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Commitments in Antitrust[*]

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Abstract: Competition agencies have the power to close an antitrust case in return for the commitment to end the alleged infringement. We examine how such a procedure affects deterrence and consumer welfare. We first show that it lowers the deterrent effect of competition policy. However, under asymmetric information, commitments may enhance consumer surplus with shortened proceedings and avoidance of trial type-II errors. The variation of consumer harm w.r.t. the firm's gain from the practice determines the optimal usage frequency of this negotiation tool. Finally, we show that trial and commitments may be complements as the latter is not always an answer to a lack of efficiency of the agency.

Keywords: Commitments in antitrust; Plea bargaining; Consumer Surplus.

Résumé : Les autorités de la concurrence ont la possibilité de clore une affaire en échange de l'engagement pris par les entreprises en cause d'abandonner la pratique alléguée. Nous étudions l'impact de l'introduction d'une telle procédure sur la dissuasion et le surplus des consommateurs. Il s'avère tout d'abord qu'elle réduit *a priori* la capacité de dissuasion des autorités. Toutefois, en asymétrie d'information, les consommateurs peuvent en bénéficier du fait d'un traitement plus rapide et d'une limitation des erreurs de type II en procès. Par ailleurs, la variation du dommage aux consommateurs en fonction du gain de l'entreprise détermine la fréquence optimale du recours à cette procédure. Enfin, dans certains cas, plus l'autorité est efficace en procès plus elle aura intérêt à utiliser les engagements : ces deux outils peuvent être complémentaires.

Mots clés: Procédure d'engagements ; plea bargaining ; Surplus des consommateurs.

JEL Codes: K21, K42, L41

1 Introduction

Enforcement of the competition law traditionally relies on one major instrument: the fine. Recent modernization of the legal framework of the European authorities involve negotiated procedures, among which leniency programs, direct settlements and the commitments procedure.

In collusion cases, leniency programs and direct settlements provide some incentives for a firm to reveal its participation and provide proofs concerning an alleged infringement, before or during an investigation.[1]

As compared to these procedures, the commitments procedure has been mostly employed in cases of unilateral practices, and does not formally establish the guiltiness of the firm: no fine can be set. Moreover, it is focused on the future behavior of the firm more than on the cooperation in investigations.[2] Such an outcome is more than often chosen in front of the *US Department of Justice*, where *consent decrees* concern 70 to 80 % of antitrust cases.

Article 9 § 1 of Council Regulation 1/2003 disposes that:

> "*Where the Commission intends to adopt a decision requiring that an infringement be brought to an end and the undertakings concerned offer commitments to meet the concerns expressed to them by the Commission in its preliminary assessment, the Commission may by decision make those commitments binding on the undertakings.*"

The wording of this article leaves some discretion to the European Commission, and the case law plays an important role in the formation of firms' anticipations. However, competition authorities are well aware of the need to announce their policy in advance, and in addition generally use public speeches or guidelines to define the commitments policy.[3] In Europe, it may depend on observable variables such as the sector or the type of the practice. In this article, we analyze whether the commitments procedure should be applied equally to such different cases such as abuse of dominant position, vertical restraints or predation.

[1] In leniency programs, only the first informant is rewarded by an immunity of the fine, while direct settlements are more like a plea bargaining procedure where several firms may be equally rewarded. On leniency programs, see for example Motta and Polo [17], Aubert, Kovacic and Rey [1] and Harrington [13]. Essentially, they can make tacit collusion harder to sustain through an increase in the probability of sanctions: reductions of the fine may provide sufficient incentives for proof cooperation. The recent procedure of direct settlements has not yet been analyzed in the economic literature, but an example of bargaining with multiple defendants is found in Kobayashi [14].

[2] We will only study unilateral practices. Examples of such cases are found in *German Football League* (COMP/37.214, decision of Jan., 19th of 2005), *Coca-Cola* (COMP/39.116, decision of Jun., 22nd of 2005), *Alrosa & De Beers* (COMP/E-2/38.381, decision of Feb., 22nd of 2006), *Repsol* (COMP/B-1/38.348, decision of Apr., 12th of 2006). However, there is no such limitation in the European dispositions. See for example: *Buma and Sabam* (COMP/37.749, decision of Aug., 17th of 2005), *Scandinavian Airline System and Australian Airlines* (COMP/39.152, decision of Sept., 22nd of 2005) and *DaimlerChrysler, Toyota, General Motors and Fiat* (COMP/39.140 to 143, communication IP/07/409 of Mar., 23rd 2007). For detailed legal analyzes see, for example, Furse [9], Cook [4], Wils [30] and Vialfont [28]. For an economic analysis of leniency and commitments procedures in collusion cases, see Vialfont [29].

[3] See for example the communication of the French Competition Authority, dated March 3rd of 2009, available on its Web site.

In this article, we assume that commitments are to bring the alleged practice to an end. They cannot be divided in the sense of the article of Shavell [25]. The Competition Authority (hereafter CA) is assumed to have the ability to credibly announce, according to the practice in cause, the probability of a preliminary assessment that initiates the commitments procedure. We also analyze the possibility that the CA does not fit to its guidelines concerning the usage frequency of this so called negotiated procedure. This latter circumstance is discussed together with the legal interest to provide the CA with such an ability.[4]

We show that the commitments procedure has typically two opposite effects. On the one hand, consumers benefit from the avoidance of the trial (less procedural time and less uncertainty). On the other hand, by closing a case with commitments, the CA gives up the fine, and inevitably loses some deterrent effect of its intervention: the potential immunity of fine prevails as compared to procedural efficiency in terms of deterrence.

The main purpose of this article is to analyze the welfare tradeoff between these two effects. We find that the commitments procedure may improve the enforcement of the competition law through an amelioration of consumer surplus: the firm has always the ability to choose the trial procedure and efficiency derives from the consumers' gain. However, in some circumstances the commitments procedure may harm consumers.

This article is related to the literature on settlement and plea bargaining, where a defendant is given the option to plead guilty in exchange for a reduction of the fine or penalty.[5] Among the early articles on this topic, Landes [15], Gould [11], Posner [18], and Shavell [23] have shown that avoiding administrative costs of trial motivates settlements. Here, these costs are considered through the temporal aspect of proceedings both for the CA and the firm.

A second type of argument concerning pretrial negotiation is provided by Grossman and Katz [12] that first identified their role with judicial errors. We focus on their insurance effect assuming that a firm that has not initiated a potentially anticompetitive practice is never prosecuted. Even with risk-neutral parties, we will find some value of commitments against type-II errors (not condemning a guilty firm).

Finally, the impact of negotiations on deterrence is a critical question in plea bargaining analysis with a budget constrained authority. The compliance incentives of settlements and their effects on welfare were first analyzed in asymmetric information frameworks by Reinganum [21], Miceli [16] and Franzoni [10].[6] This literature mainly shows that the reduction of sanctions, needed to give sufficient incentives for negotiations, reduces deterrence.

We do consider a simple model where all these effects are at play in an antitrust context: a firm can engage in a practice that enhances its profit and harms consumers, but not necessarily in a one-to-one proportion or a monotonic way. This allows us to measure in the objective of the CA the relative importance of deterrence and procedural effects associated to commitments.

In the European antitrust law, competition authorities do not grant direct

[4]Partial remedies in the commitments procedure are introduced in Souam and Vialfont [26].

[5]See Daughety and Reinganum [6, 7] and Spier [27] for excellent surveys.

[6]Polinsky and Rubinifeld [20] first tackled the deterring consequences of a fine reduction in negotiations in a symmetric information game.

compensations to consumers since the trial fine is paid back to the public revenue department. In addition, formal decisions and the commitments procedure have also some effects on the future market equilibrium, respectively through injunctions and commitments. Notice that only the latter dimension of sanction affects both consumers and the firm, generally by different amounts: the negotiation stage is a positive sum game.[7]

In addition, we assume that the gain of the firm associated to an alleged practice is the firm's private information. As a result, the timing of the game is close to the screening model of Bebchuk [2] with a continuum of types. Indeed, the authority initiates the commitments procedure and the firm makes the commitments offer. The ability of the CA to ask for indivisible commitments prescribes any signaling game in the sense of Reinganum and Wilde [22].[8]

We first show that the introduction of the commitments procedure induces a loss in terms of deterrence: a firm that could be deterred with the expected trial always gains with an accepted commitments proposal. This is why, under symmetric information, the CA proposes a negotiation only to the firms that benefit enough from the practice.

