Airline Market Power and Airport Regulation

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Konferenz „Verkehrsökonomik und –politik“

Berlin, June 14-15, 2018

The Problem

Airport services as typical inputs for airlines

Market power in the market for the final commodities may:

- Change optimal congestion charges (Brueckner, 2002; Brueckner & Van Dender, 2008)
- Change optimal Ramsey prices (Laffont & Tirole, 2000; Hart & Tirole, 1990)
- Even manipulate congestion tolls (Brueckner & Verhoef, 2010)
- What about airport regulation?

The Problem

- Typical reason for airport regulation: Danger of monopolistic pricing (Natural monopoly; non-contestable and possibly non-sustainable markets)

- Reasons that an unregulated airport will not charge (some) airlines too high:
  - Airport competition
  - Political economy
  - Vertical integration & Foreclosure (Hart & Tirole, 1990; Rey & Tirole, 1996)
  - Mono- or oligopsony airline power (Starkie, 2001, 2002, 2012; Button, 2012)

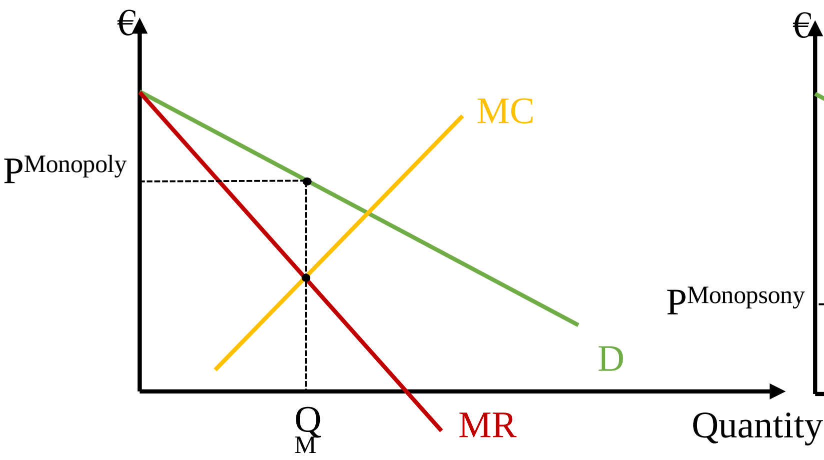
In this presentation:

- Modification of existing model (Oum et al. 2004)
- Mono- and oligopsony airline power (Insights from tolling literature)

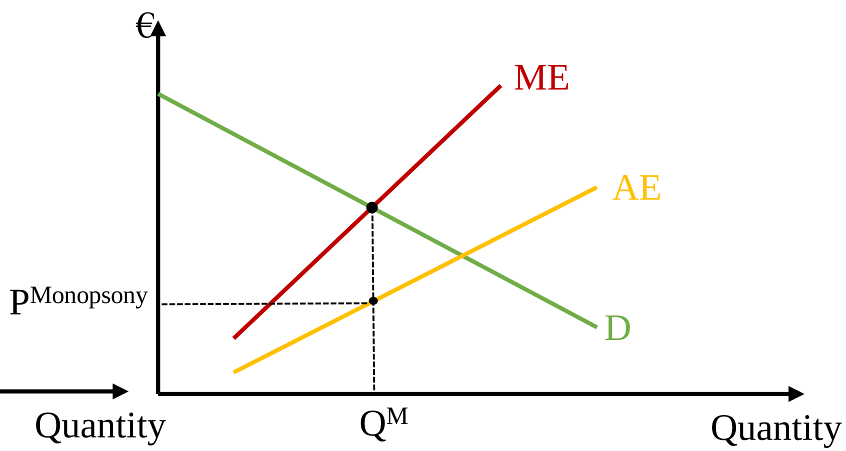
The Problem

In this presentation:

Monopoly



Monopsony



Model set-up

Passengers

- Pay the full price ϱ (fare and delay)
- Thus: Full price ϱ determines flight volume Q, with: $\frac{\partial Q}{\partial \varrho} < 0$

Airlines

- Delay costs depending on flight volume and the airport capacity K : $D(Q, K)$

Airport

- Sets landing fee P; Operating costs for aeronautical services: $\mathrm{C}(\mathrm{Q})$
- In addition: $\frac{\partial D}{\partial Q} > 0; \frac{\partial D}{\partial K} < 0; C' > 0.$
- Has r capital cost.

