

Effects of Airport Pricing and Regulation on LCC-FSA Competition

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Outline

- I. **Background and Sydney Airport Case**
- II. Purpose of the paper
- III. Differentiated Duopoly Model
- IV. Numeric Simulation And Sensitivity Analysis
- V. Conclusion and Future Research

Airport Regulation

Some economists question whether price regulation of privatized airports is necessary:

1. Profitable concession business moderates incentives for monopoly pricing as airport mgt takes advantage of demand complementarity between airside and concession demands

- Increasing share of airport revenues comes from concession and other non-aviation activities;
- Under single-till price-cap regulation, airport may need to charge a negative landing fees when concessions become very profitable (e.g., Heathrow)

2. Cost of regulation

- A-J effect for rate of return; possibility of less than optimal investment in the long run under price-cap (Oum, Zhang, Zhang, 2004);
- Expensive and cumbersome regulatory administration

3. “Threat of regulation” may be enough to induce good behavior of airports mgt

Issues on Airport Regulation – cont'd

Most countries adopted some form of price regulation on privatized airports: U.K., Ireland, Denmark, Italy, Austria, Swiss, etc.

Exceptions: NZ, Australia – currently no formal price regulation:

- Some call “light handed regulation”: i.e. regulation without teeth: Monitoring prices and releasing information
- Promise of future review to see whether regulation needs to be introduced

Canada: currently no formal regulation on airports, which are run by not-for-profit local airport authorities who are allowed to make profit

Issues on Airport Regulation – cont'd

Australia ended price-cap regulation on all privatized airports for a provisional period of five years beginning July, 2002:

1. Airports required to report user charges and accounting and financial information to government;
2. ACCC, the de-facto regulator, can monitor and publish airport operations. It can not give directions.
3. **Threat of re-regulation:** Independent review planned after 5 years to determine whether regulation is necessary –

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Sydney Airport (SACL) Case

Virgin Blue filed a case against **Sydney Airport**: to **Declare the SACL's airside services under the Trade Practices Act, 1974, of Australia.** This would require SACL mgt to settle any future changes of airside service charges via negotiation with airlines.

Virgin Blue (VB) claims:

- **SACL has incentive and ability to increase airport charge substantially beyond competitive level**
- **Incentives for increasing concession profits is not sufficient to constrain SACL management from increasing airside service charges (including landing fees) substantially beyond the current levels (Oum, Zhang, Zhang, 2004)**
- **Airside price increase will harm competition in the downstream airline markets to/from Sydney Airport by harming VB's ability in compete with Qantas**

Interesting: Qantas joined and supported VB Case against SACL.

II. Purpose of This Paper

Main Question addressed in the paper: **Does an airport's pricing affect the competition in downstream airline markets?**

- **If yes, then the welfare effect of not regulating a monopoly airport's pricing would be greater than initially considered**
- **Our paper is the first attempt to incorporate the effects of downstream airline market competition in the analysis of airport price regulation** : other industries with similar downstream markets – Rail track, IT/telecom tie lines; Electric power transmission line, etc.

Our Approach to Modeling

Since Qantas (an FSA with national and international network) and Virgin Blue (a successful LCC with national network) are the two main competitors in Australian domestic markets to/from Sydney, we focus on analyzing the effect of substantially increasing airside user charges on Qantas (QA) and Virgin Blue (VB);

If an increase in airside user charges harms Virgin Blue (LCC) more than Qantas (FSA), then competition in the downstream airline markets would be harmed;

Our analysis includes:

- **Obtain analytical results by constructing a duopoly competition model (differentiated products case);**
- **Numerical simulations to obtain values of differential effects on outputs, prices, and profitability of QA and VB, when we increase airside user charges substantially.**

Difficulties we faced

Most US studies on LCCs use Fare Regressions instead of oligopoly modeling (they have longer LCC history)

For us, rich confidential Data available only for a short period of 11 months ending Feb 2004) furthermore,

- **FSA's prices and market share, both, were declining while LCC was gaining market share at fairly stable price!**
- Temp equilibrium may have existed only at the end of our data period, but sample size too small to do any statistical tests

⇒⇒⇒ **impossible to do any** econometric estimation;

