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Murat C. Mungan
Texas A&M University School of Law, mmungan@gmu.edu

Joshua Wright

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Murat C. Mungan*, Joshua Wright

George Mason University School of Law, United States

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ABSTRACT

Economic analyses of antitrust institutions have thus far focused predominantly on optimal penalties and the design of substantive legal rules, and have largely ignored the standard of proof used in trials as a policy tool in shaping behavior. This neglected tool can play a unique role in the antitrust context, where a given firm may have the choice to engage in exceptional anticompetitive or procompetitive behavior, or simply follow more conventional business practices. The standard of proof used in determining the legality of a firm's conduct affects not only whether the firm chooses to engage in pro- versus anticompetitive behavior, but also whether it chooses to remain passive. We introduce a model to investigate the effects of this additional tradeoff on the optimal standard of proof. The nature of these effects depends upon the relationship between the beneficial impact of procompetitive behavior versus the harmful impacts of anticompetitive behavior, since this relationship is what determines the costs associated with Type I and Type II error. Adopting Judge Easterbrook's presumption that preventing procompetitive behavior is more harmful than allowing anticompetitive behavior, we show that the standard of proof facing plaintiffs in antitrust cases ought to be stronger than preponderance of the evidence.

1. Introduction

A critical function of antitrust law is deterrence. Indeed, United States antitrust law has recognized the primacy of deterrence in achieving its goal of promoting economic efficiency when faced with tradeoffs involving competing considerations such as compensating victims of anticompetitive behavior.[1] In a world with perfect information, designing antitrust sanctions for optimal deterrence is a relatively straightforward task. The expected sanction faced by potential offenders is set equal to the social harm caused by the offense. This causes the actor to internalize the costs associated with his actions, and engage in it, if, and only if, his cost of preventing social harm is greater than the social harm itself.

The analysis becomes more complex in a more realistic setting with imperfect information, such as when courts sometimes incorrectly find liability or fail to find a wrongdoer liable. In these cases, the standard of proof used in trials, which determines how much evidence is required for imposing liability, becomes a tool through which these two types of errors can be traded off. Prior literature has investigated how the standard of proof used can affect deterrence (e.g., Demougin and Fluet, 2005), and how it may have less obvious impacts such as affecting the behavior and adjudication investments of innocent parties to avoid convictions (Kaplow, 2011; Mungan, 2011; Mungan, 2019; Mungan and Samuel, 2019).[2]

Here, we identify and formalize an additional channel through which standards of proof can affect behavior and welfare: A change in the standard of proof may not only affect parties' decisions to engage in anti or prosocial behavior, but also whether they choose to remain inactive. The presence of this inaction option is particularly relevant in the antitrust context where the goals of preventing anticompetitive behavior and not discouraging procompetitive acts must be balanced against each other.[3] Thus, we incorporate this possibility by extending the binary act framework provided in the prior literature (Demougin and Fluet, 2005; Demougin and Fluet, 2006) to one where firms choose one of three options (i) procompetitive behavior, (ii) anticompetitive behavior, and (iii) inaction.[4] The first two options yield private benefits to the firm, but may cause them to be found

* Corresponding author.
E-mail address: mmungan@gmu.edu (M.C. Mungan).

[1] *Illinois Brick Co. v. Illinois*, 431 U.S. 720 (1977).

[2] Existing work has also focused on welfare comparisons between per se rules and rules of reason, but without questioning the impacts of different standards of proof (e.g. Katsoulacos and Ulph, 2009).

[3] Although the latter objective is well understood among antitrust lawyers and scholars, formalizations of this trade-off are lacking. Immordino et al. (2011) notes this gap in the literature, as well, and analyzes the effects of policies on firms' incentives to innovate and adopt new technologies.

[4] The behavioral and welfare impacts of judicial error in this context differ from those where potential criminals and individuals who may engage in benign behavior form disjoint groups (Kaplow, 2011; Katsoulacos and Ulph, 2009) and also from those in (Mungan, 2011) where benign acts only benefit the actor.

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liable with some probability (and this probability is greater for anticompetitive acts), whereas inaction generates neither benefits nor legal risk.