Model set-up

Airport

- Sets price for concession services u, so that demand for concession services is: $\mathrm{X}(u)$. Cost for concession services: $\mathrm{c}(X)$
- $c' > 0; X' < 0.$

The profit maximizing airport:

$$\max_{P,u,K} PQ - C(Q) - Kr + Q[uX - c(X)]$$

After deriving the FOC's we obtain for P:

$C' + Q\frac{\partial D}{\partial Q}$=SMC

$\frac{P}{\varepsilon}$= Airport Market Power

$$P_\pi = C' + Q\frac{\partial D}{\partial Q} + \frac{P}{\varepsilon} - R$$

Per flight concession profits

The bilateral monopoly case

For bilateral monopoly cases: Possibility of no equilibrium (Myerson & Satterthwaite, 1983).

Thus, alterations:

- The airline has an exit option
- Knowing this: The airport sets the landing fee P: $P(Q,K)$

The airport profit function:

$$\pi_{AP} = P(Q,K)Q - C(Q) - Kr + Q[uX(u) - c(X(u))]$$

The bilateral monopoly case

Transforming the FOC's we get:

Same as in the monopoly case

Additional Discount

$$P_m(.) = C' - R - \frac{\partial P}{\partial Q} Q = \frac{C' - R}{1 + \frac{1}{\eta}}$$

Discount depends on the supply elasticity η.

$$u_m = c' + \left(\frac{X}{-X'} \right)$$

$$r_m = \frac{\partial P}{\partial K} Q$$

Two Airlines

Flight volume Q depends on the form of competition between airlines:

Two possibilities: a) Cournot b) Stackelberg

Ad a) Cournot competition (insights from tolling literature, in particular Brueckner & Van Dender, 2008)

- Q_1, Q_2: Flight volumes by airline 1 resp. airline 2
- Passengers pay the full price φ (fare and delay)
- Delay costs for passengers: $\mathrm{t}(Q_1 + Q_2)$
- Delay costs for airlines: $\mathrm{g}(Q_1 + Q_2)$
- Combined (airlines and passengers) delay costs per flight: $\mathrm{M}(Q_1 + Q_2)$

Two Airlines

- Seat capacity per aircraft: s
- Operating cost: τ
- Landing fees for airlines: $P_{1,2}(Q_1, Q_2, K)$ (1, 2 denotes the airline)
- Symmetric airlines

Airline profit function:

$$\pi_1 = \varphi s Q_1 - M(Q_1 + Q_2)Q_1 - \tau s Q_1 - P_1(Q_1, Q_2, K)Q_1$$

Impact of Q_1 on congestion for 1

Impact of Q_1 on the landing fee

The FOC yields:

$$\varphi_{1_{Cournot}} = \tau + \frac{M'Q_1 + M(.) + \frac{\partial P_1}{\partial Q_1} + P_1(.)}{s}$$

Two Airlines

The airport profit function

$$\pi_{AP} = P(Q_1 + Q_2, K)(Q_1 + Q_2) + (Q)[uX(u) - c(X(u))] - Kr - C(Q)$$

The optimal landing fee is obtained from FOC's:

Additional discount, similar to the monopsony case

$$P_{1_{Cournot}}(.) = C' - R - \frac{\partial P}{\partial Q} Q_1$$

All others remain the same as before.

Assuming symmetry: $P_{Cournot}(.) = C' - R - \frac{\partial P}{\partial Q}\frac{1}{2}Q$

Thus: $P_{Monopsony} < P_{Cournot}$

Two Airlines

Ad b) Stackelberg Duopoly

Similar as in Cournot, but now, airline 1 is the leader and airline 2 is the follower. The follower considers the output of airline 1 as parametric, thus, choosing its volume given the volume of airline 1.

