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PRIVATE ANTITRUST ENFORCEMENT IN THE PRESENCE OF PRE-TRIAL BARGAINING*

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We study the effect of encouraging private actions for breaches of competition law. We develop a model of litigation and settlement with asymmetric information. We show that screening liable from non-liable defendants requires the Court to restrict the rules governing admissible evidence. We study how to design the rules so as to enhance the role of private litigation in antitrust enforcement and prove that increasing damages is better than reducing costs of initiating suits. We also find large benefits from introducing a system of compensation for defendants found non-liable, paid by unsuccessful plaintiffs.

I. INTRODUCTION

IS IT A GOOD IDEA TO ENCOURAGE PRIVATE CIVIL ACTIONS by those who have suffered from breaches of competition law? The United States has long been home to a culture of private antitrust litigation, encouraged in part by the availability of treble damages, while such litigation has been comparatively rare in Europe. This may be about to change: the European Commission has opened a debate on whether and how to increase the frequency of private antitrust litigation in the EU. In 2005, it issued a Green Paper entitled 'Damages Actions for Breach of the EC Antitrust Rules.' After a first public consultation and discussion by the European Parliament, the Commission published in April, 2008, a White Paper that proposed a first set of measures. The Commission's aim to facilitate private actions in Europe was

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encouraged by a comprehensive study by Waelbroeck *et al.* [2004]. This study contrasts the situation in the EU, where very few private actions take place, with that in the U.S., where approximately ten private actions are 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 (for a discussion see McMichael and Kemp [2007]). 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 then study the optimal design of rules for private litigation so as to enhance their role in enforcement.

Encouraging private actions may help enforce competition law by making use of decentralized information. Customers, suppliers or competitors that are hurt by anticompetitive behavior are likely to have relevant information about such breaches of competition law; giving them an opportunity to bring this information to a court in order to seek compensation may help punish violators and, in this way, contribute to detering future breaches of law. 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.'

However, encouraging private parties to sue violators of competition laws may result in excessive, even frivolous actions, undertaken despite low evidence of a breach of antitrust laws. Interested parties may have an incentive to complain for the wrong reasons – for instance to weaken a rival through legal harassment or to induce the rival to desist from behavior that increases the intensity of competition in the market. This concern may be particularly serious when pro and anti-competitive behavior can have superficially similar effects. For example, predatory pricing and competition on the merits can be quite hard to distinguish at first sight, and may equally harm competitors. Similarly, a supplier or distributor may be terminated either because it is inefficient or alternatively to exclude or harm rivals in vertically related markets. The same applies to tying, which can be motivated by efficiency gains but also by exclusionary motives in adjacent markets. As a result, private parties may have an incentive to launch a complaint even if they do not have any specific knowledge of wrongdoing – and in some extreme cases, even if their information suggests there was no anti-competitive behavior at all.

To analyze the role of private actions in enforcing competition law, we therefore develop a framework which accounts explicitly for interested parties' private information and incentives. The main ingredients are as follows. First, firms have the opportunity of undertaking profitable actions,

a fraction of which are anticompetitive. A potential plaintiff then obtains private information about whether the action is indeed anticompetitive and chooses whether to launch a case. Opening a case is costly, due to the expenses incurred in retaining lawyers, preparing documents, court fees, and so on, as well as the costs of collecting sufficient data for initiating a private antitrust action. The rules on the disclosure of documents and the standard of evidence influence the magnitude of these costs. Different values of these parameters thus reflect 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 U.S. discovery system in which many of the costs are borne by the defendant.

If the case goes to trial, the proceedings generate evidence about whether or not the competition law has been violated. We assume that the evidence is not completely reliable, 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. The magnitude of these damages constitutes another key parameter of the framework, and reflects measures such as the introduction of multiple damages, as in Canada or the U.S. where double and treble damages are respectively awarded to successful plaintiffs.

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, which allows the parties to save some of the costs of the proceedings. We model pre-trial bargaining between the plaintiff and the defendant by assuming that, once the plaintiff has launched the case, and before going to trial, it makes a settlement offer to the defendant. If (and only if) the defendant refuses the offer, the case proceeds to trial. The relative magnitude of the costs of the two phases (launching a case and going to trial) depends on the specificities of the judicial system. In the U.S., for example, settlements often occur when the plaintiff is granted discovery. In Germany, settlements usually take place instead when the court decides that the defendant is liable, before the last stage of the trial determining the damages. Also, since many EU member states use a loser-pays rule, we first assume that the costs of the trial (i.e., the second phase) are supported by the losing party, but consider later on the effect of a division of the costs in some proportion between the losing and winning parties.

The possibility of private settlements has important consequences. To be effective at deterring violations of competition law, private actions should lead to significantly greater costs for firms that have violated the law than for those that have not. It is natural to think that the way private actions achieve this goal is by bringing violators of the law in front of the courts. However, as already noted in the literature (see next section), when pre-trial bargaining takes place, violators have more incentives to settle while innocent firms have more incentives to resist and go to trial. In a system that is working well, the courts therefore become a place where the non-violators go to prove their

innocence rather than a place where violators are tried and punished. Indeed, prudent violators will settle long before a trial is reached.

In our context, these incentives create an adverse selection problem which may make private actions ineffective in deterring anticompetitive behavior, since violators and innocent defendants may end up being treated alike. If the courts took into account that defendants are less likely to settle when innocent, they would be inclined to decide in favor of those defendants that go to trial. But if they did so, it would no longer be attractive to violators to settle. As a result, all equilibria would involve complete 'pooling,' where either no plaintiffs ever launch a case, or all the cases that are launched are settled for the same amount independently of whether the defendant breached the law. In inducing non-liable defendants to settle as well, the private antitrust actions regime would fail to enforce competition law, simply transferring resources from defendants to plaintiffs, without sorting antitrust violators from others.

In practice, things do not work quite this way. Far from taking into account the likely proportions of violators and non-violators appearing before them and using these do decide the appropriate weight to give to the evidence, the courts are typically constrained to rely on rules of evidence and standards of proof that are independent of the statistical characteristics of the case. We show in this paper that this is a desirable, even essential feature of the judicial system when pre-trial bargaining plays an important role in determining who appears before the courts. There is a more effective screening of violators from non-violators (and therefore a more effective anti-trust enforcement) when the rules of judicial procedure oblige the court to rely solely on the facts established during the trial and not on background evidence about settlement offers. Another way of expressing this is that the courts should not act as Bayesian decision-makers; their decision-making should be independent of what they know about the incentives for violators and non-violators to settle out of court.

It is central to our analysis that private actions should encourage parties who have information relevant to the enforcement process to reveal it. Indeed, unless this occurs the authorities would do as well by opening investigations randomly. This makes it all the more important to understand why Bayesian reasoning is not an appropriate procedure for the courts to use. The reason is that in the presence of pre-trial bargaining between the parties, the deterrent impact of private actions arises not directly through the sanctions imposed by the courts but rather by the pressure placed on defendants to settle for large sums if they expect to lose the case. The procedure of the courts has therefore to be designed not just to allow them to make the optimal decision conditional on the facts of the cases that appear before them, but also to give the right incentives for settlement by the parties, a settlement that will in turn affect the types of case that go to trial. We show that the need to give the right incentives for settlement typically requires the

courts to restrict the kinds of information that may be allowed in evidence: thus, paradoxically, a procedure whose sole point is to encourage the revelation of relevant information must, if it is to work well, use less than the full information that it thereby makes available to the courts.

We discuss how the effectiveness of private actions depends on various parameters of the judicial process, with fines being a more effective deterrent than the fear of legal costs since the latter are more likely to discourage legitimate pro-competitive behavior. In principle transfer payments (such as fines) are better than real costs (such as the costs of proceedings), both because transfer payments do not involve real resource costs and because it is usually easier to target them more precisely on those who break the law. Furthermore, we show that the procedure can be enhanced if symmetric transfer payments are introduced for defendants. By this we mean that rewarding successful defendants with compensation payments from unsuccessful plaintiffs can restore a more effective balance between the deterrence of anti-competitive actions and the encouragement of pro-competitive actions. However, given that there are practical limits to the extent to which fines and compensation payments can be used (because of limited liability, for instance), it is not always true that costs of proceedings should be minimized. For instance, it may be better not to encourage private actions by reductions in the costs of opening a suit. Indeed, this may lead to higher eventual costs of proceeding to trial and will encourage well-founded and poorly-founded cases to the same degree**.** We show that, under such constraints, private actions should not be encouraged unless the plaintiffs have information whose quality exceeds a certain threshold; otherwise the fear of such actions will deter legitimate pro-competitive activities by firms. This need to avoid deterring legitimate pro-competitive activity is what distinguishes the analysis of anti-trust actions we perform here from the more general analysis of legal procedure with negotiated settlement, and it gives a distinctive flavor to our characterization of the optimal procedure, and notably to its 'caution' in the use of private information.

We do, however, make a number of simplifications to enhance the clarity of our analysis and to bring out the intuition of the results, most of which we discuss as we set out the model. One that should be stated at the outset is that we consider only the direct financial motives of plaintiffs for bringing private actions in pursuit of damages, and only the direct financial costs damage payments and the cost of trial may impose on defendants. As we have suggested, there are a number of important strategic motives that might lead some plaintiffs to open cases (such as the wish to weaken competitors), and there are some corresponding strategic costs that such cases may impose on defendants. Our simplification is motivated by the fact that such strategic considerations may be quite complex. Though they will often bear particularly heavily on defendants who have committed no violation of antitrust action, and therefore provide a reason for the public authorities to

err on the side of caution before facilitating private actions, there are also some circumstances in which strategic considerations may have an opposite bias: when plaintiffs are discouraged from seeking redress for antitrust violations because they are clients or suppliers of the defendant for instance. It is difficult to be confident about the overall bias of such strategic motives, if only because actions encouraged for such reasons are more visible than actions discouraged. Nevertheless, even when we ignore such strategic motives, it will become clear that the risk of encouraging actions that are motivated purely by the hope of financial reward due the to uncertainty of the outcome of litigation should be an important brake on the enthusiasm with which private actions are encouraged.

Some other complications we ignore include the extent to which class actions may differ from those brought by individual plaintiffs, and more generally issues that arise out of possible heterogeneity between plaintiffs other than in respect of the reliability of their information about whether an antitrust violation has been committed. These are interesting questions but they go substantially beyond those raised in this paper.

Our paper is organized as follows. Section 2 reviews the relevant literature in order to emphasize what is novel in our own findings. Section 3 describes the model and emphasizes the negative role of Bayesian reasoning on settlement bargaining. Section 4 characterizes the parties' behavior when Bayesian reasoning is excluded – that is, when the courts are constrained to rely on the evidence before them without using other background evidence. In section 5, we design the optimal rules for private antitrust litigation when this may modify their incentives to undertake anticompetitive actions. Finally, section 6 concludes.