Our approach: Duopoly model with plausible conduct Parameters

Airline duopoly model work: Brander and Zhang (1990, 1993) and Oum, Zhang and Zhang (1993) on FSA duopoly – econometric work on AA-UA

Tim Hazledine etc. (1999, 2001) based on model calibration

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III. Differentiated Product Duopoly FSA (firm 1) vs. LCC (firm 2)

Differentiated duopoly facing linear demands:

$$p_1 = a_1 - b_1q_1 - kq_2$$

$$p_2 = a_2 - kq_1 - b_2q_2$$

Assumptions:

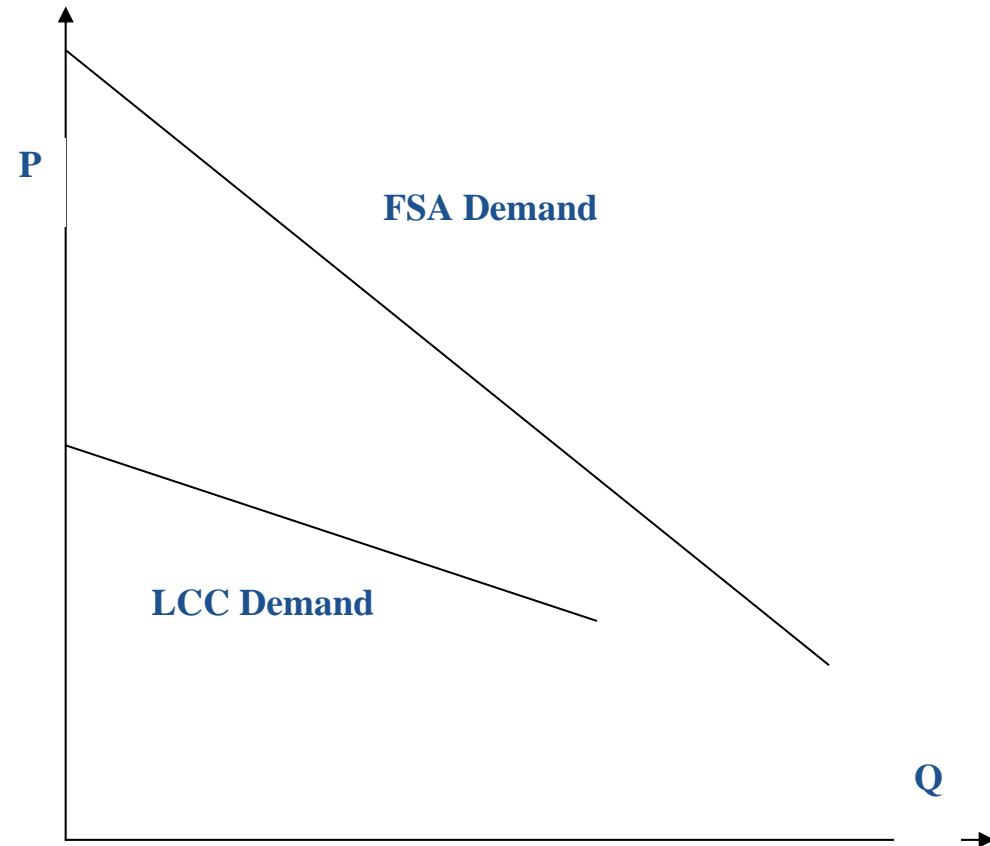
(1) $b_1b_2 - k^2 > 0$

(2) $(a_1b_2 - a_2k) > 0$ $(a_2b_1 - a_1k) > 0$

(3) $a_1 > a_2 > c_1 > c_2$

$$b_1 > b_2 > k > 0$$

(4) $-1 \leq v_i \leq 0$



(1) Concave utility function; (2) Positive outputs for both firms;
(3) LCC serves more price sensitive demands; (4) No collusion

Duopoly Model with Differentiated Products

$$\begin{aligned}\text{Max } \pi_i &= p_i(q_1, q_2)q_i - c_i(q_i) \\ &= (a_i - b_i q_i - kq_j)q_i - c_i(q_i)\end{aligned}$$