$$\pi_2 = \varphi s Q_2 - M(Q_1 + Q_2)Q_2 - \tau s Q_2 - P_2(Q_1, Q_2, K)Q_2$$

Totally differentiating the FOC, we get:

$$\frac{\partial Q_2}{\partial Q_1} = -\frac{M' + M''Q_2 + \frac{\partial^2 P_2}{\partial Q_2 \partial Q_1} Q_2 + \frac{\partial P_2}{\partial Q_1}}{2M' + M''Q_2 + \frac{\partial^2 P_2}{\partial Q_2^2} Q_2 + 2\frac{\partial P_2}{\partial Q_2}}$$

$\frac{\partial Q_2}{\partial Q_1}$ is negative. If airline 1 increases Q_1 , airline 2 will decrease Q_2

Two Airlines

Ad b) Stackelberg Duopoly

Assuming zero second order derivatives gives:

$$\frac{\partial Q_2}{\partial Q_1} = -\frac{M' + \frac{\partial P_2}{\partial Q_1}}{2M' + 2\frac{\partial P_2}{\partial Q_2}}$$

$\frac{\partial P_2}{\partial Q_2}$: change in the airport charge of carrier 2 when altering the flight volume of carrier 2

$\frac{\partial P_2}{\partial Q_1}$: change in the landing fee of carrier 2 when airline 1 chooses to shift its number of flights.

Since airline 1 is the leader: $\frac{\partial P_2}{\partial Q_2} > \frac{\partial P_2}{\partial Q_1}$

Two Airlines

Ad b) Stackelberg Duopoly

Airline 1 anticipates the behavior by airline 2 and behaves accordingly:

The FOC: $\varphi s - M' \left[1 + \frac{\partial Q_2}{\partial Q_1}\right] Q_1 - M(.) - \tau s - \left[\frac{\partial P_1}{\partial Q_1} + \frac{\partial P_1}{\partial Q_1}\frac{\partial Q_2}{\partial Q_1}\right] Q_1 - P_1(.) = 0$

Compared to Cournot:

$$\left[\frac{\partial P_1}{\partial Q_1} + \frac{\partial P_1}{\partial Q_1}\frac{\partial Q_2}{\partial Q_1}\right] Q_1 < \frac{\partial P_1}{\partial Q_1} Q_1$$

Airline 1 will have less interest in keeping landing fees low. Airline 2 will offset a part of flight volume reduction by airline 1.

Two Airlines

Ad b) Stackelberg Duopoly

Since both flight volumes are different, the airport may discriminate landing fees:

$$\pi_{AP} = P_1(Q_1, Q_2, K)Q_1 + P_2(Q_1, Q_2, K)Q_2 + (Q)\left[uX(u) - c\big(X(u)\big)\right] - Kr - C(Q)$$

Which derives the aeronautical charge for airline 1:

Impact of Q_1 on P_1

$$P_{1_{Stackelberg}}(.) = C' - R - \frac{\partial P_1}{\partial Q_1}Q_1 - \frac{\partial P_2}{\partial Q_1}Q_2$$

Impact of Q_1 on P_2

The airport rewards Airline 1 for its impact on P_2

Further limitation of monopsony power. Signaling?

A competitive fringe

Similar to Stackelberg, but now airline 2 is a group of small airlines

No carrier representing airline 2 has the power to negotiate with the airport. Thus, they consider the airport charge to be parametric.

Profit function of airline group 2:

$$\pi_2 = [\varphi s - M - \tau s - P_2]Q_2$$

For the airport: P_2 will depend on total volume Q_2. Thus, we can derive:

Any attempt by airline 1 to influence P_1 will be offset by airlines from group 2. Thus, buying power for carrier 1 practically vanishes and the result reflects the atomistic carrier case.

Regulation

We have seen:

- In the extreme case of monopsony power: Discount
- As we relax more and more assumptions: Discount decreases and landing fees increase.
- For the competitive fringe case: No buying power

What about airport regulation? (for details see Evangelinos & Szilvay, 2018)

Regulation

A regulator should additionally to the known problems of:

- Regulatory commitment
- Investment risks
- Information on CAPEX, OPEX, elasticities etc.
- Forecasts; possibly sharing rules etc.

A) Understand the competition game and its impact on landing fees

B) Understand the offsetting behavior by airlines.

CAN HE REALLY UNDERSTAND THIS?

IS “GOOD” AIRPORT REGULATION STILL POSSIBLE?

Thank you for attention

Many thanks to: Eric Pels and Stefan Tscharaktschiew