II. REVIEW OF THE LITERATURE

II(i). *Literature on the Economics of Judicial Procedure*

Some of the elements of our analysis are already well known in the literature, and we note them here so as to emphasize what is original in our results. Spier [2007] provides a comprehensive review of the law and economics of litigation, a literature that goes back to Landes [1971], Posner [1972] and Gould [1973]. As she emphasizes, it is well known that pre-trial settlement may result in the innocent being disproportionately represented among the cases that go to trial (see Grossman and Katz [1983], Bebchuk [1984], Reinganum and Wilde [1986], Reinganum [1988], and Baker and Mezzetti [2001]). What we show is that this fact requires restrictions on the use of certain information by the courts if the appropriate incentives for deterring anti-competitive, and encouraging pro-competitive behavior are to be maintained. Indeed, while Spier [2007] notes in her review that encouraging productive economic activities is an important *desideratum* in general for the

design of litigation procedures, we show that this is critical *inter alia* for the information that courts may use. Our paper is the first to our knowledge to characterize the problem of designing a system of private anti-trust actions as one of inducing the optimal use of private information of potential plaintiffs so as to discourage undesirable behavior among defendants without discouraging desirable behavior. The critical role played here by the sensitivity of pro-competitive actions to the threat of litigation is what distinguishes the analysis of anti-trust actions from the domain of litigation more generally.

Other authors have argued for restrictions on background information but in a context different from ours. Daughety and Reinganum [1995, 2000a, 2000b], Spier [1997] and Friedman & Wickelgren [2002] have noted that for the courts to use Bayesian reasoning may have a negative effect on deterrence. We build on this insight to show what restrictions are required for the judicial system to use the private information of the parties to create the right balance of deterrence and encouragement of pro-competitive actions.[1] Fluet and Demougin [2006, 2008] make a similar point but in a quite different context without pre-trial settlement. They consider the provision of *ex ante* incentives to exert care in tort litigation and show that better *ex ante* incentives are provided by not relying on evidence such as background statistics or character evidence. However, this has nothing to do with incentives for out-of-court settlement, which has no place in their model. Secondly, the nature of the evidence they find it would be desirable to exclude is different: they show that litigation provides better *ex ante* incentives by excluding evidence that is insensitive to the parties' decisions or actions, while our own result excludes evidence about the likelihood of guilt conditional on the outcome of pre-trial bargaining.

An important contribution to the economics of litigation design was Shavell [1982], who studies the relative merits of alternative methods for the allocation of legal costs. The literature on the economics of settlement is comprehensively reviewed in Daughety [2000] and Daughety and Reinganum [2008] who note the extreme sensitivity of judicial outcomes to the nature of the rules governing how settlement takes place. Among the first explicit settlement models, Png [1983] and Ordover and Rubinstein [1986] already introduce asymmetric information (in static and dynamic settings, respectively), but postulate a fixed settlement amount (the only decision being whether to accept or not). The type of settlement negotiation in our model is closest in spirit to Bebchuk [1984], who allows an uninformed plaintiff to choose the terms of the settlement; the defendant has private information about the probability of being found liable, which lies within

[1] A different type of argument is found in Schrag and Scotchmer [1994] who propose restrictions on admissible evidence when courts are prejudiced against habitual criminals.

some range, and, as here, accepts an offer when it is likely to be found liable. Wickelgren [2004] builds on Bebchuk [1984] and shows that introducing the possibility of settlements lowers welfare by reducing deterrence; the intuition is that the settlement amount imposes a damage cap, preventing the defendant's liability covering the full range of possible harms. Finally, Reinganum and Wilde [1986] study a bargaining framework in which the plaintiff has more information than the defendant about the level of damages (in contrast, the probability of a judgement of liability is fixed and common knowledge); the plaintiff's offer then involves an element of signalling. These contributions provide valuable insights that we have deployed in the present paper in order to focus explicitly on a framework of optimal deterrence.

A more complex argument is due to Daughety and Reinganum [1995] who study the admissibility of the outcome of pre-trial negotiations as evidence in courts. This is a signalling model in which an informed plaintiff makes a settlement offer to the defendant that may be observed by the Court, and show that the observation of this offer by the Court is beneficial to plaintiffs but damaging to defendants. They do not draw general conclusions for the optimal design of the judicial system. In contrast to our own model, it is the observation of the amount (rather than the fact) of the settlement offer that causes the breakdown of the separating equilibrium. We show something stronger: the mere fact that the judge may take into account the rejection of the offer suffices to rule out any desirable screening, even if the judge does not observe the offer. The difference between this model and our own lies in the fact that for Daughety and Reinganum [1995] the Court observes either the truth or nothing. The stronger result follows, as we show here, when the Court always observes an informative but imperfect signal.[2]

II(ii). *Literature on Anti-Trust Litigation*

There is also a literature on anti-trust enforcement that has studied somewhat different concerns, or used a rather different modeling framework, from our own. 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

[2] Daughety and Reinganum [2000a] introduce an axiomatic (non Bayesian) model of evidence aggregation in trial courts followed by a Bayesian Appeal Court. They model trial courts as non Bayesian not for any reasons of optimal procedure but because they argue that it is not a reasonable approximation to feasible real-world procedures. Daughety and Reinganum [2000b] use the same axiomatic model and show that there is a systematic pro-Defendant or pro-Plaintiff bias in the court's decision. Though these papers are very different in spirit from Daughety & Reinganum [1995] and from the present paper they indicate how rich are the questions raised by the reasoning processes involved in Court decisions.

anti-competitive actions where firms are engaged in price-fixing and form a cartel acting as a monopolist. Martini shows that, in his 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 that set by a public agency.

It is widely recognized in the antitrust literature 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 be multiply rewarded for the resulting increase in damages.[3] 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 long delays and therefore allow the target firm to achieve some anti-takeover strategies. Salant [1987], recognizing these perverse incentives, analyzes a model of private antitrust enforcement and states that the size of the damage multiple imposed for antitrust violations has neutral welfare consequences. This result holds because the expected damage award is a pure transfer. Besanko and Spulber [1990] show that this result is not robust to the introduction of asymmetric information. It should be noted, though, that enforcement in the latter two papers comes from consumers and not from competitors or other third parties. Furthermore, plaintiffs have no private information, and the parties do not have the possibility of settling before the trial.

McAfee, Mialon and Mialon [2008] 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 competitors 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. Contrary to us, they do not consider the possibility of settlement before the trial, although in reality most cases do not go to trial because

[3] They suggest that these incentives may have been at work in the electrical equipment conspiracy of the 1950s.

settlement offers are made. Furthermore, they only allow treble damages as a tool to encourage private actions while we also consider the effects of modifications to the costs of launching a complaint or of the complete trial.

The effects of multiplying, and in particular trebling, damages on private antitrust litigation with the possibility of out of court settlements are discussed by Briggs, Huryn and McBride [1996]. Contrary to their model, we allow the jurisdiction to encourage private actions by other means than multiple damages and analyze their effects on the incentives of the plaintiff to sue and to settle. Polinsky and Che [1991] also analyze private antitrust litigation when out of court settlements are allowed. They show that decoupling the rewards to the litigant from the penalties for the violator reduces the plaintiff's incentive to sue without affecting the potential defendant's incentive to exercise care. However, their analysis is made under symmetric information between the different parties and assumes perfect enforcement of the law. In contrast, we introduce private information on the side of the defendant and on the side of the plaintiff as well; we also study the consequences of imperfect enforcement. As we show, it is the presence of private information that gives pre-trial bargaining such striking consequences, for plaintiffs use their bargaining to try to induce separation between violators and innocent defendants.[4]

III. FRAMEWORK AND PRELIMINARY ANALYSIS

We first present our framework, in which firms may or may not have breached competition law, and potential plaintiffs, with imperfect information about the existence of such a breach, must decide whether to launch a case and can moreover offer to settle out of court. We then use this framework to make preliminary observations concerning the role of beliefs in court proceedings and the type of evidence that judges and courts should rely upon.

III(i). *Framework*

There is a large population of initially identical firms. N_B of them ('B' standing for 'Breach' of competition law) get the opportunity to undertake an anticompetitive action, which generates an extra benefit for the firm but a welfare loss L to consumers or society; at the same time, N_N firms (where 'N' stands for 'No breach') get the opportunity to undertake an action that looks similar but is not anticompetitive and generates both a benefit for the firm and a welfare gain G.[5] Letting μ_B and μ_N denote the (endogenous)

[4] See Daughety and Reinganum [2005] for a survey of settlement bargaining in civil litigation.

[5] We thus allow a given firm to either commit a breach or to undertake a legitimate action, but not to do both. This avoids complications by ruling out the possibility of simultaneous legal proceedings for the same firm, but nothing important turns on this assumption for our arguments.

probabilities that the firms take advantage of these two types of opportunities, social welfare (gross of enforcement costs) is then equal to

$$N_N \mu_N G - N_B \mu_B L.$$

We want to study how and to what extent private litigation can help foster the enforcement of antitrust laws, by reducing the adoption of anticompetitive behavior, represented by μ_B, without deterring procompetitive actions, represented by μ_N. We will model the firms' benefits from undertaking these actions more precisely later on, and focus for the moment on the resulting exposure to litigation.

As discussed above, while potential plaintiffs may have useful information about anticompetitive behavior, we cannot take for granted that they will complain only when their case is well-founded. We model this by assuming that, for each action that is undertaken, there is a potential plaintiff with imperfect information about the pro- or anticompetitive nature of the action, who must decide to launch a case, given the expected costs and benefits of doing so and the information received.

Whenever a proceeding is initiated, 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. Since by assumption P can initiate a proceeding only when the firm has adopted one of the behaviors in question, there are two states of nature $\theta \in \{B, N\}$: $\theta = B$ corresponds to a case in which D has indeed committed a breach of competition law while $\theta = N$ corresponds to one in which there has been no breach. D knows θ (and we will denote by D_θ a Defendant of type θ) while P and J initially expect that $\theta = B$ with probability β, given by:

$$\beta = \frac{N_B \mu_B}{N_B \mu_B + N_N \mu_N}. \tag{1}$$

We will allow P and J to gather additional information, which is however imperfect and may generate both type I and type II errors. More precisely, P and J respectively observe two signals s and σ, about whether a violation has occurred. Each signal can take two values, 1 or 0, and is correlated with the existence of a breach of competition law: $\Pr(s = 1|\theta = B) = \Pr(s = 0|\theta = N) = r$, and $\Pr(\sigma = 1|\theta = B) = \Pr(\sigma = 0|\theta = N) = \rho$, where r and ρ denote the levels of correlation and, without loss of generality, (weakly) exceed 1/2. A signal value of 1 can thus be interpreted as 'strong evidence' of a breach, while 0 provides 'weak evidence' of such breach, while r and ρ can be interpreted as the quality of the evidence generated by the two signals. Note that we use Latin letters for the signal of the plaintiff and its precision and the corresponding Greek letters for the signal of the judge and its precision.