In this framework, relaxing evidentiary requirements such that it is easier to find the defendant liable pushes some active (including procompetitive and antitcompetitive) marginal firms into inaction. This naturally yields some costs (due to the chilling of procompetitive behavior) as well as some benefits (due to the deterrence of anticompetitive behavior). Additionally, changes in the standard of proof affect the gains from procompetitive behavior relative to anticompetitive behavior by altering the gap between the likelihoods with which firms are found liable upon committing these two types of acts. As noted in the prior literature (e.g., Demougin and Fluet, 2006), this gap is inverse U-shaped in evidentiary requirements and is maximized by the preponderance of the evidence standard. Thus, the optimal standard of proof is stronger than preponderance of the evidence when the costs of pushing procompetitive firms towards inaction is greater than the benefits from doing the same to anticompetitive firms.

We note that the comparison between the benefits and costs of pushing firms towards inaction is closely related to Judge Easterbrook's claim that preventing procompetitive behavior is more harmful than allowing anticompetive behavior. Easterbrook argued not that markets were perfectly self-correcting, but rather that incentives to enter and compete for monopoly profits in markets impacted by anticompetitive behavior would constrain the social costs of erronously allowing such behavior more than the legal system could successfully limit the social costs of preventing procompetitive behavior (Easterbrook, 1984). The antitrust legal system is replete with examples of decades long condemnation of practices later discovered to be efficient or to have greater procompetitive virtue than presumed. The legal prohibitions against price discrimination, exclusive territories, tying, and resale price maintenance are a handful of examples. Indeed, in the case of minimum resale price maintenance, the Supreme Court took nearly a century to abandon the per se prohibition of a practice long understood by economists to be generally competitive benign if not procompetitive.[5]

Easterbrook's assumption is not without controversy. The main thrust of our analysis, however, is not to substantiate the Easterbrook assumption.[6] Importantly, there is no debate that Easterbrook's view has been fully incorporated into existing antitrust jurisprudence.[7] Thus, we take Easterbrook's assumption as given – as does much of Supreme Court antitrust doctrine – and use a model to identify the optimal standard of proof in the antitrust context.

After making the general observation that the optimal standard of proof is stronger than preponderance of the evidence when shifts towards inaction generate net-costs, we ask whether more specific statements can be made under more restrictive assumptions. To do so, we consider the case where firms' benefits from pro and anticompetitive acts are uniformly distributed, and the consumer benefits and harms from these acts are proportional to firms' private benefits. We show that in this case the optimal standard of proof is stronger than preponderance of the evidence, if the *beneficial impact* of procompetitive behavior is greater than the *harmful impact* of anticompetitive behavior. Here, we define the beneficial impact of procompetitive behavior as the ratio between the benefits to consumers from the firm's competitive conduct and the firm's private benefit from the conduct. We define the harmful impact of anticompetitive behavior analogously. We note that Easterbrook's claims can alternatively be interpreted as referring to the ranking between these two impacts as opposed to the ranking between overall benefits from procompetitive behavior versus the overall harms from anticompetitive behavior. In the specialized case that we consider, it follows that the optimal standard of proof is stronger than preponderance of the evidence regardless of which ranking is used to interpret Easterbrook's statements.

Quite interestingly, the influence of Easterbrook's observations regarding the relative costs of allowing anticompetitive behavior versus preventing procompetitive behavior has largely been seen in the evolution and shaping of antitrust liability rules, and academic discussions of these rules, rather than in specific procedural rules or evidentiary burdens.[8] Here, instead, we provide a novel analysis of the optimal standard of proof in antitrust enforcement relying upon the economic model of law enforcement. We show that because it is difficult for courts and agencies to determine whether specific conduct is anticompetitive or procompetitive (Hylton, 2015), the standard of proof in antitrust has an additional behavioral impact that is either not present, or not considered, in other contexts. We show that the presence of this additional behavioral impact causes the optimal standard of proof to be more pro-defendant than in other contexts, as long as Easterbrook's priors hold. In particular, it is stronger than the preponderance of the evidence standard which emerges as the optimal standard in prior research (Demougin and Fluet, 2006).

The intuition behind our results is that while the optimal standard in the binary act context is that which maximizes the deterrence of a single, bad conduct, the optimal standard of proof in antitrust must be set to both deter bad conduct and incentivize innovative and procompetitive conduct. The first of these objectives is enhanced by relatively weak standards, whereas the second objective is furthered by relatively strong standards. Thus, when Easterbrook's priors hold, the second objective becomes relatively more important than the first, and it becomes optimal to have relatively strong standards of proof.

