

## *Preliminary*

# **LCC vs. FSA Competition:** What Happens After the Effects of LCC Entries Stabilize?

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(With Xiaowen Fu and Martin Dresner)

# LCC Issues important

Steve Morrison (2001) estimates:

- **More than 50% of the welfare improvement induced by the U.S. airline deregulation** is attributable to Southwest (WN) airline;
- **Consumer's annual cost saving of US\$12.9 billion**, 20% of the US domestic revenue in 1998.

# Asian LCCs still evolving

- Japan: Skymark and Air Do
- Malaysia: AirAsia
- Thailand: AirAsia-Thai, One to Two, PBAir, Air Andaman
- Cambodia: Siem Reap Air
- Philippines: Cebu Pacific Airways
- India: Air Deccan
- Singapore: JetStar-Asia, and Tiger Airways
- Hong Kong: HK Express, Oasis(?)
- Australia-NZ: Virgin Blue? JetStar, Freedom Air

**My Interest in this Topic** was

stimulated by **Virgin Blue vs. Sydney Airport case** before the Australian Competition Tribunal (2004-2005)

# VB vs. Sydney Airport Case

*Virgin Blue* filed a case against **SACL**: formally 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.

## 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.*

# Findings - previous studies on Impact of LCCs

- **FSAs' drastic price reduction:**
  - Windle and Dresner(1995); Dresner, Lin & Windle(1996); Bennett and Craun (1993); Whinston and Collins (1993), Morrison and Winston (1995): Data from 1990s.
- **Actual, adjacent and potential competitive effects.**
  - Windle and Dresner (1999); Morrison (2001)

# 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 to the Case: Duopoly model with plausible conduct Parameters – (not really satisfactory)**

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

# Objectives of This Paper :

Attempt to Answer Questions not answered

- **Do LCCs and FSAs target different markets, or LCCs simply compete with lower cost?**
  - Indirectly, What is an LCC business model?
- **What is the nature of competition among FSAs and LCCs in the post entry period?**
  - Now, LCC services exist on 70% of US domestic routes
- **Does presence of a major LCC guarantee sufficient competition in the market ?**
  - Qantas vs. AirNZ partnership; AF-KLM Merger; Mergers among major US FSAs

# What do we need ?

We need a good data to do **econometric estimation of firm-specific demands** which can identify the true nature of the inter-airline competition;

Such a data should have **a long enough series** which include equilibrium (inter-firm competition) periods;

