

“Optimal Enforcement Procedures and Penalties under Legal Uncertainty and a Total Welfare Substantive Standard”¹

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Abstract

The objective of this paper is to extend the analysis of Katsoulacos and Ulph (2014 and 2015) concerning the treatment of the implications for welfare of legal uncertainty to the case where the substantive standard of Competition Authorities is that of Total Welfare (rather than that of Consumer Surplus).

Keywords: competition law enforcement, consumer surplus standard, decision errors, legal uncertainty, optimal penalties, total welfare standard.

JEL: K4, L4, K21, K23

1. Introduction

It is widely argued that when deciding the type of procedures to be used in competition law enforcement a very important consideration is that of legal uncertainty. Legal uncertainty is defined as the inability of economic agents (firms) to correctly predict whether their action will be judged by Competition Authorities as socially benign – and be allowed – or as socially harmful – and be disallowed and potentially be subject to penalties.

The issue of legal uncertainty has attracted attention in recent years for two main reasons. The first has to do with the fact that certain enforcement procedures are advocated as being superior because they generate lower levels of legal uncertainty⁵. The second reason is that many authors argue that in terms of legal perspective the imposition of fines requires the Authorities to act in accordance to the principal of *nulla poena sine lege certa*⁶. However, in practice, we have seen record fines to be imposed on antitrust cases that cannot be characterized as *per se* illegal in Competition Law⁷.

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⁵ In terms of competition policy enforcement this has been interpreted as adopting Per Se rather than Effects-Based procedures.

⁶ Translation: no penalty unless there is certainty under the Law.

⁷ For example: Microsoft Corp vs Commission (2007), Intel case (2009)

Traditional literature distinguishes three potential sources of legal uncertainty faced by firms: uncertainty about (a) the liability standard⁸, (b) the type of the action and whether it is harmful or benign and (c) the decision errors that will be made by the Authority. In this paper we focus on the last two sources of legal uncertainty. The absence or existence of the last two sources of legal uncertainty can create three different information environments:

- A) No legal uncertainty: when firms know the decision by the Authority and may or may not know the type of their action
- B) Partial legal uncertainty: when firms know whether their action is harmful or benign but do not know the decision by the Authority
- C) Complete Legal Uncertainty: When firms know neither the type of their action nor the decision by the Competition Authority.

Very important papers in the Law and Economics literature that also examine the implications of legal uncertainty and closest in spirit to our work are the papers by Kaplow (1990, 1995) and Kaplow and Shavell (1992). Our recent research on legal uncertainty (Katsoulacos and Ulph (2014, 2015)) addresses some very important differences to these papers that are also present in the current work. So in Kaplow (1990 and 1995) only one dimension of legal uncertainty is incorporated, that of agents not knowing the true type of their actions. In Kaplow and Shavell (1992) as in our work, both two last types of legal uncertainty are incorporated. Also in Kaplow (1990) it is assumed that there is only a fixed penalty the optimal value of which is related to harm although in our work we use a more general sanction structure that allows for both a penalty that is proportional to the private gain and also a fixed part, to capture respectively both deterrence objectives and the objective to penalize the firm for the social harm its action has caused. A very important difference of these papers and our work is that, although for the policy enforcement issues addressed in these papers it is natural to assume that all potential actions undertaken by firms are non-benign, this is certainly not the case for the sort of business practices dealt with by Competition Law. In the Context of Competition Law we have to allow that there are actions that can be either harmful or benign, and that the assessment of both of these types of actions by Competition Authorities is subject to decision errors. So in the framework suggested by our research the Competition Authority can make either false acquittals (Type II errors) or false convictions (Type I errors), while the analysis by Kaplow and Shavell neglect the possibility of Type I errors.

Katsoulacos and Ulph (2014 and 2015) also differs from Kaplow and Shavell in terms of the substantive standard used by the social authority. So while in the above papers the substantive standard used by the social authority is that of total welfare, in Katsoulacos and Ulph (2014 & 2015) the standard that is used is the consumer surplus standard, as this is the standard adopted by most Competition Authorities. However, a large literature has been developed arguing that the ultimate objective of competition policy should be the maximization of total welfare⁹ and many economists invite Competition Authorities to move towards the adoption of a total welfare standard.

In the current paper we investigate the effects of legal uncertainty on welfare when the substantive standard used by Competition Authorities is the total welfare standard and compare with the respective results under a consumer surplus standard. Moreover, we present Kaplow's (1990) results as subcases of this paper (for no Type I errors).

⁸ Liability standard is the threshold rule that is used by competition authorities in order to assess whether an action must be characterized as harmful or benign.

⁹ See for example Carlton (2007)

Our results show that the optimal level of penalties can be achieved by choosing to impose only a fixed part of penalties under a total welfare standard and only a proportional penalty on private benefit under a consumer surplus standard. Under a total welfare standard the penalty imposed under partial legal uncertainty will be higher than the penalty under no legal uncertainty which in turn will be higher than complete legal uncertainty. The first part of this comparison contrasts with the principle of *nulla poena sine lege certa*. The result is even stronger under a consumer surplus standard where we show that the proportion of private benefit that will be paid as a penalty will be higher under complete legal uncertainty, less under partial legal uncertainty and even lower under no legal uncertainty. We also show that while there is no problem in achieving first best penalties and outcome under a consumer surplus standard and partial legal uncertainty; this can only be achieved for a total welfare standard under the assumption that there are no false convictions (as in Kaplow 1990). We characterize the second best optimal penalty under a total welfare standard for the case of partial legal uncertainty when we do not make the assumption of no false convictions. Finally, our results below show that, while there is a clear welfare ranking of different information structures under a consumer surplus standard when penalties are optimally chosen, under a total welfare standard welfare will be higher under no legal uncertainty than under complete legal uncertainty but at this level of generality it is impossible to tell whether under partial legal uncertainty welfare is greater or less than that under no legal uncertainty.

In relation to the results obtained previously, specifically by Kaplow (1990) we show that these do depend on the assumptions that there are no false convictions and that benign actions do not confer benefits to others. If these assumptions are relaxed the results cease to hold.

