

# ATRS Global Airport Benchmarking

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# ATRS Global Airport Benchmarking

- To provide a comprehensive, unbiased comparison of airport performance focusing on
  - **Productivity, Efficiency, Cost Competitiveness**
  - **Financial Results**
  - **Comparison of Airport Charges**
- 2023 - the 22nd edition of ATRS Global Airport Benchmarking Report



# European and North American Airports made significant recovery in 2022

	Airport	Total Passengers 2019		Airport	Total Passengers 2020		Airport	Total Passengers 2021		Airport	Total Passengers 2022
1	ATLANTA (ATL)	110 531 300	1	Guangzhou (CAN)	43 760 427	1	Atlanta (ATL)	75,537,213	1	Atlanta (ATL)	93,699,630
2	BEIJING (PEK)	100 011 438	2	Atlanta (ATL)	42 918 685	2	Dallas/Fort Worth	62,465,756	2	Dallas-Fort Worth	73,362,946
3	LOS ANGELES (LAX)	88 068 031	3	Chengdu (CTU)	40 741 509	3	Denver (DEN)	58,828,552	3	Denver (DEN)	69,286,461
4	DUBAI (DXB)	86 396 757	4	Dallas/Fort Worth	39 364 990	4	Chicago (ORD)	54,020,399	4	Chicago (ORD)	68,340,619
5	TOKYO (HND)	85 505 054	5	Shenzhen (SZX)	37 916 059	5	Los Angeles (LAX)	48,007,284	5	Dubai (DXB)	66,069,981
6	CHICAGO (ORD)	84 649 115	6	Chongqing (CKG)	34 937 789	6	Charlotte (CLT)	43,302,230	6	Los Angeles (LAX)	65,924,298
7	LONDON (LHR)	80 888 305	7	Beijing (PEK)	34 513 827	7	Orlando (MCO)	40,351,068	7	Istanbul (IST)	64,486,000
8	SHANGHAI (PVG)	76 153 455	8	Denver (DEN)	33 741 129	8	Guangzhou (CAN)	40,249,679	8	London (LHR)	61,599,196
9	PARIS (CDG)	76 150 009	9	Kunming (KMG)	32 989 127	9	Chengdu (CTU)	40,117,496	9	Paris (CDG)	57,474,033
10	DALLAS/FORT WORTH	75 066 956	10	Shanghai Hongqiao	31 165 641	10	Las Vegas (LAS)	39,710,493	10	Delhi (Del)	57,290,033
11	GUANGZHOU (CAN)	73 386 153	11	Xi'an (XIY)	31 073 884	11	Phoenix (PHX)	38,846,713	11	New York (JFK)	55,287,693
12	AMSTERDAM (AMS)	71 706 999	12	Haneda (HND)	30 965 000	12	Miami (MIA)	37,302,456	12	Las Vegas (LAS)	52,600,000
13	HONG KONG (HKG)	71 415 245	13	Chicago O'Hare (MDW)	30 860 251	13	Delhi (DEL)	37,139,957	13	Amsterdam (AMS)	52,472,188
14	INCHEON (ICN)	71 204 153	14	Shanghai Pudong	30 476 531	14	Istanbul (IST)	36,988,563	14	Madrid (MAD)	50,633,652
15	FRANKFURT (FRA)	70 556 072	15	Los Angeles (LAX)	28 779 527	15	Shenzhen (SZX)	36,358,185	15	Miami (MIA)	50,600,000
16	DENVER (DEN)	69 015 703	16	Delhi (DEL)	28 501 000	16	Seattle (SEA)	36,154,015	16	Tokyo (HND)	50,334,534
17	NEW DELHI (DEL)	68 490 731	17	Hangzhou (HGH)	28 224 342	17	Mexico City (MEX)	36,056,614	17	Orlando (MCO)	50,178,499
18	SINGAPORE (SIN)	68 283 000	18	Charlotte (CLT)	27 200 000	18	Chongqing (CKG)	35,766,284	18	Frankfurt (FRA)	48,923,474
19	BANGKOK (BKK)	65 421 844	19	Dubai (DXB)	25 900 000	19	Shanghai Hongqiao	33,207,337	19	Charlotte (CLT)	47,700,000
20	NEW YORK (JFK)	62 551 072	20	Istanbul (IST)	23 409 000	20	Beijing (PEK)	32,639,013	20	Mexico City (MEX)	46,200,529