$i, j = 1(\text{FSA}), 2(\text{LCC})$

Where $p_1 = a_1 - b_1 q_1 - kq_2$

$$p_2 = a_2 - kq_1 - b_2 q_2$$

FOC:

$$(12) \quad \begin{cases} a_1 - (2b_1 + kv_1)q_1 - kq_2 - c_1 = 0 \\ a_2 - kq_1 - (2b_2 + kv_2)q_2 - c_2 = 0 \end{cases}$$

Duopoly Model with Differentiated Product - cont'd

We use a firm's conjectural variation (v_i) as a summary measure of its competitive strategy, indicating how aggressively the firm reacts to competition. Thus, we call it '*Conduct Parameter*':

$$v_i = \frac{dq_j}{dq_i} \quad -1 \leq v_i \leq 0$$

Value of conduct parameter indicates how aggressively a firm responds to competition:

$$v_i = -1 \quad (\textit{Bertrand Competition})$$

$$v_i = 0 \quad (\textit{Cournot Competition})$$

$$v_i = 1 \quad (\textit{Cartel} = \textit{perfect collusion})$$

Analytical (Comparative Statics) Results on Outputs and Prices

When there is an identical cost increase, dc ,

$$dq_1 = \left(\frac{\partial q_1}{\partial c_1} + \frac{\partial q_1}{\partial c_2} \right) dc = - \frac{n - k}{mn - k^2} dc$$

$$dq_2 = \left(\frac{\partial q_2}{\partial c_1} + \frac{\partial q_2}{\partial c_2} \right) dc = - \frac{m - k}{mn - k^2} dc$$

where

$$m = (2b_1 + kv_1) > b_1 > k > 0$$

$$n = (2b_2 + kv_2) > b_2 > k > 0$$

Differentiated Product Duopoly

Output reduction depends on demands and firm conduct:

(a) LCC loses more outputs, $|dq_2| > |dq_1|$

if the following condition on product differentiation holds: $(a_1 - c_1) > (a_2 - c_2)$, i.e., FSA's demand curve is steeper than LCC's,

(b) Firm who competes more aggressively would lose more output because

$$\frac{\partial^2 q_1}{\partial c_1 \partial v_1} = \frac{k(n-k)^2}{(mn-k^2)^2} > 0$$

i.e., If LCC competes more aggressively than FSA, $0 \geq v_1 \geq v_2 \geq -1$

then an identical cost increase would make LCC to lose more output

$$|dq_2| > |dq_1|$$

Differentiated Product Duopoly

**(c.) Price increase is less than marginal cost increase.
Neither firm can fully pass the cost increase on
to passengers:**

$$dp_1 = \left(1 - \frac{(m - b_1)(n - k)}{mn - k^2}\right)dc < dc$$

$$dp_2 = \left(1 - \frac{(m - k)(n - b_2)}{mn - k^2}\right)dc < dc$$

**(d) Magnitude of price increase depends on demands
and conduct parameters:**

e.g., if $v_1 = v_2 = v$, we have $dp_1 > dp_2$

**ie. FSA is able to pass more of the cost increase to
passengers**

Results on Profits

(a) Both FSA and LCC experience profit reduction:

$$d\pi_1 = -2 \frac{m - b_1}{(mn - k^2)^2} [n(a_1 - c_1) - k(a_2 - c_2)](n - k)dc < 0$$

$$d\pi_2 = -2 \frac{n - b_2}{(mn - k^2)^2} [m(a_2 - c_2) - k(a_1 - c_1)](m - k)dc < 0$$

(This is why Qantas supported the VB vs. SACL case)

(b) With the product differentiation, $(a_1 - c_1) > (a_2 - c_2)$,

i.e., LCC's product demand is more price-elastic than FSA;

LCC suffers proportionally more reduction of its profit than FSA;

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IV. Numerical Simulation

To evaluate the impacts of increasing Passenger Service Charge (PSC) on the outputs and profitability of FSA and LCC using Hypothetical data (due to confidentiality of real route-by-route data)

