ON OPTIMAL LEGAL STANDARDS FOR COMPETITION POLICY WHEN FIRMS DO NOT KNOW THE SOCIAL WELFARE IMPLICATIONS OF THEIR ACTIONS

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On Optimal Legal Standards for Competition Policy

when firms do not know the social welfare implications of their actions [*]

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Abstract

We present a welfare-based framework for the optimal choice of legal standards which encompasses decision-theoretic considerations **and** relates them to the underlying quality (in terms of discriminating between benign and harmful actions undertaken by firms) of economic models and information available to regulatory authorities. Our model also accounts for the ***Indirect Effects*** (or deterrence effects) caused by alternative legal standards (Joskow, 2002) as well as for ***Systemic Effects*** – *delays* in reaching decisions and (imperfect) *detection* by regulators of the actions taking place. In this paper the analysis is restricted to cases in which it would be reasonable to assume that firms do not know whether their action is socially harmful or benign[3]. After deriving necessary and sufficient conditions for adopting discriminating rules (such as Rule of Reason) we then apply our framework to two recent landmark competition cases – *Microsoft vs. EU Commission* and *Leegn Vs. PSKS* – in which a change in legal standards has been proposed.

[3] It can be argued that this is a reasonable assumption for many unilateral practices examined under article 82 in the EU, the implications of which, for social welfare, depend on a complex weighing of anticompetitive and precompetitive effects. In a companion paper, Katsoulacos and Ulph (2007) we provide a general analysis.

Section 1   Introduction and Rationale

Rationale and Brief Review

In the landmark decision on *Leegin Vs. PSKS*, of June 28th 2007, the Supreme Court of the USA overturned a nearly century old precedent of treating Resale Price Maintenance as **Per Se** Illegal under Section 1 of the Sherman Act[4]. The Court, following the advice of the Brief of Amici Curiae Economists in support of Petitioners, decided that vertical price restraints should be judged by the **Rule of Reason**[5]. By adopting this change in the Decision Rule, or Legal Standard, used in assessing the practice of RPM, the Supreme Court essentially ruled that, with the exception of hard-core (horizontal) cartels, no business practice with potentially anticompetitive effects will be treated in the future in USA under a **Per Se** illegality standard. In *Leegin*, the Supreme Court reversed the Court of Appeals decision, finding against the defendant, and remanded the case in order to be re-examined under **Rule of Reason**[6].

In another recent landmark case, the European Court of First Instance (CFI) delivering, on September 17th 2007, its decision on Microsoft's appeal on *Microsoft vs. Commission* it concurred with the Commission on all substantive issues. One aspect of the Commission's Decision, concerns the question of Refusal to Licence Intellectual Property Rights (IPRs). Microsoft's refusal to share interoperability information for Windows, protected by IPRs, with its competitors, was, according to the Commission, abusive. The Commission argued that it will have adverse effects on innovation and ultimately on consumers and ordered compulsory licensing of this technology. In order to reach these conclusions, the Commission (and the CFI) also proposed and adopted a new Legal Standard, one that significantly alters certain aspects of the "exceptional circumstances" standard prevailing until then[7].

Have the USA Supreme Court in the first case and the Commission (and CFI) in the second case been right to advocate a change in the decision rule that should be adopted in dealing with the practices of RPM and Refusal to License IPR, respectively?

Needless to say, in both these landmark cases the the proposed changes in legal standards has raised substantial opposition. On the *Leegin* case, the American Antitrust institute filed an amicus brief urging that the **Per Se** illegality standard be upheld emphasizing that procompetitive uses of RPM are not common and that the harm from anticompetitive uses is relatively substantial, as well as issues of

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[4] Supreme Court of USA (2007) "Leegin vs. PSKS Inc." Decision No. 06-480, June 28th 2007.
[5] Ab.cit. p. 1.
[6] The tendency towards Rule of Reason or a more "economics-(or effects-) based" approach is in recent years also evident in Europe. See for example, EAGCP Report (2005) and Vickers (2005).
[7] See for example J. Killick (2004).

legal uncertainty and administrability disadvantages of Rule of Reason[8]. On the *Microsoft* case it has also been very forcefully argued that the change in the legal standard will increase the cost of decision errors as well as, again, legal uncertainty and administrability costs[9].

Clearly, the issue of the appropriate Decision Rule or Legal Standard is extremely important in Competition Law and Policy. This is also true in many other contexts. Indeed, a general problem faced by a wide range of regulatory authorities (such as Competition Authorities, Sectoral Regulators dealing with competition issues in liberalised sectors, environmental agencies, tax authorities etc) is the following. Agents take actions that are privately beneficial but from a wider social point of view may be harmful or beneficial. The degree of social harm/benefit varies with the circumstances under which the action is taken in a way that is understood by the authority. While the authority may know the range of circumstances that prevails in society – and hence the average harm/benefit that would arise if every agent took the action – it cannot observe the precise circumstances under which any given action is taken.

Assuming that a random subset of cases is detected, the authority has to decide in each case whether to allow or disallow the action. The authority could simply allow or disallow **all** the actions detected depending just on its understanding of the perceived average harm/benefit – so each action is allowed or disallowed irrespective of any finer considerations of the characteristics of the action, of the firm/agent and of its environment (nature of product, market, demand, technology etc.). This is an example of a *Per Se* rule.

On the other hand, the authority may have available some more sophisticated analysis which could potentially allow it to form a view as to the type (harmful or benign) of each specific action and may decide to use this when assessing whether to allow or disallow. **Rule of Reason** is an example of such an approach[10]. Note however that the more sophisticated analysis may not allow it to discriminate effectively between benign and harmful actions, in which case it would be best again to allow or disallow on the basis of the perceived average harm, i.e. it would be best to use a *Per Se* rule[11].

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[8] See Vickers (2007), p.10.
[9] See for example, Ahlborn, Evans and Padilla (2005) and Killick (2004).
[10] For an early thoughtful exposition of Per Se vs. Rule of Reason see J W Markham (1955). The recent debate on the use of Per Se vs. Rule of Reason (or effects-based) approaches to Competition Policy implementation is very much related to the literature on the optimal complexity of legal rules. Contributions here include Ehrlich and Posner (1974), Diver (1983), Polinsky and Shavell (1989), Ogus (1992), Kaplow (1995, 2000) , Mahoney and Sanchirico (2005), and Christiansen, A. and Kerber (2006).
[11] Even though the issue of what is the appropriate legal standard to adopt when a regulatory authority faces the type of circumstances described above and several aspects of the model which we will propose to deal with this issue, have far wider applicability than in Competition Law and Policy, in the following we will be restricting our attention on, and we will be using examples that come from, this domain.

In choosing between different legal standards, as the Decision Theoretic (DT) approach[12] has long recognized, a first important consideration to take into account is the fraction of harmful actions in all possible circumstances, or what can be referred to as the "base-rate probability of anticompetitive harm"[13]. So when benign actions are very rare it may make sense to ban the lot, taking into account the costs of administration and adjudication, i.e. adopt a *Per Se Illegality* rule. When, on the other hand, harmful actions are very rare rules of *Per Se Legality* should be applied[14]. Further, "Decision theory (also) implies that it is not just the relative frequency of pro- and anti-competitive consequences that matters to the assessment of a *Per Se* rule, but the severity of resulting harm in either case"[15].

Important analyses espousing a Decision Theoretic (DT) Approach and taking into account the above considerations in order to propose optimal legal standards for a number of business practices have been undertaken in a number of papers following the seminal contribution of judge Easterbrook (1992). He put forward a <u>decision error-cost framework</u> – proposing the idea that <u>legal standards should minimise the sum of the welfare costs caused by decision errors</u> of type I (false positives or false acquittals) and type II (false negatives or false convictions)[16]. As noted originally by Ehlrich and Posner (1974), "due to the inherent ambiguity of language and the limitations of human foresight and knowledge" decision errors will occur, that is, legal rules will in practice suffer from problems of "overinclusion" (benign actions are prohibited) and "underinclusion" (harmful actions are permitted)[17].

However, DT analyses of the optimal choice of legal standards has up to now remained informal and, as shown below using the examples of the two recent antitrust decisions mentioned above, this can lead to confusion and false conclusions[18]. Specifically, no formal model of the optimal choice of decision rules has emerged in the literature that takes into account the above decision-theoretic considerations **and** relates them to the underlying quality of economic models and available information in identifying benign and harmful actions. It is such a formal model that we propose below.

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[12] See for example Hylton and Salinger (2001), Hylton and Salinger (2004), Ahlborn, et.al (2005) and Salinger (2006).

[13] As Whinston (2006) mentions "the justification of the Per Se rule is really nothing more than an application of optimal statistical decision making".

[14] Vickers, ab.cit. p.4, quoting Easterbrook in US Court of Appeals case *Schor vs. Abbott Labs*.

[15] Vickers, ab. Cit. p.10

[16] See Beckner and Salop (1999), Tom and Pak (2000), Joskow (2002), Evans and Padilla (2004, 2005), Hylton and Salinger (2001), Ahlborn, Evans and Padilla (2005), Christiansen, A. and W. Kerber (2006), Salinger (2006).

[17] Page 268. See also Diver (1983), Polinsky and Shavell (1989), Ogus (1992), Kaplow (1995, 2000), Mahoney and Sanchirico (2005), Heyer (2005) and Christiansen, A. and Kerber (2006).

[18] Or perhaps to the right conclusion but for the wrong reasons.

Further and very importantly the DT Approach can produce false conclusions because it concentrates on just the subpopulation of cases actually investigated by the Competition Authority (CA) and thus takes into account only the cost of decision errors on these cases and, potentially, administrability considerations. However, while the costs of decision-errors are important, the **Indirect Effects** (or deterrence effects) caused by alternative legal standards may well be equally or even more important. This has been recognised by, among others, Joskow (2002) who argues that they are more important than the costs of decision-errors as they include the (cost of) the responses and adaptations that target firms as well as other "firms and markets in *general* make to antitrust rules …. and (the effect of these) on prices, costs and innovation throughout the economy"[19].

Finally, in undertaking a comparison of rules it is important to go beyond the usual decision errors and administrability considerations and recognise not just the indirect/behavioural effects of rules but also two types of **Systemic Effect** – *delays* in reaching decisions and (imperfect) *detection* by CAs of the actions taking place.

