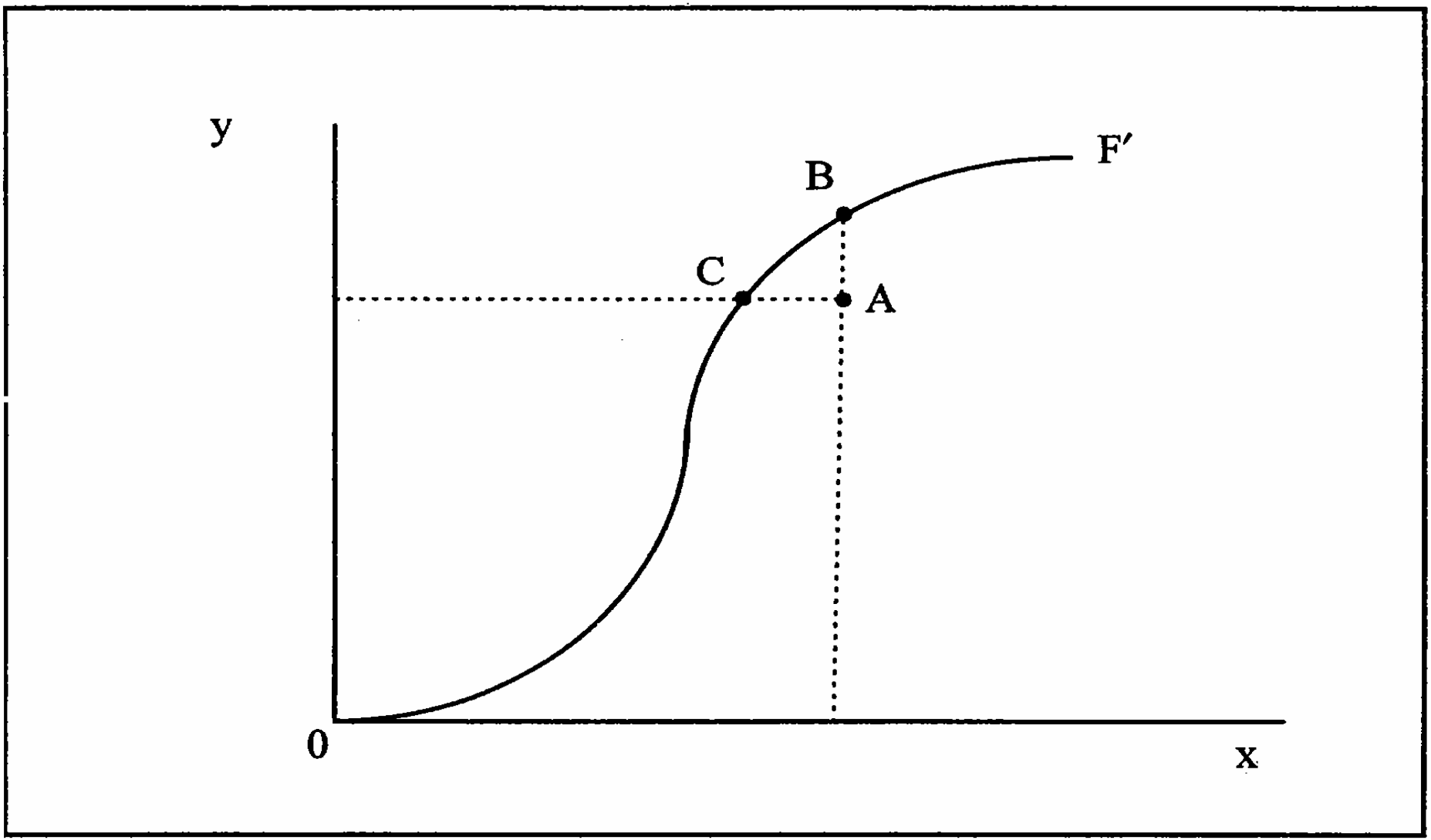
The Operational Impacts of Governmental Restructuring of the Airline Industry in China

