ITEA ANNUAL CONFERENCE AND SCHOOL ON TRANSPORTATION ECONOMICS

HONG KONG 2018

School: 25-27 Jun • Conference: 27-29 Jun
The Hong Kong Polytechnic University

We are pleased to announce that the 2018 Annual School and

The conference and school will be hosted by the Department of
Logistics and Maritime Studies at the Faculty of Business of The
Hong Kong Polytechnic University. The two and a half-day
Airport City-center Rivalry

Achim I. Czerny and Hanxiang Zhang
(Both) Hong Kong Polytechnic University
Department of Logistics and Maritime Studies

Brookings Tsinghua Center Conference 2017
Tsinghua University, 15-16 Sept 2017
“Air Transportation Issues in China and Other Countries”
Introduction
Global Airport Revenues (2015) €152bn

- Non-operating revenue: 4%
- Non-aeronautical revenue: 40%
- Aeronautical revenue: 56%

Source: 2017 ACI Economics Report
Conventional wisdom: Revenue and airport output

Reality: Aero is growing at a faster rate than commercial/non-aero

6% aero vs. 5.5% non-aero growth in 2013

Source: Lucas and Lioutov, ACI World
Table 2: Regional distribution of non-aeronotical revenues (% of total non-aeronotical revenue, 2013)

<table>
<thead>
<tr>
<th>Region</th>
<th>Retail concessions</th>
<th>Food and beverage</th>
<th>Car parking*</th>
<th>Rental car concessions</th>
<th>Advertising</th>
<th>Fuel and oil</th>
<th>Aviation catering services</th>
<th>Utility recharges</th>
<th>Property and real estate revenue or rent</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>37.1%</td>
<td>1.3%</td>
<td>15.1%</td>
<td>3.9%</td>
<td>7.1%</td>
<td>3.2%</td>
<td>0.3%</td>
<td>4.4%</td>
<td>14.9%</td>
<td>12.6%</td>
</tr>
<tr>
<td>Asia-Pacific</td>
<td>39.7%</td>
<td>3.4%</td>
<td>9.2%</td>
<td>1.2%</td>
<td>4.5%</td>
<td>1.7%</td>
<td>0.5%</td>
<td>4.1%</td>
<td>27.9%</td>
<td>7.9%</td>
</tr>
<tr>
<td>Europe</td>
<td>34.6%</td>
<td>4.8%</td>
<td>15.1%</td>
<td>2.2%</td>
<td>2.2%</td>
<td>0.8%</td>
<td>0.3%</td>
<td>5.6%</td>
<td>18.7%</td>
<td>15.7%</td>
</tr>
<tr>
<td>Latin America-Caribb.</td>
<td>25.3%</td>
<td>6.0%</td>
<td>8.9%</td>
<td>2.6%</td>
<td>4.7%</td>
<td>3.6%</td>
<td>0.4%</td>
<td>1.8%</td>
<td>13.1%</td>
<td>33.6%</td>
</tr>
<tr>
<td>Middle East</td>
<td>48.6%</td>
<td>4.9%</td>
<td>7.7%</td>
<td>2.2%</td>
<td>3.0%</td>
<td>7.0%</td>
<td>1.4%</td>
<td>2.7%</td>
<td>10.7%</td>
<td>11.9%</td>
</tr>
<tr>
<td>North America</td>
<td>8.3%</td>
<td>7.1%</td>
<td>39.3%</td>
<td>16.6%</td>
<td>5.7%</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>13.5%</td>
<td>9.4%</td>
</tr>
<tr>
<td>World</td>
<td>27.7%</td>
<td>5.2%</td>
<td>20.3%</td>
<td>6.2%</td>
<td>3.9%</td>
<td>1.1%</td>
<td>0.3%</td>
<td>3.4%</td>
<td>18.3%</td>
<td>13.7%</td>
</tr>
</tbody>
</table>

*: Car parking revenue includes revenue from airport-operated parking lots and car parking concession revenue.

Source: ACI (ACI Airport Economics Survey – 2014)
SAVE UP TO 30% COMPARED TO DOWNTOWN PRICES

AIRPORT HOT PICKS
SAVE 30%
I have a 2 day layover in Singapore & wanted to ask if there was much difference in cosmetics shopping between the airport & the city centre? As in Korean brands like Laneige etc as it's harder to buy this where I'm from.

Thank you.

Hi,

Based on my experience on SK-II and other cosmetics that I had bought from duty free changi airport cosmetic much cheaper compare to city.

