Simulation of price and capacity competition in the airlines industry

Sven E. Feldmann and Bogacan Celen*

24 February 2018

Abstract We provide a simple online game that can be played in a business strategy or economics course to illustrate the incentives faced by competitors in an oligopoly industry.

Explanation of capacity constrained demand

Two firms (airlines) first choose capacity $Q_i$ and then set prices $p_i$ with which they compete. The system of demand is linear and symmetric:

$$q_1 = a - bp_1 + cp_2$$

$$q_2 = a - bp_2 + cp_1$$

As the firms’ supply is constrained by their capacity choice in the first period and cannot be negative, their actual sales are constrained by $0 \leq q^s_i \leq Q_i$.

When firm $j$’s sales are capacity constrained ($q_j > Q_j$), the excess demand will be available to firm $i$. The (implicit) price for firm $j$’s effective supply $\tilde{q}_j$ is

$$p_j = \frac{a}{b} - \frac{1}{b} \tilde{q}_j + \frac{c}{b} p_i,$$

Firm $i$’s effective demand as a function of firm $j$’s (potentially constrained) supply is

$$q^D_i = \frac{b + c}{b} a - \frac{b^2 - c^2}{b} p_1 - \frac{c}{b} \tilde{q}_j$$

where $\tilde{q}_j = \max\{\min\{q_j, Q_j\}, 0\}$. Notice that $q^D_i > q_i$ whenever firm $j$’s capacity constraint binds.

Finally, firm $i$’s supply may also not exceed its capacity and must be non-negative. Hence firm $i$’s supply (sales) is

$$q^s_i = \max\{\min\{q^D_i, Q_i\}, 0\}.$$

*Melbourne Business School