Fine schedule with heterogeneous cartels: Are the wrong cartels deterred?*

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Abstract

The purpose of this article is to analyze the minimum fines that are necessary to prevent price fixing in the presence of heterogeneity across industries in the potential for a cartel overcharge. We show that the incentive constraint is typically binding in industries where cartels would lead to a high overcharge, while the participation constraint is typically binding in industries where the potential for overcharge is rather low. We contrast our minimum fine schedule with the one we can derive from judicial practice, a fine schedule that is proportional to the gain in per period profits. It is shown that more private litigation, as proposed by the EU Commission, can make the cartels with high overcharges more stable and only deter some of the potential cartels with low overcharges.

1 Introduction

The empirical literature on cartels shows that the price increase following price fixing differs a lot from one industry to another. While price fixing

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has a negligible effect on prices in some industries, prices raise with 40% or even more in other.[1] In this article we discuss the implication of this heterogeneity for the fine policy against cartels and we derive the minimum fine schedule that is needed to deter cartels. Our results show that it is crucial to distinguish between cartels that are not formed because they are expected to be unprofitable, and cartels that are not formed because they would have been unstable. We confront the fine policy we derive from theory with the fine schedule that can be derived from the judicial practice and actual fine policy in EU and the US.

In theory, one could set a fixed cartel fine that is so high that all potential cartels are deterred. In most industries this fine would be excessively high compared to the fine that is necessary to deter cartels from being formed or sustained. However, this would be in stark contrast to the present judicial practice in most countries. According to case law, for example in the EU and the US, the punishment of firms that violates the law should be proportional to the damage they cause.[2] An interpretation of this principle is that a cartel that has caused only limited harm should at least not pay a fine that is higher compared to a cartel that has caused serious harm. Indeed, fines for various cartels differ a lot in practice. Given that levying excessively high fines are not feasible, we examine the minimum fine schedule that ensures that all cartels are marginally deterred.[3] This minimum fine schedule is then compared with judicial practice and from this we try to predict which of the potential cartels that are excessively deterred, and which that survive.

According to judicial practice, a proportional discriminatory fine schedule is defined as one that exactly captures the marginal differences in per period

[1] See, for example, Connor and Lande (2006).

[2] The principle of proportionality is discussed in Burca (1993) concerning EU and Sullivan and Frase (2008) concerning US. For a recent discussion, see Sauter (2013).

[3] This is in line with the proposal in Becker (1968), where the crime is punished in such a way that the expected costs of the crime marginally exceeds the gains. Note, though, that it has been shown (see, for example, Shavell (1991) and Mookherjee and Png (1994) that if a firm chooses between various harmful activities (instead of between committing a crime or not) this might lead to a deviation from the stated principle.

profits.[4] We find that the minimum fine schedule we derive can be either steeper in the size of the overcharge (i.e., overproportional discriminatory) or flatter (i.e., underproportional discriminatory) than the proportional fine as it is defined from judicial practice. For example, with a sufficiently low probability of detection the fine should be more discriminatory than what follows from the judicial practice.

In some industries cartels are not formed because the participation constraint is violated (not profitable to form a cartel), whereas in other industries cartels are not formed because the incentive constraint is violated (profitable to deviate from a cartel). We show that if the participation constraint is binding, then the fine schedule must be more discriminatory than if the incentive constraint is binding. The reason is that a higher overcharge will make it more tempting to deviate. Thus, when the incentive constraint is binding, the increase in the fine for more harmful cartels should be more limited than in the case where the participation constraint is binding.

Furthermore, we find that if the fine schedule we derive is enforced, potential cartels with a limited harm are typically deterred by the participation constraint while potential cartels with a large harm are typically deterred by the incentive constraint. The reason is that potential cartels that are able to have a large overcharge are typically profitable to form, but their main problem is to avoid cartel breakdown (incentive constraint). On the other hand, the main problem for cartels with low overcharges is that they are not sufficiently profitable to form given the risk of being detected and fined. This has important implications for cartel policy. For example, more private litigation – all else equal – can make the potential cartels with limited harm less profitable but at the same time make the potential cartels with large harm more stable. It illustrates that any fine policy revision that is to be applied

[4]This follows from a straight forward interpretation of the judicial requirement of proportionality. It is in line with the interpretation made in Smith, Vaughan and Formby (1987), were they ask a similar question as we do but the approach is quite different. In particular, they do not consider asymmetries between cartels as is the heart of our analysis. Admittedly, as noted in Connor (2006) it can be questioned whether there is any proportionality at all in fine practice in many jurisdictions. If so, actual fine policy can be even more in conflict with the minimum fine schedule. We comment on this later on.

across all industries must take into account that it might destabilize cartels in some industries while at the same time make cartels in other industries more stable.