It is much cheaper than in the city.
Associated Venues

Glatt - Your First Shopping Destination

MALLS & SHOPPING CENTRES

Newe Winterthurerstrasse 99, Wallisellen

This is Switzerland's most popular shopping mall. There are typical Swiss shops as well as international brands, watches and jewellery shops and...

see more

FEATURED

Shopping in the Airside Center at Zurich Airport

MALLS & SHOPPING CENTRES

Zurich Airport

Zurich airport's passenger area is a shopping centre too! And quite a large one, in fact: more than 60 shops are located in the Airside Center...

see more

FEATURED

Bahnhof Stadelhofen

MALLS & SHOPPING CENTRES

Stadelhoferstrasse 8

22 shops in the underground of the Stadelhofen railway station, built by famous Spanish architect Santiago Calatrava. Big grocery store as well as...

see more

FEATURED

Europaallee Passage

MALLS & SHOPPING CENTRES

See more
Other examples

• Vancouver airport: city-center prices upper limit
• Atlanta airport: city-center price plus 10 percent upper limit
Literature, research objectives, agenda
Literature

- Zhang and Zhang, 1997: Social max (myopic)
- Starkie, 2001: Profit max, graphical analysis
- Zhang and Zhang, 2003 and 2009: Profit max ≠ social max (myopic)
- Czerny, 2006: Non-aero business increase profit-max aero charge (foresigh)
- Czerny, 2009 and 2013: Inside and outside airport area supply
- D’Alfonso, Jiang, Wan, 2013: congestion effects on non-aero demand
- Czerny and Lindsey, 2014: Profit-max non-aero price can be zero (foresigh)
- Flores-Fillol, Iozzi, Valetti, 2015: Unifying framework (myopic/foresigh)
- D’Alfonso, Bracaglia, Wan, 2016: Non-travelers’ demand for non-aero supply
- Kidokoro, Lin, Zhang, 2016: Endogenous non-aero capacity, self-financing
Research Objectives

• Characterize equilibrium airport pricing when airports and city-center companies have market power
• Evaluate equilibrium pricing behavior from the social viewpoint
Agenda

• Basic model (unit demands, myopic passengers)
• Myopic passengers
• Foresighted passengers
• Extensions
  • Downward sloping individual demands for “the good” (revised... error in first paper version)
  • Price-regulation (new... important to relate results to real world)
  • Preference for ancillary relative to city-center goods (revised... to make it more realistic)
  • Airline market power
• Conclusions and avenues for future research
Basic model (myopic)
Features

- $r$: airport charge
- $p_a$: ancillary charge
- $p_c$: city-center price
- $T$: travel cost to airport from city center
- $p+T$: generalized price (myopic pax, ancillary and city-center prices don’t enter)
- $q$: passenger quantity
- $\overline{B} = B + qT$: Strictly concave passenger benefits from traveling
- $u$ with $u < T$: Good’s utility
- $Q$: city-center population
Demands and profits

• D with D(r): Passenger demand determined by B’=r

\[
d_a(r, p_a, p_c) = \begin{cases} 
0 & \text{for } p_a > p_c \cup p_a > u \\
D & \text{for } (p_c > u \cap u \geq p_a > u - T) \cup (u \geq p_c \geq p_a \cap u \geq p_a \geq p_c - T) \\
Q & \text{for } (p_c > u \cap u - T \geq p_a) \cup (u \geq p_c > p_a + T).
\end{cases}
\]  

\[
d_c(r, p_a, p_c) = \begin{cases} 
0 & \text{for } p_c > u \cup u \geq p_c \geq p_a + T \\
Q - d_a & \text{for } u \geq p_c \geq p_a \cap u \geq p_a \geq p_c - T \\
Q & \text{for } u \geq p_c \cap p_a > p_c.
\end{cases}
\]

\[
\Pi_a(r, p_a, p_c) = rD(r) + p_a d_a(r, p_a, p_c).
\]

\[
\Pi_c(r, p_a, p_c) = p_c d_c(r, p_a, p_c).
\]
Best responses

• Airport

\[(r(p_c), p_a(p_c))^{br} = (-D/D' - \min \{u, p_c\}, \min \{u, p_c\})\]  \hfill (8)

• City-center

\[\tilde{p} = u \frac{(Q - D)}{Q},\]  \hfill (9)

\[p_c^{br}(r, p_a) = \begin{cases} 
    p_c & \text{for } p_a < u - T \\
    u & \text{for } \begin{cases} 
        p_a > u \\
        \cup (u - T \leq p_a \leq \tilde{p})
    \end{cases} \\
    p_a - \varepsilon & \text{for } \tilde{p} < p_a \leq u.
\end{cases}\]  \hfill (10)
Missing equilibrium in pure pricing strategies and restoring assumption

