

# Private Antitrust Enforcement

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## **Abstract**

We study the effect of encouraging private actions for breaches of competition law. We develop a model in which a plaintiff, who may or may not have private information about whether a breach of law has been committed, opens a case against a defendant. The case may be settled out of court or may proceed to full trial. The authorities can facilitate private actions by lowering the costs of opening a case, or of proceeding to a full trial, or by raising the damages to be expected in the event of success. We show that facilitating private action both increases the number of cases opened and makes plaintiffs more aggressive in pre-trial bargaining. The latter tends to make guilty defendants more likely to settle than innocent defendants, depending on the extent to which the results of the case can be influenced by pre-trial bargaining. There are welfare benefits from increasing deterrence for guilty defendants but welfare costs from increasing the expense for the others of proving their innocence. We also show that screening is enhanced when the Court is committed to rely only on submitted evidence, and not on other possibly relevant background material.

# 1 Introduction

In 2005, when it launched a Green Paper entitled “Damages actions for breach of the EC antitrust rules,” the European Commission’s objective was to increase the frequency of private antitrust litigation in the EU. Indeed, there are almost no private actions in the EU, while in the US there are approximately 10 private actions undertaken for each action by the public authorities. The EU expects that inducing private parties to play a part in antitrust enforcement will enhance Europe’s competitiveness and encourage companies to innovate, leading to economic growth and job creation. Whether this expectation is realistic is the subject of this paper, which models the effect of encouraging private actions for breaches of competition law.

We develop a model in which a plaintiff, who may or may not be privately informed about the existence of a breach of competition law, can choose to open a case against a defendant. However, access to information obviously plays a key role in private antitrust enforcement and the plaintiff faces substantial costs due to asymmetric information between the different parties. We therefore assume that opening a case involves a fixed cost for the plaintiff, which represents the expense incurred in retaining lawyers, preparing documents, and so on. Alternatively, these costs may be interpreted as the costs of collecting data for initiating a private antitrust action. Indeed, the Antitrust Authority usually sets rules on the disclosure of documents and/or determines a threshold standard of evidence above which the action may be initiated. Different values of these costs may characterize different judicial regimes, with high values describing the European regime in which the costs of collecting evidence are borne largely by the Plaintiff, and low values describing the US discovery system in which many of the costs are borne by the defendant.

Going to the trial also has a fixed cost which is usually high relative to the costs of opening a case. As many EU member states use a loser-pays rule, we assume that the trial costs are supported by the losing party, but we consider later the effect of a division of the costs in some proportion between the losing and winning parties.

A complete analysis of private antitrust enforcement cannot ignore the possibility of private settlements. Indeed, in practice, the majority of cases that are filed ultimately settle before trial. The fact that most private parties accept settlement offers without going to the trial is not irrational, since going to the trial is usually costly and time-demanding. We model pre-trial bargaining between the plaintiff and the defendant by assuming that the plaintiff makes a settlement offer to the defendant. If the defendant refuses the offer, the case proceeds to a trial, which generates some evidence about the

action of the defendant (i.e. whether or not the antitrust laws have been violated). We assume that the evidence is not completely accurate, which implies that the court may make some errors. If a breach of law is established in court the plaintiff is awarded damages against the defendant.

Once private settlements are taken into account then, as we show below, encouraging private actions can lead to some strikingly counter-intuitive consequences. Most people would expect that an increase in private actions would need to lead (if it is to be effective at deterring violations of competition law) to a significant number of firms appearing before the courts, most of whom would be guilty of the violations alleged. However, if firms can settle out of court, and if the courts are reasonably reliable at establishing the truth of allegations, it should be the guilty firms that settle and the innocent firms that refuse. An effective system should therefore lead to mainly innocent firms appearing before the courts! As we show below, this can be a difficult system to maintain, notably if the courts react to the frequency of innocent defendants by making it difficult to secure a conviction, since guilty defendants will exploit this. What this illustrates, though, is that out-of-court settlements can have a radical impact on the results of a system of private actions, and any policy proposal needs to be evaluated with this in mind.

One of the main recommendations of the Green Paper is the introduction of multiple damages, as is the practice in Canada or in the US. From a policy perspective, it is therefore important to ask what is optimal damage multiplier - should there be double damages for successful plaintiffs, for instance, or treble damages as in the US? A higher multiplier encourages private parties to sue violators of competition laws, but may also result in excessive private actions and even induce private parties to engage in "frivolous actions", or at least to bring actions even when there is low evidence of a breach of antitrust laws. Moreover, while it is widely recognized that the number of cases filed may rise when treble damages are awarded, it is important to take into account that settlement offers and the number of settlements may also rise. In this paper, therefore, we analyze the effects of multiple damages on private antitrust enforcement, taking into consideration their impact on settlements.

We first consider a situation where the plaintiff has no private information about the existence of a breach of competition law. We distinguish two polar cases, which correspond to different sets of rules of judicial procedure. In the first, which we shall call the "No background evidence" case, the Judge must decide the case purely according to the evidence generated at the trial and may not use additional evidence (for example about the prior probability that a defendant at a trial has committed an antitrust violation).

Obviously the plaintiff will not initiate a case if the opening costs are too high. However, when these costs are limited, the plaintiff initiates a case and a guilty defendant always settles, whereas an innocent defendant settles only when the plaintiff is "aggressive": this happens when the compensation damages are large, the prior probability of a violation and/or the quality of the judgements are important, and/or the cost of trials is limited. Thus when trial costs are large, for example, private enforcement benefits the plaintiff at the expense of the defendant, who moreover ends up paying the same settlement compensation, whether guilty or not. Private antitrust enforcement is clearly not desirable in such a case, since it has no deterrent effect on potential violators and merely transfers money from defendants to plaintiffs. However, when trial costs are lower, private enforcement helps to deter potential violators from engaging in anti-competitive behavior and allows the court to screen innocent defendants from guilty ones, since the former go to trial while the latter accept a high settlement offer.

In the second case, in addition to the evidence generated during the trial, we assume that the Judge can rely on any other relevant background evidence. We show that private actions have no deterrent effect, since guilty and innocent Defendants are always treated alike. This is because plaintiffs are less likely to settle when innocent, which tends to bias the decision of the courts in favor of those defendants that choose to resist settling and go to trial. As a result, all equilibria involve "complete pooling", where either no plaintiffs ever launch a case, or those cases that are launched are always settled. Consequently, there is a more effective screening of guilty from innocent defendants when the rules of judicial procedure oblige the court to rely solely on the facts established during the trial.

We then turn to the case where the plaintiff has private information about whether the defendant has committed a breach of competition law. We distinguish two types of plaintiff: an "honest" plaintiff who has observed evidence indicating that a breach of competition law is indeed likely to have taken place, and an "opportunistic" plaintiff who has observed evidence to the contrary but seeks to obtain a settlement from the defendant anyway. We show that when the costs of opening a case lie in some intermediate range, only honest plaintiffs bring a case. This enhances private antitrust enforcement because only the "right" complaints, and not the frivolous ones, are filed. In addition, when opening costs are low and trial costs are high, honest Plaintiffs are aggressive while uninformed (or opportunistic) plaintiffs are not; the screening of guilty defendants thus again benefits in this way from the Plaintiff's having some information.

Private enforcement was first studied by Becker and Stigler (1974) who argue that free competition among private law enforcers for the damages levied against convicted

violators could achieve deterrence as efficiently as optimal public enforcement. Martini (2004) analyzes anti-competitive actions where firms are engaged in price-fixing and form a cartel acting as a monopolist. Martini shows that, in the model, private enforcement of the antitrust laws dominates a public enforcement regime. However, this result depends upon differences in the objective functions of the two antitrust agents: private enforcers only care about their surplus and thus consider the reward they get in presence of anti-competitive activities as an incremental surplus, while the public agency takes into account both consumers' and producers' surplus and sees the fine as a monetary transfer. As a consequence, private enforcers credibly engage in a higher level of investigation activity than set by a public agency.

It is also important to note that, in general, private enforcers are better informed about their particular industry. As Shavell (1984) argues, "private parties should generally enjoy an inherent advantage in knowledge" over public enforcers. Thus it is easier for them to analyze their own activities and those of their competitors. "For a regulator to obtain comparable information would often require virtually continuous observation of parties' behavior, and thus would be a practical impossibility."

