

# Choice of Enforcement Procedures under Legal Uncertainty<sup>1</sup>

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## Abstract:

The issue of Legal Uncertainty (LU) is considered of fundamental importance among those involved in the design and implementation of public policy. Enforcement procedures, such as *effects-based* or *rule-of-reason* procedures increasingly implemented by Competition Authorities (CAs) in recent years are often criticized because of their “high degree of LU” relative to *object* or *form-based* procedures often referred to as *Per Se*. A related criticism by legal experts of recent enforcement practice is that the adoption of *effects-based* procedures has not, as it should, according to the principle of *nulla poena sine lege certa*, led to a reduction of the penalties imposed by CAs.

However, the concept of LU has never up to now been formalised and the welfare “cost of LU” has never been analysed using economic theory. Here we propose a formalisation of the concept that, as in Katsoulacos and Ulph (2009) is based on the premise that CAs cannot assess without mistakes the harm created by specific actions associated with certain business practices and on the assumption that there is imperfect information by firms in assessing the true harm of their actions and/or the CA’s estimate of harm in case these actions come under investigation. Depending on the type of information imperfection faced by firms a typology of LU situations emerges that classifies *effects-based* procedures into those involving: No Legal Uncertainty, Partial Legal Uncertainty, or Complete Legal Uncertainty. We compare these between themselves and with *Per Se* procedures first assuming that penalties are exogenously given and then assuming that penalties are set optimally.

We find that if *effects-based* procedures entail lower costs of decision errors than *Per Se* there is, with exogenous penalties, no monotonic link between LU and welfare. Deterrence effects imply that welfare can be higher when there is some degree of LU than when there is no LU. This is true also when firms can invest into reducing LU. This result is strengthened with endogenous penalties. Then, there is a clear welfare ranking of decision environments: an *effects-based* procedure with partial legal uncertainty dominates that with no legal uncertainty which in turn dominates that with complete legal uncertainty which in turn dominates *Per Se*. Further, we find that increased LU may well be associated with *higher* optimal fines so a CA could be justified in *raising* its penalties after adopting *effects-based* procedures.

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## 1. Introduction

An important issue when considering what type of enforcement procedure to use in situations in which regulatory intervention in markets is deemed necessary is that of Legal Certainty<sup>4</sup>. Certain enforcement or decision procedures are thought of in policy circles, as being superior, *ceteris paribus*, because their “cost” in terms, or as a result, of the legal uncertainty<sup>5</sup> generated when these procedures are adopted is relatively low. This issue is important for a broad range of regulatory interventions<sup>6</sup> which are induced by the following set of circumstances: (a) agents are taking actions related to specific business practices that are privately beneficial but from a wider social viewpoint may be harmful or beneficial (b) the degree of social harm/benefit varies with the circumstances under which the action is taken (c) the authority/regulator *cannot observe the precise circumstances* under which any given action is taken.

In the specific context of Competition Law enforcement with which we are concerned here, Forrester (2000) notes that “Legal certainty..... is very frequently invoked as a prime concern for those responsible for enforcing the competition rules. Advocates General, article writers and the Commission itself have each stated on various occasions how important it was to ensure legal certainty”<sup>7</sup>. Discussions on legal uncertainty usually involve comparisons of *Effects-Based* (or what alternatively can be termed *discriminating*) and *Per Se* decision rules or enforcement procedures<sup>8</sup>. The idea is that under *Per Se* rules either an *entire* class of actions are allowed or disallowed, depending on whether their *average* harm is negative or positive, whereas under *Effects-*

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<sup>4</sup> Legal scholars and social scientists have, of course, discussed the issue of legal certainty in a much wider context than that of economic regulation. Among early prominent authors, Max Weber, thought of legal certainty as necessary for capitalist progress – see discussion in Amato (1983) with extensive references to legal scholars including Posner’s (1977).

<sup>5</sup> Or, lack of ability to predict the outcome of a legal dispute. Amato (1983) defines “legal uncertainty” as a “situation that obtains when the (legal) rule that is relevant to a given act or transaction is said by informed attorneys to have an expected official outcome at or near the 0.5 level of predictability”. For a recent extensive treatment of a legal expert see Kevin E. Davis (2011).

<sup>6</sup> These include interventions associated with the application of Competition Policy, Sectoral Regulation, Environmental Policy, Tax Compliance mechanisms etc.

<sup>7</sup> In the context of network industry regulation, see also de Hautecloque (2008).

<sup>8</sup> Under a *Per Se* procedure an Authority allows or disallows an entire class of actions without trying to identify more carefully sub-classes of actions that might generally be harmful or generally benign. A *discriminating* legal standard or *Effects-Based* approach requires the Authority to establish explicit criteria for deeming some actions to be harmful and others benign and to then investigate each case to see which of these criteria it meets. An extreme form of the *Effects-Based* approach is what in US is termed *Rule – of – Reason* under which competition authorities have the discretion to apply different economic methodologies and criteria on a *case-by-case* basis. For this last distinction see also Vickers (...).

*Based* procedures, the Competition Authority (CA) will allow some actions and disallow some other actions. When agents make the decision as to whether or not to undertake the action they have to consider the possibility that it might come under scrutiny by the CA. Consequently, it is argued, under a *Per Se* rule they are certain how the action will be treated, whereas, under an *Effects-Based* approach, they do not know for sure what decision would be taken. This Legal Uncertainty (LU) induced by *effects –based* procedures is harmful and, it is argued, should lead the CA to favour *Per Se* procedures. The issue has gained even more in importance recently as CAs worldwide<sup>9</sup> have adopted many significant reforms in decision and enforcement procedures, increasing reliance on economics-based methodologies and consequent use of an *Effects-Based* rather than a *Per Se* approach to deciding cases.

However, arguments about the implications of LU for the choice of enforcement procedures have typically been asserted rather than demonstrated and have not been subjected to rigorous scrutiny. While the issue of legal uncertainty has been widely alluded to and considered of fundamental importance among those involved in the design and implementation of public policy, the concept has never been formalised and the “cost of legal uncertainty” has never been analysed using economic theory<sup>10</sup>. In a recent contribution, a legal expert also notes “the absence of rigorously defined yet practical measures of legal uncertainty”<sup>11</sup>.

In this paper (Section 2) we provide a formalisation of the notion of LU that is based on the premise that CAs cannot assess with accuracy, or without mistakes, the true harm created by specific actions associated with certain business practices and on the assumption of imperfect information by firms in assessing (a) the true harm of their actions and/or (b) the CA’s estimate of harm in case these actions come under

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<sup>9</sup>Examples include the adoption of a Rule-of-Reason standard for treating RPM in US, in the recent *Leegin* case (2007) – see for a discussion, Katsoulacos and Ulph (2009) – and the reforms in the assessment of article 102 practices by EU and national authorities (see the Commission Guidance Paper, 2008). These have followed earlier reforms adopting *effects-based* assessment procedures in merger, vertical and certain horizontal agreement cases.

<sup>10</sup> Indeed there are no formal or comprehensive discussions concerning exactly *how* “legal uncertainty” generates *social welfare costs* though issues relating to risk-adversity, potentially adverse deterrence effects, costs to firms for obtaining and analyzing information to reduce uncertainty and the fact that penalties, as legal experts have stressed (see also below), are less easy to justify if an action is condemned, are recognized as important considerations. As will become clear below, the emphasis in this paper is on deterrence effects and the implications of LU on the size of penalties. In an extension (Appendix ...) we address the issue of firms incurring some costs to reduce LU.

<sup>11</sup> Kevin E Davis (2011), p. 1.

investigation. Depending on the type of information imperfection faced by firms a typology of LU situations emerges that classifies *effects – based* procedures into those involving:

- (i) No Legal Uncertainty
- (ii) Partial Legal Uncertainty, and
- (iii) Complete Legal Uncertainty.

Note that, in terms of the terminology used by Kevin (2011), Legal Uncertainty in this paper is “*objective legal uncertainty*” – “a property of laws themselves”<sup>12</sup> associated with the “*ambiguity of legal texts and procedures*”<sup>13</sup> (see for more details Section 2 below). Also note that the above typology clarifies an important omission in the legalistic critique of procedures with LU and of their implications for penalties (see below): this concerns the failure to address the distinction between firms not being able to determine whether their actions are harmful or benign and firms not being able to predict how the CA will assess their actions and thus to address properly the deterrence implications of various types of legal uncertainty.

Below, we compare these procedures, involving different types of LU, between themselves and with *Per Se* (Section 3.1). A number of interesting points and results emerge from our formalisation of LU and from the comparisons between the different procedures. Treating penalties as exogenous:

- (i) To start with, while *effects-based* procedures generate *variability* of treatment (different decisions are taken in different cases) they do not necessarily create *uncertainty* of treatment (firms not knowing how their case will be treated). When under *effects-based* procedures there is no uncertainty of treatment then given that *effects-based* rules reduce decision errors, welfare under such rules is higher than under *Per Se* rules. So not only is *Per Se* not the only way of achieving legal certainty, it is not necessarily the best way of achieving it.
- (ii) . Further, *Effects-based* procedures with Partial Legal Uncertainty may be superior to *Per Se* because of the superior deterrence effects that the legal uncertainty generates. So *legal uncertainty can be welfare-enhancing*. The

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<sup>12</sup> Ibid. p. 6.

<sup>13</sup> Ibid. p. 18 – our italics. Kevin provides an extensive discussion of “*subjective*” legal uncertainty too.

intuition is that uncertainty increases deterrence of actions that should on average be allowed to take place but also produces a *differential deterrence effect*: the increase in the deterrence of harmful actions is greater than that of benign actions. If this effect is strong enough *effects-based* with Partial Legal Uncertainty is superior to *effects-based* with No Legal Uncertainty and, *a fortiori*, to *Per Se*. Under Complete Legal Uncertainty this differential deterrence effect is zero so this situation is inferior to *effects-based* with No Legal Uncertainty though it may still be superior to *Per Se*.