Assumptions for the base case:

$$p_1 = a_1 - b_1q_1 - kq_2 \quad p_2 = a_2 - kq_1 - b_2q_2$$

Conduct Parameters: $v_1 = v_2 = -0.5$

Extent of product differentiation:

$$k = t \cdot b_1 \quad t = 0.7 \quad b_2 = \frac{b_1 + k}{2}$$

Airline Market Price Elasticity: $e = -1.4$

Base Price and Quantity before the cost increase:

$$p_1 = \$100 \quad p_2 = \$75 \quad q_1 = 60,000 \quad q_2 = 40,000$$

IV. Numerical Simulation – Results

Changes in Market Equilibrium Caused by Various
% Increase in Airport Charge (current charge \$3 per pax)

\$ Increase	\$1	\$3	\$5
$\% \Delta q_1$	-0.8%	-2.3%	-3.9%
$\% \Delta q_2$	-1.7%	-5.1%	-8.5%
$\% \Delta \pi_1$	-1.5%	-4.6%	-7.6%
$\% \Delta \pi_2$	-3.4%	-9.9%	-16%
$\% \Delta P$	0.9%	2.7%	4.5%
$\% \Delta Q$	-1.1%	-3.4%	-5.7%

IV. Sensitivity on Conduct Parameter (V_i) %Output Reduction when $dc=\$1$

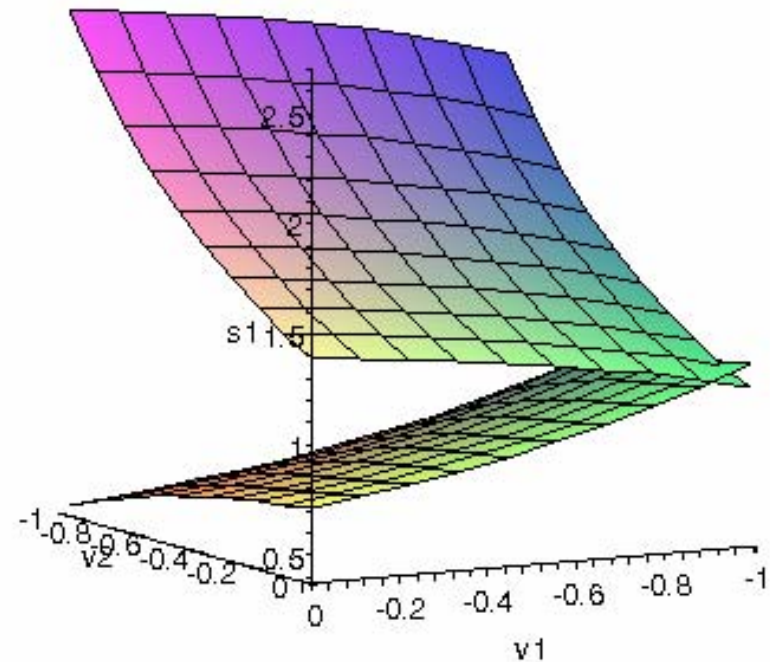
LCC experiences larger percentage of output reduction

For example:

When $a_1=171$, $c_1=\$85$

$a_2=136$, $c_2=\$55$

$(a_1-c_1)-(a_2-c_2)=5$

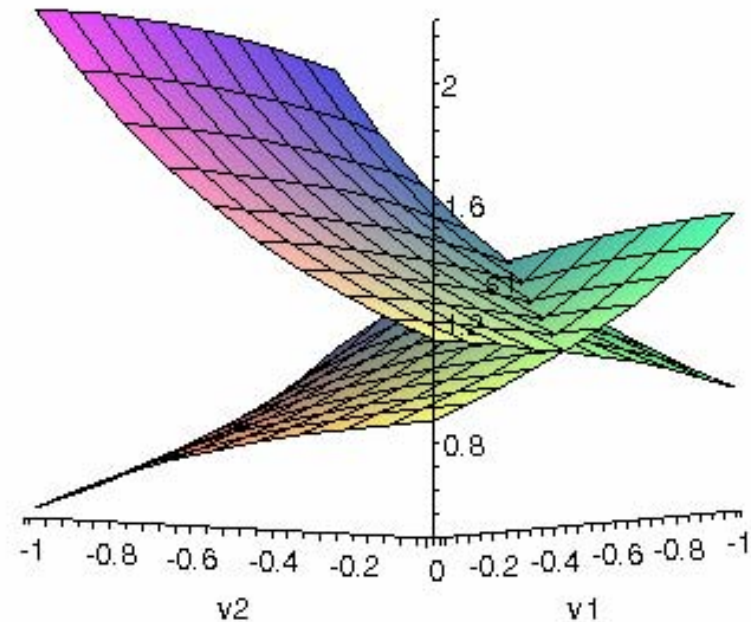


IV. Sensitivity On **Market Share**

% of Output Reduction

when $dc=\$1$ and $q_1=q_2=50,000$

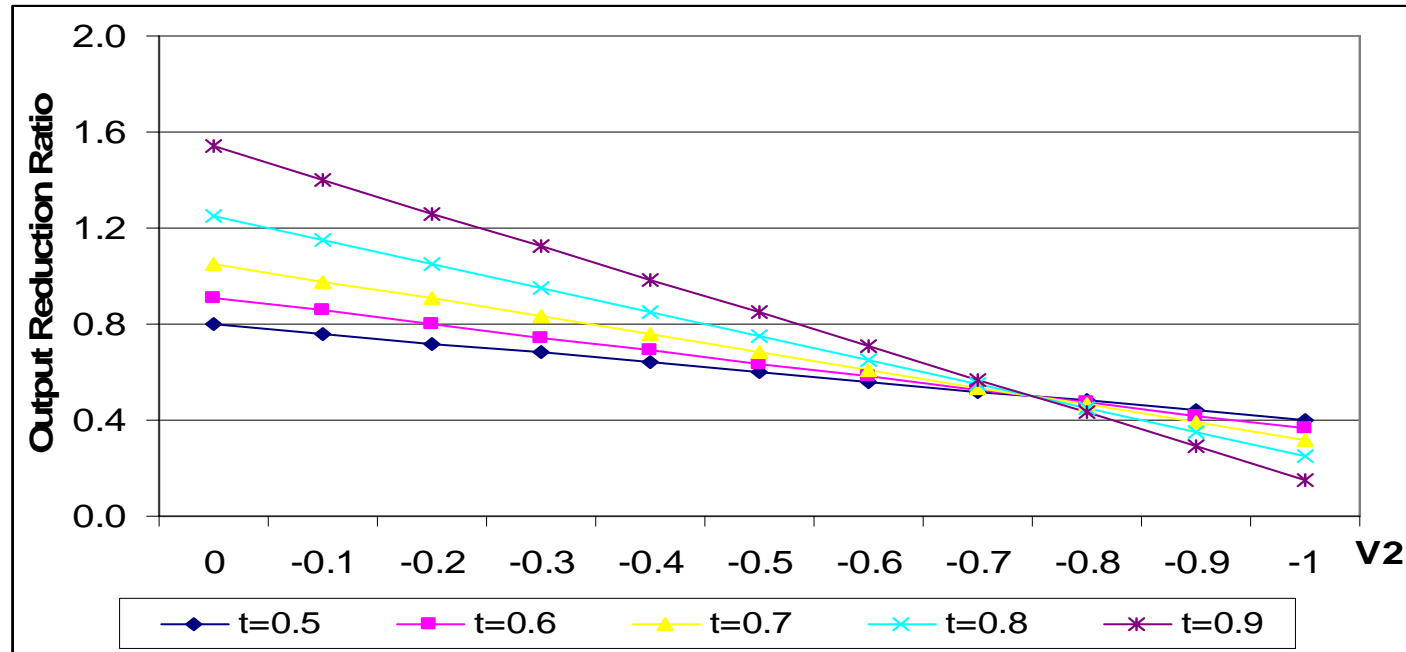
- LCC experiences larger percentage of output reduction under most of the conduct parameters
- Our conclusion holds except in some unlikely cases where FSA competes far more aggressively than LCC



Sensitivity on Degree of Product Differentiation: parameter t , $k = t b_1$

Ratio of Output Reduction when $dc=1$ ($v_1 = 0.5$)

