# The Effects of Joint and Several Liability Rule on Collusion and Antitrust Settlement

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## Introduction

Nine Japan-based companies agreed to pay a total more than $740 million in criminal fines for price-fixing conspiracy in automobile parts sold to US car manufacturers.[1] The European Commission imposed fines totaling €953 million on four Japanese companies and two European companies for their price-fixing, coordination and information exchange.[2] Recently, China also fined 10 Japanese car parts manufacturers total more than $200 million for their participation in price cartel, which is the largest fine since enactment of China's Anti-Monopoly Law 2008.[3] These firms[4] pay not only fines to competition authorities, but also may pay damages to antitrust victims as civil liability of anticompetitive behavior. The effects of these civil liability rules, especially joint and several liability

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[1]United States Department of Justice, Nine automobile parts manufacturers and two executives agree to plead guilty to fixing prices on automobile parts sold to US car manufacturers and installed in US cars, September 26 2013.

[2]EU Commission, Antitrust: Commission fines producers of car and truck bearings €953 million in cartel settlement, March 19 2014.

[3]Yahoo News, China fines Japanese auto parts firms $200mn for monopoly (http://news.yahoo.com/china-fines-japanese-auto-parts-firms-200-mn-053424855.html).

[4]Firms participated in cartel are also named as tortfeasors, conspirators and defendants in the study. Victims of cartel are also named as plaintiffs in antitrust litigation.

rules, on firms' collusion and settlement are the subject of this study. China, the EU and US adopt joint and several liability rule (JSL thereafter) for antitrust damages. Under JSL, one tortfeasors is not only responsible for own share of damages, but also for co-tortfeasors' share of damages resulting from competition harm to victim. It means that each injurer is responsible for the entirety of damages. By contrast, under several-only liability rule, each tortfeasor is only responsible for her portion or share of damages. For instance, if an injured party sues three firms participated in price-fixing agreement, two of them are responsible for 90% of damages, for any reason, under JSL, the injured party can recover the entirety of damages from the third firm which is only 10% responsible for the price-fixing agreement.

With regard to contribution, there is a marked difference in China, the EU and US. According to JSL with contribution rule in China and the EU, one firm in the cartel can seek contribution from whichever conspirator if it had paid more than its fair share of the judgment. By contrast, the liability rule in the US is JSL with no contribution.[5] Firm does not have right to obtain contributions from co-conspirators.

In the course of antitrust litigation, firm must make a choice between settlement and trial. In comparison with trial, settlement saves litigation costs and judicial resources. As a result, promoting settlement belongs to one goal in the EU competition law.[6] The contribution rule involves redistribution of liability *ex post* among the infringing firms; it can have effects on compensation for victims and firms' choice between settlement and trial.

[5]See Antitrust Modernization Commission (2007), chapter III.A 1; Areeda, Kaplow, and Edlin (2013) (p. 60-61); case Texas Industries v. Radcliff Materials, 451 US 630 (1981).

[6]See recital 48, 51 and article 18 of Directive on Antitrust Damages Action, adopted by the council on 10 November 2014.

## Methodology

Different JSL may have different deterrent effects. It is generally accepted that the discount factor is a decisive factor for firm's decision to participate in cartel. Market concentration, number of firms, cost structure, multimarket contact, frequency of orders and evolution of demand are the classic determinants of the critical discount factor and collusion. Liability rules, which seek to deter cartel, may also influence firms' decision on collusion, i.e. JSL with different contribution rules may have different effects on the critical discount factor and collusion. To the best of our knowledge, these effects have not been analyzed although determinants of the discount factor of collusion have long been the center of the study of collusion. Besides, study of firms' choice between settlement and trial is an important part of economics of litigation and legal process. This study builds a dynamic game model to show firms' choice between settlement and trial under JSL.

The study proceeds as follows. After reviewing the relevant literatures on JSL and contribution rule and on firms' choice between settlement and trial, two models are developed to show the effects of different contribution rules under JSL on the critical discount factor and firm's incentive for settlement and trial. Given the results, we make suggestions for a reform of JSL in antitrust damages cases. The conclusion outlines the results of the study.

