

# Modelling the Effects of Legal Uncertainty

by

Yannis Katsoulacos<sup>1</sup> & David Ulph<sup>2</sup>

V4 – May 2009<sup>3</sup>

Preliminary – Work in Progress – Comments Welcome

## 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 Uncertainty. Certain enforcement or decision procedures are thought of, *ceteris paribus*, as being superior because their cost in terms of the legal uncertainty generated when these procedures are adopted is relatively low. This issue is important for a broad range of regulatory interventions<sup>4</sup> which are induced by the following set of circumstances: (a) agents are taking actions 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.

While the issue of legal uncertainty is widely discussed and considered of fundamental importance among those involved in the design and implementation of public policy and among legal experts and economists, the concept has never up to now been formalised and the “costs of legal uncertainty” has never been analysed using economic theory. The present paper attempts to do exactly that.

The context of many of the discussions on legal uncertainty usually involves comparisons of *effects-based* (or what alternatively can be termed *discriminating*) and *Per Se* decision rules or enforcement procedures<sup>5</sup>. The idea is that under *Per Se* rules

---

<sup>1</sup> Professor, Dept. of Economics, Athens University of Economics and Business; E-mail: [yks@hol.gr](mailto:yks@hol.gr)

<sup>2</sup> Professor, Dept of Economics, University of St. Andrews. [du1@st-andrews.ac.uk](mailto:du1@st-andrews.ac.uk)

<sup>3</sup> Version 1: February 2009, see [www.cresse.info](http://www.cresse.info)

<sup>4</sup> These include interventions associated with the application of Competition Policy, Sectoral Regulation, Environmental Policy, Tax Compliance mechanisms etc.

<sup>5</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

either all actions are allowed or all are disallowed, whereas under *effects-based* procedures, the Authority will allow some actions and disallow others. 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 Authority. 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 by the Authority. This Legal Uncertainty induced by *effects-based* procedures is harmful and should lead Authority to favour *Per Se* procedures.

However these arguments have typically been asserted rather than demonstrated and have not been subjected to rigorous scrutiny. In this paper we adapt our original framework in K&U (2008a) and use it to subject these ideas to rigorous analysis. We show that whether legal uncertainty emerges under an *effects-based* procedure, its nature and extent, the implications for firm behaviour and the consequent choice of legal standard, depends crucially on:

- the information available to the Authority concerning the characteristics of firms/ their environment that determine the harm/benefit generated by their actions,
- the information available to the firms about these characteristics and about the assessment criteria/models used by the Authority.

A number of interesting points and results emerge from our analysis:

- (i) It is often presumed that just because *effects-based* procedures will make different decisions in different cases, they necessarily create Legal Uncertainty. But this is wrong. Suppose that, even after an investigation, the Authority cannot determine all the relevant characteristics that determine the harm/benefit caused by an action taken by any firm, but nevertheless can accurately measure a subset of these, and that the firms taking the actions also know the value of these characteristics. Suppose the Authority uses a decision rule that it will disallow all actions where the vector of characteristics lies in a particular set but allow all other actions. For example it might disallow all actions where market share exceeds a particular value. And suppose that this

---

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 economic methodologies on a *case-by-case* basis.

decision rule is communicated clearly and effectively to firms. This is an *effects-based* rule because different decisions will be made in different cases. Moreover it will typically be subject to both Type I Errors (False Acquittals) and Type II Errors (False Convictions) because there are harm-relevant characteristics that are excluded from the test. But there will be absolutely no Legal Uncertainty. Every firm knows the value of the characteristics that will lead the Authority to make its decision and so will know in advance exactly what decision will be made about it were it ever to be investigated. Put somewhat differently, it is very important to distinguish between *variability* of treatment and *uncertainty* of treatment. *Effects-based* procedures generate *variability* of treatment but not necessarily *uncertainty* of treatment. The crucial result we establish is that provided the *effects-based* rule can *effectively discriminate* – in the sense defined in K&U (2008a) and below – then welfare under an *effects-based* rule with no Legal Uncertainty is higher than under a *Per Se* rule. So not only is *Per Se* not the only way of achieving Legal Certainty, it is not necessarily the best way of achieving it. This result is very important because it suggests that Legal Certainty might best be achieved by *effects-based* procedures provided the tests are based on factors that are known to firms and that the rule is made transparent.

- (ii) In many cases of course these circumstances may not arise, and Authorities may use powerful tests based on characteristics not readily observable by firms and, in addition, may not fully reveal the nature of the tests to firms. For example firms may know that decisions are based at least in part on a market share test, but not know what definition of market will be used. Consequently, the things that firms know about themselves and their environment may only be loosely connected to the characteristics on which the test is based, and so firms do not know for sure whether their action will be disallowed but can only calculate/perceive the *probability* that it's being disallowed were it ever to come before the Authority. So now there is Legal Uncertainty. Moreover, since firms differ in their characteristics and/or environment, in general different firms will attach different probabilities to

their action's being disallowed. In particular, suppose that, as in K&U (2008a), firms:

- know whether their conduct is harmful or benign;
- do not know the values of the underlying characteristics which make their actions harmful or benign;
- but know enough about how the Authority will assess their conduct, that they calculate/perceive the probability of the Authority's making Type I and Type II errors.

For this case we establish two important results.

