

# Revenue-based penalties could work after all<sup>1</sup>

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## Abstract

In Katsoulacos, Motchenkova and Ulph (2015) we showed that an overcharge-based penalty structure is welfare superior to penalty structures currently employed by Competition Authorities. However it is very demanding in terms of its implementation. In this paper we show that a revenue-based penalty structure where penalty *rates* depend on the cartel overcharge, can mimic an overcharge-based structure and so obtain the same welfare improvements while being less difficult to implement.

**JEL Classification:** L4 Antitrust Policy, K21 Antitrust Law, D43 Oligopoly and Other Forms of Market Imperfection.

**Keywords:** Antitrust Penalties, Antitrust Enforcement, Antitrust Law, Cartels.

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## 1. Introduction

Monetary penalties and other sanctioning methods are recognized as one of the most important policy instruments in the enforcement of competition law in the area of cartels<sup>5</sup> that, according to the most recent empirical literature, are still very active throughout the world and pervasive in a variety of markets.<sup>6</sup>

In most developed (and some other) countries monetary penalties are based on revenue to which a fixed pre-announced penalty rate is applied – ranging between 10- 30% depending on the country. In terms of implementation such a penalty regime has two attractive features: (i) the penalty base is readily verifiable – often drawn from accounts of the cartel members; (ii) a different penalty rate does not have to be calculated in different cases. So the penalty applied in each case is both relatively costless to calculate and hard to appeal against. However, as shown in Katsoulacos and Ulph (2013) and Bageri et.al. (2013), such a penalty regime performs badly in terms of welfare since the price set by those cartels that do form will be above the monopoly price – the price that would have prevailed in the absence of a competition authority – and, moreover, the tougher the penalty the higher is the cartel price.

In Katsoulacos, Motchenkova and Ulph (2015) – hereafter KMU (2015) - we investigated the welfare properties of different penalty bases<sup>7</sup> - revenue, profits<sup>8</sup>, and overcharge - taking into account the effects of each regime on the price set by those cartels that do form and on cartel stability –and hence deterrence. We showed that in terms of both consumer and total welfare an overcharged-based regime dominates a profit-based regime, which in turn dominates a revenue-based regime. However, as specified in KMU (2015), the base of the overcharge-based penalty regime is the percentage price overcharge multiplied by the revenue that would have been earned in the “but-for” situation. Implementing such a base therefore requires estimates of both the overcharge and the counterfactual volume of sales. Obtaining reliable estimates of the overcharge may not be a major implementation problem given how often this is required in damages cases.<sup>9</sup> However estimates of the counterfactual volume of sales is likely to be very often at the mercy of legal challenge, on the grounds of their being subject to estimation errors.

This raises the question of whether it is possible to retain actual cartel revenue as the penalty base, but improve on the welfare performance of existing regimes by making the penalty rate an increasing function of the cartel overcharge. More specifically, is it possible to design the relationship between the penalty rate and the overcharge so that we can mimic the effects of a regime that uses the cartel overcharge as the penalty base - and so obtain all

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<sup>5</sup> See, for example, Harrington (2010, 2014), Houba et.al. (2010, 2013), Bageri et.al (2013), Katsoulacos and Ulph (2013).

<sup>6</sup> See, for example, Levenstein and Suslow (2011, 2012), Connor (2015).

<sup>7</sup> In doing this comparison we assumed that the penalty rate applied to each base was fixed, with the precise rate applied to each base being chosen so as to achieve certain types of equivalence.

<sup>8</sup> We showed that a profit-based regime is welfare equivalent to a fixed penalty regime.

<sup>9</sup> See for example Brander and Ross (2006).

the associated welfare gains of such a regime, while retaining much of the implementation benefits of a revenue-based regime?

In this note we show that for any given fixed-rate revenue-based regime we can find a revenue-based regime in which the penalty rate varies with the cartel overcharge in such a way that, to an approximation, (i) the level of deterrence is the same as the fixed-rate revenue-based regime; (ii) the prices set by those cartels that do form are the same as those in a deterrence-equivalent overcharge-based regime. So one can obtain the price and welfare advantages of an overcharge-based regime while retaining the major implementation advantage of using *observable* cartel revenue as the basis to which the variable penalty rate is applied.

We derive the formula giving the relationship between the penalty rate and the overcharge that achieves these outcomes.

## 2. The Model

As in KMU (2015), we consider a homogeneous product in which the demand function is  $Q(p)$ ,  $Q' < 0$ . There are  $n$  firms with identical constant unit costs  $c > 0$ . There is Bertrand competition so, absent a cartel, the “but-for”/Nash price is  $p^N = c$ .