- (iii) Administrative ineffectiveness by the CA, in terms of *imperfect detection* and *delays* in decision making, generates its own deterrence effects and has subtle effects on the choice of enforcement procedures under LU. For example we show that if administrative ineffectiveness is sufficiently small even *effects-based* with Complete Legal Uncertainty is always superior to *Per Se Illegality*.
- (iv) Allowing firms to reduce legal uncertainty by incurring some costs does not alter the qualitative nature of the welfare comparisons between procedures with and procedures with no Legal Uncertainty as stated above. This extension of the analysis is examined in Appendix 1.

The very important policy lesson to emerge from this is that even if the factors that a CA uses to reach its decisions are observable by firms, and if the way they are used to form an estimate about harm on the basis of which it decides whether to disallow or to allow are all easily communicable to firms, it may be desirable for the CA not to reveal this information.

The issue of LU has also attracted attention in recent years for an additional reason. As legal experts have stressed the increased tendency to use *effects-based* procedures should have been associated with a reduction in the level (or even removal) of fines imposed, though the reverse has been the case. As noted by Dethmers and Engelen (2011) “the European Commission recently imposed a record fine of 1.06 billion euro on Intel for having abused its dominant position by employing conditional rebates.... *despite* the adoption by the Commission of a more effects-based approach under art. 102

(TFEU)<sup>14</sup>.....These two acts clearly send conflicting messages to both practitioners and businesses. On the one hand the Commission punishes a dominant firm with extremely high fines for a type of behavior that cannot and should not be qualified as illegal per se; on the other, it officially distances itself from a per se illegality approach under art 102 TFEU”.<sup>15</sup> The authors argue that with the “advance of a more effects-based analysis, it can no longer be held that a certain behavior is by its object or very nature restrictive of competition and therefore abusive. As such, the Commission and the courts can no longer argue that the defendants are guilty of intent or negligence as they should have known that the behavior was restrictive of competition by object”<sup>16</sup>. Referring to another recent article by Kellerbauer (2010) they note that the principle of legal certainty requires “that the lawfulness of a dominant undertaking’s conduct does not depend on information which is generally not known” to the firms and that while the theoretical bases of anticompetitive conduct proposed by the Commission may be understandable to the firms, “it is questionable whether they are able to determine with any degree of certainty” when specific potentially exclusionary business practices are abusive and unlawful<sup>17</sup>. Given this, the authors argue that the imposition of fines requires, “(f)rom a legal perspective, (that) the Commission and courts must present evidence of intent or negligence in accordance with the principle of *nulla poena sine lege certa*. In terms of policy it does not make sense to impose such high fines for anti-competitive behaviours, which are not per se illegal...”<sup>18</sup>.

Below, in Section 3.2, we extend the analysis on optimal enforcement procedures under legal uncertainty by endogenising the fines set by the Competition Authority (CA). We examine the optimal level of fines under *Per Se* and under *effects-based* procedures, in the latter case under the various scenaria concerning the information available to the firms mentioned above<sup>19</sup>. Fines are proportional to the expected profits of a potentially

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<sup>14</sup> Very high fines were imposed also in Microsoft and other recent cases – see for a review p. 86 – 89 of Dethmers and Engelen (2011). As the authors also note “The courts do not appear to impose any constraint on the Commission’s discretion” to impose very high fines – p. 91.

<sup>15</sup> Dethmers and Engelen (2011), p. 86 – our emphasis.

<sup>16</sup> Ibid. p. 97.

<sup>17</sup> Ibid. p. 97.

<sup>18</sup> Ibid. p. 98.

<sup>19</sup> An issue that emerges here is that of the rationale of having costly investigation procedures if CAs can set fines at their optimal level. This and some other related issues are discussed in Appendix 2.

anti-competitive action<sup>20</sup>. For each specific procedure fines are set so as to produce the deterrence of actions under that procedure that will maximise social welfare.

We obtain the following results:

- (i) *Effects-based* procedures with some legal uncertainty are unambiguously *better* than *effects-based* procedure with no legal uncertainty.
- (ii) Provided *effects-based* procedures reduce decision errors, they are certainly no worse and will usually dominate *Per Se*. So a *Per Se* rule is never better than an *effects-based* rule<sup>21</sup>.
- (iii) In contrast to what legal experts have been arguing - that under “*greater degrees of legal uncertainty fines should be lower*”- it is shown that *effects-based* procedures with legal uncertainty, can be associated with *higher* fines than the fines under *Per Se* procedures or the fines under *effects-based* with No Legal Uncertainty. The intuition is that Legal Uncertainty reduces the anticipated likelihood that an action will be disallowed and, to compensate for this and establish the desired deterrence level, the CA has to increase the level of penalties.

The important policy lesson to emerge from this analysis with endogenous fines is that moving to enforcement procedures characterised by Legal Uncertainty implies that it may then be best for the CA to *increase* (rather than to reduce) its penalties.

## 2. Basic Set up – Modelling Legal Uncertainty

### Preliminaries

There is a population of firms of size 1 that could take a particular type of action. A fraction  $\gamma$ ,  $0 < \gamma < 1$  come from a Harmful environment so, if they take the action and it is not stopped, this generates harm, measured by the negative of the change in consumers’ surplus, that we denote by  $h_H > 0$ . The remaining fraction come from a

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<sup>20</sup> It is shown that optimality can be achieved by using only proportional fines – i.e. does not require fines a part of which relates to the expected harm of the action.

<sup>21</sup> At least when, as assumed here, Legal Uncertainty emerges, under *effects-based*, just due to the firms not knowing how exactly the CA would reach its decision in their case – that is, uncertainty under (b) mentioned above.

Benign environment, so, if they take the action, this generates harm that we denote by  $h_b < 0$ . Let  $\bar{h}$  be the average harm for this type of action. The type of action is said to be *Presumptively Legal* (resp. *Illegal*) if  $\bar{h} < 0$  (resp.  $\bar{h} > 0$ ). We assume that  $\gamma$  and  $\bar{h}$  are common knowledge.

In the absence of any intervention by the Competition Authority, taking an action will confer a private benefit  $b > 0$  for the firm<sup>22</sup>. The distribution of  $b$  is independent of the environment from which the firm comes<sup>23</sup>. We suppose that the private benefit has a positive continuous probability density  $f(b) > 0$  on  $[0,1)$ , with cumulative distribution function given by  $F(b)$ ,  $0 < F(b) < 1$ ;  $F'(b) > 0$ .

#### Competition Authority Decision Procedures

There is a Competition Authority which investigates a fraction  $\pi$  (the coverage or detection rate) of the actions taken and we assume that  $\delta$  is the delay by the Authority in making decisions<sup>24</sup>. The parameters  $\pi$  and  $\delta$  characterize the CA's Administrative (or procedural) ineffectiveness. Also, the CA is assumed to use as substantive standard the maximization of consumers' welfare. The CA can use one of two decision procedures.

*Per Se* Here it allows all actions if they are *Presumptively Legal* and disallows all actions if they are *Presumptively Illegal*. Note that the fundamental characteristics of *Per Se* rules are that each action is treated in the same way – they are either all allowed or all disallowed - and that only one type of error is made by the CA – Type I for presumptively illegal and Type II for Presumptively Legal actions.

*Effects-Based* Under this procedure the CA undertakes an investigation of each action detected as a result of which it gets an estimate or a signal of the likely harm caused by the action. This signal, which is only imperfectly correlated with the true harm will be either a “Positive Harm” - indicating that the action is likely to reduce welfare - or a “Negative Harm” - indicating that the action is likely to increase welfare – signal. The

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<sup>22</sup> Which we take to be the present value of the expected change in profits from the action over its ‘natural’ lifetime.

<sup>23</sup> The “symmetry” assumption - see K&U 2009, in which we also discuss the implications of relaxing this assumption.

<sup>24</sup> We abstract from differences in the delay in decisions across *effects-based* and *Per Se* enforcement procedures (see K&U, 2009).



probability that a Benign action generates a Negative Harm signal is  $p_B$ ,  $0 < p_B < 1$ ; the probability that a Harmful action generates a Positive Harm signal is  $p_H$ ,  $0 < p_H < 1$ . We assume that the underlying “model” used by the CA in its investigation to produce an estimate of harm has some *discriminatory power* so that  $p_B + p_H > 1$  so firms from the Harmful environment are more likely to generate a Positive Harm signal than are firms from the Benign environment, and, correspondingly, firms from the Benign environment are more likely to generate a Negative Harm signal than are firms from the Harmful environment.  $p_B, p_H$  capture the “quality” of the CA’s effects – based procedure.

The decision rule used by the CA is to allow all actions that give a Negative signal (negative harm estimate) and disallow those that give a Positive signal (positive harm estimate). So under Effects-Based a different decision will be reached for different actions investigated and there will be both types of errors made. A firm that has its action disallowed has to pay a penalty. Below we will specify in more detail how this penalty will be determined.

To ensure that the *Effects-Based* procedure is not a “straw man” and is a potentially sensible decision rule to use given the estimates generated by the CA’s investigation, we make the following stronger assumption about the discriminatory power of the CA’s model.

**ASSUMPTION 1** The *Effects-Based* Rule produces lower *Costs of Decision Errors*<sup>25</sup> than *Per Se*.

In the terminology used in Katsoulacos & Ulph (2009) we are assuming that the *effects-based* procedures can *effectively discriminate*.

We also assume the following:

**ASSUMPTION 2** The administrative costs of enforcing Competition Law are zero<sup>26</sup>.

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<sup>25</sup> For the exact conditions that must hold for this to be true see K&U (2009). This Assumption implies that our analysis does not apply to practices such as hard-core cartels for which decision errors under *Per Se Illegality* are likely to be lower than if *effects-based* procedures were used.

<sup>26</sup> Of course, we recognise that there are costs involved in collecting and analyzing the information needed to form the judgments necessary to implement an *effects-based* rule – costs that would not be incurred under a *per se* rule. So the former should only be chosen in preference to a *per se* rule, if any welfare advantages it has from all other respects are sufficient to outweigh these additional costs. However, since this point is well understood – see for example, Christiansen et al. [2006] p. 223/224, 231.- and we have nothing new to add, in what follows we will simply ignore these costs.

### Behaviour of Firms

Firms have to decide whether or not to take the action, and obviously a factor that will be relevant to them in reaching this decision is the anticipated likely decision by the CA when it investigates the action. So behaviour varies depending on what decision procedure the CA uses.