In the next section we present a standard law enforcement model, which we use to formalize the dynamics outlined above, and we present concluding remarks in section 3.

2. A model of anti and procompetitive behavior

Consider a continuum of firms which may engage in pro or anticompetitive behavior, or neither. Doing neither provides them a benefit of 0, and generates no social impact. On the other hand, engaging in procompetitive behavior generates private value (to the firm) of v and benefits to consumers of size k_p whereas anticompetitive behavior generates private value b and harm to consumers of k_a. We let $k_a = k_a(b, v)$ and $k_p = k_p(b, v)$ reflecting the

[5] See Leegin Creative Leather Products, Inc. v. PSKS, Inc., 551 U.S. 877, 881 (2007). For analyses of the competitive effects of resale price maintenance, see, e.g., Klein and Murphy (1988), Elzinga and Mills (2008), and Klein (2009).

[6] We provide a lengthier discussion of Easterbrook's assumption in Wright and Mungan (2021) where we analyze standards of proof in a setting where the supply of offenses are unresponsive to policies, and hence deterrence is not a social goal. Conversely, here we focus exclusively on deterrence.

[7] See, e.g., Pacific Bell Telephone Co. v. Linkline Comm., Inc., 555 U.S. 438, 451 (2009) ("To avoid chilling aggressive price competition, we have carefully limited the circumstances under which plaintiffs can state a Sherman Act claim by alleging that prices are too low."); Verizon Comm. Inc. v. Law Offices of Curtis V. Trinko, LLP, 540 U.S. 398, 414 (2004) ("The cost of false positives counsels against an undue expansion of ß2 liability."); Matsushita Elec. Indus. Co., Ltd. v. Zenith Radio Corp., 475 U.S. 574, 594 (1986) ("Mistaken inferences in cases such as this one are especially costly, because they chill the very conduct the antitrust laws are designed to protect.").

[8] *See* notes 3 and 4, above and accompanying text. One notable exception is Twombly, where the Court hedged against making a false inference in favor of the plaintiff at the motion to dismiss stage. *Bell Atlantic Corp. v. Twombly, 550 U.S.* 544, 554 (2007); see also *Matsushita Elc. Industrial Co. v. Zenith Radio Corp.*, 475 U.S. 574 (1986) (Plaintiff's must tend to rule out the possibility that the defendants were acting independently at the summary judgment stage).

possibility that the effects on consumers may be related to the benefits of the firm from engaging in different types of activities. The private benefits b and v vary across entities, and they are distributed according to the joint probability distribution f with support $[0, \bar{b}] \times [0, \bar{v}]$ for some $\bar{b}, \bar{v} > 0$. Thus, each firm can be classified as a two-dimensional type, represented by a pair (b, v), and the density of each type is $f(b, v)$.

Because the anticompetitive act generates competitive harms, an antitrust agency investigates firms to identify and punish such conduct to deter its commission. The severity of the punishment, whether it takes the form of fines or other sanctions, is normalized to 1, and it is assumed that $\bar{b}, \bar{v} > 1$ to reflect that some conduct cannot be deterred. It is assumed that the antitrust agency cannot perfectly detect anticompetitive conduct or distinguish it perfectly from procompetitive conduct. Thus, it must rely on a noisy signal to determine whether or not to punish firms.

The timing of events are as follows: First, the government determines its policies, i.e., the applicable standard of proof. Subsequently, firms decide what actions to take. Engaging in procompetitive and anticompetitive behavior leads to probabilities of adjudication of r and q, respectively, with $q \geq r$. Finally, during the adjudication stage, a signal (whose properties are described next) is received by the decision maker (e.g., a court or antitrust agency) who decides whether to impose a sanction on the adjudicated firm by reviewing the signal that it receives in a manner consistent with the standard of proof chosen by the government.

2.1. Signal generation

Each adjudicated firm emits a noisy signal, $x \in X = [\underline{x}, \bar{x}]$, regarding the nature of its behavior. The likelihood with which the firm emits a particular signal depends on its behavior, and the signal space X is structured such that small signals are more likely to be emitted through anticompetitive behavior, and, thus, are more indicative of guilt. This is captured by the probability density functions $h(x|a)$ and $h(x|p)$, respectively which both have support X and satisfy the monotone likelihood ratio property (MLRP) such that $\frac{d(\frac{h(x\,|\,a)}{h(x\,|\,p)})}{dx} < 0$. Here, and in the remainder of the analysis, a and p stand for anticompetitive and procompetitive, respectively.

