

RESEARCH ARTICLE

WILEY

Choosing legal rules or standards in antitrust enforcement: A proposal for extending and facilitating the use of the decision-theoretic approach

Yannis Katsoulacos^{1,2}  | David Ulph^{3,4}

¹Athens University of Economics and Business, Athens, Greece

²Jiangxi University of Finance and Economics, Nanchang, China

³University of St. Andrews, St Andrews, UK

⁴UK Competition Appeals Tribunal, London, UK

Correspondence

Yannis Katsoulacos, Athens University of Economics and Business, Athens, Greece.
Email: yanniskatsoulacos@gmail.com

Funding information

ELIDEK project "Optimal Design of Competition Policy Enforcement"

Abstract

The choice of *legal standards* (LSs) in antitrust enforcement, to guide the assessment of potentially anticompetitive conduct, in order to decide whether there is liability or not, has been hotly debated for many years. The debate has gained in intensity in recent years as a result of the concerns expressed in many countries with the antitrust treatment of the major digital platforms. This article provides a detailed presentation of a new methodology for defining LSs along the *continuum* of LSs, depending on the screens assessed at different stages of the continuum. This is followed by a detailed formal examination of how all the pertinent factors that could influence error minimisation interact to determine the optimal LSs for different conducts and markets. The framework can be used to examine how the choice of error minimising LSs depends on the context in which specific conduct types are undertaken.

JEL CLASSIFICATION

K21, L4

1 | INTRODUCTORY REMARKS AND OUTLINE OF FACTORS INFLUENCING THE CHOICE OF LEGAL STANDARDS

The appropriate choice of *legal standards* (LSs¹) in antitrust enforcement, that is, of the *assessment procedures or decision rules*² that provide the basis for how assessment of potentially anticompetitive conduct must be undertaken in order to decide whether there is liability or not, has been hotly debated for many years. How widely divergent the opinions have been in this debate and how dominant specific points of view become, in terms of their influence on enforcement

practice, has varied over time and across countries and continents. Broadly speaking, excluding hard-core horizontal agreements, for which there is broad unanimity that their treatment should rely on a strong presumption of illegality,³ for most other conducts that come under antitrust scrutiny, specifically, vertical restraints, concerted practices and monopolisation, or abuse of dominance practices, the US (or North America) enforcement practice has differed quite significantly from that in the EU and the EC in particular, as well as from other less mature jurisdictions.⁴ The present article contributes to understanding the reasons for these differences.

As will become immediately clear in our presentation below, a "legal standard" represents the "quantity" of evidence or the number and type of screens needed to be examined for proof of liability. Thus, it is a very important dimension of the *standard of proof*. However, the latter entails also the dimension of the level of certainty necessary for

Abbreviations: DEC, decision error cost; FA, false acquittals; FC, false convictions; LS, legal standard; PB, presumption based; PBD, presumption-based discriminatory; PBND, presumption-based nondiscriminatory; PI, presumptively illegal; PL, presumptively legal; SMP, significant market power; SPS, strict per se.

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proof. Below, we discuss this in more detail (Section 2), and we also discuss how the standard of proof is incorporated in our analysis and its influence on the choice of LS (in Section 4.6).⁵

The debate on the appropriate choice of LSs has gained in intensity in recent years as a result of the concerns expressed by a significant number of academics and policy makers in many countries with the treatment of the major platforms. Even in the United States, an increasing number of commentators have been arguing that the current antitrust doctrines, rules and enforcement “are too limited to protect competition adequately, making it needlessly difficult to stop anticompetitive conduct in digital markets” and growing market power (Baker et al., 2020).⁶ More generally, it has been argued, for the United States, that, “as a result of unsound economic theories and unsupported empirical claims about the competition effects of certain practices ... *antitrust rules* constructed by the courts reflect a systematically skewed error cost-balance⁷: they are too concerned to avoid chilling procompetitive conduct and the high cost of litigation, and too dismissive of the cost of *failing* to deter harmful conduct.” Also, they have “encouraged overly cautious enforcement policies and overly demanding proof requirements and have discouraged government enforcers and private plaintiffs from bringing meritorious exclusionary conduct cases.”⁸ Using the terminology below, all these statements express a disagreement for often considering presumptively illegal (PI) conduct as presumptively legal (PL) and, when considered PI, for not relying more on presumptions to establish liability thus avoiding the examination of all the screens under rule-of-reason. That is, they express a disagreement about the LSs adopted.

Our main objective in this article is to provide a detailed presentation of a methodology for defining legal standards along the *continuum* of legal standards (Areeda & Hovenkamp, 2017; Jones & Kovacic, 2017; Katsoulacos et al., 2021; Katsoulacos & Ulph, 2022), depending on the screens or preconditions assessed at the different stages of the continuum. This is followed by a detailed formal examination of how all the pertinent factors that could influence error minimisation interact to determine the optimal error-minimising LSs for different conducts and markets. The framework can be used to examine how the choice of error minimising LSs depends on the context in which specific conducts are undertaken, in particular, how this choice is affected when comparing developing jurisdiction/countries to developed countries/jurisdictions, a topic further examined in Bageri and Katsoulacos (2020) and how the choice is affected when the conduct is undertaken in digital multisided platforms (a topic further examined in Katsoulacos & Ulph, 2022).

LSs are formulated by the continuous and evolving interaction of courts/judges, agencies,⁹ defendants and plaintiffs and their representatives (arguing in support of their case) and academic researchers and commentators contributing new ideas and results from the latest economic theories and empirical research about the potential anticompetitive effects of business conduct. Committees of mainly academics and representatives from agencies and courts,¹⁰ formed by government departments or by agencies, periodically examine latest

developments and provide recommendations and advice for improving enforcement practice for specific economic segments (like the digital markets), or for specific areas of competition law. This article is written “as if” the “decision maker” in our model below, that considers the appropriateness of different LS for assessing a conduct type, is such a committee. Of course, changes in LSs is a very slow process, and it only occurs when judges adopt the changes proposed in a number of different judgements.

1.1 | Factors influencing the choice of LSs: A brief outline

A large number of broad considerations influence the choice of LSs and have been the subject of an extensive literature. The most important are: the desire to minimise decision errors¹¹; the desire to minimise implementation/enforcement costs¹²; the deterrence effects and the legal uncertainty effects of different LSs¹³; the substantive (or liability) standards applied¹⁴; reputational concerns, for Competition Authorities (CAs).¹⁵ The first four considerations are encapsulated in the so-called *normative or welfare maximising approach* to the choice of LSs (Katsoulacos & Ulph, 2009, 2015, 2016, 2020). Reputational concerns can be important, given that when decisions are reached by different LSs, they encapsulate economic analysis to a different extent and degree of sophistication, and this may affect appeal courts, leading to higher annulment rates of decisions that rely on rule-of-reason decision annulment influencing negatively the reputation of CAs (Katsoulacos, 2019b). Finally, the adoption of nonwelfarist *substantive standards*¹⁶ leads to optimal LSs that are closer to per se (Katsoulacos, 2019a).

In this paper, we focus on the consideration that has had the greatest influence on thinking in this area and that has been discussed most extensively and for a longer period than all others: the desire to minimise the welfare costs of decision errors¹⁷ (see Beckner & Salop, 1999; Easterbrook, 1984; Evans & Padilla, 2005; Hylton & Salinger, 2001; Katsoulacos & Ulph, 2009; and for a very recent authoritative nontechnical review applied to exclusionary conduct, by Gavil & Salop, 2020¹⁸). As the latter note:

It has been recognized for decades that decision theory is useful for understanding and formulating legal standards. Making legal decisions based on probability, inferences, and presumptions is consistent with a decision-theoretic approach to legal rules. Decision theory provides a methodology for information-gathering and decision-making when outcomes are uncertain, information is inherently imperfect, and information is costly to obtain. This methodology is a rational process in which a decision-maker begins with initial beliefs (i.e., presumptions) based on prior knowledge and then gathers additional information (i.e., evidence) to supplement the presumption in order to make a better, more accurate decision. (p. 16)

In particular, Katsoulacos and Ulph (2009), extended by their 2016 paper and followed by Seifert (2020), Katsoulacos and Ulph (2020) and, especially, Katsoulacos and Ulph (2022),¹⁹ and this paper contribute to the other existing literature by providing models²⁰ that for the first time incorporate the idea of the continuum of LSs and which examine all the factors that must be taken into account in choosing optimal LSs and derive *simple representations*, in terms of conditions expressed by simple formulae, of exactly the way that these factors interact and influence the error-minimising choice of LSs, and whether/when/how much additional information should be gathered in the assessment of specific categories of conduct.²¹

2 | THE CONTINUUM OF LEGAL STANDARDS

The starting point in our analysis of error-minimising LSs is the recognition that the objective of limiting errors in the assessment of business conduct under competition law enforcement has to be decided to what extent the assessment should rely on *presumptions* and to what extent on additional distinct economic analyses and information gathering investigations that improve our ability to correctly discriminate between genuinely harmful and benign conducts of the same type. Additional assessment tests can be thought of as lying along a *sliding scale or continuum*, at the extremes of which are, on the one hand, assessments based purely on *presumptions* (namely, the Strict Per Se rule, that relies on just the characterisation of the conduct) and, on the other, assessments based on the findings of all potential case-specific economic analyses and tests of the market(s) that could influence the conduct's impact (full effects based, or rule of reason²²). The idea that “the modes of antitrust analysis represent a continuum, or “sliding scale” with different fact-finding requirements for different situations” was initially developed in the *Antitrust Law* treatise of Areeda and Hovenkamp.²³ This idea's articulation that best represents the approach in Katsoulacos and Ulph (2022) and in this paper is that of Jones and Kovacic (2017). As they note “the general progression in U.S. doctrine has been toward recognition of an *analytical continuum* whose boundaries are set, respectively, by categorical rules of condemnation (*per se* illegality) or acquittal (*per se* legality) and an elaborate, fact-intensive assessment of reasonableness (Rule of Reason). These poles are connected by a range of intermediate tests that seek to combine some of the clarity and economy of bright-line rules with the greater analytical accuracy that a fuller examination of evidence can produce.”²⁴

In Katsoulacos and Ulph (2022), the continuum is described by a sequence of steps or stages, in each of which additional screens are examined, using further blocks or components of economic analysis, generating additional information, building on the information already gathered in previous steps. The objective of each step of the information gathering and analysis process is to examine whether certain preconditions or screens that are considered necessary for demonstrating liability (welfare harm) are satisfied—such as significant

extant market power/lack of contestability, potential for exclusion, potential for consumer harm and potential for efficiencies. Then, decision error costs across steps or stages can be derived and compared in order to determine the optimal number of stages, which defines the error-minimising LS.

What is the relationship of the above to the important concept of the *standard of proof*? The procedure above can be thought of as determining the “quantity” (or degree) of evidence dimension of this concept. That is, the evidence necessary to establish proof, if the objective is to minimise the cost of decision errors. The other dimension of the standard of proof, that of the level of certainty necessary to establish proof, can also be considered within our framework, allowing for its influence on the choice of LSs. For example, when the necessary level of certainty is considered satisfied, additional evidence will not be examined in practice even though this evidence could reduce further the costs of decision errors. We explain below (Section 4.6) how the parameters in our approach allow us to say whether a given level of certainty imposed by the standard of proof is or is not satisfied and how this influences LSs.

To appreciate the usefulness of this approach, one could for example think its application for comparing whether, when assessing tying arrangements, a modified *per se* illegality LS, under which we rely, in order to reach a decision, on certain contextualisation tests and the existence of significant market power, is preferable (in terms of decision errors) to strict *per se* illegality under which there is no pre-requirement of extant market power, or whether a disadvantaging rivals (truncated effects based) LS is preferable to modified *per se* illegality—where, under the former, for illegality, significant market power is not enough, it is also required to demonstrate that rivals are likely to be excluded (in a broad sense) from the market by the conduct, or whether a full effects based is preferable to the disadvantaging rivals LS. As noted by Evans and Padilla (2005), first, strict *per se* and then later modified *per se* illegality have been the standards favoured for tying by both US and EU jurisdictions until about the end of the 1990s²⁵ and since then it has been decided to move to LSs closer to effects based.