Under asymmetric information, we show that the introduction of the commitments procedure and the way it should be used crucially depend on the variation of the consumer surplus with the firm's gain while the alleged practice takes place. When these amounts are positively correlated, the gain of the firm always comes from the prescription of a higher level of competition. The CA always initiates the commitments procedure in this case. Contrarily, when an increase in the firm's gain is due to some efficiency gains partially passed on to consumers, the CA should only use trial. Non-monotonic correlations may induce a stochastic use of this procedure.

Finally, using comparative statics we show that the commitments procedure is not always an answer to a lack of efficiency of the CA: trial and commitments may be complementary tools. This possible result gives some theoretical arguments in favor of the European introduction of this procedure that was coupled with an increase in the trial expected fine.

The article continues as follows. In section 2 we present the model. Section 3 presents the different tradeoffs of the firm. In section 4, we look for the authority's decision. Section 5 concerns a treatment of predation cases. Concluding remarks follow in section 6.

2 The Model

We consider a firm that may engage in a practice that increases its profits and reduces consumer surplus. We denote by $\Delta \in [0, \overline{\Delta}]$ the firm's incremental gain

[7] Polinsky and Che [19] first analyzed the decoupled liability providing some optimal differentiated transfers in trial between parties, in terms of crime deterrence and suits reduction. Daughety and Reinganum [5] have provided an analysis of settlements in a decoupled liability context under asymmetric information. For an article measuring the compliance effect of settlement under asymmetric information, see Chu and Chien [3] including an extension where the probability of a damage uniformly depends on the degree of precaution undertaken by the offender.

[8] The firm knows its private gain but can only propose the interruption of the practice for an immunity of fine. From the CA's point of view, the fact that a firm offers commitments rather than going to trial will only reveal a part of its private information.

resulting from the practice, which follows a density $\phi(.)$ on the concerned sector.

When the firm adopts the practice, consumer surplus known to the CA is denoted by $S \geqslant 0$. We denote by $S^*(\Delta)$ consumer surplus in the reference situation where the firm does not engage in the practice. When a practice is implemented, the CA observes a price and knows the underlying surplus but does not necessarily know the counterfactual situation that depends on Δ.

We denote by $h(\Delta) = [S^*(\Delta) - S]\phi(\Delta) \geqslant 0$, the weighted harm to consumers, and assume that it is continuous and once differentiable. In addition, we do assume that $h(0) \geqslant 0$, so that a practice that does not insure any benefit to the firm may harm consumers.

The correlation between what the firm gains and what consumers lose is not necessarily monotonic: for different values of Δ, efficiency gains may be at play and partially passed on to consumers while the anticompetitive effects of a practice might be rather complicated. Hence, $h(\Delta)$ is not necessarily increasing. As an example, consumers' utility may be a function of the price but also of the quality of the good or service provided. In the case of selective distribution, the firm owning a trademark could refuse to integrate distributors in its network in order to maintain some quality rules. In our model, we do not consider such a practice as anticompetitive *per se*, but we consider the harmful ones to consumers because of the price dimension. Nevertheless, $h(\Delta)$ could be a decreasing function of Δ when the selection rules out inefficient distributors.

The intervention of the CA is modeled as follows. First, we assume that it maximizes consumer surplus, so that its first-best would be to deter any practice. In order to make a sense to the use of a commitments procedure, we do assume that the fine is not high enough to reach full deterrence. For the sake of simplicity, we also assume that the firm is never prosecuted when it does not adopt the practice.[9]

If the firm engages in the practice, we assume that it might be detected, after a preliminary investigation, with a probability $\alpha \in (0, 1)$. While detected, the practice is found anticompetitive in trial, with a probability $\beta \in (0, 1)$, in which case the firm pays a fine F and receives an injunction to interrupt the practice. We assume that Δ cannot be credibly disclosed by the firm, and that it always remains its private information.[10] Finally, we assume that α and β are exogenous because of an implicit budget constraint.

For the firm, the commitments procedure consists in a proposal to put an end to the alleged practice once it has received a *preliminary assessment* from the authority. It saves the fine but immediately loses its benefits from the practice.

The different steps of the game are presented in figure 1, where we consider three periods in order to fully address the stakes at play. Each period is discounted with a factor $\delta_i > 0$, $i = 1, 2, 3$, reflecting different lengths or importance of the three periods. Note that Δ is assumed to be constant across the periods. This excludes for example predation cases. However we present a simple extension of the model in which we show that our main results still hold

[9] We assume that there exists no type-I error so that a firm that does not implement a possible anticompetitive practice could not be fined in trial. In this article, this is equivalent to consider that the firm is not even audited. See Franzoni [10] for a study that considers the two types of errors.

[10] Shavell [24] shows that if private information can be credibly revealed on a voluntary basis, no trial will occur in equilibrium when it is costly for the parties. This point is discussed in section 4.

in these cases.

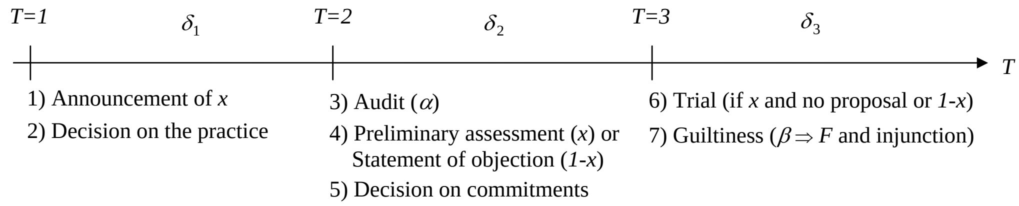

Figure 1: Timing of the game

At the first period of the game ($T = 1$), the CA announces the frequency at which it will use the commitments procedure, denoted by $x \in [0, 1]$. We first assume this announcement to be credible. Given that frequency, a firm of type Δ decides whether or not to implement the practice.

At the second period of the game ($T = 2$), the firm is audited with probability α. With probability x, the CA initiates the commitments procedure by sending the *preliminary assessment*, and, with probability $1 - x$, chooses the normal procedure by sending the *statement of objection* at the end of the investigation. If the firm responds to the preliminary assessment with some commitments that meet the competition concerns, the CA accepts them and immediately closes the case. If the firm does not offer any commitments or if the CA does not send the preliminary assessment, the investigation continues.[11]

At the third period ($T = 3$), there is no particular strategic decision. No practice is ongoing on the market if and only if the firm was deterred in $T = 1$, commitments were offered in $T = 2$, or the trial establishes firm's guiltiness in $T = 3$.

At the sequel and for the sake of the exposure, the values of the different strategies are always evaluated at $T = 1$.

3 Firm's Decisions

We solve the game by backward induction. We first study whether a firm, that is audited and has received a preliminary assessment in $T = 2$, offers commitments or goes to trial.

At the beginning of the second period, if the firm decides to face trial, its expected gain, up to a discounting factor, is $\delta_2\Delta + \delta_3[(1 - \beta)\Delta - \beta F]$. Indeed, it continues the practice during the second period. In $T = 3$, it may be found guilty with probability β and thus is imposed an injunction and pays a fine F. With the complementary probability, it is not found guilty and thus gains Δ.

If the firm decides to offer commitments, its expected gain, up to the same discounting factor, is 0. It must immediately stop the practice but saves the fine.

[11] An additional step in $T = 2$ would be that offered commitments are only accepted by the CA with a probability x'. As it will be discussed in footnotes 12 and 14, what matters in this game is the *ex ante* probability of a commitments procedure. In that sense the credibility of the announcement on x in guidelines or case law will matter as it is discussed hereafter.

Comparing these two outcomes gives the following lemma. We assume without loss of generality that indifference causes a commitments proposal.

Lemma 1. *There exists a threshold, denoted by Δ^r, such that the firm offers commitments if and only if its incremental gain with the practice is smaller than Δ^r.*

A firm for which $\Delta > \Delta^r$ always chooses the trial, while a type $\Delta \leqslant \Delta^r$ offers commitments after a preliminary assessment. Indeed, trial corresponds to a negative or null expected gain for the firm if and only if:

$$\Delta \leqslant \frac{\delta_3 \beta F}{\delta_2 + \delta_3(1-\beta)} \equiv \Delta^r$$

The firm will lose $\beta(F + \Delta)$ in expectation by going to trial while it will lose Δ for sure by proposing commitments. If Δ is sufficiently small, the latter is better for the firm. Conversely, when the benefit from the practice is large enough the firm would prefer trial.[12]

In order to analyze the firm's tradeoff in $T = 1$ concerning the initiation of the practice, let us first assume that only trial is possible. If the firm decides to engage in the practice, its expected gain is $(\delta_1 + \delta_2)\Delta + \delta_3\{(1-\alpha)\Delta + \alpha[(1-\beta)\Delta - \beta F]\}$. Here, the firm gains Δ in period 1, and may not be audited in period 2.