If  $\beta$ ,  $0 \leq \beta \leq 1$  is the probability of having an action banned then a firm with private benefit  $b$  that anticipates that it will have to pay a penalty  $\Phi$  if its action is disallowed, will take the action if:

$$b[1 - \beta\pi(1 - \delta)] > \beta\pi\Phi \quad (1)$$

Let  $F_e^r(b_e^r)$  be the fraction of firms from environment  $e = H, B$  that are deterred from taking the action when procedure or rule  $r$  is used where  $b_e^r$  is the value of  $b$  for which above expression is satisfied as an equality.

### Types of Legal Uncertainty

Now, when an *effects-based* approach is used and the CA decides whether or not to disallow an action on the basis of its estimate of harm,  $h^e$ , Legal Uncertainty may emerge because:

(a) the firms face uncertainty or incomplete information about the ultimate bases of making a judgement, i.e. what are the considerations taken into account (and how they are taken into account) for assessing harm<sup>27</sup> – the latter been (imperfectly) deduced from what is contained in Competition Law statutes (such as articles 101 and 102 EC), or because

(b) the firms face uncertainty about how decisions are taken by the Competition Authority, where these decisions rely on the assessment of certain indicators that characterize the firms, their products and market(s) and the actions undertaken, due to

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<sup>27</sup> Such considerations include the extent to which production is reduced, the prices are raised, innovative activity is enhanced, conduct is discriminatory etc.

incomplete information of the model(s) or of the data that are used by the CA to make the assessment of the indicators and to reach these decisions (as described in the Guidelines produced by the CA whose objective is to describe how the CA will assess actions related to specific business practices).

To clarify these sources of legal uncertainty let  $x_k$  be a vector that specifies the values of a series of indicators pertaining to firm/action  $k$  that determine the effect of this action on a series of “outcomes” specified by vector  $y_k$  (prices, production, quality, variety, innovation etc) which in turn determine the true harm of the action  $h_k$ . That is:

$$x_k \longrightarrow y_k \longrightarrow h_k$$

We assume throughout that neither the firms nor the CA know  $x_k$ . However the CA will be able to measure in the course of the investigation of action  $k$  a series of indicators pertaining to firm/action  $k$  i.e. will obtain an estimate  $x_k^e$  that allows it to obtain an estimate of “outcomes”  $y_k^e$  and hence an estimate of harm  $h_k^e$  generated by the action.

That is through the investigation the CA obtains:

$$x_k^e \longrightarrow y_k^e \longrightarrow h_k^e$$

On the other hand, we assume that firms even though they cannot observe  $x_k$  they can observe  $y_k$  - e.g. though they cannot observe  $x_k$  they can determine the extent to which their prices will be affected by their action – and given this they may or may not (depending on the completeness and clarity of the statutes) be able to determine  $h_k$ , i.e. the true harm that their action will generate (in the latter case we say that the firms “know their type”). So firms may or may not have uncertainty of type (a) above.

Also, firms may face uncertainty of type (b) which means that they may be unable to observe  $y_k^e$  and hence  $h_k^e$ , that is, they may be unable to observe the estimate of harm that the CA will reach in their case and on the basis of which the CA will decide whether or not to allow their action. We distinguish two cases: in one of these cases firms can observe  $h_k^e$  which implies that firms know exactly how the CA will decide if they are investigated, independently of whether they also know their true  $h_k$  - indicated as No Legal Uncertainty (NLU) in the Table below. In the other case firms cannot observe  $h_k^e$ .

In this case, if a firm knows  $h_k$  (its true type) then one sub-case is that in which we assume that this and the firm's observations about how the CA has treated cases with similar characteristics to its own allow it to determine  $p_B, p_H$  - indicated as Partial Legal Uncertainty (PLU) in the Table below. In the other sub-case firms do not know  $h_k$  so even this is not possible – indicated as Complete Legal Uncertainty (CLU) in the Table below. In this latter sub-case all that firms know is the average probability of having an action disallowed:

$$\bar{p} = \gamma p_H + (1 - \gamma) \cdot (1 - p_B).$$

TABLE 1: Typology of LU Situations

		Firms know: $h_k$	
		YES	NO
Firms know: $h_k^e$	YES	No Legal Uncertainty (NLU)	No Legal Uncertainty (NLU)
	NO	Partial Legal Uncertainty (PLU)	Complete Legal Uncertainty (CLU)

It is important to note that the situations PLU and CLU in the Table above are not ranked in terms of the degree of uncertainty – they just represent different assumptions about what firms know and do not know<sup>28</sup>.

We can think of NLU as a situation in which the CA specifies:

- The complete list of indicators in  $x$  on which it will collect information;
- the types of data and the techniques it will use to measure all these indicators;
- the rules  $y_k^e = f(x_k^e)$  and  $h_k^e = g(y_k^e)$  that it will use to combine all these indicators into a decision  $d_x \in \{A, D\}$  - Allow or Disallow the action.

<sup>28</sup> Also, while below we will generally assume that each of these cases applies to *all* firms – i.e. all firms have either NLU or PLU or CLU – this assumption is not necessary nor is it realistic. It is more realistic to expect that there will be a mixture of firms: some of which have NLU, some have PLU and some have CLU – our analysis is easily extended to that case.

The assumption we make in NLU is that firms know both  $x_k^e$  as well as the rules  $f(\cdot)$  and  $g(\cdot)$  and so know  $d_k$ . Of course, until it conducts an investigation, the CA does not know  $x_k^e$ , and so does not know  $d_k$ .

In the following discussion we will assume for simplicity, as in K&U (2009), that all actions in the Harmful environment generate the same harm  $h_H > 0$ , and all actions that come from a Benign environment generate the same harm  $h_B < 0$ . Thus,  $\bar{h} = \gamma h_H + (1 - \gamma)h_B$  is the average harm. We will also make the following assumption:

**ASSUMPTION 3** Assume that the “quality”, in terms of the cost of errors, of the *effects-based* procedure, captured by  $p_B, p_H$ , is the same across the three different types of legal uncertainty.

### Fines

As noted in the Introduction one of our main objectives here is to investigate optimal enforcement procedures under legal uncertainty when fines are endogenous. As noted above we wish to examine particularly how the claim that higher LU should be associated with lower fines stands up in the context of our analysis in which there is an interplay in the deterrence effects of LU and of fines.

In general we can assume that fines take the form of a fixed penalty plus a proportional penalty<sup>29</sup>. These reflect the twin desires to link penalties to harm and to the private benefit firms obtain from acting badly. As we will see, in general the optimal penalty can always be obtained by using just a penalty proportional to the private benefit.

The idea is this. Suppose the penalty takes the form  $\psi + \varphi b$ ,  $\psi \geq 0, \varphi \geq 0$ . Then for a firm with private benefit  $b$  the net benefit from taking the action is

$$b \{ [1 - \beta\pi(1 - \delta)] - \beta\pi\varphi \} - \beta\pi\psi \quad (2)$$

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<sup>29</sup> There is an extensive literature on fines and law enforcement – see in particular the survey of Polinsky and Shavell (2000). For a treatment that addresses fines under antitrust law Buccirrorri and Spangolo (2006) and Wils (2006).

If  $\varphi > \frac{1}{\beta\pi} - (1-\delta)$  then no firm will take the action whatever the value of  $\psi$ , so we might as well set  $\psi = 0$ .

If  $\varphi < \frac{1}{\beta\pi} - (1-\delta)$  and  $\psi=0$ , then all firms will take the action, while if  $\varphi < \frac{1}{\beta\pi} - (1-\delta)$  and  $\psi > 0$  then the only firms that take the action are those with high values of private benefit. But it turns out that in all cases we either want all firms of a particular type to take the action or none of them to do so. So we can achieve optimality by using ONLY proportional fines.

So then the critical value of  $\varphi$  below which a firm would definitely take the action and above which it would not is :

$$\varphi = \left( \frac{1}{\pi\beta} - 1 \right) + \delta . \quad (3)$$

There are a number of differences between this formulation and that appearing in typical treatments in the literature on law enforcement. To start with, in typical treatments the critical value depends on just the “probability of detection” and this is treated as been the same as the “probability of being disallowed”. Here the critical value depends on the administrative ineffectiveness of the CA, i.e., on the coverage rate (or probability of detection) and the delays in CA’s decision making ( $\delta$ ) AND on the probability that the CA will, possibly following an investigation, find the action harmful and thus disallow, which depends on the type of the enforcement procedure used and, under *effects-based*, the type of legal uncertainty. So the choice of enforcement procedure (*effects-based* or *Per Se*) and type of LU influences the optimal fine.

Also, in typical treatments it is assumed that firms get with certainty the benefit  $b$  from their actions while here we assume that the actions only create a benefit if it is not disallowed or, if it disallowed, just during the period ( $\delta$ ) of the investigation.

In all that follows we will generally assume that there is *administrative ineffectiveness* arising because not all firms/actions are detected and investigated -  $\pi < 1$  - and there is a delay in taking decisions -  $\delta > 0$  - so that, even if the CA’s procedures ban actions for sure -  $\beta = 1$  - a positive penalty will be needed if actions are to be deterred.

### 3. Optimal Choice of Enforcement Procedures under Legal Uncertainty

#### 3.1 Exogenous Penalties

Here we examine optimal enforcement procedures under the different types of Legal Uncertainty identified above assuming that fines are exogenous. We first define the welfare levels under the different procedures and the different types of Legal Uncertainty identified above.

