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Endogenous price leadership – A theoretical and experimental analysis

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ABSTRACT

We present a model of price leadership on homogeneous product markets where the price leader is selected endogenously. The price leader sets and guarantees a sales price to which followers adjust according to their individual supply functions. The price leader clears the market by serving the residual demand. As price leaders, firms with different marginal costs induce different prices. We compare two mechanisms to determine the price leader, majority voting and competitive bidding. According to the experimental data at least experienced price leaders with lower marginal costs choose higher prices. In the bidding treatment, compensation payments to the price leader crowd in efficiency concerns.

1. Introduction

In many situations, groups elect one member as their leader, authorizing him to make decisions affecting them all. Leadership is often associated with positive attributes. But what is good for the group, may not be good for the leader and vice versa. Furthermore, heterogeneous group members usually perform differently as leaders. Whether the best candidate is selected when the leader is determined endogenously, will be analyzed theoretically and experimentally.

To study the selection of a leader in a heterogeneous group, we rely on an industrial organization model of endogenous price leadership. The literature on this subject is vast. Using an endogenous timing game, van Damme and Hurkens (1999) analyzed duopolistic quantity competition in the case of homogeneous products with linear demand and constant unit cost, with one firm being more efficient than the other. They show that risk dominance suggests that the more efficient firm will take up the leadership position. van Damme and Hurkens (2004) addressed the same question in the context of price competition in a duopoly with substitutable products, linear and symmetric demand, and constant unit cost. Again, the more efficient firm emerges as the endogenous price leader. Taking capacity constraints into account, Deneckere and Kovenock

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(1992), Furth and Kovenock (1993) and Canoy (1996) show in a variety of circumstances that in a duopolistic setting both firms prefer the more efficient firm to lead.

We deviate from this strand of literature in at least three ways. First, by relying on the model of a dominant firm with competitive fringe, we extend the price-leadership model along the lines suggested by Ono (1982) or Güth et al. (1989) and allow for more than two firms in the market, but restrict ourselves to the case of three firms in order to experimentally implement the model. Second, we account for increasing unit cost. Third, since our focus is on the incentives for voluntary cooperation via price leadership, we enrich the setup by two alternative mechanisms to endogenously select the price leader, namely majority voting and competitive bidding. By implementing the enriched model experimentally, we provide additional empirical findings to the already available experimental evidence (see, e.g., Kübler and Müller, 2002).

In our model, the price leader sets a price to which all other competitors, the followers, adjust their sales amount optimally according to their individual supply functions. To guarantee his price choice, the leader serves the residual demand.[1] Obviously, followers are interested in a high price. The highest price occurs when the lowest cost competitor acts as price leader. Asking a competitor to act as price leader is justifiable since the price leader is not forced to choose a higher than competitive price.[2] Furthermore, followers could reward the price leader by smaller than optimal quantities in case of higher than competitive prices. In line with the price leadership literature the leader is assumed to credibly commit to his price.

More basically, leadership refers to a more or less hierarchical structure of interaction. In modern market economies, entrepreneurs or chief executive officers mostly play the role of a decisive leader. Other examples are technological leaders or simply sellers who, as in our model, precommit before others. Whereas our model assumes that leader and followers determine different action variables, namely the uniform price respectively their sales quantities, most other leadership models rely on the same type of choices by leaders and followers, e.g., on markets with quantity competition or in public good experiments with "leading by example" (see Cappelen et al., 2013). In the latter type of experiments, unlike in our scenarios, the benchmark solution, which is based on common opportunism, fails to predict voluntary cooperation via leadership. We compare two mechanisms[3] to award the leadership role in price setting, one mechanism where no other reciprocation is possible than via sales reduction and one allowing to monetarily reward the price leader: majority voting (the firm with the most votes becomes price leader) and competitive bidding (sellers determine monetary compensations for the price leader). Both mechanisms share the intuition that a lower cost competitor is the more likely price leader, whereas compensation payments in the bidding treatment are expected to crowd in efficiency concerns of price leaders.

The remainder of the paper is structured as follows: In Section 2, we introduce a triopoly model of price leadership. In Section 3, we endogenize price leadership by a voting and a bidding scenario. Section 4 describes the experimental protocol. The experimental findings are presented in Section 5. Section 6 concludes.

2. The price leadership model

We focus on a homogeneous product market with three asymmetric seller firms $i = 1, 2, 3$. Market demand is assumed to be linear

$$D(p) = \max\{0, \alpha - \beta p\}; \quad \alpha, \beta > 0,$$

with $D(p)$ denoting total demand at sales price p. We rely on firm-specific quadratic cost functions

$$C_i(q_i) = (c_i + dq_i)q_i, \quad 0 \le c_i \le \frac{\alpha}{\beta}, \quad d > 0,$$

with q_i denoting the quantity produced and sold by firm $i = 1, 2, 3$. Of course, asymmetry of cost could also rely on different coefficients of the quadratic term, but as in the experiment, this generalization is avoided here to limit complexity. Firms $i = 1, 2, 3$ earn profits

$$\pi_i = pq_i - C_i(q_i).$$

For a given price, $p > c_i \; \forall i = 1, 2, 3$, each firm i would like to sell according to its individual supply function

$$q_i(p) = \frac{p - c_i}{2d}.$$

Clearing the market by equating aggregate supply

$$S(p) = \frac{3p - \sum_{i=1}^{3} c_i}{2d}$$

[1] Rather than justifying quantity setting by tatonnement adjustment or fictitious auctioneers or, more ingeniously, by first-capacity-then-price-setting models (see Kreps and Scheinkman, 1983), the model of price leadership justifies quantity competition by all but one seller (e.g., Güth et al., 1989).

[2] Choosing the competitive price allows the leader to sell his optimal quantity at this price.

[3] With unbiased random assignment as default.

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