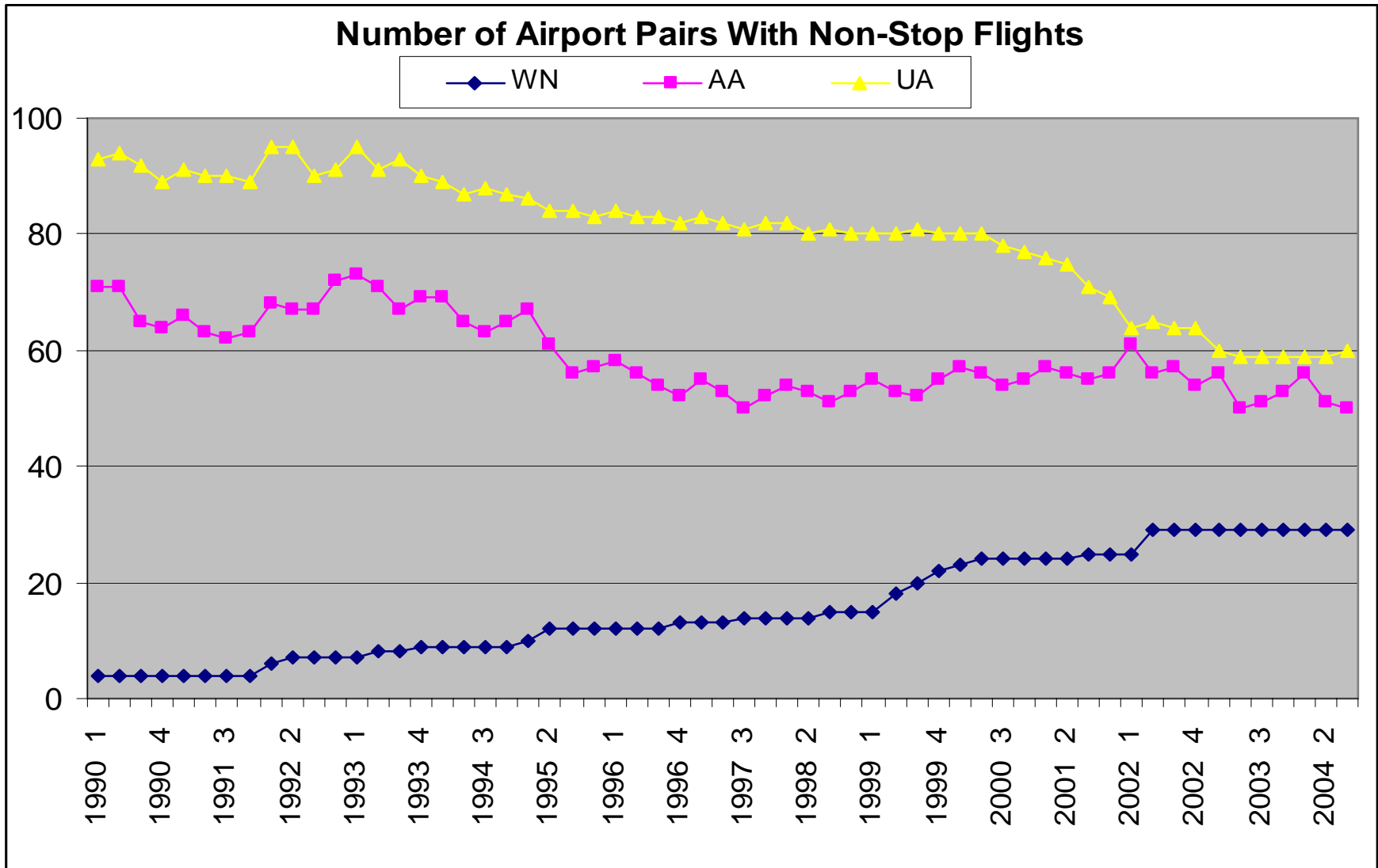
Therefore, we decide to use U.S. data:  
**SW Airlines case**

# Outline

- **Study Sample: Routes out of Chicago with competition among Southwest, United and American (1990 – 2004)**
- **Estimation of Almost Ideal Demand System (AIDS):**
  - Compare own and cross price elasticities
- **Observations from Price Equations**
  - price correlations
  - Reduced form price equation
- **Conclusion and Policy implications**