To give another example, the approach can be used to clarify and make precise why it may make sense to recommend that antitrust laws should be updated in order “to recognise that under some circumstances conduct that creates a risk of substantial harm should be unlawful even if the harm cannot be shown to be more likely than not,”²⁶ or it may be applied to examine how the choice of error minimising LSs depends on the context in which specific conducts are undertaken, for example, for comparing developing jurisdiction/countries to developed countries/jurisdictions, a topic examined in Bageri and Katsoulacos (2020); and how the choice is affected when the conduct is undertaken in digital multisided platforms. We start in Section 3 below with a detailed presentation of the methodology for defining legal standards along the continuum depending on the screens or preconditions assessed. This is followed in Section 4 by a detailed formal examination of how all the pertinent factors interact to determine the optimal error-minimising LSs for different conducts and markets. Section 5 offers concluding remarks.

3 | POTENTIAL INVESTIGATION STAGES: DEFINING LSs ALONG THE CONTINUUM DEPENDING ON THE SCREENS THAT HAVE BEEN ASSESSED

To decide whether a conduct violates competition law, assuming here that liability depends on whether the conduct is harmful to consumer welfare, a number of ways can be used. Specifically, for a liability decision, the LS specifies whether one or more of the following stages, each of which is associated with the examination of a specific screen or precondition, should be undertaken:

Stage 0: Initial characterisation of the conduct. This includes a detailed examination of all the relevant features of the conduct with a focus on those features that according to case law and established economic theory are considered most likely to influence the effects of the conduct. This conduct examination is often accompanied by a description of some basic market magnitudes such as the level of sales, which are an input to stage 2 and can be also considered as being part of that stage. We refer to this as the *conduct characterisation screen*.

Stage 1: Detailed contextualisation of the market(s)²⁷ and, most importantly, establishing that there is significant market power (SMP, lack of contestability or dominance). We can refer to this as the *market contextualisation and SMP screen*.

Stage 2: Establishing that there is potential for significant exclusionary impact, or, more generally, a competition lessening effect (by enhancing ability to exercise market power or incentives to coordinate behaviour achieving collusive outcomes). This can be manifested through the exit of a rival or rivals or through the marginalisation of rivals (so that they cannot exploit economies of scale and/or network effects) or through the exclusion of potential entrants or through concerted practices. We can refer to this as the *enhanced ability to exercise market power screen*.

Stage 3: Establishing that there is potential for consumer welfare loss *before accounting for efficiencies*. Salop (2017) provides an extensive discussion of how for many of the practices usually considered under abuse of dominance (AoD), exclusionary potential may or may not be associated with consumer welfare harm.²⁸ Ideally, consumer welfare should be evaluated in terms of effects on prices, on output, on consumer choice (product variety), on quality and on innovation.²⁹ We can refer to this as the *potential consumer welfare loss due to anticompetitive effects screen*.

Stage 4: Establishing lack of potential for significant efficiencies that can benefit consumers, specifically, establishing that *efficiencies are not sufficiently significant to outweigh the anticompetitive effect of the conduct*. We can refer to this as the *efficiencies and balancing screen*.

Depending on the screens, $i = 0, 1, \dots, 4$, examined, we can then distinguish the following legal standards.

- i. **Strict per se (SPS) LS** is the LS under which the liability decision relies purely on the initial characterisation of the conduct (in stage 0) and the presumption that this generates about its welfare impact.
- ii. **Modified per se LS (MPS LS):** Under this, a liability decision relies just on the information from stages 0 and 1 and the presumption that this generates about its welfare impact.
- iii. **Truncated effects-based I LS (TEB I LS):** Under this, a liability decision relies on the information from stages 0, 1 and 2 and the presumption that this generates about its welfare impact. The US Quick Look LS can be considered as an intermediate LS between MPS and TEB I, involving a “quick look” on the efficiency defence.³⁰
- iv. **Truncated effects-based II LS (TEB II LS):** Under this, a liability decision relies on the information from stages 0, 1, 2 and 3 and the presumption that this generates about its final welfare impact.
- v. **Full effects-based (or rule of reason) LS (FEB LS):** Under this, a liability decision relies on the information from all assessment stages 0–4 and a balancing between anticompetitive and efficiency effects to determine the net effect on consumer welfare.

We note that LSs (i)–(iv) are all what can be termed *presumption-based (PB) LSs*, in the sense that they all rely on some presumption about the outcome of subsequent assessment(s), were one or more subsequent assessments to be made. Only in case (v) the liability decision relies on case-specific information from all assessment steps (0–4). So, the distinguishing characteristic of this LS is that there is no reliance on presumptions when the liability decision is made.

Also note that in some cases, regulations are introduced about enforcement procedures that combine different LSs. The EC’s Vertical Block Exemption is a good example. It can be considered as a combination between a PB MPS legality LS, when in stage 1 the market shares are less than a certain threshold (30%), and a full effects based LS, when market shares exceed this threshold.

3.1 | Presumption of legality and illegality

Clearly, for all *PB LSs*, there can be, in stage i , either a *presumption of illegality* (i.e., a presumption that the conduct type examined is on average harmful) or a *presumption of legality* (i.e., a presumption that the conduct type is on average benign), given precondition i is satisfied. To clarify, consider stage 0: In this stage, the LS can be that of strict (or, for simplicity, let us just say, omitting the word “strict”) per se illegality if, just on the basis of the information collected in this (conduct characterisation) stage, the conduct is considered PI; or, the LS can be that of per se legality if, just on the basis of the information collected in this stage, the conduct is considered PL.

We assume that there is no uncertainty or mistakes in characterising in a specific case that the conduct belongs to a specific conduct category or type: Conducts cannot be of one or another type (i.e., $\hat{\beta}_0 = 1$) and the CA recognises what is the type with no mistakes ($\hat{\rho}_{H,0} = 1$), in terms of the notation introduced below.

We can determine whether conduct is on average harmful or benign as follows: Following the characterisation of the conduct as being, by virtue of its specific formal features, of a particular type,³¹ one can draw on knowledge of other cases involving this type of conduct, of relevant economic theory and evidence, and the information collected from the complainants and the defendants in the specific case, in order to come to a view that a fraction $\gamma_0, 0 < \gamma_0 < 1$ of cases involving such conduct (i.e., for which precondition 0 is satisfied)³² are genuinely harmful to consumer welfare,³³ with (average) harm $H > 0$, while the remaining fraction are genuinely benign, with (average) benefit $B > 0$. Given this, if the average harm across all cases is \bar{h}_0 ,³⁴ the conduct is considered PI if $\bar{h}_0 > 0$ and is considered PL if $\bar{h}_0 < 0$. Clearly, knowledge about the values of these parameters need not be very precise³⁵ in the sense that what needs to be determined is just whether on average the conduct can be presumed to be harmful or benign. This can result from agencies or courts “creating presumptions³⁶ through experience, to guide their factual investigations and decision making” (Beckner & Salop, 1999; also Gavil & Salop, 2020). They have “initial information on the likelihood and magnitude of benefits and harms ... (representing) preliminary presumptions for the entire class of similar (conducts) before gathering additional case-specific information.” The presumption of legality or illegality can of course be defined for any stage of the investigative process—see below.

3.2 | Additional remarks on per se LSs

When a per se LS or, more precisely, a PB LS is proposed to be adopted in an investigative stage, it means that the totality of all conducts in a given conduct category, for which a precondition for welfare harm is considered satisfied in that stage, are included in a group (e.g., all conducts undertaken by firms considered to have SMP or be “dominant,” or all conducts with potential for significant exclusionary impact) and the totality of conducts for which the precondition is not considered satisfied in another group, and then the conducts in each group are treated in exactly the same way: those in the first group, are banned; while all conducts in the second group are acquitted. It is important to note that a procedure for reaching liability in this way has two distinct aspects:

1. The first aspect is that *there is no attempt to undertake additional investigations* that could allow, through the examination of additional harm-conducive preconditions, a finer discrimination between harmful and benign conducts, rather than relying purely on a discrimination based just on the first screens, for example, on whether conducts are undertaken under dominance or not. Thus, the per se illegality treatment of all conducts in a category, for example, the category of conducts undertaken under dominance, relies on a *presumption* that in all additional investigations, following the stage 1 investigation, the preconditions would be satisfied, leading to a finding of welfare harm. In that sense, the term *PB LS* can be used instead of the term per se LS. The term *rule of reason* or (full) effects based refers to the LS under which decisions rely

on the outcome of the investigations of *all* the stages—so all the preconditions for welfare harm are examined—and there is *no reliance on any presumptions*.

2. The second fundamental aspect of a PB or per se LS is that, having decided to reach liability decisions following, for example, just the investigation of the precondition in stage 1 and without undertaking all other potential assessment steps, *all conducts are treated in exactly the same (nondiscriminating) way*: banned when the precondition is considered satisfied and acquitted in the other case. Thus, under a per se LS, it is proposed that we neglect the fact that the signals generated by an investigation, given that a precondition is considered satisfied, about whether or not the specific conduct is or is not harmful are subject to error: Actually, depending on the exact characteristics of the conduct and the exact characteristics of, for example, “dominance,”³⁷ a stronger or a weaker signal of harm may be generated, given that some (one or more) of the other preconditions for harm may not be examined (in subsequent stages). Specifically, we will say that, if the investigation identifies the firm as “dominant,” this allows the identification of the specific conduct as harmful when it is indeed harmful on average in a fraction $p_{H,1} < 1$ of the cases examined, and to identify the conduct as benign when it is indeed benign on average in a fraction $p_{B,1} < 1$ of the cases. In other words, $p_{H,1} + (1 - p_{B,1})$ (resp. $p_{B,1} + (1 - p_{H,1})$) can be considered as the probability that a genuinely harmful conduct by a dominant firm will be banned (resp. a genuinely benign conduct by a dominant firm acquitted) if a decision is made following the investigation in step 1. This is very important in determining decision error costs from taking decisions in any given specific stage.³⁸

What we wish to stress here is that, even though we may consider that a full analysis of all screens involving all the investigative/assessment steps is needed (which is the fundamental aspect 1 of a Per Se LS mentioned above), and that in stage $i < 4$ we can cease to pursue additional screening, we may not ban all of them at this stage; rather we may *discriminate* between them, banning a fraction $p_{H,i} + (1 - p_{B,i})$ of them and acquitting a fraction $p_{B,i} + (1 - p_{H,i})$. If it is considered that all screens should be examined, then if $i = N$ is examined and it is satisfied, the conduct would be certainly harmful, so it should be banned with certainty.³⁹

To capture these distinctions, Katsoulacos and Ulph (2022) as in this paper distinguish between PB LSs and rule of reason. For the former, we distinguish between the subcategories of (a) discriminating PB LSs and (b) per se, or nondiscriminating PB LSs.⁴⁰ To avoid confusion, we will use the term *Strict per se* when we refer to the case where liability decisions rely purely on the categorisation involving the initial characterisation of the conducts in stage 0.

3.3 | Discriminating versus nondiscriminating PB LSs

Under a PB LS_{*i*}, $i = 1, \dots, N - 1$, liability decisions rely on information from investigations up to step i , $0 < i < N - 1$, and no further case-

specific analysis/investigation is undertaken. From the information already collected by the i th and previous investigations, a presumption is formed about whether or not the preconditions for welfare harm in the stages after i , will be satisfied or not. Thus, when banning a PI conduct in stage i , it is presumed that the preconditions after i , which should in principle be examined in order to establish harm to welfare, will be satisfied. As noted above, two approaches for reaching a liability decision under PB LSs can be distinguished (for a PI conduct⁴¹) and we formalise these approaches here:

PB nondiscriminating (or per se) LS_{*i*}, henceforth referred to as *PBNDLS_{*i*}*: Under this *all* PI conducts for which precondition i is considered to be satisfied are banned, though it is recognised that precondition i is identified with errors and that some of the conducts for which the precondition is satisfied are not harmful.

PB discriminating LS_{*i*}, henceforth referred to as *PBDLS_{*i*}*: Under this, liability decisions are made on the basis of the understanding that if an assessment step shows a precondition $i = 1, \dots, N - 1$ as satisfied; this allows us to identify the specific conduct as harmful when it is indeed harmful on average in a fraction $p_{H,1} + (1 - p_{B,1})$ of the cases and to identify the conduct as benign when it is indeed benign on average in a fraction $p_{B,1} + (1 - p_{H,1})$ of the cases (further details on these probabilities are provided below).

We note here that the choice between a discriminating and a nondiscriminating LS makes sense when $\gamma_i < 1$ —the probability that the conduct is considered harmful is less than unity, which will apply in stages $i = 1, \dots, N - 1$. Then, as already mentioned, one can either ignore this and treat (as under Per Se) all conducts for which precondition i is satisfied as one category for which a uniform “ban” decision will be applied (ALL these conducts being presumed harmful), or one can try to discriminate between harmful and benign conduct for which precondition i is satisfied, *taking into account that there will be a range of different circumstances under which precondition i will be considered to be satisfied*, and this allows us to identify truly harmful conduct in a fraction $p_{H,1} + (1 - p_{B,1})$ of the cases and to identify truly the conduct as benign in a fraction $p_{B,1} + (1 - p_{H,1})$ of the cases.