First of all, note that given that the probability ( $\beta$ ) of being banned across different enforcement regimes is:

$$0 = \beta^{PSL} < \beta_B^{EBP} = 1 - p_B < \beta^{EBC} = \bar{p} < \beta_H^{EBP} = p_H < \beta^{EBO} = \beta^{PSI} = 1 \quad (4)$$

it follows from (1) and (4) that the fraction of firms deterred under the different regimes, assuming that *the exogenous penalty if an action is disallowed is lower than that which would deter all actions when the probability of being disallowed if investigated is unity*, will be:

$$0 = F^{PSL} < F_B^{EBP} < F^{EBC} < F_H^{EBP} < F^{EBO} = F^{PSI} < 1 \quad (5)$$

#### Welfare Levels

##### *a. Per Se*

If the action is *Presumptively Legal* all firms will take the action whatever the penalty and the associated level of welfare is

$$W^{PSL} = -\bar{h} > 0 \quad (6)$$

If the action is *Presumptively Illegal*, under any penalty regime, the same fraction of firms ( $F^{PSI}$ ,  $0 \leq F^{PSI} \leq 1$ ) will be deterred from the harmful and benign environments given our assumption that  $b$  is not correlated to harm, and so welfare is just:

$$W^{PSI} = -(1 - F^{PSI})[1 - \pi(1 - \delta)]\bar{h} \leq 0 \quad (7)$$

Let us measure for the purposes of the analysis below Administrative Ineffectiveness by:

$$A = [1 - \pi(1 - \delta)], 0 \leq \pi \leq 1, 0 \leq \delta \leq 1 \quad (8)$$

So A is zero when  $\pi = 1$  and  $\delta = 0$  while  $A = 1$  when  $\pi = 0$  or  $\delta = 1$ .

Thus:

$$W^{PSI} = -(1 - F^{PSI})A\bar{h} \leq 0 \quad (7')$$

That is,  $W^{PSI} = 0$  when there is no administrative ineffectiveness ( $A = 0$ ) and is negative otherwise. The intuition is that administrative ineffectiveness induces firms to undertake actions that are on average harmful even though they know that if investigated these actions will be certainly disallowed and the firms will be liable for a penalty.

*b. Effects Based: No Legal Uncertainty*

Here, given the CA's *effects-based* model for estimating harm, a fraction  $p_B$  resp.  $1 - p_H$  of firms from the benign (resp. harmful) environment know for sure that their action will be allowed. So, irrespective of the penalty, they will take the action. The remaining firms from the harmful (resp. benign) environment will know for sure that their action will be disallowed. Given our assumption that private benefit is uncorrelated with harm it follows that for *any* given penalty the same fraction  $F^{EBO}$ ,  $0 \leq F^{EBO} \leq 1$  of these firms will be deterred. Consequently welfare under any given penalty regime under *effects-based* with No Legal Uncertainty ( $W^{EBO}$ ), is:

$$W^{EBO} = -\{\gamma h_H (1 - p_H) + (1 - \gamma) h_B p_B\} + \\ - A(1 - F^{EBO})\{\gamma h_H p_H - (1 - \gamma)(-h_B)(1 - p_B)\} \quad (9)$$

where  $A = [1 - \pi(1 - \delta)]$ . The term in the first curly brackets on the RHS of (9) shows the average harm of the actions allowed (taken by firms that know with certainty, given No Legal Uncertainty, that their actions will be allowed), while the term in the second curly brackets on the RHS of (9) shows the average harm of actions disallowed (taken by those



firms that know for certain that their actions will be disallowed if investigated but are not deterred given that the coverage rate is less than unity and there is a positive delay in decision making. These terms are respectively negative and positive given our assumption that the CA's rule can *effectively discriminate* (i.e. reduce the costs of decision errors relative to *Per Se*) whether an action is *Presumptively Legal* or *Presumptively Illegal*<sup>30</sup>. That is we have, for later reference, that when *effect-based* can *effectively discriminate* :

$$\begin{aligned} -[\gamma h_H (1 - p_H) + (1 - \gamma) h_B p_B] &> 0 \\ \gamma h_H p_H - (1 - \gamma)(-h_B)(1 - p_B) &> 0 \end{aligned} \quad (10)$$

Note that if there is no administrative ineffectiveness, i.e.  $A = [1 - \pi(1 - \delta)] = 0$ :

$$W^{EBO} = -\{\gamma h_H (1 - p_H) + (1 - \gamma) h_B p_B\} > 0 \quad (9')$$

**Lemma 1** Comparing the two terms in the square brackets on the RHS of (9):

$$[\gamma(-h_H)(1 - p_H) + (1 - \gamma)(-h_B)p_B] \geq \gamma h_H p_H - (1 - \gamma)(-h_B)(1 - p_B) \quad \text{iff} \quad -\bar{h} \geq 0 \quad (10')$$

So welfare under *effects-based* with no legal uncertainty will:

- (a) Certainly be positive for presumptively legal actions ( $\bar{h} < 0$ ) but may be negative for presumptively illegal actions.

Also, from (9):

- (b) Will be positive if administrative ineffectiveness (A) is quite small and / or, for given A, the penalty is quite high so the fraction of firms not deterred from taking actions that would be disallowed if investigated is small – i.e.,  $(1 - F^{EBO})$  is small.

Intuitively, under an *effect-based* procedure with no legal uncertainty there is a positive effect on welfare as the procedure allows actions that should be allowed – as they are having on average a positive effect on welfare. However, administrative ineffectiveness ( $A > 0$ ) and penalties that are not high enough to deter all actions that would be certainly disallowed if investigated imply that some actions that on average create positive harm are undertaken and this tends to reduce welfare.

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<sup>30</sup> See for details K&U (2009). Essentially the two terms (two inequalities in (8)) measure the difference in the cost of decision errors between *effects-based* and *Per Se* for *Presumptively Illegal* and *Presumptively Legal* actions, respectively.

c. *Effects Based: Partial Legal Uncertainty*

For any given penalty scheme fewer firms from the benign environment will be deterred than from the harmful environment, since the probability of being disallowed in the former case is smaller than it is in the latter case ( $1 - p_B < p_H$ ). That is, given that the fraction deterred from environment  $e = H, B$  is  $F_e^{EBP}$ ,  $0 \leq F_e^{EBP} \leq 1$ , then  $F_H^{EBP} > F_B^{EBP}$  and so welfare under any penalty is:

$$W^{EBP} = (1 - F_H^{EBP})\gamma(-h_H)[1 - \pi p_H(1 - \delta)] + (1 - F_B^{EBP})(1 - \gamma)(-h_B)[1 - \pi(1 - p_B)(1 - \delta)] \quad (11)$$

Which can also be written as follows:

$$W^{EBP} = -[(1 - F_H^{EBP})\gamma(h_H)(1 - p_H) + (1 - F_B^{EBP})(1 - \gamma)(h_B)p_B] - A[(1 - F_H^{EBP})\gamma(h_H)p_H - (1 - F_B^{EBP})(1 - \gamma)(-h_B)(1 - p_B)] \quad (11')$$

In (9') the term in the first square brackets on the RHS is the average harm of actions not deterred and allowed by the CA's rule while the term in the second square bracket is the average harm of actions that would be disallowed if investigated but are not deterred and are undertaken given that the coverage rate is less than unity and there is a positive delay in decision making. Given that *effects-based* can *effectively discriminate* these are respectively negative and positive.

Intuitively, as under an *effect-based* procedure with no legal uncertainty, here again, there is a positive effect on welfare as the procedure allows actions that should be allowed – as they are having on average a positive effect on welfare – though, in contrast to the case of no legal uncertainty, some of these actions are now deterred (given that they are not going to be allowed with certainty if investigated and firms will face a positive penalty if disallowed), though at a differential rate for harmful and benign actions. And, again, administrative ineffectiveness ( $A > 0$ ) and penalties that are not high enough to deter (now) all harmful actions imply that some actions that on average create positive harm are undertaken and this tends to reduce welfare.

d. *Effects-Based: Complete Legal Uncertainty*

When there is complete legal uncertainty then each firm sees the risk of having their action disallowed as just the average probability  $\bar{p} = \gamma p_H + (1-\gamma)p_B < p_H$ , and, given our assumption of zero correlation between the harm and private benefit, under any penalty regime the same fraction of firms will be deterred from each of the two environments ( $F^{EBC}$ ). So welfare is just

$$W^{EBC} = (1 - F^{EBC})W \quad (12)$$

where:

$$W = \gamma(-h_H)[1 - \pi p_H(1 - \delta)] + (1 - \gamma)(-h_B)[1 - \pi(1 - p_B)(1 - \delta)] \quad (13)$$

Thus welfare is given by:

$$W^{EBC} = -(1 - F^{EBC})[\gamma(h_H)(1 - p_H) + (1 - \gamma)(h_B)p_B] - A(1 - F^{EBC})[\gamma(h_H)p_H - (1 - \gamma)(-h_B)(1 - p_B)] \quad (12')$$

Again, in (12') the term in the first square brackets on the RHS is the average harm of actions allowed by the CA's rule while the term in the second square bracket is the average harm of actions that would be disallowed if investigated but are undertaken given that the coverage rate is less than unity and there is a positive delay in decision making. Given (10) these are respectively negative and positive. The intuition is very similar to the previous two cases. The difference with no legal uncertainty being that now only a fraction, rather than all, of the actions that should be allowed are undertaken ( $1 - F^{EBC}$ ), though a lower fraction of those that should be disallowed are undertaken ( $F^{EBC} < F^{EBO}$ ).

### Comparison of Welfare Levels: Optimal Choice of Enforcement Procedures

We now carry out a systematic comparison between the levels of welfare under the different decision procedures and between different types of legal uncertainty.

(i) *Per Se vs Effects-Based with No Legal Uncertainty*

**Proposition 1** An *Effects-Based* procedure with *No Legal Uncertainty* is welfare superior to *Per Se*. Formally, if the action is *Presumptively Legal* (resp. *Illegal*) then:

$$W^{EBO} > W^{PSL} \quad (\text{resp. } W^{EBO} > W^{PSI}) \quad (14)$$

Proof: From (6), (7') and (9) we have:

$$\begin{aligned} W^{EBO} - W^{PSL} &= [1 - A(1 - F^{EBO})][p_H(\gamma h_H) - (1 - \gamma)(-h_B)(1 - p_B)] > 0 \\ W^{EBO} - W^{PSI} &= -[1 - A(1 - F^{EBO})][(\gamma h_H)(1 - p_H) + (1 - \gamma)(h_B)p_B] > 0 \end{aligned} \quad (15)$$

given (10). Note that when there is no administrative ineffectiveness ( $A = 0$ ) the difference in welfare between *effects-based* with *No Legal Uncertainty* and *Per Se* will depend only on the difference in the costs of decision errors. As intuition would suggest greater administrative ineffectiveness (greater  $A$ ) reduces the attractiveness of *effects-based* relative to *Per Se*<sup>31</sup>. On the other hand, higher penalties that increase, for any given  $A$ , the fraction of firms deterred, increase the attractiveness of *effects-based* relative to *Per Se*.