# Asian Airports are emerging from the Pandemic

**Number  
of  
Departure  
Seats**

	Airport	August, 2019		Airport	August, 2020		Airport	August, 2021		Airport	August, 2022		Airport	July, 2023
1	ATL	5,649,216	1	CGK	3,735,161	1	ATL	4,662,902	1	ATL	4,749,253	1	ATL	5,537,361
2	PEK	5,585,939	2	CAN	3,370,976	2	DFW	3,831,835	2	DXB	4,082,589	2	DXB	4,893,683
3	DXB	4,928,089	3	ATL	3,222,258	3	DEN	3,736,563	3	DFW	3,924,350	3	HND	4,559,864
4	HND	4,742,417	4	HND	2,975,621	4	ORD	3,727,639	4	HND	3,841,828	4	IST	4,457,362
5	LAX	4,689,867	5	PEK	2,895,795	5	LAX	3,304,485	5	IST	3,825,377	5	LHR	4,450,450
6	ORD	4,576,338	6	CTU	2,890,403	6	IST	2,902,176	6	ORD	3,772,331	6	DFW	4,396,392
7	LHR	4,478,338	7	SZX	2,801,236	7	CAN	2,728,987	7	DEN	3,738,762	7	DEN	4,202,455
8	CDG	4,220,888	8	DEN	2,615,675	8	AMS	2,535,188	8	LHR	3,678,230	8	LAX	4,089,329
9	FRA	4,172,623	9	DFW	2,584,547	9	HND	2,512,473	9	LAX	3,579,363	9	CAN	4,007,953
10	PVG	4,090,134	10	KMG	2,507,465	10	SEA	2,470,035	10	CDG	3,404,016	10	ORD	3,933,288
11	DFW	4,042,849	11	PVG	2,504,913	11	DEL	2,457,785	11	DEL	3,344,717	11	CDG	3,770,426
12	HKG	3,994,901	12	CKG	2,402,599	12	SZX	2,420,357	12	CAN	3,301,787	12	PEK	3,716,484
13	IST	3,908,308	13	SHA	2,400,274	13	CLT	2,412,606	13	JFK	3,227,944	13	DEL	3,694,420
14	CAN	3,881,621	14	XIY	2,340,655	14	LAS	2,380,626	14	FRA	3,157,563	14	FRA	3,638,364
15	ICN	3,750,372	15	ORD	2,102,985	15	FRA	2,318,673	15	AMS	3,141,463	15	PVG	3,515,214
16	AMS	3,693,421	16	HGH	1,994,902	16	PEK	2,317,808	16	CGK	3,094,781	16	AMS	3,473,594
17	DEN	3,653,896	17	CDG	1,824,220	17	DXB	2,317,066	17	LAS	2,844,460	17	JFK	3,408,641
18	SIN	3,606,234	18	AMS	1,789,563	18	CDG	2,311,058	18	MAD	2,792,919	18	CGK	3,178,841
19	DEL	3,528,718	19	LAX	1,762,965	19	JFK	2,308,254	19	MEX	2,649,887	19	SIN	3,154,043
20	JFK	3,464,721	20	SEA	1,655,742	20	MCO	2,300,648	20	SZX	2,639,605	20	SZX	3,145,355