Per Se vs. Discriminating Rules

The framework described below distinguishes between **Per Se** and **Discriminating Rules**. **Per Se** rules are equivalent to non-discriminating rules. (Effectively) Discriminating rules are rules that discriminate between benign and harmful actions. The criterion used to discriminate, given that the CA cannot observe the precise circumstances of the action, and the *discriminating quality* of a rule will be made precise below. Our framework allows for a continuum of discriminating rules that differ in terms of their discriminating quality, with **Per Se** and **Rule of Reason**[20] located at the two ends of the spectrum[21].

Adopting a discriminating rule implies that the CA uses an economic model (out of the many potentially available to it) and available information on the market, the firm, technology, demand etc.

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[19] Page 98. Joskow (2002), adopts a Transactions Cost framework. The remarks of Commissioner Kroes on the importance of the "precedential value" of the recent Microsoft Decision testifies that policy makers are very much aware of these effects.

[20] The standard interpretation of Rule of Reason is that of case-by-case assessment - as the Supreme Court makes clear in its *Leegin* decision (p. 3). However, careful commentators even when favouring the use of a more "economics-based approach", warn that this should not mean unlimited discretionary powers on behalf of the authority: as Vickers (2007a) points out "rules of law should (not) be replaced by discretionary decision making based on whatever is thought to be desirable in economic terms case by case……….not least for reasons of predictability and accountability". In our model, where rules differ in terms of their "discriminating quality", it is natural to reserve the term Rule of Reason for the rule with the highest such quality – see below.

[21] For further discussion of the concept of discriminating rules see also Christiansen, A. and W. Kerber (2006), p. 221-2. Kaplow (1995) defines the complexity or precision of rules as referring to the number and complexity of distinctions incorporated in the rules. Related concepts discussed are those of "general" vs, "specific" rules and "standards" – see Mahoney et al, (2005), Ehrlich and Posner (1974) and Kaplow (2000). To the extent that the distinction refers to the degree of complexity and precision of a rule then a general rule is a simple one (as a Per Se rule) in our sense and a specific rule or a standard (in Ehrlich and Posner's, 1974 sense) is a Discriminating Rule in our sense. This is of course fundamentally different from the notion of "toughness" of rules (eg Evans and Padilla, 2004). Per se legality and per se illegality are polar opposites in terms of "toughness" but are identical in terms of "complexity" in Kaplow's sense.

to discriminate between benign and harmful actions. To "use a model" involves a combination of (i) examining some specified criteria to test for whether the action is pro- or anti-competitive, (though CA may have huge discretion about how it does this and interprets the results); (ii) using other considerations that the CA has the discretion to determine in order to come to an overall view about the action.

The models that the CA uses are not fine enough to enable it to accurately assess the probability that the action before it is pro-competitive (benign) or anti-competitive (harmful). Rather we assume that all the CA can do having applied its model is to say whether it thinks the action before it is likely on balance to be anti-competitive or likely on balance to be pro-competitive. As a short-hand we will call making the former judgement putting the action into a Red Box and making the second judgement putting it into a Green Box. However the authority recognises that its tests and hence its judgement could be faulty, and there is a chance that an action that is genuinely benign could end up being classified as being on balance anti-competitive (put in Red Box) and a chance that an action that is genuinely harmful could end up being classified as being on balance likely to be pro-competitive (put in Green Box). Recognising this the authority also realises that simply banning actions that are in the Red Box and allowing those in the Green Box may not be sensible, because, for example, actions that are classified as being on balance anti-competitive could still be highly likely to be benign.

By way of illustration, suppose that it was known that 90% of all actions were benign and 10% harmful. Suppose that the criteria and models the authority uses are good enough that 80% of actions that are benign are classified as being likely to be so (put in Green Box) and 90% of actions that are harmful are classified as being likely to be so (put in Red Box). Equivalently, say that the criteria and models the authority uses are good enough that with probability $p_G = 0.8$ actions that are benign are classified as being likely to be so, and with probability $p_R = 0.9$ actions that are harmful are classified as being likely to be so. So of every 100 actions detected and investigated, 18 benign actions and 9 harmful ones would be classified as likely to be harmful. That is, in this example, banning actions in the Red box means that there is a 2/3 probability of banning benign ones. As will become evident below, in this example, unless the degree of harm caused by anti-competitive outcomes is greater than twice the level of benefit from pro-competitive outcomes it would not be sensible to ban actions just because there is a presumption that on balance they are anti-competitive (are in the Red box). So what we assume is that the CA allows or disallows actions based on the basis of the following criterion. Given:

(i)   the CA's judgement about the quality of the model it uses (i.e. p_R and p_G);

(ii)   its understanding of the proportion of harmful cases in the population (γ); and

(iii) its view of the harm from anti-competitive outcomes and the benefit from pro-competitive actions

the CA forms a view of the likely harm caused by actions in the Green Box and the likely harm caused by actions in the Red Box and <u>bans/allows all the actions in a given Box depending on whether this expected harm is positive or negative</u>[22].

If the expected harm conditional on been in the Red Box is of the same sign as the expected harm conditional on been in the Green Box then *the rule cannot effectively discriminate between harmful and benign actions*, its discriminating quality is poor, and the CA should use a ***Per Se*** rule disallowing all actions if the sign is positive and allowing all actions if the sign is negative. ***Rule of Reason*** is defined as the rule that adopts the criteria, economic models and information that maximise discriminating quality – in a sense that will be made precise below.

The literature also refers to rules such as *Modified Per Se Legality/Illegality* or *Structured Rule of Reason*[23]. These can be thought of as examples of Discriminating Rules in the sense defined above. In contrast to the existing literature, our model allows an explicit comparison of such rules on the basis of their underlying discriminating quality and thus their effectiveness in minimising decision errors as well as their deterrence effects[24].

In the following sections, after setting out our model, we start with a comparison of decision rules concentrating, as in the DT approach, just on the subpopulation of actions that are detected and investigated by a CA. We then provide a full welfare comparison of different decision rules taking into account also indirect and systemic effects. Indirect effects are produced as firms are deterred from taking the action, realising that with a certain frequency the CA disallows them. The extent to which this happens depends on the size of fines and the costs of remedies.

Key insights and results

The key results / messages of the paper are as follows:

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[22] Thus, if for example the expected harm conditional on been in the Green Box is positive the action will be disallowed even though it is in the Green Box.

[23] For example Evans and Padilla (2004, 2005) and Ahlborn, Evans and Padilla (2004, 2005) propose Modified Per Se Legality (MPSL) approaches or Structured Rule of Reason for tying and MPSL for refusal to licence an IP right..

[24] Finally, in the *Two-Tier Approach* used in Merger Procedures and proposed for the case of Predatory Price Cutting (Joskow and Klevorick (1979), Motta (2004)), a "simpler model" is first developed, composed of a series of simple "screen tests" that aim to separate the large fraction of actions that can be thought of as pro-competitive, from the potentially anti-competitive actions. For the latter, the approach proposes the application in a second phase of a more "sophisticated" model. Undertaking a systematic analysis of such a procedure that requires the sequential application of a low quality and high quality rule is an interesting but straightforward extension of our framework.

1. We derive a simple but powerful necessary condition for adopting Discriminating rules depending on:

(i) The frequency (γ) of harmful actions in the overall population.

(ii) The economic harm (benefit) that arises from harmful (benign) actions.

(iii) The underlying quality of the criteria, economic models and available information used by the CA in identifying benign and harmful actions – i.e. the values of p_R and p_G.

The necessary condition is different when the business practice under consideration is judged by the CA as been ***presumptively legal*** (raising, on average, consumer welfare) than when the business practice is judged by the CA as been ***presumptively illegal*** (reducing, on average, consumer welfare).

When actions are ***presumptively legal*** high - p_G economic models are more likely, ceteris paribus, to produce effective discriminating rules while when actions are ***presumptively illegal*** high - p_R economic models are more likely, ceteris paribus, to produce effective discriminating rules.

As the necessary condition indicates, using a better economic model is not enough – models have to be sufficiently good to be able to effectively discriminate.

2. While having good enough economic models to be able to effectively discriminate is a necessary condition for a discriminating rule to be better than Per Se it is not in general sufficient. It would be sufficient if we only took account of decision errors. But when we recognise indirect and systemic effects this is no longer sufficient. Indeed a discriminating rule that is just good enough to discriminate will actually do worse than ***Per Se***. This is because discriminating rules have higher *indirect costs* than ***Per Se*** as they impose a stronger deterrent than ***Per Se*** in conditions where it is preferable to have a weaker deterrent effect (actions are ***presumptively legal)*** and a weaker deterrent effect than ***Per Se*** in conditions where it pays to have a stronger deterrent effect (actions are ***presumptively illegal)***. To be better than ***Per Se*** it is necessary that models are **very much better** than just being able to discriminate.

3. Apart from decision errors, deterrence effects also depend on the underlying quality of the economic model used – i.e. on p_R and p_G, as these affect the frequency with which actions are disallowed by the CA under discriminating rules. Increasing p_G reduces deterrence while increasing p_R increases deterrence effects. When actions are ***presumptively legal*** high - p_G discriminating rules will minimise negative deterrence effects while when actions are ***presumptively illegal*** high - p_R discriminating rules will minimise negative deterrence effects.

4. While being **very much better** than just being able to discriminate is necessary for a rule to be better than *Per Se* it is still not sufficient. *How* you improve models/rules matters.

   - If an action is ***presumptively legal*** then we should, *ceteris paribus*, concentrate on improving prevention of false convictions since this will both be the most effective way of reducing the costs of decision errors but will also reduce the amount of benign actions that are wrongly deterred. Reducing false acquittals will reduce the costs of decision errors – though less effectively – but will actually increase the rate of wrongful deterrence.

   - If an action ***presumptively illegal,*** again how you improve models/rules is very important, though we show that there is no unambiguous prediction as to whether it is best to improve the prevention of false acquittals or the prevention of false convictions.

   - It is not in general safe, when choosing between different legal standards for a specific practice to draw conclusions by just comparing their quality in preventing false convictions or in preventing false acquittals. The comparison should be based on a quality index taking into account both these dimensions.