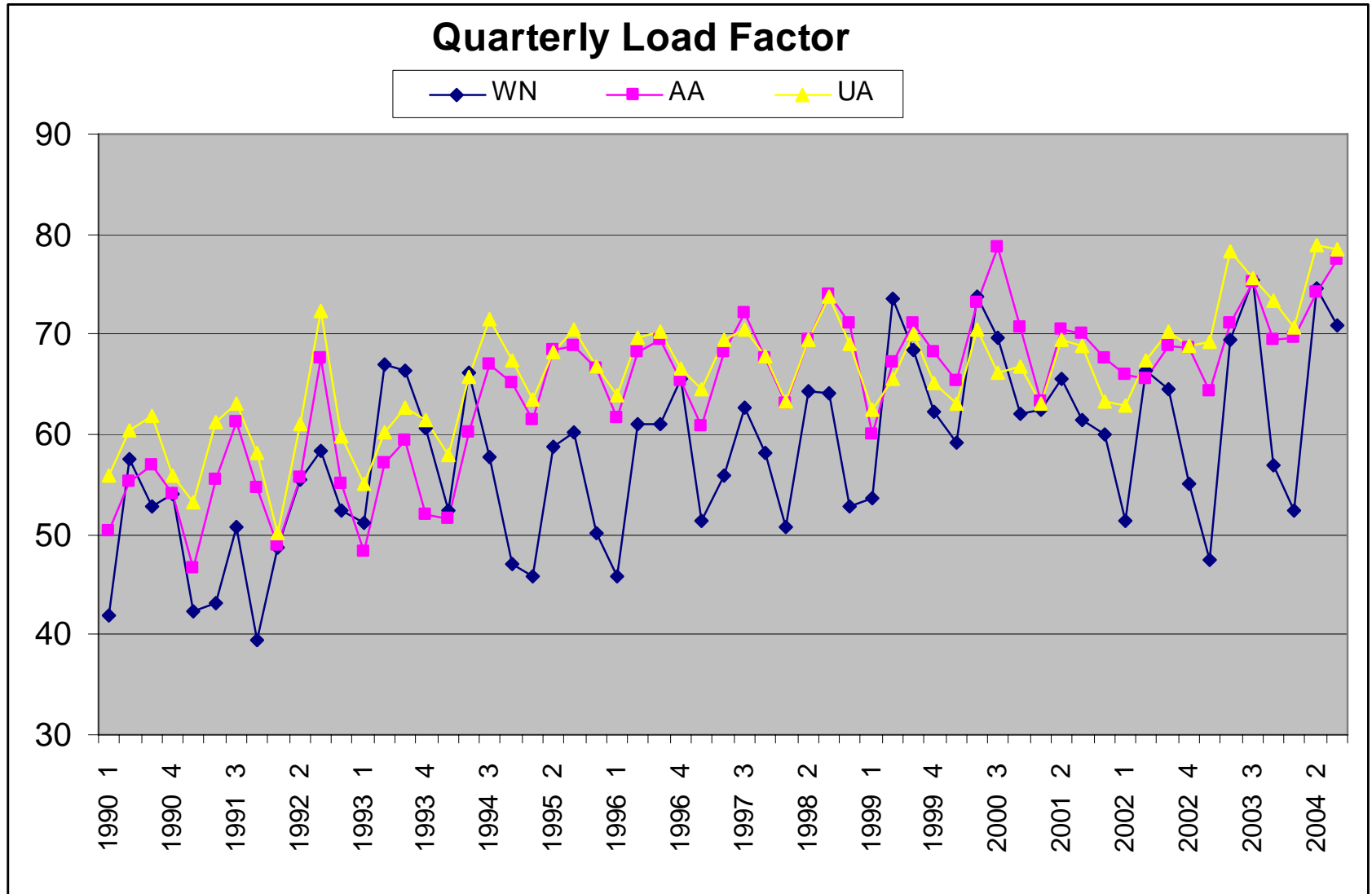
# Interesting Observation -1

## AA and UA reduce route network



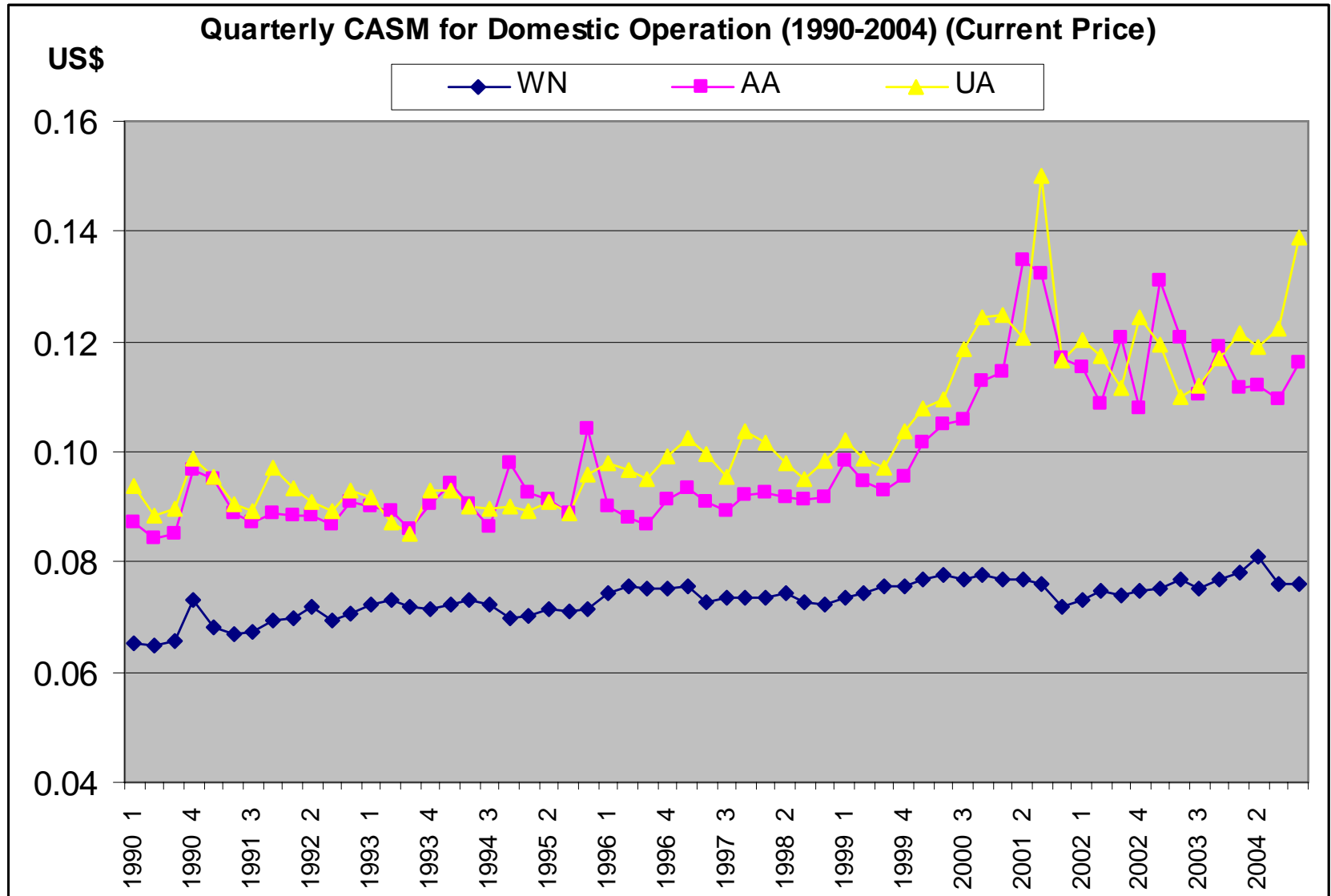
# Interesting Observation - 2

## WN's high frequency despite lower L/F



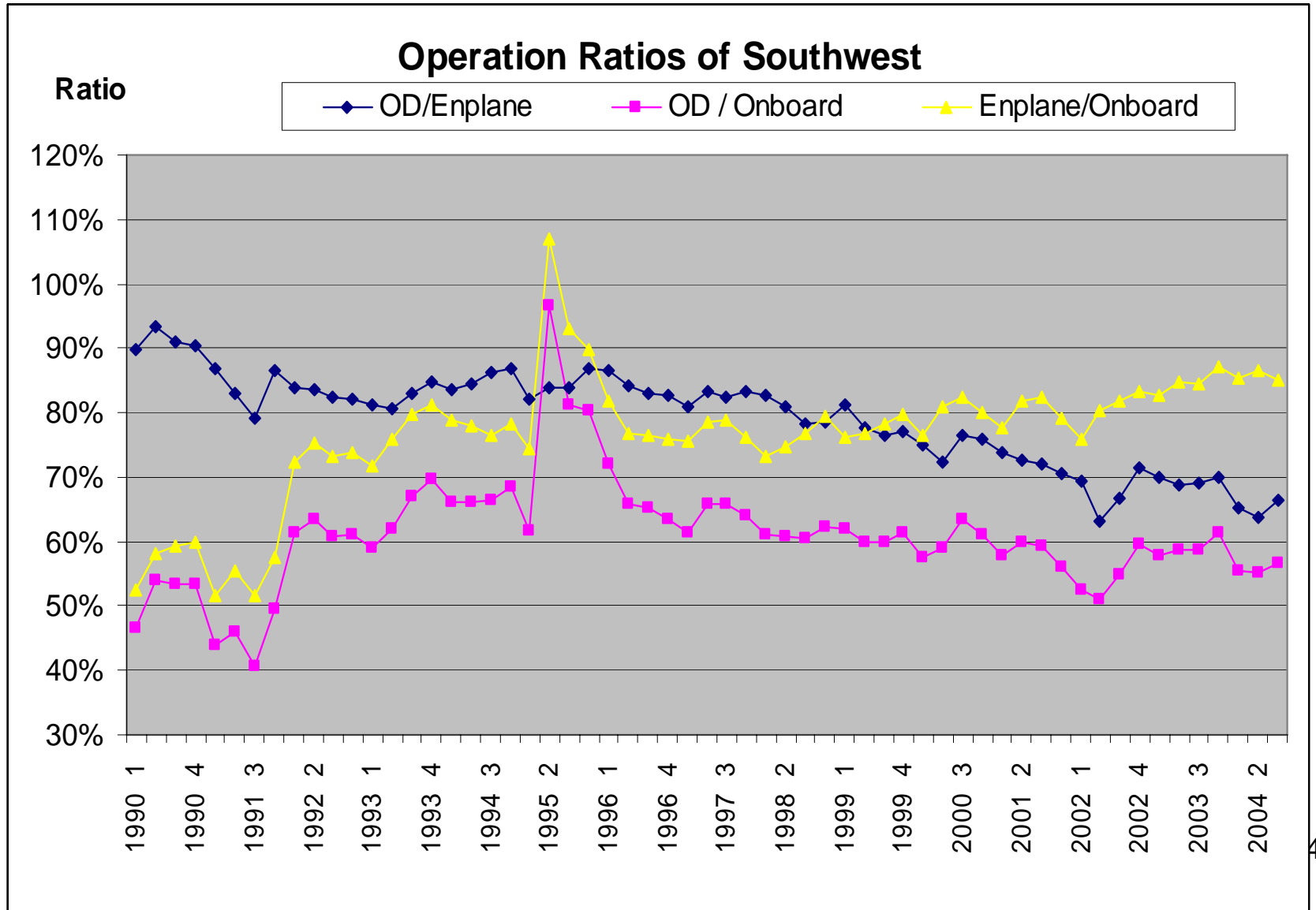
# Interesting Observatin -3

## Cost per ASM (CASM) Comparison



# Interesting Observation-4

## WN carries high % of connecting passengers



# Outline

- Study Sample: Routes out of Chicago with competition among Southwest (WN), United (UA) and American, AA (1990 – 2004)
- **Estimation of Almost Ideal Demand System (AIDS):**
  - Compare own and cross price elasticities
- **Observations from Price Equations**
  - Anecdotal evidence: price correlations
  - Reduced form price equation
- **Conclusion and Policy implications**

# Quantify Product Differentiation:

## **AIDS Estimation** (Deaton & Muellbauer, 1980)

- Budgetable two-level consumer demand.
- The bottom level demand equations for a route market

$$S_{it} = \alpha_i + \beta_i \ln \frac{Y_t}{P_t} + \sum_{j=1}^I \gamma_{ij} \ln p_{jt} + Z_t \theta + \varepsilon_t$$

- Overall demand for air travel

$$\ln Q_t = a + b \ln I_t + \lambda \ln P_t + dZ_t + \tau_t$$

where

$S_{it}$  : Airline  $i$ 's revenue share in time  $t$

$Y_t$  : Total revenue in a route market

$P_t$  : Price index for the route market

$p_{jt}$  : Average price of airline  $j$  in time  $t$

$Z_t$  : Route specific control variables and time dummy var.