Studies aiming at estimating the probability of cartel detection find this to be very low, suggesting that the annual probability might be less than 15%. Hence, our policy recommendation that fines should not only be discriminatory, but overproportional discriminatory, might be relevant. Unfortunately, actual fines are not in line with such a prediction. On the contrary, actual fines are seemingly not even discriminatory along the lines we propose in several jurisdictions. In the US, for example, the guidelines for setting fines does not require that the actual gain or losses from a cartel is determined but recommend to set the fine as a percentage of the volume of commerce. In EU, the upper limit on the fines will - if it binds - make it difficult to deter the worst cartels. Moreover, we argue that the EU Commission's initiative to promote more private litigation might stabilize rather than deter those cartels with the largest overcharges.

In the spirit of Becker (1968), there are numerous studies that discuss the optimal fine policy towards antitrust violations. For a recent review of the literature on cartel policy, see for example Buccirossi and Spagnolo (2007). Our study is focusing on the interplay between the participation and incentive constraints for cartel members. This interplay has also been present in theoretical studies, see for example Spagnolo (2004), and is strongly supported by experimental evidence (see Hinloopen and Soetevent (2008) and Bigoni, Fridolfsson, le Coq and Spagnolo (2012). In contrast to the existing theoretical literature on cartels, we show that the two constraints can be binding across different industries in a systematic way and that the regularity has important implications for the formulation of the optimal fine policy towards cartels. In that respect our study is also related to the more applied debate concerning the determination of fines. There are different views on whether the existing fines in, for example EU and the US, are sufficiently high to deter cartels.[5] However, none of these studies discuss whether cartels

[5]Connor and Lande (2006) draw on a range of empirical evidence to support the con-

are being deterred because they are unprofitable or because they are unstable. We find that the distinction between unprofitable and unstable potential cartels are of crucial importance for understanding how discriminatory fines should be set to deter potential cartels, and that some policy instruments (such as more private litigation) might deter some cartels but at the same time make other cartels more stable.

The article is organized as follows. In the next section we introduce our model and the rules of the game. In Section 3 we analyze the optimal fine schedule in the presence of heterogeneous cartels, given that either the participation or the incentive constraint is binding. In Section 4 we confront the predictions from our model with the actual policy for fines for cartels in the US and EU. Finally, we offer some concluding remarks in Section 5.

2 The model

Let us assume that there is a population of Y potential cartels. We interpret this as if there are Y different markets, and in each market there is a potential for a cartel to be formed. In the absence of antitrust policy, we assume that cartels are formed in all these markets. For various reasons, one can argue that different cartels may have different effects on welfare. One way to interpret this could be that all Y markets are identical, except for the price elasticity of demand. If a market is cartelized, the price increase is higher the lower the price elasticity is.

A cartel that raises prices substantially are typically more profitable than a cartel that chooses only a modest price increase. In order to simplify our framework we let the Y different markets be characterized by how much

clusion that fines in the EU and the US are not high enough to deter cartels. Allain, Boyer, Kotchoni and Ponssard (2011) and Katsoulacos and Ulph (1984) both question some key assumptions in the calculations, and they conclude that the fine policy in the EU is sufficiently tough to deter cartels. See also Motta (2007), presenting some calculations concerning the fine policy in the EU after new guidelines were introduced in 2003.

the cartel is able to raise the price relative to the competitive price in this market. It implies that each market is characterized by the cartel overcharge $k = (p^C - p^N)/p^N$, where p^C is the cartel price and p^N is the non-collusive price under competition. We assume that the overcharge is not affected by the fine.[6] Later on we will show an example where the overcharge is endogenously determined, and it is shown that the result we report in the basic model is valid also in that case (see Section 3.4).

We assume that there is an active antitrust policy, where competition authorities (CA) detect cartels and give fines (or leniency) to detected or reported cartels. Let p denote the probability of detection.[7] At the outset we assume that $p = p(k)$, *i.e.* the cartel overcharge can have an impact on the probability of detection. One reason could be that a high overcharge makes it more likely that customers become suspicious and report to the competition authorities, or because it is more likely that someone inside the firm whistleblow about the illegal practice. On the other hand, firms that are involved may be even more cautious not to trigger an investigation and to hide any evidence of the illegal practice if the cartel overcharge is high. Furthermore, it is well known that marginal costs are difficult to observe. It is therefore difficult for an outsider to target the cartels with the highest price-cost margins.[8] Due to this, the main part of our analysis is devoted to derive the

[6]This is an assumption made in several other studies of fine policy towards cartels, see for example Cyrenne (1999) and Motta and Polo (2003). As shown in Block, Nold and Sidak (1981), the fine will not have any effect on the optimal cartel price if the probability of detection is independent of the overcharge. This is the assumption we use in the main part of our analysis. We also investigate the case where the probability of detection is influenced by the overcharge. In such a setting it has been shown that the optimal cartel price is decreasing in the fine and decreasing over time, see for example Harrington (2004). As noted in Harrington (2005), there is no empirical evidence supporting such a cartel price profile. This raises the question whether it is plausible to assume that the cartel overcharge is influenced by the fine. Moreover, joint profit maximization might not be reasonable if firms are asymmetric and transfers are not allowed. The cartel members would then disagree on what would be the optimal cartel price. Due to this, we assume that there are other factors than the fine that determines the cartel overcharge.