5. The scale of remedies and antitrust fines matters in determining the magnitude of the deterrence effect, and hence the comparison between rules. Large remedies (increasing the cost to firms of reversing their actions if disallowed) and fines will tilt the balance in favour of ***Per Se*** rules for presumptively legal practices – though no such unambiguous relation exists for presumptively illegal practices.

Section 2   The   Model

2.1 Introduction

There is a population of firms, whose size is normalised to 1, who could potentially take an action. Having taken the action there is an exogenous possibility p, $0 < p < 1$, that this could become the subject of an investigation by a CA, which could disallow it and could then require the firm to reverse it and/or impose a penalty. Anticipating this firms have to decide whether or not to take the action[25]. If there were no intervention, the action confers a positive private benefit which we take to be the present value of the expected change in profits from the action over its "natural" lifetime[26]. Let $b > 0$

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[25] Note that this is an *ex-post* investigation process. An alternative decision process involving *ex ante* intervention by the Competition Authority is a *prior clearance* process whereby firms contemplating taking an action (e.g. to merge) have to get prior approval before proceeding. We leave the investigation of this set-up to future work.
[26] This captures the idea that firms operate in a changing environment and that an action taken at a particular time might be modified or even reversed at some later date.

denote the benefit accruing to a typical firm. Actions can also cause wider social harm, which we take to be measured by the negative of the present value of the change in consumer surplus. We assume that firms belong to just two environments which reflect the exact nature of the firms' characteristics and the characteristics of the markets in which they operate. For (type 1) firms from environment 1 the action will generate harm $h_1 < 0$ - i.e. will be socially beneficial. For (type 2) firms from environment 2 the action will generate social harm of present value $h_2 > 0$ [27]. Notice that in this paper, we will be implicitly assuming that firms will not be differentiated in terms of the *nature of the action* undertaken – that is, we take actions to refer to rather specific (in contrast to generic) practices[28].

Let the fraction of firms in environment 2 be γ, $0 < \gamma < 1$. We assume that the values of γ, h_1 and h_2 are common knowledge, as is therefore the value of average harm/benefit $\bar{h} = \gamma h_2 + (1 - \gamma)h_1$. In principle the distribution of private benefits could be different for different environments. However in this paper we will impose the **symmetry assumption** that the two distributions are identical. So we suppose that the private benefit has a positive continuous probability density $f(b) > 0$ on $[0, \infty)$, with cumulative distribution function $F(b)$.

2.2 The Investigation Process

The process of investigating firms comprises a number of stages.

Stage 1 Notification

There are a number of ways in which it could come to the attention of a CA that a firm has taken an action. In some cases firms might be required to notify the authority that they have taken the action. In other cases there may be third-party reports sent to the CA or the CA may find out through its own market inquiries. We assume that third-parties are not able to observe whether an action is harmful or benign (i.e. to which environment a firm taking the action belongs). So firms being reported are drawn randomly from the set of firms that have taken the action.

Stage 2 Verification

Following notification the authority verifies whether or not the firm has indeed taken the action. We assume that the authority does not wrongly classify a firm as having taken the action when it has not. If this is common knowledge then there should be no malicious reporting of firms who have not taken the action. Of course, we recognise that this is a simplification: since we take actions to refer to rather

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[27] It is important to use present values especially for discussions related to dynamic industries. In the terminology used by Hylton and Salinger (2001), h_2 is the "welfare gain from disallowing a type 2 action" while h_1 is the "welfare loss from disallowing a type 1 action".
[28] As we noted in Section 2 above this is quite appropriate otherwise the notion of Per Se rules loses much of its practical significance.

specific (in contrast to generic) practices, the verification of such actions in some cases will not be an error-free process[29]. We assume that the authority is obliged to investigate every case that is reported to it and make a determination of whether the action should be allowed or disallowed.

Stage 3 Investigation

As noted in the introductory section above the CA can choose between **Per Se** or Discriminating decision rules. More specifically, the CA can use some "model" to try to determine whether a firm has come from environment 1 or environment 2. Models are typically imperfect so we suppose that if a firm comes from environment 1 there is a probability p_G, $0 < p_G \leq 1$ that the CA puts it in a Green box, i.e. it considers that the action is likely on balance to be benign, while if a firm comes from environment 2 there is a probability p_R, $0 < p_R \leq 1$ that the CA puts it in a Red box. In what follows a model is characterised by the two parameters (p_G, p_R). If $p_G + p_R = 1$ then the probability of being put in the Green (Red) box is exactly the same whichever environment the firm comes from, so the knowledge generated by the model is completely uninformative. However if $p_G + p_R > 1$ then firms from environment 1 are more likely to be put in the green box than are firms from environment 2, while firms from environment 2 are more likely to be put in the Red box than are firms from environment 1. So the knowledge generated by the model is potentially more informative.

Costs of Using Rules

As has been pointed out in the literature[30] some rules are more costly to operate than others. Let $K(p_G, p_R)$ be the total economic cost of employing a model (p_G, p_R). This could include: the costs of initially developing the model; the costs to the CA of gathering the information required by the model; the cost of conducting the analysis in each of the cases. Clearly, these costs could depend on p, but since that is treated as exogenous in this paper we do not make this explicit. We assume that if $p_G + p_R = 1$ then $K(p_G, p_R) = 0$ but that if $p_G + p_R > 1$ costs are increasing in each of the arguments. There will also be costs that fall on firms from the investigation process, and the anticipation of these could be relevant to a firm's decision as to whether or not to take the action. However in the interests of simplicity we ignore these costs.

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[29] A case that comes to mind is that of actions been "pricing below Average (Economic) Variable Cost". In other cases the assumption that verification is error-free (and relatively costless) is much more realistic. Our analysis can be thought of as one involving a **single-error stage** (related to the investigation phase). The multi-error stage analysis is left for future research.
[30] Christiansen et.al. (2006) p. 223/224, 231

Delay in Decisions – The Litigation Cycle

As noted by Ehrlich and Posner (1974, the choice between decision rules "affects the speed, and hence indirectly the costs and benefits, of legal dispute resolution…"[31]. To capture this idea we assume for simplicity that if the CA disallows an action under ***Per Se*** then a firm gets only a fraction ϕ, $0 \leq \phi \leq 1$ of the private benefit b that it would have got had the action been allowed, while if the authority disallows the action under a *Discriminating Rule* procedure then the firm gets only a fraction ϕ_D, $0 \leq \phi_D \leq 1$ of the private benefit b. We assume that $\phi < \phi_D$, that is under ***Per Se*** decisions are reached quicker than under a Discriminating Rule procedure (under the latter, the *litigation cycle* is longer). The fact that ϕ_D does not depend on (p_G, p_R) reflects the assumption that factors that lead to an improved model need not lead to a lengthier decision process[32].

Stage 4 Decision of CA

We assume that in deciding whether to allow or disallow an action a CA does so on the basis of the expected harm caused by the action. This is the standard for reaching decisions which is typically employed in Europe and US[33].

To calculate expected harm the CA has to consider how likely it is that any given firm that comes to its attention comes from environment 2. By assumption the sample of firms coming to the CA's attention is just a random sub-sample of the population of firms that *have* taken the action. However this is not necessarily the same as the base population of firms that *could* have taken the action, and so the fraction of firms who have taken the action who come from environment 2 is not necessarily γ. However, as we will show below, given the symmetry assumption, introduced above, on the distribution of b and that there are no asymmetric deterrence effects, the fraction of firms who end up taking the action that come from environment 2 will always be γ, irrespective of the decision rule chosen by the authority. So in calculating expected harm the CA can reasonably assume that the likelihood that any given firm with which it is dealing comes from environment 2 is γ.

Suppose then that the CA considers an action put into the Red box. It is easy to see that the probability that this comes from a firm from environment 1 is $\dfrac{(1-\gamma)(1-p_G)}{\gamma p_R + (1-\gamma)(1-p_G)}$, and so the

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[31] Page 265-6.

[32] For example using a more powerful theory may improve discriminatory power but may not increase length of time to collect, process and analyse the data and then deliberate on the findings.

[33] An alternative would be to base decisions on a more comprehensive welfare measure by considering the net harm $h - b$ – as is happening in some countries such as Canada. It would be interesting to extend our framework to consider this alternative standard for reaching decisions.

probability that it comes from a firm from environment 2 is $\dfrac{\gamma p_R}{\gamma p_R+(1-\gamma)(1-p_G)}$. Hence the

expected harm conditional on being in the Red box is

$$\bar{h}(R)=\frac{(1-\gamma)(1-p_G)}{\gamma p_R+(1-\gamma)(1-p_G)}.h_1+\frac{\gamma p_R}{\gamma p_R+(1-\gamma)(1-p_G)}.h_2\ (1)$$

By analogy the expected harm conditional on being in the Green box is

$$\bar{h}(G)=\frac{(1-\gamma).p_G}{\gamma.(1-p_R)+(1-\gamma).p_G}.h_1+\frac{\gamma.(1-p_R)}{\gamma.(1-p_R)+(1-\gamma).p_G}.h_2\ (2)$$

The CA will disallow or allow an action conditional on being in the Red (resp. Green) box as $\bar{h}(R)>0$ or $\bar{h}(R)<0$ (resp. $\bar{h}(G)>0$ or $\bar{h}(G)<0$).

For future purposes we note the following properties of $\bar{h}(G)$ and $\bar{h}(R)$:

Lemma 1

  (i)   If $p_G+p_R=1$ then $\bar{h}(G)=\bar{h}(R)=\bar{h}$ - this is the case in which the model is totally uninformative, or has zero discriminating quality, and only **Per Se** can be used;

  (ii)   If $\gamma=0$ then $\bar{h}(R)=\bar{h}(G)=h_1<0$ while if $\gamma=1$ then $\bar{h}(R)=\bar{h}(G)=h_2>0$. In the first (second) case a **Per Se** Legality (Illegality) rule will be used.