The structure of the paper is as follows: Section 2 presents the basic set-up of the model. Section 3 describes the 3 different information structures that can emerge according to our assumptions. In section 4 we derive the optimal penalties and welfare under different information structures for total welfare and consumer surplus standards and present the comparisons and main propositions of the analysis. Section 5 concludes.

2. Preliminaries

There is a population of agents that each may take some action. Actions chosen can be of two types: harmful or benign. If an action is harmful it creates per capita harm to others $H > 0$ and if it is benign it creates per capita benefit to others $B \geq 0$. Let θ , $0 < \theta < 1$ denote the proportion of agents whose acts, if committed, are harmful. We assume throughout that the class of actions with which we are concerned is on average harmful to others¹⁰, i.e.:

$$\bar{H} = \theta H - (1 - \theta)B > 0 \quad (1)$$

Each agents that decides to take an action, in the absence of any intervention from an enforcement authority, earns private benefit b . We assume that private benefit is distributed across firms in a way that is independent of whether action is of harmful type according to the distribution function $f(b) > 0, \forall b$, which is continuous on $[0, \infty)$.

¹⁰ In Katsoulacos and Ulph (2009) we call such acts *presumptively illegal*

There is an Authority that investigates a proportion π , $0 < \pi < 1$, of the actions that are taken, independent of whether or not the action is actually harmful. We refer to π as the coverage rate. If the Authority deems the action to be harmful, imposes a penalty that takes the form $s = \sigma + \phi b$ and the parameters σ, ϕ can vary across information structures. Decisions by the Authority may be subject to Type I (false convictions) and Type II (false acquittals) errors. We denote by p_H , $0 \leq p_H \leq 1$ the probability that, if investigated, a harmful action will be deemed harmful and a sanction will be imposed; by p_B , $0 \leq p_B \leq 1$ is the probability that, if investigated, a benign action will be deemed benign and no sanction will be imposed. We assume that the test used by the authority to determine whether or not an action is harmful has *discriminatory power*, i.e.: $p_B + p_H > 1$. This is equivalent to

$$p_H > 1 - p_B, \quad (2)$$

and

$$p_B > 1 - p_H. \quad (2')$$

We assume that the values of θ, π, p_B, p_H are common knowledge. This assumption rules out the possibility that agents might have a biased estimate of the true proportion of harmful actions – a possibility explored by Kaplow (1990)¹¹. We rule this possibility out because we want to focus on *legal* uncertainty - what individuals know about how their action will be treated under the law.

Let

$$\bar{H}_H = \frac{\theta p_H H - (1 - \theta)(1 - p_B)B}{\theta p_H + (1 - \theta)(1 - p_B)}; \quad \bar{H}_B = \frac{\theta(1 - p_H)H - (1 - \theta)p_B B}{\theta(1 - p_H) + (1 - \theta)p_B} \quad (3)$$

be, respectively, the *conditional* average harm to others of actions that, having been investigated, are deemed to be harmful and on which a sanction will be imposed; and the *conditional* average harm to others of actions that, having been investigated, are deemed not to be harmful and on which no sanction will be imposed.

The final assumption we make is the test used by the authority to determine whether or not an action is harmful can *effectively discriminate*, i.e.:

$$0 > \bar{H}_B, \quad (4)$$

which is equivalent to

$$\frac{p_B}{1 - p_H} > \frac{\theta H}{(1 - \theta)B} > 1, \quad (5)$$

where the second inequality in (5) follows from (1). The LHS of (5) is a measure of the discriminatory power of the test used by the authority, and the restriction in (5) can be interpreted as saying that this must be greater than the *strength of the presumption of illegality*¹².

Clearly (5) is a stronger restriction on the discriminatory power of the test than (2'). It is straightforward to see that (4), (1) and (2) imply:

¹¹ We concentrate on this paper, though Kaplow's contributions, as we mentioned in the Introduction section, in the literature of Law and Economics are numerous – some are shown in the References.

¹² Katsoulacos & Ulph (2009)

$$\overline{H}_H > \overline{H} > 0. \quad (6)$$

Kaplow (1990) explicitly assumes that an action will be deemed to be harmful if and only if it actually is harmful, and so effectively assumes $p_H > 0$, $p_B = 1$. This is consistent with our assumption (2) – equivalently (2’).

He also does not seem to recognise any positive benefits to others from actions that are benign, so effectively assumes that $B = 0$. Given his assumptions it follows that $\overline{H}_H = H > 0 > \theta H = \overline{H}$. Consequently, both (1) and (6) are certainly satisfied in his model.

However in his framework $\overline{H}_B > 0$ and so neither (4) nor the first inequality in (5) can hold.

3. Information Structures

We assume that there are *two* different things that agents may or may not know at the time they are deciding to take the action:

- They may or may not know whether the action they are taking is harmful or benign
- They may or may not know whether their action will be deemed to be harmful or benign, were it to be investigated.

Now the probability that an action will be deemed to be harmful is $\theta p_H + (1 - \theta)(1 - p_B)$ while the probability that it is deemed to be benign is $\theta(1 - p_H) + (1 - \theta)p_B$. Consequently the probability that

an action deemed to be harmful is in fact genuinely harmful is $p_H^H = \frac{\theta p_H}{\theta p_H + (1 - \theta)(1 - p_B)}$ while

the probability that an action deemed to be benign is genuinely benign is

$$p_B^B = \frac{(1 - \theta)p_B}{\theta(1 - p_H) + (1 - \theta)p_B}.$$

So if we strengthen our previous assumptions about p_H and p_B to now assume that they now lie strictly between 0 and 1 – i.e.

- p_H , $0 < p_H < 1$ is the probability that, if investigated, a harmful action will be deemed harmful and a sanction imposed;
- p_B , $0 < p_B < 1$ is the probability that, if investigated, a benign action will be deemed benign and no sanction imposed;

Then it follows that $0 < p_H^H < 1$; $0 < p_B^B < 1$, so it is perfectly possible that an agent could know for sure whether their action would be **deemed** to be harmful (resp. benign) and still not know for sure whether it **genuinely** is harmful or benign.