Under a rule of reason or (full) effects-based LS, henceforth referred to as *LS_{*N*}*, the liability decision relies on case-specific information from *all* assessment steps $i = 1, \dots, N$. Given that there are no more investigation steps after step N , if the precondition N is genuinely satisfied and is considered satisfied for a conduct and given that all the preconditions examined in the previous steps are also satisfied, the conduct is considered to be certainly harmful, that is, $\gamma_N = 1$, and there are no false conviction (FC) errors in banning it.⁴² If the precondition is considered not satisfied, then (as with previous preconditions) it is acquitted with certainty. This means that when, as under RoR (i.e., under *LS_{*N*}*), all assessment steps are taken, there are no errors in step N in identifying harmful conducts among those for which precondition N is genuinely satisfied and is considered satisfied. That is, applying a discriminatory approach is

irrelevant here. But there are still errors in stage N , though not in the decisions regarding harm (i.e., not in identifying whether conduct in a specific case is harmful or benign). Precondition N may be mistakenly considered not to be satisfied, when it is, leading to a false acquittal (FA), and it may be mistakenly considered to be satisfied when it is not, leading to an FC (i.e., there are errors in identifying correctly when the screen N holds or not).

4 | DETERMINING THE OPTIMAL ERROR-MINIMISING LS FOR DIFFERENT CONDUCTS AND MARKETS

4.1 | Introduction

In order to determine what is the optimal legal standard for a specific conduct undertaken in a given market, we need to determine the investigation stage at which the cost of decision errors (net of enforcement cost) is minimised for this conduct and market. We start by noting that below we measure the DEC associated with each one of the assessment stages $i = 0, \dots, 4$, as the error costs that would result if liability decisions (to condemn or to acquit) were taken in that stage. So, $DEC_{i,i=0,\dots,4}$, measures the DEC that would result if liability decisions were made on the basis of the information collected up to and including stage i . Of course, investigating the precondition associated with stage i presupposes that the preconditions associated with previous steps have been investigated and are considered to be satisfied. Measuring DEC in this way allows us to determine whether an additional assessment step should be undertaken (because it would lower DEC) as well as the optimal LS. Specifically,

- i. if $DEC_1 < DEC_0$, it is optimal to take step 1; otherwise optimal LS is LS_0 ;
- ii. if $DEC_2 < DEC_1$, it is optimal to take step 2; otherwise optimal LS is LS_1 ;
- iii. if $DEC_3 < DEC_2$, it is optimal to take step 3; otherwise optimal LS is LS_2 ;
- iv. if $DEC_4 < DEC_3$, it is optimal to take step 4; otherwise optimal LS is LS_3 .

So, the RoR (LS_4) will be the optimal LS if

$$DEC_4 < DEC_3 < DEC_2 < DEC_1 < DEC_0$$

Decision errors emerge because

- it is not possible to determine with certainty whether a precondition or screen for harm to welfare is or is not satisfied;
- when a precondition is considered to be satisfied, unless all the previous investigations have been undertaken, $i = 1, \dots, N$, it is not possible to determine with certainty whether the conduct is harmful or benign.

Of course, DEC will be different depending on whether decisions rely or not on presumptions and, when they are, depending on whether or not they are or are not discriminating.

To proceed with modelling DEC, the following parameters must now be discussed:

4.2 | Parametrization

Having already defined parameters γ (and γ_0), H and B , above, we must now also define⁴³:

$\gamma_i, i=1, \dots, N$, is the probability that conducts for which precondition i is genuinely satisfied are genuinely harmful to consumer welfare, given that the first $i-1$ steps have been undertaken and satisfied.⁴⁴ So if, for example $i=2$, γ_2 is the probability that conducts of this general type (as determined in step 0), undertaken by dominant firms⁴⁵ (as established under $i=1$), that have exclusionary effects (as established under $i=2$), lower consumer welfare. Clearly⁴⁶:

$$0 < \gamma_0 < \gamma_1 < \gamma_{i+1} < 1, i=1, \dots, N-1, \gamma_N = 1 \quad (1)$$

This means that the fraction of genuinely harmful cases in the population of conducts for which precondition i is satisfied, given that the first $i-1$ steps have been undertaken and satisfied, increases as i increases. Thus, the fraction of such cases in the population of dominant firms ($i=1$) will be less than the fraction of such cases for which there is an exclusionary effect ($i=2$), and so forth.

$0 < \beta_i < 1, i=1, \dots, N$ is the probability that the precondition examined in step i is genuinely satisfied given all preconditions in the previous assessment steps are satisfied; for example, β_1 is the probability that the conduct is undertaken by a dominant firm, while β_2 is the probability that, when undertaken by such firms, this conduct type has exclusionary effects and so forth.⁴⁷

Instead of using the probability that precondition i is satisfied in the population of conducts for which the previous preconditions are satisfied, it is also useful to define the following:

$0 < \hat{\beta}_i < 1, i=1, \dots, N, \hat{\beta}_0 = 1$, is the probability that precondition i is genuinely satisfied in the total population of conducts of the type examined. Clearly,

$$\hat{\beta}_1 = \beta_1, \hat{\beta}_2 = \beta_1\beta_2, \hat{\beta}_3 = \beta_1\beta_2\beta_3, \hat{\beta}_4 = \beta_1\beta_2\beta_3\beta_4; \hat{\beta}_1 > \hat{\beta}_2 > \hat{\beta}_3 > \hat{\beta}_4 \quad (2)$$

The extent to which $\hat{\beta}_i$ falls with i depends on the type of conduct and market context. If for example, almost all dominant firms' conduct is very likely to be exclusionary and when exclusionary almost always consumer welfare is reduced, then $\hat{\beta}_1 \approx \hat{\beta}_2 \approx \hat{\beta}_3$.

Note that

$$\gamma_0 = \beta_1\gamma_1, \gamma_1 = \beta_2\gamma_2, \gamma_2 = \beta_3\gamma_3, \gamma_3 = \beta_4\gamma_4 = \beta_4, \gamma_4 = 1 \quad (3)$$

and so

$$\gamma_0 = \prod_{i=1}^4 \beta_i = \hat{\beta}_4, \gamma_1 = \prod_{i=2}^4 \beta_i, \gamma_2 = \prod_{i=3}^4 \beta_i, \gamma_3 = \beta_4, \gamma_4 = 1 \quad (4)$$

and

$$\beta_1\gamma_1 = \gamma_0 = \hat{\beta}_4 < \gamma_1 = \beta_2\gamma_2 < \gamma_2 = \beta_3\gamma_3 < \gamma_3 = \beta_4\gamma_4 = \beta_4 \quad (5)$$

that is, $\beta_1\gamma_1$ increases with i . Also, given that we have assumed $\hat{\beta}_0 = 1$ and given $\beta_1 = \hat{\beta}_1$,

$$\hat{\beta}_0\gamma_0 = \gamma_0 = \beta_1\gamma_1 = \hat{\beta}_1\gamma_1 = \hat{\beta}_2\gamma_2 = \hat{\beta}_3\gamma_3 = \hat{\beta}_4\gamma_4 = \hat{\beta}_4 \quad (5')$$

Finally, it is clear from the above that⁴⁸

$$\hat{\beta}_1(1-\gamma_1) > \hat{\beta}_2(1-\gamma_2) > \hat{\beta}_3(1-\gamma_3) > \hat{\beta}_4(1-\gamma_4) \quad (6)$$

Also, we define the following probabilities:

$0 < \hat{p}_{H,i} < 1, i=1, \dots, N$, is the probability that having undertaken investigative step i , the precondition examined in step i is considered satisfied when indeed this is the case. Clearly, $(1-\hat{p}_{H,i})$ is the probability that the precondition examined in step i is erroneously considered as not satisfied and hence the conduct is acquitted.

$0 < \hat{p}_{B,i} < 1, i=1, \dots, N$, is the probability that having undertaken investigative step i , the precondition examined in step i is not considered satisfied when indeed this is the case. Clearly, $(1-\hat{p}_{B,i})$ is the probability that the precondition examined in step i is erroneously considered as satisfied and hence the conduct is banned (if there is no further assessment after step i).

The probabilities \hat{p}_H and \hat{p}_B in stages i and $i+1$ measure the accuracy of estimates of whether or not different preconditions examined in these stages hold, and this may rise or fall. For example, the probability of identifying correctly if dominance exists or not in stage 1 may be higher or lower than the probability of identifying correctly if there is exclusion in stage 2, given that dominance is identified in stage 1, similar for stage 3, and so forth.

Finally, we repeat here the definition of the following two parameters already defined above:

$p_{H,i} < 1, i=1, \dots, N-1$, is the average fraction of the cases examined in which the conduct is identified as harmful when it is indeed harmful, having undertaken investigative step i . Clearly, $(1-p_{H,i})$ is the average fraction of cases examined erroneously considered as benign (and acquitted) for which step i is satisfied and which reduce consumer welfare. In this framework, it makes sense to assume that this is less than one for stage 1, ..., $N-1$. In the last stage N , with all assessment steps completed, if the precondition in this stage, as all other preconditions, is considered satisfied and recognised as satisfied, the conduct is certainly assessed as harmful and is banned; that is, we assume that $p_{H,N} = 1$.

$p_{B,i} < 1, i=1, \dots, N$, is the average fraction of the cases examined in which the conduct is identified as benign when it is indeed benign, having undertaken investigative step i . Clearly, $(1-p_{B,i})$ is the average fraction of cases examined erroneously considered as harmful (and banned, if there is no further assessment after step i) for which step i is satisfied but which increases consumer welfare. Clearly, $p_{B,N} < 1$ since if precondition in stage N does not hold (so the conduct is benign), this may not be recognised and with positive probability the conduct will be wrongly banned.

All the four last probabilities are assumed to have values between 0 and 1 reflecting the fact that analyses and tests are never perfect and there can be FCs as well as FAs. Further, it is assumed that the

additional investigative steps and tests carried out have some *discriminatory power* so the probability of banning a harmful conduct is greater than the probability of banning a benign one and so

$$p_{H,i} > 1 - p_{B,i} \quad (7)$$

As can be seen, this is equivalent to assuming that the probability of acquitting a genuinely benign conduct is higher than the probability of acquitting a genuinely harmful conduct.

Also, it is assumed that

$$\hat{p}_{H,i} > 1 - \hat{p}_{B,i} \quad (8)$$

that is, the probability that precondition i is considered to be satisfied, when it is, is higher than when it is erroneously considered to be satisfied, when it is not.

It is natural to assume that

$$p_{H,i} < p_{H,i+1}, i = 1, \dots, N-1 \quad (9)$$

$$p_{B,i} < p_{B,i+1}, i = 1, \dots, N-1 \quad (10)$$

Equations (9) and (10) say that the ability of the CA to recognise without errors genuinely harmful and genuinely benign conducts increases as the investigative steps and thus the information and evidence about the specific conduct examined increases.

To conclude this subsection, we generalise our definition of PL or PI, for any stage $i = 1, \dots, N$: Having carried out i investigative steps, $i = 1, \dots, N$, we can say that the conduct is PL or PI depending on whether, respectively, $\bar{h}_i = \gamma_i H - (1 - \gamma_i)B < 0$ or $\bar{h}_i = \gamma_i H - (1 - \gamma_i)B > 0$, \bar{h}_i being the average harm of conducts for which precondition i is satisfied. Of course, $\bar{h}_N = H$.