## Literature Review

Easterbrook, Landes, and Posner (1980) find that the effects of JSL with different contribution rule are the same if the optimal deterrence is achieved and firms are risk neutral, independent of market share of the firms. The no contribution rule may be better than the contribution rule because it avoids costs of redistribution of liability *ex post* among the infringing firms. Generally, JSL with no contribution yields more deterrence than does with contribution. Polinsky and Shavell (1981) compare the deterrent effects of no contribution, contribution and claim reduction. They find that the no contribution rule increases deterrent effect than the other two rules because firms run more risk of assuming liability. Friehe (2012) is only one study which deals with effects of different liability rules on the value of the critical discount factor. He finds that the choice between negligence and strict liability rule influences the likelihood of tacit collusion in the case of product liability and environmental damages. Easterbrook, Landes, and Posner (1980) show the effects of JSL on settlement. They find that JSL with no contribution can obviously facilitate settlement between plaintiff and defendants in antitrust cases. Furthermore, victim can be overcompensated under JSL with no contribution if liability rule is optimal created. Polinsky and Shavell (1981) also study the effects of contribution, no contribution and claim reduction on settlement. They find that the no contribution rule creates great incentive to settle, which is in contrast to the other two rules. Kornhauser and Revesz (1994) is a standard model of multiple defendants' settlement. They find that JSL under broad set of circumstances encourages settlement if plaintiff's probability of success is sufficiently correlated cross the defendants, and there are no litigations in the event of the perfect correlation. Spier (1994) notes the effects of settlement on the incentives of firms *ex ante* in the environment of JSL. She finds that there exists systemic bias resulted from settlement of multiple defendants if the prospective success of plaintiff against each defendant is high correlated.

## JSL and Collusion

### The Model

For the sake of simplicity, we use Bertrand model to show the effects of JSL. Let $\pi^m$ as the sum of all firms' profits in the cartel; $n$ as the sum of firms in the cartel,

$n \geq 2$; $s_i$ as the profit share of firm $i$, $\sum_{i=1}^{n} s_i = 1$, it can refer to the market share of firm $i$, $\exists s_n > s_{n-1} > \cdots > s_i > \cdots > s_2 > s_1$; $\delta$ as the discount factor, $\delta \in [0,1]$; $X$ as the amount of damages payment at trial; $p$ as the probability of victim's success at trial, $p \in [0,1]$; $c$ as the probability of obtaining contribution from co-conspirator, $c \in [0,1]$, high $c$ means firms can easily obtain contribution from other firms.

We assume that firms are risk neutral. If firms cooperate they make a profit $\pi^m$. Any firm $i$ can defect the collusion by reducing price a little $\epsilon$, and have all profit $\pi^m$. After defection it turns to be the Bertrand competition, and then each firm has zero profit because price in Nash equilibrium is equal to marginal cost. For the incentive compatibility the condition for a stable collusion of firm $i$ is $\frac{1}{1-\delta} s_i \pi^m \geq \pi^m$, which yields $\delta \geq 1 - s_i$. For the stable collusion the firm holding the smallest profit share must have the greatest $\delta$. It means $\delta = 1 - s_1 \equiv \delta^{Bert}_{simple}$. Firms can success in establishing the stable collusion if firm 1 has at least $\delta^{Bert}_{simple} = 1 - s_1$. Therefore, we compare firm 1's $\delta$ under different JSL to show its effects on collusion.

All else being equal, for a stable collusion, the incentive compatibility condition of the smallest firm is

$$\frac{1}{1-\delta}[s_1 \pi^m - \frac{1}{n} pX + cpX(\frac{1}{n} - s_1)] \geq \pi^m - \frac{1}{n} pX + cpX(\frac{1}{n} - s_1)\,,$$

We assume that $pX \geq \pi^m$, which means that the total expected damages (liability) are weakly more than the profits of collusion. The left side is firm 1's profit by cooperating with other firms forever. $\delta$ is the discount factor of firm 1. In each stage, firm 1 has $s_1 \pi^m$ minus expected liability $\frac{1}{n} pX$ and plus expected contribution from the con-conspirators $cpX(\frac{1}{n} - s_1)$. $\frac{1}{n}$ denotes that each firm including firm 1 has the equal probability *ex ante* to be a defendant, so that it pays the total damages $pX$ *ex post*. The right side is payoffs of firm 1 by deviating from collusion, so that it has all profit $\pi^m$, but it must pay the expected damages and obtain expected contribution from the co-conspirator. It makes no profit in the Bertrand competition after deviation. The equation can be solved yielding $\delta \geq \frac{1-s_1}{\pi^m - \frac{1}{n}pX + cpX(\frac{1}{n}-s_1)} \equiv \delta^{Bert}$. $\delta^{Bert}$ is the critical discount factor for every contribution rule.

