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Price discrimination and sequential contracting in monopolistic input markets

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HIGHLIGHTS

- We study a vertically related market with one supplier and two downstream retailers.
- The supplier prefers to contract sequentially to manipulate the retailers' demand.
- It strategically contracts with an efficient retailer first and the other later.
- Allowing price discrimination improves welfare in the sequential contracting game.

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ABSTRACT

This paper examines the welfare implication of banning price discrimination in the intermediate goods market in which a monopolistic supplier contracts with asymmetric downstream retailers. We demonstrate that the supplier has a strong incentive to manipulate the interdependent demand structure through sequential contracting whether price discrimination is banned or not, and allowing price discrimination improves social welfare and consumer surplus when sequential contracting is implemented by the supplier.

1. Introduction

Considerable debate has ensued among policy makers and economists about so-called price protection policies subsequent to the amendment of the Robinson–Patman Act, which explicitly aims to protect small businesses from unfair advantages of large buyers in intermediate goods markets. Katz (1987), in particular, in his pioneering work, points out that the interdependency of buyers' demands for intermediate goods is central to the analysis of vertically related markets, and the welfare implication of the analysis of final goods markets may not carry over to intermediate goods markets. Katz (1987) presents the conditions under which price discrimination reduces welfare in the presence of a backward integration threat by a downstream firm.[1] DeGraba (1990) finds price discrimination to dampen the innovation incentives of downstream firms, as a more efficient firm is charged a higher price when the discriminatory pricing rule is allowed, and Yoshida (2000) argues that although an increase in total output is a necessary condition for welfare improvement in the case of third-degree price discrimination in a final goods market, it is a sufficient condition for welfare deterioration in an intermediate goods market.

In sharp contrast to previous studies that consider the Cournot competition in the downstream market, this paper sheds light on the fact that the monopolistic supplier strategically chooses *sequential* contracting to manipulate the interdependent demand.

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[1] O'Brien (2014) shows that such welfare implications associated with price discrimination can be reversed depending on the credibility of downstream firms' integration threat.

The supplier contracts with one retailer first, reveals its quantity, and then contracts with the other retailer. In this setting, the paper establishes two main results: (1) a monopolistic supplier has a strong incentive to contract sequentially and strictly prefers to contract with an efficient retailer first and inefficient retailer later, whether price discrimination is banned or not, and (2) allowing price discrimination raises overall output and social welfare when the sequential contracting is implemented. The intuition is that once the first retailer sets its output, the supplier offers deep discounts to the high cost retailer, which leads to a substantial increase in the later signing retailer's output, thereby raising both overall output and surplus.[2]

2. The model

We study a vertically related market in which one monopolistic supplier provides intermediate goods to two competing downstream retailers producing homogeneous products. The retailers, denoted by $i \in \{1, 2\}$, purchase intermediate goods for $\gamma_i \in \Gamma_i := [0, \infty)$ per unit and use one unit of inputs to assemble one unit of final goods at cost c_i. Throughout the paper, (c_1, c_2) is public information and we assume $c_1 \leq c_2$ without loss of generality. The demand for final goods is given by $P = a - bQ$, where $a, b > 0$. To ensure that the outcome of the simultaneous contracting game is consistent with the results of Katz (1987) and DeGraba (1990), we assume the following sufficient condition, which requires that demand be sufficiently large.[3]

Assumption 1. $a \geq (7c_2 - 5c_1)/2$.

In a model where the supplier contracts with both retailers simultaneously, the supplier sets unit prices of input (γ_1, γ_2) for each retailer and the retailers produce and sell their final products (q_1, q_2) through the Cournot competition. For expositional convenience, we assume the pair (γ_1, γ_2) to be publicly announced.[4] When price discrimination is banned, the supplier is required to set a single price for both retailers. Lemma 1 is a replication of the previous studies as a benchmark case. It shows that the efficient firm produces less and the inefficient firm more under the discriminatory than under the uniform pricing rule and social surplus is smaller under the former. Superscripts '*D*' and '*N*' stand for discriminatory and uniform pricing rules, respectively, and '*C*' signifies the Cournot structure.[5]

Lemma 1. *Suppose that the supplier contracts with both retailers at the same time.*

(i) $q_1^{NC} \geq q_1^{DC}$, $q_2^{NC} \leq q_2^{DC}$, *and* $q_1^{NC} + q_2^{NC} = q_1^{DC} + q_2^{DC}$
(ii) $CS^{NC} = CS^{DC}$ *and* $SS^{NC} \geq SS^{DC}$.