4.3 | Potential liability decisions based on the DEC following assessment in stage i ; FCs and FAs

Having discussed stage 0 above, we focus here at stages $i = 1, \dots, N$. A precondition examined in investigation stage i can be satisfied or not be satisfied: If satisfied, the conduct can be harmful or benign; if it is not satisfied, the conduct is certainly benign. Thus, having completed investigation i , the following decisions can be made:

- If precondition i , $i = 1, \dots, N$, is not considered to be satisfied, acquit the conduct in step i ;
- If precondition i , $i = 1, \dots, N - 1$, is considered to be satisfied:
 - Decide whether to use $PBNDLS_i$ or $PBDLS_i$ by comparing their respective DEC;
 - Decide whether the information and evidence collected up to step i is sufficient to reach an infringement decision or whether additional analyses and evidence should be sought, by comparing DEC under

- LS_i to DEC under LS_{i+1} . If DEC under LS_i are considered lower than DEC under LS_{i+1} , use LS_i to reach a liability decision, otherwise move to stage $i + 1$ and LS_{i+1} . If it is decided to use LS_i , then
- Ban all conduct if it is decided to use $PBNDLS_i$;
- Ban or allow the conduct depending on the strength of the harm signal received under a $PBDLS_i$ (measured by the probabilities $p_{H,i} + (1 - p_{B,i})$ and $p_{B,i} + (1 - p_{H,i})$).
- If precondition $i = N$ is considered to be satisfied and given that examining precondition $i = N$ (the last one) implies that all previous preconditions were examined and considered to be satisfied, the conduct is considered certainly harmful, so $\gamma_N = 1$. In this case, the conduct must either be banned with certainty if precondition N is considered satisfied or it must be acquitted with certainty if precondition N is not considered to be satisfied (since then it is considered certainly benign).

The following decision tree in [Diagram 1](#) provides a succinct presentation of all the decisions that could be reached depending on the circumstances, as reflected in the value of the probabilities described above. Section 4.4 that follows provides a detailed account for calculating the FAs, the FCs and hence total DEC. Equations (22)/(22') and (23)/(23') provide expressions for FA1, FC1, FA2 and FC2, which are shown in [Diagram 1](#).

4.4 | Determining the DEC from reaching liability decisions in each assessment stage

We start with the following result:

Lemma 1. A PL conduct in stage $i = 0, \dots, N - 1$ can turn into a PI conduct in the next stages, while a PI conduct in stage $i = 0, \dots, N - 1$ will be even more PI in the next assessment stage; that is, its average harm will increase.

Proof. True since γ_i and hence $\bar{h}_i = \gamma_i H - (1 - \gamma_i)B$ is increasing with i .

In most of the cases that are the focus of our investigation (i.e., abuse of dominance practices, vertical restraints or concerted practices), there is now broad unanimity that conducts are PL in step 0 but may be PI in step 1, that is, following detailed market contextualisation, when these conducts are undertaken by firms with SMP or dominant firms. If the conduct is considered PL in step 0 and is also PL in step 1, then it is unlikely that it will be condemned or be the subject of further investigation. So below we focus on cases where the conduct type is PL in step or stage 0, so $\bar{h}_0 < 0$ while it is PI in stage 1, that is, $\bar{h}_1 > 0$.

A next question is whether, given these assumptions, we should pursue investigation 1, rather than use a strict per se rule and allow all the conducts in step 0. In the latter case, the DEC will be the cost of errors from FAs, that is,

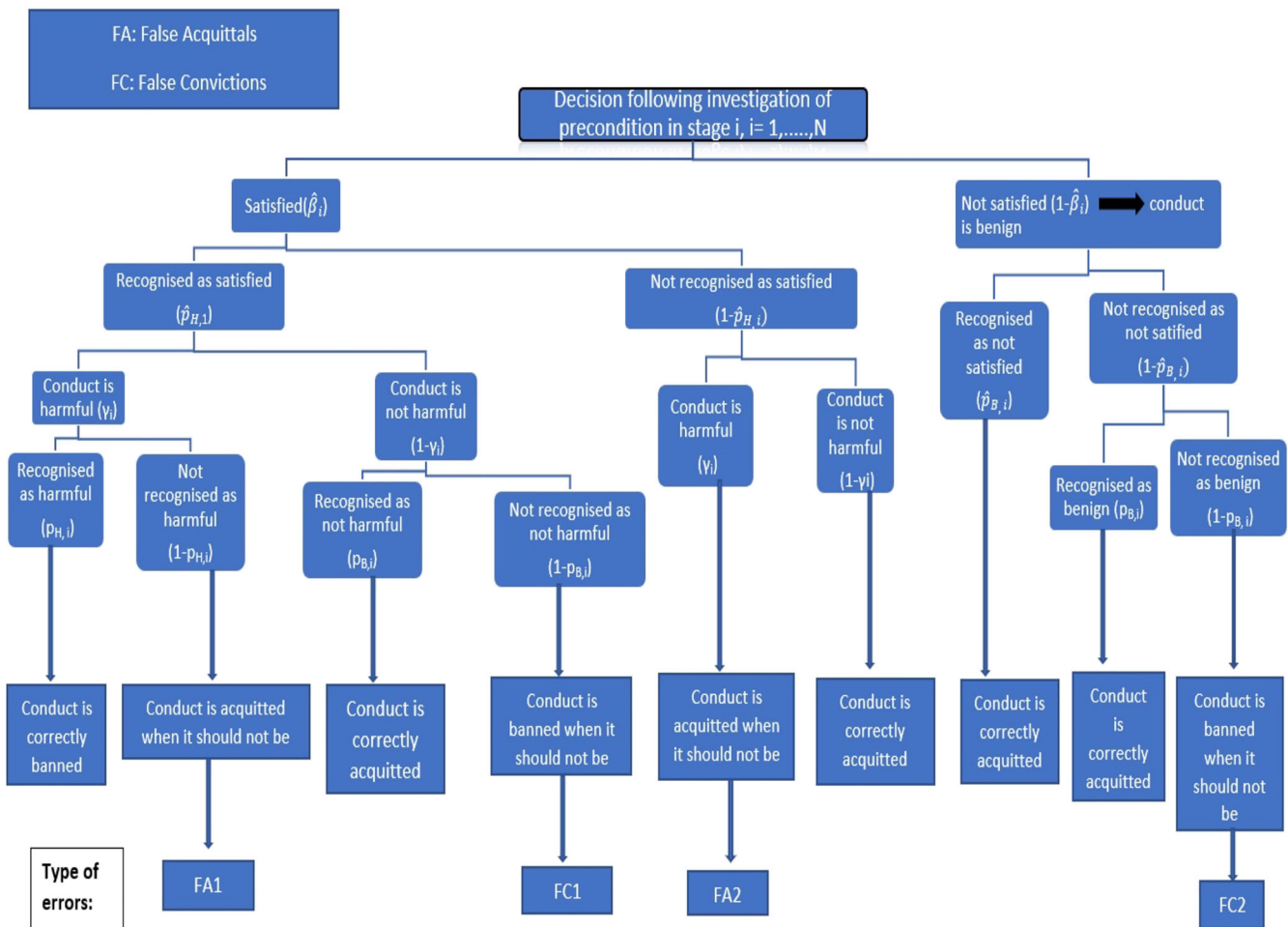


DIAGRAM 1 Potential decisions and determination of FAs and FCs depending on whether precondition *i* is or is not considered satisfied

$$DEC_0 = \gamma_0 H \tag{11}$$

If the assessment in stage 1 lowers DEC, then the question becomes whether additional information should be obtained in steps 2, 3 and so forth.

To compare DEC more generally, we now define the DEC for all the above types of LSs. They are the following:

(a) DEC of Strict Per Se (SPS) LS

$DEC_{LS_0} = \gamma_0 H = \text{DEC of FAs if } \bar{h}_0 < 0 \text{ (PL conduct) and } DEC_{LS_0} = (1 - \gamma_0) B = \text{DEC of FCs if } \bar{h}_0 > 0 \text{ (PI conduct).}$ ⁴⁹

(b) DEC of PB LS;

(b.1) DEC under a PB nondiscriminating LS: Under a PBNL LS, $j = 1, \dots, N - 1$, with $\bar{h}_j > 0$ (conduct is PI), all conducts that are found to satisfy precondition *i* are banned, though not all preconditions for establishing liability have been investigated and it is understood that not all conducts that satisfy precondition *i* are harmful (and hence should not be banned). So, for example, in step 1, under PBNL, all conducts in the category in which dominance is considered to be present are banned without any attempt to discriminate between those

conducts in this category that are harmful from those that are benign—essentially, with this LS, it is presumed that all the preconditions that must be investigated in steps after step 1 in order to establish harm to welfare are satisfied. DEC are then given by

$$DEC_{PBNL_i} = \hat{\beta}_i \hat{p}_{H,i} (1 - \gamma_i) B + \hat{\beta}_i (1 - \hat{p}_{H,i}) \gamma_i H + (1 - \hat{\beta}_i) (1 - \hat{p}_{B,i}) B \tag{12}$$

The first term on the RHS is the DEC (FCs) from banning benign (probability $(1 - \gamma_i)$) conducts, which would generate welfare benefits *B*, for which precondition *i* is genuinely satisfied (probability $\hat{\beta}_i$), given that precondition *i* is considered to be truly satisfied with probability $\hat{p}_{H,i}$. The second term on RHS is the DEC (FAs) from acquitting harmful (probability γ_i) conducts, and thus incurring welfare loss *H*, for which precondition *i* is satisfied (with probability $\hat{\beta}_i$), given that precondition *i* is mistakenly considered not to be satisfied with probability $(1 - \hat{p}_{H,i})$. Finally, the third term on the RHS is the DEC (FCs) from banning benign conducts and thus losing welfare benefit *B*, for which precondition *i* is not satisfied (with probability $(1 - \hat{\beta}_i)$), given that following the investigation it is mistakenly considered that precondition *i* is satisfied (with probability $(1 - \hat{p}_{B,i})$).

(b.2) DEC under a *PB Discriminating LS_i*: Under a PBD *LS_i*, $i = 1, \dots, N-1$, with $\bar{h}_i > 0$, not all conducts that are found to satisfy precondition i are banned, which is the difference between this *LS* and *PBND LS_i*. DEC in this case are

$$DEC PBD LS_i = \hat{\beta}_i \hat{p}_{H,i} \gamma_i (1 - p_{H,i}) H + \hat{\beta}_i \hat{p}_{H,i} (1 - \gamma_i) (1 - p_{B,i}) B + \hat{\beta}_i (1 - \hat{p}_{H,i}) \gamma_i H + (1 - \hat{\beta}_i) (1 - \hat{p}_{B,i}) (1 - p_{B,i}) B \quad (13)$$

There is now an additional FAs DEC term from not banning all harmful conducts (the first term on the RHS of Equation 13)—banning with probability $(1 - p_{H,i})$. The FCs DEC term, second term on the RHS of Equation (13) now changes compared to *DEC PBND LS_i*—first term of 12: FCs, from banning conducts for which precondition i is satisfied even though they are benign, are now lower, given that now only a fraction of these, $(1 - p_{B,i})$, are banned. The second term on the RHS of *DEC PBND LS_i* in (12) is the same as the third term in Equation (13). The fourth term in (13) shows DEC from FCs of benign conducts, for which precondition i is not satisfied, but this is not recognised, and so they are banned with probability $(1 - p_{B,i})$.

(c) DEC of rule of reason or (full) EB *LS* (*LS_N*): As explained above under this *LS* if precondition N is considered satisfied, the conduct is banned with certainty given that $\gamma_N = 1$. As noted, this cannot be a discriminating *LS*, since the latter can be used in order to discriminate between harmful and benign conducts when precondition i is satisfied. And, if precondition N is considered not-satisfied, the conduct is acquitted with certainty. Thus, depending on the finding regarding precondition N , conducts are treated in exactly the same way—all those for which the precondition is considered satisfied are banned and all those for which the precondition is considered not satisfied are acquitted. This is as for the case of *PBND LS_i*, $i = 1, \dots, N-1$. So from (12) (DEC for *PBND LS_i*), the DEC for the rule of reason are:

$$DEC LS_N = \hat{\beta}_N (1 - \hat{p}_{H,N}) H + (1 - \hat{\beta}_N) (1 - \hat{p}_{B,N}) (1 - p_{B,N}) B \quad (14)$$

So now there are (first term on RHS) DEC from FAs, from wrongly acquitting conducts for which precondition N is satisfied, but this is not recognised, and DEC from FCs (second term on RHS) from wrongly convicting conducts for which precondition N is not satisfied but, again, this is not recognised.

Expressions for FAs and FCs are also given below (Section 4.5), equations (22)/(22') and (23)/(23'), respectively.

4.5 | Comparisons and main results: Optimal LSs

We can now prove a number of results about whether additional assessment steps should be undertaken and thus about the determination of optimal *LSs* for specific conduct types. To start with, we define the following indicators:

$\frac{\gamma_i H}{(1 - \gamma_i) B} = s_i > 1$, this measures what we can call the *strength of the presumption of illegality* (s_i) in stage i , that is, the strength of the

presumption that the conduct is harmful, when the preconditions for welfare harm in i and before i ($i = 1, \dots, N-1$) are considered satisfied.

$\frac{\hat{p}_{H,i}}{(1 - \hat{p}_{B,i})} > 1$, this measures the *discriminatory power* (\hat{d}_i) in identifying correctly when precondition i is satisfied.