Accordingly there are 4 logically possible information structures that can arise.

- (i) Agents know for sure both whether their action is **genuinely** harmful or benign and also know for sure whether, if investigated, it will be **deemed** to be harmful or benign.
- (ii) Agents know for sure whether their action is **genuinely** harmful or benign but do not know for sure whether, if investigated, it will be **deemed** to be harmful or benign.
- (iii) Agents do not know for sure whether their action is **genuinely** harmful or benign but do know for sure whether, if investigated, it will be **deemed** to be harmful or benign.
- (iv) Agents neither know for sure whether their action is **genuinely** harmful or benign nor know for sure whether, if investigated, it will be **deemed** to be harmful or benign

However we are interested in how anticipated penalties affect agents' decisions as to whether or not to take the action and hence the total welfare arising from these decisions. Since all that matters to agents in deciding whether or not to take an action is the probability of being investigated and the probability that, if investigated, the action will be deemed harmful, then it follows that if agents know for sure whether or not their action will be deemed to be harmful or benign it is not going to matter for either behaviour or welfare whether or not they know if their action is genuinely harmful.

Consequently there are just **three** relevant information structures to consider:

- O) *No Legal Uncertainty*: Here agents know for sure whether, if investigated, their action will be **deemed** to be harmful or benign but may or may not know for sure whether their action is **genuinely** harmful or benign
- P) *Partial Legal Uncertainty*: Here agents do NOT know for sure whether, if investigated, their action will be **deemed** to be harmful or benign, but DO know for sure whether their action is **genuinely** harmful or benign.
- C) *Complete Legal Uncertainty*: Here agents NEITHER know for sure whether, if investigated, their action will be **deemed** to be harmful or benign NOR do they know for sure whether their action is **genuinely** harmful or benign

4. Optimal Penalties and Welfare under different Information Structures

Following Kaplow, in this section we assume that, at the time it imposes the penalty, the Tribunal is able to determine what information was available to agents taking the action and can impose a different penalty regime depending on the information structure under which agents were acting.

We are interested in how the optimal penalty regime and the associated level of welfare vary across the different information structures.

Following Kaplow we assume that the factors determining what agents know are independent of the underlying factors determining the fraction of harmful actions etc. Formally,

Assumption. The model parameters $H, B, \theta, \pi, f(b), p_B, p_H$ are the same across all information structures.

In his paper Kaplow uses a total welfare standard – one that combines the private benefit to the agent taking the action plus the *external* harm/benefit that the action causes to others. In the context of competition policy this would be captured by the impact of the action on consumer surplus. However

competition authorities often focus solely on the impact of an action on consumer surplus when determining whether or not the action is harmful.

In this paper we will examine the impact of different information structures on penalty regimes and welfare using both welfare standards¹³.

We begin by determining the optimal penalties and the associated levels of welfare in the various information structures, and then we undertake a comparison.

4.1 Derivation of optimal penalties and welfare in various information structures

0) No Legal Uncertainty

As it is also explained in our previous work, it is not true that when there are decision errors there will be legal uncertainty in the standard sense defined above, since firms may be able to perfectly predict the judgement of their action by Competition Authorities, irrespective of whether they are aware of the true nature of their action. In this section we examine exactly the case in which although decision errors are present there is no legal uncertainty faced by the firms.

When there is no legal uncertainty a proportion θ of actions are harmful, and, of these, a fraction p_H of the agents taking them will know for sure that, if investigated, their action will be deemed harmful and a penalty will be imposed. So expected net profit in their case is $b - \pi(\sigma + \phi b) = (1 - \pi\phi) \left(b - \frac{\pi\sigma}{1 - \pi\phi} \right)$ and an agent will take the action only if this is positive, generating net gain $b - H$ for society under a total welfare standard and a net gain $-H$ under a consumer surplus standard. The remaining fraction $(1 - p_H)$ of the agents will know for sure that, if investigated their action will be deemed benign and no sanction will be imposed, so they expect net profit b and will always take the action again generating net gain $b - H$ for society under a total welfare standard and a net gain $-H$ under a consumer surplus standard.

A proportion $(1 - \theta)$ of actions are benign, and, of these a fraction $(1 - p_B)$ of the agents taking them will know for sure that, if investigated, they will be deemed harmful and the sanction will be imposed. So expected net profit is $b - \pi(\sigma + \phi b) = (1 - \pi\phi) \left(b - \frac{\pi\sigma}{1 - \pi\phi} \right)$ and an agent will take the action only if this is positive, generating a net gain $b + B$ for society under a total welfare standard and a net gain B under a consumer surplus standard. The remaining fraction p_B of the agents will know for sure their action will be deemed benign and no penalty will be imposed so they expect net profit b and will always take the action again generating net gain $b + B$ for society under a total welfare standard and a net gain B under a consumer surplus standard.

Let

¹³ To focus solely on the impact on both penalties and welfare of what agents know (information structures) we assume for notational simplicity that the underlying model parameters are the same across the two different welfare standards. There is no loss of generality in doing so, because all the comparisons we make are across information structures keeping the welfare standard constant.

$$\underline{b}^0 = \frac{\pi\sigma}{1-\pi\phi}, \quad (7)$$

be the minimum value of private benefit above which action will be taken.