**Assumption 1** The city population is large enough in the sense that $Q \geq uD/\varepsilon$ for $\varepsilon \to 0$. 
Results for myopic passengers

Proposition 1 For myopic passengers and given Assumption 1, an equilibrium in pure pricing strategies exists where the ancillary price and the city-center price are determined by the good’s utility, \( u \), that is, \( p_a^N = p_c^N = u \), and the airport charge is reduced by an amount that is equal to the good’s utility relative to a situation where ancillary businesses are absent, \( r^N = -D/D' - u \).

\[
W(q, q_a, q_c) = B(q) + (q_a + q_c) u
\]  
(18)

Proposition 2 For myopic passengers and given Assumption 1, airport and city-center prices maximize welfare if \( u = -D/D' \) in equilibrium, while passenger quantities are excessive or too low from the social viewpoint if \( u > -D/D' \) or \( u < -D/D' \) in equilibrium, respectively.
Intuition

• Profit-max ancillary price depends on $u$
• Welfare-max ancillary price equal to marginal costs and independent of $u$
• $u$ can be such that profit-max airport charge is socially optimal
Foresighted
Generalized price

\[ \eta(r, p_a, p_c) = \begin{cases} 
  r + T & \text{for} \ p_a > u \\
  r - (u - p_a) + T & \text{for} \ p_a \leq u, \ p_c > u \\
  r + (p_a - p_c) + T & \text{for} \ p_a \leq p_c \leq u.
\end{cases} \]  

(19)

Airport best responses

\[ (r(p_c), p_a(p_c))^{br} = \{(r, p_a) : (\min \{u, p_c\} \geq p_a > \min \{u, p_c\} - T) \cap (r + p_a = -D/D')\} \] 

(21)
Results for foresighted passengers

Proposition 3 For foresighted passengers and given Assumption 1, there exists a set of equilibria in pure pricing strategies, which can be described by \( \{ (r^N, p_a^N) : r + p_a = -D/D', u - T \leq p_a \leq u \} \) and \( p_c^N = u \).

welfare-maximization requires \( \eta(r^N, p_a^N, u) = r^N + p_a^N - u = 0 \) \with \( \eta = \eta - T \)

Proposition 4 For foresighted passengers and given Assumption 1, equilibrium airport and city-center prices maximize welfare if \( u = -D/D' \) in equilibrium, while passengers quantities are excessive or too low from the social viewpoint if \( u > -D/D' \) or \( u < -D/D' \) in equilibrium, respectively.
Intuition

• Profit-max sum of airport charge and ancillary price independent of $u$
• Welfare-max generalized price depends on $u$
• $u$ can be such that profit-max airport charge is socially optimal
Extensions
Downward sloping demands

New (adjusted) generalized price of traveling

\[ \eta(r, p_a, p_c) = r - (cs(p_a) - cs(p_c)) \]  \hspace{1cm} (23)

\[ W(q, q_a, q_c) = W(q, q\delta(0), (Q - q_a)\delta(\bar{p})) = B(q) + qb(\delta(0)) + (Q - q) b(\delta(\bar{p})). \] \hspace{1cm} (24)

**Proposition 5** Consider downward sloping individual demands for the good, \( \delta(p_i) \). With myopic and foresighted passengers, it holds that the welfare-maximizing airport charge can be achieved when the absolute value of the inverse semi-price elasticity of passenger demand, \(-D/D'\), is equal to the profit per customer, \(-\delta^2(\bar{p})/\delta'(\bar{p})\), in equilibrium, while the equilibrium ancillary and city-center prices are excessive from the social viewpoint only if passengers are myopic because profit-maximizing ancillary prices are welfare-maximizing in equilibrium if passengers are foresighted.
Price regulation

• Airports worldwide generate more than 20 percent of their non-aeronautical revenues by car parking (Airports Council International, 2015).

• Consider an upper limit on aeronautical charges

\[ r \leq \bar{r}. \]

• Results on the previous slides change.
Preference for ancillary good

Figure 4: Airport versus city-center utilities
Airline market power

• Airline market power: Socially optimal airport charge tends to be reduced and (most likely) negative
Conclusions
Conclusions

• Equilibrium airport pricing is not per se excessive
• Welfare evaluation of equilibrium profit-maximizing airport tends to be improved by passenger foresightedness
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