$Q_t$  : Total number of passengers in route

$I_t$  : Weighted Personal income in OD cities

# Elasticity and Cross Elasticity

- Elasticities

$$E_{iit} = \frac{1}{S_{it}} (\gamma_{ii} - \beta_i w_i) - 1 + (1 + \frac{\beta_i}{S_{it}})(1 + \lambda)w_i$$

$$E_{ijt} = \frac{1}{S_{it}} (\gamma_{ij} - \beta_i w_j) + (1 + \frac{\beta_i}{S_{it}})(1 + \lambda)w_j$$

- Where

$\gamma_{ij}$  : Estimated coefficients for airline j's price in airline i' share regression

$\beta_i$  : Estimated coefficients for  $\ln \frac{Y_t}{P_t}$  (normalized quantity)

$\lambda$  : Estimated market level elasticity

$w_i$  : Airline i's average revenue share in a route (used in Stone index formula to aggregate the price index)

# AIDS Estimation

## Quarterly Route Statistics of WN, AA, UA

(all other carriers lumped together)

Route (City)	Sample Period (year/quarter)	Average Pax Number			Average Revenue Share		
		WN	AA	UA	WN	AA	UA
BNA (Nashville, TN )	1990/1 - 2000/4	23045	13733	7220	41%	37%	19%
DTW (Detroit, MI)	1990/1 - 2004/3	36225	18967	28001	20%	15%	22%
MCI (Kansas City, MO)	1990/1 - 2004/3	45717	21299	23006	41%	23%	28%
PVD (Providence, RI)	1997/2 - 2004/3	11673	10444	13384	27%	28%	38%
STL (St Louis, MO)	1990/1 - 2004/3	47512	16913	18500	35%	18%	19%
Sample Average		35865	17096	19204	33%	23%	24%

## Firm-Specific Elasticities (1 -WN; 2 - AA; 3-UA )

Route (Airport, City)	Own Price Elasticity			Cross Price Elasticity					
	E11	E22	E33	E12	E13	E21	E23	E31	E32
BNA (Nashville, TN )	-1.24	<b>-1.64</b>	<b>-3.32</b>	0.19	0.13	0.20	0.57	0.62	<b>1.36</b>
DTW (Wayne County, MI)	-1.53	<b>-2.69</b>	<b>-3.01</b>	0.32	0.31	0.47	1.57	0.59	<b>1.23</b>
MCI (Kansas City, MO)	-1.24	<b>-2.03</b>	<b>-2.59</b>	0.16	0.15	0.36	0.99	0.39	<b>0.93</b>
PVD (Providence, RI)	-1.38	<b>-1.84</b>	<b>-2.22</b>	0.28	0.28	0.25	0.84	0.31	<b>0.67</b>
STL (St Louis, MO)	-1.28	<b>-2.37</b>	<b>-3.35</b>	0.18	0.15	0.46	1.26	0.65	<b>1.45</b>
<b>Sample Average</b>	<b>-1.30</b>	<b>-2.05</b>	<b>-2.85</b>	<b>0.21</b>	<b>0.18</b>	<b>0.34</b>	<b>0.99</b>	<b>0.50</b>	<b>1.10</b>

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- Study Sample: Routes out of Chicago with competition among Southwest, United and American (1990 – 2004)
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  - Reduced form price equation
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# Anecdotal Evidence

## Higher Price Correlation (AA, UA)

Route (Airport, City)	Average Revenue Share			Price Correlation		
	WN	AA	UA	WN-AA	WN-UA	AA-UA
BNA (Nashville, TN )	41%	37%	19%	0.192	0.299	<b>0.943</b>
DTW (Wayne County, MI)	20%	15%	22%	0.654	0.769	<b>0.923</b>
MCI (Kansas City, MO)	41%	23%	28%	0.670	0.699	<b>0.878</b>
PVD (Providence, RI)	27%	28%	38%	-0.113	0.375	<b>0.347</b>
STL (St Louis, MO)	35%	18%	19%	0.648	0.626	<b>0.917</b>