# Recovery Continues: Resuming Flights and Emerging Stronger

## Number of Non-Stop Destinations

	Airport	Oct-19		Airport	Oct-20		Airport	Oct-21		Airport	Oct-22
1	CDG	297	1	IST	260	1	FRA	267	1	IST	280
2	FRA	288	2	AMS	223	2	IST	261	2	FRA	271
3	IST	283	3	CDG	221	3	DFW	238	3	CDG	252
4	AMS	261	4	PVG	215	4	AMS	234	4	AMS	251
5	PEK	245	5	DFW	214	5	ORD	229	5	DFW	248
6	DFW	236	6	FRA	210	6	CDG	217	6	DXB	222
7	ORD	233	7	DXB	209	7	DXB	203	7	DEN	207
8	DXB	224	8	PEK	198	8	DEN	201	8	ATL	206
9	PVG	222	9	ORD	192	9	ATL	197	9	LHR	204
10	ATL	220	10	LHR	189	10	LHR	196	10	MUC	190
11	MUC	213	11	CAN	183	11	SVO	177	11	IAH	189
12	SVO	207	12	VIE	182	12	MUC	173	12	MAD	181
13	BCN	203	13	DEN	176	13	PVG	170	13	DUB	180
14	DEN	199	14	SZX	156	14	IAH	170	14	BCN	177
15	FCO	195	15	MUC	155	15	VIE	169	15	STN	175
16	LHR	195	16	ATL	154	16	CLT	166	16	VIE	175
17	MAD	195	17	MAD	147	17	BCN	165	17	CLT	174
18	LGW	192	18	STN	147	18	MAD	155	18	JFK	174
19	VIE	192	19	CLT	146	19	CAN	155	19	FCO	168
20	GVA	188	20	ICN	143	20	ZRH	154	20	EWR	168



# LCCs in Asia Pacific and Europe take bigger Shares

	Asia Pacific	Europe	North America
Mean	32%	44%	39%
Median	24%	41%	41%
Minimum	1%	3%	0%
Maximum	85%	100%	96%
Count	50	70	82

\* Low Cost Carriers' Market Shares (departure seats) in Oct 2022

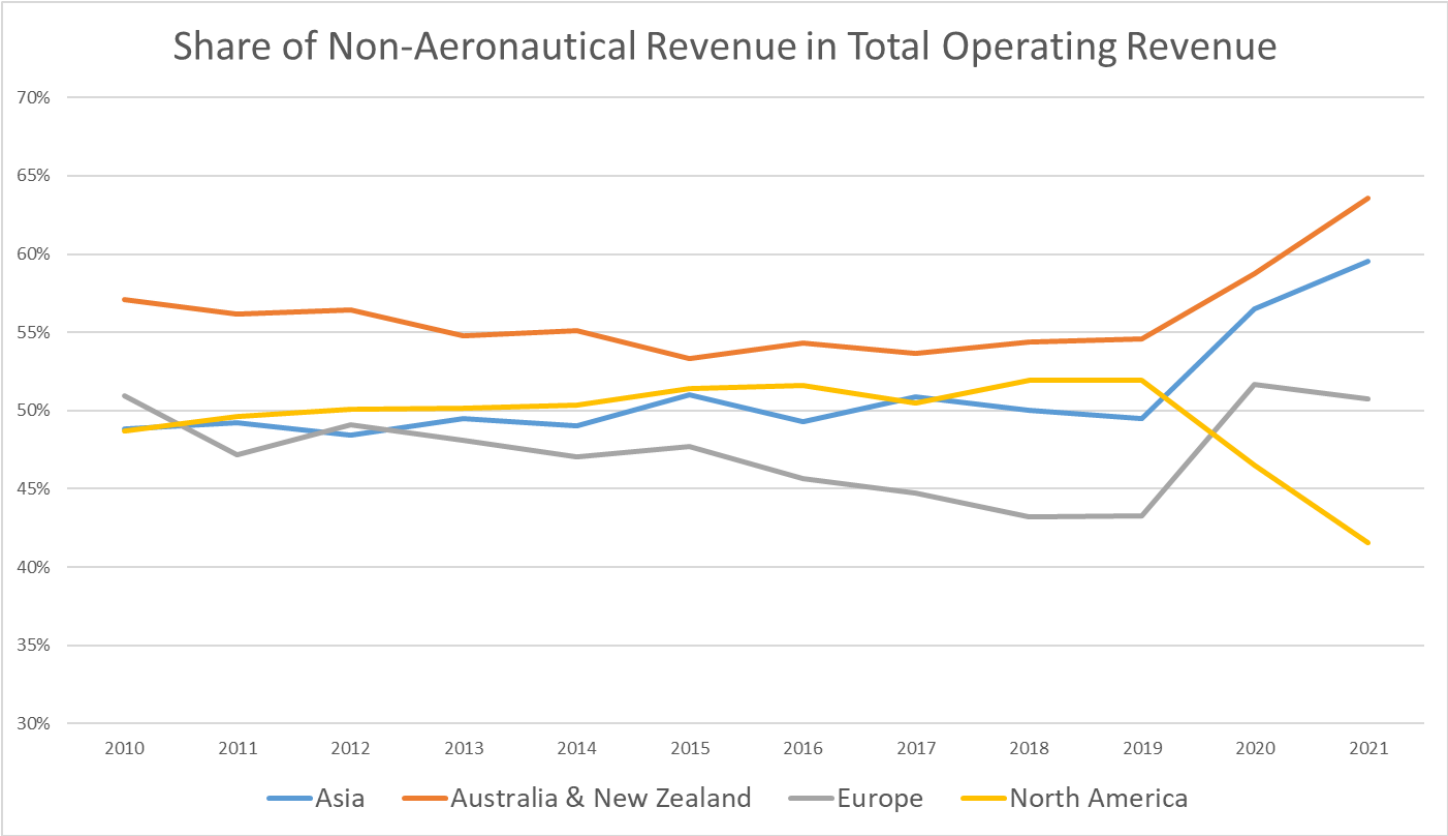
# Prominent Airline Dominance at Airports