  (iii)   if $p_G+p_R>1$, so the model has some discriminating quality, then

$h_2\geq\bar{h}(R)>\bar{h}>\bar{h}(G)\geq h_1$;

  (iv)   if $p_G+p_R>1$ and $p_G=1$ then $\bar{h}(R)=h_2>0$

  (v)   if $p_G+p_R>1$ and $p_R=1$ then $\bar{h}(G)=h_1<0$

  (vi)   if $p_G+p_R>1$ and both $p_R<1$ and $p_G<1$ then an increase in either p_G or p_R will increase $\bar{h}(R)$ and lower $\bar{h}(G)$

From part (iii) of the Lemma, for a *Discriminating Rule* to be an *Effective Discriminating Rule* it is necessary that $\bar{h}(R)>0>\bar{h}(G)$. In this case the CA will disallow actions put in the Red box and allow actions put in the Green box. We define **Rule of Reason** as the model (p_G,p_R) that maximises

$\bar{h}(R)$ when an action is presumptively legal ($\bar{h}<0$ and so $\bar{h}(G)<0$) and minimises $\bar{h}(G)$ when an

action is presumptively illegal ($\bar{h} > 0$ and so $\bar{h}(R) > 0$). To see when a discriminating rule is effective we consider the following:

Proposition 1 (Necessary Conditions for *ED-Rules*)

1.(i) If $\bar{h} < 0$, so $\gamma h_2 < (1-\gamma).(-h_1)$, $\bar{h}(G) < 0$, from Lemma 1(ii). It is then necessary so that the CA

uses a discriminating rule that $q_R \equiv \dfrac{p_R}{1-p_G} > \dfrac{(1-\gamma).(-h_1)}{\gamma h_2}$ where we can think of q_R as an index of the

rule's discriminating quality when $\bar{h} < 0$.

Proof: The above inequality is necessary for $\bar{h}(R) > 0$, from (1), which is necessary for the rule to be

effectively discriminating given $\bar{h} < 0$.

1.(ii) If $\bar{h} > 0$, so $\gamma h_2 > (1-\gamma).(-h_1)$, $\bar{h}(R) > 0$, from Lemma 1(ii). It is then necessary so that the

CA uses a discriminating rule that $q_G \equiv \dfrac{p_G}{1-p_R} > \dfrac{\gamma h_2}{(1-\gamma).(-h_1)}$ where we can think of q_G as an

index of the rule's discriminating quality when $\bar{h} > 0$.

Proof: The above inequality is necessary for $\bar{h}(G) < 0$, from (2), which is necessary for the rule to be

effectively discriminating given $\bar{h} > 0$.

1.(iii) From the definition of q_R and q_G:

$$\frac{\partial q_R}{\partial p_G} = \frac{p_R}{1-p_G}.\frac{1}{1-p_G} > \frac{1}{1-p_G} = \frac{\partial q_R}{\partial p_R}.$$

and

$$\frac{\partial q_G}{\partial p_R} = \frac{p_G}{1-p_R}.\frac{1}{1-p_R} > \frac{1}{1-p_R} = \frac{\partial q_G}{\partial p_G}.$$

(a)   If $\bar{h} < 0$, then, to have an E*ffective Discriminating Rule* it is important to identify accurately actions in the Red box, and this is most effectively done by increasing p_G, the model's ability to identify firms of type 1.

(b)   If $\bar{h} > 0$, then, to have an E*ffective Discriminating Rule* it is important to identify accurately actions in the Green box, and this is most effectively done by increasing p_R, the model's ability to identify firms of type 2.

If an action is investigated and disallowed, then there are two possible consequences for the firm. It may have to pay a penalty, and it may have to reverse the action.

Fines

In practice, CAs impose fines on the basis of imperfect criteria related to the revenue or profit of the offender -see also Wils (1995) - which are likely to bear little relation to the amounts suggested by the literature on optimal fines[34] - though this seems to be changing[35]. In what follows we will assume that if the CA disallows an action it imposes a fixed exogenous penalty $s \geq 0$.

Reversing the Action (Remedies)

We also want to allow the possibility that when the authority disallows an action it may impose certain remedies such as requiring the firm to reverse it. This could potentially cause the firm to incur significant costs[36] - though these will be lower when there are good ***substitutes*** for the action that firms can use. We capture this through the parameter $C \geq 0$ which reflects the costs to firms of reversing their actions. Obviously if firms are not required to reverse their action then $C = 0$.

2.3 Firms' Decisions

In deciding whether or not to take an action, firms anticipate the possibility that they might be investigated and that the action is disallowed – possibly after a delay. We assume that while firms may know the values of γ, h_1 and h_2 they do not know whether their specific action is socially harmful or benign. This is a reasonable assumption for many unilateral practices examined under article 82 in the EU, the implications of which, for social welfare, depend on a complex weighing of anticompetitive and precompetitive effects. Thus, though firms can infer the type of model that the CA is using, this information does not produce asymmetric deterrence effects on firms depending on their type[37]. Firms' behaviour is however affected, given that they know how many cases have come before the CA and what fraction is allowed and what fraction is disallowed. We now consider the implications of this.

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[34] This is an area to which substantial attention has been given both by academics and policy makers. Wils (2006) discusses the feasibility of estimating optimal fines (Section IV).

[35] See for example Commissioner Nelie Kross'speech on "Developments in Competition Policy in 2006" of 20/3/2007 mentioning the "record fines" of 1.8 billion Euro imposed on cartels in 2006 and her speech in the joint Commission / IBA Conference on Competition Policy of 8/3/2007.

[36] These include many sunk costs involved in implementing an action potentially including R&D costs, costs in unbundling products, rearranging contractual commitments, modifying price lists, as well as the managerial effort involved in redirecting the firm's strategy. Such costs can be quite substantial as they may involve difficult to reverse technological, marketing and/or other contractual commitments.

[37] We are very grateful to Patrick Rey for constructive discussions on the assumptions made here. A general analysis is contained in the companion paper – Katsoulacos and Ulph (2007) – where we examine the implications of asymmetric deterrence introduced by assuming that firms know their type.

<u>Case 2.3.1</u> $\bar{h} < 0$ (presumed legality) <u>and</u> $1 \le \dfrac{p_R}{1 - p_G} < \dfrac{(1-\gamma).(-h_1)}{\gamma h_2}$ so the CA uses **Per Se** (from

Proposition 1(i)). All actions will be allowed. Firms will receive the full private benefit and so all firms will take the action. So the population of firms who take the action is the same as the population who could take it, and the fraction of cases coming before the CA from environment 2 is indeed γ.

<u>Case 2.3.2</u> $\bar{h} < 0$ <u>and</u> $\dfrac{p_R}{1 - p_G} > \dfrac{(1-\gamma).(-h_1)}{\gamma h_2}$ so the CA uses an **Effective Discriminating (ED) Rule**.

Here the CA will disallow actions in the Red box, and this happens with frequency $\lambda^{ED} = (1-\gamma).(1 - p_G) + \gamma.p_R$. Since the risk of coming before the authority is p the risk a firm perceives of having its action disallowed is $p.\lambda^{ED}$. If the firm's action is disallowed it will get only a fraction ϕ_D of its private benefit and in addition will have to incur a fine s and a cost of reversing its action C. The expected net benefit is therefore

$$(1 - p.\lambda^{ED})b + p.\lambda^{ED}\left[\phi_D b - (s + C)\right]$$

A firm will therefore only take the action if

$$b > \underline{b}^{ED} = \frac{p\lambda^{ED}(s + C)}{1 - p\lambda^{ED}(1 - \phi_D)} .(3)$$

Consequently <u>the same</u> fraction $F\left[\underline{b}^{ED}\right]$ of firms from each environment t = 1,2 will be deterred from taking the action. This guarantees that of the firms taking the action, the fraction who come from environment 2 is indeed γ.

<u>Case 2.3.3</u> $\bar{h} > 0$ (presumed illegal action) <u>and</u> $1 < \dfrac{p_G}{1 - p_R} < \dfrac{\gamma h_2}{(1-\gamma).(-h_1)}$ so the CA uses a **Per Se**

Rule (from Proposition 1(ii). Here the CA rules everything **Per Se Illegal** and disallows all actions - but with delay ϕ. The probability of having the action disallowed is just p. In this case the firm will take the action only if

$$b > \underline{b}^{PSI} = \frac{p(s + C)}{1 - p(1 - \phi)} .(4)$$

As above a fraction $F\left[\underline{b}^{PSI}\right]$ of firms from each environment will be deterred from taking the action, so, of the firms taking the action, the fraction who come from environment 2 is indeed γ.

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<u>Case 2.3.4</u> $\bar{h} > 0$ and $\dfrac{p_G}{1-p_R} > \dfrac{\gamma h_2}{(1-\gamma).(-h_1)}$ so the CA uses an **ED-Rule**. Here firms will take the

action only if:

$$b > \underline{b}^{ED} = \dfrac{p\lambda^{ED}(s+C)}{1-p\lambda^{ED}(1-\phi_D)}.(5)$$

As above a fraction $F\left[\underline{b}^{ED}\right]$ of firms from each environment will be deterred from taking the action,

so, of the firms taking the action, the fraction who come from environment 2 is indeed γ.

Proposition 2

(i)***Per Se Illegality*** creates a greater deterrence than an **ED-Rule** ($\underline{b}^{PSI} > \underline{b}^{ED}$).

(ii) Improving the quality of an **ED-Rule** may increase or decrease its deterrent effect. Formally,

$$\dfrac{\partial \underline{b}^{ED}}{\partial p_R} > 0; \quad \dfrac{\partial \underline{b}^{ED}}{\partial p_G} < 0.$$

The proof is straightforward and the intuition is clear. PSI creates greater deterrence than an **ED-Rule** because it disallows all actions while the latter allows some. However sharpening an **ED-Rule** could increase deterrence if it increases p_R but will lower it if it increases p_G, as an increase in the former (latter) increases (decreases) the frequency with which actions are disallowed.

Notice that our model captures two aspects of the idea of *legal uncertainty*.

(i)   While under PSI firms know for sure that their case will be disallowed by the CA, with an **ED-Rule** they do not know in advance what the outcome will be and have to await the outcome of the investigation;

(ii)   There is a lack of transparency. Firms do not know the model and hence the probability that a firm from their environment will have its case disallowed. All they can observe are past judgements and so the average probability λ^{ED}.