Moreover, in the antitrust literature, it is widely recognized that treble damages can create perverse incentives for private enforcers. Breit and Elzinga (1974) have argued that under a multiple damages remedy, private parties may even seek to increase the damage they suffer in anticipation that they may get rewarded trebly for the resulting increase in damages<sup>1</sup>. Multiple damages may, for that reason, induce plaintiffs to "get damaged". In addition, hostile takeover targets often initiate antitrust cases against the bidders, because this may create huge delays and therefore allow the target firm to achieve some anti-takeover strategies.

McAfee, Mialon, and Mialon (2005b) compare private and public enforcement of the antitrust laws in a simple strategic model of antitrust crime and lawsuits with asymmetric information. In their model, a firm chooses whether or not to violate the antitrust laws harming both competition and consumers. They assume that private firms are ex ante more likely than the government to be informed about antitrust violations, but are also more likely to use the antitrust laws strategically. They show that when policy makers trust in the ability of the courts to make the right decision, they should encourage private antitrust enforcement. However, when the court may make mistakes and public enforcers are quite efficient, policy makers should discourage private enforcement. However, they

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<sup>1</sup>They suggest that these incentives may have been at work in the electrical equipment conspiracy of the 1950s.

do not consider the possibility of settlement before the trial, although in reality most cases do not go to trial because settlement offers are made.

## 2 A simple model

We first consider a situation where the Plaintiff has no private information about the existence of a breach of competition law. This allows us to develop the framework and derive some insights in a relatively simple way; we consider later the more relevant case where the Plaintiff does have private information about the existence of anti-competitive behavior.

### 2.1 Framework

The participants are the Defendant ( $D$ ), the Plaintiff ( $P$ ) and the Judge ( $J$ ). Though we speak of the Judge as a single individual she can equally be interpreted collectively, as a court.

There are two states of nature  $\theta \in \{B, N\}$ . The state  $\theta = B$  corresponds to a case in which the Defendant has committed a breach of competition law while  $\theta = N$  corresponds to one in which there has been no breach. The Defendant knows  $\theta$  while, initially at least, the Plaintiff and the Judge only know that  $\theta = B$  with probability ( $\beta$ ) and  $\theta = N$  with probability ( $1 - \beta$ ). If the case proceeds to trial the Judge will receive a signal about  $\theta$ .

The sequence of events is as follows. First, the Plaintiff may choose to open a case. This involves a fixed cost  $\phi$ , which represents the expense incurred in retaining lawyers, preparing documents, and so on. We note that  $\phi$  is usually low relative to the costs of a full trial, which we discuss below. Alternatively,  $\phi$  may be interpreted as the costs of collecting data for initiating a private antitrust action<sup>2</sup>; what matters for our purposes is that the Plaintiff must send a credible signal of its intent to proceed to a trial if necessary. In the latter interpretation we can think of different values of  $\phi$  as characterizing different judicial regimes, with a high  $\phi$  describing the European regime in which the costs are supported by the Plaintiff, and a low  $\phi$  describing the US discovery system in which many of the costs are borne by the Defendant.

Pre-trial bargaining then ensues between the Plaintiff and the Defendant. We model this by assuming that the Plaintiff makes a single settlement offer  $R$  to the Defendant,

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<sup>2</sup>The Antitrust Authority usually sets rules on the disclosure of documents and/or determine a certain amount of evidence above which the action may be initiated.

which the Defendant may either accept or refuse; to rule out trivial cases, we restrict the settlement offer to be positive:  $R > 0$ <sup>3</sup>. If the Defendant refuses the offer, the case proceeds to a trial.

At the trial the Judge observes a signal  $\sigma$ , which can take one of two values,  $S$  or  $W$ , and is correlated with the existence of a breach of competition law:  $\Pr(\sigma = S|\theta = B) = \Pr(\sigma = W|\theta = N) = \rho$ , where  $\rho > 1/2$  denotes the level of correlation<sup>4</sup>;  $\sigma = S$  can thus be interpreted as "strong evidence" of a breach, while  $\sigma = W$  provides "weak evidence" of such breach. On the basis of this signal the Judge determines an outcome of the trial (according to rules of procedure which we discuss below). The trial has a fixed cost  $c$ , borne by the losing party; we consider later the effect of a division of the costs in some proportion  $(\gamma, 1 - \gamma)$  borne by the losing and winning parties respectively. If a breach of law is established in court the Plaintiff is awarded damages  $F$  against the Defendant.

Formally, then, the timing of the game is the following:

**Date 0 :** Nature chooses  $\theta$ , observed by the Defendant.

**Date 1 :** The Plaintiff chooses whether to initiate a case, in which case it pays  $\phi$  and chooses a settlement offer  $R$ .<sup>5</sup>

**Date 2 :** The Defendant observes  $R$  and accepts or rejects the offer.

**Date 3 :** If the offer is rejected, the case goes to trial; then Nature chooses  $\sigma$ , which is observed by the Judge: if the Defendant is found guilty, she bears a cost  $c$ , and pays  $F$  to the Plaintiff; if instead the Defendant is found innocent, she pays nothing, while the Plaintiff bears the cost  $c$ .

The nature of the pre-trial bargaining evidently depends on the likely outcome of the trial, and this depends in turn on the way in which the Judge is constrained to use the evidence at her disposal, and on the kinds of relevant evidence that are admissible. In

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<sup>3</sup>This is without loss of generality if we suppose that at least some of the costs of opening a case are incurred only if an offer is made - such as the cost of a telephone call.

<sup>4</sup>The parameter  $\rho$  measures the quality of the evidence generated at the trial: the higher the correlation  $\rho$  (i.e., the closer it is to 1), the better the quality of the information available to the Judge; in contrast, there is little information - implying that decisions based on that information will often be mistaken - when  $\rho$  is close to 1/2. Assuming that  $\rho > 1/2$  is without loss of generality since it requires only that the signal improve the judge's information"

<sup>5</sup>Since by assumption  $J$  does not take into consideration any pre-trial activity, there is no loss of generality assuming that  $P$  always make a settlement offer once a case has been opened: a sufficiently high offer will always be rejected and de facto amounts to no settlement offer. If  $J$  observes whether an offer is being made (and possibly its content) then allowing  $P$  to decide whether to make an offer might affect the analysis.

many judicial proceedings some relevant evidence is not admissible. For instance, juries in criminal cases may often not hear evidence about the accused's previous convictions, even though this may well have some bearing on the probability that the accused committed the crime in question. The proceedings are therefore constrained to rely purely on evidence directly generated by the crime under investigation and may not use background evidence.

In a similar spirit we distinguish two polar cases. In the first one, which we shall call the "No Background Evidence" case, the Judge must decide the case purely according to the signal she receives: the Defendant must be found guilty if  $\sigma = S$ , and must otherwise be found innocent (we assume that an appeal court would throw out a conviction in the absence of the appropriate signal  $\sigma$ ). In the second case, which we call the "Full Background Evidence" case, the Judge must convict the Defendant if and only if she believes that the Defendant is guilty with sufficient probability, taking into account not only  $\sigma$  but also any other background evidence which would affect that probability.

## 2.2 No background evidence

We characterize the Subgame Perfect equilibrium of the above-described game. As usual, we proceed backwards.

If the case goes to trial, at date 3, the Defendant pays  $F + c$  if found guilty, which happens with probability  $\rho$  if it has indeed committed a breach of competition law, and only with probability  $1 - \rho$  otherwise. Therefore, at date 2, the Defendant accepts the settlement offer  $R$  if

$$R \leq \begin{cases} \bar{R} \equiv \rho(F + c) & \text{if } \theta = B \\ \underline{R} \equiv (1 - \rho)(F + c) & \text{if } \theta = N \end{cases}$$

It is never optimal for the Plaintiff to offer a prohibitively high settlement that would be rejected by both types of Defendant, since settling allows the parties to save the cost of the trial: indeed, asking instead for  $\bar{R}$  leads to the same outcome (i.e., going to trial) when the Defendant is innocent, but yields a higher expected payoff when the Defendant is guilty, since going to trial gives the Plaintiff an expected payoff equal to  $\rho F - (1 - \rho)c = \bar{R} - c < \bar{R}$ . Two settlement proposals are therefore relevant: either a high amount,  $\bar{R}$ , only accepted by guilty Defendants, or a low amount,  $\underline{R}$ , accepted by all Defendants.<sup>6</sup>

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<sup>6</sup>The benefits of saving the cost of the trial also implies that it is best for the Plaintiff to have an offer accepted with probability 1 by all the Defendants that are indifferent between accepting or rejecting it.