$\frac{\hat{p}_{H,i}}{(1 - \hat{p}_{B,i})} > 1$, $\frac{p_{B,i}}{(1 - p_{H,i})} > 1$, these measure the *discriminatory power* ($d_{H,i}, d_{B,i}$) of *PB discriminatory LSs* (*PBD LSs*) in identifying correctly when the conduct is harmful and when it is benign, given that precondition i is satisfied.⁵⁰

$\left(\frac{\hat{\beta}_i}{1 - \hat{\beta}_i} \right)$, this measures the *degree of prevalence* (\hat{w}_i) of the precondition i , that is, the extent to which the presence of the precondition is widespread in the market under consideration.

Proposition 1. Conditions for not adopting strict per se (i.e., for not undertaking step 1):

Assuming that the conduct is PL in step 0 but PI in step 1, so $\bar{h}_0 < 0$ while $\bar{h}_1 > 0$, it is optimal to proceed with the step 1 investigation, as this will lower DEC relative to a strict per se treatment of the conduct, when γ_1 and hence s_1 , as well \hat{w}_1 and $\hat{d}_{H,1}$ are quite large.

Proof. We need to compare *DEC LS₀* = $\gamma_0 H$, given $\bar{h}_0 < 0$, with *DEC PBND LS₁* and *DEC PBD LS₁*. For the result to hold, at least one of the two latter should be lower than the former. Comparing first with the *DEC PBND LS₁*, we get, given that $\gamma_0 = \beta_1 \gamma_1$ and $\hat{\beta}_1 = \beta_1$:

$$DEC LS_0 > DEC PBND LS_1, \text{ if } \gamma_0 H > \hat{\beta}_1 \hat{p}_{H,1} (1 - \gamma_1) B + \hat{\beta}_1 (1 - \hat{p}_{H,1}) \gamma_1 H + (1 - \hat{\beta}_1) (1 - \hat{p}_{B,1}) B \quad (15)$$

that is, if $\hat{\beta}_1 \hat{p}_{H,1} (1 - \gamma_1) B - \hat{\beta}_1 (\hat{p}_{H,1}) \gamma_1 H + (1 - \hat{\beta}_1) (1 - \hat{p}_{B,1}) B < 0$

$$\left(\frac{1 - \hat{\beta}_1}{\hat{\beta}_1} \right) \left(\frac{1 - \hat{p}_{B,1}}{\hat{p}_{H,1}} \right) < (1 - \gamma_1) \left[\frac{\gamma_1 H}{(1 - \gamma_1) B} - 1 \right] \text{ or } 1 < (1 - \gamma_1) \left[\frac{\gamma_1 H}{(1 - \gamma_1) B} - 1 \right] \left(\frac{\hat{\beta}_1}{1 - \hat{\beta}_1} \right) \left(\frac{\hat{p}_{H,1}}{(1 - \hat{p}_{B,1})} \right) \quad (15')$$

or using the notation of the indicators introduced above:

$$(1 - \gamma_1) \hat{w}_1 \hat{d}_1 (s_1 - 1) > 1 \quad (16)$$

$$\hat{w}_1 \hat{d}_1 \left[\gamma_1 \frac{H}{B} - (1 - \gamma_1) \right] > 1 \quad (16')$$

This can be generalised to the case where, according to the information available in stage i , the conduct is PL while in stage $i + 1$ it is PI. In this case, $\bar{h}_i < 0$ while $\bar{h}_{i+1} > 0$. In stage i , we can allow all conducts with DEC cost $\gamma_i H$ or move to the next stage. The DEC in the two stages can be compared as above, leading again to exactly Equations (15)/(16) with subscripts 0 replaced by i and 1 replaced by $i + 1$.

The condition (16') says something eminently intuitive: It is more likely to be optimal to take step 1 and then adopt all other things equal (i.e., before determining whether it will be optimal to take additional steps), a PBNB LS:

- the more widespread are dominant firms in the market for the type of conduct examined (the greater \widehat{w}_1);
- the more likely that the conduct is harmful given it is undertaken by a dominant firm that is, the higher is γ_1 , hence, the greater the strength of the presumption of illegality s_1 ;
- the greater the discriminatory power in distinguishing dominant from nondominant firms (\widehat{d}_1).

The interpretation is of course analogous for the general comparison between stages i and $i + 1$.

4.5.1 | Discussion

Note also that all these parameters/indicators are potentially different when we consider the same conduct types and markets across different economies and jurisdictions in which market structures and other characteristics are different. Thus, these indicators can provide the basis for developing empirical hypotheses about why there should be differences in LSs adopted for similar type of conduct in different countries.

As we have mentioned above, there is one case for which there is unanimous agreement that a strict per se LS should be used, that of hard-core cartels. In this case, in stage 0, the conduct is PI and if a strict per se illegality LS is used, the DEC will be $(1 - \gamma_0)B$. The use of this LS is optimal, therefore $(1 - \gamma_0)B < RHS$ of (15). This certainly holds, given that γ_0 is now close to 1 while the RHS remains strictly positive.

Proposition 2. Comparison of discriminating to nondiscriminating PB LSs at stage 1 (relative to the strict per se):

Using the discriminating $PBDLS_1$ in stage 1 is more likely to lower DEC relative to the use of the SPS LS in stage 0, than when the nondiscriminating $PBNDLS_1$ is used. In that sense the discriminating LS ($PBDLS_1$) is superior to the nondiscriminating one ($PBNDLS_1$).

Proof. Comparing strict per se to undertaking step 1, using, however, a PBD (i.e., discriminating) LS, the DEC under the former will be higher if:

$DECLS_0 > DEC PBDLS_1$, that is, if

$$\gamma_0 H > \widehat{\beta}_1 \widehat{p}_{H,1} \gamma_1 (1 - p_{H,1}) H + \widehat{\beta}_1 \widehat{p}_{H,1} (1 - \gamma_1) (1 - p_{B,1}) B + \widehat{\beta}_1 (1 - \widehat{p}_{H,1}) \gamma_1 H + (1 - \widehat{\beta}_1) (1 - \widehat{p}_{B,1}) (1 - p_{B,1}) B$$

or given that $\gamma_0 = \beta_1 \gamma_1$ and $\widehat{\beta}_1 = \beta_1$ and rearranging, if

$$\widehat{\beta}_1 \widehat{p}_{H,1} \gamma_1 p_{H,1} H - \widehat{\beta}_1 \widehat{p}_{H,1} (1 - \gamma_1) (1 - p_{B,1}) B - (1 - \widehat{\beta}_1) (1 - \widehat{p}_{B,1}) (1 - p_{B,1}) B > 0 \quad (17)$$

or

$$\widehat{\beta}_1 \widehat{p}_{H,1} (1 - \gamma_1) \left[\frac{\gamma_1 H}{(1 - \gamma_1) B} p_{H,1} - (1 - p_{B,1}) \right] - (1 - \widehat{\beta}_1) (1 - \widehat{p}_{B,1}) (1 - p_{B,1}) > 0 \quad (18)$$

or

$$\widehat{w}_1 \widehat{d}_1 \left[\gamma_1 \frac{H}{B} d_{H,1} - (1 - \gamma_1) \right] > 1 \quad (19)$$

Comparing (19) with expression (16), we see that the expression on the LHS of (19) is greater if $d_{H,1} > 1$, which holds, assuming, as we do, that there is some discriminatory power in our discriminating procedure (it is better than deciding randomly whether examined conducts are harmful or benign).

Next, we can compare PB LSs in any given stage. We can do this for stage i , $i = 1, \dots, N$. First we compare PBNB LSs to PBD LSs and give a general proof that condition (19) is a sufficient condition for a discriminating LS to be superior in stage $i < N$ to a nondiscriminating LS.

Proposition 3. General comparison of the two types of PB LSs in stage i :

A sufficient condition for the $PBDLS_i$, to lower DEC relative to a $PBNDLS_i$, $i = 1, \dots, N - 1$, is that the discriminatory power of $PBDLS_i$ ($d_{B,i}$) following the investigation in step i is higher than the strength of the presumption of illegality (s_i) of the conduct for which precondition i is considered to be satisfied.

Proof. We must examine when $DEC PBDLS_i > DEC PBNDLS_i$. This will be true if:

$$\widehat{\beta}_i \widehat{p}_{H,i} (1 - \gamma_i) B + \widehat{\beta}_i (1 - \widehat{p}_{H,i}) \gamma_i H + (1 - \widehat{\beta}_i) (1 - \widehat{p}_{B,i}) B > \widehat{\beta}_i \widehat{p}_{H,i} \gamma_i (1 - p_{H,i}) H + \widehat{\beta}_i \widehat{p}_{H,i} (1 - \gamma_i) (1 - p_{B,i}) B + \widehat{\beta}_i (1 - \widehat{p}_{H,i}) \gamma_i H + (1 - \widehat{\beta}_i) (1 - \widehat{p}_{B,i}) (1 - p_{B,i}) B \quad (20)$$

or if

$$\widehat{\beta}_i \widehat{p}_{H,i} (1 - \gamma_i) B - \widehat{\beta}_i \widehat{p}_{H,i} (1 - \gamma_i) (1 - p_{B,i}) B + (1 - \widehat{\beta}_i) (1 - \widehat{p}_{B,i}) (p_{B,i}) B > \widehat{\beta}_i \widehat{p}_{H,i} \gamma_i (1 - p_{H,i}) H \quad (21)$$

or if

$$\widehat{w}_i \widehat{p}_{H,i} (1 - \gamma_i) p_{B,i} B + (1 - \widehat{p}_{B,i}) (p_{B,i}) B > \widehat{w}_i \widehat{p}_{H,i} \gamma_i (1 - p_{H,i}) H$$

or if

$$\widehat{w}_i \widehat{p}_{H,i} [(1 - \gamma_i) d_{B,i} B - \gamma_i H] + (1 - \widehat{p}_{B,i}) (d_{B,i}) B > 0 \quad (19')$$

which can also be written as

$$\widehat{w}_i \widehat{d}_i (1 - \gamma_i) (d_{B,i} - s_i) + d_{B,i} > 0 \text{ (alternative to 19')}$$

This condition for discriminatory LSs to lower DEC (relative to non-discriminating ones)—called *condition for effective discrimination*—was first put forward in a simplified form by Katsoulacos and Ulph (2009).⁵¹

Next, and most importantly, we examine when an additional assessment step (taking a further step in the analysis of the conduct's effects) will lower DEC, for stages $i = 1, \dots, N - 1$. We focus our discussion on the comparison between discriminatory LSs in stages i and $i + 1$, $i = 1, \dots, N - 1$ and so compare DEC of *PBDLS_i* to the DEC of *PBDLS_{i+1}*.

Taking an additional assessment step will lower the DEC, that is, *DEC PBDLS_i > DEC PBDLS_{i+1}* if

$$\begin{aligned} & \widehat{\beta}_i \widehat{p}_{H,i} \gamma_i (1 - p_{H,i}) H + \widehat{\beta}_i \widehat{p}_{H,i} (1 - \gamma_i) (1 - p_{B,i}) B + \widehat{\beta}_i (1 - \widehat{p}_{H,i}) \gamma_i H \\ & + (1 - \widehat{\beta}_i) (1 - \widehat{p}_{B,i}) (1 - p_{B,i}) B > \widehat{\beta}_{i+1} \widehat{p}_{H,i+1} \gamma_{i+1} (1 - p_{H,i+1}) H \\ & + \widehat{\beta}_{i+1} \widehat{p}_{H,i+1} (1 - \gamma_{i+1}) (1 - p_{B,i+1}) B + \widehat{\beta}_{i+1} (1 - \widehat{p}_{H,i+1}) \gamma_{i+1} H \\ & + (1 - \widehat{\beta}_{i+1}) (1 - \widehat{p}_{B,i+1}) (1 - p_{B,i+1}) B \end{aligned}$$

Note that if we assumed that $p_{H,i} = 1$, $p_{B,i} = 0$, as under a nondiscriminating PB LS, the above expressions would simplify to 12.

