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The deterrence of collusion by a structural remedy

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HIGHLIGHTS

- Structural remedies are examined as a penalty for collusion.
- When firms are very patient, a structural remedy makes collusion unprofitable.
- A structural remedy can be more deterrent than fines and damages.

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ABSTRACT

As a penalty for illegal collusion, this paper shows that a structural remedy makes collusion unprofitable when collusion is most stable, and that it can be a greater deterrent than fines or damages.

1. Introduction

In a recent paper, I proposed the use of a structural remedy as a penalty for firms having illegally colluded (Harrington, 2017a). More specifically, cartel members are required to divest assets in order to make the market less inclined towards collusion by, for example, creating a new competitor. Though the primary rationale of a structural remedy is to make future collusion less likely, it would also generally have the effect of lowering competitive profits in the post-conviction environment. Here, we explore this latter effect and the extent to which it offers an effective deterrent distinct from the traditional penalties of government fines and customer damages.[1]

2. Model

Consider an infinitely repeated oligopoly game where firms have a common discount factor $\delta \in (0, 1)$. If firms do not collude, they achieve a stage game Nash equilibrium that yields firm profit $\pi^n > 0$. If firms were instead to collude, each would earn profit $\pi^c\ (> \pi^n)$. Let $\pi^d\ (> \pi^c)$ denote a firm's maximal static profit if it were to deviate from the collusive outcome. Our attention will focus on when the collusive outcome is sustained using the grim punishment; that is, permanent reversion to the non-collusive outcome.

In each period that firms are colluding, there is an exogenous probability $\alpha \in (0, 1)$ that the cartel is discovered, prosecuted, and convicted. In that event, firms are levied a penalty and are assumed not to collude thereafter. A penalty could be financial or involve divestiture of assets as part of a structural remedy. The financial penalty is as modeled in Harrington (2004, 2005, 2014). For each period the cartel has existed, a firm is assessed an amount $f > 0$. Due to the greater difficulty in documenting collusion that is in the more distant past, the penalty is assumed to depreciate over time. If F_t is the penalty that a firm would have to pay if caught and

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[1] Katsoulacos et al. (2015) provide a comparative analysis of fines and damages. For a general survey of the theory of collusion with antitrust enforcement, the reader is referred to Harrington (2017b).

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convicted in period t then $F_{t+1} = (1-\beta)F_t + f$, where $\beta \in (0,1)$ is the depreciation rate. If firms collude forever (without having been caught) then the steady-state value for the penalty is defined by: $F^{ss} = (1-\beta)F^{ss} + f \Rightarrow F^{ss} = f/\beta$. As it is assumed the cartel starts operating in period 1, $F_0 = 0$ and $F_t \in [0, f/\beta]$, $\forall t \geq 1$.

A second type of penalty that the cartel could face is a structural remedy which has each of the cartel members divest assets to create a new firm. The only property of that remedy which we will use here is that the post-cartel environment is more competitive than the pre-cartel environment, as reflected in each of the former cartel members earning profit $\pi^p \in [0, \pi^n)$. π^p is defined to include both post-divestiture product market profits plus the (amortized) payment for the assets divested. An example of the construction of π^p is provided in Section 5.[2]

The primary rationale for a structural remedy is that it reduces the likelihood of recidivism; that is, a less concentrated market structure makes it less likely the cartel reforms or that tacit collusion arises in its stead. That benefit from a structural remedy is assumed away by our assumption that, upon conviction, firms never collude again, whether or not a structural remedy is used. As conditions will be identified whereby a structural remedy is a greater deterrent than financial penalties, the result would only be strengthened if a structural remedy were also to reduce the likelihood of future collusion.

3. Equilibrium conditions for cartel stability

Let us begin by characterizing the collusive value after the cartel has formed. With a slight modification of what is in Harrington (2014), the expected present value of profits to a cartel member when the accumulated penalty is F is defined recursively by

$$V(F) = \pi^c + \alpha\left[\delta W - ((1-\beta)F + f)\right] + (1-\alpha)\delta V((1-\beta)F + f),$$

where W is the post-cartel continuation payoff after a conviction and

$$W = \begin{cases} \dfrac{\pi^n}{1-\delta} & \text{if there is no structural remedy} \\ \dfrac{\pi^p}{1-\delta} & \text{if there is a structural remedy.} \end{cases}$$

Solving for $V(\cdot)$, it can be shown that

$$V(F) = \frac{\pi^c + \alpha\delta W}{1-(1-\alpha)\delta} - \left(\frac{\alpha(1-\beta)[1-(1-\alpha)\delta]F + \alpha f}{[1-(1-\alpha)\delta(1-\beta)][1-(1-\alpha)\delta]}\right).$$