The following lemma indicates which Δ-types are deterred in $T = 1$ when only trial is expected.

Lemma 2. *There exists a threshold, denoted by Δ^0, such that trial deters the firm from engaging in the practice if and only if its incremental gain is smaller than Δ^0.*

Indeed, the types of firm that have a negative expected gain in $T = 1$ are deterred from implementing the practice. This is the case when

$$\Delta \leqslant \frac{\delta_3 \alpha \beta F}{\delta_1 + \delta_2 + \delta_3(1-\alpha\beta)} \equiv \Delta^0 < \Delta^r.$$

Intuitively, when the firm's gain increases, the trial sanction has a smaller importance in its initial tradeoff.

In order to analyze a non trivial game, we make the following assumption concerning the deterrent effect of the intervention of the CA when only trial exists.[13]

[12] Even with an additional step in $T = 2$ where offered commitments would be accepted with probability x', the same set of $\Delta \in [0, \Delta^r]$ would offer commitments. Indeed, the expected gain of a firm would be $(1-x')\{\delta_2\Delta + \delta_3[(1-\beta)\Delta - \beta F]\}$: if the authority accepts the offered commitments, the firm interrupts the practice, and otherwise the firm faces the trial expected gain. The only determining element at this point is whether the trial expected gain is negative or positive.

[13] If Δ is common knowledge, the CA can decide an adjusted level of fine. In such a case, $F(\Delta) = \frac{\delta_1 + \delta_2 + \delta_3(1-\alpha\beta)}{\delta_3 \alpha\beta F}\Delta$ is sufficient to deter each Δ-type. Under asymmetric information, F cannot be a function of Δ, but the CA can deter all Δ-types by setting $F \geqslant \frac{\delta_1 + \delta_2 + \delta_3(1-\alpha\beta)}{\delta_3 \alpha\beta F}\overline{\Delta}$. Given that in both information structures complete deterrence constitutes the first-best in terms of consumer surplus, we do analyze a game where some types cannot be deterred while using the trial as the unique tool of intervention. This is for example because the fine is legally bounded or increases less faster than Δ.

Assumption 1. *We assume that all types of firm would not be deterred, even if a preliminary investigation was certain ($\alpha = 1$).*

This assumption is equivalent to $\Delta^r < \overline{\Delta}$ or $F < \dfrac{\delta_2 + \delta_3(1-\beta)}{\delta_3\beta}\overline{\Delta}$. As long as $\Delta^0 < \Delta^r$, Δ-types in $(\Delta^0, \Delta^r]$ are not deterred but have a negative expected gain in front of the CA: these types *regret* their initial decision once audited. Assumption 1 implies that all potential Δ-types exist as presented in figure 2.

Figure 2: Types of firm

Suppose now that commitments are possible, and note that, under assumption 1, some types ($\Delta > \Delta^r$) will never offer commitments. The CA sends a preliminary assessment with probability $x \geqslant 0$. If the firm chooses to implement the practice and offers commitments once audited, its expected gain in $T = 1$ can be written $\delta_1\Delta + \delta_2\Delta(1-\alpha x) + \delta_3\{(1-\alpha)\Delta + \alpha(1-x)[(1-\beta)\Delta - \beta F]\}$. As compared to the initial evaluation of the trial, the firm may lose Δ in $T = 2$ but is also less probably fined.

Two opposite effects appear concerning the ability to deter anticompetitive practices with the commitments procedure: the interruption of the practice may be obtained during the investigation but an immunity of fine shall be granted while a commitment is offered in case of preliminary assessment. The following lemma presents the effect of the introduction of the commitments procedure on the initial decision of the firm in $T = 1$.

Lemma 3. *Any introduction of the commitments procedure increases the set of Δ-types that engage in the practice in $T = 1$.*

Intuitively, lemma 3 comes from the fact that the Δ-types that may be deterred with the trial intervention are necessarily interested by a commitments proposal. The CA introduces a procedure that grants an immunity of fine, while the trial always remains an option for the firm as opposed to a quickened and certain treatment of the case.

Indeed, for $x \geqslant 0$, the Δ-types that decide not to engage in the practice are those for which:

$$\Delta \leqslant \frac{\delta_3\alpha\beta(1-x)F}{\delta_1 + \delta_2(1-\alpha x) + \delta_3[1-\alpha+\alpha(1-\beta)(1-x)]} \equiv \Delta^d(x)$$

Figure 3 illustrates the form of $\Delta^d(x)$ decreasing with the *ex ante probability* of a commitments application, x.[14]

[14]If this probability of commitments is reduced to xx', the loss of deterrence in $T = 1$ is reduced. However, the results qualitatively hold given that in our framework x can be chosen by the CA in the set $[0, 1]$.

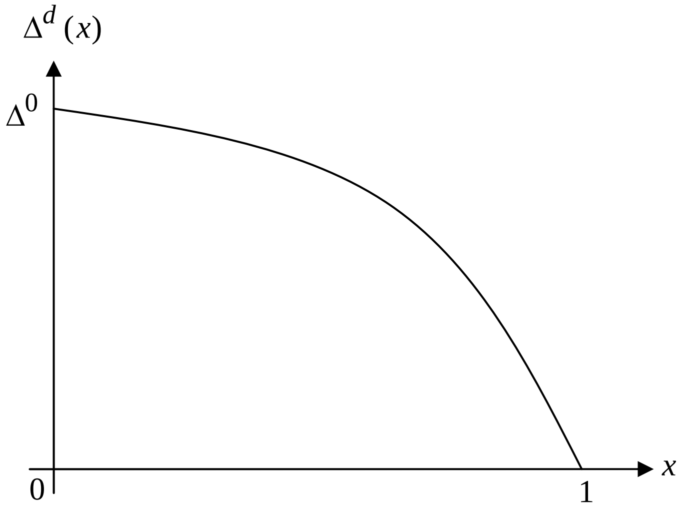

Figure 3: *Ex ante* probability of commitments and deterrence

Given that $\Delta^d(0) = \Delta^0$, a slight increase in x means that the CA first loses the deterrence of Δ-types next to Δ^0. In addition, $\Delta^d(x) = 0$ for $x = 1$: when the CA always uses the commitments procedure, all types that could be deterred adopt a "*wait-and-see strategy*", given that they never pay any fine in this case.[15]

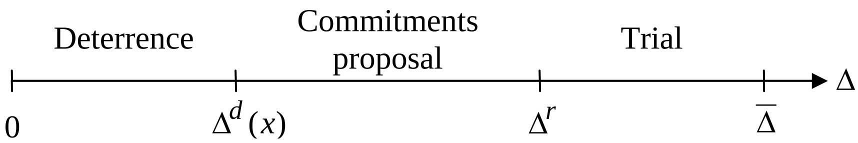

Figure 4: Choices of types of firm for $x \geqslant 0$

Figure 4 summarizes the decision of the different types of firm when the CA announces an x in $[0, 1]$.

The smallest types ($\Delta \leqslant \Delta^d(x)$) decide not to adopt the practice when $0 < x < 1$. Intermediary Δ-types (that belong to $(\Delta^d(x), \Delta^r]$) adopt it but regret their decision once audited and offer commitments after a preliminary assessment. Δ-types which largely gain from the practice ($\Delta > \Delta^r$) choose trial expecting for a dismissal.

Comparative statics with respect to the parameters describing the intervention of the CA give some interesting insights on the repartition of the Δ-types between these three strategies. They are summarized in table 1.

Let us first detail which parameters affect the initial efficiency of the CA's intervention. This comparative-analysis will be used hereafter to give the intu-

[15] The term "wait-and-see" in an antitrust context refers to Fenn and Veljanovski [8] where the authority uses either sanction or monitoring. Here, for $x = 1$ and for any Δ, the firm implements the practice and waits for a possible audit. If its practice is detected it will simply offer commitments if it gains to do so ($\Delta \leqslant \Delta^r$) or goes to trial ($\Delta > \Delta^r$).