[7]Obviously, the probability of detection can be increased by a more active policy (higher activity level) by antitrust authority. In this article we focus on the optimal use of fines, and we leave the issue concerning an optimal activity level for future research.

[8]Block et al. (1981) have shown that if cartels with a higher overcharge would have a large probability of detection, then it would be optimal for cartels to let the cartel

minimum fine schedule when the cartel overcharge does not affect the probability of detection.[9] Note, however, that our main results are valid also when assuming that the cartel overcharge affects the probability of detection.

Let F denote the fine for a detected cartel member and L the fine for the cartel member if leniency is admitted. We assume that $F > L = 0$. The latter implies that a firm that is granted leniency will have a zero fine. Finally, we allow for private litigation where a party that has suffered a damage from the cartelization can ask for a compensation. If the cartel is detected or it reports to CA, we assume that private litigation leads to a payment S. We allow this payment to the consumers to be increasing in the overcharge.

Let us consider a game with the following sequence of moves:

Stage 1 CA sets fines F.

Stage 2 Firms decide to form cartels or not, or to apply for leniency.

Stage 3 CA detects cartels, gives fines and/or leniency, and firms pay fines F and compensation S.

At stage 3 cartels are detected and fined, and those that report to CA (leniency) are given a lower or zero fine. We assume that detected cartels are randomly drawn from the population of cartels. At stage 3 there is then a

price depend on the fine. This has been further investigated in Motchenkova (2008) and Houba, Motchenkova and Wen (2010). Furthermore, Harrington (2004) has shown that this would imply that the cartel price would decrease over time since the accumulated fine for a cartel is increasing over time. As already mentioned, Harrington (2005) note that there is no empirical evidence supporting such a cartel price profile. He infers from this that 'detection is not largely driven by the price level' (p. 152). This makes it natural to assume that there is no relationship between the cartel overcharge and the probability of detection, as we do in the main part of our analysis. The same assumption is made in several studies of fine policy towards cartels, see for example Cyrenne (1999), Motta and Polo (2003) and Spagnolo (2006).

[9] In Jensen and Sørgard (2012) it is shown that if the size of the overcharge has a sufficiently large and positive impact on the probability of detection, the minimum fine schedule would be such that cartels with a high overcharge should face a lower fine than cartels with a low overcharge. It is shown that this is more likely if the probability of detection is either very low or very high, which illustrates that there can be a non-monotonic relationship between the probability of detection and the minimum fine schedule.

probability p for a cartel being detected, where the probability may depend on the cartel overcharge. If a cartel is detected, it must pay a fine. We allow the fine to depend on the cartel overcharge, *i.e.*, $F(k)$. Furthermore, we assume that the amount paid in private litigation may also depend on k. The profit of each firm when they all stick to collusion with overcharge k is given by $\pi^C = \alpha(k)\pi_N$ where $\alpha(k) > 1$ ($\alpha(k) \to \infty$ when $\pi_N \to 0$). π^N is the profit per firm when all firms chose the non-cooperative Nash strategy. If all other firms are colluding, the profit a firm earns by deviating is $\beta\alpha(k)\pi_N$, where $\beta > 1$. We simplify the notation by dropping subscript N. If we for instance assume that the cartel is able to coordinate on a price that maximizes joint profit (monopoly price), then $k \in [\underline{k}, \overline{k}]$, where $\underline{k}$ is the cartel overcharge when the competitive price is high, for instance due to products being differentiated, and $\overline{k}$ is the cartel overcharge when the competitive price approaches marginal cost.

At stage 2 the firms decide whether to form cartels or not, or deviate from a cartel. We assume that a deviating firm will also report to CA and thereby apply for leniency. This implies that we rule out deviation followed by no reporting to CA. Deviations with reporting is a more profitable strategy than deviating and not reporting if S is sufficiently low.

Finally, competition authorities are assumed to determine fines at stage 1 to secure that all potential cartels are either deterred or desisted.

3 Cartel Stability

As explained in Buccirossi and Spagnolo (2007) and Spagnolo (2006), a cartel is sustainable only if the (i) participation constraint and (ii) the incentive constraint is met.

3.1 Participation constraint: Cartel deterrence

The participation constraint for a cartel, *i.e.*, for all cartel members, is met if the expected profit from forming a cartel is positive. Let us assume that detection leads to competition in the period the cartel is detected and in all future periods.