## Results

We consider $\delta^{Bert}$ in the specific case $c = 0$, which corresponds to JSL in the US, and $c = 1$, which corresponds to JSL in China and the EU. If $c = 0$, $\delta^{Bert} = \delta_n^{Bert} = \frac{(1-s_1)\pi^m}{\pi^m - \frac{1}{n}pX}$. If $c = 1$, $\delta^{Bert} = \delta_c^{Bert} = \frac{(1-s_1)\pi^m}{\pi^m - s_1 pX}$. The only difference of these critical discount factors is the denominator, i.e. $\frac{1}{n} > s_1$, it yields $\delta_n^{Bert} > \delta_c^{Bert}$. As a result, the American JSL with no contribution can make collusion more difficult than do JSL with contribution in China and the EU.

## Discussion

There are three scenarios in which the contribution rules may have different effects on the effectiveness of damages. If $pX = \pi^m$ (Efficient Deterrence), we get

$$\delta^{Bert} = \begin{cases} \delta_n^{Bert} = \frac{1-s_1}{1-\frac{1}{n}} > 1 & \text{if } c = 0 \\ \delta_c^{Bert} = 1 & \text{if } c = 1 \end{cases} \tag{1}$$

Because the underlying assumption is $\delta \in [0, 1]$, JSL with contribution can effectively deter collusion. The result $\delta_n^{Bert} > 1$ contradicts the assumption $\delta \in [0, 1]$. It can be explained by that no contribution leads to over-deterrence. As a result, firms must be paid by the third party to participate in collusion. Under efficient enforcement regime, the contribution rule is better than no contribution rule in order to avoid over-deterrence.

If $pX > \pi^m$ (Over-Deterrence), we get

$$\delta^{Bert} = \begin{cases} \delta_n^{Bert} = \frac{(1-s_1)\pi^m}{\pi^m - \frac{1}{n}pX} \gg 1 & \text{if } c = 0 \\ \delta_c^{Bert} = \frac{(1-s_1)\pi^m}{\pi^m - s_1 pX} > 1 & \text{if } c = 1 \end{cases} \tag{2}$$

Both contribution rules have over-deterrent effect. The contribution rule is better than no contribution rule because the former is less over-deterring.

If $pX < \pi^m$ (Under-Deterrence), we get

$$\delta^{Bert} = \begin{cases} \delta_n^{Bert} = \frac{(1-s_1)\pi^m}{\pi^m - \frac{1}{n}pX} & \text{if } c = 0 \\ \delta_c^{Bert} = \frac{(1-s_1)\pi^m}{\pi^m - s_1 pX} < 1 & \text{if } c = 1 \end{cases} \tag{3}$$

In this enforcement regime the antitrust authority or court should choose no contribution rule because $\delta_n^{Bert} > \delta_c^{Bert}$ and $\delta_c^{Bert} < 1$. The no contribution rule can mitigate the under-deterrence in this regime.

The efficiency of enforcement depends on $p$ and $X$ (fine). Many empirical works find that $p$ falls within the range of between 10% and 20%.[7] For the most part, the fine under EU competition law is nowadays insufficient to deter cartel.[8] The maximum fine of a firm is 10% of its total turnover in last business year.[9] Combe, Monnier, and Legal (2008) find that $p$ in the EU is only approximately 13%. The private antitrust damages action is rare. There is also no criminal prosecution of responsible persons working in firms. Although American antitrust seems to be the toughest enforcement in the world in terms of enforcement effort and penalty, the current deterrence of antitrust law enforcement in the US may also

[7] See Connor (2008), footnote 20.