Then welfare under a total welfare standard is:

$$TW^0 = \theta \left[p_H \int_{\underline{b}^0}^{\infty} (b-H) f(b) db + (1-p_H) \int_0^{\infty} (b-H) f(b) db \right] + \\ (1-\theta) \left[p_B \int_0^{\infty} (b+B) f(b) db + (1-p_B) \int_{\underline{b}^0}^{\infty} (b+B) f(b) db \right]$$

while under a consumer surplus standard it is

$$CS^0 = \theta \left[p_H \int_{\underline{b}^0}^{\infty} (-H) f(b) db + (1-p_H) \int_0^{\infty} (-H) f(b) db \right] + \\ (1-\theta) \left[p_B \int_0^{\infty} B f(b) db + (1-p_B) \int_{\underline{b}^0}^{\infty} B f(b) db \right]$$

We have:

$$\frac{dTW^0}{d\underline{b}^0} = f(\underline{b}^0) [\theta p_H + (1-\theta)(1-p_B)] (\overline{H}_H - \underline{b}^0); \quad (8) \\ \frac{dCS^0}{d\underline{b}^0} = f(\underline{b}^0) [\theta p_H + (1-\theta)(1-p_B)] \overline{H}_H$$

Proposition 1. Under No Legal Uncertainty, penalty structures σ, ϕ that produce maximum welfare¹⁴ are:

- (i) $\hat{\phi}^0 = 0$; $\hat{\sigma}^0 = \frac{\overline{H}_H}{\pi} > 0$ under a total welfare standard;
- (ii) $\hat{\phi}^0 = \frac{1}{\pi}$; $\hat{\sigma}^0 = 0$ under a consumer surplus standard.

Proof:

- (i) Insert the stated values of the penalty parameters σ, ϕ into (8) and we find $\underline{b}^0 = \overline{H}_H$, which, from first part of (8) is the required value to maximise welfare.
- (ii) Insert the stated values of the penalty parameters σ, ϕ into the expression for expected net profits $b - \pi(\sigma + \phi b) = (1 - \pi\phi) \left(b - \frac{\pi\sigma}{1 - \pi\phi} \right)$ and we see that these are zero. So, as required, this penalty deters every agent that knows for sure that their action will be deemed harmful from taking the action.

¹⁴ These may not be the only values of σ, ϕ that are consistent with achieving maximum welfare

So, given our assumption (4) under a consumer surplus standard it will be optimal to set penalties to deter from taking the action everyone who knows for sure that, if investigated, their action will be deemed to be harmful.

The intuition is as follows. The only agents whose decisions will be influenced by penalties are those that know for sure that, if investigated, their acts will be deemed harmful. Given (6), on average these acts are indeed harmful. So, under a total welfare standard, penalties are set to deter from taking the act all those agents whose private benefit is less than the average harm; whereas, under a consumer surplus standard, penalties are set so as to deter all these agents from taking the action.

Corollary 1 The associated maximum welfare levels are:

$$\begin{aligned} \widehat{TW}^0 &= \theta \left[p_H \int_{\bar{H}_H}^{\infty} (b - H)f(b)db + (1 - p_H) \int_0^{\infty} (b - H)f(b)db \right] \\ &\quad + (1 - \theta) \left[p_B \int_0^{\infty} (b + B)f(b)db + (1 - p_B) \int_{\bar{H}_H}^{\infty} (b + B)f(b)db \right] \\ &= [\theta p_H + (1 - \theta)(1 - p_B)] \int_{\bar{H}_H}^{\infty} (b - \bar{H}_H)f(b)db + [\theta(1 - p_H) + (1 - \theta)p_B](\bar{b} - \bar{H}_B) \end{aligned} \quad (9)$$

under a total welfare standard, while under a consumer surplus standard it is

$$\begin{aligned} \widehat{CS}_0 &= \theta(1 - p_H) \int_0^{\infty} (-H)f(b)db + (1 - \theta)p_B \int_0^{\infty} Bf(b)db \\ &= [(1 - \theta)p_B B - \theta(1 - p_H)H] = -[\theta(1 - p_H) + (1 - \theta)p_B]\bar{H}_B \end{aligned}$$

Proof: Follows by inserting optimal penalty parameters into the corresponding expressions for welfare.

Again the intuition is clear. Under a total welfare standard, maximum welfare is the sum of two terms. The first is the fraction of actions that will be deemed harmful multiplied by the average net benefit (private benefit minus average harm to others) of such actions. This is positive since all actions where private benefit is less than average harm to others are deterred. The second term is the fraction of acts that will be deemed benign – all of which will be taken – multiplied by the average private plus social benefit of such acts. Under a consumer surplus standard all actions that will be deemed harmful to others are deterred, so consumer surplus arises only from the fraction of actions multiplied that will be deemed benign multiplied by the average net benefit to others that these confer.

P) Partial legal uncertainty

When there is partial legal uncertainty we assume that agents know whether their act is genuinely harmful or benign but do not know the assessment of their act by the Authority. In fact a proportion θ of agents have actions that would be harmful if taken, but all that these agents know about the decision that will be taken if their action is investigated is that there is a probability p_H that their action will be deemed harmful and have the sanction applied. So expected net profit in their case is $b - \pi p_H (\sigma + \phi b)$ and agents will take the action only if this is positive, generating a net welfare $b - H$, (resp. $-H$) under a total welfare (resp. consumer surplus) standard.

A proportion $(1 - \theta)$ of agents has actions that, if taken, would be benign, but all that these agents know about the decision that will be taken if their action is investigated is that there is a probability $(1 - p_B)$ that their action will be deemed harmful and a sanction applied. So net profit is $b - \pi(1 - p_B)(\sigma + \phi b)$ and so individuals will take the action only if this is positive, generating a net gain for society of $b + B$, (resp. B) under a total welfare (resp. consumer surplus) standard.

Let

$$\underline{b}_H^P = \frac{\pi p_H \sigma}{1 - \phi \pi p_H}; \quad \underline{b}_B^P = \frac{\pi(1 - p_B) \sigma}{1 - \phi \pi(1 - p_B)} \quad (10)$$

be the minimum values of private benefit above which the act will be taken by agents who know for sure their action is harmful (resp. benign).

So welfare is:

$$TW^P = \theta \int_{\underline{b}_H^P}^{\infty} (b - H) f(b) db + (1 - \theta) \int_{\underline{b}_B^P}^{\infty} (b + B) f(b) db \quad (11)$$

under a total welfare standard and

$$CS^P = \theta \int_{\underline{b}_H^P}^{\infty} (-H) f(b) db + (1 - \theta) \int_{\underline{b}_B^P}^{\infty} B f(b) db$$

under a consumer surplus standard.