In specifying the deviation payoff, it is assumed that the cartel could be caught in the period of deviation but has no chance of being caught in the future when firms are no longer colluding. The incentive compatibility constraints (ICCs) are then[3]:

$$V(F) \geq \pi^d + \delta\left(\alpha W + (1-\alpha)\left(\frac{\pi^n}{1-\delta}\right)\right) - \alpha((1-\beta)F + f), \ \forall F \in [0, f/\beta].$$

Note that

$$\frac{\partial\left[V(F) - \pi^d - \delta\left(\alpha W + (1-\alpha)\left(\frac{\pi^n}{1-\delta}\right)\right) + \alpha((1-\beta)F + f)\right]}{\partial F} = -\frac{\alpha\delta(1-\beta)(1-\alpha)(1-\beta)}{1-(1-\alpha)\delta(1-\beta)} < 0,$$

which implies the ICC is more stringent when F is higher. Hence, the binding ICC is at the steady-state when $F = f/\beta$. Thus, collusion is stable (i.e., a grim trigger strategy is a subgame perfect equilibrium) if and only if (iff)

$$V(f/\beta) = \frac{\pi^c + \alpha\delta W - \alpha(f/\beta)}{1-(1-\alpha)\delta} \geq \pi^d + \delta\left(\alpha W + (1-\alpha)\left(\frac{\pi^n}{1-\delta}\right)\right) - \alpha(f/\beta). \quad (1)$$

4. Deterrence

The analysis will focus on when firms highly value future profits, which is the situation most conducive to collusion. The stability and profitability of collusion are then examined when $\delta \to 1$. As α is kept fixed as δ goes to one, the presumption is that a higher value for δ comes from firms' time preferences rather than the length of the period.[4] However, I suspect that results hold as long as δ goes to 1 faster than α goes to zero.

Let us begin by considering the standard case of financial penalties without a structural remedy, so the post-conviction payoff is $W = \frac{\pi^n}{1-\delta}$. (1) is then

$$\frac{\pi^c + \alpha\delta\left(\frac{\pi^n}{1-\delta}\right) - \alpha(f/\beta)}{1-(1-\alpha)\delta} \geq \pi^d + \delta\left(\frac{\pi^n}{1-\delta}\right) - \alpha(f/\beta)$$

or, equivalently,

$$\Lambda(\delta) \equiv (1-\delta)\left(\frac{\pi^c - \alpha(f/\beta)}{1-(1-\alpha)\delta}\right) + \left(\frac{\alpha\delta\pi^n}{1-(1-\alpha)\delta}\right) - (1-\delta)\pi^d - \delta\pi^n + (1-\delta)\alpha(f/\beta) \geq 0.$$

Given

$$\lim_{\delta\to 1}\left((1-\delta)\left(\frac{\pi^c - \alpha(f/\beta)}{1-(1-\alpha)\delta}\right) + \left(\frac{\alpha\delta\pi^n}{1-(1-\alpha)\delta}\right)\right) = \pi^n$$

and

$$\lim_{\delta\to 1}\left((1-\delta)\pi^d + \delta\pi^n - (1-\delta)\alpha(f/\beta)\right) = \pi^n,$$

then $\lim_{\delta\to 1}\Lambda(\delta) = 0$. Thus, $\exists\varepsilon > 0$ such that $\Lambda(\delta) > 0$ $\forall\delta \in (1-\varepsilon, 1)$ iff $\lim_{\delta\to 1}\Lambda'(\delta) < 0$. Given the equation in Box I then

$$\lim_{\delta\to 1}\Lambda'(\delta) = -\frac{(\pi^c - \alpha(f/\beta))}{\alpha} + \pi^d - \alpha(f/\beta).$$

Hence, $\lim_{\delta\to 1}\Lambda'(\delta) < 0$ requires

$$\pi^c - \alpha(f/\beta) > \alpha\left(\pi^d - \alpha(f/\beta)\right). \quad (2)$$

In sum, collusion is stable (i.e., (1) holds) when firms are sufficiently patient and (2) holds.

Having formed a cartel, collusion could be stable even though, from an ex ante perspective, collusion is less profitable than competition. Firms can always avoid penalties by not forming a cartel but, once having cartelized, a penalty cannot be avoided for sure.

[2] The model is also subject to the interpretation that the cartel was not all-inclusive and the assets are divested to non-cartel members. In that case, π^c, π^n, π^d, and π^p apply only to cartel members.

[3] Note that a firm's penalty is the same whether it complies or deviates because it is the act of agreeing to coordinate on prices that is illegal, and not the price that a firm sets.

[4] To appreciate this issue in the context of collusion with imperfect monitoring, see Sannikov and Skrzypacz (2007).