1. If the authority uses an *effects-based* procedure then welfare in this situation where there is Legal Uncertainty could still be higher than in the situation described in (i) above where there was no Legal Uncertainty. So Legal Uncertainty can be welfare-enhancing. This is because Legal Uncertainty can generate deterrence effects that are on balance welfare-improving. *A fortiori* if the *effects-based* rule can *effectively discriminate* then, given the result we reported in (i) welfare will be higher than under *Per Se*.
  2. Even if under an *effects-based* procedure welfare is lower with Legal Uncertainty than in the situation in (i) where there is no Legal Uncertainty, welfare may still be higher than under *Per Se*. This is because:
    - If the *effects-based* procedure can *effectively discriminate* it has lower costs of decision errors
    - Firms whose actions are harmful face a higher probability of having their actions disallowed than firms whose actions are benign and so, given that firms know their type, there is greater deterrence of harmful actions than benign actions.
- (iii) In the most extreme case of Legal Uncertainty firms may know so little about the characteristics that the Authority uses in the tests that it conducts and about the nature of the tests that it employs, that not only do they not know for sure whether their action will be allowed or disallowed and can only calculate/perceive a probability of its being disallowed, but, this probability is

unrelated to anything that the firm knows about itself and is common to all firms<sup>6</sup>. Effectively the only thing that firms know is how often on average actions of the type they are contemplating taking are disallowed when they come before the Authority. For this reason this case is referred to as the “*average deterrence*”<sup>7</sup> case while that in (ii) above is referred to as “*marginal deterrence*”. The key result we establish is that if the CA uses an *effects-based* procedure then welfare under *average deterrence* will be lower than welfare under *marginal deterrence* and the likelihood that *effects-based* procedures welfare dominate *Per Se* is correspondingly smaller. But even in this case of extreme Legal Uncertainty welfare may still be higher under an *effects-based* procedure than under *Per Se*.

To summarise:

- There is no automatic equivalence between *effects-based* rules and Legal Uncertainty.
- There is no monotonic link between Legal Uncertainty and welfare. While very great degrees of Legal Uncertainty are welfare reducing, welfare can be higher when there is some degree of Legal Uncertainty than when there is no Legal Uncertainty.
- If the tests on which *effects-based* procedures are based are good enough to enable the Authority to *effectively discriminate* then *effects-based procedures* will often be welfare superior to *Per Se* rules even though they involve Legal Uncertainty.

---

<sup>6</sup> Vickers (2007) also distinguishes between “discretionary decision making” by an Authority “based on whatever is thought to be desirable in economic terms case by case” and the *effects-based* approach proposed recently in EU. The case-by-case approach can be thought of as *Rule of Reason*. The *effects-based* approach need not necessarily produce legal uncertainty in the second sense above, as when the Authority uses clearly specified models and criteria that allow firms to anticipate correctly how their conduct will be assessed—in the sense of correctly anticipating when the conduct will be allowed or disallowed depending on whether it is harmful or benign.

<sup>7</sup> See Katsoulacos and Ulph (2008a, b); also G. IMMORDINO AND M. POLO, JUDICIAL ERRORS AND INNOVATIVE ACTIVITY, mimeo (2008).

## 2. The Model

Consider the following set-up. There is a population of agents who could take an action. This action will confer some private benefit  $b \geq 0$ , but can also generate some social harm which can be positive or negative – so it can also be socially beneficial.

There is an Authority that conducts investigations into these actions. To focus purely on *legal uncertainty*, we will assume that all actions come to the attention of the authority and that its investigation is costless and incurs no delay. The Authority can only imperfectly determine the harm caused by the action of each agent. But nevertheless it has to reach a decision as to whether to allow or disallow the action. If the action is disallowed it is instantly stopped and the agent has to pay a penalty  $f > 0$ .

Anticipating the decision by the Authority agents decide whether or not to take the action.

Agents differ in two characteristics  $x$  and  $y$  that are relevant to determining the true harm caused by the action. These are each independently and uniformly distributed on  $[0,1]$ , so  $(x, y) \in \Omega = [0,1] \times [0,1]$ . The private benefit,  $b$ , conferred by an action is independently distributed on  $\Omega^+$  according to the distribution function  $F(b)$  which satisfies  $F(0) = 0$ ;  $F(b) > 0$ ,  $F'(b) > 0 \quad \forall b > 0$

Assume that the harm function is

$$h(x, y), h_x, h_y > 0, \forall x, y. \quad (1)$$

We assume throughout that the nature of the harm function, as well as the fact that  $x$  and  $y$  are uniformly distributed on  $[0,1]$  are common knowledge.

Given our assumptions the average harm that would be caused were all agents to take the action would be

$$\bar{h} = \iint_{\Omega} h(x, y) dx dy. \quad (2)$$

We will say that the action is *Presumptively Illegal* (resp. *Legal*) if  $\bar{h} > (\text{resp. } <) 0$ .

Given our assumptions  $\bar{h}$  is also common knowledge.

Let  $H = \{(x, y) \in \square \mid h(x, y) \geq 0\}$  and  $B = \{(x, y) \in \square \mid h(x, y) \leq 0\}$  be, respectively, the set of Harmful and Benign actions. The iso-harm function is defined by:

$h(x, y) = 0$  and given (1) it has a negative slope.

We assume throughout that all agents know their type – that is they know whether their characteristics  $(x, y)$  lie in  $H$  or in  $B$ .