We will moreover allow P's information to be of variable quality (including the possibility that P does not have any private information, so

that $r = 1/2$), but assume throughout that the trial has a given degree of reliability $\rho > 1/2$ – private actions would otherwise never help enforcing antitrust laws.

The sequence of events is as follows. Having observed its signal s, P chooses whether to launch a complaint, in which case it must incur a fixed cost, ϕ, which represents the expense incurred in retaining lawyers, preparing documents, institutional fees for opening a case, and so on; different systems may result in different cost values, and thus encourage or discourage plaintiffs to complain. Alternatively, ϕ may be interpreted as the cost of collecting data for initiating a private antitrust action;[6] what matters for our purposes is that P 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 ϕ as characterizing different judicial regimes, with a high ϕ describing the European regime in which the costs are supported by plaintiffs, and a low ϕ describing the U.S. discovery system in which many of the costs are borne by defendants.

Pre-trial bargaining then ensues between P and D. We model this by assuming that P makes a single settlement offer R to D, which D may either accept or refuse. If D refuses the offer, the case proceeds to a trial.

The trial generates the signal σ, on the basis of which J determines the 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 alternative divisions of the costs. If a breach of law is established in court P is awarded damages F against D.

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

- *Stage 0:* Nature chooses whether D can adopt a particular (anticompetitive or competitive) conduct, in which case D chooses whether to take advantage of the opportunity; whenever such a conduct is adopted, the game proceeds to Stage 1.
- *Stage 1:* P observes its signal s and chooses whether to launch a complaint, in which case it pays ϕ and chooses a settlement offer R.[7]
- *Stage 2:* D observes R and accepts or rejects the offer.
- *Stage 3:* If the offer is rejected, the case goes to trial;[8] then Nature chooses σ, which is observed by J: if a violation is found, D bears the cost c and

[6] The judicial system usually set rules on the disclosure of documents and/or determine a certain amount of evidence above which the action may be initiated.

[7] 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) and can take this into account in reaching a decision, then allowing P to decide whether to make an offer might affect the analysis.

[8] We thus rule out here the possibility that P withdraws the complaint in the absence of settlement. This can correspond to specific legal provisions or implicitly supposes that P finds it

pays F to P; if instead no violation is found, D pays nothing, while P bears the cost c.

Private complaints can help enforcing antirust laws by forcing law-breachers to compensate plaintiffs. At the same time, though, law-abiding firms should not be deterred from adopting efficient, pro-competitive conduct. Therefore, the above-described system will be helpful only if it 'screens' violators of competition law from non-violators. This evidently depends on the likely outcome of the trials, which in turn depends on the way in which the judge is constrained to use the evidence at her disposal, as well as on the kinds of relevant evidence that are admissible. In 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. As we will see now, our analysis supports such restrictions on the use of background evidence, due to what can be called the 'innocent's curse.'

III(ii). *The Innocent's Curse*

As already noted in the literature on plea bargaining and civil litigation, pre-trial negotiations are subject to a standard case of adverse selection. Going to trial exposes D to pay $F+c$ if it is found liable, and nothing otherwise; D will therefore be willing to settle as long as the settlement offer R is lower than the expected cost of a trial, that is:

$$R \leqslant \rho_\theta(F+c),$$

where ρ_θ denotes the probability that D will be found liable, conditional on having committed a breach ($\theta = B$) or not ($\theta = N$). It follows that a defendant who has *not* behaved anticompetitively is more likely to refuse to settle, and thus to go to court, whenever it is less likely to be found liable, i.e., whenever $\rho_B > \rho_N$. Indeed, if

$$\rho_N(F+c) < R < \rho_B(F+c),$$

then D will settle when it has committed a breach of law, and will instead reject the settlement offer and rather go to trial when it did not breach the law. In such a case, the judge will only see defendants that have not committed a breach. It might be tempting to conclude that such

optimal to go to trial. As we will see (see the discussion after Proposition 3), this is indeed the case when c is small enough.

'background information' should be taken into account by the court when reaching its decision. This would have perverse consequences, however, since it would lead the judge to decide systematically in favour of the defendant, prompting in turn all defendants, guilty or innocent, to refuse any settlement and instead always to go to court.

We now show that, because of this innocent's curse, allowing the judge to rely on background evidence about possible settlement negotiations would actually render private actions quite ineffective in screening liable defendants from non-liable ones.

III(iii). *The Negative Role of Background Evidence*

To see this, suppose that the judge convicts the defendant if and only if her posterior belief about the existence of a violation, based on any relevant evidence, (weakly) exceeds some threshold, $\underline{\beta} \in (0, 1)$. In practice, the judge may benefit from many sources of information that are relevant to the case: the identity and history of the various parties, their reputation, their behavior in related cases, and so forth. To keep the analysis simple, we will assume here that the judge does not have any specific pre-trial information, beyond the general structure of the game described above (in particular, she does not observe any settlement offer[9]). Assuming that J is fully rational, her posterior belief will then depend on (and only on) the *ex ante* probability β of a breach of competition law (which depends on the equilibrium behavior of the firms), as well as on the fact that the case has gone to trial after pre-trial bargaining (together with P and D' equilibrium settlement strategies), and finally on the signal σ generated by the trial. In the following, we will denote by $\tilde{\beta} = \Pr(\theta = B|\text{trial})$ J's equilibrium interim belief, prior to observing the signal σ, about the likelihood that a defendant who proceeds to trial has indeed committed a breach of law, and by $\beta_\sigma = \Pr(\theta = B|\sigma)$ her posterior belief, given the signal σ generated by the trial. Given σ, D will thus be found liable when:

$$\beta_\sigma \geqslant \underline{\beta}.$$

Intuitively, J is more likely to find a violation when she receives 'strong evidence,' which in turn makes a violator more likely to lose the case; indeed, Bayes' rule and $\rho > 1/2$ imply:

$$(2) \qquad \beta_0 = \frac{\tilde{\beta}(1-\rho)}{\tilde{\beta}(1-\rho) + \left(1-\tilde{\beta}\right)\rho} \leqslant \beta_1 = \frac{\tilde{\beta}\rho}{\tilde{\beta}\rho + \left(1-\tilde{\beta}\right)(1-\rho)},$$

[9] This rules out 'signalling effects' which could otherwise arise if P's settlement offer was observed by J. Here, P's offer is only observed by D, which knows the true state θ anyway, and has no impact on J's beliefs.

with a strict inequality whenever $0<\tilde{\beta}<1$.[10] This, together with $\rho > 1/2$, in turn implies that the probability of a conviction is indeed higher for violators:

$$\begin{aligned}\rho_B &= Pr\left(\beta_\sigma \geqslant \underline{\beta}|B\right) = \rho Pr\left[\beta_1 \geqslant \underline{\beta}\right] + (1-\rho)Pr\left[\beta_0 \geqslant \underline{\beta}\right] \\ &\geqslant \rho_N = Pr\left(\beta_\sigma \geqslant \underline{\beta}|N\right) = \rho Pr\left[\beta_0 \geqslant \underline{\beta}\right] + (1-\rho)Pr\left[\beta_1 \geqslant \underline{\beta}\right],\end{aligned} \tag{3}$$

with again a strict inequality whenever $0<\tilde{\beta}<1$. Therefore, as noted above, a non-violator is indeed more likely to resist settling.

Anticipating that D_θ will settle as long as

$$R \leqslant R_\theta \equiv \rho_\theta(F+c),$$

P will either offer to settle for R_B, which is then only accepted by violators if $R_B > R_N$, or for a lower amount, R_N, which is then accepted by both types of defendants. Moreover, any D_θ that is indifferent between settling or not will in equilibrium settle with probability one; otherwise, P would rather deviate (undetected by J) and offer a slightly lower settlement, in order to save the cost of trial.[11] Thus, there is no equilibrium in which D randomizes between settling or not along the equilibrium path.

We can therefore distinguish three candidate equilibrium configurations, depending on whether $\underline{\beta}$ is above β_1, between β_1 and β_0, or below β_0:

- If $\underline{\beta} > \beta_1$, then J never issues a conviction. As a result, $R_B = R_N = 0$, implying that P will never open a case.[12] Such an equilibrium is indeed supported by (out-of-equilibrium) beliefs for J such that, in case of trial, $\tilde{\beta}$ is small ($\tilde{\beta} = 0$, say).
- If $\underline{\beta} \leqslant \beta_0$, then J always issues a conviction in case of trial. As a result, $R_B = R_N = F + c$, implying that P will open the case whenever $\phi < F + c$, and then systematically settle for $F + c$ – there will thus never be a trial.

[10] If $\tilde{\beta} \in (0,1)$, $\beta_0 = 1/\left(1+\frac{1-\tilde{\beta}}{\tilde{\beta}}\frac{\rho}{1-\rho}\right) < \beta_1 = 1/\left(1+\frac{1-\tilde{\beta}}{\tilde{\beta}}\frac{1-\rho}{\rho}\right)$. If $\tilde{\beta}=1$, then $\beta_0 = \beta_1 = 1$, whereas if $\tilde{\beta}=0$, then $\beta_0 = \beta_1 = 0$.

[11] Assume first that that, in response to an offer $R = R_\theta$, D_θ accepts to settle with probability μ. P's expected payoff, conditional on θ, is then

$$\mu R_\theta + (1-\mu)(\rho_\theta F - (1-\rho_\theta)c) = \rho_\theta(F+c) - (1-\mu)c.$$

Offering to settle for a slightly lower R would break D_θ's indifference (and either not affect the other type of defendant, if it was not initially indifferent between settling or not, or affect it in the same way, if it was also indifferent) and avoid the expected cost of going to trial, thereby increasing P's expected payoff by μc.

[12] More precisely, P will never open a case whenever $\phi > 0$; if $\phi = 0$, P might be willing to open a case but the outcome is formally equivalent, since P and D will settle for no compensation ($R = 0$).

Such an equilibrium can however be supported only by very high (out-of-equilibrium) interim beliefs $\tilde{\beta}$.[13]

- Finally, if $\beta_1 \geqslant \underline{\beta} > \beta_0$, in case of trial J convicts D when and only when there is strong evidence of breach ($\sigma = 1$), and the relevant settlement offers are thus $R_B = \rho(F+c)$ and $R_N = (1-\rho)(F+c) < R_B$. However, there is no equilibrium in which P would offer R_B, since then D would refuse to settle and go to trial when and only when innocent, implying $\tilde{\beta} = 0$ and thus $\beta_1 = \beta_0 = 0 < \underline{\beta}$. There may exist an equilibrium where P offers to settle for R_N, which is accepted by both types of D, but then again, no trial occurs in this candidate equilibrium.

