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Legal Uncertainty, Competition Law Enforcement Procedures and Optimal Penalties

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Abstract

In this paper we make three contributions to the literature on optimal Competition Law enforcement procedures. The first (which is of general interest beyond competition policy) is to clarify the concept of "legal uncertainty", relating it to ideas in the literature on Law and Economics, but formalising the concept through various *information structures* which specify the probability that each firm attaches – at the time it takes an action – to the possibility of its being deemed anti-competitive were it to be investigated by a Competition Authority. We show that the existence of Type I and Type II *decision errors* by competition authorities is neither necessary nor sufficient for the existence of legal uncertainty, and that information structures with legal uncertainty can generate higher welfare than information structures with legal certainty – a result echoing a similar finding obtained in a completely different context and under different assumptions in earlier Law and Economics literature (Kaplow and Shavell, 1992). Our second contribution is to revisit and significantly generalise the analysis in our previous paper, Katsoulacos and Ulph (2009), involving a welfare comparison of *Per Se* and *Effects-Based* legal standards. In that analysis we considered just a single information structure under an *Effects-Based* standard and also penalties were exogenously fixed. Here we allow for (a) different information structures under an *Effects-Based* standard and (b) endogenous penalties. We obtain two main results: (i) considering *all* information structures a *Per Se* standard is **never** better than an *Effects-Based* standard; (ii) optimal penalties may be *higher* when there is legal uncertainty than when there is no legal uncertainty.

JEL: K4, L4, K21, K23
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Introduction

It is widely argued that, when deciding what type of procedures to use to enforce regulatory intervention in markets, an important consideration is the degree of legal uncertainty[4] - the extent to which agents know, at the time they decide to take an action, what decision a regulatory authority will make as to whether to allow or disallow (and possibly penalise) the agent's action should it ever be investigated by the authority. Certain enforcement procedures are advocated in policy circles as being superior, *ceteris paribus*, because the legal uncertainty[5] they generate is relatively low.

While this issue is important for a very broad range of regulatory interventions[6], we frame our discussion and analysis in the specific context of competition policy / law and its enforcement. Here discussions on legal uncertainty usually involve comparisons of *Effects-Based*[7] enforcement procedures and *Per Se* enforcement procedures[8]. Under *Per Se* an *entire class* of actions is allowed (resp. disallowed), depending on whether their *average* harm[9] is negative (resp. positive), whereas under *Effects-Based* procedures, the Competition Authority (CA) will investigate actions, and allow (resp. disallow) them if some estimate of their individual harm is negative (resp. positive)[10]. It is argued that

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[4] Legal scholars and social scientists have, of course, discussed the issue of legal uncertainty 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 D'Amato (1983) with extensive references to legal scholars including Posner (8th edition, 2010). For a discussion of the importance of legal certainty by a EU competition law expert, see Forrester's (2000) account in the context of Competition Policy. In Section 2 we provide a review of the extensive Law and Economics (mainly US) literature that has examined over many years various implications of legal uncertainty for law enforcement.

[5] Or, lack of ability to predict the outcome of a legal dispute. D'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 by a legal expert see Kevin E. Davis (2011).

[6] As has been recognised in the Law and Economics literature reviewed in Section 2. These include interventions associated with the application of Environmental Policy, determining eligibility for welfare benefits, Tax Compliance mechanisms, as well as, Competition Policy, Sectoral Regulation, etc.

[7] Sometimes alternatively called *discriminating or Rule-of-Reason* procedures. One can think of what in US is termed *Rule–of–Reason* as an extreme form of the *Effects-Based* approach 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 (2007).

[8] Often also referred to as *object* or *form-based* procedures.

[9] Usually it is "harm to others" that is the adopted criterion, or a *consumer surplus substantive standard* is used (see also below).

[10] This distinction is similar to the comparison between unconditional/rigid and conditional/flexible contracts. In the context of welfare policy there is an analogous distinction between universal and targeted benefits.

under a *Per Se* rule firms are certain how their action will be treated if it ever comes under scrutiny by a CA, whereas, under an *Effects-Based* approach, they do not know for sure what decision would be taken, and consequently this legal uncertainty induced by *Effects –Based* procedures should lead the CA to favour *Per Se* procedures. For example, in his classic article, after reviewing all the reasons why it is hard to have clarity as to the circumstances under which an action may in principle be harmful or benign, and the difficulties of obtaining data and carrying out the calculations required to implement whatever tests might be available, Easterbrook (1992) writes "Do we then abandon antitrust? Hardly! We should instead use more widely the method we apply to cartels: per se rules based on ordinary effects disdaining the search for rare counter-examples."[11]

The issue of legal uncertainty has attracted attention in recent years for another reason. Thus, legal experts have stressed that 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. Thus Dethmers and Engelen (2011) note that "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)[12]" The authors go on to argue that from a legal perspective the imposition of fines requires that "the Commission and courts must present evidence of intent or negligence in accordance with the principle of *nulla poena sine lege certa*[13]. In terms of policy it does not make sense to impose such high fines for anti-competitive behaviors, which are not per se illegal…"[14].

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[11] The issue has gained even more in importance recently as CAs worldwide have adopted significant reforms in decision and enforcement procedures, with an increasing use of *Effects-Based* rather than *Per Se* procedures. 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. See also Katsoulacos and Ulph (2011a), Kokkoris and Lianos (2008), Will and Schmidtchen (2008).

[12] 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.

[13] This Latin phrase may be translated as "no penalty unless there is certainty under the Law".

[14] Ibid. p. 98.

In this paper we first propose a formalisation to the concept of legal uncertainty. This is explained and related to the existing literature in Section 2. Then we extend and generalise significantly our previous analysis Katsoulacos and Ulph (K&U, 2009)[15] in which we undertook an welfare comparison of *Per Se* and *Effects-Based* legal standards, assuming, for the latter case, a specific information structure that we now call *Partial Legal Uncertainty*. In addition in K&U (2009) we assumed fixed penalties. Here we allow for different information structures under *Effects-Based* procedures – namely what we will call *No Legal Uncertainty*, *Partial Legal Uncertainty* and *Complete Legal Uncertainty* - and also we allow the competition authority to adjust penalties depending on both the legal standard that is employed and the information structure that prevails.[16] The model is set out in Section 3. In Section 4 we establish the welfare levels under the different information structures and in Section 5 we establish our main results. In summary, these are as follows.

1. Generally[17] when firms know whether their actions are harmful or benign but are uncertain about the CA's potential assessment of these actions (so there is what we call *Partial Legal Uncertainty*), welfare *may* be higher than when firms face no legal uncertainty (Proposition 2). This is *certainly* the case with optimal endogenously set penalties (Proposition 5a). This result echoes a similar finding obtained in a completely different context and different assumptions in the earlier Law and Economics literature by Kaplow and Shavell (1992).

2. Turning to a comparison of *Effects-Based* to *Per Se* legal standards, we find that with exogenously fixed penalties, *Effects-Based* welfare dominates *Per Se* when in the former there is *No Legal Uncertainty* (Proposition 1) and may dominate *Per Se* when in the former there is *Partial Legal Uncertainty* (Corollary 2 of Proposition 2). This last result is the result of K&U (2009). The intuition is that under *Partial Legal Uncertainty* there is a *differential deterrence effect* - the fraction of harmful actions deterred is greater than that of benign actions - and the

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[15] See also Kwak (2010) that deals with related issues to those discussed here, concerning judicial errors and the choice of the liability standard.

[16] As in Katsoulacos & Ulph (2009), we ignore the potential cost advantage of decision-making under *Per Se* as compared to *Effects-Based* rules as an additional factor favouring *Per Se*. This is readily incorporated and we have no new insights to offer on this issue. See Christiansen, A. and W. Kerber. (2008).