(ii) *No Legal Uncertainty vs Partial Legal Uncertainty*

From (9) and (11') we have:

$$\begin{aligned} W^{EBO} - W^{EBP} &= (F_B^{EBP} W^{EBO}) - (F_H^{EBP} - F_B^{EBP})\gamma(1 - p_H)h_H \\ &\quad + A(F^{EBO} - F_B^{EBP})[\gamma h_H p_H - (1 - \gamma)(-h_B)(1 - p_B)] \end{aligned} \quad (16)$$

Given (5) and (10) the first term on the RHS of (15) is positive if  $W^{EBO} > 0$  – see for conditions Lemma 1 above – while the second is negative and the third term is positive. Assuming that there is no administrative ineffectiveness (so  $A = 0$ ), (15) indicates two distinct effects determining the relative welfare levels under no legal uncertainty and under partial legal uncertainty. First, since with  $A = 0$ ,  $W^{EBO} > 0$ , there is what we can

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<sup>31</sup> Note that in the extreme case when  $\pi = 0$  (no actions are detected),  $A = 1$ ,  $F = 0$  and the welfare of two procedures are the same.

call an **absolute deterrence effect**. Partial legal uncertainty generates a negative effect on welfare relative to no legal uncertainty because uncertainty leads to an increase in the fraction of actions that are deterred (and not undertaken) that should be allowed – see also (9'). What this tells us is that if, under Partial Legal Uncertainty deterrence was exactly the same for firms from the Harmful environment than for firms from the Benign environment, then this is a factor that would lead to welfare being higher with No Legal Uncertainty than with Partial Legal Uncertainty. This can be seen given that if  $F_H^{EBP} = F_B^{EBP} = F^{EBP}$  then  $W^{EBP} = (1 - F^{EBP})W^{EB0} \Rightarrow W^{EBP} < W^{EB0}$ ; it is due to partial legal uncertainty generating, relative to no-uncertainty, additional deterrence that lowers welfare by  $F^{EBP}W^{EB0}$  where (with  $A = 0$ )  $W^{EB0}$  is the average welfare of actions allowed. Thus, if under *Effects-Based* with Partial Legal Uncertainty there were no differential deterrence, its net effect on welfare would be negative compared to *Effects-Based* with No Legal Uncertainty. The first term on the RHS of (16) can be thought of as the *Cost of Partial Legal Uncertainty*.

But the second term on the RHS of (16) is negative and represents what we can call the **differential deterrence** effect. This just reflects the fact that one of the advantages of *Partial Legal Uncertainty* is that it creates greater deterrence for firms from the harmful environment than for firms from the benign environment.

Given the very general level of our analysis there is no guarantee that one of these terms is larger than the other and hence no restriction that we can place on the sign of the welfare difference between *No Legal Uncertainty* and *Partial Legal Uncertainty* even if  $A = 0$ . Further, if  $A > 0$  (but not large, so it is still true that  $W^{EBO} > 0$ ) this creates an extra factor in favour of *effects-based* with no legal uncertainty relative to partial legal uncertainty (third term in (16) above) because in the former case the fraction of actions that are deterred that should be disallowed is higher. **However, if  $A$  is large enough AND actions are presumptively illegal (see Lemma 1 above), then  $W^{EBO} < 0$  and so the absolute deterrence effect now tends to increase welfare under partial legal uncertainty relative to no legal uncertainty.**

So we have established:

**Proposition 2** Welfare can be higher under *Partial Legal Uncertainty* than under *No Legal Uncertainty*.

A very powerful implication of this proposition is that even if the factors that the CA used to make its decision were observable by firms, and if the way they were used to form a signal about potential harm and the critical value at which it was decided to disallow rather than allow were all easily communicable to firms, it may be desirable for the CA not to reveal this information.

An interesting corollary is:

**Corollary 1** Other things being equal – same discriminatory power, same deterrence effects – *No Legal Uncertainty* is more likely to be a superior procedure to *Partial Legal Uncertainty* for *Presumptively Legal* actions than for *Presumptively Illegal* actions.

Proof: For any given level of discriminatory power  $W^{EB0}$  - and hence the first term on RHS of (16) will be higher for *Presumptively Legal* actions than for *Presumptively Illegal* types of action.

From **Proposition 1** and **Proposition 2** we can establish the following:

**Corollary 2**

(a) If *Partial Legal Uncertainty* welfare dominates *No Legal Uncertainty* then *a fortiori* it welfare dominates *Per Se*.

(b) **Effects-based with Partial Legal Uncertainty vs. Per Se:** Even if welfare is lower under *Partial Legal Uncertainty* than under *No Legal Uncertainty* it may still be higher than under *Per Se* given that *No Legal Uncertainty* – by (15) – is superior to *Per Se*.

(iii) *No Legal Uncertainty vs Complete Legal Uncertainty*

It is straightforward to see from (9) and (12') and given (5) and (10) that:

$$\begin{aligned}
W^{EBO} - W^{EBC} = & -F^{EBC} [\gamma h_H (1 - p_H) + (1 - \gamma) h_B p_B] \\
& + A(F^{EBO} - F^{EBC}) [\gamma h_H p_H - (1 - \gamma)(-h_B)(1 - p_B)] > 0
\end{aligned} \tag{17}$$

Intuitively, what we have in this case is an **absolute deterrence effect** favouring no legal uncertainty, that was also present in the comparison between *No Legal Uncertainty* and *Partial Legal Uncertainty* with no offsetting **differential deterrence effect**. Again, as in the comparison with partial legal uncertainty, a positive administrative ineffectiveness ( $A > 0$ ) favours no legal uncertainty given that with such ineffectiveness a fraction of actions that on average have negative impact on welfare are not deterred and are undertaken and this fraction is higher under complete legal uncertainty ( $1 - F^{EBO} < 1 - F^{EBC}$ ), since then the probability of being disallowed if investigated is smaller. So we have:

**Proposition 3** *No Legal Uncertainty* welfare dominates *Complete Legal Uncertainty*.

(iv) *Partial Legal Uncertainty* vs *Complete Legal Uncertainty*

From (11') and (12') and given (5) we have:

$$\begin{aligned}
W^{EBP} - W^{EBC} = & \gamma h_H (1 - p_H) (F_H^{EBP} - F^{EBC}) + (1 - \gamma) h_B p_B (F_B^{EBP} - F^{EBC}) + \\
& A[(F_H^{EBP} - F^{EBC}) \gamma h_H p_H + (F^{EBC} - F_B^{EBP})(1 - \gamma)(-h_B)(1 - p_B)] > 0
\end{aligned} \tag{18}$$

From (5) we see that both the first two terms on the RHS of (18) are positive: the first because having *Partial Legal Uncertainty* deters more harmful actions and the second because it deters fewer benign actions compared to the situation of *Complete Legal Uncertainty*. For the same reason, positive administrative ineffectiveness ( $A > 0$ ) favours partial legal uncertainty (the third term in (18) is also positive).

So we have:

**Proposition 4** *Partial Legal Uncertainty* welfare dominates *Complete Legal Uncertainty*

Finally we compare Complete Legal Uncertainty to *Per Se*.

(v) *Effects-based with Complete Legal Uncertainty vs. Per Se*

We have from (17) and (15) that:

$$\begin{aligned}
 W^{PSL} - W^{EBC} &= (W^{EBO} - W^{EBC}) - (W^{EBO} - W^{PSL}) \\
 &= -F^{EBC} [\gamma h_H (1 - p_H) + (1 - \gamma) h_B p_B] \\
 &\quad - [1 - A(1 - F^{EBC})] \cdot [\gamma h_H p_H - (1 - \gamma)(-h_B)(1 - p_B)]
 \end{aligned} \tag{19}$$

and

$$\begin{aligned}
 W^{PSI} - W^{EBC} &= (W^{EBO} - W^{EBC}) - (W^{EBO} - W^{PSI}) \\
 &= [\gamma h_H (1 - p_H) + (1 - \gamma) h_B p_B] [(1 - F^{EBC}) - A(1 - F^{EBO})] \\
 &\quad + A(F^{EBO} - F^{EBC}) [\gamma h_H p_H - (1 - \gamma)(-h_B)(1 - p_B)]
 \end{aligned} \tag{20}$$

Given (10) the first term on the RHS of (19) is positive but the second term is negative. Also, given (5) and (10) the second term on the RHS of (20) is positive while the first term is negative since the term in the first bracket is negative and the term in the second bracket is positive, since  $(1 - F^{EBC}) > A(1 - F^{EBO})$  - given that  $F^{EBO} > F^{EBC}$  (and  $A < 1$ ).

So we have that:

**Proposition 5** *Complete Legal Uncertainty may welfare dominate Per Se for Presumptively Legal and Presumptively Illegal actions. Indeed, from (20), it will certainly welfare dominate Per Se for Presumptively Illegal actions when administrative ineffectiveness is small.*

### 3.2 Endogenous Penalties

Up to now we have assumed that penalties are exogenously given. In this section we determine the level of fines when these are set by the CA to maximise welfare under any



given enforcement procedure and we then examine again the choice of enforcement procedures given these optimal penalties.

### Optimal Penalties

The optimal penalty, given the probability of being disallowed if investigated, under any given enforcement regime is defined by (3). So we have:

#### (a) *Per Se*

If the action is *Presumptively Legal* all actions will be allowed and taken with a *Per Se* decision rule whatever the penalty.

If the action is *Presumptively Illegal* under any penalty regime a fraction of firms  $(1 - F^{PSI})$  will not be deterred due to positive administrative ineffectiveness from undertaking actions that generate on average positive harm and would be certainly disallowed if investigated. This fraction is the same from the harmful and benign environments given our assumption that  $b$  is not correlated to harm. So as noted above welfare is just  $W^{PSI} = -(1 - F^{PSI})[1 - \pi(1 - \delta)]\bar{h} < 0$ . Thus the optimal penalty should deter all these actions – or, the optimal penalty should satisfy (3) with the probability of being disallowed equal to one, as it is under *Per Se Illegality*.