	Asia Pacific	Europe	North America
Mean	42%	44%	48%
Median	37%	40%	43%
Minimum	11%	18%	21%
Maximum	94%	89%	97%
Count	54	69	82

\* Dominant Carriers' Market Shares (seats) in Oct 2022



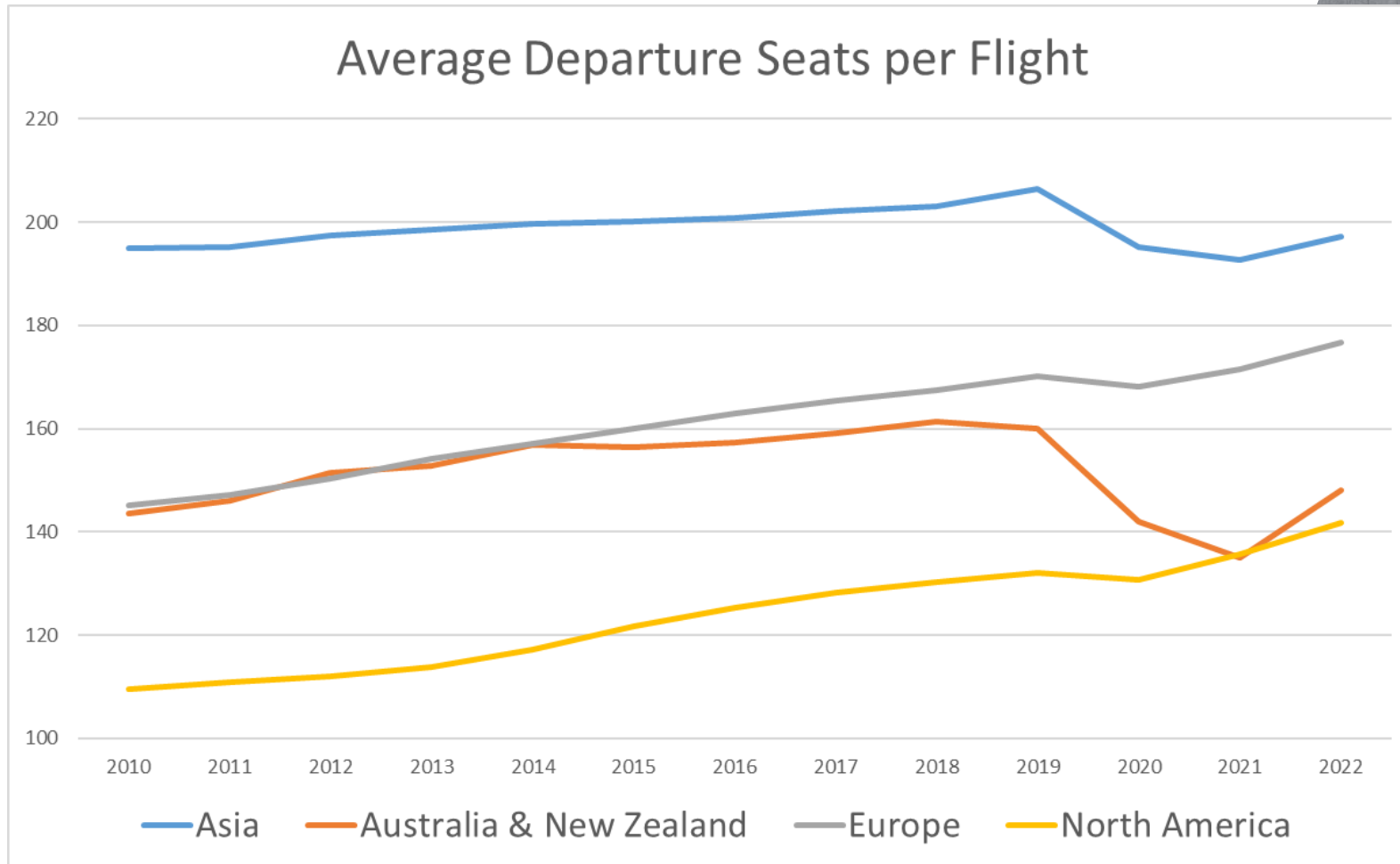
# Noticeable Drop in % of Non-Aeronautical Revenues among North American airports