The discounted net present value for the firms of forming a cartel with overcharge k is:

$$V^C(k) = (1 - p(k))[\alpha\pi + \delta V^C(k)] + p(k)[\frac{\pi}{1-\delta} - F(k) - S]$$

where δ is the discount factor for the cartel members. Solving with respect to $V^C(k)$, we have the discounted net present value for the firms of forming a cartel:

$$V^C(k) = \frac{(1 - p(k))\alpha\pi + p(k)\left(\frac{\pi}{1-\delta} - F(k) - S\right)}{1 - \delta\,(1 - p(k))} \tag{1}$$

Comparing with the net present value if a cartel is not formed we find that a cartel is profitable if

$$V^C(k) > \frac{\pi}{1-\delta} \tag{2}$$

Solving for $F(k)$ in the participation constraint in (2) gives the fine that is necessary in order to deter a cartel with overcharge k:

$$F \geq \frac{1 - p(k)}{p(k)}(\alpha(k) - 1)\pi - S \tag{3}$$

We assume that there exists a marginal cartel, *i.e.*, a cartel that is indifferent between forming or not. We define the marginal cartel as k^{PC}. The participation constraint is then binding for $k^{PC} \in [0, \bar{k}]$ and the fine that just deter the cartel is:

$$F_{PC} = \frac{1 - p(k^{PC})}{p(k^{PC})}(\alpha(k^{PC}) - 1)\pi - S.$$

We see that the cartel overcharge k will influence both the probability of

detection and the profits from colluding.

3.2 Incentive constraint: Cartel desistence

Let us now consider the incentive constraint. If there is a leniency program, this implies that a firm may find it individually rational to defect and inform CA about the cartel. If a firm deviates, it increases the profit relative to the collusive profit $\pi_C = \alpha\pi$ by a factor $\beta > 1$, capturing $\beta\alpha\pi$ in the period it deviates. β can also be interpreted as a parameter capturing the number of firms, since a larger number of firms will imply that the gain from deviating is increased.

We will assume that deviate and report is the most profitable strategy if the firm deviates.[10] The strategy "deviate and report" will of course always dominate the strategy "collude and report". Hence, the two strategies we are comparing are "always collude" and "deviate and report". The incentive constraint gives the following restriction on the fine

$$\frac{(1-p)\alpha(k)\pi + p\left(\frac{\pi}{1-\delta} - F - S\right)}{1-\delta(1-p)} < \beta\alpha(k)\pi - S + \frac{\delta}{1-\delta}\pi \tag{4}$$

Let us assume that there exists a marginal cartel, *i.e.*, a cartel that is indifferent between collusion and deviation. We define this marginal cartel by $k^{IC} \in (0, \bar{k})$. Knowing that the incentive constraint is binding for k^{IC} the fine that just desists this cartel is

[10] Leniency as such, where fine is assumed to be reduced to zero, can be sufficient to ensure that deviation and report is better than only deviation. If deviation leads to an increase in the probability of detection this will make deviation and report even more profitable compared to only deviation. This is explained more in detail in Jensen and Sørgard (2012). Note that our assumption is identical to the one made in Cyrenne (1999) and Spagnolo (2004).

$$F_{IC} = \frac{[(1-p(k^{IC}))(1+\delta\beta)-\beta]\alpha(k^{IC})+(p(k^{IC})-\delta(1-p(k^{IC})))}{p(k^{IC})}\pi + \frac{(1-\delta)(1-p(k^{IC}))}{p(k^{IC})}S \quad (5)$$

3.3 Participation versus incentive constraint

Let us now assume that the fine schedule that is enforced has the characteristics as described above, implying either that F_{PC} or F_{IC} is binding. All cartels are marginally deterred, and in each industry either the incentive constraint or the participation constraint binds. Let us include an additional element in the analysis. We assume that there are non-pecuniary costs C associated with being caught for involvement in cartel activities. For example, there might be some social norms saying that price fixing is an unlawful action and thereby an action that is detrimental to the welfare for the persons violating the law.[11] We then have the following result:

Proposition 1 *The participation constraint is the binding constraint if* $S + C > \beta\pi_C - \pi_N$

Proof: Let V^C = present value of a cartel, V^N = present value of competition and V^D = present value if a firm deviate from the cartel and there is full competition in all future periods. We know from the analysis that if $V^C > V^N$, then the participation constraint binds and if $V^C > V^D$ then the incentive constraint binds. In the previous sections we have solved for the lowest fine that will ensure that the participation constraint and the incentive constraint is binding, respectively. Since $\partial V^C/\partial F < 0$ and $\partial V^N/\partial F = \partial V^D/\partial F = 0$,

[11] For a discussion of the forming of social norms, see for example Fehr and Fischbacher (2004). As discussed in Stephan (2010), in some societies social norms might not be hostile towards cartel activities. If so, $C = 0$.

the fine F should be increased until either $V^C < V^N$ or $V^C < V^D$. This implies that the participation constraint (incentive constraint) is the binding constraint if $V^N > V^D$ (if $V^N < V^D$). We can use the expressions for V^N and V^D as defined in the previous sections. Then we have that $V^N > V^D$ if

$$\frac{\pi_N}{1-\delta} > \beta\pi_C - S - C + \left(\frac{\pi_N}{1-\delta}\right)\delta$$

By rearranging, we have the expression in the Proposition 1. QED.