Consider the DEC from FAs and FCs at stage i (the same expressions can be used for stage $i + 1$ by replacing subscript “ i ” with subscript “ $i + 1$ ”). These are given by

$$DEC FA_i = \widehat{\beta}_i \widehat{p}_{H,i} \gamma_i (1 - p_{H,i}) H + \widehat{\beta}_i (1 - \widehat{p}_{H,i}) \gamma_i H \quad (22)$$

or

$$DEC FA_i = \widehat{\beta}_i \gamma_i (1 - \widehat{p}_{H,i} p_{H,i}) H \quad (22')$$

and

$$DEC FC_i = \widehat{\beta}_i \widehat{p}_{H,i} (1 - \gamma_i) (1 - p_{B,i}) B + (1 - \widehat{\beta}_i) (1 - \widehat{p}_{B,i}) (1 - p_{B,i}) B \quad (23)$$

or

$$DEC FC_i = \widehat{\beta}_i (1 - p_{B,i}) B [\widehat{p}_{H,i} (1 - \gamma_i) - (1 - \widehat{p}_{B,i})] + (1 - \widehat{p}_{B,i}) (1 - p_{B,i}) B \quad (23')$$

Diagram 1 can be used to clarify the above magnitudes. Note that in 22,

$$\begin{aligned} & \widehat{\beta}_i \widehat{p}_{H,i} \gamma_i (1 - p_{H,i}) = \text{prob of FA1 (Diagram 1) and} \\ & \widehat{\beta}_i (1 - \widehat{p}_{H,i}) \gamma_i = \text{prob. of FA2 (Diagram 1).} \end{aligned}$$

In 23,

$$\begin{aligned} & \widehat{\beta}_i \widehat{p}_{H,i} (1 - \gamma_i) (1 - p_{B,i}) = \text{prob of FC1 (Diagram 1) and} \\ & (1 - \widehat{\beta}_i) (1 - \widehat{p}_{B,i}) (1 - p_{B,i}) = \text{prob of FC2 (Diagram 1).} \end{aligned}$$

We start by comparing (22) or (22') to (23) in order to get an exact characterisation of the factors that determine FA and FC and thus to determine under what conditions the Easterbrook (1984) hypothesis that has led to what Hovenkamp (2021) calls “an anti-enforcement bias in antitrust,” namely, that expected error costs from FC are higher than from FA, holds⁵². Specifically, we see that:

Lemma 2. The Easterbrook (1984) hypothesis is likely to be valid, that is, *DEC FC_i > DEC FA_i*, when

$$\begin{aligned} & \frac{\gamma_i H}{(1 - \gamma_i) B} + \frac{\gamma_i H}{B} \left(\frac{\widehat{\beta}_i}{(1 - \widehat{\beta}_i)} < (1 - p_{B,i}) \left[\left(\frac{1}{1 - p_{H,i}} \right) + \left(\frac{1 - \widehat{p}_{B,i}}{1 - p_{H,i}} \right) \right] \right) \text{ or} \\ & s_i + \frac{\gamma_i H}{B} \widehat{w}_i < (1 - p_{B,i}) \left[\left(\frac{1}{1 - p_{H,i}} \right) + \left(\frac{1 - \widehat{p}_{B,i}}{1 - p_{H,i}} \right) \right] \end{aligned}$$

Proof. Straightforward comparison of Equations (22) and (23).

Thus, DEC of *FC_i* will tend to be higher than DEC of *FA_i*, the lower the strength of the presumption of illegality s_i and the lower the prevalence of precondition i \widehat{w}_i . Also, when:

- $\widehat{p}_{H,i}$ and $p_{H,i}$ are large; that is, we can identify when harmful conduct is indeed harmful with a high degree of accuracy, while $\widehat{p}_{B,i}$, $p_{B,i}$ are small; that is, we cannot identify when benign conduct is indeed benign with a high degree of accuracy;
- γ_i is small, so the likelihood that the specific conduct type investigated is genuinely harmful (even by firms with SMP) is small;
- B is large relative to H (H/B is small).

The hypothesis has recently been the subject of severe criticism. According to Shapiro (2021), “... Easterbrook argued that antitrust courts should err on the side of defendants,” because “judicial errors that tolerate baleful practices are self-correcting, while erroneous condemnations are not. Like Bork, Easterbrook achieved his desired result based not on economic theory or empirical evidence, but by making strong and unjustified assumptions.”

Hovenkamp (2021) criticises particularly the Easterbrook (1984) assumption that the average welfare cost B from a FC is likely to be larger than the average welfare cost H from a FA and provides a rich set of arguments about why this may not be so. But we also see from the above comparison of the DEC from FC and from FA that even if this were to be true (which may well not be in many cases), there is no obvious reason to expect in general that *DEC FC_i > DEC FA_i*.

Next, and very importantly, we compare DEC for successive stages, using expressions (22)/(22') and (23), and we get the following:

Proposition 4. Comparison of LSs in successive stages (relative DEC of taking additional assessment steps, for stages $i = 1, \dots, N - 1$):

We compare DEC in stages i and $i + 1$. Specifically, we compare first the DEC of FAs and then the DEC of FCs of the successive stages. We show that:

- i A necessary and sufficient condition for $DECFA_{i+1} \leq DECFA_i$ is that $\hat{p}_{H,i+1}p_{H,i+1} > \hat{p}_{H,i}p_{H,i}$, that is, an increase in the discriminatory power of the screens' results;
- ii A sufficient condition for $DECFC_{i+1} \leq DECFC_i$ is that $p_{B,i+1}$ is significantly higher than $p_{B,i}$. For any given change (increase) in p_B , it is more likely that $DECFC_{i+1} \leq DECFC_i$ the greater is between the stages the increase in γ and the fall in $\hat{\beta}$, and the smaller the increase in the discriminatory power of the tests for identifying whether new screens hold or not (increase in \hat{p}_H, \hat{p}_B).

Proof.

- i $DECFA_{i+1} \leq DECFA_i$ if:

$$\hat{\beta}_{i+1}\gamma_{i+1}(1 - \hat{p}_{H,i+1}p_{H,i+1})H \leq \hat{\beta}_i\gamma_i(1 - \hat{p}_{H,i}p_{H,i})H \quad (24)$$

We know that (5') that $\hat{\beta}_i\gamma_i$ does not change. Thus, 24 will hold iff

$$\hat{p}_{H,i+1}p_{H,i+1} > \hat{p}_{H,i}p_{H,i}$$

It is reasonable to assume that the "total" discriminatory power of the economic analyses applied on identifying whether a screen is satisfied and, if it is, on identifying correctly whether it is harmful, that is, $\hat{p}_H p_H$, is increasing with additional investigative steps, that is, that $\hat{p}_{H,i+1}p_{H,i+1} > \hat{p}_{H,i}p_{H,i}$.⁵³ Thus, we expect that $DECFA_{i+1} < DECFA_i$.

- ii $DECFC_{i+1} \leq DECFC_i$ if, after some rearranging:

$$\begin{aligned} & (1 - p_{B,i+1}) \left[\hat{\beta}_{i+1} \{ (1 - \gamma_{i+1}) \hat{p}_{H,i+1} - (1 - \hat{p}_{B,i+1}) \} + (1 - \hat{p}_{B,i+1}) \right] B \\ & \leq (1 - p_{B,i}) \left[\hat{\beta}_i \{ (1 - \gamma_i) \hat{p}_{H,i} - (1 - \hat{p}_{B,i}) \} + (1 - \hat{p}_{B,i}) \right] B \end{aligned} \quad (25)$$

Consider the following expressions E on the two sides of the inequality:

$$E1 = (1 - p_{B,i+1}) \text{ and } E1' = (1 - p_{B,i})$$

$$\begin{aligned} E2 &= \hat{\beta}_{i+1} \{ (1 - \gamma_{i+1}) \hat{p}_{H,i+1} - (1 - \hat{p}_{B,i+1}) \} B \text{ and } E2' \\ &= \hat{\beta}_i \{ (1 - \gamma_i) \hat{p}_{H,i} - (1 - \hat{p}_{B,i}) \} B \end{aligned}$$

$$E3 = (1 - \hat{p}_{B,i+1}) B \text{ and } E3' = (1 - \hat{p}_{B,i}) B$$

Clearly, $E1 < E1'$ given our assumption that our ability to discriminate between harmful and benign cases increases and, also, if $p_{B,i+1}$ increases considerably, E1 will tend to zero and so will DEC of FCs in

stage $i + 1$. Together with result (i), this implies that DEC will be falling between stages $p_{B,i+1}$ increases considerably and $\hat{p}_{H,i+1}p_{H,i+1} > \hat{p}_{H,i}p_{H,i}$.

Concerning E2 and E2', we know from (6) that $\hat{\beta}(1 - \gamma)$ decreases and this also tends to make DEC of FCs lower in $i + 1$. The effect of this will be greater the greater the increase in γ , the larger the fall in $\hat{\beta}$. $E2 < E2'$ will hold indeed if the increase in the discriminatory power of the tests for identifying whether new screens hold or not (increase in \hat{p}_H, \hat{p}_B) is small (indeed if there is no increase or these probabilities decrease, we will certainly have $E2 < E2'$).

The condition for \hat{p}_B just mentioned is, however, reversed when comparing E3 to E3'. $E3 < E3'$ if \hat{p}_B increases.

We concentrated above on the parameters that determine the probability of FAs and FCs without mentioning H and B, which determine the costs of these errors. It is clear from (25) that if the probability of FAs falls and that of FCs rise with additional investigative steps and $H \gg B$ total DEC are likely to fall, while if $B \gg H$, total DEC are likely to rise. If, on the other hand, the probability of FAs rises and that of FCs falls with additional investigative steps and $H \gg B$ total DEC are likely to rise, while if $B \gg H$, total DEC are likely to fall.

One last result concerns the comparison between the full effects-based LS, which involves undertaking also the last assessment stage (stage 4 in our context), with using an LS that stops short of this last stage in the investigation. Let us consider in particular whether it is optimal to undertake this last step—which involves comparing DEC of stage 3 to DEC of stage 4, assuming that in stage 3 a PBD LS is used—the comparison with PBD LS for stage 3 is then obvious given Proposition 3.

We use Equations (22') and (23) for $i = 3$ and Equation (14), repeated here for stage $i = 4 = N$:

$$DECLS_4 = \hat{\beta}_4(1 - \hat{p}_{H,4})H + (1 - \hat{\beta}_4)(1 - \hat{p}_{B,4})(1 - p_{B,4})B \quad (26)$$

We can compare DEC from FAs and DEC from FCs for these two LSs. We get:

Proposition 5.

- o It is sufficient (though not necessary) condition for the last assessment step to lower the DEC from FAs that the probability of identifying the precondition in step 4 ($\hat{p}_{H,4}$) is greater or not much smaller than it is for step 3.
- o However, the last step can decrease or increase FCs, so the overall effect on DEC is ambiguous.

Proof. To see (a), note that

$$DECFA_3 = \hat{\beta}_3\gamma_3(1 - \hat{p}_{H,3}p_{H,3})H \quad (27)$$

and

$$DECFA_4 = \hat{\beta}_4(1 - \hat{p}_{H,4})H \quad (28)$$

Thus, given that $\gamma_3 = \beta_4$ and $\hat{\beta}_3\gamma_3 = \hat{\beta}_4$

$$DECFA_4 < DECFA_3 \text{ if } p_{H,3}\hat{p}_{H,3} < \hat{p}_{H,4} \quad (29)$$

For (b), we need to compare

$$DECFC_3 = \hat{\beta}_3\hat{p}_{H,3}(1-\gamma_3)(1-p_{B,3})B + (1-\hat{\beta}_3)(1-\hat{p}_{B,3})(1-p_{B,3})B \quad (30)$$

with

$$DECFC_4 = (1-\hat{\beta}_4)(1-\hat{p}_{B,4})(1-p_{B,4})B \quad (31)$$

Thus, there are two conflicting effects. $DECFC_3$ tend to be greater than $DECFC_4$ because:

- We have the additional positive first term on the RHS of (30): This is because, before the investigation in stage 4 is undertaken, there is no certainty whether the conduct is harmful, even though all preconditions were satisfied in the previous stages, so $\gamma_3 < 1$. On the other hand, $\gamma_4 = 1$;
- Also, as noted above, given that $p_{B,3} < p_{B,4}$ and the assumption in (a), we may have that

$$(1-\hat{p}_{B,3})(1-p_{B,3}) > (1-\hat{p}_{B,4})(1-p_{B,4}) \quad (32)$$

On the other hand, comparing the second term on the RHS of (31) with (32), we note that this term will tend to be smaller than (32) because $\hat{\beta}_3 > \hat{\beta}_4$. However, for many conducts and markets in which preconditions 2 and 3 are satisfied, efficiency considerations in stage 4 will not be sufficient to outweigh the anticompetitive effects of the conducts and so the probability $\hat{\beta}_4$ will be very close to probability $\hat{\beta}_3$. In these cases, certainly, $DECFC_3 > DECFC_4$ and a full effects based or rule of reason should be adopted.