We analyze now the case in which the supplier contracts sequentially with the retailers. After the supplier signs a contract with one retailer (stage 1), which is then announced by either party, it contracts with the other retailer (stage 2). The retailer contracting first is termed 'leader' (or retailer 1 without loss of generality), the one contracting after, 'follower' (or retailer 2). We simply assume that the supplier contracts first with retailer 1, but we show later that the supplier does so indeed.

One might wonder what would happen if the supplier commits to input prices for both retailers upfront. In the presence of such a commitment device, the welfare implication of price discrimination is not reversed. However, in general, the commitment is barely credible because a joint deviation between the supplier and retailer 2 in the subsequent contract can take place. Furthermore, such a commitment to control the offer to the third party is often regarded as a violation of fair argmax_{q_2} competition.

2.1. When third-degree price discrimination is permitted

Consider stage 2 first. Given (q_1, γ_2), the follower chooses $q_2 : \mathbb{R}_+ \times \Gamma_2 \to \mathbb{R}_+$ such that

$$q_2(q_1, \gamma_2) = \underset{q_2}{\text{argmax}}\, [a - b(q_1 + q_2) - c_2 - \gamma_2]q_2. \tag{1}$$

Note that if profit per unit is less than zero, retailer 2 optimally shuts down its business. The supplier wants to set $\gamma_2 : \mathbb{R}_+ \to \Gamma_2$ such that

$$\gamma_2(q_1) = \underset{\gamma_2}{\text{argmax}}\ \gamma_2 q_2(q_1, \gamma_2). \tag{2}$$

In stage 1, the leader, taking $\gamma_1 \in \Gamma_1$ as given, chooses $q_1 : \Gamma_1 \to \mathbb{R}_+$ to maximize its profit. If the leader decides to accommodate, it will choose $q_1(\gamma_1) \in [0, (a - c_2)/b)$ such that[6]

$$q_1(\gamma_1) = \underset{q_1}{\text{argmax}}\, [a - b(q_1 + q_2(q_1)) - c_1 - \gamma_1]q_1. \tag{3}$$

The supplier chooses $\gamma_1 \in \Gamma_1$ to maximize $\gamma_1 q_1(\gamma_1) + \gamma_2(q_1(\gamma_1))$ $q_2(q_1(\gamma_1), \gamma_2(q_1(\gamma_1)))$. Solving for the equilibrium yields

$$\begin{aligned} \gamma_1^{DS} &= \frac{1}{44}[21a - 20c_1 - c_2], \\ q_1^{DS} &= \frac{1}{11b}[2a - 4c_1 + 2c_2], \quad \text{and} \end{aligned} \tag{4}$$

$$\begin{aligned} \gamma_2^{DS} &= \frac{1}{22}[9a + 4c_1 - 13c_2], \\ q_2^{DS} &= \frac{1}{44b}[9a + 4c_1 - 13c_2]. \end{aligned} \tag{5}$$

Superscript '*DS*' represents the 'Discriminatory pricing' and 'Stackelberg structure'.

2.2. When price discrimination is banned

When price discrimination is not permitted, the supplier cannot offer the follower a different price, which implies that $\gamma_2 = \gamma_1 = \gamma$. If the leader decides to accommodate, it will choose $q_1(\gamma) \in [0, (a - c_2 - \gamma)/b)$, such that

$$q_1(\gamma) = \underset{q_1}{\text{argmax}}\, [a - b(q_1 + q_2(q_1, \gamma)) - c_1 - \gamma]q_1. \tag{6}$$

When the price of intermediate goods is less than $a + 2c_1 - 3c_2$, the leader decides to accommodate the follower. If the leader decides to force out the follower from the market, it chooses $\tilde{q}_1(\gamma_1) \in [(a - c_2 - \gamma)/b, \infty)$ to maximize its monopoly profit. Note that,

[2] Herweg and Müller (2012) and Dertwinkel-Kalt et al. (2013) show that, in the presence of a potential downstream entrant, banning price discrimination prevents a potential price discount to the entrant and reduces overall output and surplus. Dertwinkel-Kalt et al. (2015) posit similar welfare implications for price discrimination in an environment in which uniform pricing may degrade welfare due to higher input prices when the downstream retailers have outside options (i.e., the 'exit' threat).

[3] This assumption ensures that both retailers produce in the simultaneous contracting setting.

[4] There are studies such as McAfee and Schwartz (1994) and Rey and Vergé (2014) that focus on the case in which this assumption is relaxed and examine the issue of firms' belief about rivals' contracts.

[5] The proof of Lemma 1 follows immediately from the proofs of Observations 1 and 2 in DeGraba (1990) or Propositions 1 and 2 in Yoshida (2000) as a special case of α- and β- cost efficiencies.

[6] The leader may either accommodate the follower or drive it out of business exploiting its first mover advantage. One can easily check that to accommodate is the dominant strategy under Assumption 1 when price discrimination is allowed.