If the Plaintiff asks for a low amount,  $\underline{R}$ , she earns

$$\underline{R} = (1 - \rho)(F + c), \quad (1)$$

since both types of Defendant accept to settle; if the Plaintiff asks instead for a high amount,  $\overline{R}$ , she earns

$$\beta \overline{R} + (1 - \beta)[(1 - \rho)F - \rho c] = \beta \rho(F + c) + (1 - \beta)[(1 - \rho)F - \rho c], \quad (2)$$

since an innocent Defendant prefers going to the trial. The Plaintiff favors a low amount when the payoff in (1) exceeds that in (2), which amounts to

$$\beta < \beta^* \equiv \frac{1}{2\rho} \text{ and } c > c^* \equiv \frac{\beta(2\rho - 1)F}{1 - 2\rho\beta}.$$

We are now able to determine the payoffs depending on the total cost of the trial. Let  $W_P$ ,  $W_D^B$  and  $W_D^N$ , respectively be the payoff of the Plaintiff, a guilty (i.e., type  $B$ ) Defendant and an innocent (i.e., type  $N$ ) Defendant.

- When  $\beta > \beta^*$  or  $c < c^*$ , the Plaintiff is "aggressive", that is, demands a high settlement compensation; as a result, the Defendant settles when guilty and refuses instead to settle when innocent; the payoffs are then:

$$\begin{aligned} W_P &= \beta \rho(F + c) + (1 - \beta)[(1 - \rho)F - \rho c] - \phi \\ &= [\beta \rho + (1 - \beta)(1 - \rho)](F + c) - (1 - \beta)c - \phi, \\ W_D^B &= -\rho(F + c), \\ W_D^N &= -(1 - \rho)(F + c). \end{aligned}$$

- When  $\beta < \beta^*$  and  $c > c^*$ , the Plaintiff is less aggressive and offers a low settlement compensation, which is always accepted by the Defendant, irrespective of being guilty or innocent; the payoffs are then:

$$\begin{aligned} W_P &= (1 - \rho)(F + c) - \phi, \\ W_D^B &= W_D^N = -(1 - \rho)(F + c). \end{aligned}$$

Finally, the Plaintiff will decide to initiate a case whenever  $W_P > 0$ . Figure 1 depicts the equilibrium outcomes, as a function of the cost of complaint  $\phi$  (horizontal axis) and of the cost of trial  $c$  (vertical axis); each case corresponds to different prior beliefs  $\beta$ , keeping constant the other exogenous parameters  $\rho$  and  $F$ .

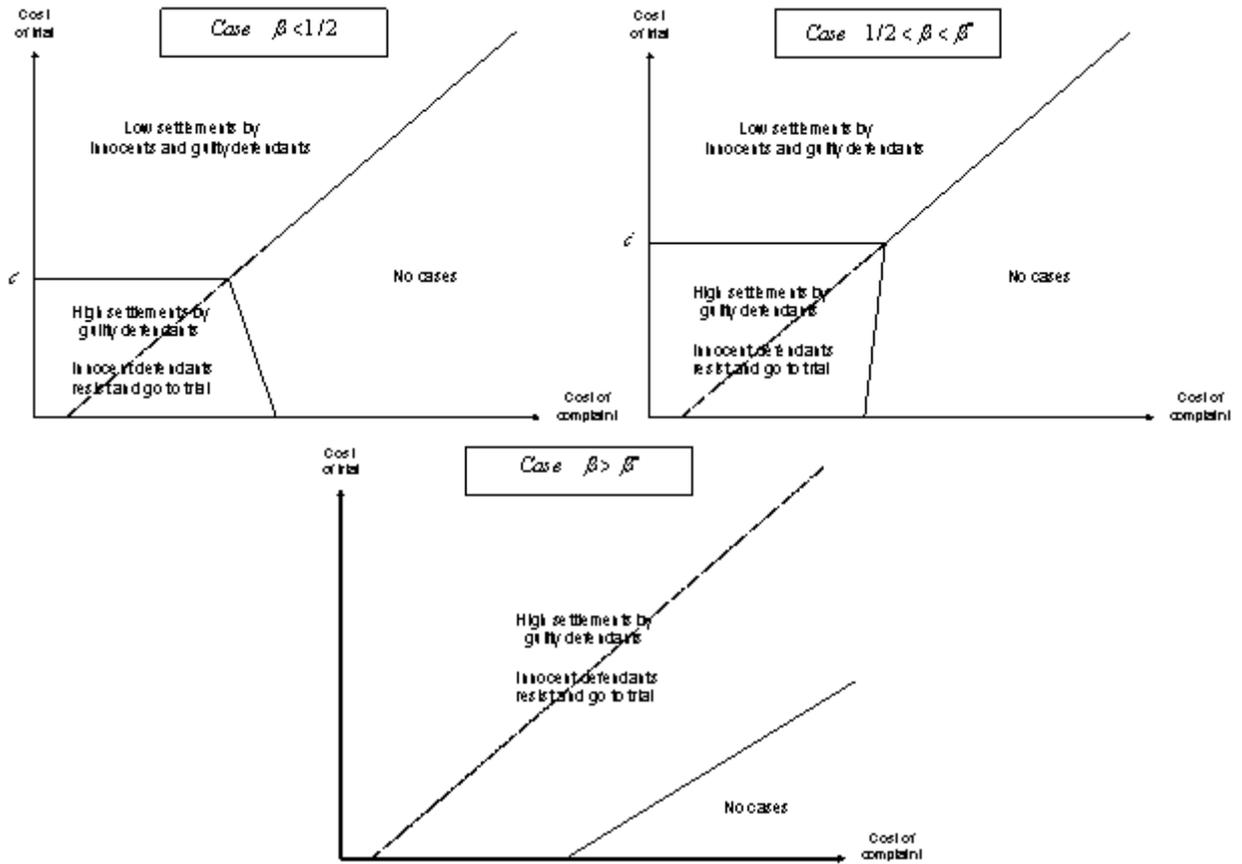


Figure 1

## 2.3 Comments

Obviously,  $P$  does not initiate a case if the cost  $\phi$  is too high. If instead this cost is limited, then  $P$  initiates a case and a guilty  $D$  always settles, whereas an innocent  $D$  settles only when  $P$  is "aggressive", which is the case when the compensation  $F$  is large, when the prior probability of a violation  $\beta$  and/or the quality of the judgements  $\rho$  are important, and when the cost of going to trial  $c$  is limited.

Therefore, when the cost  $c$  is large, whenever it takes place private action benefits  $P$  at the expense of  $D$ , who moreover ends up paying the same settlement compensation,  $\bar{R}$ , whether guilty or not. Private action is clearly not desirable then, since it does not have any deterrent effect on potential violators but simply acts as a "tax" on target Defendants. When instead the cost  $c$  is small, private action still benefits  $P$  at the expense of  $D$  whenever it takes place, but a guilty  $D$  ends-up paying more than an innocent  $D$ : a guilty  $D$  accepts the high settlement offer  $\bar{R}$ , whereas an innocent  $D$  resists and goes to trial and pays (in expected terms) less than  $\bar{R}$ . In that case, private action can therefore contribute to deter potential violators from engaging in anti-competitive behavior; note however that

this still comes at a cost, since even an innocent  $D$  ends up paying compensation to  $P$  with some positive probability.

This analysis allows us to describe more precisely the impact of alternative ways to foster private actions.

For example, other things being equal, reducing  $\phi$ :

- increases the number of cases opened (i.e., makes it more likely that  $P$  will initiate a case, depending on the other parameters, since  $\partial_\phi W_P < 0$ ) and, in this way, the expected cost from litigation for all Defendants (guilty or not);
- does not affect the "aggressiveness" of  $P$  and/or the "resistance" of  $D$  and, therefore, does not affect either the proportion of cases that are settled out-of-court, nor the "quality" of the screening of guilty Defendants.

Similarly, increasing the compensation  $F$ :

- increases the number of cases opened, and increases even more the expected cost from litigation for all Defendants, not only by increasing the number of cases opened but also by making each litigation more expensive for the Defendant (either through higher settlements or by higher expected sanctions in court);
- however, it also tends to make  $P$  more aggressive, which contributes to enhance the screening of guilty Defendants.