We have:

$$\begin{aligned} \frac{\partial TW^P}{\partial \underline{b}_H^P} &= \theta f(\underline{b}_H^P)(H - \underline{b}_H^P); & \frac{\partial TW^P}{\partial \underline{b}_B^P} &= -(1 - \theta) f(\underline{b}_B^P)(\underline{b}_B^P + B) \\ \frac{\partial CS^P}{\partial \underline{b}_H^P} &= \theta f(\underline{b}_H^P)H; & \frac{\partial CS^P}{\partial \underline{b}_B^P} &= -(1 - \theta) f(\underline{b}_B^P)B \end{aligned}$$

IF the welfare maximising values of \underline{b}_H^P and \underline{b}_B^P could be freely chosen, then, under a total welfare standard, we would set: $\underline{b}_H^P = H$; $\underline{b}_B^P = 0$. In what follows refer to these as the **first-best** outcomes – the outcomes that could be achieved by a fully informed social planner who could potentially set a penalty on actions that are genuinely harmful that is different from that set on actions that are genuinely benign. Denote these by $\hat{\underline{b}}_H^{FB}$ and $\hat{\underline{b}}_B^{FB}$ respectively. Now if, as Kaplow assumes, $p_B = 1$ and $B = 0$ then, under a total welfare standard, there is no difficulty in achieving these outcomes under conditions of partial legal uncertainty since, from (10), $\underline{b}_B^P = 0$ whatever penalties are set, and the penalty just need to be set to achieve the first-best optimal value of \underline{b}_H^P .

Under a consumer surplus standard the optimal values of \underline{b}_H^P and \underline{b}_B^P would be $\hat{\underline{b}}_H^P = \infty$; $\hat{\underline{b}}_B^P = 0$. As we will show, **there are no problems in achieving the first best outcome under a consumer surplus standard.**

We have the following proposition.

Proposition 2. The values of \underline{b}_H^P and \underline{b}_B^P that would be optimal if these could be freely chosen¹⁵ can be achieved by setting:

- (i) $\hat{\phi}^P = 0$; $\hat{\sigma}^P = \frac{H}{p_H \pi}$ under a total welfare standard **but only if** $p_B = 1$;
- (ii) $\hat{\phi}^P = \frac{1}{p_H \pi}$; $\hat{\sigma}^P = 0$ under a consumer surplus standard.

Proof:

- (i) As noted if $p_B = 1$ then $\underline{b}_B^P = 0$ for all values of σ, ϕ . The stated values of σ, ϕ will then guarantee that $\underline{b}_H^P = H$.
- (ii) If $\hat{\phi}^P = \frac{1}{p_H \pi}$; $\hat{\sigma}^P = 0$ then the expected net private benefit for every individual whose action is harmful is zero and so no one will take the action. However the expected net private benefit for someone whose action is benign is $b \left[1 - \pi \hat{\phi}^P (1 - p_B) \right] = b \left[1 - \frac{(1 - p_B)}{p_H} \right] > 0$, where the last inequality follows from (2), so all harmful actions are deterred and all benign actions are taken.

Corollary 2 The associated levels of maximum welfare are:

$$\widehat{TW}^{FB} = \theta \int_H^\infty (b - H)f(b)db + (1 - \theta) \int_0^\infty (b + B)f(b)db$$

under a total welfare standard, and, under a consumer surplus standard:

$$\widehat{CS}^P = (1 - \theta) \int_0^\infty Bf(b)db = (1 - \theta)B$$

Proof: Follows by inserting optimal values of \underline{b}_H^P and \underline{b}_B^P into the corresponding expressions for welfare.

However, in this paper we assume $p_B < 1$. So, under a total welfare standard, it is no longer possible to achieve the first-best optimal values of \underline{b}_H^P and \underline{b}_B^P using the two penalty parameters σ, ϕ , since achieving $\underline{b}_B^P = 0$ would require $\sigma = 0$, while achieving $\underline{b}_H^P = H$ would require $\sigma > 0$. So we need to consider a second best setting where a social planner, not knowing whether an action is

¹⁵ In the case of a total welfare standard these are the first-best optimal levels.

genuinely harmful or benign, is constrained to set the same penalty parameters σ, ϕ on all actions. Setting these optimal second best penalty parameters will require balancing off the costs of having a value of \underline{b}_B^P that is higher than its first-best level, against the costs of having a value of \underline{b}_H^P that is below its first best level.

To analyse this problem, set $\phi = 0$ and consider the optimal second-best choice of $\sigma \geq 0$. We can write

$$TW^P(\sigma) = \theta \int_{\pi p_H \sigma}^{\infty} (b - H) f(b) db + (1 - \theta) \int_{\pi(1-p_B)\sigma}^{\infty} (b + B) f(b) db$$

We then have:

$$\frac{dTW^P(\sigma)}{d\sigma} = \pi \left\{ \theta p_H f(\underline{b}_H) (H - \underline{b}_H) - (1 - \theta) (1 - p_B) f(\underline{b}_B) (\underline{b}_B + B) \right\} \quad (12)$$

If $\sigma = 0$ then $\underline{b}_H^P = \underline{b}_B^P = 0$ and so

$$\frac{dTW^P(0)}{d\sigma} = \pi f(0) \left\{ \theta p_H H - (1 - \theta) (1 - p_B) B \right\} > \pi f(0) p_H \bar{H} > 0 \quad (13)$$

Where the first inequality follows from (2) and the second from (1). So the second-best optimal penalty is certainly positive.

