Economics Bulletin

Volume 30, Issue 4

Price discrimination in oligopoly with asymmetric firms

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Abstract

Kutlu (2009, "Price discrimination in Stackelberg competition", Journal of Industrial Economics) shows that the Stackelberg leader sells to the highest value consumers and only the Stackelberg follower practises price discrimination. We show that this result is not robust if the marginal cost of the leader is lower than that of the follower. In this situation, both the leader and the follower practise price discrimination.

I thank an anonymous referee for valuable comments and suggestions. The usual disclaimer applies.
Citation: Arijit Mukherjee, (2010) "Price discrimination in oligopoly with asymmetric firms", *Economics Bulletin*, Vol. 30 no.4 pp. 2668-2670.
Submitted: Aug 12 2010. **Published:** October 10, 2010.

1. Introduction

The literature on price discrimination considers different types of price discrimination. Stole (2007) provides a nice survey of this literature. In a recent paper, Kutlu (2009) considers second degree price discrimination in a Stackelberg model, where the firms are able to segment consumer demand by ranges of reservation price. For example, the consumers with reservation price between r_1 and r_2 pay one price, those between r_2 and r_3 pay another, and so on. In this framework, Kutlu (2009) shows that the Stackelberg leader sells to the highest value consumers and only the Stackelberg follower practises price discrimination. We show that the above result of Kutlu (2009) does not hold if the marginal cost of the leader is lower than that of the follower. In this situation, both the leader and the follower practise price discrimination.

The remainder of the paper is organized as follows. Section 2 describes the model and derives the results. Section 3 concludes.

2. The model and the results

Consider an economy with a Stackelberg leader (firm 1) and a Stackelberg follower (firm 2). We assume that the firms produce a homogeneous product with constant marginal costs. The marginal costs of firms 1 and 2 are respectively zero and c, with $c > 0$. Hence, firm 1 is more cost efficient than firm 2. We assume that each consumer buys at most one unit of the good and the consumers differ in terms of valuations.

We adopt the price discrimination model of Hazledine (2006) and Kutlu (2009). The firms know the valuations of the consumers and can prevent resale of the good. The firms divide the consumers into different groups according to their valuations. Since the main result of Kutlu (2009), which says that only the Stackelberg follower practises price discrimination, does not depend on the number of different prices or the number of consumer groups, we focus on two groups of consumers (i.e., consider two different prices) to show our result in the simplest way.

We assume that the prices for groups 1 and 2 are respectively

$$P_1 = 1 - q_1^1 - q_1^2 \tag{1}$$

$$P_2 = 1 - q_1^1 - q_1^2 - q_2^1 - q_2^2 , \tag{2}$$

where P_i is the price for group i and q_i^j is the output of firm j for group i, where $i, j = 1, 2$ and $i \neq j$.

The justification for such a setting follows from Hazledine (2006) and Kutlu (2009). Consider the airline industry, where the airline tickets are purchased in unit quantity. Consumers come to the market at different times and their valuations differ. The airlines charge different prices to consumers with different valuations.

We consider the following game. At stage 1, firm 1 determines its outputs. At stage 2, firm 2 determines its outputs and the profits are realized. We solve the game through backward induction.

Given the demand and cost functions, firm 2 determines its outputs to maximize the following expression:

$$\underset{q_1^2, q_2^2}{Max} (1 - q_1^1 - q_1^2 - c) q_1^2 + (1 - q_1^1 - q_1^2 - q_2^1 - q_2^2 - c) q_2^2 . \tag{3}$$

Straightforward calculation gives:

$$q_1^2 = \frac{(1 - c - q_1^1) + q_2^1}{3} \tag{4a}$$

$$q_2^2 = \frac{1 - c - q_1^1 - 2q_2^1}{3} . \tag{4b}$$

Firm 1 maximizes the following expression to determine its outputs:

$$\underset{q_1^1, q_2^1}{Max}(1-q_1^1-q_1^2)q_1^1+(1-q_1^1-q_1^2-q_2^1-q_2^2)q_2^1, \tag{5}$$

subject to (4a) and (4b).

The equilibrium outputs of firm 1 can be found as

$$q_1^1=\frac{1}{2} \text{ and } \quad q_2^1=\frac{c}{2}. \tag{6}$$

Hence, the equilibrium outputs of firm 2 are:

$$q_1^2=\frac{(1-c)}{6} \quad \text{and} \quad q_2^2=\frac{1-4c}{6}. \tag{7}$$

Both firms produce positive outputs for $c<\frac{1}{4}$. If $\frac{1}{4}<c$, firm 2 serves only the high value consumers. If all the outputs are positive, the equilibrium prices are $P_1=\frac{2+c}{6}$ and $P_2=\frac{1+2c}{6}$.

The following results are immediate from the above discussion.

Proposition 1: *If* $0<c<\frac{1}{4}$*, both firms produce positive outputs for both groups, and the outputs are higher for group 1, i.e.,* $q_1^1>q_2^1$ *and* $q_1^2>q_2^2$.

In contrast to Kutlu (2009), Proposition 1 shows that cost difference between the leader and the follower forces both firms practising price discrimination.

The reason for our result is as follows. While choosing output for the low-valued consumers, firm 1 considers the implication it has on the output of firm 2 for the high-valued consumers. It is clear from (4a) and (4b) that higher output of firm 1 for the low-valued consumers reduces firm 2's output for the low-valued consumers, but it increases firm 2's output for the high-valued consumers. It follows from Kutlu (2009) that, under symmetric costs, this strategic reaction of firm 2 eliminates firm 1's incentive for serving the low-valued consumers. However, cost difference between the firms forces firm 2 (the less cost efficient firm) to reduce sales to the low-valued consumers and increase those to the high value ones, thus encouraging firm 1 (the more cost efficient firm) to enter the low value segment through price discrimination.

3. Conclusion

We show that the main result of Kutlu (2009), which says that the Stackelberg leader sells to the highest value consumers and only the Stackelberg follower practises price discrimination, does not hold under cost asymmetry. Under cost asymmetry, both the leader and the follower practise price discrimination.

References

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