Finally, reducing the cost of trials  $c$ :

- limits the Defendants' willingness to settle ( $\underline{R}$  and  $\bar{R}$  are both reduced) and, as a result, reduces the number of cases opened by non-aggressive Plaintiffs (when  $c > c^*$ ,  $\partial_c W_P > 0$ ); in contrast, aggressive Plaintiffs may gain less or more (when  $c < c^*$ ,  $\partial W_P / \partial c = (2\beta - 1)\rho$  and is thus positive if and only  $\beta > 1/2$ ), and thus the impact on the number of cases opened is ambiguous;
- reduces the cost from each litigation for all Defendants (guilty or not), whether the Plaintiff is aggressive or not – and reduces this cost even more for guilty Defendants when the Plaintiff is aggressive;
- but reducing the cost from litigation also encourages  $P$  to be aggressive and, in this way, contributes to a screening of guilty Defendants.

Let us also note that raising the accuracy of the court, i.e., raising  $\rho$ :

- Encourages  $P$  to be aggressive ( $\partial_\rho c^* > 0$ ) and, consequently, forces innocent Defendants to go to trial, which is good for screening Defendants;
- Reduces the number of cases initiated by non-aggressive Plaintiffs as well as the costs for the Defendants of such cases (when  $c > c^*$ ,  $\partial W_P/\partial\rho < 0$  and  $\partial W_D/\partial\rho > 0$ );
- Raises the costs for guilty Defendants while reducing them for innocent Defendant when the Plaintiff is aggressive; aggressive Plaintiffs may gain less or more (when  $c < c^*$ ,  $\partial W_P/\partial\rho = (2\beta - 1)[F + c]$  and is positive if and only  $\beta > 1/2$ ), so that the impact on the number of cases opened is ambiguous;

In the same way, when prior evidence about the antitrust violation is stronger, i.e., when  $\beta$  rises, this:

- encourages  $P$  to be aggressive ( $\partial c^*/\partial\beta > 0$  and for  $\beta \geq \beta^*$ ,  $P$  are always aggressive) and, consequently, forces innocent Defendants to go to trial, which is good for screening Defendants;
- has no effect on the costs for the Defendants and on the number of cases initiated by non-aggressive Plaintiffs;
- makes aggressive Plaintiffs gain more (when  $c < c^*$ ,  $\partial W_P/\partial\beta > 0$  as  $\rho > 1/2$ ), so that more cases are opened.

This first analysis sheds some light on the impact of private actions, and shows that different ways to encourage them have different impacts.

First, innocent Defendants are more prepared to go to court since they are more likely to avoid a conviction; indeed, in this simple framework, *only* innocent Defendants ever go to trial. This may have implications for court proceedings, which are explored in the next sections.

Second, encouraging private actions has both desirable and less desirable effects:

- it may trigger more cases; this increases overall litigation costs for Defendants, but may help to improve the enforcement of antitrust laws if guilty Defendants suffer more from litigation;
- it may or may not make it more likely that guilty Defendants suffer more from litigation;

- however, when the court is sufficiently accurate, guilty Defendants suffer more from litigation than innocent Defendants.

Remarks:

- Making each party bear its own cost (e.g.,  $c/2$ ) makes things worse; introducing a compensation for "false claims" may help correcting the bias against (innocent) Defendants, at the expense of discouraging private actions.
- It would probably be a good idea to introduce the possibility of a compensation for a successful Defendant (beyond the reimbursement of its cost). In our set-up, there is a "bias" against the Defendant, who is at best "unharmd": either the Defendant ends up paying nothing (when winning a trial) or suffering (when settling or losing a trial); and in expected terms, even an innocent Defendant is always hurt (since winning a trial is never a sure thing). Therefore, some compensation would be needed to make even an innocent Defendant neutral; this may also help screen out real/false claims in the section with informed Plaintiffs.

## 2.4 Accounting for background evidence

We now suppose that the Judge must convict the Defendant if and only if her posterior belief about the Defendant's guilt, based on any relevant evidence, (weakly) exceeds some threshold,  $\hat{p}$ . Assuming that the Judge is fully rational, her posterior belief will depend on the *ex ante* probability  $\beta$  of a breach of competition law, the fact that the case has gone to trial after pre-trial bargaining (together with the parties' strategies), and finally the signal  $\sigma$ . We will denote by  $\hat{\beta} = \Pr(\theta = B|\text{trial})$  the Judge's equilibrium interim belief, prior to observing the signal  $\sigma$ , about the likelihood that a Defendant who proceeds to trial is guilty, and by  $P_J(\sigma) = \Pr(\theta = B|\sigma)$  her posterior belief about the Defendant's guilt, given the signal  $\sigma$  generated by the trial.

Given  $\sigma$ , the Defendant will thus be found guilty when:

$$P_J(\sigma) \geq \hat{p}.$$

To ensure consistency with the previous analysis, we will assume that, in the absence of any other background information, the Judge would convict the Defendant when and only when receiving a bad signal:

$$\frac{\beta(1-\rho)}{\beta(1-\rho) + (1-\beta)\rho} < \hat{p} < \frac{\beta\rho}{\beta\rho + (1-\beta)(1-\rho)}. \quad (3)$$

Intuitively, the Judge is more likely to find the Defendant guilty when she receives a "bad" signal, which in turn makes a violator more likely to be found guilty; indeed, the Judge's posterior beliefs satisfy Bayes' rule:

$$P_J(W) = \frac{\hat{\beta}(1-\rho)}{\hat{\beta}(1-\rho) + (1-\hat{\beta})\rho}, P_J(S) = \frac{\hat{\beta}\rho}{\hat{\beta}\rho + (1-\hat{\beta})(1-\rho)},$$

which, since  $1/2 < \rho < 1$ , implies

$$P_J(S) \geq P_J(W), \quad (4)$$

with a strict inequality whenever  $0 < \hat{\beta} < 1$ .<sup>7</sup> As a result, a violator (type  $B$ ) is more likely to be found guilty than a non-violator (type  $N$ ); letting  $P_D(\theta) = \Pr(P_J(\sigma) \geq \hat{p}|\theta)$  denote a type- $\theta$  Defendant's perceived probability of being found guilty, we have:

$$P_D(B) = \rho P_J(S) + (1-\rho) P_J(W), P_D(N) = (1-\rho) P_J(S) + \rho P_J(W),$$

and thus (4) and  $\rho > 1/2$  imply

$$P_D(B) \geq P_D(N), \quad (5)$$

with a strict inequality whenever  $0 < \hat{\beta} < 1$ . But this, in turn, implies that an innocent Defendant is more likely to resist settling. Indeed, going to trial exposes a type- $\theta$  Defendant to paying an expected sum equal to

$$P_D(\theta)(F+c),$$

which is thus higher for a violator. Since the Defendant's payoff from accepting a settlement offer  $R$  is independent of her type, it follows that a violator will be more tempted to settle. This, in turn may induce the Judge to revise downwards her belief ( $\hat{\beta} \leq \beta$ ) when a trial gets started.

If the case goes to trial, at date 3 a type- $\theta$  Defendant accepts the settlement offer,  $R$ , whenever

$$R \leq R(\theta) \equiv P_D(\theta)(F+c),$$

and rejects it whenever  $R > R(\theta)$ . As before, these acceptance thresholds constitute the relevant settlement offers for the Plaintiff, who will choose either a high offer,  $R(B) = P_D(B)(F+c)$ , which is only accepted by (all) violators or a low offer,

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<sup>7</sup>If  $\hat{\beta} \in (0, 1)$ ,  $P_J(W) = 1 / \left(1 + \frac{1-\hat{\beta}}{\hat{\beta}} \frac{\rho}{1-\rho}\right) < P_J(S) = 1 / \left(1 + \frac{1-\hat{\beta}}{\hat{\beta}} \frac{1-\rho}{\rho}\right)$ . If  $\hat{\beta} = 1$ , then  $P_J(W) = P_J(S) = 1$ , whereas if  $\hat{\beta} = 0$ , then  $P_J(W) = P_J(S) = 0$ .

$R(N) = P_D(N)(F + c)$ , which is accepted by all Defendants. The remark from footnote 7 still applies: in equilibrium, any Defendant who is indifferent between accepting or not the settlement offer accepts it with probability one (otherwise, the Plaintiff would rather deviate and offer a slightly lower settlement). Thus, there is no equilibrium in which the Defendant randomizes between accepting or not along the equilibrium path.