As noted in previous studies, MLRP implies that the cumulative distribution functions $H(x|j \in \{a, p\})$ associated with $h(x|j \in \{a, p\})$ are such that $H(x|p)$ first order stochastic dominates $H(x|a)$. Given MLRP, for any targeted probability of incorrectly convicting a procompetitive firm, an adjudicator can maximize the probability of finding an anticompetitive firm guilty, by choosing a threshold signal, $\hat{x}$, and finding firms guilty only if they emit a signal $x < \hat{x}$. A threshold rule $\hat{x}$ implies that, conditional on being audited, a procompetitive firm is found guilty with probability

$$H(\hat{x}|p) \tag{1}$$

and an anticompetitive firm is found guilty with probability

$$H(\hat{x}|a) \tag{2}$$

For modeling purposes, since both probabilities are increasing in $\hat{x}$, it is more convenient to use the probability of incorrect findings of liability (i.e. type 1 errors, denoted α) as the choice variable for the government, and expressing the probability of correctly convicting an anticompetitive firm as a function of α (denoted $\gamma(\alpha)$). To do so, we may denote the inverse of $H(.\,|p)$ as $H^{-1}(.\,|p)$, and observe that

$$\hat{x}(\alpha) = H^{-1}(\alpha|p) \tag{3}$$

Thus, γ can be expressed as:

$$\gamma(\alpha) = H(H^{-1}(\alpha|p)|a) \text{ such that} \tag{4}$$

$$\gamma(0) = 0 \quad \text{and} \quad \gamma(1) = 1 \tag{5}$$

As noted in the prior literature,[9] due to MLRP, γ is increasing and concave in α, i.e.,

$$\gamma' > 0 > \gamma'' \tag{6}$$

2.2. Standards and burdens of proof

The signal generation process described above can be used for purposes of defining standards and burdens of proof. Intuitively, a higher evidentiary threshold $\hat{x}$ corresponds to a weaker standard of proof, in the sense that it leads to more frequent convictions of both anti and procompetitive firms, since a firm is convicted whenever $x < \hat{x}$. This point can be made more apparent by formalizing the standard of proof as a threshold value, s, such that the defendant is convicted if and only if the evidence presented is associated with a higher likelihood ratio of anticompetitive to procompetitive behavior that exceeds this standard, i.e., if

$$\frac{qh(\hat{x}|a)}{rh(\hat{x}|p)} > s \tag{7}$$

Moreover, following Demougin and Fluet (2006), we can define the preponderance of the evidence standard as a rule that convicts a defendant only if he emits a signal that is more likely to be produced by an anticompetitive defendant than a procompetitive defendant, i.e., one where $s = 1$. Thus, the threshold rule which convicts a firm if he emits a signal $x < \tilde{x}$ where

$$\frac{qh(\tilde{x}|a)}{rh(\tilde{x}|p)} = 1 \tag{8}$$

corresponds to the preponderance of the evidence standard. This is because MLRP implies that a signal x is produced more frequently by an anticompetitive firm than an procompetitive only if $x < \tilde{x}$, and the opposite is true whenever $x > \tilde{x}$. The existence of such a signal is not guaranteed by the assumption of MLRP,[10] because if the signal is sufficiently noisy or uninformative, it may be the case that all x have likelihood ratios that are very close to 1. To see this, note that in the extreme case where the signal is completely uninformative it follows that $\frac{h(x\,|\,a)}{h(x\,|\,p)} = 1$, and thus, there are no signals that satisfy (8). Thus, if the signal were sufficiently noisy, it would trivially follow that all signals would be sufficient to convict the defendant under a preponderance of the evidence standard. Therefore, we assume that the signal is informative enough that there exists an $\tilde{x} \in X$ that satisfies (8). Because the welfare analysis takes α, instead of $\hat{x}$, as the choice variable of the government, it is useful to define $\tilde{\alpha}$, as follows:

$$\tilde{\alpha} \equiv H(\tilde{x}|p) \tag{9}$$

where $\tilde{x}$ satisfies (8).