This discussion can be summarized as:

Proposition 1. When the judge relies on full background evidence, there is no equilibrium where the payoff of the defendant depends on whether or not it has breached the law: either the plaintiff never starts a case, or always starts a case but systematically settles with the defendant, for an amount that does not depend on the type of defendant.

The proposition stresses that private actions are here completely ineffective in sorting out violators from innocent defendants: cases are either never started, or always settled for a fixed amount that is paid by violators and innocent defendants alike. In neither case does a violator end up worse off than a non-violator. This absence of 'screening' stems from the fact that: (i) it is always desirable for the plaintiff to settle with at least one type of defendant, in order to save on trial costs (and for the same reason, to settle with all defendants of that type); and: (ii) the defendant is less likely to settle when innocent. As a result, there is no separating equilibrium, since in any such an equilibrium all violators would settle while non-violators would not do so; but then, anticipating that only non-violators would ever come to trial, the judge would never issue any convictions, which in turn would induce violators, too, to resist settlements.

Suppose instead that the judge is required to ignore any information relative to settlement bargaining; then, given her pre-trial belief[14] β and the evidence generated by the trial (i.e., the signal σ), her posterior beliefs are

[13] In particular, one would need $\tilde{\beta} > \beta$ if, in the absence of any other background information, J would convict D when and only when receiving a bad signal:

$$\frac{\beta(1-\rho)}{\beta(1-\rho)+(1-\beta)\rho} < \underline{\beta} < \frac{\beta\rho}{\beta\rho+(1-\beta)(1-\rho)}.$$

This would however be contrary to the 'intuitive criterion' of Cho and Kreps [1987] which, given $R_B \geqslant R_N$, implies here that a defendant who proceeds to trial is no less likely to be innocent than one taken at random from the population.

[14] These pre-trial belief can be based on the initial belief β but may however rely on additional elements, such that P's incentive to open a case given the quality of its own information.

respectively given by:

$$\beta_0 = \frac{\beta(1-\rho)}{\beta(1-\rho)+(1-\beta)\rho}, \beta_1 = \frac{\beta\rho}{\beta\rho+(1-\beta)(1-\rho)}.$$

If the trial generates evidence of 'good quality' (i.e., ρ close to 1), J's posteriors will be close to 1 in case of strong evidence and close to 0 otherwise; therefore, as long as the trial generates evidence of good enough quality, we will have

$$\beta_0 < \underline{\beta} < \beta_1, \tag{4}$$

implying that J issues a conviction when and only when the trial generates strong evidence of wrongdoing ($\sigma = 1$). The same insight applies if the judge is also restricted from using any other background information (such as the numbers of opportunities, N_B and N_G, or the probabilities μ_B and μ_G that particular conducts are adopted), and must for example 'start' instead from exogenous 'beliefs' ($\beta = 1/2$, say), as long as the quality of trial evidence is good enough. In all these cases, D is more likely to be convicted when it breaches the law, since violators are convicted with probability ρ while innocent defendants are convicted only with probability $1-\rho$. Private actions are then more likely to treat violators more harshly than non-violators; indeed, as we will see later, there can exist equilibria where P 'targets' violators (i.e., P offers to settle for a large amount, N_B, which is accepted by D_B but rejected by D_N) and where, as a result, violators are indeed treated more harshly than non-violators. This calls for constraining courts to rely purely on the evidence brought before them, and not on additional background information such as the existence of a settlement offer, its content, and so forth.

Fluet and Demougin [2006 and 2008] derive related results. In a model where agents may cause harm depending on their level of care, they show that it is optimal to constrain courts to use neutral normative priors about the case even if they know they are incorrect. However, background evidence in their models means using even or unbiased priors about the liability of the defendants, while in our framework it is information coming from the settlement negotiation (whether or not the settlement offer has been accepted). Relying on such strategic information would prevent a system of private actions from fulfilling its beneficial screening function.

III(iv). *Uncertain Costs*

The above analysis relies in part on the assumption that P knows exactly 'how far to go': P knows how much a violator is willing to pay and is therefore able to 'target' violators and make sure that violators (and only violators) settle. To check the robustness of the analysis, in this subsection we extend the framework so as to allow for some uncertainty about D's willingness to settle, by introducing a random cost of proceeding to trial.

Specifically, we assume in this subsection that, in case of trial, besides the verifiable cost c, a violator also bears an additional cost k, which is uniformly distributed on an interval $[0, K]$. To fix ideas, we will assume that this additional cost is non-transferable, even if D wins the case. For a violator, the expected cost of going to trial is then $\rho(F+c)+k$.[15]

We assume that (4) holds, so that in the absence of any background information about settlement negotiations J would issue a conviction only in the case of strong evidence ($\sigma = 1$). If instead J can take settlement bargaining into consideration, there always exists an equilibrium where no case is launched, supported by low (out-of-equilibrium) beliefs that would lead J never to issue a conviction, and there may also exist an equilibrium where P offers to settle for a low amount R_N, and D always accept whatever its type. None of these equilibria 'screens' violators from non-liable defendants, however; such screening can only occur if P targets violators, i.e., offers to settle for $R_B > \max\{R_N, 0\}$, which is then accepted only by (some of the) violators. When only a proportion α of violators settle, J's posterior beliefs, β_σ, are given by

$$(5)\qquad \begin{aligned} \beta_1 &= \beta_1(\alpha) \equiv \frac{\beta(1-\alpha)\rho}{\beta(1-\alpha)\rho + (1-\beta)(1-\rho)} \\ \beta_0 &= \beta_0(\alpha) \equiv \frac{\beta(1-\alpha)(1-\rho)}{\beta(1-\alpha)(1-\rho) + (1-\beta)\rho}. \end{aligned}$$

It is easy to check that, given (4), J never convicts D when there is weak evidence of breach: $\beta_0(\alpha) < \underline{\beta}$.[16] Moreover, $\beta_1(\alpha)$: (i) decreases as α increases; and (ii) equals 0 for $\alpha = 1$ but coincides with $\beta_1 > \underline{\beta}$ for $\alpha = 0$. Thus, there exists a unique value $\hat{\alpha} \in (0,1)$ such that $\beta_1(\alpha) = \underline{\beta}$ for $\alpha = \hat{\alpha}$, which is equal to:

$$\hat{\alpha}(\beta, \rho, \underline{\beta}) \equiv 1 - \frac{1-\beta}{\beta}\,\frac{1-\rho}{\rho}\,\frac{\underline{\beta}}{1-\underline{\beta}}.$$

If $\alpha > \hat{\alpha}$, J never convicts D, implying that all defendants, violators or not, would reject any positive settlement. In contrast, any $\alpha \in [0, \hat{\alpha}]$ may support a candidate equilibrium in which: (i) P offers to settle for $R_B(\alpha) = \rho(F+c)+(1-\alpha)$ (ii) D refuses to settle when it is innocent and settles

[15] The same analysis 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 $(2\rho - 1)(F+c)$. A similar analysis also applies 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 $K' = \rho K$.

[16] Indeed,

$$\beta_0(\alpha) = \frac{\beta(1-\rho)}{\beta(1-\rho) + \dfrac{(1-\beta)\rho}{1-\alpha}} < \frac{\beta(1-\rho)}{\beta(1-\rho)+(1-\beta)\rho} = \beta_0 < \underline{\beta}.$$

otherwise with probability α (namely, when $k < \alpha K$); and (iii) D is convicted when (and only when) J receives strong evidence of a breach ($\sigma = 1$). For this to be an equilibrium, however, P must prefer to 'target' violators (i.e., choose 'R_B' rather than 'R_N') and moreover wish that its offer be accepted by a proportion α of violators. Given its signal s and associated belief, $\hat{\beta}$, that D has breached the law, P's expected payoff is equal to

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

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

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

The optimal proportion α for P is thus equal to:

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

which exceeds 1 when $K < c/2$ and otherwise decreases as K increases. A screening equilibrium can only exist when $\alpha^*(K) \leqslant \hat{\alpha}(\beta, \rho, \underline{\beta})$, which leads to:

Proposition 2. Suppose that violators bear an uncertain non-transferable cost of going to trial k, uniformly distributed on the interval $[0, K]$. If courts can use background evidence, then a screening equilibrium (i.e., an equilibrium in which the outcome of the settlement/trial game depends on the defendant's type) exists only when

$$\frac{c}{K} \leqslant 1 - 2\frac{1-\beta}{\beta}\frac{1-\rho}{\rho}\frac{\underline{\beta}}{1-\underline{\beta}}.$$

The proposition shows that the previous insight is quite robust. When K is low (i.e., little uncertainty about the defendant's cost in case of trial), there is again no scope for screening out violators: in equilibrium, either no case is

launched or a case is launched but always settled, whether the defendant is innocent or not. And the same holds true, however large K is, whenever $\hat{\alpha} \leqslant \frac{1}{2}$, which is indeed the case when the evidence is of poor quality, reflected by a low ρ, when the pre-trial belief β is low, or when the standard of proof $\underline{\beta}$ is high.

IV. TRIALS WITHOUT BACKGROUND EVIDENCE

From now on, we shall assume that the judge must reach her decision purely on the basis of the evidence brought before her, and suppose that J finds D liable of a breach of law (only) in case of 'strong evidence' of such a breach, that is, if and only if $\sigma = 1$. We study in this section the behavior of the interested parties in the settlement/trial game, as a function of P's belief about the likelihood of a breach. That is, we assume throughout this section that P believes that D has broken the law with probability $\hat{\beta}$, and consider P's resulting incentive to open a case as well as its choice of a settlement offer. This probability $\hat{\beta}$ depends in turn on firms' initial choices (engaging in a pro or anti-competitive action when the opportunity arises) as well as on the information obtained by P; conversely firms' initial choices depend on expectations of the behavior of the plaintiff in the ensuing trial/settlement game. We consider in the next sections the implications of this interplay for the optimal design of the rules for private actions.

IV(i). *The Settlement Game*

Suppose that P proposes to settle for an amount R. If D rejects the offer and the case goes to trial, a violation will be found found with probability ρ if D has indeed committed a breach of competition law, and only with probability $1 - \rho$ otherwise. Anticipating this, D accepts to settle if

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

It is never optimal for P to offer a prohibitively high settlement that would be rejected by both types of D, since settling allows the parties to save the cost of the trial: indeed, asking instead for $\overline{R}$ leads to the same outcome (i.e., going to trial) when D is a non-violator, but yields a higher expected payoff to a violator, since going to trial gives P an expected payoff equal to $\rho F - (1 - \rho)c = \overline{R} - c < \overline{R}$. Two settlement proposals are therefore relevant: either a high amount, $\overline{R}$, only accepted by violators, or a low amount, $\underline{R}$, accepted by all defendants.[17]

[17] The benefit 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 who are indifferent between accepting or rejecting it. Also, starting from any $R < \overline{R}$ which differs from $\underline{R}$, a slightly higher offer would be accepted by the same type(s) of defendants and would thus be better for P. Hence, $\overline{R}$ and $\underline{R}$ constitute the only relevant offers.

