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Fighting collusion by permitting price discrimination

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HIGHLIGHTS

- We investigate whether a ban on price discrimination facilitates collusion.
- A deviation from the cooperative action is more tempting under price discrimination.
- A ban on price discrimination makes a collusive outcome "more likely".

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ABSTRACT

We investigate the effect of a ban on third-degree price discrimination on the sustainability of collusion. We build a model with two firms that may be able to discriminate between two consumer groups. Two cases are analyzed: (i) Best-response symmetries so that profits in the static Nash equilibrium are higher if price discrimination is allowed. (ii) Best-response asymmetries so that profits in the static Nash equilibrium are lower if price discrimination is allowed. In both price discrimination scenarios, firms' discount factor has to be higher in order to sustain collusion in grim-trigger strategies than under uniform pricing.

1. Introduction

A classic topic in the economic literature on antitrust are the effects of price discrimination—or the ban of it—on total welfare. The static effects of permitting third-degree price discrimination are by now well understood. Little is known, however, regarding the effects of a ban on price discrimination on dynamic competition. Does a legal ban on price discrimination facilitate a collusive outcome instead of promoting competition? Whether tacit collusion can be sustained in equilibrium depends, on the one hand, on the gains from collusion, and, on the other hand, on the temptation of a firm to deviate unilaterally from the collusive agreement. Permitting price discrimination affects both the gains from collusion and the temptation to deviate. Under price discrimination, a deviation from the collusive agreement can be targeted to specific consumer groups, enhancing the one-period profit from a deviation. Due to this effect, collusion is harder to sustain if price discrimination is permitted. On the other hand, price discrimination may enhance the gains from collusion, in particular when it enhances competition. Thus, there can be opposing effects at play regarding whether a ban on price discrimination facilitates collusion or supports competition.

Our main finding is that permitting price discrimination enhances the temptation to deviate significantly and thus hampers the formation of cartels; i.e., the set of discount factors for which collusion can be sustained is larger under uniform pricing than under price discrimination. This result holds true for both (i) best-response symmetries—static Nash equilibrium profits are higher if price discrimination is allowed—and (ii) best-response

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asymmetries—static Nash equilibrium profits are lower if price discrimination is allowed.[1]

To the best of our knowledge, this is the first paper that investigates the effect of a ban on third-degree price discrimination on the 'likelihood' of collusion to occur. We build on the literature on third-degree price discrimination in oligopolistic markets (Borenstein, 1985; Holmes, 1989; Thisse and Vives, 1988).[2] The sustainability of collusion when firms are able to price discriminate is analyzed by Liu and Serfes (2007) and Colombo (2010b). Liu and Serfes (2007) analyze a model where two horizontally differentiated firms can acquire information about consumers' preferences. They investigate whether colluding firms agree not to acquire information and thus also not to price discriminate. Colombo (2010b) investigates how the degree of differentiation affects the sustainability of collusion on a uniform price and on discriminatory prices.[3] The crucial difference of these papers to our approach is that, if a firm deviates from the collusive agreement, this firm acquires information and engages in price discrimination. In our model, price discrimination may be banned by law. This implies that, if a firm deviates, it is restricted by law to charge a uniform price. Moreover, these papers only investigate situations with best-response asymmetries, while we analyze collusion also under best-response symmetries.

Our paper is also related to the literature on most-favored customer (MFC) clauses: With collusion being harder to sustain under price discrimination, firms may have an incentive to commit to a uniform price. MFC clauses are considered as such a commitment device. The theoretical literature shows that MFC clauses can facilitate collusion in finitely repeated interactions (Cooper, 1986; Schnitzer, 1994). Recent empirical evidence by Chen and Liu (2011) shows that MFC clauses can be used as a price discrimination tool—not all customers request the rebate—and thus lead to lower prices.

2. The model

We consider an industry with two symmetric firms, A and B, producing differentiated goods. Each firm produces at constant marginal cost $c \geq 0$ and without fixed costs.

There is a continuum of consumers with measure normalized to one. A consumer is interested in purchasing at most one unit. We use a simple discrete choice model with perfectly negatively correlated brand preferences—similar to Hotelling (1929)'s model. The utility of a consumer with type (θ, ρ) is

$$u = \begin{cases} v - \rho\theta - p_A & \text{if purchasing from firm } A \\ v + \rho\theta - p_B & \text{if purchasing from firm } B \\ 0 & \text{if not purchasing a good,} \end{cases} \tag{1}$$

where p_i is the price charged by firm $i \in \{A, B\}$ from this consumer. We assume that θ is uniformly distributed around mean zero; i.e., $\theta \sim U[-\bar{\theta}, \bar{\theta}]$ with $\bar{\theta} > 0$. Moreover, $\rho \in \{\rho_L, \rho_H\}$ with $0 < \rho_L < \rho_H$. A fraction α of the consumers has type ρ_L and the remaining $1 - \alpha$ consumers have type ρ_H. The ρ-types are distributed independently from the θ-types. Consumers of type ρ_L react more strongly to price differences than consumers of type ρ_H and are in that sense more price sensitive. Consumers with a high (low) θ have strong brand preferences. Those with high (low) θs strongly prefer brand B (A) to brand A (B).

