget of damages collected from injurers to compensate for the victim’s loss. Furthermore, negligence rules can in principle achieve both of them.

JEL Classification Numbers: K32, Q52
Keywords: Joint and several liability, Contribution

I. INTRODUCTION

Pollution problems such as air or water pollution are frequently brought about by multiple agents. It is easily imagined that solving this kind of conflicts is more costly and difficult than setting one injurer-one victim cases. In some countries including the U. S. law sets up a device to facilitate them being solved, which is called the joint and several liability. (Let us call it the JSL hereafter).

Since the 1980’s, this legal system has received much attention in the field of law and economics. Both of Landes and Posner (1987) and Shavell (1987) showed fundamental features of this system. Following them, Tietenberg (1989) focused on its economic implications to environmental problems. The fundamental results in these pioneer articles, however, need to be re-examined their validity from a basic viewpoint. We try to reinforce the JSL system by adding merits to it on an efficiency basis. That is, strict as well as negligence rules under the JSL system can overcome their demerits mentioned in the preceding articles under a certain circumstance. They have an ability to obtain characteristics which were denied or ignored in the literature.

The rest of this note is organized as follows. Section II presents terminology and main outcomes concerning the JSL concept in the literature. We reinforce in the above sense both of strict and negligence rules in section III. Section IV closes this note with concluding remarks.

II. TERMINOLOGY AND MAIN OUTCOMES IN THE LITERATURE

We show the necessary terminology and main outcomes (traditional propositions) about the JSL system, which will make the understanding of the following arguments easier.

II-1. Terminology

Every injurer concerned with any pollution which gives the victim damage is possibly held liable for paying the
damages to him. **Joint liability** requires the liable injurers to make the payment of damages as a whole. On the other hand, **several liability** apportions a certain amount of damages to each injurer independently. And the **Joint and Several Liability** decides the damages to be paid by the liable injurers as a whole, but the actual payer(s) need not to be all of the liable injurers. To be extreme, it is possible for one liable injurer to pay the entire amount of damages by himself. Finally, **contribution** allows the liable injurer(s) who make the payment to require those who escape from paying damages to pay the amount to him (them), by which equity among the injurers is to be restored.

### II – 2. Main Outcomes

The JSL system has been studied on the basis of two criteria; (i) incentive effect, (ii) balanced budget, both of which are based on efficiency standard. Incentive effect tests whether an injurer chooses the socially optimal (=efficient) level of his activity which generates pollution (and/or his care to prevent pollution from enlarging). Balanced budget, on the other hand, asserts that total damages collected from injurer(s) should equal the actual loss inflicted on the victim.¹

Applying these criteria to representative two tort rules (strict liability and negligence), the following two results are obtained.

**Result 1**: Under the JSL system, strict liability rule cannot have the efficient incentive effect as long as the budget is balanced.

**Proof**: Suppose that there exist n injurers \(1, \cdots, n\) whose activities generate pollution which in a body gives rise to damage to a victim. Let \(x_i\) \((i = 1, \cdots, n)\) denote activity level by injurer \(i\), and \(D(x_1, \cdots, x_n)\) damage on the part of the victim. Here we take uncertainty into account by letting \(P(x_1, \cdots, x_n)\) be the probability for \(D(x_1, \cdots, x_n)\) to happen.²

Then the social objective to describe the efficient situation is defined as

\[
\text{Max}_{x_i} \sum_i B_i(x_i) - P(x_1, \cdots, x_n) \cdot D(x_1, \cdots, x_n) = \sum_i B_i(x_i) - ED(x_1, \cdots, x_n)
\]

where \(B_i(x_i)\) is net benefit for agent \(i\), that is, benefit minus production cost, both of which his activity causes, \(ED(x_1, \cdots, x_n)\) expected damage for the victim. Differentiating the above equation with respect to \(x_i\) leads to the first order necessary condition to maximize the objective function, which provides the efficient level of \(x_i\) for any \(i\).