First, note that the participation constraint is binding if S is sufficiently high. In such a case an existing cartel will be punished quite fiercely by reporting, since it then also must pay with certainty a compensation S to the consumers. Then the fine must be rather high to give the existing cartel members incentives to deviate and report, and the cartel is not formed because it is unprofitable (participation constraint not met) even though it is stable (incentive constraint met). Second, the participation constraint will also bind if the social norm is such that there are large non-pecuniary costs C associated with being caught for cartel activities. Since the only way to avoid such costs is not to form a cartel, this tends to make the participation constraint binding (not profitable to form a cartel).

We also see that a low discount factor, as well as a large difference between period profits in a cartel and period profits with competition, also tends to make the participation constraint the binding constraint. This implies that in some industries the participation constraint can be binding, while in others the incentive constraint can be binding.

Furthermore, let us check the slope of the fine schedule when the incentive and the participation constraints, respectively, are binding:

Proposition 2 *Without private litigation ($S = 0$), the slope of the fine schedule $F(k) \equiv \min F_{PC}(k), F_{IC}(k)$ is always steeper when the participation constraint is binding rather than the incentive constraint, i.e, $\frac{dF_{PC}}{dk} > \frac{dF_{IC}}{dk}$*

Proof: From the previous conditions, we have the following two conditions:

$$\frac{\partial F_{PC}}{\partial k} = \frac{1-p}{p}\frac{\partial \alpha}{\partial k}\pi - \frac{(\alpha-1)}{p^2}\frac{\partial p}{\partial k}\pi$$

$$\frac{\partial F_{IC}}{\partial k} = \frac{(1-p)(1+\delta\beta)-\beta}{p}\frac{\partial \alpha}{\partial k}\pi - \frac{(1+\beta(1-\delta))\alpha-\delta}{p^2}\frac{\partial p}{\partial k}\pi$$

We define the following parameters

$$A = \frac{1-p}{p}$$
$$B = \frac{(\alpha-1)}{p^2}$$
$$Z = \frac{(1-p)(1+\delta\beta)-\beta}{p}$$
$$X = \frac{(1+\beta(1-\delta))\alpha-\delta}{p^2}$$

We then have the following condition for the minimum fine schedule being less steep according to the incentive constraint than according to the participation constraint:

$$\frac{dF_{IC}}{dk} \equiv Z\frac{\partial \alpha}{\partial k} - X\frac{\partial p}{\partial k} < A\frac{\partial \alpha}{\partial k} - B\frac{\partial p}{\partial k} \equiv \frac{dF_{PC}}{dk}$$

Rearranging, we have that the F_{IC} fine schedule is flatter than the F_{PC} fine schedule if:

$$-\frac{p\beta[1-\delta(1-p)]}{(1-\delta)(\alpha\beta+1)} < \frac{p'}{\alpha'}$$

We see that the lefthand side is negative, while $p' \geqq 0$ and $\alpha' \geqq 0$. It implies that the F_{IC} fine schedule is always flatter than the F_{PC}, irrespective of whether the overcharge influences the probability of detection or not. QED.

Proposition 2 shows that the fine schedule will always be steeper if the participation constraint binds rather than the incentive constraint. It implies that the additional fine for a more harmful cartel should be larger if the participation constraint binds than if the incentive constraint binds. We characterize this as a discriminatory fine. To understand this, note that with a binding incentive constraint each cartel member is tempted to deviate. A higher overcharge will make the short term gain from deviating larger, which dampens the need for an increased fine for a more harmful cartel.

Let us consider the case where $p' = 0$ (k has no effect on p), and again allowing $S \geq 0$. Then it can easily be shown that the fine must be increasing in the overcharge, no matter which constraint is binding. By comparing the two binding constraints we see, in line with what we have already shown, that the participation constraint leads to a more discriminatory fine than the incentive constraint does. This can easily be seen from the following:

$$\frac{dF_{IC}}{dk} \equiv \frac{(1-p)(1+\beta\delta)-\beta}{p} < \frac{1-p}{p} \equiv \frac{dF_{PC}}{dk}, \tag{6}$$

which reduces to $1-\delta(1-p) > 0$. Let us assume that the fine is discriminatory, so that it can capture at least some of the gain associated with a more profitable cartel. If the additional fine for a cartel with a larger negative impact is larger than the additional per period profits ($\frac{\partial F}{\partial k} > \frac{\partial \pi_C}{\partial k} = \frac{\partial \alpha}{\partial k}\pi$), we define this as an overproportional discriminatory fine.[12] Until otherwise stated, we assume that the private litigation is not influenced by the overcharge. The we have the following result:

Proposition 3 *(i) If the participartion constraint is binding, an overproportional discriminatory fine is needed if*

$$p < \tfrac{1}{2}$$

(ii) If the incentive constraint is binding, an overproportional discrimina-

[12]This is identical to the definition of proportionality in Smith et al. (1987).

tory fine is needed if

$$p < 1 - \frac{1+\beta}{2+\delta\beta} < \frac{1}{2}$$

Proof: It can easily be verified from equation (5). QED

Proposition 3 shows that if a discriminatory fine captures exactly the additional per period profit due to a larger cartel overcharge so that $\frac{\partial F(k)}{\partial k} = \frac{\partial \pi_C(k)}{\partial k}$ and a particular cartel is marginally deterred, the fine schedule will not be able to deter cartels with a larger harm if the probability of being detected is sufficiently low. In particular, it should be overproportional discriminatory if the participation constraint is binding and the probability of detection is less than half. If the incentive constraint is binding though, the fine schedule should be overproportional discriminatory for a detection probability that is even lower. To explain this, let us assume that the fine is set such that the cartel with the lowest negative impact on welfare is indifferent between forming a cartel and not. To ensure that a cartel that has a larger negative impact on welfare is indifferent as well, the fine must of course be higher than for the cartel with the lowest negative impact on welfare. What we have shown is that if the probability of being detected is sufficiently low, it is not sufficient to increase the fine by the difference in per period profits between the two potential cartels, but that the increase in the fine must overcompensate for the difference in per period profits. In the design of the fine schedule it is necessary to take into account the fact that cartels anticipates the low probability of being detected. A higher fine for cartels with a larger negative impact on welfare is needed to deter it, and in this case the additional fine is larger than the difference in per period profits for those two cartels.

In line with what we explained above, the fine schedule is less discriminatory if the incentive constraint rather than the participation constraint is binding. We see that the gain from deviating (β) and the discount factor (δ) is of importance for whether the fine schedule in that case is overproportional or not.

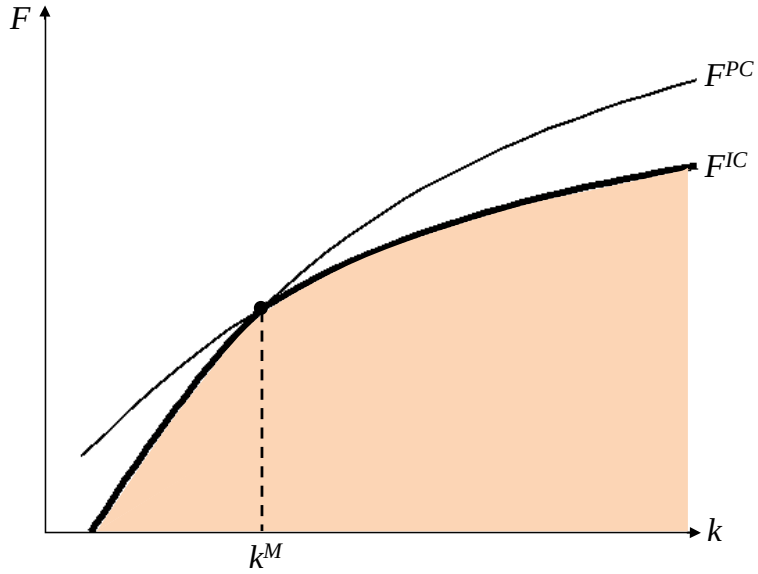

Figure 1: The fine given that either the particpation or the incentive constraint binds

In Figure 1 we have illustrated optimal fines given that the participation constraint and the incentive constraint, respectively, is binding. We assume that the non-pecuniary cost C has an identical effect on all cartels. It implies that the incentive constraint line F_{IC} is shifted upwards.

The solid piece-wise line shows the binding constraint. If any part of the schedule $F(k)$ lies within the shaded area these cartels are neither deterred nor desisted, thus they are formed and stable. We then have the following result:

Proposition 4 *Assume that there exist some level of k such that $F_{IC} = F_{PC}$ for the cartel with overcharge $k^M \in (\underline{k}, \overline{k})$, where k^M is defined by*

$$\alpha(k^M) = \frac{\pi + C + L + S}{\beta\pi}$$

If $F = \min[F_{PC}, F_{IC}] \equiv F^*(k)$, then all cartels $k \in [0, k^M\rangle$ are deterred while all cartels $k \in [k^M, \bar{k}]$ are desisted.