Let  $\gamma$ ,  $0 < \gamma < 1$  be the fraction of agents in  $H$ . So

$$\gamma = \iint_H dx dy; \quad 1 - \gamma = \iint_B dx dy. \quad (2)$$

Also let

$$\bar{h}_H = \frac{1}{\gamma} \iint_H h(x, y) dx dy > 0; \quad \bar{h}_B = \frac{1}{1 - \gamma} \iint_B h(x, y) dx dy < 0$$

be, respectively, the average harm caused by harmful actions and the average harm caused by benign actions. Obviously

$$\bar{h} = \gamma \bar{h}_H + (1 - \gamma) \bar{h}_B \quad (3)$$

Following Katsoulacos & Ulph (2009), if an action is *Presumptively Illegal* ( $\bar{h} > 0$ ) we will call

$$s_I = \frac{\gamma \bar{h}_H}{(1 - \gamma) \cdot (-\bar{h}_B)} > 1$$

the *strength of the presumption of illegality*. Analogously if an action is *Presumptively Legal* ( $\bar{h} < 0$ ) we will call

$$s_L = \frac{(1 - \gamma) \cdot (-\bar{h}_B)}{\gamma \bar{h}_H} > 1$$

the *strength of the presumption of legality*.

### 3. Decision Rules of the Authority

Having set out the basic assumptions of the model we first want to describe and compare the decision rules/legal standards used by the Authority.

#### 2.1 *Decision Rules*

We assume that the authority does not know the true value of the harm  $h(x, y)$  of any agent whose action it is considering. There are two types of legal standard or decision rule available to the authority.

The first is a *Per Se* legal standard whereby the authority will simply allow (resp. disallow) ALL actions provided they are *Presumptively Legal* (resp. *Presumptively Illegal*). A *Per Se* Legal standard entails no *legal uncertainty* because all agents know in advance exactly how their action will be treated.

The second legal standard is an *Effects-Based* standard. Here the assumption is that the authority conducts an investigation into the nature of the action. However after conducting an investigation it learns the true value of  $x$  for each agent but still cannot observe  $y$ . It sets some criterion  $\hat{x}$ ,  $0 < \hat{x} < 1$ , and then disallows all actions with  $1 \geq x > \hat{x}$  and allows all actions with  $0 \leq x \leq \hat{x}$ . Clearly the fraction of all actions that will be disallowed under this criterion will be

$$\lambda(\hat{x}) = 1 - \hat{x}. \quad (5)$$

Let  $HD(\hat{x}) = \{(x, y) \in H \mid 1 \geq x > \hat{x}\}$ ;  $BD(\hat{x}) = \{(x, y) \in B \mid 1 \geq x > \hat{x}\}$  be, respectively, the sets of Harmful and Benign actions that will be disallowed, while  $HA(\hat{x}) = \{(x, y) \in H \mid 0 \leq x \leq \hat{x}\}$ ;  $BA(\hat{x}) = \{(x, y) \in B \mid 0 \leq x \leq \hat{x}\}$  are, respectively, the sets of Harmful and Benign actions that will be allowed.

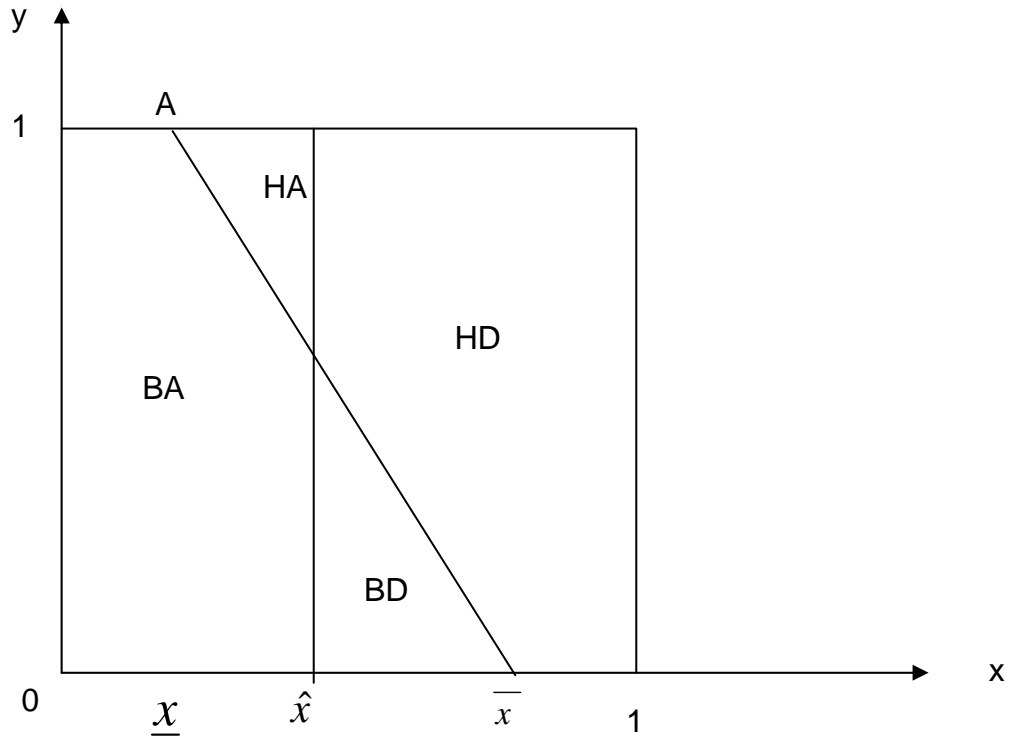
Figure 1 gives an example of an iso-harm function with the sets  $HD$ ,  $BD$ ,  $HA$ ,  $BA$  that it generates. In Fig. 1 we assume that the iso-harm function  $h(x, y) = 0$  is not very flat. To ensure this we define  $\underline{x}$  and  $\bar{x}$ ,  $\underline{x} < \bar{x}$  by

$$h(\underline{x}, 1) = h(\bar{x}, 0) = 0.$$

Where we constrain the harm function to ensure that  $0 < \underline{x} < \bar{x} < 1$ . We assume that  $\underline{x} < \hat{x} < \bar{x}$ , as shown in Fig. 1 below.