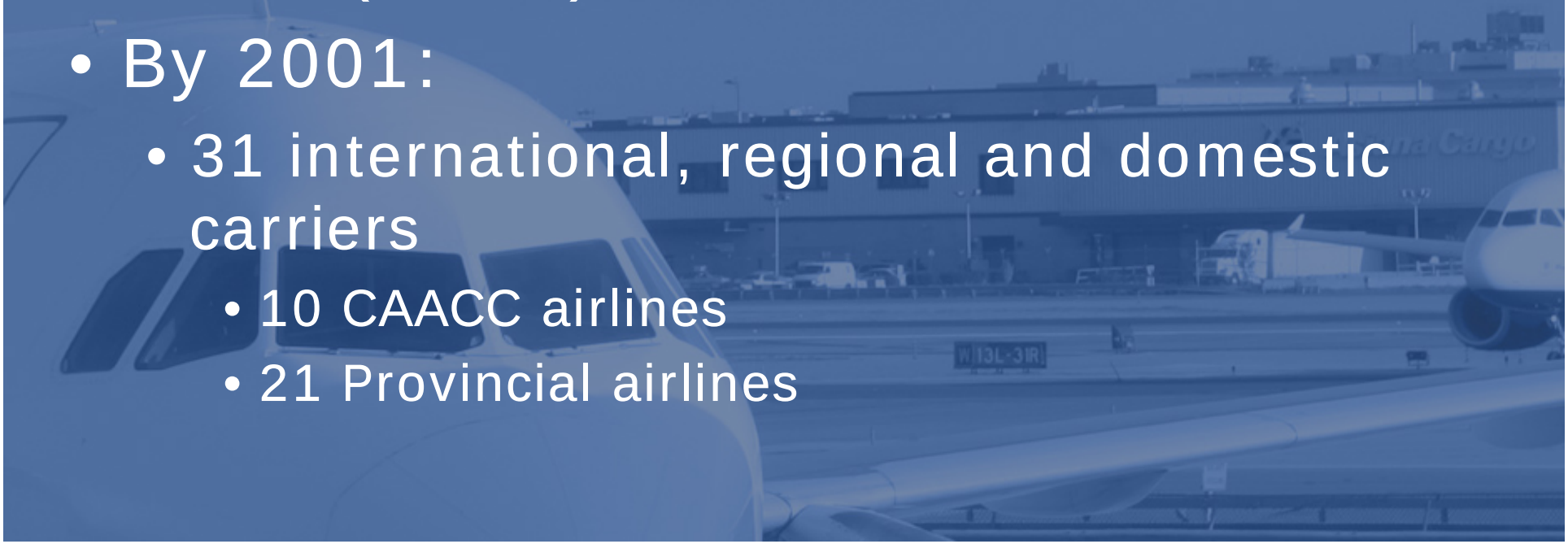
Carl Scheraga
Fairfield University
Charles F. Dolan School of Business

Data Envelopment Analysis



The Restructuring

- Prior to 2001, the commercial aviation industry was overseen and controlled by the Civil Aviation Administration of China (CAAC).
- By 2001:
  - 31 international, regional and domestic carriers
    - 10 CAACC airlines
    - 21 Provincial airlines



The Restructuring – 2000 Directive

- ***Air China*** consolidated with China National Aviation Corporation, China Southwest Airlines, and Zhejiang Airlines.
- ***China Eastern Airlines*** absorbed Air Great Wall, China Yunnan Airlines and China Northwest Airlines.
- ***China Southern Airlines*** absorbed China Northern Airlines, China Xinjiang Airlines and Zhongyuan Airlines.