[17] That is under both exogenous and optimal (endogenously set) penalties

conclusion will hold when this effect is strong enough. We further establish that under an *Effects-Based* legal standard, *No Legal Uncertainty* and *Partial Legal Uncertainty* welfare dominate *Complete Legal Uncertainty* (Propositions 3 and 4).

3. With optimally set endogenous penalties, we show that there is an unambiguous welfare ranking of legal standards and information structures. For a given *Effects-Based* procedure, welfare is higher when there is *Partial Legal Uncertainty* than it is with *No Legal Uncertainty* that is in turn higher than when there is *Complete Legal Uncertainty*[18]. Further the latter is welfare equivalent to a *Per Se* legal standard (Proposition 5a and 5b).

4. Under an *Effects-Based* procedure the penalty chosen by the CA when there is *Partial Legal Uncertainty* will be *higher* than when there is *No Legal Uncertainty* and also higher than under the corresponding *Per Se* standard (Proposition 6a and 6d). 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.

5. When there is *Complete Legal Uncertainty* then, if the action is *Presumptively Illegal* the Competition Authority will want to deter all actions which, for the reasons given above, requires a higher penalty than under *Partial Legal Uncertainty* (Propositions 6b and 6c)[19]. However, if the action is *Presumptively Legal,* the Competition Authority will set a zero penalty. Thus we find limited support for the legal principle of *nulla poena sine lega certa*.

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[18] As explained below, *Complete Legal Uncertainty* is the situation where *both* of the potential dimensions of uncertainty are present: firms do not know the true type of their actions and are also uncertain about how an error-prone authority will assess these actions were they to be detected and investigated.

[19] These results on optimal penalties are entirely consistent with the Beckerian tradition (Becker, 1968) as we discuss in Section 5.

1. *Formalising the Concept of Legal Uncertainty: Brief Review of and Relation to Existing Literature*

While one legal expert has noted that there is an "absence of rigorously defined yet practical measures of legal uncertainty"[20], the concept, loosely defined as the lack of ability to predict the outcome of a legal dispute, has been subject to extensive discussion by economists and legal experts. Calfee and Craswell (1984) offer an excellent informal review of early contributions, and, in a follow-up article – Craswell and Calfee (1986) - provide more formal analysis. They stress two potential sources of legal uncertainty.

The first is uncertainty regarding the *liability standard* which we can think of as the threshold level of harm caused by an action such that if the authority perceives the harm caused by a firm's action to be above this threshold it will disallow and penalise the action, while if the perceived level of harm is below this threshold then the authority will allow the firm's action.

The second source of legal uncertainty, which has since received much more extensive attention in the literature[21], arises because authorities are unable to determine the actual harm caused by an action and so have to form some estimate of the harm, and an action is disallowed if the estimated value of harm is above the liability standard. Since these estimates contain errors this gives rise to possible Type I and Type II *decision errors* whereby actions that should be allowed are disallowed and actions that should be disallowed are allowed.

In their analyses, Craswell and Calfee (1984, 1986) examine welfare implications of the above considering more specifically how under-compliance and over-compliance are affected.[22] In line with this reasoning, assume that the decision rule used by the authority is to set *liability standard $\underline{h}$* and then disapprove the action taken by firm *k iff*

$$h_k^e > \underline{h}$$

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[20] Davis (2011), p. 1.

[21] For example, in the context of competition policy, Schinkel, M.P. and J. Tuinstra, (2006), Kwak J (2010) and Lang M (2012), Also, in the context of the more general Law and Economics literature, see references mentioned below.

[22] More recent analyses of the impact of errors have been undertaken by Schinkel and Tuinstra (2006) and by Lang (2012).

where h_k^e denotes the authority's estimate of the harm caused by firm k. Now, in principle, the liability standard may be positive negative or zero. While below we could permit the possibility that firms do not know the liability standard, since we are going to allow the possibility that one of the reasons why they may not know for sure what decision the authority will make in their case is that they don't know what estimate of harm the authority will make, and since the decision rule depends simply on the difference between the estimate of harm and the liability standard, it will simplify the analysis if we assume that firms know the liability standard, and, furthermore that this is normalised so that $\underline{h} = 0$.

Following Craswell and Calfee (1984, 1986), many papers in the Law and Economics literature have used models in which, as in our model below, agents that undertake privately beneficial but socially harmful actions can face uncertainty along two dimensions, specifically, either (a) because they do not know whether their actions are or are not harmful or/and (b) because they do not know how their actions will be treated by a social authority, the decisions of which are subject to errors. If actions are detected and, following an investigation, are found harmful they are subject to sanctions, also as in our model below. This literature includes the important papers by Kaplow (1990), Kaplow (1995) and Kaplow and Shavell (1992). Kaplow (1990) examines the issue of optimal sanctions on agents that may be uncertain about whether their actions are harmful and thus sanctionable, though they may become perfectly informed at a positive cost. Specifically, the paper addresses three questions: if sanctions can be differentiated, is their optimal level the same for informed and uninformed agents? If sanctions must be the same, is the value of the optimal sanction affected by the presence of uninformed agents? And, when is it efficient for a tribunal to undertake the cost required in order to apply differential sanctions? Kaplow (1995) uses a similar setting, but with actions differing in their level of harm and examines the issue of whether it is welfare improving for a tribunal to undertake the cost of differentiating between actions of different harm by using more complex legal rules and setting different sanctions depending on the harm. Kaplow and Shavell (1992) uses a model closer in spirit than all other models in the literature to the model below in the sense that agents face uncertainty because they may not know their true type *or* because of errors made in determining true harm by the social

authority. Agents can obtain legal advice in order to eliminate *both* of these sources of uncertainty and the analysis examines whether the demand for such advice is socially appropriate. The analysis, although dealing with an issue (the demand for legal advice) completely different from the issues we are concerned with here and although, in most important respects, it utilises very different assumptions to those we utilise (see immediately below and Section 3 where we interpret Kaplow and Shavell (1992) in terms of our framework), it leads to a result that seems to be an early precedent to one of the results also established below, namely that legal uncertainty may be welfare improving - Kaplow and Shavell (1992), Proposition 3[23].

There are very important differences between all the above papers and the present paper[24].

- In these papers the substantive standard used by the social authority for assessing whether an action is illegal is that of total welfare while we assume, as is much more natural in the context of competition law enforcement[25], that the standard is that of consumer welfare. This is important given that the standard used influences in a critical way the deterrence objectives of the social authority and optimal penalties.

- Kaplow (1990 and 1995) incorporate only one of the main dimensions of legal uncertainty – that related to agents not knowing their type.

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[23] Hylton (1990), extending Ordover (1978), could also be considered an early predecessor in the literature on enforcement errors and uncertainty – see footnote 23.

[24] In addition to the differences between our paper and the earlier literature that are discussed below in the main text, the papers by Hylton and Ordover differ from ours in the crucial respect that they relate to another strand in the Law and Economics literature that deals with important private litigation issues, which we do not consider here. The main source of uncertainty in their analysis is that individuals do not know the extent to which other people are negligent, though they know the average degree of negligence. Thus Ordover (1978) examines the implications of costly litigation for compliance in these contexts while Hylton (1990) extends the Ordover analysis by introducing judicial errors in assessing negligence. These errors make it possible to achieve perfect compliance equilibria – something that cannot happen in Ordover's framework – and so can, in this sense, be thought of as increasing welfare. However, one of the major contributions of this paper is to make it clear that – contrary to much of the Law and Economics literature mentioned in the text - (i) Legal Uncertainty and judicial errors are two logically distinct phenomena, and (ii) the existence of judicial errors is neither neither necessary nor sufficient for the existence of Legal Uncertainty. Consequently there is an important difference between Hylton's finding and one of our main findings – the welfare-enhancing effects of Legal Uncertainty.