Share of Non-Aeronautical Revenue - FY2021



# Average Aircraft size continues to increase in Europe and North America



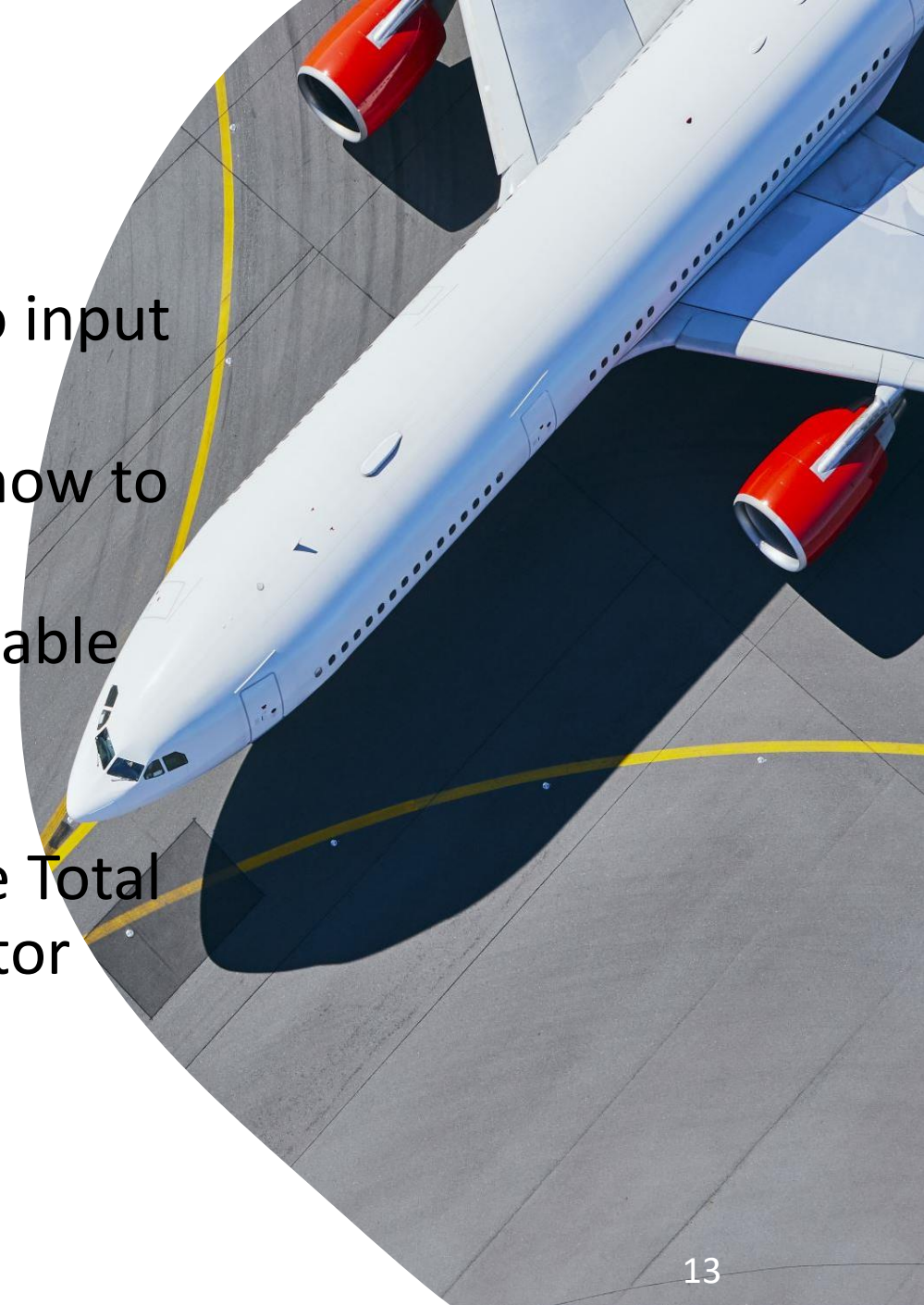
# The Airport Efficiency Excellence Awards

- Award Winning Airports are decided by rankings in terms of residual **Variable Factor Productivity** (VFP) Index in their respective region and size categories.



# Productivity and Efficiency

- Productivity is defined as the ratio of output to input
  - Airports employ multiple inputs to produce multiple outputs → complications arise in how to Aggregate
    - Need to use simple methodology acceptable and understood by the industry and government agencies
    - Multilateral Index Procedure to Measure Total factor productivity (TFP) or Multiple Factor Productivity
      - <https://www.bls.gov/productivity/>
    - Variable Factor Productivity





# Productivity and Efficiency

## Multilateral Index Procedure

- This multilateral **output (input)** index procedure uses the **revenue (cost)** shares to aggregate **output (inputs)**