- PVD (Providence) route was not in equilibrium
- After a Major FSA competitor exited MCI (Kansas) and STL routes, the Price correlations became:
  - MCI Route: WN-AA 0.414; WN-UA 0.522; AA-UA 0.850
  - STL Route: WN-AA 0.162; WN-UA -0.051; AA-UA 0.771

# Reduced Form Price Equations

- For WN (Southwest):

$$\begin{aligned} \ln(P_{nt}^{WN}) = & \alpha_1 + \alpha_2 \ln(\text{Frq}_{nt}^{WN}) + \alpha_3 \text{LF}_{nt}^{WN} + \alpha_4 \text{NFSA}_{nt} + \alpha_5 \text{NREG}_{nt} + \alpha_6 S_{nt}^{WN} \\ & + \alpha_7 \ln(\text{Pax}_t) + \alpha_8 \ln(\text{Dist}_n) + \alpha_9 \ln(\text{Pop}_{nt}) + \sum_{m=1}^3 c_{mi} \text{QR}_m + \sum_{k=91}^{04} e_k Y_k + \varepsilon_t \end{aligned}$$

- For UA

$$\begin{aligned} \ln(P_{nt}^{UA}) = & \beta_1 + \beta_2 \ln(\text{Frq}_{nt}^{UA}) + \beta_3 \text{LF}_{nt}^{UA} + \beta_4 \text{NFSA}_{nt} + \beta_5 \text{NREG}_{nt} + \beta_6 S_{nt}^{UA} \\ & + \beta_7 \ln(\text{Pax}_t) + \beta_8 \ln(\text{Dist}_n) + \beta_9 \ln(\text{Pop}_{nt}) + \sum_{m=1}^3 C_{mi} \text{QR}_m + \sum_{k=91}^{04} E_k Y_k + \tau_t \end{aligned}$$

# Quarterly Statistics For Price Equation Estimation

Route City	Sample Period (Year/Quarter)	Average Frequency		Average Price		Coefficient of Price Variation	
		WN	UA	WN	UA	WN	UA
BHM	1995/4-1999/2	170	180	96.96	120.77	0.085	0.078
BNA	1990/1-2000/4	692	269	69.29	108.96	0.080	0.233
BWI	1994/1-2004/3	654	528	81.19	110.16	0.217	0.169
CLE	1992/3-2004/3	696	521	52.33	88.08	0.161	0.209
CMH	1992/4-2004/3	468	525	51.62	96.84	0.223	0.202
DTW	1990/1-2004/3	821	550	54.58	76.15	0.213	0.203
IND	1992/3-2004/3	414	599	46.51	98.29	0.130	0.287
MCI	1990/1-2004/3	1247	499	57.19	79.25	0.148	0.151
OMA	1995/3-2004/3	519	516	55.49	96.41	0.060	0.173
PVD	1997/2-2004/3	237	349	109.08	134.32	0.077	0.093
SDF	1993/4-2000/1	589	199	46.77	103.72	0.165	0.221
STL	1990/1-2004/3	1168	467	54.59	75.03	0.163	0.156

\*Note: AA not included due to lack of data.