In Fig. 1, actions in the area  $HA$  represent false acquittals (Type II errors) while actions in the area  $BD$  represent false convictions (Type I errors).

Figure 1



Let

$$p_H(\hat{x}) = \frac{1}{\gamma} \iint_{HD(\hat{x})} dx dy, \quad 0 \leq p_H(\hat{x}) \leq 1 \quad (6)$$

be the fraction of Harmful actions that are disallowed, and

$$p_B(\hat{x}) = \frac{1}{1-\gamma} \iint_{BA(\hat{x})} dx dy, \quad 0 \leq p_B(\hat{x}) \leq 1 \quad (7)$$

be the fraction of Benign actions that are allowed. These are essentially the fraction of Harmful and Benign actions that are correctly identified as such.

Note that in terms of Fig 1:

$$Area_{HD} = \gamma \cdot p_H(\hat{x}); Area_{HA} = \gamma \cdot (1 - p_H(\hat{x})); Area_{BD} = (1 - \gamma) \cdot (1 - p_B(\hat{x})); Area_{BA} = (1 - \gamma) \cdot p_B(\hat{x})$$

Also notice that:

$$\lambda(\hat{x}) = \gamma p_H(\hat{x}) + (1 - \gamma) \cdot [1 - p_B(\hat{x})] \quad (8)$$

In everything that follows we assume that the value of  $\lambda$  is common knowledge.

Also let

$$\bar{h}_{HD}(\hat{x}) = \frac{1}{\gamma p_H(\hat{x})} \iint_{HD(\hat{x})} h(x, y) dx dy > 0 \quad (9)$$

be the average harm of Harmful actions that are disallowed, with analogous definitions for  $\bar{h}_{HA}(\hat{x}) > 0$ ,  $\bar{h}_{BA}(\hat{x}) < 0$ ,  $\bar{h}_{BD}(\hat{x}) < 0$ .

So we obviously have the following links between the various average harms:

$$\bar{h}_H = p_H(\hat{x}) \bar{h}_{HD}(\hat{x}) + [1 - p_H(\hat{x})] \bar{h}_{HA}(\hat{x}); \quad \bar{h}_B = p_B(\hat{x}) \bar{h}_{BA}(\hat{x}) + [1 - p_B(\hat{x})] \bar{h}_{BD}(\hat{x}) \quad (10)$$

Finally let

$$\bar{h}_D(\hat{x}) = \frac{\gamma p_H(\hat{x}) \bar{h}_{HD}(\hat{x}) + (1 - \gamma) [1 - p_B(\hat{x})] \bar{h}_{BD}(\hat{x})}{\lambda(\hat{x})} \quad (11)$$

be the average harm of actions that are disallowed under an *Effects-Based* decision rule and

$$\bar{h}_A(\hat{x}) = \frac{\gamma [1 - p_H(\hat{x})] \bar{h}_{HA}(\hat{x}) + (1 - \gamma) p_B(\hat{x}) \bar{h}_{BA}(\hat{x})}{1 - \lambda(\hat{x})} \quad (12)$$

be the average harm of actions that are allowed under an *Effects-Based* decision rule.

Also note that from (3) and from (10) - (12) it follows that:

$$\bar{h} = \lambda(\hat{x}) \bar{h}_D(\hat{x}) + [1 - \lambda(\hat{x})] \bar{h}_A(\hat{x}) \quad (13)$$

From (13) it follows that

$$\bar{h}_D(\hat{x}) > \bar{h} \Leftrightarrow \bar{h}_A(\hat{x}) < \bar{h}. \quad (14)$$

## 2.2 Costs of Decision Errors

Under both types of legal standard the Authority will be making either Type I errors (false convictions - disallowing actions that are beneficial) or Type II errors (false acquittals - allowing actions that are harmful) or both. We wish to compare the welfare costs of these decision errors under the two rules.

To measure the decision error costs of any given rule we suppose that ALL actions come before the Authority<sup>8</sup>, calculate the number of benign actions that are disallowed (resp. Harmful actions that are allowed) under the rule, and by multiplying by  $-\bar{h}_B$  (resp.  $\bar{h}_H$ ) calculate the resulting welfare cost of these decision errors.

Accordingly, under a *Per Se* decision rule, if an action is *Presumptively Illegal* all actions are disallowed so the costs of decision errors are:

$$CDE^{PSI} = (1-\gamma) \left[ -\bar{h}_B \right] \quad (15)$$

while if the action is *Presumptively Legal* all actions are allowed and so the costs of decision errors are:

$$CDE^{PSL} = \gamma \bar{h}_H. \quad (16)$$

Under an *Effects-Based* decision rule using criterion  $\hat{x}$  some actions are allowed and some disallowed so the costs of decision errors are:

$$CDE^{EB}(\hat{x}) = \gamma \left[ 1 - p_H(\hat{x}) \right] \bar{h}_{HA}(\hat{x}) + (1-\gamma) \left[ 1 - p_B(\hat{x}) \right] (-\bar{h}_{BD})(\hat{x}). \quad (17)$$

We then have the following:

**Result 1** If an action is *Presumptively Illegal* then

---

<sup>8</sup> Effectively we assume that there are no deterrence effects. This has the advantage of enabling us to clearly decompose the overall welfare effects of any given rule into the decision error costs and the deterrence costs.