[8] See Veljanowski (2007) and Smuda (2013). Some argue that the European competition antitrust law is over-deterrent, e.g. Jones and Sufrin (2008) (p.427) and Monti (2007) (p.18).

[9] Art. 23 sentence 2 of 1/2003 regulation EC.

be inadequate.[10]

If the deterrence of Chinese and European antitrust laws is inadequate, the JSL should be based on no contribution rule. JSL with contribution rule in the EU Directive on Antitrust Damages Action may not effectively prevent firms from colluding with each other. The opposite may be true because JSL with contribution can stabilize their collusion. The no contribution rule can increase the deterrent effect of antitrust damages in Chinese and European under-deterring regimes.

## JSL and Settlement

### The Model

The model builds upon the basic frameworks developed by Easterbrook, Landes, and Posner (1980) and Kornhauser and Revesz (1994). For simplicity, we assume there are no litigation costs and firms are risk neutral. Let $n$ as the sum of firms establishing cartel, $n \geq 2$; $X$ the amount of damages payment at trial; $p$ the probability of defendant prevailing at trial, $p \in [0, 1]$; $s_i$ the profit share of firm $i$, $\sum_{i=1}^{n} s_i = 1$, which can refer to the market share of firm $i$, $\exists\ s_n > s_{n-1} > \cdots > s_i > \cdots > s_2 > s_1$; $S_i$ the settlement amount of the defendant $i$; $V_{si}$ the expected value of the defendant $i$ from settlement; $V_{ti}$ the expected value of the defendant $i$ at trial; $c$ the contribution rule or as the probability of obtaining contribution from co-conspirators, $c \in [0, 1]$, the more $c$ is, the easier the defendants can obtain the contribution from other firms; $Y$ the sum of the contribution, defined as $Y \equiv s_i X - S_i$.

The game is constructed as follows: the players are one plaintiff and $n$-defendants; the plaintiff's payoff is $\sum_{i=1}^{n} S_i = 1$ if settling, the payoff of defendant

[10] See Kaplow (2013) (pp. 251 and 447), Jones and Sufrin (2008) (p.427) and Monti (2007) (p.18) and the opposite arguments, e.g. Blair and Durrance (2008).

$i$ is $V_{si}$ if settling. The plaintiff first makes take-it-or-leave-it offer $S_i$; then, $n$-defendants play non-cooperative game in which defendant $i$ accepts or rejects $S_i$; lastly, the plaintiff settles the case or litigates against the defendants rejected $S_i$.

We solve this game by backward induction as follows. In the third period, the plaintiff settles the case if $\sum_{i=1}^{n} S_i \geq pX$, or litigates against the defendant $i$ otherwise. In the second period, the $n$-defendants simultaneously play the non-cooperative game. The defendant $i$ accepts $S_i$ if $S_i \leq S_i^*$, or rejects $S_i$ otherwise. $S_i^*$ is the optimal settlement amount derived from as follows. The defendant $i$ has the expected value from the settlement $V_{si} = S_i + cp(s_i X - S_i)$, given other defendants will be at trial. If the set-off rule at trial is pro tanto, which is usually the case of the EU and US,[11] the defendant $i$ has the expected value from trial $V_{ti} = p[X - \sum_{j=1, j\neq i}^{n} S_i - c\sum_{j=1,j\neq i}^{n}(s_j X - Sj)]$ given that other defendants settle the case. The condition of indifference between settlement and trial is $V_{si} = V_{ti}$, which means

$$S_i + cp(s_i X - S_i) = p[X - \sum_{j=1, j\neq i}^{n} S_i - c\sum_{j=1,j\neq i}^{n}(s_j X - Sj)] \tag{4}$$

The equation can be solved yielding a reaction function of $S_i(S_j) = \frac{p(1-c)(X - \sum_{j=1,j\neq i}^{n} S_j)}{1-pc}$. It then yields the optimal settlement amount in equilibrium $S_i^* = \frac{pX(1-c)}{1+pn-p-pnc}$. In the first period, the plaintiff makes offers $S_i^*$ for settlement under condition $\sum_{i=1} nS_i^* \geq pX$, which is the same as the decision in the third period. The plaintiff anticipates that the defendant $i$ accepts $S_i$ if $S_i \leq S_i^*$, so that $S_i^*$ is the optimal offers, which could maximize the plaintiff's utility.