If P asks for a low amount, $\underline{R}$, it earns

$$\underline{R} = (1-\rho)(F+c), \tag{7}$$

since both types of defendant are willing to settle; if P asks instead for a high amount, $\overline{R}$; it earns

$$\begin{aligned}&\hat{\beta}\overline{R} + (1-\hat{\beta})[(1-\rho)F - \rho c] \\ &= \hat{\beta}\rho(F+c) + (1-\hat{\beta})[(1-\rho)F - \rho c],\end{aligned} \tag{8}$$

since an innocent D prefers going to the trial. P favors a low amount when the payoff in (7) exceeds that in (8), that is, when

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

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 violator (type B) and an innocent defendant (type N).

- When $\hat{\beta} \geqslant \beta^*$ or $c \leqslant c^*$, P is 'aggressive,' that is, demands a high settlement compensation; as a result, the violator settles and the non-violator refuses to settle; the payoffs are then:

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

- When $\hat{\beta} < \beta^*$ and $c > c^*$, P is less aggressive and offers a low settlement compensation, which is always accepted by the defendant, irrespective of her type; 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 $W_P > 0$; that is, when

$$\begin{aligned}&\phi < \phi^* = \left[\hat{\beta}\rho + \left(1-\hat{\beta}\right)(1-\rho)\right](F+c) - \left(1-\hat{\beta}\right)c && \text{if } \hat{\beta} \geqslant \beta^* \text{or } c \leqslant c^* \\ &\phi < \phi' = (1-\rho)(F+c) && \text{if } \hat{\beta} < \beta^* \text{ and } c > c^*\end{aligned}$$

Figure 1 depicts the equilibrium outcomes, as a function of the cost of complaint ϕ (horizontal axis) and of the cost of trial c (vertical axis); each

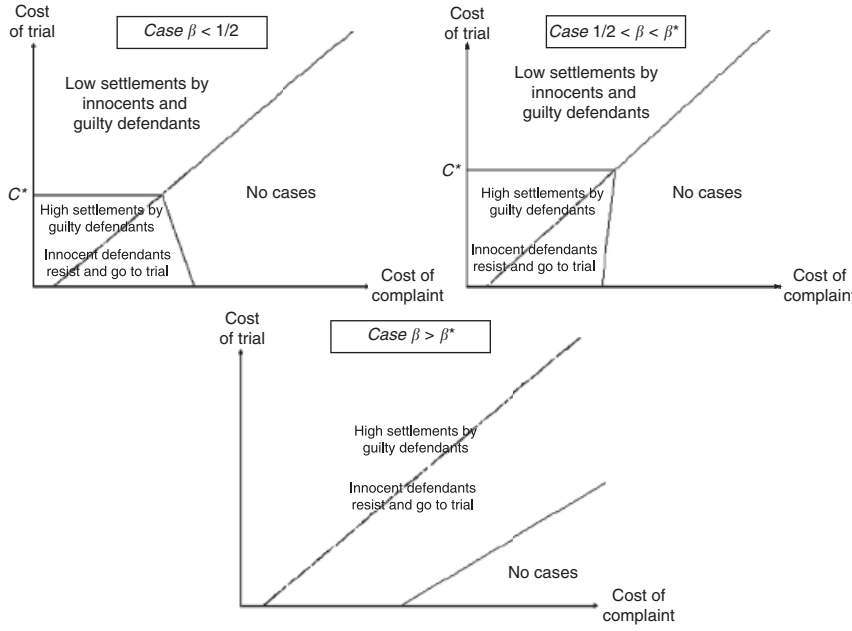

Figure 1

case corresponds to different beliefs $\hat{\beta}$, keeping constant the other exogenous parameters ρ and F.

We draw together these findings in the following Proposition 3:

Proposition 3. In the subgame perfect equilibrium of the private action game when courts are constrained to use no background evidence:

i) if $\hat{\beta} \geqslant \beta^*$ *or* $c \leqslant c^*$, *and in addition* $\phi < \phi^*$, *P opens a case and is 'aggressive,' demanding a high settlement* $\overline{R} \equiv \rho(F + c)$, *which is accepted by violators and refused by non-violators, who go to court.*

ii) otherwise, either P does not open a case or P is 'non-aggressive,' demanding a low settlement $\underline{R} = (1 - \rho)(F + c)$, *which is accepted by violators and non-violators alike.*

This proposition stresses that private actions succeed in sorting out violators from non-violators only when plaintiffs are aggressive in pre-trial negotiations, which in turn requires that breaches of competition law are likely and/or trial costs are not too large. In that case, there indeed exists an equilibrium where *P* opens a case if doing so is not too costly, and then asks for a high settlement, which is accepted only by violators.

As already noted, we assumed throughout that, once launched, a complaint goes to trial in the absence of settlement. In the absence of legal provisions ensuring that this is automatically the case, following a rejection

P indeed chooses to go to trial as long as $(1-\rho)F \geqslant \rho c$,[18] which is satisfied when the costs of a trial are small enough; we will see that it is indeed optimal to maintain c as low as possible, which thus validates the analysis.

IV(ii). *Comparative Statics*

Proposition 3 indicates that the main parameters of the model influence outcomes in two ways: they affect not only the plaintiffs' incentives to open a case, but also – when a case is launched – their incentives to behave aggressively in pre-trial negotiations. Aggressiveness is highly desirable from an enforcement perspective, since it is only when plaintiffs are aggressive that violators and non-violators end up facing different costs – and only thus can the fear of private actions create a greater disincentive for harmful actions than for beneficial ones. So it is only by encouraging plaintiffs to be aggressive that private actions can have a beneficial impact on the behavior of firms.

It can be noted that P is more likely to be aggressive when it has a high prior β of wrongdoing. This confirms the intuition that, from an enforcement perspective, 'good' plaintiffs are those who have obtained evidence of wrongdoing. Fortunately, these are also the plaintiffs that are most likely to open a case. Indeed, the expected payoff of an aggressive plaintiff, given by:

$$W_P = \left[\hat{\beta}\rho + \left(1-\hat{\beta}\right)(1-\rho)\right](F+c) - \left(1-\hat{\beta}\right)c - \phi, \tag{9}$$

increases with $\hat{\beta}$:

$$\frac{\partial W_P}{\partial \hat{\beta}} = (2\rho - 1)(F+c) + c > 0.$$

[18] When $(1-\rho)F < \rho c$ but $\rho F > (1-\rho)c$, there may however exist a similar equilibrium in which P's settlement offer $\overline{R}$ is rejected by D when innnocent and accepted with probability $p < 1$ otherwise; P's expected payoff becomes $\hat{\beta}p\overline{R} + \left(1-\hat{\beta}p\right)\hat{W}_P(p)$, where $\hat{W}_P$, P's expected payoff following a refusal, is equal to:

$$\hat{W}_P(p) = \frac{\hat{\beta}(1-p)[\rho F - (1-\rho)c] + (1-\hat{\beta})[(1-\rho)F - \rho c]}{1-\hat{\beta}p}.$$

This equilibrium exists as long as (i) $\hat{W}_P(p) \geqslant 0$ and (ii) P favors a high settlement offer, which is the case when either $\hat{\beta} \geqslant \beta^{**}(p) \equiv \frac{1}{p+2\rho-1}$, or $c \leqslant c^{**}(p) \equiv \frac{\hat{\beta}(2\rho-1)F}{1-(p+2\rho-1)\hat{\beta}}$. This is, for example, the case when $\hat{W}_P(0) = \beta[\rho F - (1-\rho)c] + (1-\beta)[(1-\rho)F - \rho c] > 0$ (so that $\hat{W}_P(p) > 0$ for p low enough) and either $\hat{\beta} > \beta^{**}(0) \equiv \frac{1}{2\rho-1}$ or $c > c^{**}(0) \equiv \frac{\hat{\beta}(2\rho-1)F}{1-(2\rho-1)\hat{\beta}}$ (so that the other conditions hold for any $p \leqslant 1$). Note that, in this equilibrium, P is deterred from breaking D_B's indifference (by slightly decreasing the settlement amount, say), since this would eliminate the threat of trial (Nalebuff [1987] studies similar equilibria in a context with a continuum of defendant types).

Therefore, the cost of launching a complaint, ϕ, determines both the number and the 'quality' of the plaintiffs that will open a case: a reduction in ϕ (or subsidizing the proceedings) increases the expected payoff of a potential plaintiff, but will also attract plaintiffs with a lower prior $\hat{\beta}$.

It can furthermore be checked that plaintiffs are more likely to be aggressive when:

- The cost of a trial, c, is small; it thus appears desirable to limit these costs and/or subsidize the proceedings, in order to encourage plaintiffs to be aggressive and ensure in this way that violators are sorted out from innocent defendants.
- Courts are reliable (i.e., ρ is high): an increase in ρ reduces the threshold β^* and increases the threshold c^*; both effects tend to make it more likely that plaintiffs will be aggressive. An increase in ρ moreover encourages 'good plaintiffs' (i.e., those with a high prior, namely, $\hat{\beta} > 1/2$) to launch a complaint while discouraging bad plaintiffs (those for which $\hat{\beta} < 1/2$), since $\partial W_P/\partial\rho = (2\hat{\beta} - 1)(F + c)$ is positive if and only if $\hat{\beta} > 1/2$.
- The compensation F is large, since an increase in F increases c^*; increasing the compensation also encourages plaintiffs to open a case ($\partial W_P/\partial F = \hat{\beta}\rho + (1 - \hat{\beta})(1 - \rho) > 0$), and more so for good plaintiffs ($\partial^2 W_P/\partial F\partial\hat{\beta} = (2\rho - 1) > 0$).

V. DESIGNING THE RULES

We now study how to design the rules so as to enhance the role of private litigation in antitrust enforcement. In particular, we analyze how to influence the number and quality of cases, as well as the optimal ways to encourage private actions.

To understand the effect of a system of private actions on the whole array of relevant behavior (not just on cases but also on firms' willingness to undertake anti-competitive actions) we need to model more explicitly the benefits that firms can derive from legitimate as well as from anticompetitive actions. We shall also allow potential plaintiffs to be more or less well informed. This implies a relationship between the number and the quality of cases, which depends on the information the Plaintiff has when launching a complaint.