[25] It is standard practice for CAs to use a consumer surplus substantive standard – see Salop (2010), though, among economists, there are strong voices in favour of a total welfare standard (e.g. Carlton, 2007).

- While Kaplow (1990) deals specifically with optimal sanctions, it is essentially assumed that there is a *fixed penalty* the optimal value of which is related to harm[26], whereas we use a more general sanction structure that allows for both a penalty that is proportional to the private gain and a fixed part, to capture, respectively, both deterrence objectives and the objective to penalise the firm for the social harm its action causes. Such a penalty structure also reflects fining procedures in competition policy practice.

- All three papers conflate the probability of being found illegal into a single number while it is important for our analysis to take explicitly into account that this probability is the product of two distinct probabilities: the probability of being investigated by an authority; and the probability that, if investigated, the authority, making decisions subject to errors, actually decides that the action is harmful and imposes a penalty.

- In the context of the issues addressed by all the above papers, it may be natural to assume, as they do, that all potential actions considered by the authority are non-benign[27]. Thus it is implicitly assumed that all benign actions are condoned and consequently that there are no Type I errors.[28] However this is certainly not the case for the sort of business practices dealt with by Competition Law, so below in our framework we have to allow for actions that are either socially harmful or socially benign and to allow the authority's decision errors to extend to its assessment of the latter type of actions[29].

Here we propose what we call the *information structure approach* to the formalisation of legal uncertainty. An *information structure* specifies the probability that

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[26] Note that interactions between the various differences in the assumptions mentioned here can also affect the results: e.g. it is easy to show that in Kaplow (1990), with a more general penalty structure the optimal structure depends on whether a total welfare or a consumer surplus substantive standard is assumed.

[27] That is, they generate positive or zero (but *not* negative) harm.

[28] An alternative way to put this is to say that Kaplow (1990) just deals with actions that in the terminology below, are *presumptively illegal* while we also have to consider *presumptively legal* actions. This also has serious implications for the results we get on optimal penalties under the different information structures.

[29] An additional difference between the above papers and the present one is that we examine the important phenomenon of *desistance*, i.e. how *delays* in the authority's procedures affects the outcomes. Agents' anti-competitive actions will normally take some time before they create benefits and social harm and so the size of these accruing will depend critically on delays in the authority's procedures, which therefore will affect the value of optimal sanctions (see also, Katsoulacos and Ulph, 2013).

each agent attaches - at the time they take an action – to the possibility that, were the CA to investigate this action, it would deem it to be harmful (and impose a sanction). The approach also involves specifying the number of different *information structures* that could arise and how/why individual agents' probabilities vary across them.

While this approach is closely related to the main ideas introduced in the different strands of the literature above concerning the nature and sources of legal uncertainty, it also clarifies why it is very important to distinguish the phenomenon of legal uncertainty from the Type I and Type II decision errors made by competition authorities. In particular, we show that the existence of decision errors made by the authority are neither necessary nor sufficient for the existence of legal uncertainty.

Now, firms' perceived probability of having their actions deemed anti-competitive will depend on:

(i)   Whether or not they know the true harm (positive or negative) caused by their action[30].

(ii)   Whether or not they know the estimate that will be made by the authority the harm caused by their action (which depends on their understanding of exactly how the authority reaches its estimates of harm).

(iii)   Whether or not they know the liability standard that the authority is using.

Assuming, as already noted, that the authority uses a zero-harm liability standard and that this is common knowledge, we can distinguish the following three information structures[31]:

I.   **No Legal Uncertainty (NLU)**: here, at the time they take their action, all firms know for certain the estimate of harm that the authority will make in their case[32], should it ever be investigated. In particular this is true *irrespective of whether or not firms know the true harm of their action.* However decision errors made by the authority imply that some benign actions will be falsely convicted (Type I errors) and some harmful actions will be falsely acquitted (Type-II errors). So, with No Legal Uncertainty, firms of

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[30] That is whether or not their type

[31] We indicate below how the analysis of Kaplow and Shavell (1992) can be interpreted in terms of these.

[32] This could arise if the CA set out the factors it would measure, the data it would use to measure these, and the calculations it would make, and if firms could costlessly access exactly the data the CA would use in its particular case and perform the calculations before it decided to take the action.

different type may face the same probabilities of being convicted or not convicted. While, in certain contexts, this information structure will be unrealistic, nevertheless it serves as a useful benchmark for making the point that the use of an *Effects-Based* procedure that makes both Type I and Type II decision errors does NOT entail the existence of *legal uncertainty*. Put differently, one should not confuse *variability of decisions* across otherwise identical firms with *legal uncertainty* about the decision that will be reached in a specific case.

II. **Partial Legal Uncertainty (PLU)**: here all firms know their true type but have an imperfect understanding of exactly how the authority reaches its estimates of harm and thus do not know for certain the estimate of harm that the authority will make in their case. However firms are assumed to know probability of the authority's making Type I and Type II errors[33] and, knowin their own type, this allows each firm to calculate the probability of being convicted if investigated. This information structure is distinguished by two features:

a) All firms of the same type perceive the same probability of being convicted.

b) This probability varies with firms' type, being monotonic with the harm caused by the action to others.

As we will see, these features generate differential deterrence effects and, with optimal penalties, the authority can then deter all harmful actions.

III. **Complete Legal Uncertainty (CLU)**: here firms know neither the true harm caused by their action nor the estimate of harm that the authority will make in their case. In this case firms' perceived probability of their action being found illegal and a penalty imposed, is assumed to be the *average* probability of conviction[34]. Notice that this case can arise even if the authority makes no decision errors.

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[33] We make this assumption because we do no want to confuse mis-perceptions that could arise for many factors with legal uncertainty which arises from imperfect information about how authorities make their decisions.

[34] Once again we make this assumption to avoid confusion with other sources of mis-perception.

So in our framework legal uncertainty relates solely to what firms know about the decision that will be made should their action be investigated under a *given* decision procedure used by the CA. Since the decision rule is fixed, so too are the associated costs of the Type I and Type II errors to which it gives rise, and the different information structures matter solely because of the different deterrence effects that they generate due to the different perceived probabilities of conviction to which they give rise. A number of additional remarks are likely to be useful.

If there is *No Legal Uncertainty* the competition authority does not exploit any of the information that the firms know about the harm caused by their action, so, amongst firms who will be convicted, those whose actions are more harmful perceive no greater probability of conviction than those whose actions are less harmful. Similarly amongst firms whose actions will not be convicted. So, in that sense, there is no *differential deterrence effect*. While there is some statistical sense in which there is a differential deterrence effect at work – on average actions which are more harmful will be more likely to be deterred than actions that are less harmful, this does not happen at the level of individual firms.

With *Partial Legal Uncertainty,* on the other hand, there is a strong *differential deterrence effect* since all firms whose actions are more harmful will face a higher probability of conviction than those whose actions are less harmful. Finally, under *Complete Legal Uncertainty* there is absolutely no differential deterrence effect since all firms perceive exactly the same probability of conviction. As we show these generate important welfare consequences.

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 – which is potentially prohibited under Competition Law. We assume that this action has a natural life, and normalise the length of this natural life to 1.

A fraction γ, $0 < \gamma < 1$ of firms taking this action come from a Harmful environment so, if they take the action, this generates a social harm that is measured by

the negative of the change in consumers' surplus, and denoted by $h_H > 0$[35]. The remaining fraction come from a Benign environment, so, if they take the action, this generates harm that we denote by $h_B < 0$. Let $\bar{h} = \gamma h_H + (1 - \gamma)h_B$ be the average harm for this type of action. The type of action is said to be *Presumptively Legal* (resp. *Illegal*) if $\bar{h} < 0 \ \left(\text{resp.} \ \bar{h} > 0 \right)$. We assume that γ is common knowledge.