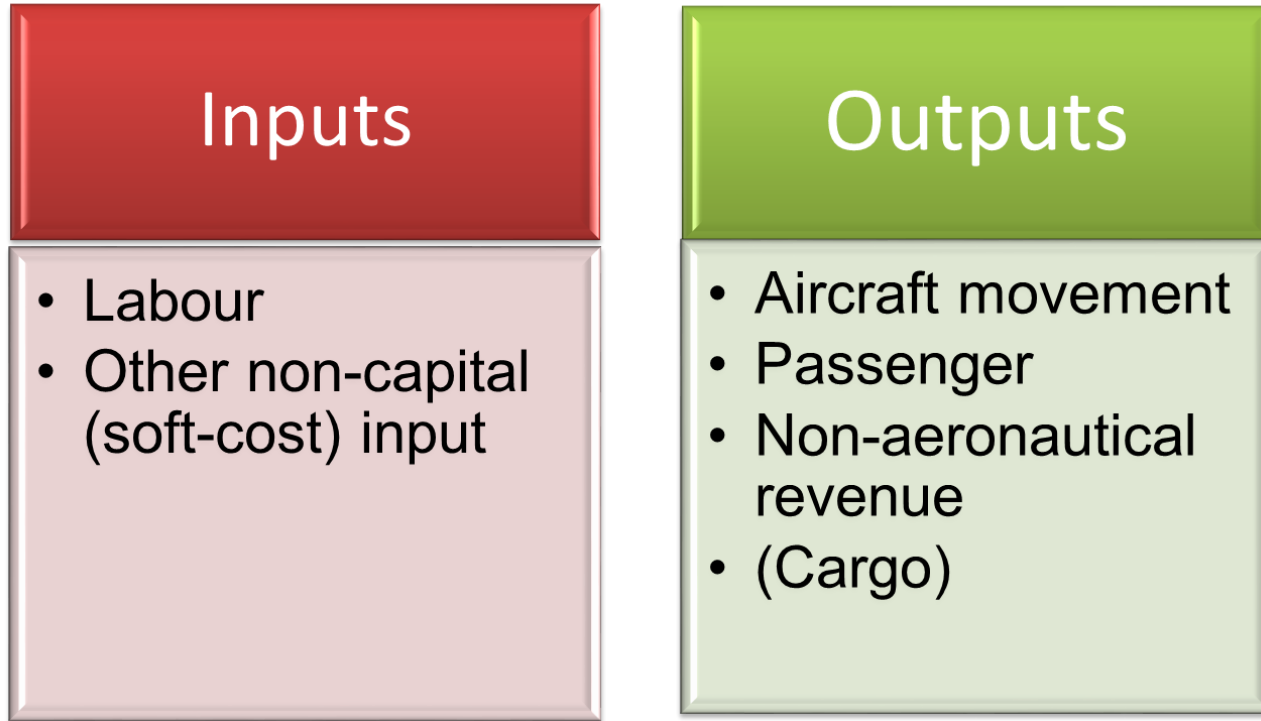
$$\ln \frac{Y_i}{Y_j} = \sum \frac{R_{ki} + \bar{R}_k}{2} \ln \frac{Y_{ki}}{\tilde{Y}_k} - \sum \frac{R_{kj} + \bar{R}_k}{2} \ln \frac{Y_{kj}}{\tilde{Y}_k}$$

$$\ln \frac{X_i}{X_j} = \sum \frac{W_{ki} + \bar{W}_k}{2} \ln \frac{X_{ki}}{\tilde{X}_k} - \sum \frac{W_{kj} + \bar{W}_k}{2} \ln \frac{X_{kj}}{\tilde{X}_k}$$



# Productivity and Efficiency

## Variable Factor Productivity (VFP) Index



**Gross Variable Factor Productivity  
or Observed Productivity**





# Observed Productivity $\neq$ Efficiency

- **Efficiency** measures how well a firm performs relative to the best practice or the most output obtainable from a given input level with the given production
- The observed productivity does not always reflect the true efficiency level because of factors beyond managerial control





# Productivity and Efficiency

## Factors Beyond Managerial Control:

- Airport size (Scale of aggregate output)
- Average aircraft size
- Share of international traffic
- Share of air cargo traffic
- Extent of capacity shortage - congestion delay
- etc
- FY 2020 and FY 2021 - Influence of COVID

**Residual (Net) variable factor productivity (RVFP)** is computed after removing effects of these Factors



# Effects of the Pandemic

- Airports have different fiscal year ending month
  - the impacts of COVID on the FY results differ
- Different Pandemic Policy and Travel Restrictions
  - Oxford COVID-19 GOVERNMENT RESPONSE TRACKER
    - Stringency index, International travel controls, Restrictions on internal movement
      - U.S and Canada at State or Province Level
      - Other Countries at Country level