Variable	δ_1	δ_2	δ_3	α	β	F	x
Δ^0	-	-	$+$	$+$	$+$	$+$	n.r.
Δ^r	n.r.	-	$+$	n.r.	$+$	$+$	n.r.
$\Delta^d(x)$	-	-	$+$	$+$	$+$	$+$	-
$\Delta^r - \Delta^0$	$+$	-	$+$/-	-	$+$	$+$	n.r.
$\Delta^r - \Delta^d(x)$	$+$	-	$+$/-	-	$+$	$+$	$+$

Table 1: Effects of the audit and trial technologies on the choice of types (n.r.: not relevant; $+$/-: positive or negative)

itions of the main results of this article.

The parameter δ_1 reflects the time necessary for the CA to order a preliminary investigation. It somewhat measures its ability to react after a firm engages in a possible anticompetitive practice. The parameter δ_2 represents the length of the investigation before the trial. Higher parameters δ_1 and δ_2 lessen the efficiency of the CA. On the opposite, an increase in the investigation probability α, the conviction probability β or the fine F represents an increase in the deterrence power of the CA. Finally, the parameter δ_3 represents the period during which the CA's decision has an economic impact on the market.

It thus appears that $\Delta^d(x)$ decreases with the parameters δ_1 and δ_2 (time before and during investigation) and increases with the parameters constituting the expected fine (α, β and F). Intuitively, more Δ-types are deterred when they receive large sanctions more quickly and probably. Δ^r varies in the same way than $\Delta^d(x)$, except for the parameters δ_1, α and x which are irrelevant.

For a given probability of sending a preliminary assessment x, table 1 highlights the fact that the efficiency to initiate an audit and the threat in front of the CA have different effects on the deterrence and commitments tradeoffs. More precisely, the detection affects the initial decision of the firm while the conviction has a larger effect on the willingness to negotiate. Indeed, the set of Δ-types that wish to offer commitments ($\Delta^r - \Delta^d(x)$) decreases when the audit technology becomes more efficient (δ_1 decreases and/or α increases) but increases with a more efficient trial technology (δ_2 decreases, β increases and/or F increases).

Finally, by definition, an increase in x makes more likely a commitments proposal. It also indirectly increases it by lowering the deterrence threshold ($\Delta^r - \Delta^d(x)$ increases).

In this section we have developed a simple model in which the firm decides whether or not to implement a practice that harms consumers and, in the event an audit occurs, to choose the trial or the commitments procedure. Starting from a small gain with the practice, we find that the firm is deterred from engaging in the practice, then implements it but offers commitments, and finally, for largest gains, to always choose the trial option expecting for a valuable dismissal.

We also have shown that these three strategies are affected by the audit and prosecution technologies that rely on an implicit budget constraint. An increase in the detection technology, *i.e.* faster and more likely, as well as in the expected sanction, increase the set of the deterred types. The set of types that would offer commitments decreases with detection technology but increases with the prosecution threat.

4 The Competition Authority's Decision

In this section we present the CA's optimal decision on x when it anticipates the three possible strategies of the firm described above.

Let us first present consumer surplus associated to the different situations and the optimal announcement of the CA when it can discover Δ in the early investigation. These elements will constitute a useful framework for the asymmetric information case.

Consumer expected surplus associated to a deterred Δ-type ($\Delta \leqslant \Delta^d(x)$) is given by:

$$cs^d(\Delta) = (\delta_1 + \delta_2 + \delta_3)S^*(\Delta)$$

For such a type, consumer surplus is simply the discounted value of $S^*(\Delta)$ during each period. In this case, $cs^d(\Delta)$ does not depend on x.

Consumer expected surplus associated to a Δ-type that implements the practice and offers commitments in the event of a preliminary assessment ($\Delta \in (\Delta^d(x), \Delta^r]$) is given by:

$$\begin{aligned} cs^c(\Delta) &= \delta_1 S + (1-\alpha)(\delta_2+\delta_3)S \\ &\quad + \alpha \left\{ x(\delta_2+\delta_3)S^*(\Delta) + (1-x)\left[\delta_2 S + \delta_3((1-\beta)S + \beta S^*(\Delta))\right]\right\} \end{aligned}$$

During the first period, the firm adopts the practice: the observed consumer surplus is S. With probability $1-\alpha$, the firm is not audited. It thus continues the practice during the last two periods. While audited (with probability α), it receives a preliminary assessment with a probability x and offers commitments. Consumer surplus is thus $S^*(\Delta)$. With probability $1-x$, it does not receive a preliminary assessment. It thus continues the practice until trial that provides $S^*(\Delta)$ under a guilty decision.

Finally, consumer expected surplus associated to a Δ-type that implements the practice and decides to go to trial ($\Delta > \Delta^r$) is given by:

$$cs^t(\Delta) = (\delta_1+\delta_2)S + \delta_3\left\{(1-\alpha)S + \alpha[(1-\beta)S + \beta S^*(\Delta)]\right\}$$

Here $S^*(\Delta)$ is achieved in $T=3$ with an ex ante probability of $\alpha\beta$. Note that when $x=0$, there is no commitments procedure and $cs^c(\Delta) = cs^t(\Delta)$.

The following proposition describes the optimal commitments' policy under symmetric information on Δ. This corresponds to the announcement of the CA if the parameter is initially a common knowledge or a decision rule specified for when Δ is revealed in the preliminary investigation.

Proposition 1. *Under symmetric information on Δ, the optimal policy for the CA is to always send a preliminary assessment ($x = 1$) if $\Delta > \Delta^0$, and never otherwise ($x = 0$).*

Under symmetric information, the CA has an optimal decision rule that only refers to the value of Δ, without any explicit respect to the link between the firm's gain and consumer harm. It sets $x^* = 0$ for $\Delta \leqslant \Delta^0$, and $x^* = 1$ otherwise: deterrence means no harm to consumers while commitments only imply some procedural efficiency as compared to trial.

Indeed, $\Delta^d(x)$ decreases with x and $\Delta^d(0) = \Delta^0$, while it comes immediately that: $cs^c - cs^d = -[S^*(\Delta) - S]\{\delta_1 + \delta_2(1 - \alpha x) + \delta_3[1 - \alpha(x + (1-x)\beta)]\} < 0$. On the complementary set of Δ-types, commitments insure against type-II errors and accelerate proceedings: $cs^c - cs^t = [S^*(\Delta) - S]\,\alpha x\,[\delta_2 + \delta_3(1-\beta)] > 0$. It is worth noting that for $\Delta > \Delta^r$, the parameter x has no effect on consumer surplus since trial is always chosen in this case.

Note however that the optimal policy presented in Proposition 1 relies on the intertemporal consistency of the CA between the periods $T = 1$ and $T = 2$. More precisely, it is always in the interest of the CA to send a preliminary assessment during an investigation. Indeed, the commitments solve the competition concerns while injunctions in trial are uncertain at this stage. Without a credible announcement, all Δ-types of firm adopt the wait-and-see strategy described above, anticipating $x = 1$. This pure strategy of the CA entails an equilibrium that does not anymore depend on Δ.

Hereafter, we analyze a game under asymmetric information where the announcement of the CA is assumed to be credible, for example with the help of published guidelines and/or speeches. However, this credibility issue is, while necessary, discussed hereafter with our main results.

Under asymmetric information on Δ, it is obvious that the optimal policy presented in Proposition 1 is not incentive compatible. Here, a firm benefits from an informational rent if and only if $\Delta \in (\Delta^d(x), \Delta^0]$. Such Δ-types decide to mimic larger ones. Indeed, when they reveal their real type, they would face, for deterrence reasons, a systematic refusal from the CA. However, asymmetric information implies only partial antiselection. Indeed, a firm with $\Delta \in (\Delta^0, \Delta^r]$ gains from revealing it with a certain acceptance by the CA. Hence, the CA loses deterrence as x increases but is unable to treat efficiently larger Δ-types as x decreases.[16]

In order to determine the optimal CA's decision, let us first present the weighted consumer surplus. According to the three types of firm's strategy, expected consumer surplus is given by:

$$CS(x) = \int_0^{\Delta^d(x)} cs^d(\Delta)\phi(\Delta)d\Delta + \int_{\Delta^d(x)}^{\Delta^r} cs^c(\Delta)\phi(\Delta)d\Delta + \int_{\Delta^r}^{\overline{\Delta}} cs^t(\Delta)\phi(\Delta)d\Delta$$

As it will be shown hereafter, the optimal policy under asymmetric information essentially depends on the link between Δ and $h(\Delta)$ for a given practice.