Of course there is no obvious reason why the first aspect of uncertainty is harmful – a rule that is certainly wrong is not in general better than one that produces outcomes that are uncertain but more often right. We leave for future research the exploration of the question of whether it would be advantageous to increase transparency by requiring authorities to reveal their models.

Section 3 Welfare Comparison of the Rules

3.1 First Best

We begin by establishing as point of reference the outcome that would arise in the first best world. The CA would then be perfectly informed and could costlessly and instantly determine from which environment each firm taking the action came. It would allow all actions taken by firms from environment 1 and disallow all actions by firms from environment 2.   Accordingly welfare in the first best would be:

$$W^{FB} = (1-\gamma).\left(-h_1\right).(6)$$

3.2 A Decision-Theoretic Comparison of Rules

Before undertaking a full welfare comparison, it will be useful to re-examine some of the discussion in the literature using the framework developed here. The literature has focused very heavily on the impact of the decisions made by the CA on the set of firms coming before it. So in the remainder of this subsection we focus solely on this sub-population of firms and assume that this is fixed and independent of the CA's actions. For simplicity normalise the size of this sub-population to 1. Also, we abstract from the costs of implementing different decision rules.

Case 3.2.1 $\bar{h} < 0$.

We want to compare *Per Se* with an *ED-Rule*. Suppose first that the rule $\left(p_G, p_R\right)$ that was being operated by the CA was such that $1 \leq \dfrac{p_R}{1-p_G} < \dfrac{(1-\gamma).\left(-h_1\right)}{\gamma h_2}$ and so, from Proposition 1 (i) the CA uses

Per Se Legality (PSL) and all actions will be allowed. So welfare will be:

$$W^{PSL} = -\bar{h} = (1-\gamma)(-h_1) - \gamma h_2$$

Consequently the welfare loss – the difference between actual welfare and that in first-best - from using PSL is:

$$L^{PSL} = W^{FB} - W^{PSL} = \gamma h_2 .(7)$$

Notice that under PSL the CA is correctly allowing all the benign actions but wrongly allowing all harmful actions. To bring out more fully the error-costs involved note that:

- the Rate of False Convictions is $RFC^{PSL} = 0$;
- the Rate of False Acquittals is $RFA^{PSL} = \gamma$;
- the Cost of False Convictions is $CFC^{PSL} = RFC^{PSL}(-h_1) = 0$;
- the Cost of False Acquittals is $CFA^{PSL} = RFA^{PSL}.h_2 = \gamma h_2$

and so the overall Cost of Decision Error is

$$CDE^{PSL} = CFC^{PSL} + CFA^{PSL} = \gamma h_2 \ (8)$$

So from (7) and (8) the cost of decision errors is exactly the same as the welfare loss, i.e.

$$CDE^{PSL} = L^{PSL}$$

Now suppose that the rule (p_G, p_R) that was being operated by the CA was such that

$\dfrac{p_R}{1 - p_G} > \dfrac{(1-\gamma).(-h_1)}{\gamma h_2}$ and so we had an **ED- Rule**. From Proposition 1 (i) the CA will allow

(disallow) all cases in the Green (Red) box. Welfare under this **ED-Rule** is:

$$W^{ED} = (1-\gamma) p_G (-h_1) - \gamma.(1 - p_R).h_2,$$

and the Welfare Loss is

$$L^{ED} = W^{FB} - W^{ED} = (1-\gamma).(1 - p_G).(-h_1) + \gamma.(1 - p_R).h_2 .(9)$$

Under this Rule the CA will be wrongly disallowing some cases from environment 1 being in the Red box and wrongly allowing some cases from environment 2 being in the Green box. So under the **ED-Rule**:

- the Rate of False Convictions is $RFC^{ED} = (1-\gamma).(1 - p_G)$;

- the Rate of False Acquittals is $RFA^{ED} = \gamma.(1 - p_R)$;

- the Cost of False Convictions is $CFC^{ED} = RFC^{ED}.(-h_1) = (1-\gamma).(1 - p_G).(-h_1)$;

- the Cost of False Acquittals is $CFA^{ED} = RFA^{ED}.h_2 = \gamma.(1 - p_R)h_2$;

and consequently the overall Cost of Decision Error is:

$$CDE^{ED} = CFA^{ED} + CFC^{ED} = (1-\gamma).(1 - p_G).(-h_1) + \gamma.(1 - p_R).h_2 \ (10)$$

As before, from (9) and (10) we see that the cost of decision error is the same as the welfare loss – i.e:

$CDE^{ED} = L^{ED}$

To compare the two rules note that from (8) and (10) it follows that:

$$CDE^{ED} \leq CDE^{PSL} \Leftrightarrow (1-\gamma)(1 - p_G)(-h_1) \leq \gamma.p_R.h_2 \Leftrightarrow \frac{p_R}{1 - p_G} \geq \frac{(1-\gamma)(-h_1)}{\gamma h_2} (11)$$

which implies that although an *ED-Rule* has both False Acquittals and False Convictions whereas PSL has only False Acquittals, the overall error cost of the *ED-Rule* is lower.

Case 3.2.2 $\bar{h} > 0$

Again we want to compare **Per Se** with an **ED-Rule**. Under **Per Se Illegality** (PSI) all actions are disallowed, so welfare is

$$W^{PSI} = 0$$

and hence the welfare loss is:

$$L^{PSI} = W^{FB} - W^{PSI} = (1-\gamma)(-h_1) \quad (12)$$

Under PSI all harmful cases are rightly stopped but benign cases are wrongly disallowed:

- the Rate of False Convictions is $RFC^{PSI} = (1-\gamma)$;

- the Rate of False Acquittals is $RFA^{PSI} = 0$;

- the Cost of False Convictions is: $CFC^{PSI} = RFC^{PSI}.(-h_1) = (1-\gamma)(-h_1)$;

- the Cost of False Acquittals is $CFA^{PSI} = RFA^{PSI}.h_2 = 0$;

and so the overall Cost of Decision Error is

$$CDE^{PSI} = CFA^{PSI} + CFC^{PSI} = (1-\gamma)(-h_1) \quad (13)$$

As before it follows from (12) and (13) that $CDE^{PSI} = L^{PSI}$.

Now suppose $\dfrac{p_G}{1-p_R} > \dfrac{\gamma h_2}{(1-\gamma).(-h_1)}$ so, from Proposition 1(ii), the CA had an **ED-Rule**. As in the previous Case this means that the CA will allow (disallow) all cases in the Green (Red) box. The welfare loss and the Cost of Decision Error are exactly the same as in Case 1 and are given by (9) and (10). As in Case 1 it is straightforward to use (10) and (13) to compare the decision errors and show that:

$$CDE^{ED} \leq CDE^{PSI} \iff \frac{p_G}{1-p_R} \geq \frac{\gamma h_2}{(1-\gamma)(-h_1)} \quad (14)$$

and so, again, an **ED-Rule** produces lower decision error costs. We can now state:

Proposition 3

    (i)   In terms of both welfare and (equivalently) Decision Error Costs any *Effective Discriminating Rule* is better than **Per Se Rules.**

    (ii)   Improving an *Effective Discriminating Rule* by increasing p_R or p_G will reduce Decision Error Costs (improve welfare);

    (iii)   However when $\bar{h} < 0$ (resp. $\bar{h} > 0$) the most effective way of reducing errors is to increase p_G (resp. p_R).

We have already proved (i); (ii) follows immediately from (10) and (iii) from (10) and Proposition 1 (iii).

3.3 A Full Welfare Comparison

In this sub-section we undertake a full welfare comparison of different rules. That is we look at the effects of the CA's actions on the full population of firms that could potentially take an action. We first compare *Per Se* and *ED-Rules* to the First Best, and then compare them to each other.

3.3.1 Welfare Comparisons I: Comparisons to the First Best

In the previous sub-section we showed how the welfare losses from different rules could be equated to the cost of decision errors. In this section we will show that the welfare loss is equal to the sum of the costs of Type I and Type II errors plus the resource costs used up in implementing the Rule. We define:

- Type I Errors: harmful actions that are not prevented.
- Type II Errors: benign actions that are prevented.

Type I errors can arise because harmful actions are not deterred, and, having been taken, are either not detected or, if detected, are either wrongly allowed or, if disallowed, this happens with a delay. As such they go beyond the conventional decision error - False Acquittals – and include:

(i)   the *indirect effect* of failing to deter;

(ii)   the *systemic effect* of failing to detect;

(iii)   a further *systemic effect* of delays in conviction.

Type II errors can arise either because firms are deterred from taking benign actions or because, if taken, they are reported and falsely convicted – albeit after a delay. As such they include False Convictions (though we now recognise that the damage these False Convictions cause can be mitigated by the *systemic effect* of delay) but now includes the *indirect effect* of wrongful deterrence.

Note that if the proportion of firms taking action who come to the attention of the authority, *p,* is small, then the conventional decision errors will be just a small part of the Type I and Type II errors now being considered.

Consider *Per Se Rules***.** If $\bar{h} < 0$ and the CA uses a *Per Se* rule it will rule everything to be *Per Se Legal* (PSL) and so allow all actions. Then no one reports, no investigations are undertaken (and so no resources used up) and everyone takes the action.

Welfare is therefore

$$W^{PSL} = -\overline{h} = (1-\gamma).(-h_1) - \gamma.h_2 \,(15)$$

Compared to the first-best, from (6) and (15), the welfare loss is:

$$L^{PSL} = W^{FB} - W^{PSL} = \gamma h_2 = CFA^{PSL} \,(16)$$

This loss takes the form of a Type I Decision Error - False Acquittals. The loss is greater the larger the fraction of anticompetitive (harmful) acts and the greater the welfare harm caused by these acts.

If $\overline{h} > 0$ and the CA uses a **Per Se** rule it will rule all actions to be **Per Se Illegal** (PSI) and disallow them. However the CA can only disallow the action for the fraction p of the firms that come to its attention –and this after a delay ϕ. The remaining fraction $(1 - p)$ will successfully undertake the action. However anticipating the possibility that they might have their actions stopped and have to incur a penalty plus reversal costs a fraction $F^{PSI} = F\left(\underline{b}^{PSI}\right)$ will decide not to undertake the action.