So we have:

**Proposition 6** Under *Per Se*,

- (I) if the action is *Presumptively Legal* then
- (i) the optimum penalty is  $\varphi^{PSL} = 0$ , and (21)
  - (ii) the associated maximum level of welfare is  $W^{PSL} = -\bar{h} > 0$ ; (22)

- (II) if the action is *Presumptively Illegal* then
- (i) the optimum penalty is  $\varphi^{PSI} = \left[ \frac{1}{\pi} - 1 \right] + \delta$ , and (23)

- (ii) the associated maximum level of welfare is  $W^{PSI} = 0$ . (24)

(b) *Effects-based: No Legal Uncertainty*

Given (9) above, it follows that to maximise welfare we want to deter all the firms who know for sure that their action will be disallowed if investigated but undertake actions due to administrative ineffectiveness, thus reducing the second term on the RHS of (9) to zero), and, from (3) to do this we set the proportional penalty, as under *Per Se Illegality*, at the level  $\left(\frac{1}{\pi}-1\right)+\delta$ <sup>32</sup>. So we have:

**Proposition 7** When there is *no legal uncertainty*

(i) the optimal penalty is  $\varphi^{EBO} = \varphi^{PSI} = \left(\frac{1}{\pi}-1\right)+\delta$ ; (25)

(ii) the associated maximum level of welfare is  $W^{EBO} = -\{\gamma h_H(1-p_H) + (1-\gamma)h_B p_B\} > 0$ . (26)

(c) *Effects Based: Partial Legal Uncertainty*

From (11) the welfare optimum is clearly to set  $F_H^{EBP} = 1, F_B^{EBP} = 0$  and, from (3) we can do this by setting a penalty  $\left(\frac{1}{\pi p_H}-1\right)+\delta$  since this will deter all harmful actions while – since  $p_H > 1-p_B$  - none of the benign actions will be deterred. So we have:

**Proposition 8** When there is *partial legal uncertainty* then

(i) the optimal penalty is  $\varphi^{EBP} = \left(\frac{1}{\pi p_H}-1\right)+\delta$ , and (27)

(ii) the associated maximum level of welfare is  $W^{EBP} = (1-\gamma)(-h_B)[1-\pi(1-p_B)(1-\delta)] > 0$ . (28)

(d) *Effects-Based: Complete Legal Uncertainty*

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<sup>32</sup> Given the probability of been disallowed if investigated is unity.

From (12') which we re-write here for convenience as:

$$W^{EBC} = (1 - F^{EBC})[\gamma(-h_H)(1 - p_H) + (1 - \gamma)(-h_B)p_B] - A(1 - F^{EBC})[\gamma(h_H)p_H - (1 - \gamma)(-h_B)(1 - p_B)] \quad (12')$$

we obtain the following proposition:

**Proposition 9** If there is *complete legal uncertainty* then:

(a) For *Presumptively Legal* actions we know that the term in the first square brackets is greater than that in the second square brackets (see (10') above) so  $W^{EBC} > 0$ , and to maximise welfare the penalty should be set so as to make  $F^{EBC} = 0$ . Hence:

(i) the optimal penalty is  $\varphi^{EBC} = 0$ , and, (29)

(ii) the associated maximum level of welfare is  $W^{EBC} = W > 0$ <sup>33</sup>; (30)

(b) This is also true for *Presumptively Illegal* actions for as long as administrative ineffectiveness (A) is quite small (and so  $W^{EBC} > 0$ ).

(c) For *Presumptively Illegal* actions and large A,  $W^{EBC} \leq 0$  and then to maximise welfare the penalty should be set so as to make  $F^{EBC} = 1$ . So in this case:

(i) the optimal penalty is  $\varphi^{EBC} = \left[ \frac{1}{\pi p} - 1 \right] + \delta$  (31)

(ii) the associated level of welfare is  $W^{EBC} = 0$ . (32)

### Comparisons of Enforcement Procedures with Optimal Penalties

We can now turn to a comparison of the outcomes in terms of welfare and penalties.

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<sup>33</sup> Where  $W$  is given by (13).

a. *Effects-Based: Partial vs No Legal Uncertainty*

From (28):

$$W^{EBP} > (1-\gamma)(-h_B)[1-(1-p_B)] = (1-\gamma)(-h_B)p_B > -[\gamma h_H(1-p_H) + (1-\gamma)h_B p_B] = W^{EBO} \quad (33)$$

Also, from (25) and (27) it is clear that

$$\varphi^{EBP} > \varphi^{EBO} . \quad (34)$$

Thus we have:

**Proposition 10** If the CA sets the optimum penalty then *partial legal uncertainty* is unambiguously welfare superior to *no legal uncertainty* AND entails a higher penalty.

The reason is straightforward: with *partial legal certainty* the CA exploits its ability to discriminate (*albeit* imperfectly) between harmful and benign actions as well as the fact that firms know their own types **but** they cannot predict with certainty the CA's decision if investigated to set a penalty high enough so that it deters ALL harmful actions. Because the probability of disallowing benign actions is smaller than that for harmful actions, at this penalty none of the benign actions are deterred<sup>34</sup>. However when there is no legal uncertainty then, although the CA can deter the firms that are induced by administrative ineffectiveness from taking actions when they know that their actions will be certainly disallowed if investigated, because firms can predict with certainty the CA's decision if their action is investigated the CA cannot use high penalties to deter some harmful actions that will be taken, among those that are certainly allowed. The higher optimal penalty under *effects-based* with partial legal uncertainty than under *effects-based* with no legal uncertainty is a result of the difference in the information available to the firms under these two procedures.

Note that this is a stronger result than that in Proposition 2 above according to which *partial legal certainty* welfare-dominates *no legal uncertainty* only in certain cases.

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<sup>34</sup> Given that the probability of disallowing benign actions is smaller a higher penalty is required in order to deter benign than to deter harmful actions.

Also, it is important to note that the above result about relative fines (which is confirmed below for other types of legal uncertainty too) is contrary to the legal principle of *nulla poena sine lege certa* according to which under uncertain enforcement procedures fines should be very low or eliminated. What this principle neglects is that given that all enforcement procedures are subject to decision errors, with uncertainty about how the CA will reach its decision the CA can use the policy tool of penalties to achieve better deterrence results than when there is no uncertainty about how it reaches its decision. While the fact that under partial legal uncertainty firms know their types (the true harm of their actions) is important in reaching the above result but it is NOT necessary for optimal fines to be higher under legal uncertainty than under no legal uncertainty or under *Per Se* as we show below when comparing complete legal uncertainty (under which firms do not know their types) with these enforcement procedures.

*b. Effects-Based: No Legal Uncertainty vs Complete Legal Uncertainty*

From Proposition 4, with any given exogenous penalties No Legal Uncertainty welfare dominates Complete Legal Uncertainty. Thus this result will also hold at the optimal penalty levels. The result can also be obtained from Propositions (7) and (9) by comparing (26) to (30) and (32) taking account of (13), so we get:

**Proposition 11** If the CA sets the optimum penalty then:

- (a) Welfare under *No Legal Uncertainty* is at least as great as that under *Complete Legal Uncertainty*. Welfare under *No Legal Uncertainty* is identical to that under *Complete Legal Uncertainty* if and only if there is administrative ineffectiveness ( $A = 0$ ) – i.e. all cases are investigated ( $\pi = 1$ ) and decisions reached without delay ( $\delta = 0$ ).
- (b) Optimal penalties under *No Legal Uncertainty* may be higher than those under *Complete Legal Uncertainty* - certainly the case if actions are *Presumptively Legal* – but may also be lower – which will be the case only if actions are *Presumptively Illegal*.

c. *Effects-Based with Complete Legal Uncertainty vs Per Se*

If the action is *Presumptively Illegal* then from Proposition 6 and Proposition 9 we see that

$$W^{EBC} \geq 0 = W^{PSI} \quad (35)$$

whereas

$$\varphi^{EBC} = \begin{cases} \left[ \frac{1}{\pi p} - 1 \right] + \delta > \left[ \frac{1}{\pi} - 1 \right] + \delta = \varphi^{PSI} & \text{as } W^{EBC} = 0 \\ 0 < \left[ \frac{1}{\pi} - 1 \right] + \delta = \varphi^{PSI} & \text{as } W^{EBC} > 0 \end{cases} \quad (36)$$

On the other hand, if the action is *Presumptively Legal* then from Proposition 6 and Proposition 9 again and given (13), we have:

$$\begin{aligned} W^{EBC} &= W = -\bar{h} + \pi(1-\delta) \left[ p_H \gamma h_H - (1-p_B)(1-\gamma)(-h_B) \right] \\ &= W^{PSL} + \pi(1-\delta) \left[ p_H \gamma h_H - (1-p_B)(1-\gamma)(-h_B) \right] > W^{PSL} \end{aligned} \quad (37)$$

In addition:

$$\varphi^{EBC} = \varphi^{PSL} = 0 \quad (38)$$

So we have:

**Proposition 12**

(a) If an action is *Presumptively Illegal* then an *Effects-Based Rule with Complete Legal Uncertainty* is no worse and may sometimes be better than a *Per Se Rule*. In cases where it is welfare superior the optimal penalty is lower (indeed it is zero), otherwise the optimal penalty is higher.

(b) If an action is *Presumptively Legal* and if the CA's rule can *effectively discriminate* then an *Effects-Based Rule with Complete Legal Uncertainty* welfare dominates a *Per Se Rule* but requires exactly the same penalty – zero.

Note that this is a stronger result than that established in Proposition 5 according to which *complete legal certainty* welfare-dominates *Per Se* only in certain cases (and may be inferior to *Per Se* in other cases).

From Propositions 10, 11 and 12 we get:

**Proposition 13**

If *effects-based* can *effectively discriminate* and provided it sets optimal penalties then there is a clear welfare ranking of decision environments: an *Effects-Based* rule with *Partial Legal Uncertainty* dominates that with *No Legal Uncertainty* which in turn dominates that with *Complete Legal Uncertainty* which in turn dominates a *Per Se* Rule.

Put differently a *Per Se* Rule is never better than an *Effects –Based* Rule - and is in many cases worse - however great the degree of *Legal Uncertainty*. However while in many cases a higher welfare ranking is associated with the imposition of tougher penalties, this is not always the case.