In the absence of any intervention by the CA, taking an action will confer a private benefit $b > 0$ for the firm[36]. The distribution of b is independent of the environment from which the firm comes[37]. We suppose that the private benefit has a positive continuous probability density $f(b) > 0$ on $[0, \infty)$ with cumulative distribution function given by $F(b), \quad 0 < F(b) < 1; \quad F'(b) = f(b) > 0$.

Competition Authority Decision Procedures

There is a CA that detects and initiates enforcement procedures against a fraction $\pi, 0 < \pi \leq 1$ of the actions taken. We refer to π as the *coverage rate*.

These enforcement procedures include verifying that a potentially anti-competitive action has been taken by the firm and, in the case of an *Effects-Based* standard, carrying out an investigation into its potential harm. If, under either a *Per Se* or an *Effects-Based* procedure an action is deemed harmful, then, the CA imposes a penalty, and, in common with virtually all the literature on optimal penalties, we assume that this penalty is imposed immediately after the action has reached its natural life.[38]

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[35] As noted above, this is the substantive standard used by most Competition Authorities – see Motta (2004) or O'Donohue & Padilla (2007) - and employed in our previous paper – Katsoulacos & Ulph (2009). It is the standard advocated by Salop (2010) This differs from a total welfare standard that would include the private benefit to the firm taking the action – advocated by Carlton (2007).

[36] Which we take to be the present value of the expected change in profits from the action over its 'natural' lifetime.

[37] The "symmetry" assumption - see Katsoulacos and Ulph (2009), in which we also discuss the implications of relaxing this assumption.

[38] In Katsoulacos & Ulph (2013) we explore the implications of allowing for the possibilities that the CA might make its decision either before the action has reached its natural life or long after it has done so. In the former case the CA will order the firm to cease the action and the loss of all subsequent profits will itself be a penalty for taking the action. Consequently the optimal penalty will be lower. In the latter case the delay in imposing the penalty will, through discounting, make the penalty seem small relative to anticipate profits, and so necessitate a higher optimal penalty. In an electronic version of this paper, Katsoulacos & Ulph (2014) we develop the analysis that follows in a much more general setting that allows for the possibility that a CA might investigate an action and, if it is deemed harmful, terminate it before it

As mentioned, we assume that the CA uses a liability standard $\underline{h} = 0$, and can use one of two decision procedures.

Per Se   Here the CA allows <u>all</u> actions of a given type if that type is *Presumptively Legal* and disallows <u>all</u> actions if the type is *Presumptively Illegal.* Consequently, for any given type of action, only one type of decision error is made by the CA: Type I (False Convictions) if the type of action is *Presumptively Illegal* and Type II (False Acquittals) if it is Presumptively Legal.

Effects-Based   Under this procedure the CA undertakes an investigation of each action that comes before it, 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: "Positive Harm" indicating that on the basis of the evidence obtained the CA thinks the action is likely to reduce welfare; or "Negative Harm", indicating that the action is likely to increase welfare. The CA's decision rule is to disallow an action if it gets a Positive Harm signal and allow it if it gets a Negative Harm signal.

The quality of the CA's model for estimating harm is embodied in the parameters p_B, $0 < p_B < 1$ - the probability that a Benign action generates a Negative Harm signal - and p_H, $0 < p_H < 1$- the probability that a Harmful action generates a Positive Harm signal. We assume that the model used by the CA 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 vice versa.

We are interested in the question of whether legal uncertainty would ever be a reason for preferring a *Per Se* procedure to an *Effects-Based* one in situations where there was a *prima facie* reason to prefer to use *Effects-Based*, and we take that *prima facie* reason to be that the *Effects-Based* procedure has lower *decision error costs*[39] than *Per Se*. In Katsoulacos & Ulph (2009) we establish the condition for this to be true. Consequently in all that follows we assume:

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has reached its natural life. So actiosn can be stopped through both desistance and deterrence. All our major conclusions go through in this more general setting.

[39] In Katsoulacos & Ulph (2009) we say that in this case the *Effects-Based* model can *effectively discriminate.*

ASSUMPTION 1 *Effects-Based Procedure Has Lower Decision-Error Costs*

(i)   If the action is *Presumptively Legal* – so $\bar{h} = \gamma h_H + (1 - \gamma)h_B < 0$- then:

$$\frac{p_H}{1 - p_B} > \frac{(1 - \gamma)(-h_B)}{\gamma h_H} > 1 \qquad (1)$$

(ii)   If the action is *Presumptively Illegal* – so $\bar{h} = \gamma h_H + (1 - \gamma)h_B > 0$ - then:

$$\frac{p_B}{1 - p_H} > \frac{\gamma h_H}{(1 - \gamma)(-h_B)} > 1 \qquad (2)$$

Assumption 1(i) guarantees that the average welfare of the actions that are disallowed will be negative, while 1(ii) guarantees that the average welfare of actions that are allowed is positive. It is straightforward to show that if an action is *Presumptively Legal* then (1) implies (2), while if it is *Presumptively Illegal* then (2) implies (1).   So from now on we assume that **both** (1) and (2) hold.

Characterization of Information Structures

We assume that firms know whether the CA is using a *Per Se* or an *Effects-Based* procedure, and that, if it is *Per Se,* whether it is *Per Se Legal* or *Per Se Illegal.* When an *Effects-Based* procedure is used, then, consistent with our assumption in Section 2 above, that the distribution of errors is known we make the assumption:

ASSUMPTION 2   All firms know the parameters p_B, p_H.   Further, as mentioned, we assume that firms know the liability standard, $\underline{h} = 0$

For simplicity, in what follows we make the following additional assumption, though almost all our results go through without it[40].

ASSUMPTION 3 All firms face exactly the same type of legal uncertainty.

We can then characterise the three information structures identified in Section 2 above as follows.

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[40] More precisely, if there were fixed but unknown fractions of firms facing different types of legal uncertainty, and if these were random subsets of the population of firms, then the welfare rankings of legal standards and of information structures that we derive in Section 4 will go through. The only result that would change would be that the CA would set just one level of penalty – that which applies when there is what we call *Complete Legal Uncertainty*.

- *No Legal Uncertainty.* As explained in Section 2, here firms know what decision the authority will take in their case. So a fraction p_H of firms from the Harmful environment will know for sure that their action will be disallowed, while the remaining fraction know for sure that it will be allowed. Similarly a fraction p_B of firms from the Benign environment will know for sure that their action will be allowed, while the remaining fraction know for sure that it will be disallowed. As already noted, here there is no legal uncertainty though there are decision errors.

- *Partial Legal Uncertainty.* Here firms know whether their actions are truly harmful or truly benign. However, at the time they decide whether or not to take the action, they do not know what estimate of harm the CA will make in their particular case. Instead a firm from the Harmful environment knows that there is a probability p_H of having its action disallowed, while a firm from the Benign environment knows that there is a probability p_B of having its action allowed.