We will denote by Π the private benefit from committing an anticompetitive action and by π the benefit of undertaking a legitimate competitive action, and assume that these benefits vary across firms. That is, at date 0, each of the N_B firms that have an opportunity to breach the law learns the benefit Π it could derive from doing so, and then decides whether to commit the breach or not. Similarly, each of the N_N firms that have an opportunity to undertake a legitimate action learns the benefit it would so

obtain. For the sake of exposition, we assume that the benefits Π and π are independently and uniformly distributed over $[0, \overline{\Pi}]$ and $[0, \overline{\pi}]$, respectively.

V(i). *When Are Private Actions Useful?*

The decisions of the firms determine how many actions are undertaken and, among those, the proportion β, as defined in equation (1), of breaches of competition law. Thus, with probability β, plaintiffs suspect the existence of a breach of competition law and with probability $1-\beta$ plaintiffs suspect no breach. Then, at date 1, each P receives a signal s which correctly reports whether a violation has occurred with probability r, and makes an incorrect report with probability $(1-r)$. We allow r, the parameter measuring the quality of the signals, to vary across plaintiffs (they may be more or less well acquainted with the industry, have access to different types of evidence, and so forth) and assume that it is independently and uniformly distributed over [1/2, 1].

For a plaintiff, conditional on having received a signal suggesting a breach ($s = 1$), the probability that a firm has indeed committed a breach is:

$$\hat{\beta}_1 = \frac{\beta r}{\beta r + (1-\beta)(1-r)} = \frac{1}{1 + \frac{1-\beta}{\beta}\frac{1-r}{r}}. \tag{10}$$

Similarly, the probability that a firm is a violator when the plaintiff receives the signal $s = 0$ is:

$$\hat{\beta}_0 = \frac{\beta(1-r)}{(1-\beta)r + \beta(1-r)} = \frac{1}{1 + \frac{1-\beta}{\beta}\frac{r}{1-r}}. \tag{11}$$

The two probabilities $\hat{\beta}_1$ and $\hat{\beta}_0$ coincide with the prior β for $r = 1/2$ and are respectively increasing and decreasing in r.

Building on the above analysis, private actions cannot sort out violators from innocent defendants when plaintiffs are not 'aggressive.' We will therefore assume from now on that the parameters are indeed such that any P launching a complaint then behaves aggressively. It suffices for example that c is small enough and, as we will see, it is indeed desirable to keep c as low as possible, subsidizing the costs of trial if necessary.

Also, it is clearly not a good idea to encourage plaintiffs who have received no evidence of wrongdoing ($s = 0$, implying $\hat{\beta} = \hat{\beta}_0 < \beta$): it would be better to rely on purely random actions. Conversely, since P's expected payoff, given by (9), increases with $\hat{\beta}$ (and thus with the quality r of the signal $s = 1$) and decrease with ϕ, the authorities can use the cost of launching a complaint, ϕ, in order to control the number and thus the quality of cases. More precisely, given F and c, for any signal quality threshold $\tilde{r}$, adjusting the cost ϕ of launching a complaint to the adequate level ensures that the plaintiffs who

open a case are precisely those (i) whose quality of signal is at least $\tilde{r}$ and (ii) who received evidence of wrongdoing ($s = 1$). It suffices to choose:

$$\phi = \frac{\beta\tilde{r}}{\beta\tilde{r} + (1-\beta)(1-\tilde{r})}[(2\rho - 1)(F + c) + c] + (1 - \rho)(F + c) - c. \tag{12}$$

What is the benefit of a higher or a lower value of $\tilde{r}$? A higher value makes it less likely that a case is brought, but ensures that any case brought is more likely to succeed. We now explore the optimal trade-off of these two effects.

For a violator, the probability that the plaintiff brings an action is therefore the probability that the plaintiff has a $r > \tilde{r}$, multiplied by the (expected) probability that the signal observed by that plaintiff takes the value B, namely

$$[2(1 - \tilde{r})]\frac{(1 + \tilde{r})}{2} = 1 - \tilde{r}^2.$$

For a non-violator the probability of an action is

$$[2(1 - \tilde{r})]\left[1 - \frac{(1 + \tilde{r})}{2}\right] = (1 - \tilde{r})^2 \left(< 1 - \tilde{r}^2\right).$$

Given these probabilities of litigation, firms will undertake good or bad actions respectively if

$$\begin{cases} \Pi \geqslant \left(1 - \tilde{r}^2\right)\rho(F + c) = \left(1 - \tilde{r}^2\right)\hat{\Pi}, \\ \pi \geqslant (1 - \tilde{r})^2(1 - \rho)(F + c) = (1 - \tilde{r})^2\hat{\pi}, \end{cases} \tag{13}$$

where $\hat{\Pi} \equiv \rho(F + c)$ represents the expected cost for a violator if a case goes to trial, while $\hat{\pi} \equiv (1 - \rho)(F + c)$ represents the corresponding cost for a non-violator. Since Π and π are distributed uniformly on $\left[0, \overline{\Pi}\right]$ and $[0, \overline{\pi}]$, the probability that a firm acts on the opportunity to commit a violation is

$$\mu_B = 1 - \left(1 - \tilde{r}^2\right)\frac{\hat{\Pi}}{\overline{\Pi}},$$

and the probability that a non-violation is committed is

$$\mu_N = 1 - (1 - \tilde{r})^2\frac{\hat{\pi}}{\overline{\pi}},$$

so that the proportion β is given by

$$\beta = \frac{\left(1 - \left(1 - \tilde{r}^2\right)\frac{\hat{\Pi}}{\overline{\Pi}}\right)N_B}{\left(1 - \left(1 - \tilde{r}^2\right)\frac{\hat{\Pi}}{\overline{\Pi}}\right)N_B + \left(1 - (1 - \tilde{r})^2\frac{\hat{\pi}}{\overline{\pi}}\right)N_G}. \tag{14}$$

We can now characterize the optimal choice of the quality threshold. Some parameters, such as the cost of launching a complaint, ϕ, or the cost of a trial, c, affect not only the firms' behavior but also have a direct impact on social welfare. For the sake of presentation, in a first step we will suppose that these are not real costs but constitute instead a monetary transfer to the authorities; this will allow us to have a clearer preliminary analysis of the impact of these and other parameters on the firms' incentives to undertake pro and anticompetitive actions. In a second step, we shall discuss how the policy should be adapted when taking into consideration the social costs of legal proceedings.

When the costs ϕ and c take the form of (socially neutral) legal fees, the social welfare function can be written as:

$$W = N_N\left(1-(1-\tilde{r})^2\frac{\hat{\pi}}{\overline{\pi}}\right)G - N_B\left(1-\left(1-\tilde{r}^2\right)\frac{\hat{\Pi}}{\overline{\Pi}}\right)L, \tag{15}$$

where the parameters $\hat{\pi}$ and $\hat{\Pi}$ only depend on ρ and on the sum $F+c$. Differentiating the welfare function with respect to $\tilde{r}$ yields:

$$\frac{\partial W}{\partial \tilde{r}} = 2N_N(1-\tilde{r})\frac{\hat{\pi}}{\overline{\pi}}G - 2N_B\tilde{r}\frac{\hat{\Pi}}{\overline{\Pi}}L,$$
$$\frac{\partial^2 W}{\partial \tilde{r}^2} = -2N_N\frac{\hat{\pi}}{\overline{\pi}}G - 2N_B\frac{\hat{\Pi}}{\overline{\Pi}}L < 0.$$

It follows that if

$$\frac{N_N G\hat{\pi}/\overline{\pi}}{N_B L\hat{\Pi}/\overline{\Pi}} = \frac{1-\rho}{\rho}\frac{N_N G}{N_B L}\frac{\overline{\Pi}}{\overline{\pi}} \leqslant 1,$$

private actions are not useful: in that case, $\partial W/\partial\tilde{r} < 0$ for any $\tilde{r} > 1/2$, implying that it would be preferable to rely on purely random actions – even ignoring the actual costs of legal proceedings; audits by the authority might furthermore allow for streamlined proceedings and lower costs. This is the case when:

- courts are highly reliable (i.e., ρ is high), so that there is less of a need to rely on evidence brought by third parties;
- there are relatively more opportunities for anticompetitive actions (i.e., the ratio N_B/N_N is high), these anticompetitive actions generate a large social cost compared with the benefit of the pro-competitive ones (L/G is high) and are comparatively easy to deter ($\overline{\Pi}/\overline{\pi}$ is low), so that it is socially desirable to discourage anticompetitive actions, even at the cost of discouraging procompetitive ones.

When instead

$$\frac{1-\rho}{\rho}\frac{N_N G}{N_B L}\frac{\overline{\Pi}}{\overline{\pi}} > 1, \tag{16}$$

private actions can provide a useful way to enforce antitrust laws. In this case, the optimal threshold $\tilde{r}$ is:

$$\tilde{r}^* = \frac{N_N G\frac{\hat{\pi}}{\overline{\pi}}}{N_N G\frac{\hat{\pi}}{\overline{\pi}} + N_B L\frac{\hat{\Pi}}{\overline{\Pi}}} = \frac{1}{1+\frac{N_B}{N_N}\frac{L}{G}\frac{\hat{\Pi}/\overline{\Pi}}{\hat{\pi}/\overline{\pi}}}. \tag{17}$$

That is, the optimal cut off point for informed litigants requires them to have signals that are at least as informative as the relative value of good projects among those that are discouraged by indiscriminate litigation. As a result, fewer plaintiffs should be encouraged to launch a case (i.e., $\tilde{r}^*$ increases) when for example there are relatively more opportunities for good actions than for bad ones (N_N/N_B increases), or when these good actions are relatively more valuable than the bad ones are costly (G/L increases). Note that it is always optimal to encourage only those plaintiffs who not only have obtained evidence of wrongdoing (i.e., they received a signal suggesting a breach, $s=1$), but whose information is moreover sufficiently precise. Indeed, condition (16) implies $\tilde{r}^* > 1/2$; the corresponding legal fee for launching a complaint is then such that $\phi = \phi^* > 0$.

The welfare function is decreasing in the trial costs c when keeping $F+c$ constant. Again, this implies that not all ways of encouraging private actions are equally good in terms of enforcement: the authorities should for example reduce c and compensate it by F so as to keep $F+c$ constant. We summarize these findings in the following proposition:

Proposition 4. Ignoring the social costs of legal proceedings, private actions by informed plaintiffs perform better than purely random actions if and only if (16) holds, that is, when court proceedings don not generate sufficient evidence ($\rho < 1$) and when anti-competitive actions are relatively profitable ($\overline{\Pi}/\overline{\pi}$ high) while pro-competitive actions are relatively desirable ($N_N G/N_B L$ also high). Moreover, when private actions are useful:

- Given F and c, the monetary costs ϕ of opening a case should not be set as low as possible, but rather high enough to strike a balance between the need to deter anti-competitive actions without deterring legitimate pro-competitive actions. Specifically ϕ should be set so as to promote actions only by those plaintiffs who have received a signal suggesting a breach ($s=1$) and whose precision $\tilde{r}$ lies above a threshold $\tilde{r}^* > 1/2$; this threshold moreover increases (implying that fewer cases should be

opened) with the relative value of good projects among those that are discouraged by litigation.