Faced with strict liability rule under the JSL system, injurer \(i\) tries to maximize his objective function. That is, he seeks to

\[
\text{Max}_{x_i} B_i(x_i) - q_i ED(x_1, \cdots, x_i, \cdots, x_n)
\]

where \(q_i\) is the probability for injurer \(i\) to be held liable for paying the entire damages, or equivalently the fraction for him to pay of the total damages in the ex ante sense. Assuming \(\sum_i q_i = 1\), which assures the budget is balanced ex ante, the necessary condition for (2) does not coincide with that of (1). ■

**Result 2**: Under the JSL system, negligence rule can have the efficient incentive effect as long as the standard activity levels are set as their efficient ones, but the budget is not balanced (made deficient).

**Proof**: Because each injurer faces total cost schedule which has a bottom at the standard activity level under negligence rule described above, he is willing to choose that level in order to maximize his net benefit in this situation. If all of the injurers are found not liable, however, no damages is collected necessary to finance the resulting loss, \(ED(x_1, \cdots, x_n)\) where \(x_i\) corresponds to the solution of (1). ■
II. REINFORCEMENT OF TWO RULES UNDER THE JSL SYSTEM

In this section, we try to reinforce both of strict liability and negligence rules under the JSL system in the sense that either incentive effect or balanced budget condition is satisfied depending on the conditions shown in Results 1 and 2.

II-1. Strict Liability Rule

As Result 1 shows, strict liability rule under the JSL system involves inefficient incentive effect. If contribution is permitted among injurers, however, that inefficiency can be improved. Suppose that injurer \( i \) should be held liable for paying the entire damages with probability \( q_i \) and not be held liable with probability \( 1 - q_i \) as before. Then if he is held liable because of losing the suit between him and the victim, he would sue other injurer(s) for redeeming the damages he paid to the victim by means of contribution. Let \( \theta_i \) be the probability of winning the suit against the injurer(s) or the fraction of the whole damages he has to incur according to the judgment. On the other hand, if he is proved not liable, he may be sued by injurer(s) who was (were) held liable in the judgment of the suit by the victim. Let \( s_i \) be the counterpart probability or fraction mentioned above in this case, which injurer \( i \) expects to pay to the damages-paying injurer(s). The situation which possibly liable injurer \( i \) is placed is depicted in Figure.

Then potentially liable injurer \( i \) would try to

\[
\max_{x_i} B_i(x_i) - q_i \theta_i ED(x_i, \ldots, x_i, \ldots, x_n) - (1 - q_i) s_i ED(x_i, \ldots, x_i, \ldots, x_n)
\]

or equivalently

\[
\max_{x_i} B_i(x_i) - \{q_i \theta_i + (1 - q_i) s_i\} ED(x_i, \ldots, x_i, \ldots, x_n).
\]

As a result of his optimizing behavior, we obtain the next proposition.

Proposition 1: If the next relationship is satisfied among \( q_i \), \( \theta_i \), and \( s_i \), then the efficient incentive effect is given to injurer \( i \).

\[
q_i \theta_i + (1 - q_i) s_i = 1
\]

PROOF: If the equation (4) holds, the necessary condition for problem (3)' becomes equivalent to that of problem (1) given that \( x_j \) (\( j \neq i \)) is efficient, which means that injurer \( i \)'s choice is efficient.

Equation (4) implies policy implications for arranging legal circumstances. Table 1 demonstrates the relationship among the three variables. It indicates that as long as equation (4) is maintained, in order to increase the probability for the injurer to be held liable for the compensation to the victim, lowering the probability for him to be recovered by other injurer(s) by means of contribution, or raising the probability of being required payment of damages by the liable injurer(s) in the case of being not liable is needed.

II-2. Negligence Rule

Negligence rule subject to the JSL system is accompanied by the inefficient budget problem. In principle, however, this problem can be solved by introducing a kind of lamp-sum tax.