$$CDE^{EB}(\hat{x}) < CDE^{PSI} \Leftrightarrow \gamma[1-p_H(\hat{x})]\bar{h}_{HA}(\hat{x}) < (1-\gamma)p_B(\hat{x})[-\bar{h}_{BA}(\hat{x})]; \quad (18)$$

while if the action is *Presumptively Legal* then

$$CDE^{EB}(\hat{x}) < CDE^{PSL} \Leftrightarrow \gamma p_H(\hat{x})\bar{h}_{HD}(\hat{x}) > (1-\gamma)[1-p_B(\hat{x})][-\bar{h}_{BD}(\hat{x})]. \quad (19)$$

From (18), (19), (11), (12) and (14) an equivalent way of stating this result is as follows:

**Corollary 1.** If an action is *Presumptively Illegal* then

$$CDE^{EB}(\hat{x}) < CDE^{PSI} \Leftrightarrow \bar{h}_A(\hat{x}) < 0 < \bar{h} < \bar{h}_D(\hat{x}); \quad (20)$$

while if the action is *Presumptively Legal* then

$$CDE^{EB}(\hat{x}) < CDE^{PSL} \Leftrightarrow \bar{h}_A(\hat{x}) < \bar{h} < 0 < \bar{h}_D(\hat{x}). \quad (21)$$

So the costs of decision errors are lower under an *Effects-Based* rule than under a *Per Se* rule if and only if actions that are allowed under the *Effects-Based* rule are on average benign while those that are disallowed are on average harmful.

Let us introduce the following measures of the *discriminatory power* (or *quality*) of an *Effects-Based* decision rule:

$$q_D(\hat{x}) = \frac{p_H(\hat{x}) \cdot \left[ \frac{\bar{h}_{HD}(\hat{x})}{\bar{h}_H} \right]}{[1-p_B(\hat{x})] \cdot \left[ \frac{-\bar{h}_{BD}(\hat{x})}{-\bar{h}_B} \right]}; \quad q_A(\hat{x}) = \frac{p_B(\hat{x}) \cdot \left[ \frac{-\bar{h}_{BA}(\hat{x})}{-\bar{h}_B} \right]}{[1-p_H(\hat{x})] \cdot \left[ \frac{\bar{h}_{HA}(\hat{x})}{\bar{h}_H} \right]} \quad (22)$$

If we consider the first measure,  $q_D(\hat{x})$ , then this comprises two terms. The first is the relative likelihood of harmful actions being disallowed to benign actions being disallowed. The second is the ratio of a measure of how harmful are the disallowed harmful actions (relative to all harmful actions) to a measure of how benign are the disallowed benign actions (relative to all benign actions). If the *Effects-Based* rule is any good then:

- it should be disallowing a higher proportion of harmful than benign actions;
- the disallowed harmful actions should be worse than harmful actions in general;

- the disallowed benign actions should be less good than the population of benign actions in general.

Similarly for the second measure,  $q_A(\hat{x})$ . So for all these reasons we would want to say:

**Definition 1** If an *Effects-Based* rule has *discriminatory power* then, for actions that are *Presumptively Illegal* (respectively *Presumptively Legal*)

$$q_A(\hat{x}) > 1 \text{ (respectively } q_D(\hat{x}) > 1). \quad (23)$$

**Definition 2** Given (18), for actions that are *Presumptively Illegal* (respectively *Presumptively Legal*) we will say that an *Effects-Based* decision rule using criterion  $\hat{x}$  can *effectively discriminate* if and only if

$$q_A(\hat{x}) > s_I \text{ (respectively } q_D(\hat{x}) > s_L). \quad (24)$$

So to be able to *effectively discriminate* the *discriminatory power* of an *Effects-Based* rule has to be greater than the strength of the presumption of legality/illegality.

From (18) and (19) we then get the following way of re-stating Result 1 which is a generalisation of the analogous result from Katsoulacos and Ulph (2009).

**Result 2** Decision cost errors are lower under an *Effects-Based* Rule than under a *Per Se* Rule if and only if the *Effects-Based* Rule can *effectively discriminate*.

NOTE: I WOULD FIND IT MORE STRAIGHTFORWARD AND SIMPLER TO DEFINE EFFECTIVELY DISCRIMINATING AN EFFECTS-BASED RULE THAT REDUCES COSTS OF DECISION ERRORS AND THEN JUST SAY THAT (18), (19) IS EQUIVALENT TO (24).

The key message from Results 1 and 2 is that there is no great virtue in having the kind of blanket certainty that comes with a *Per Se* Rule as compared to the more conditional decision making of an *Effects-Based* approach which bases its decision on additional evidence collected about each case – even though it is incomplete. Put somewhat crudely, it is better to be uncertainly right rather than to be certainly wrong. [I

DO NOT THINK THIS IS THE RIGHT PLACE TO SAY THIS: EFFECTS – BASED IS NOT ACCUSED OF BEEN INFERIOR TO PER SE ON THE BASIS OF DECISION ERROR COMPARISONS. WE HAVE TO SAY THIS WHEN WE COMPARE WELFARE LEVELS].

#### 4. Decisions by Agents and Deterrence Effects

We will consider three different information scenarios for which we will undertake welfare comparisons between the *Per Se* and *effects-based* standards. First we will describe here the implications of these scenarios for decisions by agents and deterrence effects.

##### 1. Transparent Criterion & Nature of Test – Decision Relevant Characteristics Observable by Agents Themselves

In this situation we assume that:

- (i) the fact that the Authority is basing its decision on an  $x$ -test and the precise value,  $\hat{x}$ , and nature of the test is common knowledge;
- (ii) all agents know their own value of the characteristic ( $x$ ) that will lead the CA to make its decision

It follows that all agents know with certainty how their actions will be treated by the Authority and so, even though the Authority is using an *Effects-Based* approach, there is no *Legal Uncertainty*.

