

# 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:

$$q_1 = a - bp_1 + cp_2 \quad (1)$$

$$q_2 = a - bp_2 + cp_1 \quad (2)$$

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

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

$$p_j = \frac{a}{b} - \frac{1}{b}\tilde{q}_j + \frac{c}{b}p_i, \quad (3)$$

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

$$q_i^D = \frac{b+c}{b}a - \frac{b^2-c^2}{b}p_1 - \frac{c}{b}\tilde{q}_j \quad (4)$$

where  $\tilde{q}_j = \max\{\min\{q_j, Q_j\}, 0\}$ . Notice that  $q_i^D > q_i$  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

$$q_i^s = \max\{\min\{q_i^D, Q_i\}, 0\}.$$

---

\*Melbourne Business School