Proposition 2: If a lamp-sum tax in the form of \( \frac{ED(x_i^*, x_i, x_n^*)}{n} \) is levied upon all injurers, then negligence rule under the JSL system can maintain the efficient incentive effect with the budget balanced.
PROOF: Faced with the above type tax, injurer \(i\)’s optimization problem becomes as follows.

\[
\max_{x_i} \begin{cases} 
B_i(x_i) - F_i(x_i, \bar{x}_i, ED(x_1, \cdots, x_n)) - \frac{ED(x_1^*, \cdots, x_i^*, \cdots, x_n^*)}{n} & \text{if } x_i > \bar{x}_i, \\
B_i(x_i) - \frac{ED(x_1^*, \cdots, x_i^*, \cdots, x_n^*)}{n} & \text{if } x_i \leq \bar{x}_i
\end{cases}
\]

(5)

where \(F_i(x_i, \bar{x}_i, ED(x_1, \cdots, x_n))\) is the fine for injurer \(i\) in the case that his negligence is detected, \(\bar{x}_i\) is the due activity level set for him. Since the tax is lamp-sum in essence, it does not affect the injurer’s behavior. Therefore he would choose the efficient level of \(x_i\) as Result 2 shows.

Information needed for implementing the above scheme is extraordinarily costly to collect. But the same criticism should be applied to Result 2 which demonstrates a less attractive statement than Proposition 2.

### IV. CONCLUDING REMARKS

In this note we showed more solid characteristics of strict liability as well as negligence rules under the JSL system than the traditional results. Strict liability rule can either give injurers the appropriate incentive by introducing contribution when engaging in their productive activities or keep its budget in compensating for the victim balanced. Negligence rule, on the other hand, is in principle able to have both the efficient incentive effect and the balanced budget, although the enforcement of the scheme may involve formidable cost.

The JSL system originally in the Coasian prospect plays its role in circumstances where parties involved in an externality problem (e.g., polluter(s) and pollutee(s) in pollution conflict) cannot reach an agreement in the process of its solving negotiation. Therefore policy makers, first of all, should test the necessity of intervening private transactions, then the priority of law enforcement such as the JSL system over other policy methods, that is, direct controlling such as standard-setting, taxation.

After these screening tests, we can stand the point to elaborate our contribution. If the victim’s behavior also has an effect on the probability of the damage occurring and/or the magnitude of it, the above propositions we presented might be influenced. In addition, the relationship between the magnitude and each injurer’s activity should be taken into account in a more explicit way.

### REFERENCES


### FOOTNOTES

1) Strictly speaking, there is another issue. Does the JSL system promote or mitigate settlement among the parties out of court? This note does not deal with this matter. Readers interested in this question, however, can get recent outcomes in Chang and Sigman (2007).

2) We assume for simplicity that both probability and damage functions depend on injurers’ activity levels, neither their care levels
nor the victim’s behavior. However, modification of the models reflecting assumption changes is easily derived. Similar model buildings as those in this note are found in Miceli and Segerson (1991).

**FIGURE 1. Injurer i’s Expected Damages with Contribution**

![Diagram](image)

*The values in the brackets are expected damages for injurer i in each case.*

**TABLE 1. Relationship among Three Variables mentioned in Proposition 1**

<table>
<thead>
<tr>
<th></th>
<th>$q_i$</th>
<th>$\theta_i$</th>
<th>$s_i$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$q_i$</td>
<td>$-$</td>
<td>$-$</td>
<td>$+$</td>
</tr>
<tr>
<td>$\theta_i$</td>
<td>$-$</td>
<td>$-$</td>
<td>$-$</td>
</tr>
<tr>
<td>$s_i$</td>
<td>$+$</td>
<td>$-$</td>
<td>$-$</td>
</tr>
</tbody>
</table>