Using this observation, we will take $\tilde{\alpha}$ as a point of reference when describing the burden of proof, and we will say that the burden of proof is on the defendant (resp. plaintiff) if $\alpha > \tilde{\alpha}$ (resp. $\alpha < \tilde{\alpha}$) to ease descriptions of results (see Demougin and Fluet, 2005, for a more detailed explanation of this interpretation).

[9] This result can easily be derived by noting that

$$\gamma' = \frac{h(H^{-1}(\alpha|p)|a)}{h(H^{-1}(\alpha|p)|p)} > 0$$

since $h(x|a), h(x|p) > 0$ for all $x \in X$. Letting, $\gamma'(\alpha) = \Gamma(\hat{x}(\alpha))$ we have that

$$\gamma'' = \frac{d\Gamma}{d\hat{x}}\frac{d\hat{x}(\alpha)}{d\alpha} = \frac{d\left(\frac{h(\hat{x}\,|\,a)}{h(\hat{x}\,|\,p)}\right)}{d\hat{x}}\frac{d\hat{x}(\alpha)}{d\alpha} < 0$$

since $\frac{d\left(\frac{h(\hat{x}\,|\,a)}{h(\hat{x}\,|\,p)}\right)}{d\hat{x}} < 0$ due to MLRP and $\frac{d\hat{x}(\alpha)}{d\alpha} = \frac{1}{h(\hat{x}(\alpha))} > 0$.

[10] We note, however, that when $q = r$, the existence of such a signal is, in fact, guaranteed by MLRP, because $h(x|a)$ and $h(x|p)$ cross once at $\tilde{x}$.

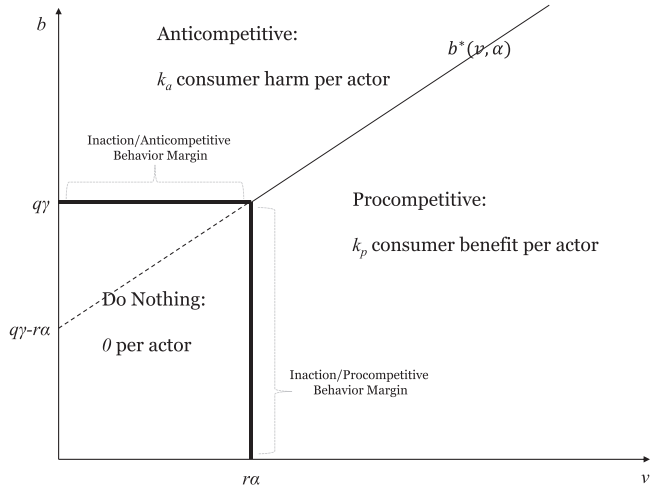

Fig. 1.

2.3. Decision making process

A firm has three actions to choose from, which yield the following payoffs: (i) procompetitive: $\pi_p \equiv v - r\alpha$; (ii) anticompetitive: $\pi_a \equiv b - q\gamma(\alpha)$; and (iii) inaction: 0. Thus, if $\max\{\pi_p, \pi_a\} < 0$, then the entity chooses to do nothing. Otherwise, his behavior depends on the comparison between π_p and π_a, and it commits the procompetitive behavior if

$$b^*(v, \alpha) \equiv v + q\gamma(\alpha) - r\alpha > b \tag{10}$$

or, equivalently,

$$v^*(b, \alpha) \equiv b - (q\gamma(\alpha) - r\alpha) < v \tag{11}$$

The behavior of firms, depending on their benefits, are summarized in figure 1, which also summarizes the welfare impacts of each entity's behavior (discussed in the next section).