Thus, welfare under PSI is:

$$W^{PSI} = [1 - F(\underline{b}^{PSI})](-\overline{h})[(1-p) + p\phi] \,.(17)$$

If we compare (17) with (6) the welfare loss from PSI is:

$$L^{PSI} = W^{FB} - W^{PSI} = \left(1 - F^{PSI}\right)\gamma h_2[(1-p) + p\phi] +$$
$$F^{PSI}(1-\gamma)(-h_1) + \left(1 - F^{PSI}\right).p.(1-\phi).CFC^{PSI} \quad (18)$$

The first expression on the RHS of (18) is the cost of the Type I errors created by this rule. There are two of these errors:

(i) The first, $\left(1 - F^{PSI}\right).(1-p).\gamma.h_2$, is the cost of the *failure to deter and detect* firms whose actions are harmful.

(ii) The second, $\left(1 - F^{PSI}\right).p.\phi.\gamma.h_2$ is the cost of the *failure to deter and rapidly enough close down* the harmful actions of those firms who do come before the CA, and whose actions are rightly declared illegal.

The second expression is the costs of the Type II errors. There are two of these.

(i) The first, $F^{PSI}.(1-\gamma).(-h_1)$ is the cost of *wrongly deterring* some firms whose actions are beneficial.

(ii) The second, $\left(1 - F^{PSI}\right).p.(1-\phi).CFC^{PSI}$, is the cost of *falsely convicting* that fraction of firms who do take benign actions and who come to the attention of the CA. However the

normal *cost of false convictions* under PSI, CFC^{PSI}, is scaled down by $(1-\phi)$ in recognition of the delay in CA's decision.

Notice that an increase in delay increases the Type I error but reduces the Type II error.

Suppose now that the CA uses an ***Effective Discriminating Rule***. Of the firms taking the action a fraction $(1-p)$ will not come to the CA's attention, and so generate welfare $-\overline{h}$. Of the fraction p that do come to its attention a fraction λ^{ED} of those in the Red box will have their action stopped, albeit after a delay ϕ_D - generating welfare $\phi_D.\left(-\overline{h}(R)\right)$ - while the remaining fraction $(1-\lambda^{ED})$ - in the Green box - will have their action allowed, thus generating welfare $\left(-\overline{h}(G)\right)$. Anticipating the possibility that they might have their actions stopped and have to incur a penalty plus reversal costs a fraction $F^{ED} = F\left(\underline{b}^{ED}\right)$ will decide not to undertake the action. We also need to take account of the costs of using this rule.

Bringing this altogether, it is straightforward to show that, after a little re-arranging, welfare under an ***ED-Rule*** will be

$$W^{ED} = \left[1 - F^{ED}\right].\left\{-\overline{h} + \lambda^{ED}p\left(1-\phi_D\right)\overline{h}(R)\right\} - K\left(p_G, p_R\right).(19)$$

By comparing (19) with (6) we see that the welfare loss under an ***ED-Rule*** is:

$$
\begin{aligned}
L^{ED} = &\left\{\left[(1-F^{ED})(1-p)\gamma h_2\right] + \left[(1-F^{ED})pCFA^{ED}\right] + \phi_D\left[(1-F^{ED})p\gamma h_2 p_R\right]\right\} \\
&+ \left\{\left[F^{ED}(1-\gamma).(-h_1)\right] + \left[(1-F^{ED})p(1-\phi_D)CFC^{ED}\right]\right\} \qquad (20) \\
&+ K\left(p_G, p_R\right)
\end{aligned}
$$

The first term on the RHS of (20) is cost of the Type I Errors made by the ***ED-Rule***. It can be expressed as the sum of three different effects.

(i)   The first, $\left[(1-F^{ED})(1-p)\gamma h_2\right]$, is the cost of *failure to deter and detect* a fraction of firms that are taking harmful action.

(ii)   The second term $\left[(1-F^{ED})pCFA^{ED}\right]$ is the cost of *false acquittals*. These are firms who should not have taken the action but do, and are now detected, but are wrongly acquitted.

(iii)   Finally there is the term $\phi_D\left[(1-F^{ED})pp_R\gamma h_2\right]$ which reflects the cost of the *failure to deter and rapidly enough close down* the harmful actions of those firms who do come before the CA, whose actions are correctly identified as being harmful, and rightly declared illegal.

The second expression on the RHS of (20) captures all the Type II errors made by the **ED-Rule**. As with the PSI rule it can be expressed as the sum of two different effects.

(i)   The first $\left[F^{ED}(1-\gamma).(-h_1) \right]$ is the cost of *falsely deterring* firms from taking actions that should have been taken.

(ii)   The second $\left[\left(1-F^{ED}\right)p\left(1-\phi_D\right)CFC^{ED} \right]$ is the cost of *falsely convicting* that fraction of firms who do take benign actions that come to the CA's attention. However the normal *cost of false convictions* under an **ED-Rule**, CFC^{ED}, is scaled down by $(1-\phi_D)$ in recognition of the delay in taking the action.

3.3.2 Welfare Comparisons II: ED-Rules vs Per Se Rules

Let us now compare welfare under an **ED-Rule** with that under **Per Se**. As in Section 3.2 it is useful to consider separately two cases.

Case 3.3.2.1 $\bar{h} < 0$

Here the relevant **Per Se** rule is PSL. If we compare (19) with (15) then, after some re-arranging we get:

$$W^{ED} - W^{PSL} = -F^{ED}.\left(-\bar{h}\right) + \left[1-F^{ED}\right].p.\left(1-\phi_D\right).\left[CDE^{PSL} - CDE^{ED}\right] - K(.) \quad (21)$$

The first term on the RHS is negative because the **ED-Rule** introduces a *deterrent effect* that stops some firms from taking actions which are on balance beneficial. The second term is positive because, as we saw in Proposition 3(i), *the **ED-rule** makes better decisions* – involves lower costs of false acquittals and false convictions. Finally the **ED-Rule** has a higher implementation cost. This has a number of important implications which we summarise in the following:

Proposition 4

(i)   While, as we saw from Proposition 3 (i) an **ED-Rule** is better than **Per Se** in terms of its *direct effects* (decision costs), a **Per Se** rule is better than an **ED-Rule** in terms of its *indirect* (deterrent) effects, because the **ED-Rule** creates a stronger deterrent effect than **Per Se** when actions are on balance benign and so the CA should not be deterring them.

(ii) When the quality of the CA's model and information is just good enough for an **ED-Rule** to be used – i.e. $\bar{h}(R) > 0,$ but $\bar{h}(R) \approx 0$ - then the *indirect* effect dominates the direct effect.

Proof: With $\bar{h}(R) > 0,$ but $\bar{h}(R) \approx 0$, $CDE^{PSL} \approx CDE^{ED}$ from (11), given Prop.1 (i), and then, from (21) PSL is the superior rule.

Proposition 5

(i) If we improve the quality of the **ED-Rule** in the most effective way – i.e. by increasing p_G [38] - then this will lower **both** decision error costs[39] - and $\underline{b}^{ED}$ [40] and F^{ED}. That is it will increase the advantage of the **ED-Rule** in terms of the *direct effects*[41] and reduce its disadvantage in terms of the *indirect* effects. It follows that an **ED-Rule** is more likely to be preferable to a PSL rule when the CA's model recognises with a high degree of accuracy actions of type 1 ($p_G \approx 1$).

The above can be illustrated in Figure 1 below where, for $1 \le q_R \le \tilde{q}_R$, $\overline{h}(R) \le 0$, and it is certainly optimal to use a PSL rule. For $\tilde{q}_R < q_R \le q_R^2$, while an **ED-Rule** is preferable on the grounds of decision error cost minimisation (this holds, net of K-costs, for $q_R^1 \le q_R \le q_R^2$) nevertheless the PSL rule is overall preferable when taking into account the deterrent effects. However for $q_R > q_R^2$ the advantage of the **ED-Rule** in terms of direct effects is strong enough, and its disadvantage in terms of *indirect effects* is weak enough that overall it is preferable.

Figure 1
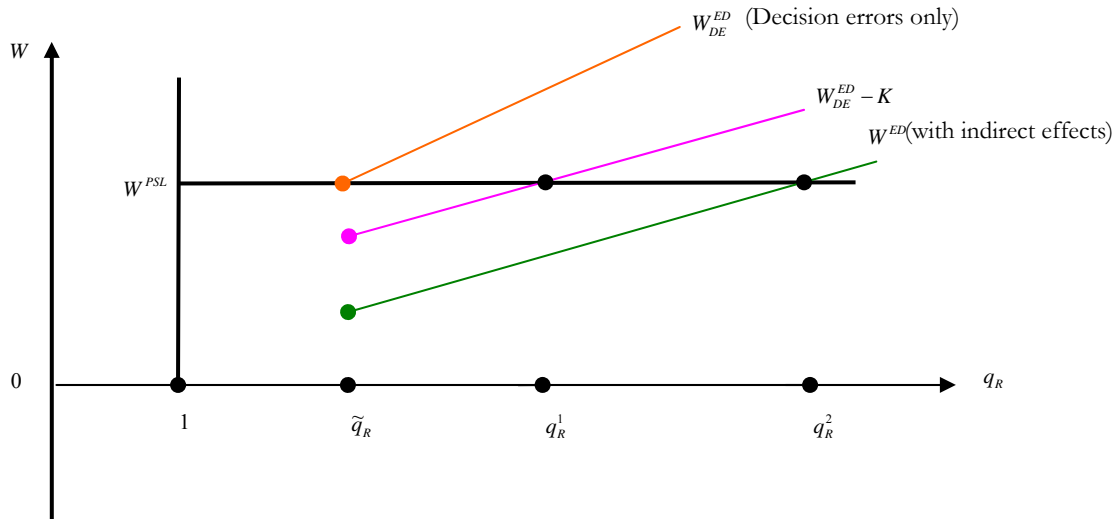
(ii) If, instead, the quality of the **ED-rule** is improved by increasing p_R then this will lower error costs but not as fast as by increasing p_G and, more importantly, it will <u>increase</u> indirect costs as it will raise $\underline{b}^{ED}$ [42] and F^{ED}. Therefore W^{ED} **may be concave in** p_R: there will be cases when, <u>even</u> neglecting implementation costs, adopting a higher quality rule will **not** be optimal due to the high indirect costs that it generates.