However, in contrast with the previous case, the Judge's posterior beliefs  $P_J(\sigma)$  now depend on the equilibrium strategies and so too, therefore, do Defendant's beliefs  $P_D(\theta)$  and the corresponding settlement offers. We can distinguish three cases, depending on whether  $\hat{p}$  is above  $P_J(B)$ , between  $P_J(B)$  and  $P_J(W)$ , or below  $P_J(W)$ .

If  $\hat{p} > P_J(B)$ , then the Judge never issues a conviction. As a result,  $\bar{R} = \underline{R} = 0$ , implying that the Plaintiff will never open a case (at least when  $\phi > 0$ ). Such an equilibrium, where there is thus no trial, is indeed supported by (out-of-equilibrium) beliefs (for the Judge, in case of trial) such that  $\hat{\beta}$  is small ( $\hat{\beta} = 0$ , say).

If  $\hat{p} \geq P_J(W)$ , then the Judge always issues a conviction in case of trial. As a result,  $\bar{R} = \underline{R} = F + c$ , implying that, whenever  $\phi < F + c$ , the Plaintiff will open the case and systematically settle for  $F + c$  – so that, there again, there will never be a trial. Such an equilibrium could however only be supported by very high (out-of-equilibrium) beliefs  $\hat{\beta}$ ; in particular, given (3), one would need  $\hat{\beta} > \beta$ , which would be contrary to the "intuitive criterion" of Cho and Kreps (1987) which, given  $R(B) \geq R(N)$ , implies here that a Defendant who proceeds to trial is no less likely to be innocent than one taken at random from the population.

Finally, if  $P_J(B) \geq \hat{p} > P_J(W)$ , in case of trial the Judge convicts the Defendant when there is strong evidence of breach ( $\sigma = S$ ). The two relevant settlement offers are then the same as before,  $R(B) = \bar{R} = \rho(F + c)$  and  $R(N) = \underline{R} = (1 - \rho)(F + c)$ . However, there is no equilibrium in which the Plaintiff would offer  $\bar{R}$ , since then the Defendant would refuse to settle and go to trial only when innocent, implying  $\hat{\beta} = 0$  and thus  $P_J(B) = P_J(W) = 0 < \hat{p}$ . There may exist however an equilibrium where the Plaintiff offers to settle for  $\underline{R}$ , which is accepted by all Defendants; no trial occurs in this candidate equilibrium, but it can be supported by (out-of-equilibrium) beliefs close enough to the prior ones ( $\hat{\beta} = \beta$ , say). For this candidate equilibrium to exist, the Plaintiff must not find it profitable to deviate and – taking as given the Judge's equilibrium behavior – opt for a high settlement offer  $\bar{R}$ ; from the previous analysis, this equilibrium thus only exists when  $c \geq c^*$ .

This discussion leads to:

**Proposition 1** *There always exists an equilibrium where the Plaintiff never starts a case, anticipating that the Defendant would always reject any positive offer if made and that the Judge will never decide against a Defendant in case of trial. When  $c \geq c^*$  and  $\phi \leq \underline{R} = (1 - \rho)(F + c)$ , there also exists an equilibrium where the Plaintiff starts the case and always settles with the Defendant for  $\underline{R}$ , anticipating that in case of trial the Judge would convict the Defendant when finding strong evidence of breach. There is no other equilibrium satisfying the intuitive criterion of Cho and Kreps.*

The proposition stresses that private action is here very ineffective in screening out guilty from innocent Defendants: cases are either never started, or always settled for an amount,  $\underline{R}$ , that is paid by guilty and innocent Defendants alike. In neither case does a guilty Defendant end up worse off than an innocent one. This absence of "screening" stems from the fact that: (i) it is always desirable for the Plaintiff to settle with at least some types of Defendants, in order to save on trial costs (and for the same reason, to settle with all the Defendants of this or these types); and: (ii) the Defendant is less likely to settle when innocent. As a result, there is no separating equilibrium, since in such an equilibrium all guilty Defendants would have to settle while no innocent would do so; anticipating that only innocent Defendants would ever come to trial, the Judge would then never issue any convictions, which in turn induces guilty Defendants, too, to resist settlements.

## 2.5 Uncertain costs

The above analysis therefore stresses a difficulty in relying on private litigation and courts to enforce competition law: since innocent firms are more likely to resist settlement, Judges anticipate seeing mostly innocent Defendants in court, which in turns tends to bias their attitude and make the system less effective; in one scenario, no complaint is ever launched; in the other scenario, complaints are launched but innocent Defendants end up being treated in the same way as guilty ones.

The underlying difficulty stems in part from the implicit assumption that the Plaintiff knows exactly "how far to go"; i.e., she knows how much a guilty Defendant would be willing to pay and is therefore able to "target" guilty Defendants and make sure that, if needs be, all of the guilty ones (but only those) settle. To explore further the implications of this assumption, we now extend the framework so as to allow for some uncertainty about the costs to the Defendant of proceeding to trial. Specifically, we assume in this section that, in case of trial, besides the verifiable cost  $c$ , a guilty Defendant also bears

an additional cost  $k$ ,<sup>8</sup> which is uniformly distributed on an interval  $[0, K]$ ; to fix ideas, we will assume that this additional cost is non-transferable, even if the Defendant wins the case. For a guilty Defendant, the expected cost of going to trial is then  $\rho(F + c) + k$ .<sup>9</sup>

We first briefly analyze the case where the Judge has to rely solely on the evidence generated at the trial. In that case, the Plaintiff can offer a low settlement  $\underline{R}$ , which is always accepted, or "target" guilty Defendants and propose a high settlement. Since a proportion  $\alpha$  of guilty Defendants have costs higher than  $k$  when  $k = (1 - \alpha)K$ , a settlement offer  $\bar{R}(\alpha) = \rho(F + c) + (1 - \alpha)K$  will be accepted by a proportion  $\alpha$  of guilty Defendants; the Plaintiff's expected payoff is then equal to

$$\begin{aligned} W_P(\alpha) &= \beta \{ \alpha \bar{R}(\alpha) + (1 - \alpha) [\rho F - (1 - \rho)c] \} + (1 - \beta) [(1 - \rho)F - \rho c] - \phi \\ &= \beta \{ \alpha (\rho(F + c) + (1 - \alpha)K) + (1 - \alpha) [\rho(F + c) - c] \} + (1 - \beta) [(1 - \rho)(F + c) - c] - \phi \\ &= [\beta\rho + (1 - \beta)(1 - \rho)](F + c) + \beta\alpha(1 - \alpha)K - (1 - \beta\alpha)c - \phi \end{aligned} \quad (6)$$

Decreasing the settlement increases the proportion  $\alpha$  of guilty Defendants that accept it: it therefore involves a trade-off between acceptance and payoff in case of acceptance, which is reflected in the second term,  $\beta\alpha(1 - \alpha)K$ ; it moreover makes it more likely to avoid the trial cost, which is reflected in the third term,  $(1 - \beta\alpha)c$ . The overall expected payoff is concave in  $\alpha$  and the first-order derivative is:

$$\frac{\partial W_P}{\partial \alpha} = \beta [c + K(1 - 2\alpha)].$$

For the Plaintiff, when targeting the guilty Defendants the optimal proportion  $\alpha$  is thus equal to:

$$\alpha^* = \min \left[ 1, \frac{1}{2} + \frac{c}{2K} \right] > \frac{1}{2}.$$

The Plaintiff will indeed target the guilty, and favors a high amount when the payoff in (6) exceeds  $\underline{R} - \phi = (1 - \rho)(F + c) - \phi$ , which amounts to

$$c < c^{**} \equiv \frac{\beta(2\rho - 1)F + \beta(1 - \alpha^*)\alpha^*K}{1 - 2\rho\beta + \beta(1 - \alpha^*)}.$$

Therefore, when the Judge can only rely on the evidence submitted at the trial, the Plaintiff will launch a case whenever its cost  $\phi$  is low enough, and:

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<sup>8</sup>The analysis still applies when innocent Defendants, too, bear additional non-transferable costs, as long as these additional costs remain small compared with the difference in expected sanctions, measured by  $(2\rho - 1)(F + c)$ .

<sup>9</sup>The analysis is qualitatively the same when the additional cost  $k$  is ex post (observed and) transferred to the losing party. The expected cost of going to trial is then  $\rho(F + c + k)$  and the analytics are the same, replacing  $k$  with  $k' = \rho k$  and  $K$  with  $K' = \rho K$ .

