

Bertrand Competition under Three-part Tariffs in Vertically Related Markets

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Introduction

Nowadays contracts signed among input suppliers and final good manufacturers have become more complex, including apart from a per-unit of input price, a variety of other terms, such as: trade discounts, slotting and listing fees and other lump-sum payments.

In this paper we investigate the mode of competition that will arise in equilibrium in a vertically related market in which an upstream supplier trades with two competing downstream firms using three-part tariff contracts.

The Model

An upstream firm, U , produces, at zero marginal cost, an input that two downstream firms, D_1 and D_2 , use, in one-to-one-proportion, to produce their final goods.

Each D_i , with $i=1,2$, incurs no other cost than the cost of obtaining the input from U .

Consumers' inverse and direct demands for D_i 's final good:

$$p_i = a - q_i - \gamma q_j \text{ and } q_i = \frac{(a - p_i) - \gamma(a - p_j)}{1 - \gamma^2}, i \neq j$$

We model bargaining by invoking the Nash equilibrium of simultaneous generalized Nash bargaining problems, in which the bargaining power of U and D_i is given respectively by β and $1-\beta$ with $\beta \in (0, 1]$.

To guarantee existence and stability of all the (candidate) equilibria we assume throughout:

$$\beta \geq \bar{\beta}(\gamma) \equiv \frac{\gamma^2}{(2-\gamma)(2-\gamma^2)} \text{ and } \gamma < (\sqrt{17}-1)/4$$

Timing

Three stage game with observable actions:

St.1: U makes simultaneous take-it-or-leave-it offers to the downstream firms regarding the type of contract (p , or q) that each D_i will offer to customers and a compensation fee, G_i , to be paid by U to D_i .

St.2: U bargains simultaneously and separately with each D_i over the wholesale price, w_i , and fixed fee, F_i .

St.3: D_1 and D_2 choose each its price or its quantity, depending on the outcome of the first stage.

Note that: Trading between U and D_i takes the form of a three-part tariff contract (G_i, w_i, F_i), where G_i is a back payment by U to D_i in case that D_i complies with the 1st stage agreement.

Equilibrium Analysis

In the last stage, there are three possible subgames:

i) qq subgame: each D_i solves, $\max_{q_i} \Pi_{D_i}(q_i, q_j)$

ii) pp subgame: each D_i solves, $\max_{p_i} \Pi_{D_i}(p_i, p_j)$

iii) pq subgame: D_1 solves, $\max_{p_1} \Pi_{D_1}(p_1, q_2)$ and D_2 solves, $\max_{q_2} \Pi_{D_2}(p_1, q_2)$

In the second stage, U bargains with each D_i over (w_i, F_i) taking as given the equilibrium trading terms offered to D_j

$$\max_{w_i, F_i} [\Pi_U^m(w_i, w_j^*) + F_i + F_j^* - d(w_j^*, F_j^*)]^\beta [\Pi_{D_i}^m(w_i, w_j^*) - F_i]^{1-\beta}$$

with $m=qq, pp, pq$

Results

Lemma 1. The equilibrium wholesale prices satisfy:

$$w_1^{pp} > w_2^{pp} > 0 > w_1^{qq} > w_2^{qq}$$

Lemma 2. i) The equilibrium output and prices satisfy:

$$q_1^{qq} = q_2^{qq} > q_1^{pp} > q_2^{pp} \text{ and } p_1^{pp} > p_1^{qq} > p_2^{pp} > p_2^{qq}$$

ii) The equilibrium downstream and upstream profits satisfy:

$$\Pi_{D_1}^{qq} = \Pi_{D_2}^{qq} \equiv \Pi_{D_1}^{pp} > \Pi_{D_1}^{pp} > \Pi_{D_1}^{pp}; \quad \Pi_U^{pp} > \Pi_U^{qq} > \Pi_U^{qq}$$

iii) The joint profits of U and D_i satisfy:

$$\Pi_{U, D_1}^{pp} > \Pi_{U, D_2}^{pp} \equiv \Pi_{U, D_1}^{pp} > \Pi_{U, D_1}^{pp} > \Pi_{U, D_1}^{qq}$$

Results

Proposition 1. In equilibrium the upstream monopolist offers (p, G^*) with $G^* = \Pi_{D_1}^{pp} - \Pi_{D_1}^{pp}$ to each downstream firm and these offers are accepted by both downstream firms. Hence, Bertrand competition is established in the downstream market.

Proposition 2. Consumers' surplus and total welfare satisfy:

$$CS^{qq} > CS^{pp} > CS^{pp} \text{ and } TW^{qq} > TW^{pp} > TW^{pp}$$

Conclusions

In a vertically related market in which an upstream monopolist trades with two competing downstream firms via three-part tariff contracts, Bertrand competition arises as the equilibrium mode of competition in the downstream market.

In the presence of compensation fees that the upstream monopolist can pay back to the downstream firms, all firms are better-off when price contracts are offered in the downstream market.