To get a better feeling of how DEC and its components (the cost from FA and from FC) compare, in Appendix A, we make some comparisons using numerical examples with reasonable parameter values.

4.6 | The potential influence of the standard of proof

As noted in Section 2 above, the standard of proof (specifically, its dimension related to the level of certainty necessary for proof) can exercise an influence on the choice of error-minimising LSs. In our framework, we can easily see when this will happen. Assume that the level of certainty required is that expressed by probability π , $0 < \pi < 1$. Then, if in a stage i , the screen is genuinely satisfied with probability β_i and the conduct is then harmful with probability γ_i , and $\beta_i\gamma_i \geq \pi$, there is no need for additional evidence/information for proof of liability in order to satisfy the level of certainty of the standard of proof. This could be so even if, were additional evidence to be

gathered, the cost of decision errors would be reduced. In this case, the standard of proof exercises a limiting influence on the choice of the cost of decision error-minimising LS. Further, if the level of certainty of the standard of proof is set higher than the maximum that can be achieved through the investigation of all screens, that is, of $\beta_4\gamma_4 = \beta_4 = \gamma_3$, then the conduct should be acquitted.

In the examples in Appendix A, if $\pi = 0.5$, in the first example, as $\beta_i\gamma_i$ increases, it is 0.35 in stage 3 and 0.5 in stage 4. So, in this case, the cost of error minimising LS, which is the full effects based, also (just) satisfies the level of certainty of the standard of proof. If in this case π was greater than $s = 0.5$, then the conduct should be acquitted. If it was, for the sake of argument, 0.3 (which could not be the case in practice), then we could adopt the truncated effects-based LS (having examined the screen in stage 3), in order to satisfy the standard of proof even though the full effects based could reduce DEC further.

In the second example, $\beta_i\gamma_i$ increases from $\beta_1\gamma_1 = \gamma_0 = 0.252$ in stage 1, to 0.504 in stage 2, to 0.72 in stage 3 and to 0.8 in stage 4. If $\pi = 0.75$, then the level of certainty of the standard of proof is satisfied by the full effects-based LS, which is also the error minimising LS. If, on the other hand, it is $\pi = 0.5$, then the level of certainty of the standard of proof is satisfied at stage 2; that is, once exclusion is shown, though the DEC will fall by using a LS closer to full effects based. If we used $\pi > 0.8$, then the level of certainty of the standard of proof will not be satisfied even by the full effects based and the conduct should be acquitted.

5 | CONCLUDING REMARKS

We have provided for the first time, a detailed presentation of a new methodology for defining legal standards along the continuum of legal standards (Areeda & Hovenkamp, 2017; Jones & Kovacic, 2017; Katsoulacos et al., 2021; Katsoulacos & Ulph, 2022), depending on the screens or preconditions assessed at different stages of the continuum. We also provided a detailed formal examination of how all the pertinent factors that could influence error minimisation interact to determine the optimal error-minimising LSs for different conducts. This decision-theoretic framework can also be applied to examine how the choice of error minimising LSs depends on the context in which different conducts are undertaken, specifically, how this choice is affected when comparing developing jurisdiction/countries to developed countries/jurisdictions and how the choice is affected when the conduct is undertaken in digital multisided platforms. The first application is contained in Bageri and Katsoulacos (2020). A preliminary analysis of the second application can be found in Katsoulacos and Ulph (2022). This paper suggests that cost of decision error principles can be used to provide a useful and practical framework for analysing the choice of legal standards for specific categories of conduct in competition law enforcement.

ACKNOWLEDGMENTS

Over the years, we have benefitted enormously from discussions on the general issues dealt with by this paper with Svetlana Avdasheva,

David Evans, Svetlana Golovanova, Frederic Jenny, Bill Kovacic, Pierre Regibeau, Patrick Rey, Thomas Ross and Jacob Seifert. Comments by participants in the 2022 annual CRESSE Conference are gratefully acknowledged. Also, we give our sincere thanks to two referees. Of course, all responsibility for errors, omissions and ambiguities lies with us. We would like also to thank for their research assistance, Vasiliki Bageri, Eleni Metsiou and Galateia Makri, who contributed in the context of the ELIDEK project “Optimal Design of Competition Policy Enforcement” (ODECPE – HFRI – FM17 – 1314).

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

ORCID

Yannis Katsoulacos  <https://orcid.org/0000-0002-7366-4612>

ENDNOTES

- ¹ For convenience, we have included a full list of abbreviations after the concluding remarks (Section 5).
- ² We recognise that a distinction is drawn by legal scholars between “rules” (a term that, in the context of antitrust, they reserve for Per Se decision procedures) and “standards” (like the “rule of reason”)—see Blair and Sokol (2012), Jones and Kovacic (2017) and for a very recent excellent and extensive discussion (and references) Kovacic (2021). As an example, Blair and Sokol (2012, p. 472) write “The rule of reason involves a more open-ended inquiry than that of a per se analysis, moving antitrust away from rules and toward a standard.” Also, see Araiza (2011) for a discussion extending beyond antitrust. Below, for simplicity, we neglect this terminological distinction and refer to all the “decision procedures” (which might be the most appropriate term for economists) that we discuss (including the per se rule) as “legal standards.”
- ³ That is, the LS should be one of per se illegality (in the United States) or by-object restriction (in EU), though we recognise that these are not exactly equivalent LSs—see for an extensive discussion on this Katsoulacos and Makri (2020)—for our purposes, here they can be treated for much of the discussion as if they are, so below we will not distinguish between them. There are also some conducts (e.g., refusal to licence know-how) for which there is broad agreement that they should be treated under per se legality.
- ⁴ Broadly speaking, we have in mind jurisdictions that have developed the relevant laws and institutions and have been active in antitrust enforcement for at most the last 20 years. However, we also have in mind here countries that are “developing” in the sense of their general economic, technological, political and socio-cultural conditions and characteristics. Details can be found in Bageri and Katsoulacos (2020). At present, these jurisdictions are much closer to the EU than to the United States. See also Tello-Gamarral et al (2020).
- ⁵ Our discussion has potential implications also for the allocation of the “burden of proof” though we do not delve much into this issue here.
- ⁶ “Joint Response to the House Judiciary Committee on the State of Antitrust Law and implications for Protecting Competition in Digital Markets” by 12 of the most prominent economists and legal experts in the United States.
- ⁷ For a very systematic and extensive criticism of the view that the primary objective in antitrust enforcement is to limit false convictions rather than false acquittals, which has its origins in Easterbrook (1984), see Hovenkamp (2021)—that also contains many references to opposing views. Gavil and Salop (2020) and Baker (2015) are also very critical. Gavil and Salop (2020) point out that “Many of the assumptions that guided this generation-long retrenchment of antitrust rules were mistaken, and advances in the law and in economic analysis have rendered them anachronistic. This is especially the case with respect to exclusionary conduct” (p. 6).
- ⁸ Baker et al. (2020, pp. 4–5). This situation has “been defended with reference to mistaken and unjustified assumptions—including erroneous claims that markets self-correct quickly, monopolies best promote innovation, firms with monopoly power can obtain only a single monopoly profit, vertical restraints ... almost invariably benefit competition even in oligopoly markets, courts and enforcers are manipulated by complaining competitors, and courts cannot tell whether exclusionary conduct harms competition or benefits it” (p. 5). The authors go on to devote a distinct section on legal rules. See also discussion below of the work of other commentators.
- ⁹ The role of judges and agencies is different in adversarial (US) and inquisitorial systems (EC/EU). But in both cases the role played by courts in the actual evolution of LSs is fundamental, even if in a more direct way in the US than in EC, where the Courts’ influence comes mainly through the appeal process.
- ¹⁰ Like the recent Committees involving Baker et al. (2020) in the United States, Furman et al (2019) in UK and Cremer et al. (2019) in EC to examine the challenges posed for antitrust enforcement by the digital markets, bi-tech platforms and big data. The same procedure has also been followed in recent years in Australia, UK and other countries. See also OECD (2021), Stigler Center Report (2019), Rogerson and Shelsanski (2020), Salop (2021),
- ¹¹ And, hence, on the factors that influence decision errors, on which our analysis here is dedicated. See below.
- ¹² Grant and Sanghvi (2021) focus on these. They consider “the per se rule a profoundly economic approach to the problem that the demand for judicial resources exceeds its supply” (p. 99), recognising however that “Administrative convenience alone is not enough to justify the per se rule,” as the *Leegin* (2007) decision, to which they point out, shows (footnote 5), as well as the multitude of the other cases in which per se has been abandoned in the United States (and many other countries)—see also Kovacic (2021). Clearly, the welfare cost of decision errors and implementation costs are two sides of the same coin: choosing the most suitable LS must take both into account. On the other hand, it is important to stress that in many cases (hard-core horizontal cartels been the most obvious) Per Se rules minimise decision error costs—the existing analyses on decision errors and the one presented here explain exactly when this is the case (abstracting from implementation costs).
- ¹³ Easterbrook (1984); Lemley and Leslie (2008). See also, however, Katsoulacos and Ulph (2015, 2016) who distinguish between different *types of legal uncertainty* and show that under many circumstances the rule of reason remains superior.
- ¹⁴ See below for more details.
- ¹⁵ When, in the absence of such concerns, the CA would consider adopting a different LS to that expected to be adopted by appeal courts. For the influence of the standard of proof in terms of the *level of certainty* necessary for proof on the choice of LS, see Section 2.
- ¹⁶ Such as “protecting the competitive process” or “non-disadvantaging rivals.” See for more details below and Katsoulacos (2019a).
- ¹⁷ More precisely, in the words of Beckner and Salop (1999), “minimising the expected consumer welfare costs of erroneous decisions” (p. 50). For early applications of this error-cost approach to legal rules, see Ehrlich and Posner (1974) and Posner (1973).
- ¹⁸ Especially section II. They provide a number of references to earlier work in decision theory and optimal statistical decisions in footnote 62, p. 16.