- *Complete Legal Uncertainty.* Here firms do not know how harmful their action is, nor what view the authority will take of how harmful it is. We assume that the uncertainty is so great that all that firms know is just the average probability of conviction,

$$\overline{p} = \gamma \, p_H + (1 - \gamma) . (1 - p_B).$$

Interpreting Kaplow and Shavell (1992)

As mentioned above, in Kaplow and Shavell's (1992) set-up agents also either do not know whether their action is harmful *or* are uncertain about the authority's error-prone decisions were their action to be investigated. Using their terminology, agents can be "uninformed" because of either of these types of uncertainty. They can eliminate the uncertainty and become "informed" by getting "legal advice" at a cost. The paper examines whether the demand for legal advice is optimal. In terms of the framework used here, we can say that in Section 2 of their paper, agents' information structure is one of *Complete Legal Uncertainty*[41] and by getting legal advice they move to *No Legal Uncertainty*. In Section 3, agents' information structure is one of *Partial Legal Uncertainty* and by getting legal advice they move to *No Legal Uncertainty*. Proposition 3 (in their Section 3) essentially establishes that getting legal advice and moving from *Partial* to *No Legal Uncertainty* is not socially optimal – removing uncertainty reduces welfare.

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[41] In this section, agents can be uninformed about whether their action is harmful and if they become informed they learn the true harm that is what the authority will determine if it undertakes an investigation.

As we noted above (Section 2), this result is established on the basis of a completely different set of assumptions to those utilised in this paper[42]. Further, here we are also primarily concerned, unlike Kaplow and Shavell (1992), with a comparison between different enforcement procedures[43]. With respect to this note that, while, as in Section 2 of Kaplow and Shavell (1992) we find that moving from *Complete* to *No Legal Uncertainty* reduces welfare, we also show the important result that moving from an *Effects-Based* procedure with *Complete Legal Uncertainty* to a *Per Se* procedure can also reduce welfare.

Fines

In general fines can take the form of a *fixed* penalty plus a component that is *proportional* to the private benefit that is obtained by the firm [44]. The fixed component reflects the desire to link the penalty to the social harm that an anti-competitive action causes, while the proportional component reflects the desire to create deterrence by reducing the private benefit of firms gain by acting anti-competitively. Formally, we assume that if a firm with private benefit $b > 0$ has its action deemed anti-competitive it faces a penalty $\psi + \varphi b, \quad \psi \geq 0, \varphi \geq 0$. The parameter pair (ψ, φ) characterise a penalty regime.

Behaviour of Firms

Clearly if a firm knows for sure that, if investigated, its action will be allowed by the CA, penalties are irrelevant, and it will take the action whatever the penalty regime.

Consider then a firm that anticipates some positive probability $\beta, \quad 0 < \beta \leq 1$ of having its action banned/disallowed by the CA should it ever be investigated. Since it anticipates a probability $\pi, \quad 0 < \pi < 1$ of being investigated its expected net benefit from taking the action is

$$b(1 - \beta\pi\varphi) - \beta\pi\psi , \tag{3}$$

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[42] As explained in Section 2 above, the different issues examined in the two papers – demand for legal advice in Kaplow and Shavell (1992) vs. optimal competition policy enforcement procedures here - can be considered as responsible for the differences in the assumptions.

[43] And not just with a comparison across information structures. While comparing different enforcement procedures was the subject also of K&U (2009), as noticed above, in that paper the analysis was restricted to one information structure and only exogenous penalties.

[44] There is an extensive literature on fines and law enforcement – see in particular the survey of Polinsky and Shavell (2000). For treatments that address fines under antitrust law see Buccirossi and Spangolo (2006), Wils (2006) and Katsoulacos and Ulph (2013).

which we can write as

$$\beta\pi\left\{b\left[\frac{1}{\beta\pi}-\varphi\right]-\psi\right\} \qquad (4)$$

. There are then two cases. If:

(i) $\varphi \geq \dfrac{1}{\beta\pi}$, the firm cannot make a profit by taking the action, whatever the

value of b and ψ;

(ii) $\varphi < \dfrac{1}{\beta\pi}$ then taking the action is profitable for all values of

$b > \dfrac{\psi}{\left(\dfrac{1}{\beta\pi}\right)-\varphi} \geq 0^{45}$.

Taking these together, we see that for a group of firms facing a given penalty regime (ψ,φ) and having the same anticipated probability β, $0 \leq \beta \leq 1$ of having their action disallowed by the CA, the fraction, D, of such firms deterred from taking the action is:

$$D(\beta,\varphi,\psi) = \begin{cases} F\left[\dfrac{\psi}{\left[\left(\dfrac{1}{\beta\pi}\right)-\varphi\right]}\right] & \text{if } \varphi < \dfrac{1}{\beta\pi} \\ 1 & \text{if } \varphi \geq \dfrac{1}{\beta\pi} \end{cases} \qquad (5)$$

As we will see, it turns out that if the CA can choose the penalty, it will want to deter either all or none of the firms from such a group. We assume that, in the interests of proportionality, it will want to use the lowest penalty that achieves its objectives and so, in those ciecumstances where it wants to deter all firms it will set $\varphi = \dfrac{1}{\beta\pi}$ and $\psi = 0$, whereas, when it wants to deter none it will set $\varphi = 0$ and $\psi = 0$. So, given our assumptions, *the CA can achieve its objectives by using penalties that are*

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[45] Notice also that the case where the action will certainly be allowed - $\beta = 0$ - is just a special case of the above analysis and generates the conclusion that the action will always be taken.

purely proportional to private benefit. The dependence of the critical value of the penalty on the probability of an action's being disallowed means that the penalty chosen will vary depending on both the legal standard in force and the information structure – the type of legal uncertainty.

3. *Outcomes Under Different Enforcement Procedures and Different Information Structures*

In this section we set out the levels of welfare under different enforcement procedures and, in the case of an *Effects-Based* procedure, under different information structures. We do this for both the case where penalties are exogenous and the case where the CA chooses the optimal level of penalty.

4.1   *Effects-Based* Procedure

In this sub-section we assume that the CA uses an *Effects-Based* procedure, and that this has lower decision error costs than under the appropriate *Per Se* procedure, so both (1) and (2) hold. We consider in turn different information structures.

4.1.1   No Legal Uncertainty

Here a fraction p_B $\left(\text{resp. } 1 - p_H \right)$ of firms from the Benign (resp. Harmful) environment know for sure that their action will be allowed and so will take it irrespective of the penalty. The remaining firms from each environment know for sure that, if investigated, their action will be disallowed, albeit after a delay. Since private benefit is uncorrelated with harm, then, for any given penalty, the same fraction

$$D^{EB0} = \begin{cases} F\left[\dfrac{\psi}{\dfrac{1}{\pi} - \varphi} \right] & \text{if } \varphi < \dfrac{1}{\pi} \\ \\ 1 & \text{if } \varphi \geq \dfrac{1}{\pi} \end{cases}$$

of these firms will be deterred from taking the action. Of those that do take the action, harm will arise to the extent that only a fraction will be investigate Consequently welfare under a given penalty is:

$$W^{EB0} = \left\{ (1-\gamma)(-h_B)p_B - \gamma h_H (1-p_H) \right\} - \\ (1-D^{EB0})\left\{ \gamma h_H p_H - (1-\gamma)(-h_B)(1-p_B) \right\}$$

(6)

The first term captures the welfare arising from those who know for sure that their action will be deemed benign, while the second is the expected welfare arising from those who know for sure that their action will be deemed harmful. Since the CA's rule is assumed to be able to effectively discriminate, actions that are allowed will on average be beneficial while those that are disallowed will on average be harmful. Hence, from (1) and (2), both the expressions in curly brackets are positive.