(iii) A long litigation cycle under the **ED-Rule**, implying ϕ_D close to unity, will virtually eliminate the **ED-Rule's** advantage in terms of the *direct effect* and Per Se is then likely to be the optimal rule.

(iv) On the other hand if: (a) the cost, *C*, of reversing the action is small – as would be the case if there are good substitutes that firms can use; and (b) penalties, *s*, are small, then the disadvantage of an **ED-Rule** in terms of the *indirect effects* is likely to be small as then $\underline{b}^{ED}$ and F^{ED} will be small from (3).

Corollary 1:

All other things equal, for presumptively legal practices ($\bar{h} < 0$)**,** a high - p_G **ED-rule** will be superior to a high- p_R **ED-rule**: the reason is that increasing p_G reduces the cost of decision errors faster than increasing p_R and increasing $p_G(p_R)$ reduces (increases) indirect costs. This suggests that, when $\bar{h} < 0$, *ceteris paribus,* the optimal way to use economic theory to formulate legal standards is for developing models that identify with a high degree of accuracy actions of type 1 and thus avoid false convictions. However all other things may not be equal and there may be cases when a high p_R - rule is superior when $\bar{h} < 0$. A foolproof comparison requires that we know the value of p_G in the high- p_R rule and the value of p_R in the high- p_G rule.

Case 3.3.2.2 $\bar{h} > 0$

Here the relevant **Per Se** rule is **Per Se Illegality** (PSI). If we compare (19) with (17) then after a bit of rearranging we get:

$$
\begin{aligned}
W^{ED} - W^{PSI} = &\left[F^{ED} - F^{PSI} \right] \bar{h} \left[1 - p\left(1 - \phi_D\right) \right] + \\
&\left[1 - F^{ED} \right].p.(1 - \phi_D)(CDE^{PSI} - CDE^{ED}) - \\
&\left[1 - F^{PSI} \right] \bar{h}.p.\left(\phi_D - \phi\right) \\
&- K(.)
\end{aligned} \qquad (22)
$$

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[42] Proposition 2(ii)

We consider in turn the implications of the four terms on the RHS of (22):

- the first term on the RHS is negative because, as we saw in Proposition 2(i), PSI generates a stronger *deterrent effect* than the ***ED-rule***;
- the second term is positive because, as we saw in Proposition 3(i), the ***ED-Rule*** makes better decisions and so generates lower decision cost errors than PSI;
- the third term is negative because the ***ED-Rule*** involves more *delay* in stopping actions that are on balance harmful;
- finally there is the cost, K, of implementing the ***ED-Rule*** to take into account.

Again this has a number of implications which we summarise in the following:

Proposition 6

(i)   While, as we saw from Proposition 3 (i) an ***ED-Rule*** is better than ***Per Se*** in terms of its *direct effects* (decision costs), a ***Per Se*** rule is better than an ***ED-Rule*** in terms of its *indirect* (deterrent) effects, because the ***ED-Rule*** creates a <u>weaker</u> deterrent effect than ***Per Se*** when actions are on balance harmful and so the CA should be deterring them.

(ii) When the quality of the CA's model and information is just good enough for an ***ED-Rule*** to be used – i.e. $\overline{h}(G) < 0,$ but $\overline{h}(G) \approx 0$ - then the *indirect* effect dominates the direct effect.

Proof: With $\overline{h}(G) < 0,$ but $\overline{h}(G) \approx 0$, $CDE^{PSI} \approx CDE^{ED}$ from (14), given Prop.1 (ii), and then, from (22), PSI will be the superior rule.

(iii) If we improve the discriminating quality of the ***ED-Rule*** in the most effective way – i.e. by increasing p_R[43]- then this will lower the ***ED-Rule's*** decision error costs[44] - and will increase $\underline{b}^{ED}$ [45] and so F^{ED}. This latter effect will certainly reduce the disadvantage of the ***ED-Rule*** in terms of *indirect effects*. While the increase in p_R increases the decision cost advantage of the ***ED-Rule*** *per capita*, it reduces the population of firms taking the action on whom this advantage is applied, so the overall effect is ambiguous.

The above conclusions are illustrated in Figure 2 where we assume that as p_R increases the total cost of decision errors on the population of firms taking the action decreases. For $1 \le q_G \le \tilde{q}_G,$ $\overline{h}(G) \ge 0$ and it is optimal to use a PSI rule. For $\tilde{q}_G \le q_G \le q_G^2$, while an ***ED-Rule*** is preferable on the grounds of decision error cost minimisation nevertheless the PSI rule is preferable overall when taking into

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[43] See Proposition 1 (iii).
[44] Proposition 3(ii)
[45] Proposition 2(ii)

account the deterrent and delaying effects. However for $q_G \geq q_G^2$ the advantage of the **ED-Rule** in terms of direct effects is strong enough, and its disadvantage in terms of *indirect effects* is weak enough that overall it is preferable.

(iv) The likelihood that the **ED-Rule** will be the optimal rule is higher with a short litigation cycle relative to the PSI rule, implying that ϕ_D is close to ϕ.

Figure 2
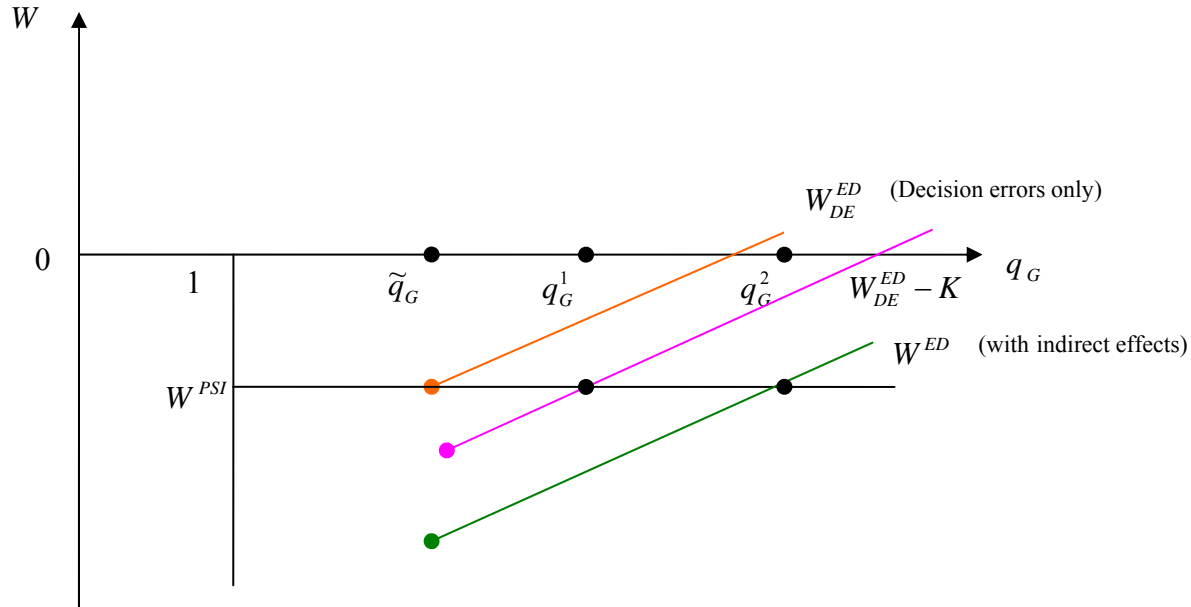
(v) An increase in p_G will also lower the **ED-rule's** decision error costs but not as fast as by increasing p_R. Further it will lower $\underline{b}^{ED}$ and so F^{ED} and this will enhance the disadvantage of the **ED-rule** in terms of indirect effects. Lowering F^{ED} implies that there is an unambiguous increase in the second (positive) term of (22) but also of the first (negative) term. So, compared to an increase in p_R, we cannot unambiguously predict whether an increase in p_G is worse or better.

(vi) In this case there is no unambiguous effect of C or s on the comparison between ED-rules and PSI.

Section 4 Applying the Framework

Salinger (2006) identifies three sets of factors which according to decision theory should enter the choice of legal rules:

1) What do we know about anticompetitive aspects of the practice? What is the underlying theory of how it can be anticompetitive? When it is, what is the cost to consumers and to economic welfare? (That tells us about the error cost of permitting anticompetitive instances.) How often is the practice anticompetitive?

2) What do we know about the pro-competitive uses of the practice. What is the nature of the pro-competitive benefit? When the practice is pro-competitive, how large are the gains from it? (That tells us about the error cost of inadvertently chilling pro-competitive instances of it.)...

3) What sort of tests might one use to identify anticompetitive instances? For any such test, what is the risk that it will label a pro-competitive instance as anticompetitive and ...the risk that it will fail to catch an anticompetitive instance?

As Salinger also notes, "No one seriously supposes that we can objectively measure all of these factors. In particular, there is no practical way to take a random sample of instances of a particular practice … and assess the relative frequency of ... anticompetitive instances. Still, any policy implicitly rests on judgments about these factors, so it is useful to form subjective estimates of the answers when objective measures are not available"[46].

The framework described above takes into account all these factors. The first set of factors allows one to form presumptions about the likely value of h_2 *and* γ. The second set of factors, about the value of h_1 and the third about p_G and p_R. Further our framework stresses that a number of additional considerations must be accounted for. One set of additional considerations concerns the factors that would allow one to form a presumption about the strength of deterrence effects: such factors include the potential costs of reversing actions – their potential size and whether there exist good substitutes for the action under consideration that firms can use – as well as the remedies and the fines policies of CAs. The second set of additional considerations concerns systemic effects: assessing the potential length of the litigation cycle relative to the product cycle for the industry under consideration and the probability of detection by the CA.

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[46] See also his paper with Hylton (2001).