On the other hand if we set $\sigma = \frac{H}{p_H \pi}$ then we would have $\underline{b}_H^P = H$ and so, from (12)

$$\frac{dTW^P(\sigma)}{d\sigma} = -\pi (1 - \theta) (1 - p_B) f(\underline{b}_B) (\underline{b}_B + B) < 0.$$

To characterise the second-best optimal penalty we make the simplifying assumption that the density function is locally constant so $f(\underline{b}_H) = f(\underline{b}_B)$. It then follows from (12) that the second-best optimal penalty is

$$\hat{\sigma}^P = \frac{1}{\pi} \cdot \frac{\theta p_H H - (1 - \theta) (1 - p_B) B}{\theta p_H^2 + (1 - \theta) (1 - p_B)^2} = \frac{\bar{H}_H}{p_H \pi} \cdot \frac{\theta p_H + (1 - \theta) (1 - p_B)}{\theta p_H + (1 - \theta) (1 - p_B) \cdot \frac{(1 - p_B)}{p_H}} > \frac{\bar{H}_H}{p_H \pi}, \quad (14)$$

Where the inequality in (14) follows from (2). Notice that if $p_B = 1$ then (14) just reduces to

$\hat{\sigma}^P = \frac{H}{p_H \pi}$ - precisely the expression given in Proposition 2. So the formula in (14) is a

generalisation of the formula in Proposition 2 and holds for any value of p_B . From (14) we get

$$\begin{aligned}\hat{b}_H^P &= \pi p_H \hat{\sigma}_P = \bar{H}_H \cdot \frac{\theta p_H + (1-\theta)(1-p_B)}{\theta p_H + (1-\theta)(1-p_B) \cdot \frac{(1-p_B)}{p_H}} > \bar{H}_H; \\ \hat{b}_B^P &= \pi \hat{\sigma}_P (1-p_B) = \bar{H}_H \cdot \frac{\theta p_H + (1-\theta)(1-p_B)}{\theta p_H \cdot \frac{p_H}{(1-p_B)} + (1-\theta)(1-p_B)} < \bar{H}_H\end{aligned}\quad (15)$$

From the analysis above we know that, if $p_B < 1$ then $\hat{\sigma}^P < \frac{H}{p_H \pi} \Rightarrow \hat{b}_H < H$.

If we insert these into (11) then total welfare in the second best optimum achieved by setting the optimal value of the fixed component of the welfare penalty structure is:

$$\widehat{TW}^P = \theta \int_{\hat{b}_H^P}^{\infty} (b - H) f(b) db + (1 - \theta) \int_{\hat{b}_B^P}^{\infty} (b + B) f(b) db < \widehat{TW}^{FB} \quad (16)$$

So we have established:

Proposition 3 If, under a Total Welfare standard, there is Partial Legal Uncertainty and if the density function is locally constant and the proportional component of the penalty is zero then:

- (i) the second-best optimal fixed component of the penalty function is given by (14) and the critical values of private benefit below which agents who know for sure whether their action is harmful or benign will be deterred from taking the action are given by (15);
- (ii) the associated value of second-best total welfare is given by (16).

We now turn to the third information structure.

C) Complete Legal Uncertainty

Under complete legal uncertainty firms will neither know their type nor the decision by the Authorities. They will only know the average probability of having their actions disallowed if investigated.

So a proportion θ of agents have actions that would be harmful if taken but all they know is that there is a probability $\bar{p}_H = \theta p_H + (1-\theta)(1-p_B)$, $(1-p_B) < \bar{p}_H < p_H$ that, if investigated, their action will be deemed harmful and have a sanction applied. So expected net profit is $b - \pi \bar{p}_H (\sigma + \phi b)$ and agents will take the action only if this is positive, generating a net welfare for society of $b - H$, (resp. $-H$) under a total welfare (resp. consumer surplus) standard.

A proportion $(1 - \theta)$ of agents has actions that, if taken, would be benign, but all that these agents know is that there is a probability $\bar{p} = \theta p_H + (1-\theta)(1-p_B)$, $(1-p_B) < \bar{p} < p_H$ that, if investigated, their action will be deemed harmful and have the sanction applied. So net profit is

$b - \pi \bar{p}(\sigma + \phi b)$ and so individuals will take the action only if this is positive, generating a net gain for society of $b + B$, (resp. B) under a total welfare (resp. consumer surplus) standard.

Let

$$\underline{b}^C = \frac{\pi \bar{p} \sigma}{1 - \phi \pi \bar{p}} \quad (16)$$

be the minimum values of private benefit above which the act will be taken by all agents

So welfare is:

$$TW^C = \theta \int_{\underline{b}^C}^{\infty} (b - H) f(b) db + (1 - \theta) \int_{\underline{b}^C}^{\infty} (b + B) f(b) db = \int_{\underline{b}^C}^{\infty} (b - \bar{H}) f(b) db$$

under a total welfare standard and

$$CS^C = \theta \int_{\underline{b}^C}^{\infty} (-H) f(b) db + (1 - \theta) \int_{\underline{b}^C}^{\infty} B f(b) db$$

under a consumer surplus standard.

So we get

$$\frac{dTWC}{d\underline{b}^C} = f(\underline{b}^C)(\bar{H} - \underline{b}^C); \quad \frac{dCS^C}{d\underline{b}^C} = f(\underline{b}^C)\bar{H} \quad (17)$$

So, given our assumption (1), under a consumer surplus standard it will be optimal to set penalties to deter all agents from taking the action.

Proposition 4. If there is Complete Legal Uncertainty, penalty structures σ, ϕ that produce maximum welfare¹⁶ are:

- (i) $\hat{\phi}^C = 0$; $\hat{\sigma}^C = \frac{\bar{H}}{\pi p_H} > 0$ under a total welfare standard;
- (ii) $\hat{\phi}^C = \frac{1}{p_H \pi}$; $\hat{\sigma}^C = 0$ under a consumer surplus standard.

Proof:

- (i) Insert the stated values of the penalty parameters σ, ϕ into (16) and we find $\underline{b}^C = \bar{H}$, which, from (17), is the required value to maximise welfare.
- (ii) Insert the stated values of the penalty parameters σ, ϕ into the expression for expected net profits $b - \pi \bar{p}_H(\sigma + \phi b)$ and we see that, for all values of b these are zero. So, as required, this penalty deters every agent from taking the action.

¹⁶ These may not be the only values of σ, ϕ that are consistent with achieving maximum welfare

Corollary 2 The associated levels of maximum welfare are:

$$\widehat{TW}^C = \int_{\bar{H}}^{\infty} (b - \bar{H})f(b)db$$

under a total welfare standard, and, under a consumer surplus standard:

$$\widehat{CS}^C = 0$$

Proof: Follows by inserting optimal values of \underline{b}^C into the corresponding expressions for welfare.