It is worth pointing out that the term $q\gamma(\alpha) - r\alpha$, which occurs in the definition of the critical benefits in (10) and (11), has an important function and intuitive meaning. It refers to the marginal increase in the probability with which a firm is found liable, if it switches from engaging in the procompetitive act to committing the anticompetitive act. A property of this term, which is implied by MLRP, is that it is single peaked in α and is maximized by the preponderance of the evidence standard. To see this, note that

$$\frac{d[q\gamma(\alpha) - r\alpha]}{d\alpha} = q\gamma'(\alpha) - r = q\frac{h(\hat{x}(\alpha)|a)}{h(\hat{x}(\alpha)|p)} - r \tag{12}$$

where the last equality follows from the definitions of $\hat{x}$ and γ in (3) and (4). Since (due to MLRP) the likelihood ratio, $\frac{h(\hat{x}(\alpha)\mid a)}{h(\hat{x}(\alpha)\mid p)}$, is decreasing in α, and since, as noted in (8), $\frac{qh(\hat{x}(\tilde{\alpha})\mid a)}{rh(\hat{x}(\tilde{\alpha})\mid p)} = 1$, it follows that

$$\frac{d[q\gamma(\alpha) - r\alpha]}{d\alpha} \geq 0 \text{ iff } \alpha \leq \tilde{\alpha} \tag{13}$$

The next section will make references to this property when conducting a welfare analysis.

2.4. Welfare

As we previously noted, procompetitive behavior results in some benefits to consumers of size $k_p(b, v)$ and anticompetitive behavior leads to consumer harm of size $k_a(b, v)$. Therefore, consumer welfare can be expressed as follows

$$W(\alpha) = \underbrace{\int_{r\alpha}^{\bar{v}}\int_0^{b^*(v,\alpha)} k_p(b, v)f(b, v)dbdv}_{P(\alpha)=\text{Procompetitive Benefits}} - \underbrace{\int_{q\gamma}^{\bar{b}}\int_0^{v^*(b,\alpha)} k_a(b, v)f(b, v)dvdb}_{A(\alpha)=\text{Anticompetitive Costs}} \tag{14}$$

where $P(\alpha)$ and $A(\alpha)$, respectively, express the consumer welfare gains from procompetitive conduct, and the losses from anticompetitive conduct. A quick inspection of (14) reveals that the welfare impact of a change in the standard of proof is impacted by how v and b are distributed across firms, i.e. the functional form of f, as well as the distribution and size of pro and anticompetitive conduct. Thus, we first ask what standard of proof maximizes consumer welfare without making any specialized assumptions regarding these distributions and values. Subsequently, we consider the case where benefits are uniformly distributed, and consumer harms and benefits are proportional to firms' benefits from pro and anticompetitive conduct, i.e. $k_p = \kappa_p v$ and $k_a = \kappa_a b$ for some $\kappa_p, \kappa_a > 0$.

2.4.1. General case

The impact of a change in the standard of proof, captured by α, on the benefits from procompetitive behavior, is given by:

$$\frac{dP(\alpha)}{d\alpha} = -r\int_0^{q\gamma(\alpha)} k_p(b, r\alpha)f(b, r\alpha)db + (q\gamma'(\alpha) - r)\int_{r\alpha}^{\bar{v}} k_p(b^*(v, \alpha), v)f(b^*(v, \alpha), v)dv \tag{15}$$

Similarly, the impact of a change in the standard of proof on losses from anticompetitive behavior is:

$$\frac{dA(\alpha)}{d\alpha} = -q\gamma'(\alpha)\int_0^{r\alpha} k_a(q\gamma(\alpha), v)f(q\gamma(\alpha), v)dv - (q\gamma'(\alpha) - r)\int_{q\gamma(\alpha)}^{\bar{b}} k_a(b, v^*(b, \alpha))f(b, v^*(b, \alpha))db \tag{16}$$

Therefore, the overall effect on welfare is given by:

$$\frac{dW}{d\alpha} = \frac{dP(\alpha)}{d\alpha} - \frac{dA(\alpha)}{d\alpha} = \underbrace{(q\gamma'(\alpha) - r)\left(\int_{r\alpha}^{\bar{v}} [k_p(b^*(v, \alpha), v) + k_a(b^*(v, \alpha), v)]f(b^*(v, \alpha), v)dv\right)}_{\delta_1(\alpha)\text{ switch from anti to procompetitive}} + \underbrace{q\gamma'(\alpha)\int_0^{r\alpha} k_a(q\gamma(\alpha), v)f(q\gamma(\alpha), v)dv - r\int_0^{q\gamma(\alpha)} k_p(b, r\alpha)f(b, r\alpha)db}_{\delta_2(\alpha)\text{ switch to inaction}} \tag{17}$$

An inspection of (17) reveals that weakening the standard, i.e., increasing the probability of conviction for pro and anticompetitive behavior, has two primary effects labeled δ_1 and δ_2: first, it causes firms to switch between committing the anticompetitive and procompetitive acts (this effect is labeled $\delta_1(\alpha)$), and, second, it causes both procompetitive and anticompetitive firms to switch to inaction (this effect is labeled $\delta_2(\alpha)$).