A. Dynamic Industries

One of the most interesting and important issues in recent debates is that of how the characteristics of dynamic industries affect the design of competition policy rules.[47]

Firstly, as Ahlborn, Denicolo, Geradin and Padilla (2006) note, in dynamic industries with rapid innovation the welfare loss from wrongly condemning a benign action is likely to be much higher than the welfare gain from disallowing a harmful action. That is, is likely to be much larger than h_2. For many practices, such as Refusal to License IPRs, for which γ can be presumed to be small, this would then suggest that $\bar{h} \leq 0$ and that a PSL rule is the optimal Per Se rule.

Secondly, as Easterbrook (1992) has argued it is likely that the litigation life cycle is very long (and even longer) relative to the product life cycle in rapid technological change industries. In our context this implies that ϕ_D is large and may even be 1. Given $\bar{h} \leq 0$, then our framework suggests that this has three effects: (a) A large ϕ_D reduces the negative deterrence effect of an **ED-rule** and (b) increases the population of firms taking the action on which the advantage of lower costs of decision errors from using an **ED-rule** applies. Both of these tend to favour an **ED-rule**. However, a large ϕ_D also reduces, due to the delay in reaching decisions, the net gain from better decisions achieved with an **ED-rule**. This third effect tends to favour a **Per Se** rule. When ϕ_D is sufficiently large the third effect certainly dominates and then a PSL rule would be superior to any **ED-Rule** including **Rule of Reason** (from equation (21)).

Thirdly, the cost of implementing **ED-Rules**, $K(.)$, is likely to increase as the difficulty of devising high quality discriminating models is much greater in dynamic industries. This is so as the standard criteria for differentiating harmful from benign cases suggested by static models (such as market shares and concentration) are not going to be equally useful in dynamic industries. (see for example Evans and Schmalensee, 2002 and Ahlborn et.al. 2001). This would again tend to make **Per Se Legality** the optimal procedure.

Fourthly and finally, another characteristic of dynamic / new economy sectors is that firms will have to support their innovative activity through large sunk investments. This increases the cost (C) to the firms in the event of having to reverse any of their actions that are condemned by antitrust authorities. This raises the value of $\underline{b}^{ED}$ and hence of $F(\underline{b}^{ED})$ and has two effects: one, increasing the negative

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[47] For an overview of the main issues relating competition policy to innovation see Shapiro (2002).

deterrent effect of **ED-rules,** and a second reducing the population of firms taking the action on which the advantage of lower costs of decision errors from using an **ED-rule** applies Both of these raise the likelihood that PSL is the best decision rule.

Thus a number of important considerations suggest that it is more likely that many practices will be presumptively legal rather than illegal and that **Per Se Legality** rules will be superior to discriminating rules in dynamic industries than in other industries.

B. Leegin vs. PSKS (2007)

In this case the US Supreme Court decided that the lower Court was wrong to adopt a **Per Se Illegality** standard to deal with RPM and remanded the case so that it is re-examined under **Rule of Reason**, thus overturning nearly a century old tradition. Certain aspects of the decision are characteristic of the confusion that the lack of a formal model for thinking about decision rules can cause. Thus it is argued (p. 3) that "A **Per Se** rule should not be adopted for administrative convenience alone. Such rules can be counterproductive, increasing the antitrust system's total cost by prohibiting procompetitive conduct the antitrust laws should encourage". But, as the model above shows one cannot judge the relative appropriateness of a rule purely on the basis of its relative rate of false convictions. Indeed, though there may well be discriminating rules that lower the rate of false convictions relative to **Per Se Illegality**, it could be the case that none of these is an effective discriminating rule and even if there is such a rule it could still be inferior to **Per Se** because it would deter relative to **Per Se** too few actions when these are on average harmful.

Consider an illustrative example. First, despite the Supreme Court's decision, it may nevertheless still be safe to assume that most economists would consider the practice of RPM as presumptively illegal i.e one for which $\bar{h} > 0$ (because on balance we think that γ is quite large and h_2 is larger than h_1). For example, while Vickers (2007) argues that it is "hard to see how Per Se treatment of RPM is justified in economic logic" he declares himself "no great fan of RPM"[48]. If this is true, a discriminating rule would be effective and thus superior to **Per Se** in minimising the cost of decision errors if

$q_G \equiv \dfrac{p_G}{1 - p_R} > \dfrac{\gamma h_2}{(1-\gamma).(-h_1)}$. Though those arguing for a PSI rule would propose that the value of γ is

very large, assume for the sake of argument that quite a large proportion of RPM cases is benign, or that $\gamma = 0,75$. Also, let the gain from disallowing a harmful action be twice as large as the loss from

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[48] Ab.cit.p.11. The views of Comanor and Scherer mentioned by Vickers (footnote 20) are also consistent with this interpretation.

wrongly convicting a benign action. The latter can be justified as harmful RPM acts are likely to be associated with collusive horizontal practices. Coming to the quality of models that a CA can use to discriminate, critics of the decision, such as Judge Breyer have pointed out (p. 8-10) that given available evidence it is very difficult to be able to recognise when an RPM practice might be on balance benign. But again for the sake of argument assume that p_G = 0.5. Even under these conditions there would still be no effectively discriminating rule for as long as $p_R < 0.92$! That is, our models, criteria and empirical evidence must be extremely good in identifying correctly harmful RPM cases for an **ED-rule** to be superior to **Per Se**. And even this is not enough. Moving from **Per Se** to a **Rule of Reason** would likely induce many more firms to undertake RPM, an action that is on average harmful, and will have negative delaying effects. These negative (deterrence and systemic) effects strengthen the argument that **Per Se** is likely to be the optimal rule.

C. Commission vs. Microsoft (2007)

In the Microsoft case the Commission has been criticized for altering the legal standard for dealing with <u>Refusal to License IPRs</u>. Specifically, Ahlborn, Evans and Padilla (2005) have argued that the "Exceptional Circumstances" decision rule that was adopted in such cases before Microsoft is superior to the new rule. They identify a number of differences between the two rules in terms of the criteria that need to be satisfied for establishing that refusal is abusive. Perhaps the most important difference and the most novel aspect of the new rule concern the part of the rule that deals with "objective justification" for the refusal. In the new rule the Commission suggests that this should be based on "an incentives to innovate for the whole industry" test.

As noted in our discussion of dynamic industries above, it is widely accepted that Refusal to License IPR is a presumptively legal practice ($\bar{h} \leq 0$). Further, A-E-P (2005) argue that the traditional rule is better than the new rule. They call the traditional rule a Modified Per Se Legality rule and the new rule a Rule-of-Reason one. So they are saying that a MPSL rule is better than a Rule of Reason. The reason for this seeming paradox, in our context, is that they do not distinguish rules in terms of their discriminating quality (as we do). A-E-P term the new rule RoR simply because relative to the traditional rule it gives the CA greater discretion to assess the practice on a case by case basis.

The question is: can we translate the A-E-P critique in terms of our framework? And, if this can be done, does their conclusion still hold?

The answer to the first question is positive but not so for the second[49]. Even though in A-E-P there is no formal model for comparing rules and no clear theoretical basis for calling one rule MPSL and the other RoR, it is absolutely clear how they differentiate between the two rules in terms of decision errors. Their argument is that the traditional rule (their MPSL rule) is one that generates a lower likelihood of false convictions while the new rule (their RoR) is a rule that generates a lower likelihood of false acquittals. Because, as they argue, the welfare loss from wrongly condemning a benign action is likely to be much higher than the welfare gain from disallowing a harmful action in refusal to license cases, they conclude that the old rule is superior to the new one[50]. However our framework suggests that this conclusion is <u>not</u> warranted.

In terms of our framework, A-E-P are simply saying that the old rule is a high - p_G discriminating rule while the new rule is a high - p_R discriminating rule. Comparing rules purely in terms of decision errors and given that we are dealing with a ***presumptively legal*** practice then our model shows clearly that the first rule will, all other things equal, <u>tend</u> to be more effective in minimising decision errors. <u>However this is not certain, as all other things may not be equal</u>. A foolproof comparison requires that we know the value of p_R in the high - p_G rule and the value of p_G in the high - p_R rule before we can safely argue that the first rule is better.

Further, as we have shown, a full welfare comparison requires that we take into account the indirect effects of rules. Concerning these effects what we know is that for a ***presumptively legal*** practice a high - p_G rule will minimise negative deterrence effects while a high - p_R rule will maximise negative deterrence effects. Thus while A-E-P neglect the costs of indirect effects, taking into account of such costs is probably more important, than relative costs of decision errors, for their argument that the traditional (exceptional circumstances) rule <u>is</u> superior!

Section 5 Conclusions and Directions for Future Research

This paper attempts a systematic formal analysis of ***Per Se*** and Discriminating decision rules in Competition policy, which takes into account both their direct and indirect implications. It is motivated by a number of very important recent decisions in US and the EU questioning established legal standards, the emphasis that has been placed in recent years by academics, policy makers and

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[49] Note that here we are not assessing the economic arguments advanced by the authors in order to justify these statements. We are only assessing their approach to comparing legal standards.
[50] See page 1142-4 and 1155-6. In another article on tying (2004) they mention that a <u>MPSL is a version of RoR with lower likelihood of false convictions</u>.

practitioners on the use of a more economics-based approach in Competition Policy and the parallel emphasis on adopting a decision error-cost minimisation approach in selecting decision rules.

Our contribution consists in providing a formal model for the optimal choice of decision rules that addresses decision-theoretic considerations, relates them to the underlying quality of economic models in identifying benign and harmful actions and accounts for the important indirect effects of different rules and for systemic effects.

A number of interesting results and insights emerge and a number of areas for further future research are suggested by our framework. The main results were summarised in the introductory section. An important policy implication suggested by our analysis is that in practice, there could be many cases where CAs may be using the wrong decision rule. Thus they could be using *ED-rules* when in fact they should be using *Per Se* rules and vice versa.

Directions for future research include:

- Allowing for a total welfare standard for reaching decisions

- Allowing firms to know their type - deterrence effects will then be asymmetric.

- Allowing for asymmetric distributions of benefits in the two environments – essentially recognising the correlation between private benefit and social harm.

- Examining the comparison of different decision rules in a pre-clearance context where firms have to get permission from a CA before taking action.

- Examining two-tier rules, multi-error stages and, more generally, the issue of case selection.

- Examining the design of optimal policy packages (such as fine-tuning antitrust penalties to the decision rules).

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