Behavioral Model – Schefczyk (1993)

- 2 outputs
  - (1) Revenue passenger kilometers and (2) Non-passenger revenue ton-kilometers
- 3 inputs
  - (1) Available ton-kilometers, (2) Operating cost, and (3) non-flight assets
- Available ton-kilometers
  - Available aircraft capacity
- Operating cost
  - Operating cost excluding capital and aircraft captured by available ton-kilometers
- Non-flight assets
  - Facilities, reservation systems, and current assets

Table 1 – Sample Airlines

Aerolines Argentinas	**EL AL**
Aeromexico	**Iberia**
Air Canada	**KLM**
Air China	**Korean Air**
Air France	**LOT Polish Airlines**
Air India	**Lufthansa**
All Nippon Airways	**Malaysia Airlines**
American Airlines	**Mexicana**
Asiana Airlines	**Northwest Airlines**
Austrian Airline Group	**Pakistan International Airlines**
British Airways	**Scandinavian Airlines**
Cathay Pacific	**Singapore Airlines**
China Eastern Airlines	**SriLankian Airlines**
China Southern Airlines	**TAP Air Portugal**
Continental Airlines	**Tarom**
CSA Czech Airlines	**Thai Airways International**
Delta Airlines	**United Airlines**

Base Model

Table 3
Input and Output *Percentage* Inefficiencies
Air China (CCA), China Eastern Airlines (CES), China Southern Airlines (CSN)

	CCA (%)	CES (%)	CSN (%)
INPUT			
Available Ton-Km	0	0	0
Operating Cost	-30.83	-33.62	-36.22
Non-Flight Assets	-44.74	-43.52	-24.24
OUTPUT			
Revenue Passenger-Km	0	+21.54	+40.38
Non-Passenger Ton-Km	+20.19	+43.24	+90.30

Negative/Positive Sign = Necessary Reduction/Increase Required to Achieve Efficiency

Input-Oriented Model

Table 2
Input-Oriented Operating Efficiencies

NAME	t^I	NAME	t^I
Aerolines Argentinas	1.00	EL AL	1.00
Aeromexico	0.94	Iberia	0.87
Air Canada	0.84	KLM	1.00
Air China	0.86	Korean Air	0.76
Air France	1.00	LOT Polish Airlines	0.86
Air India	0.95	Lufthansa	1.00
All Nippon Airways	0.73	Malaysia Airlines	1.00
American Airlines	1.00	Mexicana	0.81
Asiana Airlines	0.91	Northwest Airlines	0.90
Austrian Airline Group	0.92	Pakistan International Airlines	0.90
British Airways	0.89	Scandinavian Airlines	0.85
Cathay Pacific	1.00	Singapore Airlines	1.00
China Eastern Airlines	0.71	SriLankian Airlines	1.00
China Southern Airlines	0.58	TAP Air Portugal	0.91
Continental Airlines	1.00	Tarom	1.00
CSA Czech Airlines	1.00	Thai Airways International	1.00
Delta Airlines	0.89	United Airlines	1.00

	Mean	Std. Dev.	Min.	Max.
t^I	0.91	0.10	0.58	1.00

Operating and Environmental Variables

- Average Flight Length
- Passenger revenues as a percentage of total revenues
- Scheduled service revenues as a percentage of total revenues
- International passenger revenue-kilometers as a percentage of total passenger revenue-kilometers
- Average load factor
- Expenditures on passenger services per revenue passenger-kilometer
- Expenditures on ticketing sales and promotion per revenue passenger-kilometer

Table 5b
Tobit Regression Results with Interaction Term
Dependent Variable: Transformed t^{l}

Variable	Estimate	Chi-Square	Pr > ChiSq
Intercept	14.0271	12.6022	0.0004***
Percentage of Revenues from International Operations	-0.2960	9.0537	0.0026***
Percentage of Revenues from Scheduled Operations	-13.2794	9.4635	0.0021***
Percentage of Revenues from Passenger Services	-17.1145	12.0534	0.0005***
Percentage of Revenues from Scheduled Operations *X* Percentage of Revenues from Passenger Services	17.9920	10.9494	0.0009***
Average Stage-Length	-0.00013	4.3971	0.0360**
Passenger Load Factor	-1.3784	6.4045	0.0114***
Expenditures on Passenger Services per Revenue Passenger-Km	-4.9759	1.2641	0.2609
Expenditures on Ticketing Sales and Promotion per Revenue Passenger-Km	14.8527	4.6704	0.0307**

Table 4b
Descriptive Statistics: Tobit Regression Variables
Dependent Variable: Transformed Iota: $[(1/\iota^{I}) - 1]$