Let  $p > c$  denote the price charged by any cartel that forms and let  $\theta = \frac{p - p^N}{p^N}$  denote the percentage overcharge. We assume that  $p$  is observable by the Competition Authority (hereafter CA) and that  $p^N$  and hence  $\theta$  are common knowledge to firms and the CA.

If the CA were to operate an overcharge-based penalty regime with a fixed penalty rate  $\rho_o > 0$ , then, as in KMU (2015), the penalty paid by any cartel that is successfully prosecuted would be

$$F_o(\theta) = \rho_o \theta p^N Q(p^N). \quad (1)$$

Suppose now that the CA operated a revenue-based penalty regime under which the penalty rate was a function,  $\rho_R(\theta)$ , of the cartel’s overcharge. Under this regime the penalty paid by any cartel that is successfully prosecuted by the CA would be:

$$F_R(\theta) = \rho_R(\theta) p Q(p) = \rho_R(\theta) (p^N (1 + \theta)) Q(p^N (1 + \theta)). \quad (2)$$

Thus, provided

$$\rho_R(\theta) = \rho_o \frac{\theta Q(p^N)}{(1 + \theta) Q(p^N (1 + \theta))}, \quad (3)$$

the relationship between the penalty the cartel pays if successfully prosecuted and the price/overcharge it chooses will be exactly the same under the two penalty structures and

so will generate exactly the same level of deterrence and induce those cartels that do form to set exactly the same price. That is, we have:

**Proposition 1:** *For any  $\rho_o > 0$ , a revenue-based penalty regime in which the penalty rate varies with the cartel overcharge according to the formula (3) will induce exactly the same level of deterrence and exactly the same cartel price as an overcharge-based regime with fixed penalty rate  $\rho_o$ .*

The formula in (3) has four problematic features.

- (i) It contains the parameter  $p^N$  - the so the functional relationship between the penalty rate and the overcharge could vary with  $p^N$ .
- (ii) It depends on the precise shape of the demand function, which may not be perfectly observable by the CA.
- (iii) (i) and (ii) further imply that the formula given by (3) could vary across industries, which would again make such a regime subject to legal challenge.
- (iv) It depends on a given overcharge penalty rate. But no CA uses an overcharge-based regime, so it is not clear what is the appropriate value to use for  $\rho_o$ .

To address the first two issues we take a Taylor expansion of  $Q(p^N(1+\theta))$  around  $p^N$ , and (3) becomes:

$$\rho_R(\theta) = \rho_o \frac{\theta}{(1+\theta)(1-\varepsilon\theta)}, \quad (4)$$

where  $\varepsilon = -\frac{p^N Q'(p^N)}{Q(p^N)} > 0$  is the elasticity of demand at the but-for price.<sup>10</sup>

The formula given in (4) for linking the penalty rate to the overcharge, still suffers from problem (iii) above, since the relationship can vary across industries with different elasticities. Trying to implement such a formula would be very problematic since (a) there would be yet another component to estimate; (b) it gives rise to a further issue on which a CA would be subject to a legal challenge as to why firms with the same overcharges were being penalized at different rates just because they came from different industries. In order to have a **single** schedule relating the penalty rate to the overcharge, we therefore propose that the CA should therefore use the formula:

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<sup>10</sup> Taking the Taylor approximation is equivalent to using the demand function  $Q = c \left( 1 + \frac{1}{\varepsilon} \right) - p$  as a

linear approximation to the actual demand function, where, by suitable choice of units in which output and price are measured the coefficient on price is -1, and the constant is chosen so that the elasticity evaluated at the “but-for” price is indeed  $\varepsilon$ .

$$\rho_R(\theta) = \rho_O \frac{\theta}{(1+\theta)(1-\bar{\varepsilon}\theta)}, \quad (5)$$

where  $\bar{\varepsilon}$  is the average elasticity.<sup>11</sup>

Then we have:

**Proposition 1a:** *For any  $\rho_O > 0$ , a revenue-based penalty regime in which the penalty rate varies with the cartel overcharge according to formula (5) will induce approximately the same level of deterrence and approximately the same cartel price as a given overcharge-based regime with fixed penalty rate  $\rho_O$ .*

The approximations referred to in this Proposition arise both because the formula involves a linear approximation to the true (but unobservable) demand function and because of the use of the average elasticity.<sup>12</sup>