- ¹⁹ Our 2022 working paper contains a more detailed description of what is presented in the current paper.
- ²⁰ The models in Katsoulacos and Ulph (2022) are preliminary versions of the model developed below.
- ²¹ We do not think that the error-minimising framework should be applied on a case-by-case basis, rather than conduct types or categories. The categories we refer to are, for example, tying, bundling, exclusive dealing, royalty rebates, refusal to deal and margin squeeze. In this, we fully agree with Cremer et al. (2019).
- ²² We will use the terms “effects-based” (popular in Europe, also as “economics-based”) and “rule-of-reason” (used in the United States) interchangeably though, as has been pointed out, Vickers (2005), under the latter there is greater discretion afforded to an agency/court than under the former. Intermediate LSs are described in detail below.
- ²³ Fourth Edition, 2017. See also the detailed discussion in Hovenkamp (2018); as noted there, this was an idea discussed in all three previous editions of the Areeda and Hovenkamp treatise, p. 123).
- ²⁴ Also, Kovacic (2021), Gavil and Salop (2020, p. 3, also referring to Gavil, 2012), Gavil (2008, p. 139) and Italianer (2013, p. 2), referring to Justice Stevens who was one of the first to point out that one should think of legal standards (for dealing with restraints under US Section 1) as forming a *continuum* with per se and rule of reason being at the opposite ends of this *continuum* (on Judge Stevens see also Araiza, 2011, who notes that “Justice Stevens has suggested that a judge better performs her role by paying careful attention to facts and context, as opposed to unthinkingly applying rigid legal rules”). As Italianer notes, the US Supreme Court has explicitly recognised that “the categories of analysis cannot be pigeonholed into terms like ‘per se’ or ... ‘rule of reason’”. No categorical line can be drawn between them. Instead, what is required is a situational analysis moving along what the Court referred to as a ‘*sliding scale*’.” Applying the idea of continuum of LSs also helps to clarify the relation between Legal and Substantive Standards, a relation that we think is often confused in the literature (see Katsoulacos, 2019a, 2019b).
- ²⁵ Under this LS, tying is presumed to violate the law (i.e., it is considered presumptively illegal) when undertaken by dominant firms. See also Ahlborn et al. (2004) and Evans et al. (2006).
- ²⁶ That is, when, in terms of our model, $\gamma < 0.5$. Recommendation of group of US experts (Baker et al., 2020, p. 1) to Joint Judiciary Committee.
- ²⁷ If, as in the tying cases, there are more than one market to consider, market power must be established in the tying and the tied market.
- ²⁸ As noted, we are assuming that the substantive or liability standard is one of consumer welfare. With a total welfare standard, an additional investigation stage would be added. See also Katsoulacos (2019a).
- ²⁹ Concentrating on consumer choice may mean reaching decisions on the basis of effects on “competitors,” the exclusion of which may reduce consumer choice. This would be wrong, however, since there can be an increase in consumer welfare even with less consumer choice, as when, for example, price is reduced and/or quality is improved.
- ³⁰ Under this, a liability decision relies just on the information from stages 0 and 1 and sometimes on the effect to competitors assessed in stage 2, on the basis of which anticompetitive effect is inferred. This term is used essentially in discussions of US enforcement and it signifies that the court reviews also (has a quick-look) on the efficiency defence presented by defendants (see Harrington, 2020; Hovenkamp, 2018, pp. 122–131, considers this LS as problematic and argues that it has rarely been used).
- ³¹ For example, tying of products, engaging in exclusive dealing contracts, offering quantity discounts or fidelity rebates and refusing to deal with a rival firm. In each type, the formal characteristics of different cases are likely, of course, to be different.
- ³² This is what Hylton and Salinger (2001) call the “base rate” probability (p. 60). At this point, we neglect subscript 0 on parameter γ , indicating that the value of γ depends only on stage 0 information. We extend and generalise below.
- ³³ We assume throughout here that the substantive (or liability) standard is that of consumer welfare. This would seem, according to a number of commentators, to be the most appropriate assumption for North America: In the United States since the end of 1970s, the courts have accepted the view that antitrust law is a “consumer welfare prescription” (Jones & Kovacic, 2017; Kovacic and Shapiro, 2000; also, Hyman & Kovacic, 2013). But it is worth noting that recently there have been quite a few voices that have argued that this should change, and the emphasis should return to the protection of the competitive process (e.g., Werden & Froeb, 2018; Wu, 2018). Indeed, Werden (2014) claims that, “commentators either have merely asserted that a welfare standard must be applied or mistakenly claimed that the Supreme Court has endorsed a welfare standard.” In the EU, the weaker substantive standard concerning the impact on competitors or on the competitive process has been favoured by courts (see for discussion and references, Katsoulacos, 2019a), though not necessarily the DGCOMP. In developing countries, other *public interest objectives* are also very important. This will tend to strengthen the argument that effects-based LSs aiming to assess the welfare impact of conduct are not appropriate. For a recent discussion putting forward arguments in favour of the consumer welfare liability standard, see Melamed and Petit (2019). They argue that “both the general and platform-specific assaults on the CW standard are misguided, that the CW standard is capable of addressing the economic concerns that critics have raised, and that the proposed alternatives would make things worse—not better.” For a strong critique, see Khan (2018). For an extensive review, see ABA Report (2020).
- ³⁴ $\bar{h}_0 = \gamma_0 H - (1 - \gamma_0) B$.
- ³⁵ In an adversarial system of enforcement, such as that of the United States, estimates of the values of these parameters will be provided by the defendants and the plaintiffs.
- ³⁶ Easterbrook (1984) emphasised the importance of presumptions in antitrust inquiries and thought that the open-ended rule-of-reason approach is often impractical—he advocated a more structured rule-of-reason inquiry when a per se rule is not used, which may be considered closer to the concept of the rule of reason used here. For a recent very useful discussion in the context of applying decision theory, see also Gavil and Salop (2020).
- ³⁷ A firm may be assigned to the category of firms that are considered dominant with a 50% market share and with a 90% market share. Often the signal that the conduct of the latter will be harmful will be much stronger.
- ³⁸ Remember that $p_{H,i}$ is the fraction of cases, characterised as being of the specific conduct type, that would be banned in the population of cases that are genuinely harmful; $1 - p_{B,i}$ is the fraction banned in the population of cases that are genuinely benign.
- ³⁹ If the last assessment step (N) is considered necessary (which implies that all previous ones would have been undertaken and considered satisfied), and precondition N is also considered satisfied, then the conduct is considered to be *certainly* harmful (and can be banned without errors). So, in stage N, either the precondition N is considered satisfied and the conduct is banned with certainty or precondition N is not considered satisfied and then the conduct is acquitted with certainty. Thus, in stage N, having completed all steps of analysis needed in order to establish welfare harm, the decision does not need any more to rely on presumptions about harm.

- ⁴⁰ To complete this discussion, we note that the term Per Se is commonly and rather loosely deserved for the case in which the liability decision is based only on the initial characterisation of the conducts in stage 0. However, in EU, the often similarly treated term object-based LS is deserved to categorise and reach decision on conducts on the basis of the initial characterisation and also the initial market contextualisation associated with stage 1. Further, in formal terms, no conduct is strictly per se illegal, in the sense that all (including hard-core cartels) are rebuttable under article 101 (3). The closest to a (strict) per se LS is that used in the United States to treat hard-core horizontal cartels, though, as noted by Harrington (2020), in the United States too there are always defences in practice, so “in practice, there does not seem to be much difference between the US and the EU with regard to explicit agreements” (p. 10).
- ⁴¹ We simplify the discussion focusing on PI conducts unless otherwise stated.
- ⁴² Given the definition of γ —see for this above discussion and Section 4.2 below.
- ⁴³ The precise meaning of these parameters is clarified in the next few pages and in Diagram 1 below.
- ⁴⁴ Undertaking step i implies that the preconditions associated with the previous steps are considered satisfied.
- ⁴⁵ From now on, we will use, for simplicity, the term “dominance” to indicate “SMP.”
- ⁴⁶ We discussed this above.
- ⁴⁷ As noted above, since stage 0 is just a conduct classification stage, we assume $\hat{\beta}_0 = 1$. We comment on other parts of the paper how the value of these parameters β_i can be assessed. To give an example here, a most important consideration for assessing the value of β_1 is whether without significant market power there is no incentive to undertake the conduct. If so (as, e.g., in a refusal to deal or an exclusive deal case), β_1 is likely to be very high, otherwise (as for a number of tying practices) it will be low.
- ⁴⁸ Given that, for example, $\hat{\beta}_2(1 - \gamma_2) = \hat{\beta}_1\beta_2(1 - \gamma_2) < \hat{\beta}_1(1 - \gamma_1)$ and so forth.
- ⁴⁹ See also Beckner and Salop (1999), and Hylton and Salinger (2001, p. 63).
- ⁵⁰ These terms were first used by Katsoulacos and Ulph (2009).
- ⁵¹ See also Katsoulacos and Ulph (2015, 2016).
- ⁵² According to Manne (2020), “It was Judge Frank Easterbrook (1984) who generalized the approach for antitrust, and offered the clearest exposition of the error-cost approach” (p. 40).
- ⁵³ As we noted above, while the assumption that p_H increases is uncontroversial, the assumption that \hat{p}_H increases is not. However, we consider the assumption made in the text (that the increase in the former will outweigh a fall in the latter, if there is a fall, in successive investigative stages), relatively uncontroversial.

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How to cite this article: Katsoulacos, Y., & Ulph, D. (2022). Choosing legal rules or standards in antitrust enforcement: A proposal for extending and facilitating the use of the decision-theoretic approach. *Managerial and Decision Economics*, 1–19. <https://doi.org/10.1002/mde.3787>

APPENDIX A: NUMERICAL EXAMPLES

Example 1:

Assume that dominant firms make up 10% of the population (so to undertake the conduct it is not necessary to possess significant market power), cases with exclusionary effects by dominant firms are 40%, cases where exclusionary effects are associated with consumer welfare loss, if no account is taken of efficiencies, are 70% and cases with no significant efficiencies to outweigh the loss in consumer welfare are 50%. That is,

$$\beta_1 = 0.1, \beta_2 = 0.4, \beta_3 = 0.7, \beta_4 = 0.5$$

So

$$\hat{\beta}_1 = \beta_1 = 0.1, \hat{\beta}_2 = \beta_1\beta_2 = 0.1 * 0.4 = 0.04, \hat{\beta}_3 = \beta_1\beta_2\beta_3 = 0.1 * 0.4 * 0.7 = 0.028, \hat{\beta}_4 = \beta_1\beta_2\beta_3\beta_4 = 0.1 * 0.4 * 0.7 * 0.5 = 0.014;$$

And so

$$\left(1 - \hat{\beta}_1\right) = 0.9, \left(1 - \hat{\beta}_2\right) = 0.96, \left(1 - \hat{\beta}_3\right) = 0.972, \left(1 - \hat{\beta}_4\right) = 0.986$$

$\gamma_3 = \beta_4 = 0.5$ and $\gamma_0 = \hat{\beta}_4 = 0.014$ so less than 1.5% of cases of the conduct type are harmful. $\gamma_1 = 0.14$, $\gamma_2 = 0.35$. Thus, here we focus on a conduct type for which the expected fraction of harmful cases is very small, which does not favour the use of effects based. On the other hand, in order to compare overall DEC's, we need to assign values to H and B. To do that, we note that we focused on cases where the conduct is PL in step or stage 0, so $\bar{h}_0 < 0$ while it is

PI in stage 1, that is, $\bar{h}_1 > 0$. In order for the conduct to be PL in stage 0 and PI in stage 1, given the values of the parameters above, the value of H must be higher than 6.17B. Let us assume that $H = 7B$, so harmful conducts lead to considerably greater harm than the benefit created by benign conducts.

Assume also that, discriminatory power is not very high (given that at a minimum we need $\hat{p}_H + \hat{p}_B > 1$ and $p_{H,3} + p_{B,3} > 1$). Specifically let

$$\hat{p}_{H,3} = \hat{p}_{B,3} = p_{H,3} = p_{B,3} = 0.6 \text{ and } \hat{p}_{B,4} = \hat{p}_{H,4} = 0.7$$

So, there is a small increase in discriminatory power in stage 4 and

$$(1 - \hat{p}_{B,3})(1 - p_{B,3}) > (1 - \hat{p}_{B,4})(1 - p_{B,4}) \text{ (condition 32 holds)}$$

So, from (27), (28) and (30), (31):

$$DECFA_3 = 0.00896H$$

$$DECFA_4 = 0.0042H$$

So, there is a 53.1% reduction in the DEC of FAs from the last step. Then

$$DECFC_3 = (0.00336 + 0.1552)B = 0.15888B$$

$$DECFC_4 = 0.0887B$$

So, there is a decrease of 44.1% in the DEC of FCs from the last step.

Then total DEC's are given by

$$DEC_3 = 0.00896*(7B) + 0.15888B = 0.2216B$$

$$DEC_4 = 0.0042*(7B) + 0.0887B = 0.1216B$$

So, the last investigative step reduces DEC by about 45.2%. While here the saving in DEC's is very high, generally, while the last step may be preferred in terms of minimising DEC's, given the additional implementation cost of the last step, it may seem optimal not to undertake this step. See also Section 4.6 on the standard of proof.

Example 2:

For some conducts, a more reasonable set of parameter values would be

$$\beta_1 = 0.5, \beta_2 = 0.7, \beta_3 = 0.9, \beta_4 = 0.8$$

or even higher values of β_1 .

In this case,

$$\gamma_3 = \beta_4 = 0.8, \gamma_2 = 0.72, \gamma_1 = 0.504 \text{ and } \gamma_0 = \hat{\beta}_4 = 0.252. \text{ And } \hat{\beta}_3 = 0.315, \hat{\beta}_2 = 0.35, \hat{\beta}_1 = 0.5$$

In this case, the conduct is PL in stage 0 and PI in stage 1 with approximately equal H and B. Assume that the values of the discriminating parameters are as in the previous example.

Then

$$DECFA_3 = 0.16128H$$

$$DECFA_4 = 0.0756H$$

So, there is the same 53.1% reduction in the DEC of FAs from the last step. This is as we expect, since in this example, $\hat{\beta}_3\gamma_3 = \hat{\beta}_4 = 0.252$ and the discriminating parameters are the same. Now,

$$DECFC_3 = (0.01512 + 0.115648)B = 0.2130768B$$

$$DECFC_4 = 0.06732B$$

So, there is a 68.4% decrease in the DEC of FCs from the last step.

We compare overall DEC's assuming that $H = B$ (having H been much larger or even larger than B may appear unreasonable to some that think that FCs are the important errors in accordance with the Easterbrook Hypothesis). Then

$$DEC_3 = 0.16128B + 0.2130768B = 0.37435B$$

$$DEC_4 = 0.0756B + 0.06732B = 0.14332B$$

So, the last investigative step reduces DEC significantly by about 61.7%.

- Increasing the value of the discriminating parameters

It can be easily seen using the above examples that such increases lead to significant reductions in DEC's when an additional investigative step is undertaken.