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Endogenous price leadership

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Abstract

We consider a linear price setting duopoly game with differentiated products and determine endogenously which of the players will lead and which one will follow. While the follower role is most attractive for each firm, we show that waiting is more risky for the low cost firm so that, consequently, risk dominance considerations, as in Harsanyi and Selten (A General Theory of Equilibrium Selection in Games, MIT Press, Cambridge, MA, 1988), allow the conclusion that only the high cost firm will choose to wait. Hence, the low cost firm will emerge as the endogenous price leader.

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1. Introduction

Standard game theoretic models of oligopoly situations impose the order of the moves exogenously, an assumption that was already criticized by Von Stackelberg (1934), well before game theory invaded the field of industrial organization. Von Stackelberg pointed out that players have preferences over which role (leader or follower) to play in the game and he argued that a stable equilibrium would result only if the actual role assignment would be consistent with these preferences. As Von Stackelberg argued, in many situations both duopolists prefer the same role so that a stable situation does not appear to exist.

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In the case of quantity competition, the typical situation is that the position of leader is most preferred and that the follower's position is least desirable, with simultaneous moves resulting in intermediate payoffs. Hence, in this situation a fight—a Stackelberg war—might arise as to which of the players will assume the leadership role. In an earlier paper in this journal (van Damme and Hurkens, 1999) we addressed the question of which player will succeed in obtaining this most privileged position. We focused on the case of homogeneous products with linear demand and constant marginal cost, with one firm being a more efficient producer than the other. Using an endogenous timing game introduced by Hamilton and Slutsky (1990), we showed that committing to move early is more risky for the high cost firm, hence, that risk dominance considerations (Harsanyi and Selten, 1988) imply that the efficient firm will take up the leadership position.

In the present paper we address the same question in the context of price competition in a duopoly with differentiated substitutable products, linear and symmetric demand, and constant marginal cost. Again we assume that one firm is more efficient than the other and has lower marginal cost. The question is whether also in this case the more efficient firm will emerge as the leader in the game.

Price competition, however, is fundamentally different from quantity competition in that the leadership role now is not the most preferred one. While it is indeed true that, under general conditions, a price duopolist prefers to move first to moving simultaneously, a player can benefit even more if he can move last. (See Boyer and Moreaux, 1987; Dowrick, 1986; Gal-Or, 1985.) The basic intuition can be easily seen when firms are identical. First of all one notices that the price of the leader p^L is larger than the Nash equilibrium price p^N since the leader's total profit, taking into account the rival's optimal reaction, is increasing in his price at the Nash equilibrium. Since the follower's reaction curve is flatter than the 45 degree line, the follower's price p^F is smaller than p^L. Consequently,

$$\pi^F\left(p^L, p^F\right) > \pi^F\left(p^L, p^L\right) = \pi^L\left(p^L, p^L\right) > \pi^L\left(p^L, p^F\right) > \pi^L\left(p^N, p^N\right).$$

(The first inequality follows since p^F is on the follower's reaction curve, the second since the leader profits from a higher price of the follower, and the last since the leader could have chosen p^N instead of p^L.) Hence, if firms are identical, each firm prefers following above leading, while any sequential order is preferred above moving simultaneously. By continuity, these preferences remain when differences between the firms are not too large.[1]

As in our earlier paper, we use the "action commitment" model from Hamilton and Slutsky (1990) to determine which player will get which role. The model allows firms to choose a price either early or late; choices within a period are simultaneous, but if one firm moves early and the other moves late, the latter is informed about the former's price before making its choice. Since following confers advantages, it follows that the game has two pure equilibria corresponding to the two possible sequential orderings of the moves,

[1] Preferences of players may, however, be perfectly aligned when there are capacity constraints, since limited capacity reduces the follower's incentive to undercut the leader's price. Deneckere and Kovenock (1992), Furth and Kovenock (1992) and Canoy (1996) show, in a variety of circumstances, that both firms prefer the large firm to lead in this case, provided that capacities are sufficiently asymmetric.