- Keeping $F+c$ constant, the monetary costs of a trial, c, should be reduced (and the damages, F, adjusted accordingly), so as to ensure that active plaintiffs will be 'aggressive' in pre-trial negotiations, and thus that private actions will succeed in sorting out violators from innocent defendants.

Proposition 4 stresses that private actions are useful when plaintiffs' information helps complement the evidence generated by court proceedings, and when pro-competitive actions are desirable but easily deterred. It is moreover then better to encourage only those plaintiffs who have significant private information about the presence of anti-competitive actions. In other words, the decision maker should take care not to encourage 'frivolous actions,' i.e., actions initiated by plaintiffs who do not have enough private information to improve the decision of the court about the case. In addition, it is optimal to rely as much as possible on the damages F rather than on the trial costs c. While both dimensions tend to impose a higher cost on violators than on non-violators, high trial costs tend to discourage plaintiffs from being aggressive, which is the only way in which private actions can sort violators from innocent defendants. Thus, keeping $F+c$ constant, it is optimal to increase the damages F and reduce the trial costs c as much as possible (and even to subsidize trial costs, to ensure that plaintiffs are aggressive in pre-trial negotiations).[19]

A more difficult issue concerns the optimal level of F. It is first worth noting that, since the ratio $\hat{\pi}/\hat{\Pi}$ only depends on ρ, $\tilde{r}^*$ is independent of F; thus, higher values of F (which raise the returns to private actions) require the authorities to raise ϕ so as to maintain the level of $\tilde{r}^*$ unchanged. Second, it can be checked that under our assumptions, it is actually optimal to increase F so as to deter all anticompetitive actions. Indeed, as long as $(1-\tilde{r}^2)\rho(F+c)<\overline{\Pi}$ and $(1-\tilde{r})^2(1-\rho)(F+c)<\overline{\pi}$, $W|_{\tilde{r}=\tilde{r}^*}$ is increasing in F:

$$\left.\frac{\partial W}{\partial F}\right|_{\tilde{r}=\tilde{r}^*} = -(1-\rho)\frac{N_N G}{\overline{\pi}}(1-\tilde{r}^*)^2 + \rho\frac{N_B L}{\overline{\Pi}}\left(1-(\tilde{r}^*)^2\right)$$
$$= (1-\tilde{r}^*)(1-\rho)\frac{N_N G}{\overline{\pi}}[-(1-\tilde{r}^*)+\lambda(1+\tilde{r}^*)],$$

where

$$\lambda \equiv \frac{N_B}{N_N}\frac{L}{G}\frac{\rho}{1-\rho}\frac{\overline{\pi}}{\overline{\Pi}},$$

[19] As noted before, reducing c moreover makes it more likely that plaintiffs will go to trial in case defendants refuse to settle, which also contributes to making private actions successful in sorting out violators from non-violators. Moreover, as we will see later, it is socially desirable to reduce the *actual* costs of court proceedings.

and the above expression is non-negative since $(1-\tilde{r}^*)(1-\rho)N_N G/\overline{\pi} \geqslant 0$ and

$$-(1-\tilde{r}^*)+\lambda(1+\tilde{r}^*)=\frac{-\lambda+(2+\lambda)\lambda}{1+\lambda}=\lambda \geqslant 0.$$

This finding clearly relies on our assumptions of constant social values G and L attached to pro and anticompetitive actions, together with a uniform distribution of the private benefits π and Π, which implies that the ratio of good and bad actions deterred also remains constant as F changes. This result implies that, if

$$\frac{\overline{\pi}}{(1-\tilde{r})^2(1-\rho)}<\frac{\overline{\Pi}}{\left(1-\tilde{r}^2\right)\rho},$$

that is, if

$$\frac{\overline{\Pi}}{\overline{\pi}}>\frac{1+\tilde{r}}{1-\tilde{r}}\frac{\rho}{1-\rho}\,(>1),$$

then it is optimal to deter all anticompetitive actions, at the cost of discouraging all procompetitive ones as well: the above insight shows that it is indeed desirable to increase F as long $F+c<\overline{\Pi}/\left(1-\tilde{r}^2\right)\rho, \overline{\pi}/(1-\tilde{r})^2(1-\rho)$, that is, as long as doing so deters additional good and bad actions; and when instead $\overline{\pi}/(1-\tilde{r})^2(1-\rho)<F+c<\overline{\Pi}/\left(1-\tilde{r}^2\right)\rho$, all procompetitive actions are deterred but increasing F further allows one to deter additional anticompetitive ones. It is thus desirable to choose $F+c$ larger than $\overline{\Pi}/\left(1-\tilde{r}^2\right)\rho$, so as to deter all anticompetitive actions as well.

However, when

$$\frac{\overline{\Pi}}{\overline{\pi}}<\frac{1+\tilde{r}}{1-\tilde{r}}\frac{\rho}{1-\rho},$$

the amount F should instead be set just large enough to deter all anticompetitive actions: F, that is, such that $\left(1-\tilde{r}^2\right)\rho(F+c)=\overline{\Pi}$; in that case, increasing F further would discourage additional procompetitive actions without bringing any other benefit. More generally, F should not be set too high whenever increasing deterrence would increasingly deter valuable actions rather than bad ones.

V(ii). *Costly Proceedings*

In practice, launching a complaint and going to trial involves real costs, which should be taken into consideration when evaluating the social desirability of private actions as an enforcement tool. To fix ideas, suppose that the costs borne by the parties, ϕ and c, can be decomposed into two parts: actual costs, $\hat{\phi}$ and $\hat{c}$, and monetary transfers, $\phi-\hat{\phi}$ and $c-\hat{c}$. The

social welfare can then be written as:

$$\begin{aligned} W\left(\tilde{r};\hat{c},\hat{\phi}\right) &= N_N\mu_N(\tilde{r})\left(G-(1-\tilde{r})^2\left(\hat{c}+\hat{\phi}\right)\right) \\ &\quad - N_B\mu_B(\tilde{r})\left(L+\left(1-\tilde{r}^2\right)\hat{\phi}\right) \\ &= W(\tilde{r};0,0)-\lambda_N(\tilde{r})\left(\hat{c}+\hat{\phi}\right)-\lambda_B(\tilde{r})\hat{\phi}, \end{aligned}$$

where $\lambda_N(\tilde{r}) \equiv (1-\tilde{r})^2 N_N\mu_N(\tilde{r})$ and $\lambda_B(\tilde{r}) \equiv \left(1-\tilde{r}^2\right)N_B\mu_B(\tilde{r})$ respectively denote the numbers of complaints respectively triggered by procompetitive and anticompetitive actions (and as before, $\hat{\pi} = (1-\rho)(F+c)$, $\hat{\Pi} = \rho(F+c)$ and $\tilde{r}$ can be controlled through the total – real plus monetary – cost ϕ).

Clearly, the costs of proceedings, $\hat{c}$ and $\hat{\phi}$, are socially undesirable and should thus be minimized.[20] They also have an effect on the optimal policy, however. A standard revealed preference shows indeed that an increase in either $\hat{c}$ or $\hat{\phi}$ calls for adapting the rules so as to reduce the number of complaints:

- An increase in the actual costs of trial, $\hat{c}$, reduces the number of complaints triggered by procompetitive actions. Suppose for example that the trial cost $\hat{c}$ increases from $\hat{c}'$ to $\hat{c}'' > \hat{c}'$, and denote by $\tilde{r}'$ and $\tilde{r}''$ the corresponding optimal thresholds; by assumption, $W(\tilde{r}';\hat{c}',\hat{\phi}) \geqslant W(\tilde{r}'';\hat{c}',\hat{\phi})$ and $W(\tilde{r}'';\hat{c}'',\hat{\phi}) \geqslant W(\tilde{r}';\hat{c}'',\hat{\phi})$, which implies:

$$\begin{aligned} &W(\tilde{r}';0,0)-\lambda_N(\tilde{r}')\left(\hat{c}'+\hat{\phi}\right)-\lambda_B(\tilde{r}')\hat{\phi} \geqslant W(\tilde{r}'';0,0) \\ &-\lambda_N(\tilde{r}'')\left(\hat{c}'+\hat{\phi}\right)-\lambda_B(\tilde{r}'')\hat{\phi}, \\ &W(\tilde{r}'';0,0)-\lambda_N(\tilde{r}'')\left(\hat{c}''+\hat{\phi}\right)-\lambda_B(\tilde{r}'')\hat{\phi} \geqslant W(\tilde{r}';0,0) \\ &-\lambda_N(\tilde{r}')\left(\hat{c}''+\hat{\phi}\right)-\lambda_B(\tilde{r}')\hat{\phi}. \end{aligned}$$

  Summing-up these two inequalities yields:

$$[\lambda_N(\tilde{r}'')-\lambda_N(\tilde{r}')](\hat{c}''-\hat{c}') \leqslant 0.$$

  Therefore, an increase in $\hat{c}$ leads to an adjustment in the threshold $\tilde{r}$ (through the choice of ϕ) so as to reduce the number of complaints triggered by procompetitive actions.

[20] In practice, however, there may a be a trade-off between the costs of the legal proceedings and the accuracy of the decision-making process. Excessively summary proceedings may for example save costs at the expense of the quality of the evidence generated by the trial. This could be accomodated in our framework by introducing a negative relationship between ρ and c (so that ρ decreases as c increases); the present analysis then shows how the other policy parameters (such as ϕ or $\tilde{r}$) should be adjusted when optimizing over c and ρ.

- It can similarly be confirmed that an increase in the actual cost of launching a complaint, $\hat{\phi}$, leads to a reduction in the total number of complaints, $\lambda_N(\tilde{r}) + \lambda_B(\tilde{r})$.

V(iii). *Alternative Cost Sharing Rules*

We have assumed so far that the losing party bears the costs of the trial, which corresponds to the so-called British rule. We now check that this rule is indeed desirable. To see this, denote by c_P and c_D the costs directly born by P and D, respectively, and suppose that D pays a share α_P of P's costs when losing, whereas P pays of share α_D of D's costs when losing. Our initial rule corresponds to $\alpha_P = \alpha_D = 1$, whereas the rule commonly described as the American rule corresponds to $\alpha_P = \alpha_D = 0$. In the U.S., however, there exists an asymmetry in that the costs of a plaintiff may be borne by the defendant when the latter is found liable, whereas a defendant always bears its cost, whether it is found liable or not. This would correspond here to $\alpha_P > \alpha_D = 0$.