4.2 Comparison of optimal penalties and welfare across information structures

4.2.1 Total Welfare Standard

4.2.1.1 Comparison of Penalties

From Propositions 1- 4 we have:

$$\begin{aligned} - \hat{\sigma}^0 &= \frac{\bar{H}_H}{\pi} \\ - \hat{\sigma}^P &= \begin{cases} \frac{H}{\pi p_H}, \text{ if } p_B = 1 \\ \frac{\bar{H}_H}{\pi p_H} \frac{\theta p_H + (1-\theta)(1-p_B)}{\theta p_H + (1-\theta)(1-p_B) \frac{(1-p_B)}{p_H}} > \frac{\bar{H}_H}{\pi p_H}, p_B < 1 \end{cases} \\ - \hat{\sigma}^C &= \frac{\bar{H}}{\pi p} \end{aligned}$$

So we have:

Proposition 5

- (i) If $p_B = 1$ and $B = 0$ then $\hat{\sigma}^C = \hat{\sigma}^P = \frac{H}{\pi p_H} > \frac{H}{\pi} = \hat{\sigma}^0$;
- (ii) If $p_B < 1$ and $B \geq 0$ then $\hat{\sigma}^P > \hat{\sigma}^0 > \hat{\sigma}^C$

Proof:

- (i) If $p_B = 1$ then from (3) $\bar{H}_H = H$ and $\bar{p} = \theta p_H$, while if $B = 0$ then $\bar{H} = \theta H$ and the result follows by substituting these values into the expressions for the optimal penalties.

(ii) From (14) $\hat{\sigma}^P > \frac{\bar{H}_H}{p_H \pi} > \frac{\bar{H}_H}{\pi} = \hat{\sigma}^C$. While from (3)

$$\begin{aligned} \bar{p} \cdot \bar{H}_H &= \theta p_H H - (1 - \theta)(1 - p_B)B = \theta p_H H - (1 - \theta)B + p_B(1 - \theta)B \\ &> \theta p_H H - (1 - \theta)B + (1 - p_H)\theta H = \bar{H} \end{aligned}$$

where the first inequality follows from (5). This implies $\hat{\sigma}^0 > \hat{\sigma}^C$.

The first part of Proposition 5 is the result established by Kaplow in the context of his model where only harmful actions are ever penalised; benign actions confer no benefit on others; a total welfare standard is employed. He showed that if agents know the true probability of actions being harmful, but do not know for sure what decision will be made if their own action is investigated, then the penalty will be exactly the same whether or not agents know if their own action is genuinely harmful – whether there is partial or complete legal uncertainty. The proposition also establishes that this common penalty would be lower if agents know what decision would be made were their actions to be investigated.

However as soon as we recognise the possibility of Type I errors – wrongful conviction – these results no longer hold. It is still the case that IF agents know whether their action is truly harmful then the penalty will be lower if they also know the decision that will be made than if they don't know this – essentially because the penalty doesn't have to compensate for the risk of being found harmful. However if agents do not know the decision that will be made, then the penalty is higher if they know their type than if they don't. This is because when there is complete uncertainty then the penalty is determined by the unconditional average harm and the unconditional average probability of conviction (if investigated) in the population as a whole; whereas if agents know their type then the optimal penalty is related to the average harm and the probability of conviction (if investigated) conditional on the action's being harmful. These conditional figures are both higher than the unconditional figures relating to the population as a whole, and, if the authority can effectively discriminate, the conditional average harm increases by more than the conditional probability of conviction.

4.2.1.2 Comparison of Total Welfare

From Corollaries 1 – 4 we have:

$$\widehat{TW}^0 = [\theta p_H + (1 - \theta)(1 - p_B)] \int_{\bar{H}_H}^{\infty} (b - \bar{H}_H) f(b) db + [\theta(1 - p_H) + (1 - \theta)p_B](\bar{b} - \bar{H}_B)$$

$$\widehat{TW}^P = \begin{cases} \widehat{TW}^{FB} = \theta \int_H^{\infty} (b - H) f(b) db + (1 - \theta) \int_0^{\infty} (b + B) f(b) db & \text{if } p_B = 1 \\ \theta \int_{\hat{b}_H^P}^{\infty} (b - H) f(b) db + (1 - \theta) \int_{\hat{b}_B^P}^{\infty} (b + B) f(b) db < \widehat{TW}^{FB} & \text{if } p_B < 1 \text{ where } 0 < \hat{b}_B^P < \bar{H}_H < \hat{b}_H^P < H \end{cases}$$

$$\widehat{TW}^C = \int_{\bar{H}}^{\infty} (b - \bar{H}) f(b) db$$

By using (3) then, after a bit of re-arranging, we have

$$\begin{aligned} \widehat{TW}^0 &= \int_{\bar{H}}^{\infty} (b - \bar{H})f(b)db + [\theta(1 - p_H) + (1 - \theta)p_B] \int_0^{\bar{H}} (b - \bar{H}_B)f(b)db \\ &+ [\theta p_H + (1 - \theta)(1 - p_B)] \int_{\bar{H}}^{\bar{H}_H} (\bar{H}_H - b)f(b)db \end{aligned}$$

i.e.

$$\begin{aligned} \widehat{TW}^0 &= \widehat{TW}^C + [\theta(1 - p_H) + (1 - \theta)p_B] \int_0^{\bar{H}} (b - \bar{H}_B)f(b)db \\ &+ [\theta p_H + (1 - \theta)(1 - p_B)] \int_{\bar{H}}^{\bar{H}_H} (\bar{H}_H - b)f(b)db \end{aligned} \quad (18)$$

The second term on the RHS of (18) is positive because, if there is no legal uncertainty, then all those actions that, if investigated, would be deemed to be benign will be taken whereas some of these¹⁷ will be deterred if there is complete legal uncertainty. Given our assumption that the tribunal can *effectively discriminate*, those actions deemed to be benign will, on average, be benign, so deterring some of these will entail a loss of welfare. The third term on the RHS of (18) is also positive because, if there is no legal uncertainty then, of the actions which, if investigated, will be deemed to be harmful, the ones that will not be deterred are those for which private benefit exceeds the average harm conditional on being deemed harmful. However if there is complete legal uncertainty some additional actions will be taken where the private benefit is less than this conditional harm, but greater than the unconditional average harm. So again this constitutes a welfare loss.