This implies that if the CA could choose the penalty, it would like to deter all those firms who know for sure their action will be disallowed from taking it, so it would set a penalty

$$\hat{\varphi}^{EB0} = \frac{1}{\pi}, \quad \hat{\psi}^{EB0} = 0,$$

(7)

giving rise to welfare:

$$\hat{W}^{EB0} = (1-\gamma)(-h_B)p_B - \gamma h_H (1-p_H) > 0.$$

(8)

4.1.2 Partial Legal Uncertainty

Here, while no firm knows for sure whether their action will be allowed or disallowed, firms know the liability standard and so know for sure whether their action is Harmful or Benign. Firms from the Harmful environment anticipate that, if investigated, there is a probability, p_H of having their action deemed illegal and a penalty's being imposed, whereas firms from the Benign environment anticipate a lower probability $1-p_B < p_H$ of an unfavourable decision by the CA. The fraction of firms from the Harmful environment that are deterred from taking the action is,

$$D_H^{EBP} = \begin{cases} F\left[\dfrac{\psi}{\left[\left(\dfrac{1}{p_H}\pi\right)-\varphi\right]}\right] & \text{if } \varphi < \dfrac{1}{p_H}\pi \\[2em] 1 & \text{if } \varphi \geq \dfrac{1}{p_H}\pi \end{cases},$$

while the fraction from the Benign environment that are deterred is

$$D_B^{EBP} = \begin{cases} F\left[\dfrac{\psi}{\dfrac{1}{(1-p_B)\pi}-\varphi}\right] & \text{if } \varphi < \dfrac{1}{(1-p_B)\pi} \\[2em] 1 & \text{if } \varphi \geq \dfrac{1}{(1-p_B)\pi} \end{cases}.$$

Note that, since $1-p_B < p_H < 1$, then $\dfrac{1}{(1-p_B)\pi} > \dfrac{1}{p_B\pi} > \dfrac{1}{\pi}$. Consequently if the

penalty is so severe that all firms from even the Benign environment are deterred then we

will have $D_B^{EBP} = D_H^{EBP} = D^{EB0} = 1$. However if $\varphi < \dfrac{1}{(1-p_B)\pi}$ it will be the case that

$D_B^{EBP} < D_H^{EBP} \leq D^{EB0} \leq 1$.

Whatever the penalty regime, welfare in this case is given by:

$$W^{EBP} = (1-\gamma)\left(1-D_B^{EBP}\right)(-h_B) - \gamma\left(1-D_H^{EBP}\right)h_H. \tag{9}$$

The first term gives the welfare arising from those firms from the Benign environment who take the action, while the second term is the analogous expression for firms from the Harmful environment.

If the CA can choose the penalty, it will want to ensure that NONE of the firms from the Benign environment are deterred, whereas ALL those from the harmful environment are deterred, and it can achieve this by setting a purely proportional penalty

$$\hat{\varphi}^{EBP} = \dfrac{1}{\pi p_H}, \quad \hat{\psi}^{EBP} = 0, \tag{10}$$

giving rise to welfare:

$$\hat{W}^{EBP} = (1-\gamma)(-h_B) > 0. \tag{11}$$

4.1.3 *Complete Legal Uncertainty*

Once again, no firm knows for sure whether their action will be allowed or disallowed, so there is legal uncertainty. But, in this case, firms do not even know their type, so all firms anticipate the same probability $\overline{p} = \gamma p_H + (1-\gamma)(1-p_B) < p_H$ of having their action disallowed if investigated. Accordingly the same fraction of firms

$$D^{EBC} = \begin{cases} F\left[\dfrac{\psi}{\dfrac{1}{\overline{p}\pi} - \varphi}\right] & \text{if } \varphi < \dfrac{1}{\overline{p}\pi} \\[2em] 1 & \text{if } \varphi \geq \dfrac{1}{\overline{p}\pi} \end{cases}$$

from each environment will be deterred from taking the action. If $\varphi < \dfrac{1}{\overline{p}\pi}$ so the penalty is sufficiently low that some firms do indeed take the action, then we will have $D_B^{EBP} < D^{EBC} < D_H^{EBP} \leq 1$.

For any given penalty regime welfare is

$$W^{EBC} = \left(1 - D^{EBC}\right)\overline{W}^{EBC} \tag{12}$$

where

$$\overline{W}^{EBC} = (1-\gamma)\left(-h_B\right) - \gamma h_H = -\overline{h} \tag{13}$$

is the average welfare generated by those firms which take the action when there is Complete Legal Uncertainty.

In considering the implications for the penalty that would be chosen by the CA, and the associated level of welfare, two cases arise:

<u>Case 1</u>. Action is *Presumptively Legal* $\left(\overline{h} < 0 \Rightarrow \overline{W}^{EBC} > 0\right)$

Here the authority would want to allow all actions and to do this would set a penalty

$$\hat{\varphi}_{PL}^{EBC} = 0, \quad \hat{\psi}^{EBC} = 0 \tag{14}$$

giving rise to welfare:

$$\hat{W}_{PL}^{EBC} = -\overline{h} > 0 \tag{15}$$

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<u>Case 2</u>.   Action is *Presumptively Illegal* $\left(\bar{h} > 0 \Rightarrow \overline{W}^{EBC} < 0 \right)$

In this case, the CA will want to deter all firms from taking the action in which case

$$\hat{\varphi}_{PI}^{EBC} = \frac{1}{\bar{\pi} \, p}, \quad \hat{\psi}^{EBC} = 0 \tag{16}$$

and the associated level of welfare is:

$$\hat{W}_{PI}^{EBC} = 0. \tag{17}$$

Taking the two cases together we see that, when the CA can set the penalty, welfare under an *Effects-Based* legal standard when there is *Complete Legal Uncertainty* is

$$\hat{W}^{EBC} = MAX \left\{ -\bar{h}, 0 \right\}. \tag{18}$$

4.2   Per Se Procedure

In this sub-section we assume that the CA uses a *Per Se* procedure whereby all actions will be either allowed by the CA if the action is *Presumptively Legal* or, if the action is *Presumptively Illegal* will certainly be disallowed (albeit with a delay) if the action is investigated by the CA. This is common knowledge so there is no legal uncertainty when such a legal standard is used. To understand the implications consider in turn two cases.

4.2.1   Presumptively Legal Actions $\left(\bar{h} < 0 \right)$

In this case all firms take the action whatever the penalty and the associated level of maximum welfare is

$$\hat{W}^{PSL} = -\bar{h} > 0. \tag{19}$$

Since penalties are irrelevant they can effectively be set to zero, so:

$$\hat{\varphi}^{PSL} = 0, \quad \hat{\psi}^{PSL} = 0 \tag{20}$$

4.2.2   Presumptively Illegal Actions $\left(\bar{h} > 0 \right)$

In this case all firms know that, if they are investigated their actions will certainly be penalised. Consequently the same fraction of firms from both the Harmful and Benign environments will be deterred, namely

$$D^{PSI} = \begin{cases} F\left[\dfrac{\psi}{\dfrac{1}{\pi} - \varphi}\right] & \text{if } \varphi < \dfrac{1}{\pi} \\[2em] 1 & \text{if } \varphi \geq \dfrac{1}{\pi} \end{cases} = D^{EB0}. \qquad (21)$$

Welfare for any given penalty is therefore:

$$W^{PSI} = -\left(1 - D^{PSI}\right)\bar{h} = -\left(1 - D^{EB0}\right)\bar{h} \leq 0. \qquad (22)$$

If the CA can choose the penalty it will want to deter all actions and so will set a penalty

$$\hat{\varphi}^{PSI} = \frac{1}{\pi} = \hat{\varphi}^{EB0}, \quad \hat{\psi}^{PSI} = 0 \qquad , \qquad (23)$$

giving rise to welfare

$$\widehat{W}^{PSI} = 0. \qquad (24)$$

So, in general, when the CA can choose the penalty, welfare under a *Per Se* procedure is

$$\widehat{W}^{PS} = MAX\left\{-\bar{h}, 0\right\}. \qquad (25)$$

5. Welfare *Comparisons and Optimal Penalties: Main Results*

In this section we compare welfare under different procedures and information structures. We start with the case where penalties are fixed and the same across regimes.