With these sharing rules, the relevant costs for violators and non-violators respectively become:

$$(18) \qquad \begin{cases} \hat{\Pi} = \rho(F + \alpha_P c_P + c_D) + (1-\rho)(1-\alpha_D)c_D, \\ \hat{\pi} = (1-\rho)(F + \alpha_P c_P + c_D) + \rho(1-\alpha_D)c_D. \end{cases}$$

It follows that, starting from any limited sharing rule satisfying $\alpha_P, \alpha_D < 1$, a simultaneous increase in both shares can be used to deter anti-competitive actions further *and* encourage additional pro-competitive actions: indeed, any simultaneous increase ($\delta\alpha_D > 0$, $\delta\alpha_P > 0$) such that:

$$\frac{1-\rho}{\rho} < \frac{c_P \delta\alpha_P}{c_D \delta\alpha_D} < \frac{\rho}{1-\rho},$$

increases $\hat{\Pi}$ and, at the same time, reduces $\hat{\pi}$. Therefore, it is always optimal to increase the share of the cost borne by the losing party up to the point where at least one party is completely reimbursed when winning – in particular, the above-mentioned 'American' and 'U.S.' rules cannot be optimal. It can similarly be confirmed that, for $\varepsilon > 0$, simultaneously increasing α_D by $\delta\alpha_D = (1-\rho)\varepsilon/c_D$ and F by $\delta F = \rho\varepsilon$ increases $\hat{\Pi}$ (by $(\rho^2 - (1-\rho)^2)\varepsilon > 0$) while keeping $\hat{\pi}$ constant; this change thus further deters anticompetitive actions without discouraging any additional procompetitive ones. It follows that it would always be optimal to have the defendant reimbursed for its costs when it is not found liable (i.e., $\alpha_D = 1$).[21]

[21] Interestingly, the same argument does not apply to the costs of the plaintiff: any change in F and α_P that deters additional anticompetitive actions must increase $F + \alpha_P c_P$, in which case it also deters additional procompetitive actions.

When asymmetric cost sharing rules between the plaintiff and the defendant are allowed, the English rule may therefore not be the most efficient in discouraging low-probability-of-prevailing plaintiffs and in encouraging high-probability-of-prevailing plaintiffs as this was suggested by Shavell [1982] and Katz [1990].

V(iv). *Compensating Defendants*

The previous remark stresses that, in order to reduce the litigation burden on non-violators, defendants who are found non-liable should be reimbursed for the costs they incur during the trial. It may actually be desirable to go further and award a compensation C to successful defendants. For violators, the expected cost of going to trial would now be given by

$$\hat{\Pi} = \rho(F + c) - (1 - \rho)C$$

whereas the cost to non-violators would be:

$$\hat{\pi} = (1 - \rho)(F + c) - \rho C$$

It is then possible to deter all anticompetitive actions, while encouraging all procompetitive ones, by increasing simultaneously the damages awarded to successful plaintiffs, F, and the compensation attributed to successful defendants, C. Indeed, for any given F, it is possible to maintain $\hat{\pi} = 0$ by choosing

$$C(F) \equiv \frac{1 - \rho}{\rho}(F + c). \tag{19}$$

It then suffices to increase F (and $C = C(F)$) sufficiently, namely, so as to satisfy

$$\left(1 - \tilde{r}^2\right)\hat{\Pi} = \left(1 - \tilde{r}^2\right)\frac{2\rho - 1}{\rho}(F + c) \geqslant \overline{\Pi}, \tag{20}$$

to deter all anticompetitive actions. In other words, since ρ is perfectly known, it is possible fully to compensate the defendant with the appropriate C for unfounded cases, which in turn allows for deterring all actions without discouraging desirable ones. In the absence of any restraint on the levels of F and C, this mechanism can work even with very few active plaintiffs – that is, even when $\tilde{r}$ is close to 1. Thus, even if legal proceedings are costly ($\hat{c} > 0$ and/or $\hat{\phi} > 0$), in the limit it is possible to deter all anticompetitive actions at no cost (on the principle that a high enough fine can always compensate for a low probability of detection). Note however that the required levels for F and C tend to infinity as $\tilde{r}$ approaches 1.

Summing up:

Proposition 5. When successful defendants can be compensated with a sum C, F should be set as high as is required to deter all violations of competition

law, and C as high as is required to ensure that no pro-competitive actions are deterred. For any given $\tilde{r}$, the minimal levels of F and C are $F = \frac{\rho}{2\rho-1}\frac{\overline{\Pi}}{1-\tilde{r}^2} - c$ and $C = \frac{1-\rho}{2\rho-1}\overline{\Pi}$.

When legal proceedings are costly, in the absence of any restriction on F and C, this mechanism can (almost) achieve the first-best by choosing $\tilde{r}$ close to 1 and by adjusting F and C accordingly.

As we have shown above, encouraging private actions increases the litigation burden on non-violators as well. Proposition 5 shows that one way to minimize this is to allow courts to give a compensation for defendants found non-liable as there exists a level of compensation such that, when the damages paid by defendants found liable are high enough, all violations of competition would be deterred without reducing the firms' incentives to engage in pro-competitive actions.

This result is consistent with Polinsky and Rubinfeld [1996] who show that compensating winning plaintiffs allows us to achieve the desired degree of deterrence with lower litigation costs. However, in their model defendants are always liable while in ours, some defendants may undertake legitimate competitive actions. Compensating winning defendants in our analysis therefore allows the judge not only to achieve the desired degree of deterrence but also to screen liable from non liable defendants. This decreases the number of anti-competitive actions without deterring legitimate pro-competitive actions.

The proposition offers a useful benchmark but considers an extreme case which is quite unrealistic, since it assumes away any limits, political or practical, to the levels of damages and compensation payments that can be enforced. In practice, firms may have limited liability and various institutional constraints may also limit the damages as well as the compensation that can be awarded to the parties. Whenever such constraints are binding, they will put a cap on the admissible levels of F and C. Given these caps, the analysis we have made of the factors determining the optimal threshold $\tilde{r}^*$ will remain relevant. Interestingly, a cap on the amount of damages, F, would also call for limiting the compensation C. And given that there are limits on the levels of fines, optimal deterrence of anti-competitive actions may require lowering $\tilde{r}^*$ substantially below 1 so as to provide a sufficiently high probability of detection of law-breaking. Note that the costs of legal proceedings will imply choosing a level of $\tilde{r}^*$ higher (and thus a probability of detection lower) than if such costs could be ignored.

Even in the absence of any restriction on compensation and damages, risk aversion may limit their desired levels. To be sure, risk aversion means that lower sanctions are needed to deter violations; but these sanctions would also have a greater negative impact on procompetitive actions as well. And there may be no realistic level of compensation that could simultaneously be

extracted from unsuccessful plaintiffs and compensate non-violators for the risk of losing their case.[22]

The arguments of this section nevertheless provide strong grounds for concluding that the payment of compensation to successful defendants can go a long way towards counteracting what might otherwise be a serious drawback of a system of private actions – namely its potential for discouraging legitimate pro-competitive behavior as well as illegal anti-competitive behavior. In effect such a dual system of fines-plus-compensation would help to ensure that the kinds of actions that took place would be ones that plaintiffs felt very confident they would win. Any doubts about using such compensation, on the grounds that it will be difficult for plaintiffs to feel a high enough degree of confidence in a fallible judicial system, imply in turn that public policy should think very carefully before using a system of actions brought by private plaintiffs to make a substantial contribution to competition law enforcement.

VI. CONCLUSION

What have we learned? The model we have developed is very stylized and evidently fails to do justice to many important aspects of reality. However, the main conclusions that emerge do not appear to be artefacts of the model's simplifications. First, although the purpose of a system of private actions is to encourage parties who have private information about antitrust violations to contribute that information to the enforcement process, the fact that the parties engage in pre-trial bargaining means that the use of that information has to be traded off against the need to create the right incentives for that bargaining. If all defendants settle on identical terms the system will fail to deter those who have genuinely broken the law. However, to ensure that those who have broken the law should face significantly higher costs than those who have not, we show that courts should not use Bayesian reasoning about background probabilities but should rather restrict their decision-making to the bare facts of the case.

Although this conclusion applies to any judicial process with plea-bargaining, the context of antitrust raises some particular issues that are at the heart of our analysis. It is not enough for the judicial procedure to deter law-breaking; it must also avoid deterring legitimate pro-competitive activity, which is often difficult to distinguish from anti-competitive actions without significant investigation, unlike many other forms of criminal activity. This sets important constraints upon the design of a system of private actions. In particular, we argue that simply lowering the costs of such

[22] For example, if firms are infinitely risk-averse, the mere prospect of being fined with positive probability would suffice to discourage procompetitive actions, whatever compensation C successful defendants may obtain.

actions is not the right way to foster private enforcement, since this encourages well-founded and poorly-founded lawsuits alike. Instead we argue that the right way to do so is to increase fines, which are more costly in expectation to those who have broken the law than to those who have not. Since increasing fines will also deter legitimate pro-competitive actions we argue for a system of compensation, to be paid by unsuccessful plaintiffs to defendants who win their case. In principle, if firms were perfectly risk neutral and there were no limits to the level of either fines or compensation payments, such a mechanism could perfectly balance the need to deter law-breaking and encourage pro-competitive behavior. However, considerations of limited liability and risk-aversion will restrict the extent to which law-breaking can be deterred and innocent pro-competitive actions encouraged. Some degree of risk for innocent defendants will be impossible to avoid.

Some simple policy conclusions that follow from this include:

- Private actions should not be encouraged unless they are likely to impose substantially higher expected costs on antitrust violators than on non-violators;
- Private actions should be encouraged only when potential plaintiffs are likely to have information that can useful complement the evidence generated by court proceedings.
- If they are to be encouraged, it is better to do so by raising the level of damages than by lowering the costs of opening a case, since the former gives a greater relative encouragement to well-founded cases;
- The adverse effects of private actions on innocent defendants can to some extent be mitigated by requiring unsuccessful plaintiffs to pay compensation to defendants.
- The courts need to be constrained to convict on the basis of available evidence without taking into account background proportions of violators and non-violators who go to trial.

Facilitating private actions may have some merits but our paper has shown that it is as important to do more than simply ensure that the courts have the best information on which to make their judgments. Instead of having a principal role in sorting the innocent from the guilty, the courts are – much more importantly – the background threat that gives credibility to a process in which the innocent are sorted from the guilty much earlier, in the (nowadays) smoke-free rooms where pre-trial bargaining takes place. What happens at this stage is of crucial importance for ensuring that a system of private actions fosters rather than inhibits competition.

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