Air China, China Eastern Airlines, China Southern Airlines

(Figures in Parentheses Represent Number of Standard Deviations Above or Below the Mean for the Entire Sample)

Variable	CCA	CES	CSN
Percentage of Revenues from International Operations	38% (-1.25)	29% (-1.57)	19% (-1.93)
Percentage of Revenues from Scheduled Operations	89% (0.05)	94% (0.73)	99% (1.40)
Percentage of Revenues from Passenger Services	73% (-0.85)	76% (-0.51)	89% (0.96)
Average Stage-Length	1,618.14 Km (-0.19)	1,306.93 Km (-0.51)	1,246.96 Km (-0.58)
Passenger Load Factor	66% (-1.07)	61% (-2.08)	64% (-1.48)
Expenditures on Passenger Services per Revenue Passenger-Km	$0.0032 (-2.84)	$0.0043 (-2.66)	$0.0045 (-2.62)
Expenditures on Ticketing Sales and Promotion per Revenue Passenger-Km	$0.0070 (-0.80)	$0.0100 (-0.22)	$0.0122 (0.22)

Table 7b
Performance Measures

NAME	Current Ratio	Oper. Ratio	Alt. Oper. Ratio	Net Prof. Margin	ROI	Yield
Aerolines Argentinas	0.64	1.00	0.04	0.05	0.02	0.57
Aeromexico	0.64	0.94	-0.08	-0.07	-0.27	0.82
Air Canada	0.62	0.89	-0.18	-0.27	-0.33	0.72
Air China	0.45	1.09	0.18	0.01	-0.06	0.58
Air France	0.77	1.01	0.01	0.01	0.01	0.71
Air India	0.67	0.98	-0.03	0.00	0.02	0.72
All Nippon Airways	1.10	1.03	0.01	0.01	0.04	1.46
American Airlines	0.72	0.92	-0.11	-0.08	-0.05	0.85
Asiana Airlines	0.42	1.01	-0.01	-0.02	0.02	0.58
Austrian Airline Group	0.76	1.03	0.01	0.02	0.02	0.93
British Airways	0.65	1.07	0.04	0.02	0.05	0.76
Cathay Pacific	1.39	1.02	0.00	0.05	0.04	0.38
China Eastern Airlines	0.52	1.04	-0.03	-0.06	0.02	0.62
China Southern Airlines	0.52	1.04	-0.04	-0.01	0.03	0.62
Continental Airlines	0.91	1.00	-0.04	0.01	0.06	0.76
CSA Czech Airlines	0.84	1.05	0.03	0.04	0.06	1.10
Delta Airlines	0.81	0.92	-0.13	-0.06	-0.04	0.95
EL AL	0.51	1.02	0.00	0.01	0.03	0.57
Iberia	1.36	1.03	0.04	0.02	0.05	1.04
KLM	0.90	1.01	0.00	0.00	0.02	0.62
Korean Air	0.68	1.05	-0.01	-0.04	0.02	0.58
LOT Polish Airlines	0.92	1.00	0.00	-0.04	-0.04	1.10
Lufthansa	1.47	1.00	-0.04	-0.10	-0.04	0.65
Malaysia Airlines	1.39	1.02	0.02	0.08	0.19	0.35
Mexicana	0.53	0.96	-0.06	-0.08	-0.15	1.08
Northwest Airlines	0.88	0.97	-0.08	0.05	0.06	0.69
Pakistan Int'l. Airlines	0.97	1.13	0.06	0.03	0.19	0.57
Scandinavian Airlines	0.91	0.95	-0.08	-0.02	0.00	1.39
Singapore Airlines	0.89	1.02	0.02	0.06	0.02	0.32
SriLankian Airlines	1.23	1.07	0.06	0.10	0.31	0.54
TAP Air Portugal	0.85	1.02	0.02	0.00	0.00	1.02
Tarom	0.92	0.98	-0.08	-0.05	0.01	1.42
Thai Airways Int'l.	0.64	1.15	0.10	0.09	0.19	0.54
United Airlines	0.46	0.90	-0.15	-0.23	-0.18	0.74