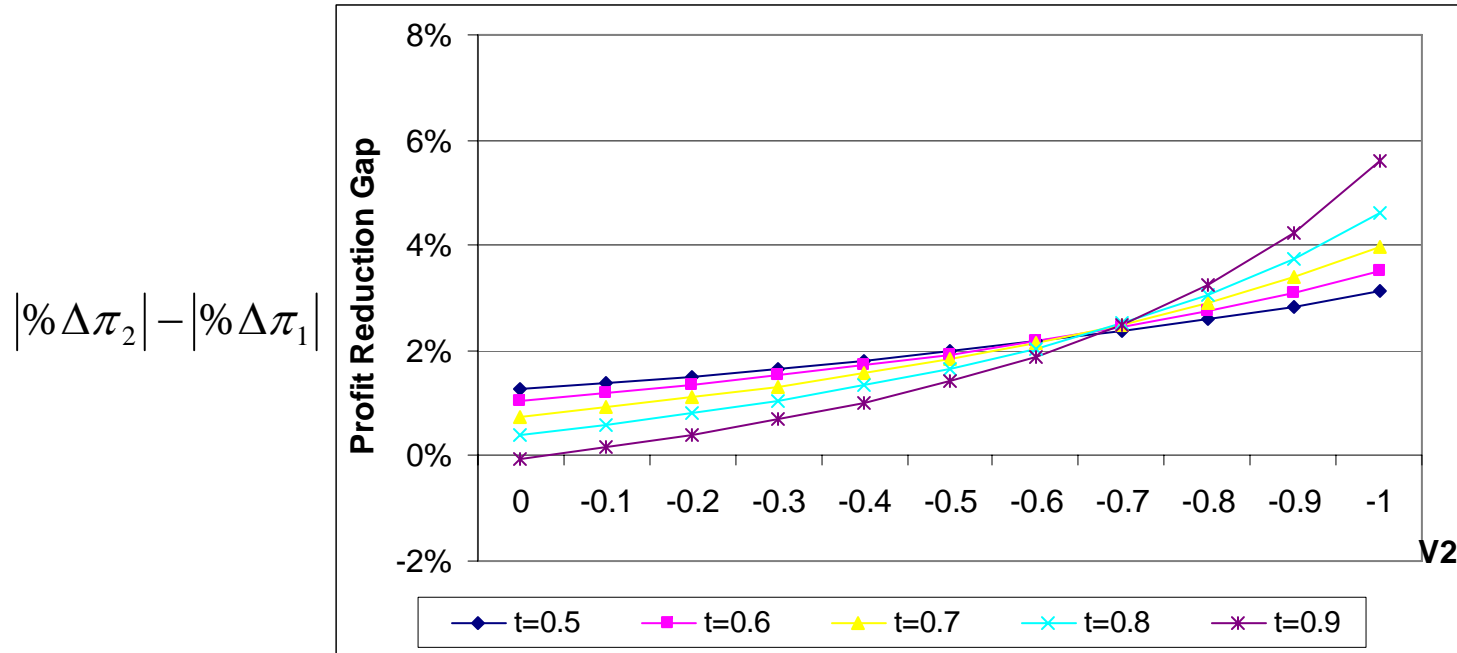
$$y = \frac{dq_1}{dq_2}$$



- As V_2 increases, LCC suffers increasingly larger output reduction relative to FSA;
- As FSA and LCC offer closer substitutes (as $t \rightarrow 1$), the ratio of output reduction (y) becomes more sensitive to LCC's conduct parameter value (V_2)

Sensitivity Test On Product Differentiation-con't

Profit Reduction Gap when $dc=1$ ($V1 = 0.5$)



- As $V2$ increases, %profit reduction gap between LCC and FSA increases
- When FSA and LCC offer closer substitutes (t value in $k=t b_1$ increases), %difference in profit reductions becomes increasingly more sensitive to $V2$

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V. Summary and Conclusion

This paper shows:

- (1) Importance of incorporating **effect of airport pricing on competition in downstream airline markets** when considering whether or not user charges of commercialized airports should be regulated; Ignoring this would lead to **an underestimation of welfare loss** caused by monopolistic airport pricing
- (2) **When FSA and LCC compete with differentiated products, an identical increase in MC (e.g., airport charges) will likely harm LCC more as:**
 - LCC loses proportionally more outputs and profits than FSA
 - The more aggressively LCC competes, the larger the amount of output and profit reductions it is likely to experience ;
 - Since both FSA and LCC will suffer from the airport price increase, FSAs will also lobby govt to regulate airport pricing despite the fact that airport price cap would benefit LCCs more than themselves.