- When  $c < c^{**}$ , the Plaintiff is "aggressive" and insists on a high settlement compensation, which is rejected by innocent Defendants but accepted by a proportion  $\alpha^*$  of guilty ones; the payoffs are then:

$$\begin{aligned} W_P &= [\beta\rho + (1 - \beta)(1 - \rho)](F + c) + \beta\alpha^*(1 - \alpha^*)K - (1 - \beta\alpha^*)c - \phi \\ W_D^B &= -\rho(F + c) - \min\{k, (1 - \alpha^*)K\}, \\ W_D^N &= -(1 - \rho)(F + c). \end{aligned}$$

- When  $c > c^{**}$ , the Plaintiff is less aggressive and offers a low settlement compensation, which is always accepted by the Defendant, guilty or innocent; the payoffs are then:

$$\begin{aligned} W_P &= (1 - \rho)(F + c) - \phi, \\ W_D^B(k) &= W_D^N = -(1 - \rho)(F + c). \end{aligned}$$

We now come back to the situation where the Judge can rely on any relevant background information as well as on the evidence generated at the trial. In that case, there always exists an equilibrium where no case is launched, supported by low (out-of-equilibrium) beliefs  $\hat{\beta}$ ; however, when  $c \geq c^{**}$  the "non-aggressive" equilibrium just described also exists, supported this time by (out-of-equilibrium) beliefs  $\hat{\beta}$  sufficiently close to the prior ones. We now study whether there can exist an equilibrium where the Plaintiff is aggressive and targets guilty Defendants. When only a proportion  $\alpha$  of guilty Defendants settle, the Judge's interim belief  $\hat{\beta}$  is given by Bayes' rule; hence  $\hat{\beta} = \hat{\beta}(\alpha)$ , where

$$\hat{\beta}(\alpha) \equiv \frac{\beta(1 - \alpha)}{(1 - \beta) + \beta(1 - \alpha)}.$$

Similarly, the Judge's posterior beliefs,  $P_J(\sigma)$ , is given by

$$\begin{aligned} P_J(S; \alpha) &\equiv \frac{\beta(1 - \alpha)\rho}{\beta(1 - \alpha)\rho + (1 - \beta)(1 - \rho)}, \\ P_J(W; \alpha) &\equiv \frac{\beta(1 - \alpha)(1 - \rho)}{\beta(1 - \alpha)(1 - \rho) + (1 - \beta)\rho}. \end{aligned} \tag{7}$$

It is easy to check that  $\hat{\beta}(\alpha) \leq \beta$ , with a strict inequality when  $\alpha > 0$ ; hence the Judge will never convict the Defendant when there is weak evidence of breach:  $P_J(W; \alpha) < \hat{p}$ . Moreover,  $P_J(S; \alpha)$ : (i) decreases as  $\alpha$  increases; and (ii) is by assumption higher than  $\hat{p}$  for  $\alpha = 0$  (since  $\hat{\beta}(0) = \beta$ ), but equal to 0 for  $\alpha = 1$ . Thus, there exists a unique value  $\hat{\alpha} \in (0, 1)$  such that  $P_J(S; \alpha) = \hat{p}$  for  $\alpha = \hat{\alpha}$ . Using (7), we have:

$$1 - \hat{\alpha} = \frac{1 - \beta}{\beta} \frac{1 - \rho}{\rho} \frac{\hat{p}}{1 - \hat{p}}.$$

Therefore,  $\hat{\alpha}$  increases with the prior  $\beta$  and with the quality of the evidence (as measured by the degree of correlation  $\rho$ ) but decreases when the standard of proof (as measured by the conviction threshold  $\hat{p}$ ) increases. If  $\alpha > \hat{\alpha}$ , the Judge would never convict a Defendant, implying that all Defendants, guilty or not, would reject the settlement offer  $\bar{R}(\alpha)$ . In contrast, any  $\alpha \in [0, \hat{\alpha}]$  may support a candidate equilibrium in which the Defendant is convicted when (and only when) the Judge receives strong evidence of a breach ( $\sigma = S$ ). Therefore, there exists an equilibrium where the Plaintiff is aggressive and targets (a proportion  $\alpha$  of) guilty Defendants when  $\alpha^* \leq \hat{\alpha}$ , which is the case when

$$\hat{\alpha} > \frac{1}{2} \text{ and } K \geq \hat{K} \equiv \frac{c}{2\hat{\alpha} - 1} (> c).$$

To sum-up, when  $K$  is low (i.e., little uncertainty about the Defendant's cost in case of trial) or when  $\hat{\alpha} \leq \frac{1}{2}$  (that is, when the evidence is of poor quality, the proportion of guilty Defendants is low or the standard of proof is high), there is again no scope for screening out guilty Defendants: in equilibrium, either no case is launched or (provided  $c \geq c^{**}$  and  $\phi \leq (1 - \rho)(F + c)$ ) a case is launched but always settled, whether the Defendant is innocent or not. When instead: (i)  $\hat{\alpha} > \frac{1}{2}$  and  $K$  is high (in particular, it must be higher than the part of the cost that is certain, since  $\hat{K} > c$ ); and (ii)  $c \leq c^{**}$  and  $\phi$  small enough, there also exists a partially separating equilibrium where guilty Defendants are worse-off than innocent ones. In this equilibrium, the payoff of the Plaintiff and of the Defendant are equal to (using the fact that  $\alpha^* < \hat{\alpha} < 1$  implies  $\alpha^* = 1/2 + c/2K$ ):

$$\begin{aligned} W_P &= [\beta\rho + (1 - \beta)(1 - \rho)](F + c) - c + \beta\alpha^*(1 - \alpha^*)K + (\beta\alpha^*)c - \phi \\ &= [\beta\rho + (1 - \beta)(1 - \rho)](F + c) + \beta(c + K)^2/4K - (c + \phi), \\ W_D^B(k) &= -\rho(F + c) - \min\{k, (1 - \alpha^*)K\} \\ &= -\rho(F + c) - \min\{k, (K - c)/2\}, \\ W_D^N &= -(1 - \rho)(F + c). \end{aligned}$$

Introducing enough uncertainty about the Defendant's cost of trial may thus sometimes restore the existence of a screening equilibrium where guilty Defendants end-up worse off than innocent ones. The effect of both enforcement costs are then qualitatively the same as previously. When the costs of initiating a case,  $\phi$ , are too large,  $P$  does not initiate a case while she does when those costs are lower. When the trial costs,  $c$ , are large, both types of  $D$  accept the settlement offer and private actions have no deterrent effect as guilty and innocent Defendants expect to get the same penalty while they are screened when those trial costs are lower as innocent Defendants expect to pay less than

guilty ones. Moreover, one should note that the trial costs bound under which  $P$  is aggressive is lower when background evidence is admissible than when it is not, i.e.  $c^{**} < c^*$ . Consequently, Plaintiffs are less aggressive when background evidence is admissible and screening of guilty Defendants is better when it is not.

More precisely, focussing when it exists on the equilibrium where the Plaintiff does launch a case then, other things being equal:

- reducing the cost of launching a case  $\phi$ 
  - increases the number of cases opened (since  $\partial W_P/\partial\phi < 0$ ) and thus the expected cost from litigation for all Defendants (guilty or not);
  - does not affect whether guilty Defendants are screened out;
- increasing the compensation  $F$ 
  - increases the number of cases opened and thus the expected cost from litigation;
  - tends to make the Plaintiff more aggressive (i.e.,  $c^{**}$  increases), which contributes to screening guilty Defendants.
- reducing the cost of trials  $c$ 
  - conditional on the Plaintiff being aggressive or not, decreases the amount demanded by the Plaintiff and thus the expected cost from litigation for the Defendant,<sup>10</sup>
  - but also encourages the Plaintiff to be aggressive and, in this way, contributes to screening guilty Defendants.
  - limits the Defendant's willingness to settle and, as a result, reduces the number of cases opened by a non-aggressive Plaintiff (when  $c < c^{**}$ ,  $\partial W_P/\partial c > 0$ ); in contrast, an aggressive Plaintiff, who goes to trial with probability  $1 - \beta\alpha^*(c)$ , may gain less or more (when  $c < c^{**}$ ,  $\partial W_P/\partial c = \beta(2\rho - 1 + \frac{c+K}{2K}) - \rho$  and is thus positive only when  $\beta > \rho/(2\rho - 1 + \frac{c+K}{2K})$ );

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<sup>10</sup>A non-aggressive Plaintiff offers to settle for  $\underline{R} = (1 - \rho)(F + c)$ , while an aggressive Plaintiff offers to settle for

$$\bar{R}(\alpha^*) = \rho(F + c) + \frac{K - c}{2} = \rho F + \left(\rho - \frac{1}{2}\right)c + \frac{K}{2};$$

both offers thus increase with  $c$ .