To deal with the fourth feature mentioned above, we draw on a result established in KMU (2015), which showed that, for any given revenue-based penalty regime with fixed penalty rate  $\rho_R > 0$ , an overcharge-based penalty regime with fixed penalty rate

$$\rho_O = \frac{1}{\beta} \left[ 1 - \frac{(1 - \beta\rho_R) \pi^M \left( \frac{c}{1 - \beta\rho_R} \right)}{\pi^M(c)} \right] > 0 \quad (6)$$

would produce exactly the same level of deterrence as the given revenue-based regime. Here  $\beta$ ,  $0 < \beta < 1$  is the probability of a cartel being investigated and successfully prosecuted, and  $\pi^M(c) \equiv \text{MAX}_p (p - c)Q(p)$  is a function giving monopoly profits as a

function of the unit costs of production,  $c$ . Take a Taylor approximation of  $\pi^M \left( \frac{c}{1 - \beta\rho_R} \right)$

around  $c$ , and (6) becomes:

$$\rho_O = \rho_R \left[ 1 + \left( -\frac{c\pi'_M(c)}{\pi_M(c)} \right) \right] = \rho_R \left[ 1 + \frac{c}{(p_M(c) - c)} \right]. \quad (7)$$

If we again use the linear approximation to the demand function  $Q = c \left( 1 + \frac{1}{\bar{\varepsilon}} \right) - p$ , then it is straightforward to see that (7) becomes

$$\rho_O = \rho_R (1 + 2\bar{\varepsilon}). \quad (8)$$

Finally substitute (8) into (5) to get:

<sup>11</sup> Something on which a CA would have to take an informed view.

<sup>12</sup> If the parameter  $\bar{\varepsilon}$  were just an arbitrary number the price set by a cartel in a given industry may not even approximate that under an overcharge-based regime.

$$\rho_R(\theta) = \rho_R \frac{(1+2\bar{\varepsilon})\theta}{(1+\theta)(1-\bar{\varepsilon}\theta)}. \quad (9)$$

We then have:

**Proposition 2:** *For any given revenue-based penalty regime with fixed penalty rate  $\rho_R > 0$ , a revenue-based penalty regime in which the penalty rate varies with the cartel overcharge according to formula (9) will induce:*

- (i) *approximately the same level of deterrence as the fixed-rate revenue-based regime;*
- (ii) *approximately the same cartel price as that which would have been produced under a deterrence-equivalent fixed-rate overcharge-based regime.*

**Corollary** The cartel price will be below the monopoly price and so below that under the fixed-rate revenue-based regime.

The corollary follows from KMU (2015) where we show that the cartel price under a fixed-rate overcharge-based regime is always below the monopoly price, while the cartel price under a fixed-rate revenue-based regime is always above the monopoly price.

To compare the penalties paid under the variable-rate and fixed-rate revenue-based penalty regimes notice that:

- the penalty rate function determined by (9) is a strictly increasing function of the price/overcharge that the cartel sets, with  $\rho_R(0) = 0$ ;
- if a cartel sets the monopoly price<sup>13</sup> – so  $\theta = \frac{1}{2\bar{\varepsilon}}$  – then the penalty rate applied to revenue will be  $2\rho_R$  i.e. twice the fixed-rate revenue-based penalty;
- the price/overcharge set by the cartel at which the penalty under the variable rate regime would be the same as the fixed-rate penalty (i.e.  $\rho_R(\theta) = \rho_R$ ) is obtained by solving the equation  $\theta^2 + 3\theta - \frac{1}{\bar{\varepsilon}} = 0$ , which implies that the overcharge would be around  $2/3$  of the monopoly overcharge.
- Taken together, these last two results give some indication of how steeply the penalty will rise as cartels increase their overcharge. It is this sharp increase that should persuade cartels to cut their price below the monopoly price.

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<sup>13</sup> Or, more precisely, the monopoly price associated with the linearly approximated demand function with average elasticity.

### 3. Conclusions

It is possible to significantly improve on current penalty regimes by relating the penalty rate applied to cartel revenue to the cartel overcharge. This obtains approximately the price and welfare advantages of a pure overcharge-based penalty regime while retaining the major implementation advantage of using *observable* cartel revenue as the basis to which the variable penalty rate is applied. A clear policy recommendation is that Competition Authorities should continue to base penalties on revenue but should publish in their guidance a schedule that relates the penalty rate applied to that base to their calculation of the overcharge that has been set by any given cartel that they successfully prosecute. We have proposed a formula from which such a schedule could be developed.

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