As shown in Proposition 4 and illustrated in Figure 1, the participation constraint stops cartels with a low potential overcharge from forming and the incentive constraint stops cartels with a large potential overcharge from sustaining collusion. Cartels with a potential for only a low overcharge can easily be deterred from forming, while cartels with a potential for high overcharges can find it profitable to form but have difficulties in preventing firms from deviating from the cartel.

Since both constraints bind, although for various industries, a change in the cartel policy can have very different effects in different industries. To illustrate, let us now consider how a change in S affects the optimal fine schedule. We assume that $S = \sigma(\alpha-1)\pi$, *i.e.*, private litigation costs depends on cartel overcharge. Then it can easily be shown that the critical fines for the participation and incentive constraint, respectively, is as follows:

$$F_{PC}^{S} = \frac{1 - p\,(1+\sigma)}{p}\,(\alpha\,(k) - 1)\,\pi$$

$$F_{IC}^{S} = \frac{((1-p)(1+\delta\beta+\sigma(1-\delta)) - \beta)\,\alpha\,(k) + (p - (\delta+\sigma(1-\delta))(1-p))}{p}\pi$$

We have the following result:

Proposition 5 *(i) In the presence of private litigation, the optimal fine is overproportional discriminatory if $p < \frac{1}{2+\sigma}$ when F_{PC} is binding and if $p < \frac{1-\delta}{2-\delta}$ when F_{IC} is binding, and*

(ii) an increase in private litigation costs (higher σ), all else equal, would lead to $\partial F_{PC}/\partial\sigma < 0$ and $\partial F_{IC}/\partial\sigma > 0$.

Proof: Concerning (i), it is easy to verify that $\partial F_{PC}^{S}/\partial\sigma > (\alpha-1)\pi$ if $p < \frac{1}{2+\sigma}$and $\partial F_{IC}^{S}/\partial\sigma > (\alpha-1)\pi$ if $p < \frac{1-\delta}{2-\delta}$. Concerning (ii), it can easily be verified that $\partial F_{PC}/\partial\sigma < 0$ and $\partial F_{IC}/\partial\sigma > 0$ since $\alpha > 1$. QED

We see from (ii) in Proposition 5 that private litigation will, all else equal, lead to less stable cartels if the participation constraint is binding and more stable cartels if the incentive constraint is binding. If firms consider to form a cartel (participation constraint is binding), they will be less tempted to do so if they know there will also be a risk of private litigation. On the other hand, if they consider to deviate and report then the prospects for private litigation will make such a decision less profitable.[13] If we combine these lessons with the lessons in Proposition 4, we see that more widespread use of private litigation makes it easier to deter cartels with relatively small overcharge and at the same time more difficult to desist cartels with larger overcharges. We see for Proposition 5 (i) that fines might have to be overproportional discriminatory also in the case when there is private litigation.

3.4 An example

In the model we have simply assumed that the price-cost margin differs between various industries. It can easily be shown that the results continue to hold if the price-cost margin is determined endogenously by market characteristics. Let us illustrate this by using an example where we assume that in each industry, firms sell identical products in a duopoly with no capacity constraint. It is then well known that profits will be zero in all industries if they compete. Now, let the only difference between industries be the market price elasticity of demand. If the two firms in a particular industry forms a cartel and set the monopoly price their profit ratio, *i.e.* profit divided by revenues, is captured by the inverse price elasticity of market demand (e_i):

$$\frac{(p_i - c_i)Q_i}{p_i Q_i} = \frac{(p_i - c_i)}{p_i} = \frac{1}{e_i}$$

This follows straight forward from the Lerner (L_i) index. Further, let us define the fine as a fraction of revenues (fine ratio):

[13] This is well known in the existing literature, see for example Spagnolo (2004).

$$f_i = \frac{F_i}{p_i Q_i},$$

Thus, we can reformulate the participation constrain and calculate the fine ratio that just deter in industry i:

$$f_{PC} = \frac{1-p}{pe_i} - S$$

In a similar way, we can reformulate the incentive constraint and calculate the fine ratio that just deter in that case in industry i:

$$f_{IC} = \frac{2\delta\,(1-p) - (1+p)}{pe_i} + \frac{S\,[(1-\delta)\,(1-p)]}{p}$$

It is easily seen that the fine ratios, both for f_{PC} and f_{IC}, are decreasing in the market price elasticity of demand. Since the overcharge is decreasing in the market price elasticity of demand, the fine must be increasing in the overcharge no matter which of those two constraints that are binding. By comparing the two binding constraints we have that the participation constraint leads to a more discriminatory fine if:

$$\frac{dF_{IC}}{de} \equiv \frac{(2\delta)\,(1-p) - (1+p)}{pe^2} < \frac{1-p}{pe^2} \equiv \frac{dF_{PC}}{de}.$$

It can easily be shown that this condition is met if $(1-p)\,(1-\delta) > 0$, which is always true.