[16] If Δ can be credibly revealed, an immediate equilibrium is $x^* = 1$ when the firm can prove that $\Delta > \Delta^0$, and $x^* = 0$ otherwise. As compared to Shavell [24], there still would be some trial for types $\Delta > \Delta^r$. As used by the US Department of Justice, partial remedies in commitments could give more incentives to the larger types in order to negotiate. In the European competition law, commitments are supposed to be complete, and trials arise for practices that are very beneficial to the firm.

Indeed, the derivative of $CS(x)$ w.r.t. x is given by:

$$CS'(x) = \alpha[\delta_2 + \delta_3(1-\beta)] \int_{\Delta^d(x)}^{\Delta^r} h(\Delta) d\Delta$$

$$+ [\delta_1 + \delta_2(1-\alpha x) + \delta_3(1-\alpha + (1-\beta)(1-x))] \, h(\Delta^d(x)) \frac{\partial \Delta^d(x)}{\partial x}$$

The first element is positive and represents the marginal gain, from an increase of the probability of sending a preliminary assessment x, through the quickening and insurance effects of commitments: the weighted harm, $h(\Delta)$, is *immediately and completely repaired.* The second element is negative given that $\partial \Delta^d(x)/\partial x < 0$ and represents the marginal loss of deterrence.

This derivative can be rewritten as follows:

$$CS'(x) = \alpha \left[\delta_2 + \delta_3(1-\beta)\right] \int_{\Delta^d(x)}^{\Delta^r} \left[h(\Delta) - h(\Delta^d(x))\right] d\Delta$$

In addition, note that $CS''(x)$ has the same sign as $h'(\Delta^d(x))$:

$$CS''(x) = -\alpha \left[\delta_2 + \delta_3(1-\beta)\right] h'(\Delta^d(x))(\Delta^r - \Delta^d(x)) \frac{\partial \Delta^d(x)}{\partial x}$$

so that the convexity of $CS(.)$ w.r.t. x directly depends on the way $h(\Delta^d(x))$ varies with x.

Let us first provide a sufficient condition under which the introduction of the commitments procedure enhances consumer surplus.

Proposition 2. *Under asymmetric information on Δ, a sufficient condition under which the commitments procedure enhances consumer surplus is that the mean value of $h(.)$ on $[\Delta^0, \Delta^r]$ is larger than $h(\Delta^0)$.*

Indeed, $\int_{\Delta^0}^{\Delta^r} \left[h(\Delta) - h(\Delta^0)\right] d\Delta > 0$ means $CS'(0) > 0$ and therefore $x^* > 0$. Intuitively, a slight increase in x from zero involves a deterrence loss of few types, but benefits consumers for all $\Delta \in (\Delta^0, \Delta^r]$. Hence, the CA introduces commitments when the procedural efficiency associated to these latter Δ-types is larger than the weighted harm due to the loss of deterrence of Δ^0.

In the remaining of this article, we provide some conditions under which there is a corner solution with $x^* = 0$ or $x^* = 1$, respectively when initiating commitments is never or always optimal. We also highlight a case where the consumer surplus maximization involves an interior solution ($0 < x^* < 1$). The CA sends stochastically a preliminary assessment.

The resolution of the model in a general way is not obvious and we describe different cases depending on the form of $h(.)$. In particular, the following proposition presents the optimal decision of the CA when the harm function $h(.)$ is monotonic.

Proposition 3. *A monotonicity of $h(\Delta)$ induces that the authority plays in pure strategy:*

1. *If $h(.)$ is increasing on the set $[0, \Delta^r]$, the authority always sends the preliminary assessment.*

2. If $h(.)$ is decreasing on the set $[0, \Delta^r]$, the authority only uses trial.

The proof of this proposition is immediate. Knowing that $\Delta^d(x) \in [0, \Delta^0]$, $CS'(x)$ is positive (resp. negative) for any x if $h(.)$ strictly increases (resp. decreases) on $[0, \Delta^r]$. Hereafter and for the sake of exposure, we give some intuitions dealing with the optimal x^* for a uniform distribution function $\phi(.)$.[17]

An increase in the firm's gain deteriorates consumer welfare when, for example, the price is the only element that enters consumer surplus on a given market, and that the firm reduces the number of entrants into the market while deciding to abuse of its dominant position. The larger the number of potential entrants, the smaller the firm's counterfactual profit and the more consumers benefit from the ending of the practice. Another circumstance under which $S^*(\Delta)$ increases with Δ deals with the case of a dominant firm (detaining an essential facility) raising its rivals' costs. As stated in Proposition 3, the deterrence loss is always dominated by the quickening and insurance effects of the commitments procedure, so that the CA always initiates the commitments procedure: $x^* = 1$. Intuitively, consumers are better off avoiding discharge and obtaining quick interruption of larger cases since the loss of deterrence concerns only "minor" ones.

On the opposite, when larger Δ's are associated with smaller consumer harm, the CA only uses trial: $x^* = 0$. This will be the case for example when the price and the quality of the distribution matter in consumer surplus and that the alleged practice is a vertical restraint allowing some efficiency gains to be partially transmitted to consumers. Indeed, when some restricted access to a distribution network allows a large number of inefficient distributors, one could reasonably think that Δ is large and that the counterfactual surplus $S^*(\Delta)$ is small. In this case, trial deters most harmful practices so that the CA never uses commitments.

However, $h(.)$ is not necessarily monotonic in Δ on the set $[0, \Delta^r]$. For example, even without any efficiency gain being at play, there might be no obvious link between the firm's gain and consumer harm. In order to highlight different and somehow more interesting tradeoffs faced by the CA, we determine hereafter the CA's optimal policy for some U and inverted U-shaped $h(.)$ functions, assuming that the initial marginal deterred firm is rather determinant or negligible.[18]

We first characterize the optimal announcement of the CA for an inverted U-shaped $h(.)$ where Δ^0 corresponds to the largest weighted harm to consumers.

Proposition 4. *If $h(.)$ is an inverted U-shaped function with its maximum reached in Δ^0, it is optimal for the CA to announce a systematic use of the commitments procedure ($x^* = 1$) or of the trial ($x^* = 0$).*

This case is illustrated in figure 5.a), with the corresponding expected consumer surplus in figure 5.b). As presented with the link between $h(.)$ and $CS(.)$ in appendix, $x = 0$ and $x = 1$ are the two local optima.

[17] Proposition 3 and the following ones rely on the form of the weighted harm to consumers. The same kind of phenomena could be generated by specific distribution functions of the parameter Δ. We do use a uniform distribution function in order to illustrate the effects on consumer surplus.

[18] Moreover and as discussed in appendix, we assume that $h(0) = h(\overline{\Delta})$ and that $h(\Delta^0)$ is rather the maximum or the minimum of $h(\Delta)$. These are sufficient conditions with no inflexion point on $h(.)$ to have distinct tradeoffs from those presented above.

Intuitively, we can see here that the deterrence of the smallest types of firm is not the main objective of the CA. Indeed, the tradeoff concerns in this case the Δ-types smaller but next to Δ^0 that will implement the practice even for small values of x. Here, the loss of their deterrence could be offset with a certain application of the commitments procedure in larger cases, and in the event where $x = 1$ is not sufficient, the CA should only use trial.

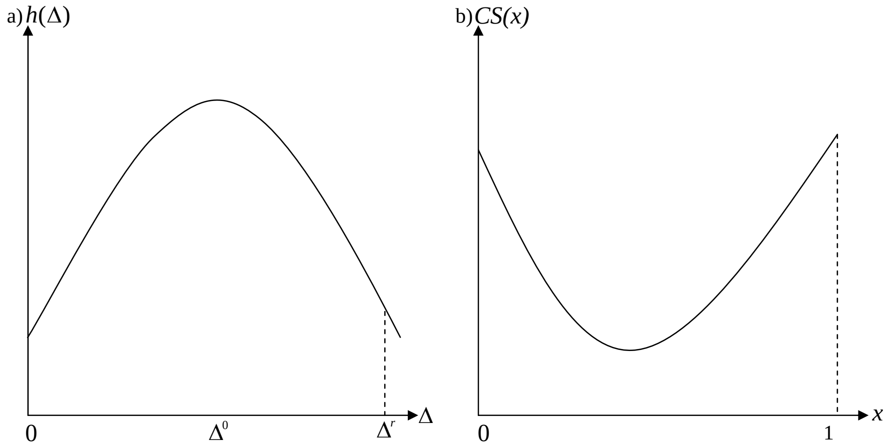

Figure 5: Inverted U-shaped weighted harm and consumer surplus

Another question is then to determine how the initial efficiency of the CA's intervention affects the choice between $x = 0$ and $x = 1$. The following proposition presents how the trial threat affects the interest of the commitments procedure.