A simple investigation of δ_1 reveals that increasing α upto the preponderance of the evidence standard (i.e. $\tilde{\alpha}$) causes some firms to switch from engaging in anticompetitive behavior to procompetitive behavior, and increases in α beyond the preponderance of the evidence standard causes the opposite effect. This is because, as noted in (13), the marginal liability likelihood, i.e. $q\gamma - r\alpha$, is single peaked in α, and is maximized by the preponderance of the evidence standard. Thus, $q\gamma' - r$, which appears in the first term, is positive if, and only if $\alpha < \tilde{\alpha}$. This implies that

$$\delta_1(\alpha) \leq 0 \text{ iff } \alpha \geq \tilde{\alpha} \tag{18}$$

This is analogous to the result in the existing literature where the preponderance of the evidence standard maximizes deterrence

(Demougin and Fluet, 2006). However, the presence of a third option, namely the option of inaction, generates the second effect captured by $\delta_2(\alpha)$, which causes results in our setting to differ from those analyzed in the prior literature.

The behavior of this second term now depends on the benefits to consumers from the procompetitive behavior of firms that are on the inaction/procompetitive behavior margin, i.e.,

$$M_p(\alpha) \equiv \int_0^{q\gamma(\alpha)} k_p(b, r\alpha) f(b, r\alpha) db \tag{19}$$

as well as harms to consumers from the anticompetitive behavior of firms on the inaction/procompetitive behavior margin, i.e.,

$$M_a(\alpha) \equiv \int_0^{r\alpha} k_a(q\gamma(\alpha), v) f(q\gamma(\alpha), v) dv. \tag{20}$$

Specifically, a simple manipulation of $\delta_2(\alpha)$ reveals that

$$\delta_2(\alpha) \lesseqgtr 0 \text{ iff } \frac{q\gamma'(\alpha)}{r} \lesseqgtr \frac{M_p(\alpha)}{M_a(\alpha)} \tag{21}$$

As noted in (12), MLRP implies that $\frac{q\gamma'(\alpha)}{r}$ is decreasing in α. Thus, it follows that when the burden is placed on the defendant, i.e., $\alpha > \tilde{\alpha}$, the second effect is negative whenever $M_p(\alpha) > M_a(\alpha)$, and the converse of this statement is also true. We summarize the implications of these observations through the following proposition where we use the word 'plaintiff' to generally refer to the party bringing suit.

Proposition 1. It is optimal to place the burden of proof on the plaintiff [resp. defendant], if the benefits from the procompetitive behavior of firms on the inaction/procompetitive margin (i.e. $M_p(\alpha)$) is greater [resp. smaller] than the harms from the anticompetitive behavior of firms on the inaction/anticompetitive margin (i.e. $M_a(\alpha)$) for all α.

Proposition 1 reveals a general relationship between the optimal standard of proof and its determinants. Specifically, the effect captured by δ_1 represents consumer welfare effects due to switches between anti and procompetitive behavior. Benefits due to these types of behavioral changes are always maximized by using the preponderance of the evidence standard. However, impacts due to behavioral shifts from inaction towards pro and anticompetitive behavior depend on the size of benefits and harms that are obtained on the two respective inaction margins. When procompetitive benefits are large relative to anticompetitive harms, as suggested by Easterbrook, the losses due to switches from procompetitive behavior to inaction dominate the opposite effect, and it becomes optimal to place the burden of proof on the plaintiff.

2.4.2. Uniformly distributed firm benefits with proportional externalities to consumers

When firm types are uniformly distributed it follows that

$$f(b, v) = \frac{1}{\bar{b}\bar{v}} \tag{22}$$

When, in addition, externalities to consumers are proportional to firms' private benefits, it follows that

$$\begin{aligned} k_p &= \kappa_p v; \quad \text{and} \\ k_a &= \kappa_a b. \end{aligned} \tag{23}$$

Here, κ_p and κ_a can be interpreted as the *beneficial impact of the procompetitive act* and the *harmful impact of the anticompetitive act*, respectively.