- raising the accuracy of the court  $\rho$ :
  - encourages the Plaintiff to be aggressive ( $\partial c^{**}/\partial \rho > 0$ )
  - reduces the number of cases initiated by a non-aggressive Plaintiff and reduces the expected litigation costs for the Defendant (when  $c > c^{**}$ ,  $\partial W_P/\partial \rho < 0$  and  $\partial W_D/\partial \rho > 0$ );
  - has an ambiguous impact on the number of cases opened by an aggressive Plaintiff (when  $c < c^{**}$ ,  $\partial W_P/\partial \rho = (2\beta - 1)(F + c)$  and is positive if and only  $\beta > 1/2$ ) but, conditional on a case being launched, improves the screening of guilty Defendants by increasing the expected cost of litigation for guilty Defendants while decreasing it for innocent ones (when the Plaintiff is aggressive,  $\partial W_D^B/\partial \rho < 0 < \partial W_D^I/\partial \rho$ );
- increasing the prior belief about antitrust violation,  $\beta$ :
  - encourages the Plaintiff to be aggressive ( $\partial c^{**}/\partial \beta > 0$ ), which contributes to screening guilty Defendants;
  - has no impact on the number of cases initiated by a non-aggressive Plaintiff and the corresponding litigation costs for the Defendant;
  - increases the number of cases opened by an aggressive Plaintiff (when  $c < c^{**}$ ,  $\partial W_P/\partial \beta = (2\rho - 1)(F + c) + (c + K)^2/4K > 0$ ).

### 3 Informed Plaintiff

We now turn to the case where the Plaintiff has some private information about whether the Defendant has committed a breach of competition law. To capture this, we will assume that the Plaintiff receives a signal  $\sigma_P$ , which can take two values,  $H$  or  $O$ : a Plaintiff who has received a signal  $\sigma_P = H$  has higher updated beliefs  $\beta_H > \beta$  about  $\theta = B$ , whereas a Plaintiff with signal  $\sigma_P = O$  has lower updated beliefs  $\beta_O < \beta$ . For the sake of exposition, we will denote by  $P_H$  and  $P_O$ , respectively, the two types of Plaintiff;  $P_H$  can be interpreted as an "honest" Plaintiff, since she believes that a breach of competition law is indeed likely to have taken place, whereas  $P_O$  can instead be seen as an "opportunistic" Plaintiff. We assume again that the Judge is not allowed to use any background evidence other than the signal  $\sigma$  generated by the trial.

If the case goes to trial, at date 3 the Defendant pays  $F + c$  if found guilty, which as in Section 2.2 happens with probability  $\rho$  if  $\theta = B$  and  $1 - \rho$  if instead  $\theta = N$ . As a result, the Defendant's optimal behavior is not altered by the Plaintiff's private information, which affects the Plaintiff's behavior but not the Judge's one;<sup>11</sup> therefore, at date 2 the Defendant again accepts a settlement offer  $R$  if

$$R \leq \begin{cases} \bar{R} = \rho(F + c) & \text{if } \theta = B \\ \underline{R} = (1 - \rho)(F + c) & \text{if } \theta = N \end{cases}$$

The same settlement offers as in Section 2.2 are therefore again relevant: the Plaintiff will either propose a high settlement,  $\bar{R} = \rho(F + c)$ , or a low one,  $\underline{R} = (1 - \rho)(F + c)$ . If the Plaintiff proposes a low settlement, both types of Defendant accept it and the Plaintiff thus earns as before

$$\underline{R} = (1 - \rho)(F + c). \quad (8)$$

If instead an honest Plaintiff  $P_H$  offers a high settlement, her offer is only accepted by violators and she earns

$$\beta_H \bar{R} + (1 - \beta_H)[(1 - \rho)F - \rho c] = \beta_H \rho(F + c) + (1 - \beta_H)[(1 - \rho)F - \rho c], \quad (9)$$

since an innocent Defendant prefers going to the trial. An honest Plaintiff favors a low amount  $\underline{R}$  when her payoff in (8) exceeds that in (9), which amounts to  $\beta_H < \beta^* = 1/2\rho$  and

$$c > c_H^* \equiv c^*(\beta_H), \quad (10)$$

where

$$c^*(\beta) \equiv \frac{\beta(2\rho - 1)F}{1 - 2\rho\beta}.$$

For the sake of exposition, we will assume that  $\beta_H < \beta^*$  in what follows. Then, when condition (10) holds, an honest Plaintiff then choose to start the case when

$$\phi < \underline{\phi}(c) \equiv (1 - \rho)(F + c).$$

If instead  $c < c_H^*$ , an honest Plaintiff  $P_H$  would opt for a high offer  $\bar{R}$  and thus starts a case when

$$\phi < \bar{\phi}_H \equiv \bar{\phi}(c, \beta_H),$$

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<sup>11</sup>This also rules out "signalling effects" that could arise if the Plaintiff's information was relevant for the Defendant.

where

$$\begin{aligned}\bar{\phi}(c, \beta) &\equiv \beta\rho(F + c) + (1 - \beta)[(1 - \rho)F - \rho c] \\ &= [\beta\rho + (1 - \beta)(1 - \rho)]F + (2\beta - 1)c.\end{aligned}$$

Likewise, an opportunistic Plaintiff  $P_O$  would ask for a low amount  $\underline{R}$  if  $c > c_O^* \equiv c^*(\beta_O)$ , in which case, once again, she starts the case when  $\phi < \underline{\phi}(c)$ ; if instead  $c > c_O^*$ , she opts for a high amount  $\bar{R}$  and thus starts a case when  $\phi < \bar{\phi}_O(c) \equiv \bar{\phi}(c, \beta_O)$ .

By construction,  $\underline{\phi}(c)$  and  $\bar{\phi}(c, \beta)$  coincide for  $c = c^*(\beta)$ ; in addition,  $\underline{\phi}$  increases in  $c$ , while  $\partial\bar{\phi}/\partial c = (2\beta - 1)\rho$ , so that  $\bar{\phi}(., \beta)$  increases in  $c$  when  $\beta > 1/2$  but decreases otherwise,  $\partial\bar{\phi}/\partial\beta = 2\rho c + (2\rho - 1)F > 0$  and  $\partial^2\bar{\phi}/\partial\beta\partial c = 2\rho > 0$ ; therefore, we have  $c_H^* = c^*(\beta_H) > c_O^* = c^*(\beta_O)$ ,  $\bar{\phi}_H(c) = \bar{\phi}(c, \beta_H) > \bar{\phi}_O(c) = \bar{\phi}(c, \beta_O)$  and  $\bar{\phi}'_H(c) = (c, \beta_H) \partial\bar{\phi}(c, \beta_H) / \partial c > \bar{\phi}'_O(c) = \partial\bar{\phi}(c, \beta_O) / \partial c$ .

We can now summarize the equilibrium strategy of the Plaintiff:

- When  $c < c_O^*$ , both types of Plaintiffs favor a high settlement  $\bar{R} = \rho(F + c)$  and

$$\left\{ \begin{array}{ll} \text{for } \phi < \bar{\phi}_O(c), & P_H \text{ and } P_O \text{ start a case;} \\ \text{for } \bar{\phi}_O(c) < \phi < \bar{\phi}_H(c), & \text{only } P_H \text{ starts a case;} \\ \text{for } \phi < \bar{\phi}_H(c), & \text{no case started.} \end{array} \right.$$

- If  $c_O^* < c < c_H^*$ , an honest Plaintiff favors a high settlement  $\bar{R}$  while an opportunistic Plaintiff favors instead a low offer  $\underline{R} = (1 - \rho)(F + c)$ , and

$$\left\{ \begin{array}{ll} \text{for } \phi < \underline{\phi}, & P_H \text{ and } P_O \text{ start a case;} \\ \text{for } \underline{\phi} < \phi < \bar{\phi}_H(c), & \text{only } P_H \text{ starts a case;} \\ \text{for } \phi > \bar{\phi}_H(c), & \text{no case started.} \end{array} \right.$$