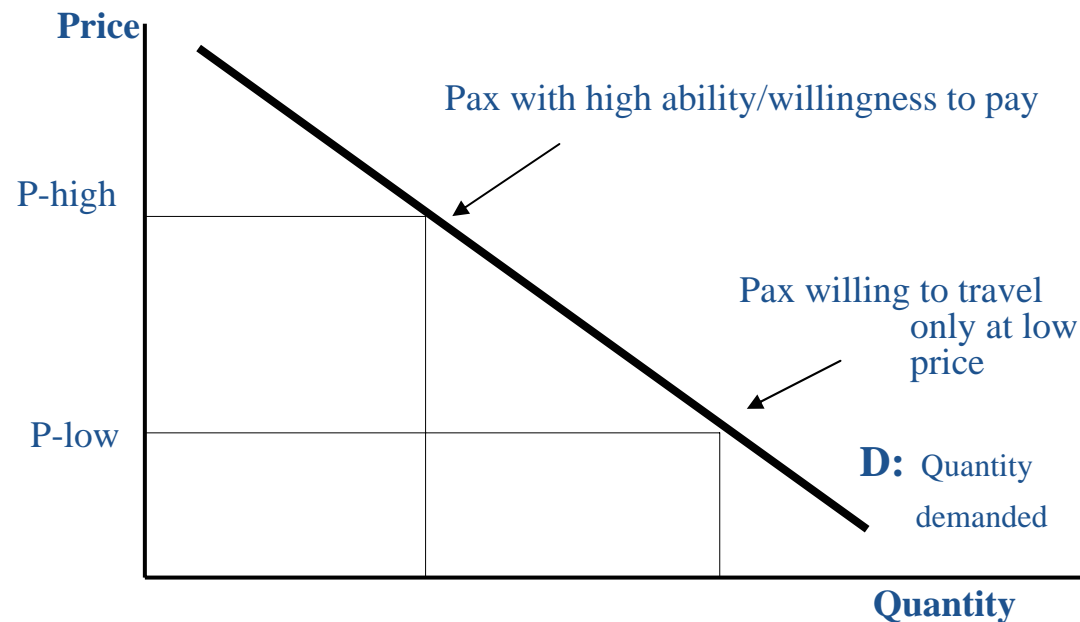
V. Summary and Conclusion – cont'd

- For marginal routes, even a small increase in airport charges would tip the LCC's profitability on those routes, causing an LCC's exits and thus **large welfare loss by turning the markets into monopoly.**

Thank you

Traditional LCC Model

- Past 10 years, there has been major growth of low cost carrier (LCCs) in the U.S., Canada, Europe, Australia and Asia
- The traditional LCCs target fare sensitive markets by combining
→ simple and highly efficient operation, no frills product, targeting leisure and fare sensitive business traffic, and serving high density short/-medium distance routes



V. Summary and Conclusion – cont'd

The frame work of analysis we used is probably useful to analysis of other markets in which a monopolist supply essential inputs to downstream firms: Internet-Telecom tie lines, electricity transmission, rail track etc.;

Preferred Approach: It is preferable to do econometric estimation of firm-specific demand functions for the downstream firms, and analyze the impact of regulating/not regulating monopoly pricing;

Useful Alternative Approach (when the data does not allow such econometric investigation):

- Obtain results from analytical models;
- Doing sensitivity analysis on key parameters of the models (e.g, Conduct Parameters; Extent of Product Differentiation; Differences in Marginal Costs, etc.

Caution in Using the Results and Future Research

- **Need for market specific empirical study:** Preferably, the nature of competition between FSA and LCC will need to be empirically estimated for each market (like many U.S. studies on LCC);
- More empirical work on the extent of product differentiation need to be empirically estimated in each market;