Plugging these expressions into (17) reveals that the total effect of a change in α on consumer welfare (multiplied by the constant $\bar{b}\bar{v}$ for expositional convenience) is given by:

$$\begin{aligned} \frac{dW}{d\alpha}\bar{b}\bar{v} &= \left[\frac{dP(\alpha)}{d\alpha} - \frac{dA(\alpha)}{d\alpha}\right]\bar{b}\bar{v} \\ &= \underbrace{\frac{q\gamma' - r}{2}\left(\kappa_p[\bar{v}^2 - r^2\alpha^2] + \kappa_a[\bar{b}^2 - q^2\gamma^2]\right)}_{\delta_1(\alpha)\text{ switch from anti to procompetitive behavior}} \\ &\quad + \underbrace{qr\gamma\alpha[\kappa_a q\gamma' - \kappa_p r]}_{\delta_2(\alpha)\text{ switch to inaction}} \end{aligned} \tag{24}$$

As in the analysis of the more general case, it follows that

$$\delta_1(\alpha) \lesseqgtr 0 \text{ iff } \alpha \gtreqless \tilde{\alpha} \tag{25}$$

On the other hand, the overall impact on welfare due to the second effect depends on the relationship between both the rate at which pro and anticompetitive firms switch their behavior, and the beneficial and harmful impacts associated with such conduct, respectively (i.e. κ_p and κ_a). In particular,

$$\delta_2(\alpha) \lesseqgtr 0 \text{ iff } \frac{q\gamma'}{r} \lesseqgtr \frac{\kappa_p}{\kappa_a} \tag{26}$$

Again, as noted in (12), MLRP implies that $\frac{q\gamma'}{r}$ is decreasing in α. Therefore, it follows that if the beneficial impact of procompetitive acts are greater than the harmful impact of anticompetitive acts, $\delta_2(\alpha)$ is negative for all standards that are weaker than preponderance of the evidence. Conversely, if the harmful impact of anticompetitive acts are greater than the beneficial impacts of procompetitive conduct (i.e. $\frac{\kappa_p}{\kappa_a} < 1$), then $\delta_2(\alpha)$ is positive for all standards that are stronger than preponderance of the evidence. These observations imply the following result.

Proposition 2. Suppose firm types are uniformly distributed and that externalities to consumers are proportional to firm benefits, i.e. $k_p = \kappa_p v$ and $k_a = \kappa_a b$. Then, it is optimal to place the burden of proof on the plaintiff [resp. defendant], if the beneficial impact of the procompetitive act is greater [resp. smaller] than the harmful impact of the anticompetitive act. The preponderance of the evidence standard is optimal only if $\kappa_p = \kappa_a$.

By focusing on specialized assumptions, proposition 2 is able to isolate the importance of the relative value, loosely speaking, of procompetitive versus anticompetitive behavior (i.e. κ_p and κ_a). We note that Easterbrook's claims regarding the ranking between the benefits from procompetitive behavior and harms from anticompetitive behavior can be interpreted as referring to these values (as opposed to $M_p(\alpha)$ and $M_a(\alpha)$, defined above). In the specific case we consider here, it follows that it is optimal to place the burden of proof on the plaintiff with a standard of proof that is stronger than preponderance of the evidence under either interpretation of Easterbrook's assumption.

3. Conclusion

In trials involving many fields of the law, a concern is to avoid finding a person liable when he has not engaged in the alleged wrong-doing. What is peculiar about antitrust law is that there is additional uncertainty as to whether the act allegedly committed by the defendant is harmful or beneficial. In other words, in addition to uncertainty about what act is committed, there is uncertainty about the social desirability of each act which may have been committed. In this article, we studied the implications of these additional concerns vis-à-vis the optimal standard of proof. Quite interestingly, our analysis revealed that these peculiar concerns in the field of antitrust law push the optimal standard of proof towards being stronger than in other contexts when Easterbrook's priors hold, i.e. the beneficial effect of procompetitive behavior exceeds the harmful effect of anticompetitive behavior. This finding suggests that courts which take Easterbrook's priors as given can achieve the goals of antitrust not

only by crafting substantive legal rules to impact behavior, but also by using standards of proof which are stronger than preponderance of the evidence.

Author Statement

This article was prepared and submitted by Murat Mungan and Joshua Wright in their individual capacities.

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