#### 4. *Concluding Remarks*

This paper proposes a formalisation of the concept of Legal Uncertainty (LU) that, as in Katsoulacos and Ulph (2009) is based on the premise that CAs cannot assess without mistakes the harm created by specific actions associated with certain business practices and on the assumption that there is imperfect information by firms in assessing the true harm of their actions and/or the CA’s estimate of harm in case these actions come under investigation. Depending on the type of information imperfection faced by firms a typology of LU situations emerges that classifies *effects-based* procedures into those involving: No Legal Uncertainty, Partial Legal Uncertainty, or Complete Legal Uncertainty. We compare these between themselves and with *Per Se* procedures first assuming that penalties are exogenously given and then assuming that penalties are set optimally.

Our analysis offers important grounds for scepticism about arguments coming mainly from legal experts, that *effects-based* procedures should be avoided because of the Legal

Uncertainty that they entail and that, if adopted, should involve much lower penalties according to the legal principle of *nulla poena sine lege certa*. Two important policy lessons emerge in particular from the analysis above.

First, enforcement procedures involving legal uncertainty may well be welfare superior to procedures without any legal uncertainty because of their superior deterrence effects. This is most likely when legal uncertainty concerns the inability of firms to predict what the CA will decide in their case but they know their own type. Thus a decision by policy makers not to adopt *effects-based* procedures cannot be based solely or even mainly on arguments relating to the legal uncertainty of such procedures. Second, the superiority of *effects-based* procedures is enhanced when CAs use penalties to achieve optimal deterrence effects. In that case it is never optimal to use *Per Se*. More practically, our analysis shows that CAs may well be justified in *raising* their penalties after adopting *effects-based* procedures.



## APPENDIX 1

In this Appendix we consider an important extension of the analysis above, that of allowing firms to reduce legal uncertainty by incurring some cost in obtaining and analysing information.

### Firms invest to reduce uncertainty

Assume for simplicity that  $A = 0$  so there is no administrative ineffectiveness. Also assume an exogenously given penalty  $\Phi$ . One of the costs sometimes associated with legal uncertainty is that firms have to incur costs to reduce the uncertainty. Above we have been implicitly assuming that these costs are too high so firms will never incur them.

To take into account this consideration suppose now that in the case of *Partial Legal Uncertainty* firms can, before they take the action, make an investment that will completely reveal the nature of the test that will be carried out by the CA and the signal the CA will discover and hence the decision the CA will make. That is firms can buy *Legal Certainty*. Suppose that the cost of the investment is  $C > 0$ .

Take a firm from the Harmful environment with private benefit  $b > 0$ . If it makes the investment then it learns with certainty whether in its case, when investigated, the CA's "model" will generate a Negative Harm signal. The probability that it belongs to those firms that will give a Negative Harm signal when investigated is  $(1 - p_H)$ . So its expected net profits from making the investment will be  $(1 - p_H)b - C$ . However if it chooses not to reduce the uncertainty then it will take the action only if the expected net profits from doing so are positive, so its expected profits if it remains uninformed are  $MAX [(1 - p_H)b - p_H\Phi, 0]$ .

From this we can see that if  $C \geq p_H\Phi$  the firm will choose not to be informed. However

if  $C < p_H\Phi$  then a fraction  $F_H^{EBPI}(C) = F[\underline{b}_H^I(C)]$  where

$\underline{b}_H^I(C) = \frac{C}{1 - p_H} < \underline{b}_H = \frac{p_H\Phi}{(1 - p_H)}$  will choose not to become informed and will not take the

action while the remaining fraction  $\left[1 - F_H^{EBPI}(C)\right]$  will choose to become informed and will take the action depending on whether they find that they belong to the fraction that will be allowed or to the fraction that will be disallowed. Notice that since  $F_H^{EBPI}(C) < F_H^{EBP}$  more firms will take the action than in the case where all firms remained uninformed.

An analogous discussion holds for firms from the Benign environment. In this case the corresponding value of  $\underline{b}$  is  $\underline{b}_B^I(C) = \frac{C}{p_B} < \underline{b}_B = \frac{(1-p_B)\Phi}{p_B}$  and a fraction

$F_B^{EBPI}(C) = F\left[\underline{b}_B^I(C)\right]$  will choose not to become informed.

So we get the following regimes:

Regime 1  $C \geq p_H \Phi$

Here all firms remain uninformed and welfare under *Partial Legal Uncertainty* is, as before:

$$W^{EBP}(C) = -\left[\gamma(1 - F_H^{EBP})(1 - p_H)h_H + (1 - \gamma)(1 - F_B^{EBP})p_B h_B\right]. \quad (\text{A.1})$$

Regime 2  $p_H \Phi > C \geq (1 - p_B)\Phi$

Here all firms from the benign environment remain uninformed while a fraction  $\left[1 - F_H^{EBPI}(C)\right]$  of firms from the harmful environment will choose to become informed and will take the action depending on whether they find that they belong to the fraction that will be allowed or to the fraction that will be disallowed. Welfare is therefore:

$$\begin{aligned} W^{EBP}(C) &= -\left\{\gamma\left[1 - F_H^{EBPI}(C)\right]\left[(1 - p_H)h_H + C\right] + (1 - \gamma)(1 - F_B^{EBP})p_B h_B\right\} \\ &= -\left\{\gamma\left[1 - F\left(\frac{C}{1 - p_H}\right)\right]\left[(1 - p_H)h_H + C\right] + (1 - \gamma)(1 - F_B^{EBP})p_B h_B\right\} \end{aligned} \quad (\text{A.2})$$

Notice that if  $C \approx p_H \Phi$  then welfare is definitely lower than in Regime 1 where  $C \geq p_H \Phi$ . This is because the fraction of firms deterred is effectively the same - i.e.

$F\left(\frac{C}{1 - p_H}\right) \approx F_H^{EBP}$  - but now there is a group of firms incurring costs to become

informed, which, *pace* discussion above, has no welfare advantage compared to just taking the action and having it allowed/disallowed.

More generally it is interesting to consider how welfare varies with costs within this regime. Differentiating (A.2) we get:

$$\frac{dW^{EBP}}{dC} = \gamma \left[ 1 - F(\underline{b}_H^I(C)) \right] \cdot \left\{ \left[ \frac{f(\underline{b}_H^I(C))}{1 - F(\underline{b}_H^I(C))} \right] \cdot (h_H + \underline{b}_H^I(C)) - 1 \right\} \quad (\text{A.3})$$

There are two separate effects of a unit increase in  $C$ . First it imposes higher costs on firms choosing to become informed – which is welfare-reducing. But second it deters more firms from incurring the costs of becoming informed and taking the action – at least with some probability. This is a good thing because it avoids some harm and the incurring of costs which, from the point of view of society are wasteful.

Regime 3       $0 \leq C < (1 - p_B)\Phi$

Here a fraction of firms from both environments will choose to become informed, and consequently welfare is:

$$\begin{aligned} W^{EBP}(C) &= - \left\{ \gamma \left[ 1 - F_H^{EBPI}(C) \right] \left[ (1 - p_H)h_H + C \right] + (1 - \gamma) \left[ 1 - F_B^{EBPI}(C) \right] (p_B h_B + C) \right\} \\ &= - \left\{ \gamma \left[ 1 - F\left(\frac{C}{1 - p_H}\right) \right] \left[ (1 - p_H)h_H + C \right] + (1 - \gamma) \left[ 1 - F\left(\frac{C}{p_B}\right) \right] (p_B h_B + C) \right\} \quad (\text{A.4}) \end{aligned}$$

There are a number of points to note.

First it follows from (A.4) and (9') that as  $C \rightarrow 0$ ,  $W^{EBP}(C) \rightarrow W^{EB0}$  - as is intuitively obvious.

Second, once again for values of  $C$  close the boundary of Regime 2 above, that is  $C \approx (1 - p_B)\Phi$ , welfare is discontinuously lower – because deterrence effects are very close to those in the higher regime, but now there is a whole new group of firms incurring learning costs.

Finally to consider more generally how welfare varies with costs on the interior of the regime we can differentiate (A.4) to get:

$$\begin{aligned} \frac{dW^{EBP}}{dC} = & \gamma \left[ 1 - F(\underline{b}'_H(C)) \right] \cdot \left\{ \left[ \frac{f(\underline{b}'_H(C))}{1 - F(\underline{b}'_H(C))} \right] \cdot (h_H + \underline{b}'_H(C)) - 1 \right\} \\ & + (1 - \gamma) \left[ 1 - F(\underline{b}'_B(C)) \right] \cdot \left\{ \left[ \frac{f(\underline{b}'_B(C))}{1 - F(\underline{b}'_B(C))} \right] \cdot (h_B + \underline{b}'_B(C)) - 1 \right\}. \end{aligned} \quad (\text{A.5})$$

The first term on RHS is as before while the sign of the additional second term arising for firms from the Benign environment is now ambiguous - because the harmful effect of deterring a few more firms from taking a beneficial action could be offset by the gain from ensuring that they do not incur costs of becoming informed.

So, in summary, the recognition that firms might incur costs to become informed and reduce uncertainty has the following implications.

The first is that welfare now explicitly takes account of the costs of becoming informed and, **other things (particularly deterrence effects) being equal** welfare will be lower under Partial Legal Uncertainty than it otherwise would have been. But other things are not equal and deterrence effects are also affected by the costs of becoming informed. So the picture is more complex.

The second is that welfare under *Partial Legal Uncertainty* varies from being equal to welfare under *No Legal Uncertainty* - in the case where  $C = 0$  - to being equal to welfare under *Partial Legal Uncertainty* as considered in the core part of the paper<sup>35</sup> - in the case where  $C \geq p_H \Phi$  (Regime 1).

So given the discussion above we can re-state Proposition 2 as follows:

**Proposition A.1** It is possible that  $W^{EBP}(C = p_H \Phi) > W^{EBP}(C = 0) = W^{EBO}$ .

Thirdly welfare varies neither continuously nor monotonically with the costs of becoming informed, but rather takes two discontinuous upward jumps as costs increase across the thresholds between the 3 regimes. This has some complex implications as shown in the two Corollaries that follow:

**Corollary A.1** Even though firms incur costs of becoming informed there may be whole ranges of costs where welfare will still be higher under *Partial Legal Uncertainty* than under *No Legal Uncertainty*, and, from Proposition 2, *a fortiori* under *Pe Se*.