So we have shown that total welfare is higher when there is no legal uncertainty than when there is complete legal uncertainty, i.e. $\widehat{TW}^0 > \widehat{TW}^C$.

By multiplying out the expression, and using (3) we can also write maximal total welfare when there is no legal uncertainty as

$$\begin{aligned} \widehat{TW}^0 &= \left\{ \theta p_H \int_{\bar{H}_H}^{\infty} (b - H)f(b)db + (1 - \theta)(1 - p_B) \int_{\bar{H}_H}^{\infty} (b + B)f(b)db \right\} \\ &\quad + \left\{ \theta(1 - p_H) \int_0^{\infty} (b - H)f(b)db + (1 - \theta)p_B \int_0^{\infty} (b + B)f(b)db \right\} \\ \widehat{TW}^0 &= \widehat{TW}^{FB} - \left\{ \theta p_H \int_{\bar{H}_H}^H (H - b)f(b)db + (1 - \theta)(1 - p_B) \int_0^H (H - b)f(b)db \right\} \\ &\quad - (1 - \theta)(1 - p_B) \int_0^{\bar{H}_H} (b + B)f(b)db < \widehat{TW}^{FB} \end{aligned}$$

So total welfare when there is no legal uncertainty is less than the first-best level of total welfare, because the optimal penalties under no legal uncertainty deter too few harmful actions – for example all those actions that are genuinely harmful but will be deemed benign will not be deterred – while it deters all those actions that are genuinely benign but will be deemed harmful.

So we have

Proposition 6 Under a total welfare standard $\widehat{TW}^C < \widehat{TW}^0 < \widehat{TW}^{FB}$.

¹⁷ Those for which the private benefit is less than average harm

Notice however that, at this level of generality, it is impossible to tell whether welfare under partial legal uncertainty is greater or less than that under no legal uncertainty.

4.2.2 Consumer Surplus Standard

From Propositions 1- 4 we have:

$$\hat{\phi}^0 = \frac{1}{\pi}, \quad \hat{\sigma}^0 = 0; \quad \hat{\phi}^P = \frac{1}{p_H \pi}, \quad \hat{\sigma}^P = 0; \quad \hat{\phi}^C = \frac{1}{p_H \pi}, \quad \hat{\sigma}^C = 0. \quad (19)$$

$$\widehat{CS}^0 = [(1 - \theta)p_B B - \theta(1 - p_H)H]; \quad \widehat{CS}^P = (1 - \theta)B; \quad \widehat{CS}^C = 0 \quad (20)$$

So we have:

Proposition 6

- (i) $\hat{\phi}^C > \hat{\phi}^P > \hat{\phi}^0$
- (ii) $\widehat{CS}^P > \widehat{CS}^0 > \widehat{CS}^C = 0$

Proof: Follows immediately from (19) and (20).

The intuition also follows from previous discussion: when there is *no legal uncertainty* the aim is to deter all those who know for sure that their action will be deemed harmful. So the penalty needs to be set so as to offset the risk of being investigated. Those who know for sure their action will be deemed benign will take the action, but, since this contains only a fraction of benign acts, and some harmful acts, consumer surplus is lower than under *partial legal uncertainty*. With *partial legal uncertainty* all those whose actions are harmful will be deterred while all those whose actions are benign will take it, since, knowing that their actions are benign they also know that they face a lower risk of their action's being deemed harmful. The penalty that deters those whose actions are harmful is higher than under no legal uncertainty since it also has to offset the risk that the action will not be deemed harmful. Finally when there is *complete legal uncertainty* everyone assumes that they face the same average probability of having their harm deemed illegal if it is investigated. Since it is assumed that, on average, the action is harmful (*presumptively illegal*) the optimal penalty deters everyone - generating zero consumer surplus. The penalty is higher than under partial legal uncertainty since the average probability that an act will be deemed harmful is lower than the probability of its being deemed harmful if it genuinely is harmful, and so penalty needs to be higher to achieve required deterrence.

5. Conclusions

In this paper we examined the implications of legal uncertainty on welfare under two substantive standards that can be adopted by Competition Authorities, the consumer surplus standard and the total welfare standard.

We showed that the optimal outcome under a consumer surplus standard can always be achieved by choosing a proportional penalty on private benefit. We have also shown that the optimal

proportional penalty will be higher under complete legal uncertainty, smaller under partial legal uncertainty and even lower under no legal uncertainty. Under a total welfare standard optimal outcome can be achieved under no legal uncertainty and complete legal uncertainty by choosing the optimal fixed penalty. Under partial legal uncertainty the first best outcome can be achieved by choosing a fixed penalty under the assumption that the Authority makes no false convictions (Kaplow's case). If this assumption is relaxed the first best outcome cannot be achieved under partial legal uncertainty and a total welfare standard. In that case we have characterised the second best fixed penalty and outcome. This penalty will be higher than the optimal penalty under no legal uncertainty which in turn will be higher than the optimal fixed penalty under complete legal uncertainty.

Finally we compare welfare when optimal penalties are imposed in each case according to different legal uncertainty structures. We find a clear welfare ranking when the consumer surplus standard is employed by Competition Authority and the optimal penalties are chosen. In that case welfare will be higher under partial legal uncertainty, lower under no legal uncertainty and even lower under complete legal uncertainty. Under a Total Welfare standard and when optimal penalties are chosen the welfare will be higher under no legal uncertainty than under complete legal uncertainty and in both cases welfare will be lower than the first best outcome that can be achieved under partial legal uncertainty and by assuming that the Authority makes no false convictions. If this assumption is relaxed it is impossible to tell whether welfare under partial legal uncertainty is greater or less than under no legal uncertainty.

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