Atomistic Congestion Tolls at Concentrated Airports?

Seeking a Unified View

In the Internalization Debate

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joint with Jan Brueckner – cf. working paper

- Are **marginal congestion costs** at commercial **airports** (mostly) **internal** or **external**?
  - Academic debate,
  - Obvious impact on policy recommendations,
  - Depends on market structure and substitutability.

- the debate, the model, the results
The debate

Daniel, 1995: “no internalization” hypothesis provides better empirical fit for MSP; competitive fringe explanation

Daniel & Harback, 2007: further empirical support (more airports)

Brueckner, 2002: theoretical model, empirical illustration: partial internalization

Mayer & Sinai, 2003: empirical evidence for partial internalization

…simple, unified framework showing the sources of theoretical disagreement
The model

- 1 airport, 2 airlines (1 and 2), 1 period (congested).

- A. perfectly elastic demand (eliminate market power),
  perfect substitutes;

- B. imperfectly elastic demand,
  perfect substitutes;

- C. imperfectly elastic demand,
  differentiated products
Airline profit function:

\[
\pi_i = [p - t(f_1 + f_2)] s f_i - [\tau s + g(f_1 + f_2)] f_i, \ i = 1, 2
\]

or

\[
\pi_i = (p - \tau) s f_i - c (f_1 + f_2) f_i, \ i = 1, 2
\]

where

\[
c(f_1 + f_2) \equiv s t (f_1 + f_2) + g(f_1 + f_2)
\]

\[c > 0 \text{ and } c \geq 0 \text{ when } c \text{ is positive}\]
The results

A. Perfectly elastic demand, perfect substitutes: 4 cases

A.1. Social optimum: \[ p - \tau - \left[(f_1 + f_2)c + c\right]/s = 0 \]

A.2. Cournot duopoly: \[ p - \tau - [f_1c + c]/s = 0 \]

\[ T = f^*c'(2f^*) = 0.5 \text{MCD}^* \]

(partial internalization)
A.3. Stackelberg leader (1),

\[ p - \tau - \frac{1}{s}[f_1 c'(1 + \frac{\partial f_2}{\partial f_1}) + c] = 0 \]

\[ T_1 = 0.5(1 + \lambda^*)MCD^* \]

Toll between Cournot and Pigouvian value.

Cournot follower (2):

\[ p - \tau - \frac{f_2 c' + c}{s} = 0 \]

A.4. Stackelberg leader (1),

\[ p - \tau - \frac{c}{s} = 0 \]

Competitive fringe (2):

\[ p - \tau - \frac{c}{s} = 0 \]

Pigouvian tolls required.
B. Imperfectly elastic demand, perfect substitutes;

demand function \( d[s(f_1 + f_2)] \), \( d' < 0 \)

B.4. Stackelberg leader (1),

\[ d - \tau - c/s = 0 \]

Competitive fringe (2):

\[ d - \tau - c/s = 0 \]

No mark-up.
Pigouvian tolls required.
C. Imperfectly elastic demand, imperfect substitutes (independent demand)

Demand functions $p_1 = d_1[sf_1]$, $p_2 = d_2[sf_2]$, $d_1' < 0$, $d_2' < 0$

C.4. Leader (1),

$$d_1 + sf_1d_1' - \tau - \frac{1}{s} \left[ f_1c' \left( 1 + \frac{\partial f_2}{\partial f_1} \right) + c \right] = 0.$$  

Toll between Cournot and Pigouvian value.

Fringe (2):

$$d_2 - \tau - c/s = 0$$

Pigouvian toll.

This generalizes to the case of imperfect substitutes.
Which model describes reality best?

- Market structure may differ across airports.
- Air travel is a commodity, but consumer loyalty programs limit substitution.
- The welfare loss from inappropriately charging atomistic tolls may be small (Morrison and Winston, 2006).
- US is not EU: different runway allocation mechanisms