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<sup>35</sup> In which the implicit assumption was that C is too high for firms to become informed.

Proof: Certainly in the case where  $W^{EBP}(p_H\Phi) > W^{EBP}(0)$  there will be ranges of costs where  $W^{EBP}(C) > W^{EBP}(0) = W^{EB0} > W^{PSL}$ . On the other hand even if  $W^{EBP}(p_H\Phi) < W^{EBP}(0)$  there still could be ranges of costs where  $W^{EBP}(C) > W^{EBP}(0) = W^{EB0} > W^{PSL}$ . Figure 1 below illustrates.

**Corollary A.2** Despite the fact that  $W^{EBP}(p_H\Phi) > W^{EBP}(0)$  there could be ranges of costs for which  $W^{EBP}(C) < W^{EBP}(0)$  so the costs of becoming informed impose a real welfare loss which drives welfare below that with *No Legal Uncertainty*. Figure 2 below illustrates.

### Appendix 1: Figures

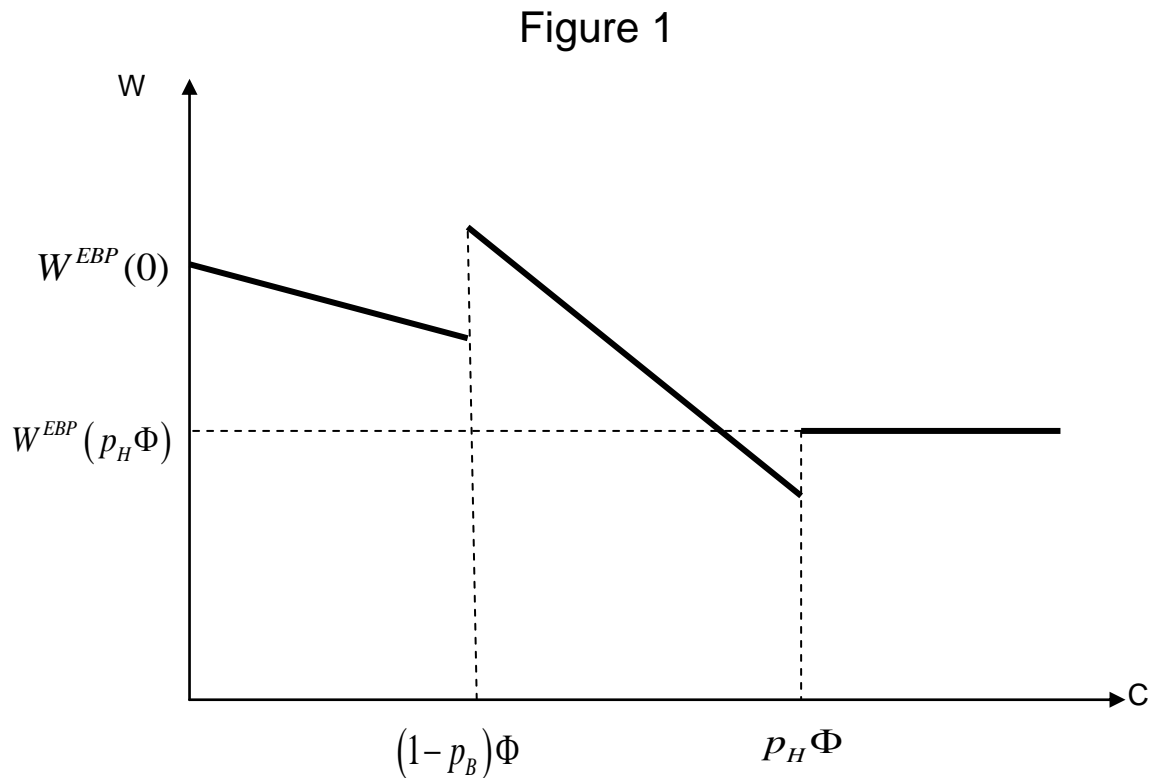
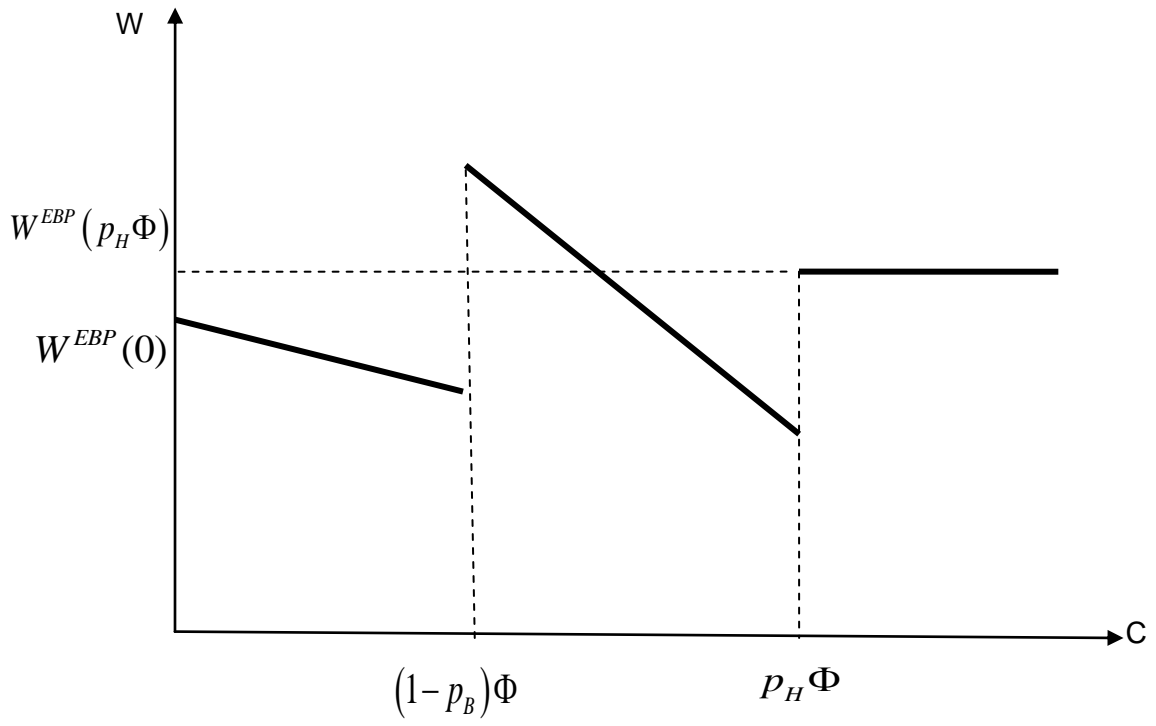


Figure 2



## APPENDIX 2

### *A note: Are investigations necessary if fines can be optimally set?*

An obvious question that emerges from the above analysis, though with more general applicability, is the following. If the CA sets a fine level that deters all harmful actions while not deterring benign actions then what is the purpose of having a (costly) mechanism for investigating actions once they are taken? Suppose an *effects-based* procedure is used and there is No Legal Uncertainty (NLU). Then, by definition, every firm knows its  $x_k^e$ . If the CA knows that it is dealing with a situation of NLU then it knows that all firms know their  $x_k^e$ . Consequently if a firm has taken the action then even if the CA does not know before investigating the precise value of  $x_k^e$  for that firm it knows that it is such that, under its announced rule the value of  $x_k^e$  is such that it will indeed allow the action. So it does not need to investigate – it should allow the action. But the problem is that if it does this it is no longer using the rule that it decides whether to allow or disallow depending on the estimate of harm that is generated by the model  $f(.)$ . Its decision rule would essentially be that “if a firm takes an action allow it”. But then all firms would know that this is the rule and then all actions will be taken – irrespective of the size of the fine - and from (3) this is certainly sub-optimal. In other words if the CA does not investigate then it is no longer using the model that generated the beliefs that led to the behaviour that it tries to manipulate through its penalty.

Alternatively, suppose that there is Partial Legal Uncertainty (PLU). Then again if the CA sets the optimal penalty that ensures only benign firms take the action then there is no need to investigate. But if it does not investigate it basically allows every action that comes before it. But in this case its decision rule is once again – “allow every action that is taken” and this is characterised by  $p_H = 0, p_B = 1$ . But then if, under PLU firms know their type and know  $p_H$  and  $p_B$  then they will know  $p_H = 0, p_B = 1$  and all firms will take the action and no penalty will stop them. Once again this is distinctly sub-optimal. So there really is a point in investigating because it supports the rule that supports the beliefs that gives rise to the behaviour that it can manipulate through penalties.

In addition, in our analysis above, under PLU, the fine that deters benign actions is higher than the fine that deters harmful actions – since the probability of a benign action being disallowed is lower. So setting the latter fine is optimal as it deters all harmful and also does not deter any benign actions. However, there are simple extensions to the model capturing a number of realistic aspects, under which fines that minimise the deterrence of benign actions will not deter harmful actions so the CA will have to investigate. Some such extensions are:

1. If the benefit ( $b$ ) to firms from the harmful environment from taking the action is much higher than the benefit to the firms from the benign environment from taking the action then setting a fine that does not deter benign actions may well not deter harmful actions.
2. If in the harmful environment there are, say, two types of harmful actions: “very harmful” ( $k$ ) and “not so harmful” ( $k'$ ). Assume that with the CA’s model  $p_H^k > 1 - p_B \geq p_H^{k'}$  so the model can discriminate between benign and “very harmful” actions but not between benign and “not so harmful” actions. Then setting a fine that does not deter benign will also not deter the “not so harmful actions.

More to the point, in practice, CAs will be setting penalties having in mind a set of different kinds of actions (e.g. anticompetitive exclusive dealing agreements and anticompetitive bundling). Assume two different kinds of actions  $k$  and  $k'$  and that while  $p_H^k > 1 - p_B^k$  and  $p_H^{k'} > 1 - p_B^{k'}$  it is also true that  $1 - p_B^k > p_H^{k'}$ . Then again setting a fine that does not deter benign actions of type  $k$  will also not deter harmful actions of type  $k'$ .



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