Hence, in line with the above results, this example show that the fine schedule is more discriminatory when the participation constraint is binding compared to when the incentive constraint is binding. It illustrates that our results are valid also when we let the difference between the industries and the overcharge be determined by some market characteristics, in this particular case the price elasticity of demand.

4 Are actual cartel fines discriminatory?

We find that for sufficiently low probability of detection the discriminatory, fines should even be overproportional to the additional damage of a more harmful cartel. There are not many detailed empirical studies of the probability of detection. Bryant and Eckard (1991) found that the probability for a cartel being detected in one year cannot be higher than 13 - 17%.[14] If this is true, it suggests that the differences in fines between cartels should be overproportional relative to the difference in damage they cause. Unfortunately, the present policy in both the US and EU is such that it is an open question whether fines are discriminatory at all.

According to the US guidelines for fines it should be set a base fine level at 20% of affected commerce.[15] This is clearly based on an average cartel overcharge consideration.[16] The base fine level should be adjusted by taking a number of factors into consideration, for instance, it should be adjusted upwards if bid rigging or other aggravating factors are involved or downward if the firm cooperates with the antitrust authority. However, it is hard to see that such adjustments introduce anything that would imply that the fine should depend on the actual damage. This suggests that the fine is not discriminatory at all.

In the EU guidelines for fines, the starting point is that the basic amount will be set at a level up to 30% of the relevant sales the last business year.[17] This amount should be multiplied with the number of years of infringement, and added a fixed component which equals 15-25% of annual sales. In the EU guidelines it is stated that factors such as the nature of the infringement,

[14]See also Combe, Monnier and Legal (2008). They use data for the EU, and find that the probability for being caught cannot be higher than 13.3% each year.

[15]See U.S. Sentencing Guidelines Manual § 2R1.1 (2012).

[16]It has been a presumption that the average gain from price-fixing is 10% of the selling price. The guidelines doubled that amount to account for harm to consumers that could not buy the product at the higher price. See Connor and Lande (2006) for a discussion of the guidelines.

[17]See Guidelines on the method of setting fines imposed pursuant to Article 23(2)(a) of Regulation No 1/2003. For a critical review of the guideline, see Van Cayseele, Camesasca and Hugmark (2008).

the combined market shares of the involved firms and the geographic scope for the infringement should influence the decision whether the basic amount should be in the lower or upper end of the scale. Except for the combined market shares, which can be decisive for how much they are able to raise the price, none of these factors are discriminatory the way we have interpreted it. This basic amount of the fine should be increased or reduced in each particular case taking into account all relevant circumstances. It leaves a large discretion for the Commission to impose discriminatory fines. However, none of the moments mentioned that could lead to an increase or a reduction in the basic amount is directly related to the differences in profits between various cartels. Finally, the fine cannot exceed 10% of the previous business year's total turnover for the firm. Clearly, this might make it impossible to deter or desist the most harmful cartels.

The EU commission has taken an initiative to spur more private litigation.[18] As argued above, if there is more private litigation without a simultaneous change in the fine policy, the worst cartels can become more sustainable. Unfortunately, the measures proposed by EU Commission will not prevent such a detrimental effect. It is proposed that the scope for damage to be paid by immunity recipients should be more limited when a leniency program is in place. The problem is that such a measure is not discriminatory, since it does not distinguish between cartels with a large harm and cartels with a more limited harm.

5 Some concluding remarks

When firms agree to fix prices, it leads with very few exceptions to higher prices. In that respect it is natural with a per se ban on price fixing. Since price fixing in almost all instances will result in higher prices, there is no need to show that it has led to higher prices to conclude that the ban is violated.

[18]See white paper on damages actions for breach of the EC antitrust rules that was issued by DG Competition 2.4.2008.

This is the present policy in most jurisdictions. We have argued that unless fines are very high, and thereby excessively high in most cases, it is a risk that the most harmful cartels are formed while the not so harmful cartels are deterred.

The obvious response to such a problem is to make fines discriminatory, in line what we have seen in other areas concerning crime and punishment. We show that it is non-trivial to design the optimal fines for cartel activities. First, for plausible parameter values we find that an overproportional discriminatory fine is needed. Second, the response to changes as, for example, more private litigation depends critically on whether cartels are deterred due to the lack of profitability or deterred due to the private incentives to deviate. Unfortunately, we find the the present policy in the US and EU are not addressing these problems in a satisfactory way. This might imply that it is a risk that the most harmful cartels are not deterred at present. In particular, the large number of leniency cases in both the US and EU the last decade indicates that the violation of the incentive constraint, at least for those firms, is decisive for the fight against cartels. If the incentive constraint is binding for the cartels with the highest overcharge, though, there is a risk that more discriminatory private litigation – as proposed by EU Commission – would deter the wrong cartels.

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