5.1 Exogenous Penalties

Given that under *Per Se* there is no legal uncertainty, we begin by comparing the outcomes between *Per Se* and *Effects-Based* legal standards when under the latter there is the same information structure, *No Legal Uncertainty*; and then we compare the outcomes when there is the same legal standard, *Effects-Based,* but different information structures.

5.1.1 No Legal Uncertainty: Effects-Based vs Per Se

We have the following result:

Proposition 1 If there is *No Legal Uncertainty* then an *Effects-Based* legal standard welfare dominates a *Per Se* legal standard.

Proof: Since $D^{EB0} = D^{PSI}$ it follows from (6), (19) and (22) , and from (1) and (2) that:

$$W^{EB0} - W^{PSI} = D^{EB0}\left\{(1-\gamma)(-h_B)p_B - \gamma h_H(1-p_H)\right\} > 0$$

and

$$W^{EB0} - W^{PSL} = D^{EB0}\left\{\gamma h_H p_H - (1-\gamma)(-h_B)(1-p_B)\right\} > 0.$$

The intuition is straightforward. Given our Assumption 1 that the *Effects-Based* rule has lower decision-error costs (so equations (1) and (2) hold)*,* the average welfare of all the firms who know for sure that their action will be allowed is positive. Since, under this rule, all of these firms take the action, this welfare dominates a *Per Se Illegal* rule since, under that rule, some of these firms will be deterred from taking the action while of those who are not deterred a fraction will be investigated and have their action disallowed. On the other hand, again given that (1) and (2) hold, the average welfare of all the firms who know for sure that their action will be disallowed is negative under the *Effects-Based* rule. So, with such a rule some of these firms will be deterred from taking the action and for those who are not deterred some might have their action stopped. However, under a *Per Se Legal* rule all these firms generating negative welfare take the action. So if there is *No Legal Uncertainty* then it is better to have the discriminatory power of an *Effects-Based* legal standard.

5.1.2 The Effect of Legal Uncertainty: Partial Legal Uncertainty vs No Legal Uncertainty

Throughout this sub-section we will assume an *Effects-Based* legal standard.

From (6) and (9) we have

$$W^{EBP} - W^{EB0} = \left(D_H^{EBP} - D_B^{EBP}\right)(1-\gamma)(-h_B)$$
$$- D_H^{EBP}\left\{(1-\gamma)(-h_B)p_B - \gamma h_H(1-p_H)\right\} \qquad (27)$$
$$- \left(D^{EB0} - D_H^{EBP}\right)\left\{\gamma h_H p_H - (1-\gamma)(-h_B)(1-p_B)\right\}$$

Recall that $D^{EB0} \geq D_H^{EBP} \geq D_B^{EBP}$ where the two inequalities are strict if, under *Partial Legal Uncertainty* some firms from the harmful environment take the action, and that, from (1) and (2) the two terms in curly brackets on RHS of (27) are positive.

The interpretation of this expression is as follows. The first term shows that welfare under *Partial Legal Uncertainty* may be higher than that under *No Legal Uncertainty* because of what we called in Katsoulacos & Ulph (2009) the *differential deterrence effect* – the fraction of Benign actions that are deterred is lower than the fraction of Harmful actions that are deterred – an effect not present under *No Legal Uncertainty*. The second effect reflects the fact that a fraction of those firms whose actions would be allowed for sure under *No Legal Uncertainty* will be deterred from taking the action under *Partial Legal Uncertainty*, and since, on average, the welfare generated by these firms is positive, this is a factor that makes welfare lower under *Partial Legal Uncertainty*. The third term reflects the fact that for those firms whose actions will be disallowed for sure under *No Legal Uncertainty* a smaller fraction may be deterred under *Partial Legal Uncertainty*. Since, on average, the welfare generated by these firms is negative, this is another factor making welfare lower under *Partial Legal Uncertainty*.

The overall welfare difference depends on the balance of these three effects, but there are certainly circumstances under which the first dominates the other two. For example, this would arise if the *Effects-Based* rule was only barely good enough to *Effectively Discriminate* – so the second term on RHS of (27) was close to zero – while, if the penalty was so large that all the firms from the Harmful environment were deterred, while some from the Benign environment took the action, then we would have $1 = D^{EB0} = D_H^{EBP} > D_B^{EBP}$ and the third term on RHS of (27) would be zero while first would be positive. So we have established:

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

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) Even if welfare is lower under *Partial Legal Uncertainty* than under *No Legal Uncertainty* it may still be higher than under *Per Se*[46].

5.1.3 *The Effect of Legal Uncertainty*: *Complete Legal Uncertainty vs Partial Legal Uncertainty*

From (9), (12) and (13) we have:

$$W^{EBP} - W^{EBC} = \left(D^{EBC} - D_B^{EBP}\right)(1-\gamma)(-h_B) + \left(D_H^{EBP} - D^{EBC}\right)\gamma h_H \geq 0 \qquad (28)$$

Note that $D_H^{EBP} \geq D^{EBC} \geq D_B^{EBP}$ with strict inequalities if some firms take the action under *Complete Legal Uncertainty*. Hence both terms on the RHS of (28) are non-negative: the first because, compared to *Partial Legal Uncertainty*, *Complete Legal Uncertainty* deters at least as many Benign actions and the second because it deters no more Harmful actions. So we have proved:

Proposition 3 *Partial Legal Uncertainty* welfare dominates *Complete Legal Uncertainty*

5.1.4 *The Effect of Legal Uncertainty*: *Complete Legal Uncertainty vs No Legal Uncertainty*

From (6), (12) and (13) we get:

$$W^{EBC} - W^{EB0} = -D^{EBC}\left\{(1-\gamma)(-h_B)p_B - \gamma h_H\left(1-p_H\right)\right\}$$
$$- \left(D^{EB0} - D^{EBC}\right)\left\{\gamma h_H p_H - (1-\gamma)(-h_B)\left(1-p_B\right)\right\} < 0 \qquad (29)$$

where, $D^{EB0} \geq D^{EBC}$. The two terms on RHS of (29) are just the analogues of the second and third terms that appear on RHS of (27), and so have the same interpretation. Since there is no offsetting **differential deterrence effect** we can unambiguously sign the welfare difference and so we have established:

Proposition 4 *No Legal Uncertainty* welfare dominates *Complete Legal Uncertainty.*

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[46] See Katsoulacos & Ulph (2009) for an extensive analysis and discussion of the conditions under which an *Effects-Based* legal standard with *Partial Legal Uncertainty* welfare dominates *Per Se.*

Notice that following the discussion of the conditions under which *Partial Legal Uncertainty* may welfare dominate *No Legal Uncertainty* there are analogous conditions under which the first term on the RHS of (29) may be extremely small and the second zero so that welfare under *Complete Legal Uncertainty* is very close to that under *No Legal Uncertainty*. Since, from Proposition 1, an *Effects-Based* legal standard with *No Legal Uncertainty* welfare dominates *Per Se* we have:

Corollary 4 Although an information structure in which there is *Complete Legal Uncertainty* is the worst information structure for an *Effects-Based* legal standard, there are conditions under which it welfare dominates the outcome under a *Per Se* legal standard. This result is strengthened with endogenous penalties.

5.2 Endogenous Penalties

In this sub-section we first compare the levels of welfare if penalties are no longer fixed but can be chosen by the CA so as to best achieve its objective given the legal standard and information structure. We then compare the associated levels of optimal penalty across both legal standards and information structures.