[11] The damages are reduced by the amount of settlement under *pro-tanto* set-off rule; the damages are reduced by the amount of settling defendants' share of damages at trial under the apportioned set-off rule. In the US the reclaim is reduced after the damages are trebled. Often is *pro-tanto* set-off rule in the US jurisdiction. The choice of set-off rules is decided by the member states of the EU. The claim reduction at trial is $\sum_{i=1}^{k,k\leq n} S_i$ under the *pro tanto* set-off rule. The claim reduction at trial is $\sum_{i=1}^{k,k\leq n} s_i X$ under the apportioned set-off rule.

The optimal offers tell us that the difference between $\sum_{i=1} nS_i^*$ and $pX$ depends on the contribution rule $c$. Because $\frac{\partial S_i^*}{\partial c} < 0$, the smaller $c$ is, the more settlement amounts the plaintiff can extract from settlement. In the events of $\sum_{i=1} nS_i^* = pX$, the optimal contribution rule should be set as $c^* = \frac{n-1}{n}$, which results from $\frac{npX(1-c)}{1+pn-p-pnc} = pX$. Consequently, the plaintiff makes offers $S_i^*$ under condition $c \in [0, \frac{n-1}{n}]$, so that the settlement between the plaintiff and $n$-defendants must be achieved if the defendants choose settlement in the event of same expected value from settlement and trial. In a regime $c \in (\frac{n-1}{n}, 1]$, the plaintiff does not make any offers because $\sum_{i=1} nS_i^* < pX$.

In sum, as a sufficient condition for settlement, the optimal offer is $S_i^* = \frac{pX(1-c)}{1+pn-p-pnc}$. Under the condition $c \in [0, \frac{n-1}{n}]$, $(\frac{pX(1-c)}{1+pn-p-pnc}, S_i^*(S_j))$ is only a subgame-perfect Nash equilibrium.

**Results**

Considering two polar contribution rules, the results can be summarized as

$$S_i^* = \begin{cases} S_i^n = \frac{pX}{1+pn-p} & \text{if } c = 0 \\ S_i^c = 0 & \text{if } c = 1 \end{cases} \tag{5}$$

$S_i^n$ is the settlement amount under the no contribution rule, which relates to JSL in the US. Because $c = 0$ meets the condition $c \in [0, \frac{n-1}{n}]$, no contribution rule powerfully facilitates settlement. $S_i^c$ is the settlement amount under the contribution rule in China and the EU. Because $c = 1$ does not meet condition $c \in [0\ ,\ \frac{n-1}{n}]$, no settlement could happen. There is a chilling effect of the contribution rule on settlement. If the settlement is successful, it can only be explained by other determinants of the settlement other than contribution, e.g. high litigation costs. Although American JSL facilitates settlement, the downside of it is its over-deterrence for defendants and its over-compensation for plaintiff as $nS_i^n = \frac{npX}{1+pn-p} > pX$.

### Discussion

We define $c < \frac{n-1}{n}$ as the weak contribution rule; $c = \frac{n-1}{n}$ as the efficient contribution rule; $c > \frac{n-1}{n}$ as the strong contribution rule. The model shows that the decision of $S_i^*$ may be incompatible with the efficient settlement. The amount of the settlement for each firm is $S_i^*$, the sum of it is $nS_i^* = \frac{npX(1-c)}{1+pn-p-pnc}$. Under the weak contribution rule $c \in [0, \frac{n-1}{n})$, $nS_i^* = \frac{npX(1-c)}{1+pn-p-pnc} > pX$. The weak contribution rule leads to over-compensation for the plaintiff and over-deterrence for the defendants. The increase in the number of defendants exacerbates the over-compensation because $\frac{\partial(nS_i^*)}{\partial n} > 0$.

This result is partly consistent with Spier (1994). The settlement has a distortion effect on the incentive of firms' activity *ex ante* under the no contribution rule in the US. $\frac{1-c}{1+pn-p-pnc}$ is the share of damages through settlement for each firm, the absolute value of $s_i - \frac{1-c}{1+pn-p-pnc}$ can be seen as the degree of distortion. As same as Spier (1994), the smaller $p$ is, the more severe the distortion is. It results from $\frac{\partial(s_i - \frac{1-c}{1+pn-p-pnc})}{\partial p} < 0$. Different from Spier (1994), the profit share (liability share) $s_i$ is not a determinant of $S_i(S_j)$ and $S_i^*$ as $\frac{\partial(s_i - \frac{1-c}{1+pn-p-pnc})}{\partial s_i} = 1$.