In particular a fraction  $p_H(\hat{x})$  of agents whose actions are harmful and a fraction  $1 - p_B(\hat{x})$  of agents whose actions are benign will know for sure that their actions will be disallowed and so will not take them, irrespective of the value of  $b$ . On the other hand a fraction  $1 - p_H(\hat{x})$  of agents whose actions are harmful and a fraction  $p_B(\hat{x})$  of agents whose actions are benign will know for sure that their actions will be allowed and so will take them, again irrespective of the value of  $b$ .

## 2. Transparent Criterion Based On Characteristic Unobservable by Agents Themselves – Nature of Test Not Fully Revealed

Now, as in K&U (2008a):

- Authority is basing its decision on an  $x$ -characteristic and the precise value,  $\hat{x}$ , is common knowledge though firms do not know the precise nature of the test (e.g. the decision relevant characteristic may be market share but firms do not how the Authority will define the relevant market);
- Firms do not know the values of the underlying characteristics  $(x, y)$  which make their actions harmful or benign;
- Firms know whether their conduct is harmful or benign;
- Firms know enough about how the Authority will assess their conduct, that they calculate/perceive the probability of the Authority's making Type I and Type II errors.

In this situation we assume that:

- (i) The fact that the Authority is basing its decision on an  $x$ -test and the precise value,  $\hat{x}$  of the test is common knowledge;
- (ii) While agents know their type,  $H$  (resp.  $B$ ), they no longer know the value of their  $(x, y)$ . Instead all they know is that this is uniformly distributed within the set  $H$  (resp.  $B$ ). But knowing  $\hat{x}$  they can therefore calculate the probability  $p_H(\hat{x})$  (resp.  $1 - p_B(\hat{x})$ ) of their action being disallowed. To put it another way, agents know their type and they are also able to correctly anticipate how the authority will assess their conduct. Note that in this case, *effects-based* introduces **Legal Uncertainty** (LU) in the sense of firms been *unable to predict with certainty* whether their actions will be allowed or disallowed.

Thus if  $\delta_e, e = H, B$  is the probability of an action of type  $e$  being disallowed where  $\delta_H = p_H(\hat{x})$  and  $\delta_B = 1 - p_B(\hat{x})$ , a fraction of firms  $F_e = F(\underline{b}_e)$  of type  $e$  will now be deterred if an *effects-based* rule is adopted, where  $\underline{b}_e$  is defined by:

$$(1 - \delta_e)b - \delta_e f = 0 \quad (25)$$

### 3. Opaque Criterion – Nature of Test and Decision Relevant Characteristics Unobservable to Firms

Here we assume that:

- (i) While authority is using a test based on the criterion  $\hat{x}$  this and the nature of the test are unknown to agents who do not know by what process the Authority makes its decision;
- (ii) Once again agents know their type, but they do not know their value of  $(x, y)$ .
- (iii) In addition now, because of the opaqueness of the rule they are incapable of working out the probabilities  $p_H(\hat{x})$  (resp.  $1 - p_B(\hat{x})$ ) of having their action disallowed. Instead the only thing that agents know that will enable them to decide whether to take the action is the average probability  $\lambda(\hat{x})$  by which actions are being disallowed by the Authority, where

$$\lambda(\hat{x}) = \gamma p_H(\hat{x}) + (1 - \gamma) \cdot [1 - p_B(\hat{x})]$$

Compared to the second scenario, under which agents are able to correctly anticipate exactly how the authority will assess their conduct<sup>9</sup>, under the third scenario we assume that the Authority adopts forms of *effects-based* procedures associated with the discretionary application of different models on a case-by-case basis. We use the term ***Rule-of-Reason*** to describe these procedures. This leads to agents not being able to infer how the Authority will assess their conduct – firms will only be able to deduce from the Authority's enforcement record the average likelihood of having their actions disallowed.

---

<sup>9</sup> Though they are unable to predict with certainty whether their actions will be allowed or disallowed (as they can under the first scenario).

It will be on the basis of this average likelihood that their action will be disallowed that agents will have to decide whether or not to undertake the action. The deterrence that is thus generated, under *Rule of Reason* procedures, we will term *average deterrence*<sup>10</sup> – to distinguish this case from the case of *marginal deterrence* generated under the second scenario.

Thus, under the third scenario the value of  $b$  below which agents will be deterred from taking the action will be given by the value of  $b$  for which:

$$(1 - \hat{\lambda}(x))b - \hat{\lambda}(x)f = 0 \quad (26)$$

So, if this is  $\underline{b}(\lambda)$ , the fraction of agents deterred will be

$$F(\lambda) = F(\underline{b}(\lambda)).$$

Note that since

$$1 - p_B(\hat{x}) < \hat{\lambda}(\hat{x}) < p_H(\hat{x}) \quad (27)$$

for as long as  $p_B(\hat{x}) + p_H(\hat{x}) > 1$ , it follows that

$$F_B(\hat{x}) < F(\hat{\lambda}(\hat{x})) < F_H(\hat{x}) \quad (28)$$

## 5. Welfare Comparisons

### *Per Se*

If the Authority adopts *Per Se* enforcement procedures then all agents will recognise that if actions are *Presumptively Legal* they will be allowed and since their private benefit from taking the action is  $b > 0$ , they will all take the action thereby generating social welfare

$$W^{PSL} = -\bar{h} > 0 \quad (29)$$

On the other hand if actions are *Presumptively Illegal* they will all be disallowed so no agent will take the action thereby generating social welfare:

---

<sup>10</sup> See also K&U (2008a, b) and Immordino & Polo (2008).

$$W^{PSI} = 0. \quad (30)$$

### ***Comparison of Per Se with Effects-based - Scenario 1***

Welfare under the first effects-based scenario is:

$$W^{EB1} = \int_0^{\hat{x}} \left[ \int_0^1 h(x, y) dy \right] dx$$

Or:

$$W^{EB1} = \gamma[(1 - p_H(\hat{x}))(-\bar{h}_{HA}(\hat{x})) + (1 - \gamma)p_B(\hat{x})(-\bar{h}_{BA}(\hat{x}))] \quad (31)$$

Thus:

$$W^{EB1} - W^{PSL} = W^{EB1} - (-\bar{h})$$

where from (3) and (10):

$$\bar{h} = \gamma p_H \bar{h}_{HD} + \gamma(1 - p_H)\bar{h}_{HA} + (1 - \gamma)p_B \bar{h}_{BA} + (1 - \gamma)(1 - p_B)\bar{h}_{BD}$$

So we have:

$$W^{EB1} - W^{PSL} = [\gamma p_H \bar{h}_{HD} - (1 - \gamma)(1 - p_B)(-\bar{h}_{BD})] \quad (32)$$

Thus we have:

### **Result 3**

If the *effects-based* procedure can effectively discriminate then under the first information scenario it will welfare dominate *Per Se* (since, from Result 1, the term on the RHS in (32) above will be positive). Since  $W^{PSI} = 0$  we can say that, in this case, *effects-based* welfare dominates *Per Se* irrespectively of whether actions are presumptively legal or illegal.

### ***Comparison of Per Se with Effects-based - Scenario 2***

Welfare with *effects-based* procedures under the second scenario will be:

$$W^{EB2} = \gamma[(1 - p_H(\hat{x}))(-\bar{h}_{HA}(\hat{x}))(1 - F_H) + (1 - \gamma)p_B(\hat{x})(-\bar{h}_{BA}(\hat{x}))(1 - F_B)] \quad (38)$$

Welfare under *Per Se Legality* and *Per Se Illegality* is given by (29) and (30), respectively.

Consider two cases:

Case 1 *Presumptive Legality*

If actions are presumptively legal then under *Per Se* a *Per Se Legality* standard would be used and

$$W^{EB2} - W^{PSL} = W^{EB2} - (-\bar{h}) \quad (39)$$

where from (3) and (10):

$$\bar{h} = \gamma p_H \bar{h}_{HD} + \gamma(1 - p_H) \bar{h}_{HA} + (1 - \gamma) p_B \bar{h}_{BA} + (1 - \gamma)(1 - p_B) \bar{h}_{BD} \quad (40)$$

So we have:

$$\begin{aligned} W^{EB2} - W^{PSL} &= [\gamma p_H \bar{h}_{HD} - (1 - \gamma)(1 - p_B)(-\bar{h}_{BD})](1 - F_B) \\ &\quad + \bar{h} F_B \\ &\quad + (F_H - F_B)[\gamma(1 - p_H) \bar{h}_{HA} + (1 - \gamma) p_B (-\bar{h}_{BA})] \end{aligned} \quad (41)$$

Given Result 1, if the effects-based procedure used by the Authority is effectively discriminating the square brackets on the first RHS term (the *cost of decision error effect*) is positive: *effects-based* procedures raise welfare by reducing decision errors. The second term (*absolute deterrence effect*) is negative, while the third (*differential deterrence effect*) is positive<sup>11</sup>.

Case 2 *Presumptively Illegal*

If actions are presumptively illegal then under *Per Se* a *Per Se Illegality* standard would be used and

$$W^{EB2} - W^{PSI} = W^{EB2} \quad (42)$$

So we have:

$$\begin{aligned} W^{EB2} - W^{PSI} &= [(1 - \gamma) p_B (-\bar{h}_{BA}) - \gamma(1 - p_H) \bar{h}_{HA}](1 - F_B) \\ &\quad + (F_H - F_B) \gamma(1 - p_H) \bar{h}_{HA} \end{aligned} \quad (43)$$

Equations (41) and (43) suggest the following result:

**Result 4**

---

<sup>11</sup> For a full discussion see Katsoulacos and Ulph (2008a).

- (i) Even though *effects-based* procedures may introduce Legal Uncertainty (LU) in the sense of firms been unable to predict with certainty whether their actions will be allowed or disallowed, nevertheless if these procedures are *effectively discriminating* they may well be welfare improving relative to *Per Se*. So there is no great virtue in reducing legal uncertainty in this sense: been certainly wrong (in a number of cases) may be welfare inferior to been uncertainly right.
- (ii) Effectively discriminating *effects-based* procedures always welfare dominate *Per Se* rules for presumptively illegal actions<sup>12</sup>.

### ***Comparison of effects-based scenarios 1 and 2***

We can also compare the two effects-based scenarios considered above. We get:

$$W^{EB1} - W^{EB2} = [(1 - \gamma)p_B(-\bar{h}_{BA}) - \gamma(1 - p_H)\bar{h}_{HA}] \cdot F_B - (F_H - F_B)\gamma(1 - p_H)\bar{h}_{HA} \quad (44)$$

This leads to:

### **Result 5**

Even though under an *effects-based* procedure there is legal uncertainty (as under the second information scenario above), it may be welfare superior to an *effects-based* procedure that does not create legal uncertainty (as under the first information scenario above). This will be true if the fraction of harmful actions being deterred when *effects-based* creates legal uncertainty is much higher than the fraction of benign actions deterred and the latter is quite small. Intuitively, legal certainty has a cost: it leads to too many of the harmful actions to be undertaken. While a procedure that creates legal uncertainty leads to too few benign actions been undertaken, if it is sufficiently good in discriminating, so it deters many more harmful than benign actions, it will increase welfare.