# SUR Price Equations with Flight Frequency

WN Price Equation			UA Price Equation		
Parameter	Estimation	t-Ratio	Parameter	Estimation	t-Ratio
<i>Frq</i>	-0.126	-6.482	<i>Frq</i>	-0.152	-5.589
<i>LF</i>	-0.001	-1.230	<i>LF</i>	-0.009	-6.910
<i>NFSA</i>	-0.013	-0.945	<i>NFSA</i>	<b>-0.056</b>	<b>-3.290</b>
<i>NREG</i>	<b>-0.050</b>	<b>-5.911</b>	<i>NREG</i>	0.007	0.700
<i>S (freq. share)</i>	<b>0.255</b>	<b>3.012</b>	<i>S(freq. share)</i>	0.040	1.154
<i>Pax</i>	0.253	1.356	<i>Pax</i>	0.191	7.511
<i>Dist</i>	0.356	16.400	<i>Dist</i>	0.249	1.003
<i>Pop</i>	0.152	5.900	<i>Pop</i>	0.402	3.685
<i>QR<sub>1</sub></i>	0.036	1.298	<i>QR<sub>1</sub></i>	0.008	0.229
<i>QR<sub>2</sub></i>	0.018	0.938	<i>QR<sub>2</sub></i>	0.087	3.645
<i>QR<sub>3</sub></i>	0.000	-0.018	<i>QR<sub>3</sub></i>	0.061	2.076
<i>R<sup>2</sup></i>	0.7365		<i>R<sup>2</sup></i>	0.4964	

\*N=521

## SUR Price Equation Estimation with Available Seats

WN Price Equation			UA Price Equation		
Parameter	Estimation	t-Ratio	Parameter	Estimation	t-Ratio
<i>Seat</i>	-0.13428	-7.399	<i>Seat</i>	-0.1816	-7.075
<i>LF</i>	-0.000812	-0.9438	<i>LF</i>	-0.0085	-6.956
<i>NFSA</i>	-0.008667	-0.6526	<i>NFSA</i>	<b>-0.03628</b>	<b>-2.106</b>
<i>NREG</i>	<b>-0.05386</b>	<b>-6.748</b>	<i>NREG</i>	0.00474	0.4838
<i>S (seat share)</i>	<b>0.295</b>	<b>3.652</b>	<i>S(seat share)</i>	<b>0.5729</b>	<b>5.699</b>
<i>Pax</i>	0.2616	1.407	<i>Pax</i>	0.2578	1.058
<i>Dist</i>	0.36177	17.55	<i>Dist</i>	0.20366	8.413
<i>Pop</i>	0.16186	6.189	<i>Pop</i>	0.05982	1.738
$R^2$	0.7386		$R^2$	0.5159	

\*N=521

# Outline

- **Airlines' operation characteristics for routes out of Chicago during 1990 – 2004**
- **Almost Ideal Demand System (AIDS) estimation:**
  - Comparison of own and cross elasticities
- **Observations from price equations**
  - Anecdotal evidences of price correlation
  - Reduced form price equation
- **Conclusion and Policy implications**

# Summary, Conclusion and Implications-1

- The following findings reveal that there are a lot more competition between FSAs (AA and UA) than between Southwest and FSAs:
  - **Firm-specific price elasticities:** High own price elasticities; Higher cross elasticities between FSAs than between Southwest and FSAs;
  - The reduced form price equations show that **UA's route average fare is a decreasing function of the number of FSAs on the route** while it is not significantly affected by the number of Regional carriers (including LCCs) on the routes.
  - **UA's route average price increases with its frequency share even when Southwest is present in the market.**
  - **Higher price correlation exists between AA and UA than between Southwest and FSA.**
- This implies that **competition between FSAs will continue to be important.** Southwest (LCC) can not be relied upon to provide effective competition for FSA: an anti-trust implication.

## Summary, Conclusion and Implications-2

- **Southwest's route average price increases with its frequency (seat capacity) share on the route** while its price decreases with the number of competing LCCs and regional carriers; The number of FSAs do not affect Southwest's route average price.
- Overall, there is some evidence that **after an initial LCC entry period the FSA and LCC do not appear to compete each other:** an important Anti-Trust implications.
- For an identical increase in frequency share, **Southwest drives higher price premium on frequency than United does.** This may be one of the major reasons why Southwest had been very aggressive in scheduling high frequency flights despite the fact that **it achieves significantly lower load factors than competing FSAs.**

# Summary and Conclusion-3

- For regulators:
  - Competition concerns is real in the markets with successful LCC;
  - Exit of an FSA (merger between two FSAs) will benefit FSAs far more than LCCs;
  - Only an LCC can effectively discipline another LCC.

**Thank You !**