Socially optimal contribution rule $c^* = \frac{n-1}{n}$ depends only on the number of firms in collusion. Because $n \geq 2$ and $\lim_{n\to\infty} \frac{n-1}{n} = 1$, we get $c^* \in [\frac{1}{2}, 1]$. As a result, the legislature or court should control the contribution rate more than $\frac{1}{2}$ by taking the number of firms of cartel into account. It can avoid over-compensation for the plaintiff. We refine the optimal contribution rule summarized in the appendix table as recommendation for competition policy.

## Conclusion

The USA as an advanced antitrust enforcement regime adopts significantly different JSL from China and the EU with respect to contribution among firms. We find that the weak contribution rule generally has more deterrence than does the strong contribution rule by comparing the critical discount factor of collusion. We argue that JSL with contribution, which has been the legal rule in China and the EU, may not effectively deter conclusion between firms because of the under-deterrence of its current antitrust enforcement.

We also show the effects of JSL on the settlement by building upon the non-cooperative game model. In an efficient regime, only $c = \frac{n-1}{n}$ is the efficient contribution rule. The American JSL with no contribution can overly facilitate the settlement and mitigate current under-deterrent enforcement. By contrast, Chinese and European JSL with contribution have the chilling effects on settlement. China and the EU should adopt JSL with the weak contribution rule in order to mitigate the current under-deterrent enforcement and save the litigation costs at trial.

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# Appendix

### Mathematical Appendix

*Decision of Defendants between Settlement and Trial:*

$$S_i + cp(s_iX - S_i) = p[X - \sum_{j=1, j\neq i}^{n} S_i - c \sum_{j=1, j\neq i}^{n} (s_jX - S_j)]$$

$$\Leftrightarrow S_i(S_j) = \frac{p(1-c)(X - \sum_{j=1,j\neq i}^{n} S_j)}{1-pc} \quad \text{(Reaction Function)}$$

$$\Leftrightarrow \sum_{i=1}^{n} S_i(S_j) = \sum_{i=1}^{n} \frac{p(1-c)(X - \sum_{j=1,j\neq i}^{n} S_j)}{1-pc}$$

$$\Leftrightarrow S_i^* = \frac{pX(1-c)}{1+pn-p-pnc} \quad \text{(Nash Equilibrium in Subgame)}$$

*Decision of Plaintiff between Settlement and Trial:*

$$nS_i^* = \frac{pXn(1-c)}{1+pn-p-pnc} \geq pX$$

$$\Rightarrow S_i^* = \frac{pX(1-c)}{1+pn-p-pnc}$$

$\Rightarrow (\frac{pX(1-c)}{1+pn-p-pnc}, S_i^*(S_j))$ is the subgame-perfect Nash equilibrium

under the condition of $c \leq \frac{n-1}{n}$.

*Relationship between Settlement and Contribution Rule:*

$\frac{\partial S_i^*}{\partial c} = \frac{-pX}{1-pn-p-pnc} - \frac{p^2Xn(1-c)}{(1-pn-p-pnc)^2} < 0$ because $1 + pn - p - pnc > 0$;

$$\frac{\partial(nS_i^*)}{\partial n} = \frac{\partial(\frac{npX(1-c)}{1+pn-p-pnc})}{\partial n} = \frac{pX(1-c)}{1+pn-p-pnc} + \frac{nXp^2(1-c)^2}{(1+pn-p-pnc)^2} > 0$$

**Table**

| Regimes | Liability and Profit | Contribution Rules |
|---|---|---|
| Efficient deterrence | $pX = \pi^m$ | $c = \frac{n-1}{n}$ |
| Overdeterrence | $pX > \pi^m$ | $c > \frac{n-1}{n}$ |
| Under-deterrence | $pX < \pi^m$ | $c < \frac{n-1}{n}$ |