---

<sup>12</sup> This need not however hold in a more general model in which the Authority can only investigate a fraction of the actions and there are delays in its decision-making – see K&U (2008a, b).

### Comparison of Per Se with Effect-based - Scenario 3

Welfare with *effects-based* procedures under the third scenario will be:

$$W^{EB3} = \gamma[(1 - p_H(\hat{x}))(-\bar{h}_{HA}(\hat{x}))(1 - F(\lambda)) + (1 - \gamma)p_B(\hat{x})(-\bar{h}_{BA}(\hat{x}))(1 - F(\lambda))] \quad (45)$$

where

$$F(\lambda) = F(\underline{b}(\lambda(\hat{x})))$$

and

$$\underline{b}(\lambda(\hat{x}))$$

is defined by (26).

Welfare under *Per Se Legality* and *Per Se Illegality* is given by (29) and (30), respectively.

Consider again the two cases:

Case 1 *Presumptive Legality*

In this case

$$W^{EB3} - W^{PSL} = [\gamma p_H \bar{h}_{HD} - (1 - \gamma)(1 - p_B)(-\bar{h}_{BD})](1 - F(\lambda)) + \bar{h}F(\lambda) \quad (46)$$

Case 2 *Presumptively Illegal*

In this case

$$W^{EB3} - W^{PSI} = [(1 - \gamma)p_B(-\bar{h}_{BA}) - \gamma(1 - p_H)\bar{h}_{HA}](1 - F(\lambda)) \quad (47)$$

### Result 6

- (i) The legal uncertainty introduced by an *effects-based* procedure under the third information scenario above, reduces considerably the likelihood that *effects-based* will dominate *Per Se* for presumptively legal actions. Comparing (41) to (46) we see that this is due to the *average deterrence* effect under the third scenario: benign and harmful actions are equally deterred in the third scenario. This tends to reduce welfare relative to a procedure that deters a greater fraction of harmful

than benign actions in three ways: because a greater fraction of benign actions is deterred the positive decision error effect is diminished; the negative absolute differential effect is enhanced; the positive differential deterrence effect disappears.

- (ii) On the other hand, from (47) we see that even in this case, effectively discriminating *effects-based* procedures welfare dominate *Per Se* rules for presumptively illegal actions.

From Results 4 and 6 it is worth stating the following corollary:

### **Corollary**

Irrespective of the information available to agents, *effects-based* procedures are preferable to *Per Se* procedures for presumptively illegal actions.

### ***Comparison of effects-based scenarios 2 and 3***

The welfare cost of average deterrence can be seen more clearly by comparing welfare under the *effects-based* scenarios 2 and 3.

$$W^{EB2} - W^{EB3} = [\gamma(1 - p_H)\bar{h}_{HA}][F_H - F(\lambda)] + [(1 - \gamma)p_B(-\bar{h}_{BA})][F(\lambda) - F_B] \quad (48)$$

Thus, given (28):

### **Result 7**

$W^{EB2} - W^{EB3} > 0$ : *Rule-of-reason* procedures that lead to an average deterrence effect reduce welfare relative to *effects-based* procedures in which agents are able to infer how the Authority will assess their conduct.

## REFERENCES

Ahlborn C, D Evans and Padilla J (2008) “Unilateral Practices, Antitrust rules and Judicial Review”, mimeo.

Christiansen, A. and W. Kerber (2006) “Competition Policy with Optimally Differentiated Rules Instead of “Per Se Rules Vs. Rule of Reason””, *Journal of Competition Law and Economics* 2(2), 215-244.

Immordino G and M Polo (2008) “Judicial Errors and Innovative Activity”, mimeo.

Katsoulacos Y. (2008) “Optimal Legal Standards for Refusals to license Intellectual Property: an Welfare Based Analysis” *Journal of Competition Law and Economics*.

Katsoulacos Y. and D. Ulph (2008a) “On Optimal Legal Standards for Competition Policy: A General Welfare-Based Analysis”, see [www.cresse.info](http://www.cresse.info) (Publications) Forthcoming in *Journal of Industrial Economics*.

Katsoulacos Y. and D. Ulph (2008b) “On Optimal Legal Standards for Competition Policy When Firms Do Not Know the Welfare Implications of their Actions”, Discussion Paper 190, Athens University of Economics & Business, see [www.cresse.info](http://www.cresse.info) (Publications).

Katsoulacos Y. And Ulph D. (2008c) “Optimal Enforcement Structures for Competition Policy”, mimeo.

Kokkoris I and I. Lianos (Eds) (2008), “*The Reform of EC Competition Law*”, Kluwer Publishers.

Schinkel, M.P. and J. Tuinstra, (2006), “Imperfect competition law enforcement”, *International Journal of Industrial Organisation*, **24**, 1267-1297.

Sorgard Lars (2008) “Optimal Merger Policy”, mimeo.

Will, B.E. and D. Schmidtchen (2008), “Fightng Cartels: Some Economics of Council Regulation (EC) 1/2003”, CSLE Discussion Paper, No. 2008-02

Vickers J. (2007), *Economics and the Competition Rules*, Speech delivered to the British Institute of International and Comparative Law.