Proposition 5. *If $h(.)$ is an inverted U-shaped function with its maximum reached at Δ^0, an inefficient initial intervention of the CA makes the commitments procedure more advantageous for consumers. The commitments procedure and the trial are substitutes: negotiation is more probably preferred if the threat in trial is low.*

Proof of Proposition 5 is provided in appendix. It simply relies on the effects of the different parameters on the difference $CS(1) - CS(0)$. This latter can be written as follows:

$$CS(1) - CS(0) = -\left[\delta_1 + (\delta_2 + \delta_3)(1 - \alpha)\right] \int_0^{\Delta^0} h(\Delta)d\Delta$$
$$+\alpha\left[\delta_2 + \delta_3(1 - \beta))\right] \int_{\Delta^0}^{\Delta^r} h(\Delta)d\Delta$$

The first element is negative given that the CA may adopt a strategy that provides incentives to all initially deterred types to choose the practice in $T = 1$, possibly with no audit in $T = 2$. However, for larger types, the quickened and certain interruption of the practice in $T = 2$, if the firm is audited, pushes the CA to choose $x = 1$. The sign of this difference is undetermined *a priori* but it is possible to determine how the different parameters of the model affect it.

A longer period before a possible audit (δ_1 increases) makes $x^* = 1$ more likely. Indeed, as presented in table 1, $\Delta^r - \Delta^0$ increases so that a "beneficial" commitments use is more likely. Longer proceedings (δ_2 increases) also make $x^* = 1$ more likely: even though the set of types willing to use commitments is reduced, the loss of deterrence is more easily offset under an inverted U-shape of $h(.)$.

A larger threat in trial, through an increase of α, β and/or F, allows for a higher level of deterrence. The exclusive use of the trial ($x = 0$) is thus more probably chosen.[19]

The following proposition characterizes, assuming a credible announcement on x, the optimal decision of the CA when the initial marginal deterred Δ-type causes the smallest weighted harm to consumers.

Proposition 6. *If $h(.)$ is a U-shaped function with its minimum reached at Δ^0, the optimum for the CA is to announce a stochastic use of the commitments procedure (x^* is interior).*

This case is illustrated in figure 6.a), with the corresponding expected consumer surplus in figure 6.b). The sufficient condition presented in Proposition 2 now holds ($x = 0$ is not a local optimum) and it is optimal to introduce the commitments procedure. Moreover, the weighted harm associated to small Δ-types being important, $x = 1$ is no more a local optimum.

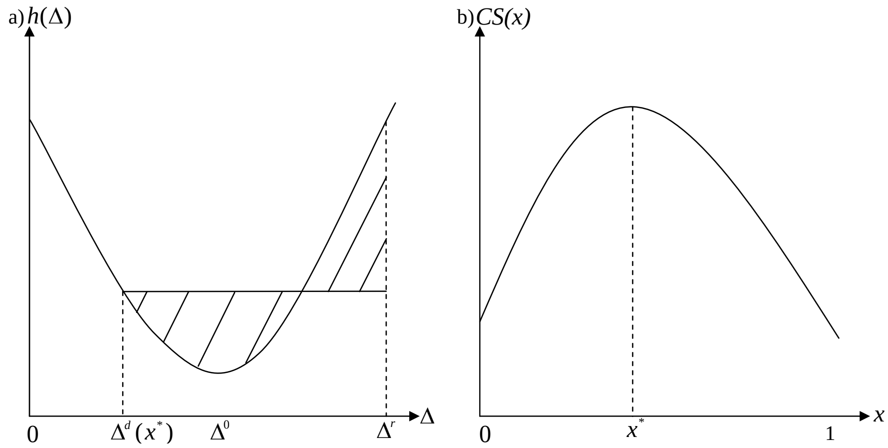

Figure 6: U-shaped weighted harm and consumer surplus

As shown in figure 6.a), x^* equalizes $h(\Delta^d(x^*))$ to the mean value of $h(.)$ on $[\Delta^d(x), \Delta^r]$:

[19]Note that Proposition 5 also deals with the case where the CA is unable to respect its announcement during the audit. The optima are $x = 0$, where the ability to negotiate is not legally given to the CA, or $x = 1$ where it is allowed to and always does. With an inverted U-shaped $h(.)$ and a CA that lacks credibility, commitments are an answer to a lack of efficiency. With a U-shaped $h(.)$, we show in appendix that they are complements if there is no credible announcement. However, one should verify whether these opposite solutions on x are candidates to the optimum of a credible authority's program.

$$\int_{\Delta^d(x)}^{\Delta^r} \left[h(\Delta) - h(\Delta^d(x))\right] d\Delta = 0.$$

Here, the CA sends a preliminary assessment with a positive but not certain probability, in order not to reduce in excess the deterrence of the smallest Δ-types which correspond to the most harmful practices. Yet some use of the commitments procedure is optimal because large Δ-types also mean large damages for which procedural efficiency matters.

The following proposition provides some comparative statics on the probability of sending a preliminary assessment, x^* w.r.t. the different parameters of the model.

Proposition 7. *If $h(.)$ is a U-shaped function with its minimum reached at Δ^0, an efficient initial intervention of the CA makes the commitments procedure more advantageous for consumers. The commitments procedure and the trial are complements: negotiation is more likely if the threat in trial is high.*

It thus appears that with a U-shaped weighted harm function, the later the CA performs an audit and the less it is likely, the less likely is its sending of a preliminary assessment: audit and commitments are complements. In addition, its optimal frequency increases when investigations are performed faster and with a higher expected fine. As discussed before with the Proposition 5, this result still holds when the announcement $x \in [0, 1)$ is not credible.

This last case could be seen as a theoretical argument in favor of the introduction, at the European level, of the commitments procedure coupled with an increase in the legal bounds of sanctions. However, let us recall that the inverted U-shape indicates that it may be a bad answer to a lack of efficiency. Note also that the commitments and sanction policies are even independent (as long as full deterrence is not achievable) under a monotonic relation between the firm's gain and consumer harm.

In this section, we have shown that from the consumers' point of view, the introduction of a commitments procedure has three effects. First, allowing for shortened proceedings, it permits some cases to be handled quickly in order to restore a higher consumer surplus (the quickening effect). Second, while the illegal nature of a practice is only established in trial decisions, the CA may obtain some behavioral remedies where a discharge in trial is possible (the insurance effect). Finally, given that commitments relies on an immunity of fine, this could give the opportunity for some types of firm to implement the practice while they would not have initially (loss of deterrence).

We first have provided a sufficient condition under which the CA should always make some use of the commitments procedure. Indeed, when the CA introduces this procedure in few cases, it only loses the deterrence of few types of firm but obtains the quickening and insurance effects for all larger types. The interest of commitments is then subjected to the relative induced harm of the types that engage in the practice.

Finally, using comparative statics, we show that the commitments procedure is not always an alternative to a lack of efficiency of the intervention of a CA. Indeed, we have found that a weak threat in trial could sometimes reduce the interest of commitments.

5 Extension of the Model: A Treatment of Predation Cases

In this section, we analyze the case of predation and in particular with respect to the credible value of an announcement on x. Using slightly modified definitions of Δ and $h(\Delta)$, we show that our main results still hold.

Predation is an anticompetitive practice where a firm prices aggressively in the only objective to exclude its competitors from the market and to deter further entry. For a pricing to be sanctioned, its anticompetitive aim must be established. The fact that a firm prices under its mean or marginal production cost is often used as such an indicator: the firm generates some losses in a first period that are offset by its benefits after eviction (the recoupment test). Hence, predation is a particular case where the firm's gain with the practice increases through the periods.

It is quiet easy to link predation cases to the former studied ones, and in particular to obtain the main results concerning the thresholds that define the different choices of the Δ-types.

This can be done by a simple redefinition of $\Delta \geqslant 0$ as the *total discounted gain* of the firm with predation such as measured from the period $T = 1$: $\Delta \equiv \delta_1 d_1 + \delta_2 d_2 + \delta_3 d_3$, where d_i is the difference between the profit with and without the practice in period i. Note that different Δ-types may exist if different values of the counterfactual profit or different profiles of d_i are possible for a given observed price during the investigation. In addition, d_1 may be negative, but we assume that, for any Δ-type, $d_1 \leqslant d_2 \leqslant d_3$ with at least one strict inequality.