Before undertaking these comparisons we note that in a *First-Best* world with costless perfect information, the CA would be able to investigate all actions, accurately and distinguish Harmful and Benign actions; instantly disallow the former while allowing the latter. All Harmful actions would therefore be deterred and all Benign actions allowed generating a *First-Best* welfare level

$$ W^{FB} = (1-\gamma)(-h_B). \tag{30} $$

Turning to the second-best world comparisons we will, for the sake of efficiency in presenting the results, show that the **worst** information structure under an *Effects-Based* standard is equivalent to *Per Se,* thus establishing that *Per Se* is **never** better than *Effects-Based.*

5.2.1 Welfare Comparisons

The following inequalities follow immediately from (8), (11), (18), (25) and (30):

$$W^{FB} = (1-\gamma)\left(-h_B\right)$$
$$= W^{EBP}$$
$$> W^{EB0} = (1-\gamma)\left(-h_B\right)p_B - \gamma h_H\left(1-p_H\right) \qquad (31)$$
$$> W^{EBC} = MAX\left\{-\bar{h}, 0\right\}$$
$$= W^{PS}$$

This establishes the following:

Proposition 5 When the CA can choose the appropriate penalty then there is a clear welfare ranking of information structures and legal standards. In particular:

   (a) With an *Effects-Based* legal standard *Partial Legal Uncertainty* strictly dominates *No Legal Uncertainty*[47] which in turn dominates *Complete Legal Uncertainty*.

   (b) An *Effects-Based* legal standard with *Complete Legal Uncertainty* is welfare welfare equivalent to a *Per Se* legal standard. Given (a) this implies that *Per Se* **never** welfare dominates an *Effects-Based* legal standard.

We comment further on these findings.

Partial Legal Uncertainty is equivalent to First Best. When there is *Partial Legal Uncertainty* the CA exploits the fact that firms know their type and the fact that, since its rule has discriminatory ability, fewer firms from the Benign environment will be convicted than from the Harmful environment, to set a penalty that ensures no Harmful actions are taken while all Benign actions are taken.

Partial Legal Uncertainty Strictly Dominates No Legal Uncertainty There are two reasons why this result holds. First, with *Partial Legal Uncertainty* all Harmful actions are deterred, whereas, under *No Legal Uncertainty,* some firms from the Harmful environment will take the action knowing for sure that, given the CA's imperfect model, they will not be convicted. Second, under *No Legal Uncertainty*, the penalty will be set to deter all actions that are on average deemed to be harmful, and some of these will be genuinely Benign which would not have been deterred under *Partial Legal Uncertainty.*

No Legal Uncertainty Strictly Dominates Complete Legal Uncertainty. There are two cases to consider. The first is where the action is *Presumptively Illegal* and so, under

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[47] Thus, with endogenous penalties, Proposition 2 is substantially strengthened.

Complete Legal Uncertainty, the CA would set a high penalty that deters all firms from taking the action, generating zero welfare. But then *No Legal Uncertainty* generates higher welfare since those firms that know for sure that their action will be allowed will take it and, given the assumption that the CA can effectively discriminate, on average these actions generate positive welfare. The second case is where the action is *Presumptively Legal* and so, under *Complete Legal Uncertainty,* the CA will set a zero penalty and so deter no actions. But then *No Legal Uncertainty* generates higher welfare since those firms who know for sure their action will be deemed harmful will be deterred from taking it, and, given the assumption that the CA can effectively discriminate, on average these actions are indeed harmful, and welfare is higher by deterring them.

Effects-Based Standards with Complete Legal Uncertainty Equivalent to Per Se

If the action is *Presumptively Illegal* then under *Per Se* the CA will set a penalty that will deter all actions – and the same is true with an *Effects-Based* standard with *Complete Legal Uncertainty.* If the action is *Presumptively Illegal* then, under an *Effect-Based* standard with *Complete Legal Uncertainty,* the CA will want to set a zero penalty so no actions are deterred.

5.2.2 Comparison of Optimal Penalties

From (7), (10), (14), (16), (20), and (23) we have the following inequalities:

$$0 = \hat{\varphi}^{PSL} = \hat{\varphi}^{EBC}_{PL} < \hat{\varphi}^{PSI} = \hat{\varphi}^{EB0} = \frac{1}{\pi} < \hat{\varphi}^{EBP} = \frac{1}{\pi p_H} < \hat{\varphi}^{EBC}_{PI} = \frac{1}{\pi \underline{p}} \qquad (32)$$

This establishes the following:

Proposition 6   Under an *Effects-Based* legal standard, the optimal penalty chosen by the CA will be:

  (a) higher when there is *Partial Legal Uncertainty* than when there is *No Legal Uncertainty*

  (b) higher still when there is *Complete Legal Uncertainty* and the action is *Presumptively Illegal*;

  (c) zero if there is *Complete Legal Uncertainty* and the action is *Presumptively Legal*;

(d) higher than under a *Per Se* legal standard except in the case where an action is *Presumptively Legal* and there is *Complete Legal Uncertainty* in which case they are the same.

Thus in situations where there is legal uncertainty the appropriate penalty may be higher than when there is no legal uncertainty, though there is one class of cases where the appropriate penalty under *Complete Legal Uncertainty* is indeed zero. While this latter result is certainly consistent with the principle of *nulla poena sine lega certa* as advocated by Dethmers and Engelen (2011) and other legal scholars, there is no *general* support for this principle.

Remark   It is worth stressing that these results are entirely consistent with the Beckerian tradition on optimal penalties. As Becker (1968) had first noted the optimal penalty is higher when uncertainty is introduced in the form of imperfect detection. Here we show that if there is increased uncertainty in the form of imperfect understanding about how actions will be treated if investigated by a CA (the form of uncertainty that has preoccupied legal writings) this may raise optimal penalties – though this will not always be the case. As shown, this result holds also when there detection is perfect ($\pi = 1$).

6. *Concluding Remarks*

In this paper we have proposed a formalisation to the concept of "legal uncertainty" and have set this out in the context of competition policy, but the framework can apply more widely. Our approach identifies legal uncertainty purely with the information structure of what a firm knows about the decision that a CA would reach should an action that the firm has taken be investigated by the authority. As such, legal uncertainty is distinct from the phenomenon of decision errors made by the authority, which are neither necessary nor sufficient for the existence of legal uncertainty. We distinguish three information structures with no legal uncertainty, partial legal uncertainty and complete legal uncertainty.. We compare these different information structures between themselves and with *Per Se* procedures first assuming that penalties are exogenous and then assuming that penalties are endogenous.

Our analysis offers important grounds for scepticism about arguments coming mainly from legal experts, that *Effects-Based* procedures are less attractive than *Per Se* *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 be welfare superior to those without any legal uncertainty because of their better deterrence effects. This is most likely when legal uncertainty arises because, although firms know their type, they cannot predict what the Competition Authority will decide in their case. 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 Competition Authorities use penalties to achieve optimal deterrence effects. In that case it is **never** better to use *Per Se.* Under a *Per Se* legal standard Competition Authorities will use penalties to either deter all actions or deter none[48]. Apart from the case of *Complete Legal Uncertainty*, under an *Effects-Based* procedure, Competition Authorities can use information that either they or firms have to set finely tuned penalties that don't deter all benign actions but do deter some harmful actions. So *Per Se* is never the preferred legal standard whatever the type of *Legal Uncertainty* – a conclusion that runs directly counter to that proposed by many legal experts.

Finally, and more practically, our analysis shows that Competition Authorities may well be justified in *raising* their penalties after adopting *Effects-Based* procedures.

There are many extensions that can be made to our analysis. Some of these extensions are made in an accompanying discussion paper, Katsoulacos & Ulph (2011b) where we show that the results obtained here go through if (i) we endogenise the information structure that firms have by allowing them to invest resources in information acquisition; (ii) instead of all firms having the same information structure different firms may have different information structures.

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[48] Depending, respectively, on whether the action is *presumptively illegal* or *presumptively legal*.

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