- If  $c \geq c_H^*$ , both Plaintiffs favor a low offer  $\underline{R}$  and

$$\left\{ \begin{array}{ll} \text{for } \phi < \underline{\phi}, & P_H \text{ and } P_O \text{ start a case;} \\ \text{for } \phi > \underline{\phi}, & \text{no case started.} \end{array} \right.$$

Those results are described in Figure 2, for alternative values of the Plaintiff's beliefs, which affect the slope of  $\bar{\phi}$  (for simplicity, we restrict attention to the case  $\beta_H < \beta^*$ ):

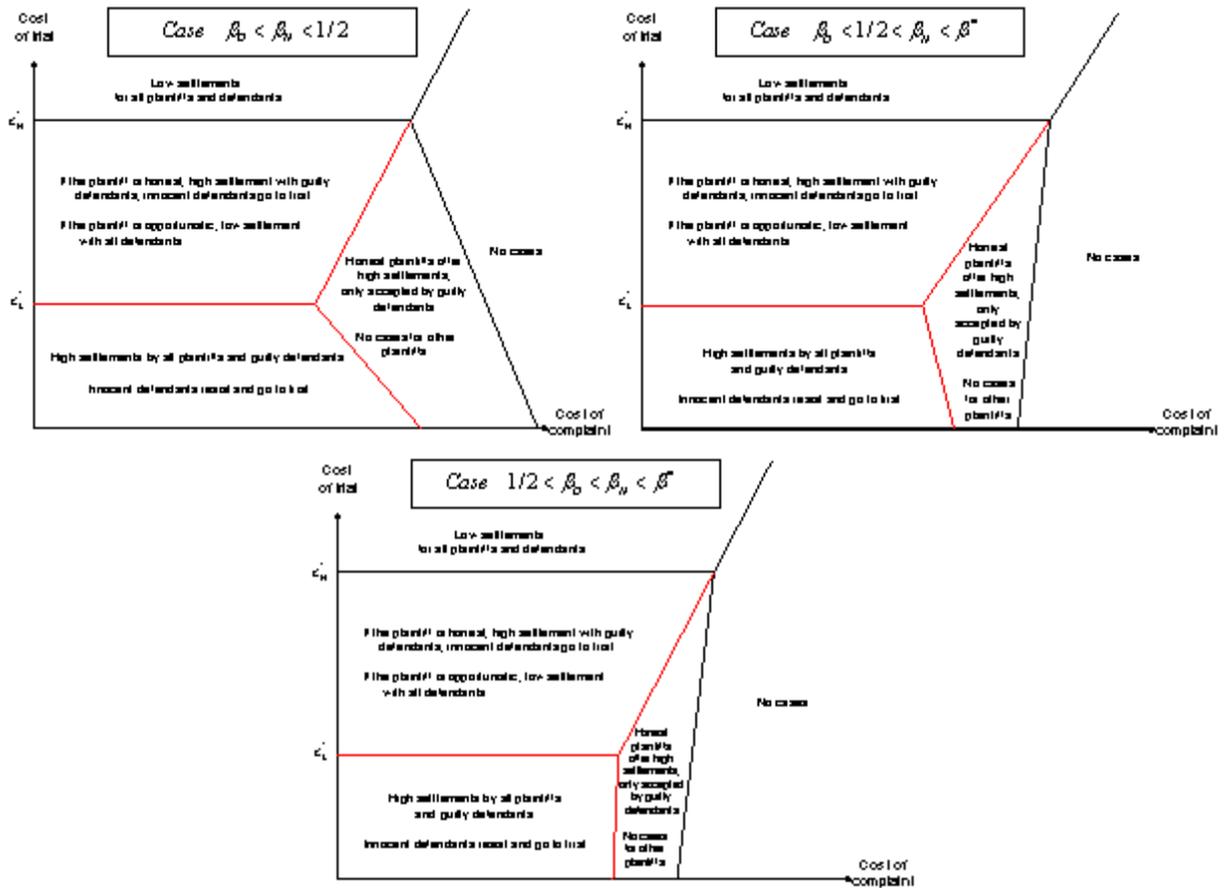


Figure 2

We can compare this case of an informed Plaintiff with the case of an uninformed Plaintiff, who would have an "intermediate" belief about  $\theta = B, \beta$ , satisfying  $\beta_O < \beta < \beta_H$  – see Figure 3 (characters in italics and regular lines refer to the case where the Plaintiff is informed, while bold characters and dashed bold lines refer to the case where she is uninformed), where we assume again  $\beta_H < \beta^*$ .

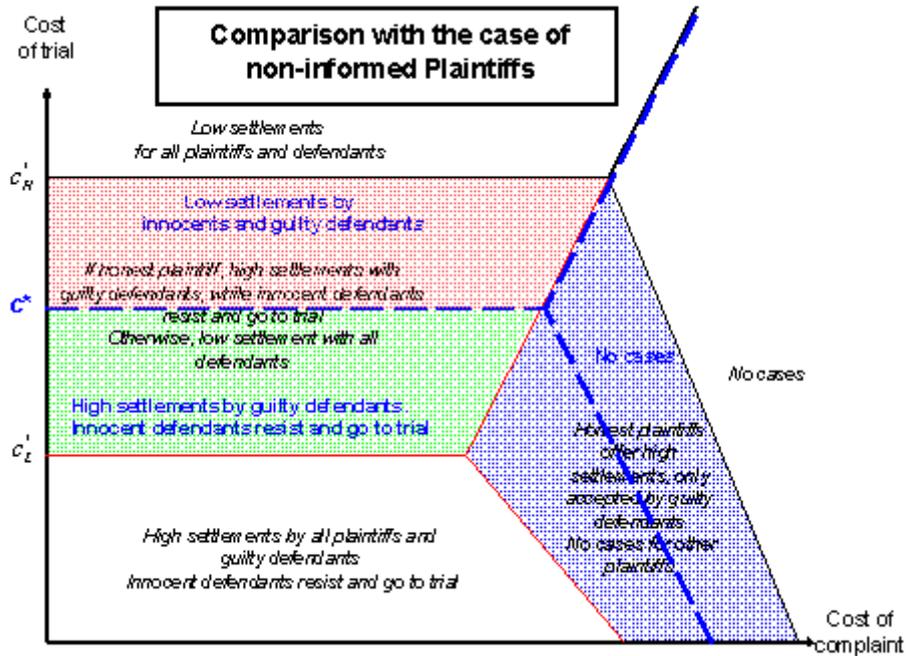


Figure 3

Plaintiffs' strategies are the same in unshaded regions. In the shaded region above the horizontal dashed line, an honest Plaintiff is aggressive while an uninformed (or opportunistic) Plaintiff is not; the screening of guilty Defendants thus benefits from the Plaintiff's having some information. In addition, in the shaded region that lies around the downward-sloping bold line, only an honest Plaintiff starts a case when informed, while either all Plaintiffs or none of them start cases when the Plaintiff has no information; this is again desirable because only good complaints, and not frivolous ones, are ever launched. In the dashed region below the horizontal bold line, however, an opportunistic Plaintiff is not aggressive whereas she would be so in the absence of any private information; this tends to harm the screening of guilty Defendants.

*Remark:* As before, if the Judge could rely on any relevant background information and decide on the basis of her posterior, updated beliefs, then again guilty Defendants could never be screened out: in equilibrium, either no case is launched or (provided that  $\phi < \underline{R}$ ), both types of Plaintiff and Defendants would always settle for  $\underline{R}$  (any other candidate equilibrium configuration, only innocent Defendants would ever go to trial, implying that the Judge would never issue a conviction). Hence, as in the case of an uninformed Plaintiff, allowing the Judge to rely on any relevant background information makes the system ineffective in screening out guilty from innocent Defendants.

This underlines one important conclusion to emerge from our analysis thus far. The

effectiveness of private antitrust enforcement actions in improving overall incentives for firms to obey the law depends on their having a different impact on antitrust violators than on innocent firms, with violators being more likely to settle their cases out of court. Paradoxically therefore the effectiveness of the system requires innocent Defendants to be more likely than the guilty to find themselves in court. This in turn depends on the rules of admissible evidence: if the courts are obliged to base their decisions on the evidence before them rather than on background information about the prior likelihood that Defendants coming to trial are guilty, an equilibrium can exist which is compatible with the incentives of all parties. But if the courts face no such obligation the only equilibria involve an increase in litigation, and in expense all round, with no improvement in the precision of the system as a whole. We conclude that reforms to facilitate private antitrust enforcement should be undertaken only with very great care if they are to avoid causing more harm than good.

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