Besides, let us define $h(\Delta) \geqslant 0$ as the *discounted weighted harm* to consumers such as measured from the period $T = 1$ for a given Δ-type. For the sake of the presentation, we consider a case where the price is the only element that enters consumer surplus. We denote by $h(\Delta) \equiv \delta_1 h_1(d_1) + \delta_2 h_2(d_2) + \delta_3 h_3(d_3)$, where we have to subscript the weighted harm to consumers in a period i when different profiles of d_i are considered: a given Δ may correspond to different values of d_i, so that $h_i(d_i) = [S^*(d_i) - S]\phi_i(d_i)$ where $\phi_i(.)$ is the density at period i of gains d_i. If we consider that all firm's gains follow the same profile for any Δ, the density of types remains the same so that $h(\Delta) = \delta_1 h(d_1) + \delta_2 h(d_2) + \delta_3 h(d_3)$. Here, we only assume that $h_1(d_1) \leqslant h_2(d_2) \leqslant h_3(d_3)$ with at least one strict inequality. Note that consumer surplus may be increased with predation during a period of time, but we do assume that this is not globally the case, i.e. $h(\Delta) \geqslant 0$.

All else equal, whenever the trial is the only option in prosecutions, the initial deterrence of types is unchanged: even though the first period's gain of the firm is smaller than it will become after competitors' supplanting, the new definition of Δ takes the discount rate into account applied to the future gains. However, for values of Δ too high for the firm to be deterred, note that it now has less incentive to offer commitments during the audit: its discounted gain with the practice has necessarily increased as compared to Δ evaluated at $T = 1$. Here, Δ^0 remains unchanged but Δ^r decreases. This single aspect allows us to establish the following results.

In the CA's point of view, the introduction of commitments is not more counterproductive in terms of deterrence but a commitments proposal is less likely. Hence, assuming a credible announcement of the CA on any $x \in [0,1]$, its initial arbitrage in $T = 1$ in terms of deterrence and procedural efficiency remains the same: a monotonic $h(\Delta)$ pushes for a pure strategy of the CA concerning the preliminary assessment, for any initial value of $\Delta^0 < \overline{\Delta}$. On the opposite, its initial level of efficiency will indicate how commitments may benefit consumers when $h(\Delta)$ has an interior extremum. To sum up, and by definition, the initial tradeoff remains the same so that only does the form of $h(.)$ determine the optimal announcement of the CA.

Finally, considering a lack of credibility of any CA's announcement $x \in [0,1)$, a systematical proposal of the commitments procedure happens at the equilibrium. Indeed, procedural efficiency has even more value during the audit from the CA' point of view, given that in a predation case, the discounted expected harm to consumers has necessarily increased as compared to its value in $T = 1$. Again, the tradeoff from the CA's point of view is between not introducing the commitments procedure ($x = 0$) and a systematical sending of preliminary assessment ($x = 1$).

6 Conclusion

In this article, we analyze the impact of the introduction of a commitments procedure in terms of procedural efficiency and deterrence.

At the European level, this procedure consists in granting an immunity of fine to a firm in return for commitments that meet the competition concerns expressed to her. We consider unilateral practices such as abuse of dominant position, vertical restraints or predation.

A first series of results assume a credible announcement of the CA on the probability of a preliminary assessment that initiates the commitments procedure. This assumption may be justified given that the CA publishes special guidelines on this procedure and has a rather public objective.

First, we show that the optimal strategy of the CA, when the gain of the firm with the practice may be identified, is to refuse the commitments procedure whenever this gain is sufficiently small. This initial announcement may rely on a symmetric information structure at the prior stage of the trial. Intuitively, the CA announces that it will not accept any commitments from a firm that could be deterred under the threat of the normal procedure. In addition, in such a circumstance it announces that it will systematically accept commitments from the larger types in order to fully benefit from the insurance and quickening effects.

When the incremental gain of a firm is its private information, the CA announces a policy that may optimally induce a stochastic use of the commitments procedure. This frequency is determined with respect to the link between the firm's gain and consumer harm. Indeed, this link allows the CA to give some specified value to the loss of deterrence and to the procedural efficiency. We show that the commitments procedure may reduce consumer surplus.

In particular, we show that when an increase in the firm's gain induces a deterioration of consumer welfare, commitments are systematically proposed. On the opposite, if the harm to consumers decreases with the gain of the firm, for example when efficiency gains are at play, the sole trial is active. Only a non-monotonic relation may push for a stochastic use of commitments.

Finally, using comparative statics, we show that the commitments procedure is not always an alternative to a lack of efficiency of the CA's intervention. Indeed, we have found that a weak threat in trial could sometimes reduce the interest of commitments.

As mentioned and discussed in different parts of the paper, a possible lack of credibility of the CA could somewhat change some of our results. Indeed, it is always in the interest of the CA, in this case, to send the preliminary assessment (during the audit) in order to benefit from the procedural efficiency associated to the negotiated procedure. As a consequence, the CA's strategy does not anymore depend on the value of the incremental gain of the firm or on its effect on consumers: all types of firm offer commitments if they gain to do so during the audit. Hence, the CA loses all the deterrent effect of its intervention.

Nevertheless, this latter result may correspond to the overall optimum depending on the effect of the practice on consumer surplus. We also have presented the associated legal tradeoff concerning the interest to grant the CA with such a negotiated ability in this circumstance. In particular we are able to apply the previous comparative statics.

The analysis of these two alternative credibility environments shows that guidelines enhance consumer surplus when they indicate a binding probability of a preliminary assessment for a given type of practice.

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A Link between $h(\Delta)$ and $CS(x)$

We study here the form of $CS(x)$ under different shapes of $h(\Delta)$ for $\Delta \in [0, \Delta^r]$. The expected weighted consumer surplus is given by:

$$CS(x) = \int_0^{\Delta^d(x)} cs^d(\Delta) d\Phi(\Delta) + \int_{\Delta^d(x)}^{\Delta^r} cs^c(\Delta) d\Phi(\Delta) + \int_{\Delta^r}^{\overline{\Delta}} cs^t(\Delta) d\Phi(\Delta)$$

where $\Delta^d(x)$ decreases with x and belongs to $[0, \Delta^0]$ with $\Delta^d(0) = \Delta^0$ and $\Delta^d(1) = 0$.

Its derivative is:

$$CS'(x) = \alpha \left[\delta_2 + \delta_3(1-\beta)\right] \int_{\Delta^d(x)}^{\Delta^r} \left[h(\Delta) - h(\Delta^d(x))\right] d\Delta$$

With a monotonic function $h(.)$, the sign of $CS'(x)$ remains the same for any $x \in [0, 1]$. On the opposite, if $h(\Delta)$ is strictly concave or convex and has an interior extremum, the sign of $CS'(x)$ may vary w.r.t. x.

One can define the sign of $CS'(x)$ in $x = 0$ and $x = 1$ as follows:

$$\text{sign}\{CS'(0)\} = \text{sign}\{\int_{\Delta^0}^{\Delta^r} [h(\Delta) - h(\Delta^0)]d\Delta\}$$

and:

$$\text{sign}\{CS'(1)\} = \text{sign}\{\int_{0}^{\Delta^r} [h(\Delta) - h(0)]d\Delta\}$$

First assume that $h(\Delta)$ is concave and reaches a unique interior maximum over $(0, \Delta^r)$: $h'(0) > 0$ and $h'(\Delta^r) < 0$. It comes straight that a sufficient condition to have $CS'(0) < 0$ is that $h'(\Delta^0) \leqslant 0$: $x = 0$ is a local optimum given that the mean value of $h(.)$ over $[\Delta^0, \Delta^r]$ is necessarily smaller than $h(\Delta^0)$. In addition, $CS'(1) > 0$ whenever $h(0) \leqslant h(\Delta^r)$.

Assume now that $h(\Delta)$ is convex and reaches a unique interior minimum over $(0, \Delta^r)$: $h'(0) < 0$ and $h'(\Delta^r) > 0$. A sufficient condition to have $CS'(0) > 0$ is that $h'(\Delta^0) \geqslant 0$: the condition presented in Proposition 2 holds so that $x = 0$ is not a local optimum. In addition, $CS'(1)$ is negative whenever $h(0) \geqslant h(\Delta^r)$.