Time is discrete and denoted by $t = 0, 1, \ldots, \infty$. At the beginning of each period, each firm chooses a price for its own product without knowing the other firm's price choice. Consumers are interested in purchasing one unit every period and are unable to store the good. Consumers first observe the prices and decide thereafter whether and from which firm to buy. At the end of each period, all choices are publicly observed. Firms discount future profits at the constant rate $\delta \in (0, 1)$.

The main research question is: How does a ban on price discrimination affect the sustainability of collusion? As the infinitely repeated price game has a continuum of equilibria, we have to rely on the comparison of equilibria in certain strategies in order to answer this question. We focus on the sustainability of collusion as a subgame perfect equilibrium in grim-trigger strategies: In the cooperation phase, the strategies prescribe to charge the price (or prices) that maximizes joint profits. In the punishment phase—after a deviation by one of the two firms—the strategies prescribe that the prices in any period are equal to the static Nash equilibrium prices.

In the following, we will analyze three scenarios.

(i) Uniform pricing (U): Both firms are restricted to charge the same price from all consumers.
(ii) Price discrimination with best-response symmetries (DS): Firms can discriminate between consumers with ρ_L and ρ_H, i.e. each firm $i = A, B$ charges two different prices p_i^L and p_i^H from consumers with type ρ_L and ρ_H, respectively.
(iii) Price discrimination with best-response asymmetries (DA): Firms can discriminate between consumers with $\theta \in [-\bar{\theta}, 0)$ and consumers with $\theta \in [0, \bar{\theta}]$, i.e. each firm $i = A, B$ charges two different prices p_i^- and p_i^+ from consumers with types $\theta < 0$ and $\theta \geq 0$, respectively.

For all scenarios $j \in \{U, DS, DA\}$, we calculate the one period static Nash equilibrium profit of a firm, π_j^N, the one period (maximal) profit of a firm under collusion, π_j^C, and the one period profit a firm makes when deviating optimally from the collusive agreement, π_j^D. Collusion is sustainable in scenario j—in grim-trigger strategies—if and only if $\sum_{t=0}^{\infty} \delta^t \pi_j^C \geq \pi_j^D + \sum_{t=1}^{\infty} \delta^t \pi_j^N$, which is equivalent to

$$\delta \geq \frac{\pi_j^D - \pi_j^C}{\pi_j^D - \pi_j^N} \equiv \bar{\delta}_j. \tag{2}$$

In order to answer our main research question, we compare $\bar{\delta}_U$ to $\bar{\delta}_{DS}$ and $\bar{\delta}_{DA}$.

We will focus on equilibria in which the market is fully covered. Moreover, we restrict attention to situations where a firm that deviates does not serve the whole market.

3. The analysis

3.1. Uniform pricing

In this subsection, we assume that price discrimination is banned and thus each firm $i = A, B$ sets a single price p_i. There are two marginal consumers, denoted by $\hat{\theta}_k = (p_B - p_A)/2\rho_k$ for $k = L, H$, who are indifferent between purchasing from firm A and firm B. Consumers with a lower θ-type than the marginal consumer purchase from firm A, while those with a higher type purchase from firm B. The demand functions of firm A and B—if the market is fully covered—are

$$D_A(p_A, p_B) = \alpha \left[\frac{p_B - p_A}{2\rho_L} + \bar{\theta} \right] \frac{1}{2\bar{\theta}} + (1 - \alpha) \left[\frac{p_B - p_A}{2\rho_H} + \bar{\theta} \right] \frac{1}{2\bar{\theta}} \tag{3}$$

and
$$D_B(p_B, p_A) = \alpha \left[\bar{\theta} - \frac{p_B - p_A}{2\rho_L} \right] \frac{1}{2\bar{\theta}} + (1 - \alpha) \left[\bar{\theta} - \frac{p_B - p_A}{2\rho_H} \right] \frac{1}{2\bar{\theta}}, \tag{4}$$

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[1] The phrases best-response symmetry and best-response asymmetry go back to Corts (1998).

[2] Cf. Stole (2007) and Armstrong (2006).

[3] Similar questions are also addressed by Colombo (2009, 2010a).