For the sake of the presentation, we only consider these two shapes of $h(.)$ assuming that $h(0) = h(\Delta^r)$ and $h'(\Delta^0) = 0$, so that the link between $CS(x)$ and $h(\Delta)$ involves a tradeoff sufficiently different from those we found under a monotonic shape of $h(.)$ over $[0, \Delta^r]$.

Note also that under the assumption that $h'(\Delta^0) = 0$, the convexities of $h(\Delta)$ in $[0, \Delta^r]$ and $CS(x)$ in $[0, 1]$ are always opposite:

$$\text{sign}\{CS''(x)\} = \text{sign}\{h'(\Delta^d(x))\}.$$

Here, $h'(\Delta^d(x))$ has a unique sign for any $x \in [0, 1]$: assuming a concave $h(.)$, $CS''(0) = 0$ and $CS''(1) > 0$, while assuming a convex function, $CS''(0) = 0$ and $CS''(1) < 0$.

Assuming $h'(\Delta^0) \neq 0$, one can see that the convexity of $CS(.)$ and $h(.)$ are different in $x = 0$ or $x = 1$. However, in the remaining of this article, the signs of $CS'(0)$ and $CS'(1)$ are more crucial than the second derivatives: assuming $h'(\Delta^0) = 0$ simplifies the exposure of more interesting tradeoffs than under monotonic $h(.)$.

B Proof of Proposition 5

In order to prove Proposition 5, we have to study how the different parameters affect the tradeoff of the CA while choosing $x = 0$ or $x = 1$.

We have:

$$\begin{aligned} CS(1) - CS(0) = &- [\delta_1 + (\delta_2 + \delta_3)(1 - \alpha)] \int_0^{\Delta^0} h(\Delta)d\Delta \\ &+ \alpha [\delta_2 + \delta_3(1 - \beta))] \int_{\Delta^0}^{\Delta^r} h(\Delta)d\Delta \end{aligned}$$

The derivative w.r.t. δ_1 is:

$$\frac{\partial[CS(1) - CS(0)]}{\partial\delta_1} = \int_0^{\Delta^0} [h(\Delta^0) - h(\Delta)]d\Delta.$$

It thus appears that a sufficient condition for the derivative to be positive is that $h(\Delta)$ increases over $[0, \Delta^0]$.

The derivative w.r.t. δ_2 is:

$$\frac{\partial[CS(1) - CS(0)]}{\partial \delta_2} = \int_0^{\Delta^0} [h(\Delta^0) - h(\Delta)]d\Delta + \alpha \int_0^{\Delta^r} [h(\Delta) - h(\Delta^r)]d\Delta.$$

Two sufficient conditions imply that it is positive: $h(\Delta)$ increases on the set $[0, \Delta^0]$ and the mean value of $h(\Delta)$ on $[0, \Delta^r]$ is larger than $h(\Delta^r)$.

Moreover, under the assumption that $h(\Delta^0) > h(\Delta^r)$, it comes straight that a larger fine F lowers $CS(1) - CS(0)$:

$$\frac{\partial[CS(1) - CS(0)]}{\partial F} = \alpha\beta\delta_3[h(\Delta^r) - h(\Delta^0)].$$

Finally, the derivatives of $CS(1) - CS(0)$ w.r.t. α and β are given by:

$$\begin{aligned}\frac{\partial[CS(1) - CS(0)]}{\partial \alpha} &= (\delta_2 + \delta_3) \int_0^{\Delta^0} h(\Delta)d\Delta \\ &\quad + [\delta_2 + \delta_3(1 - \beta)] \int_{\Delta^0}^{\Delta^r} h(\Delta)d\Delta - (\delta_1 + \delta_2 + \delta_3)\frac{\Delta^0 h(\Delta^0)}{\alpha}\end{aligned}$$

and

$$\begin{aligned}\frac{\partial[CS(1) - CS(0)]}{\partial \beta} &= \alpha(\delta_2 + \delta_3)\frac{\Delta^r h(\Delta^r)}{\beta} \\ &\quad - \alpha\delta_3 \int_{\Delta^0}^{\Delta^r} h(\Delta)d\Delta - (\delta_1 + \delta_2 + \delta_3)\frac{\Delta^0 h(\Delta^0)}{\beta}.\end{aligned}$$

They are null under a constant $h(\Delta)$ so that when the function $h(.)$ is concave over $[0, \Delta^r]$ and reaches its maximum at Δ^0, they both become negative. Hence, when the expected sanction increases $CS(1) - CS(0)$ decreases.

Contrarily, when $h(.)$ is convex with its minimum reached in Δ^0 and $h(0) = h(\Delta^r)$, a more efficient CA has a larger interest to systematically use the commitments procedure as opposed to a unique intervention by trial. Let us recall here that we have seen that $x = 1$ is actually the only equilibrium if the announcement of the CA is not credible so that this latter complementarity concerns the tradeoff of a legal introduction of the commitments procedure ($x = 0$ or $x = 1$).

C Proof of Proposition 7

In order to prove the complementarity of the commitments procedure and the trial, we have to study how the different parameters affect the choice of the CA on $x^* \in]0, 1[$.

The optimal probability x^* is such that $h(\Delta^d(x))$ is equal to the mean value of $h(.)$ over $[\Delta^d(x), \Delta^r]$:

$$\int_{\Delta^d(x)}^{\Delta^r} \left[h(\Delta) - h(\Delta^d(x))\right] d\Delta = 0.$$

We first have to define the partial derivative of $\Psi(\delta_1, \delta_2, \delta_3, \alpha, \beta, F, x)$ w.r.t. x, where $\Psi(.)$ is defined as follows:

$$\Psi(\delta_1, \delta_2, \delta_3, \alpha, \beta, F, x) = H(\Delta^r) - H(\Delta^d(x)) - h(\Delta^d(x))(\Delta^r - \Delta^d(x))$$

where $H(.)$ is a primitive of $h(.)$.

At $x = x^*$, $\Psi(\delta_1, \delta_2, \delta_3, \alpha, \beta, F, x^*) = 0$ so that the partial derivative of $\Psi(.)$ w.r.t. x can be defined as follows:

$$\Psi'_x(\delta_1, \delta_2, \delta_3, \alpha, \beta, F, x^*) = -\left.\frac{\partial \Delta^d(x)}{\partial x}\right|_{x=x^*} h'(\Delta^d(x^*))(\Delta^r - \Delta^d(x^*))$$

which is strictly negative given that $\partial \Delta^d(x)/\partial x < 0$ for any $x \in [0,1]$ and that $h'(\Delta^d(x^*)) < 0$ since $\Delta^d(x) \leqslant \Delta^0$.

Hence, x^* varies w.r.t. any parameter i, with $i \neq x^*$, as does $\Psi(.)$ given that:

$$\frac{\partial x^*}{\partial i} = -\frac{\Psi'_x(\delta_1, \delta_2, \delta_3, \alpha, \beta, F, x^*)}{\Psi'_i(\delta_1, \delta_2, \delta_3, \alpha, \beta, F, x^*)}$$

With the help of the following partial derivatives, we establish that trial and commitments are two complementary procedures. An increase in the sanction threat induces a higher usage frequency of commitments.

Indeed, for $a \in \{\delta_1, \alpha\}$ that only enter in the definition of $\Delta^d(x)$:

$$\Psi'_a(\delta_1, \delta_2, \delta_3, \alpha, \beta, F, x^*) = -\left.\frac{\partial \Delta^d(x)}{\partial a}\right|_{x=x^*} h'(\Delta^d(x^*))(\Delta^r - \Delta^d(x^*))$$

where, for any $x \in [0,1]$, $\partial \Delta^d(x)/\partial \delta_1 < 0$ and $\partial \Delta^d(x)/\partial \alpha > 0$. An increase in α or a smaller time before a possible audit makes a preliminary assessment more likely.

Besides, for $b \in \{\delta_2, \delta_3, \beta, F\}$ that enters in the definition of Δ^r and $\Delta^d(x)$:

$$\Psi'_b(\delta_1, \delta_2, \delta_3, \alpha, \beta, F, x^*) = \frac{\partial \Delta^r}{\partial b}[h(\Delta^r) - h(\Delta^d(x^*))] - \left.\frac{\partial \Delta^d(x)}{\partial b}\right|_{x=x^*} h'(\Delta^d(x^*))(\Delta^r - \Delta^d(x^*))$$

By definition of $\Delta^d(x^*)$, such that $h(\Delta^d(x^*)) < h(\Delta^r)$, it appears that a larger δ_2 reduces x^*, while larger δ_3, β, and F increase x^*.

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