# VFP Regression Results – Asia Pacific

Dependent variable:  
**LN(VFP)**

	<b>Coefficients</b>	<b>Standard Error</b>	<b>t Stat</b>
<b>Intercept</b>	-5.609	0.796	-7.042
<b>% Non-Aeronautical</b>	0.971	0.072	13.550
<b>% International</b>	-0.017	0.013	-1.320
<b>% Cargo</b>	-0.050	0.012	-4.378
<b>Aircraft Size</b>	0.341	0.058	5.890
<b>Capacity Constraint</b>	0.367	0.052	7.033
<b>Airport Size</b>	-0.187	0.040	-4.712
<b>Oceania</b>	0.620	0.050	12.400
<b>Int'l Travel Control</b>	-0.022	0.040	-0.558
<b>2011</b>	0.061	0.098	0.627
<b>2012</b>	0.102	0.096	1.064
<b>2013</b>	0.097	0.096	1.012
<b>2014</b>	0.059	0.096	0.612
<b>2015</b>	0.032	0.096	0.331
<b>2016</b>	0.086	0.096	0.903
<b>2017</b>	0.087	0.096	0.910
<b>2018</b>	0.045	0.097	0.469
<b>2019</b>	0.026	0.097	0.267
<b>2020</b>	-0.253	0.397	-0.639
<b>2021</b>	-1.027	0.414	-2.481
<b>R Square</b>	0.6436		
<b>Observations</b>	467		



# VFP Regression Results – Europe

Dependent  
variable: LN(VFP)

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	<b>Coefficients</b>	<b>Standard Error</b>	<b>t Stat</b>
<b>Intercept</b>	-9.4152	2.658	-3.542
<b>% Non-Aeronautical</b>	0.145	0.057	2.562
<b>% International</b>	-0.017	0.079	-0.212
<b>% Cargo</b>	-0.126	0.018	-6.983
<b>Capacity Constraint</b>	-0.009	0.019	-0.485
<b>Aircraft Size</b>	0.138	0.090	1.536
<b>Airport Size</b>	0.054	0.030	1.828
<b>Stringency</b>	-0.917	0.276	-3.327
<b>2011</b>	0.000	0.081	0.002
<b>2012</b>	-0.024	0.082	-0.290
<b>2013</b>	-0.026	0.084	-0.307
<b>2014</b>	0.008	0.085	0.098
<b>2015</b>	0.001	0.086	0.016
<b>2016</b>	-0.016	0.086	-0.191
<b>2017</b>	0.016	0.086	0.190
<b>2018</b>	-0.001	0.086	-0.016
<b>2019</b>	0.043	0.087	0.492
<b>2020</b>	11.589	3.640	3.184
<b>2021</b>	11.858	3.663	3.238

# VFP Regression Results – NA

## Dependent variable: LN(VFP)

	<b>Coefficients</b>	<b>Standard Error</b>	<b>t Stat</b>
<b>Intercept</b>	-4.081	0.485	-8.420
<b>% Non-Aeronautical</b>	0.349	0.023	14.950
<b>% International</b>	-0.007	0.002	-2.920
<b>% Cargo</b>	-0.024	0.005	-4.888
<b>Capacity Constraint</b>	0.075	0.019	3.887
<b>Aircraft Size</b>	-0.084	0.020	-4.213
<b>Airport Size</b>	0.067	0.016	4.137
<b>Stringency</b>	-0.413	0.048	-8.646
<b>2011</b>	0.001	0.032	0.022
<b>2012</b>	0.005	0.032	0.173
<b>2013</b>	-0.001	0.032	-0.025
<b>2014</b>	0.003	0.031	0.109
<b>2015</b>	0.028	0.031	0.883
<b>2016</b>	0.036	0.031	1.133
<b>2017</b>	0.041	0.031	1.306
<b>2018</b>	0.037	0.031	1.183
<b>2019</b>	0.026	0.031	0.813
<b>2020</b>	4.992	0.610	8.180
<b>2021</b>	5.196	0.627	8.285
<b>R Square</b>	0.4827		
<b>Observations</b>	966		

# The Airport Efficiency Excellence Awards

## Top Efficiency Award Winners





# The Airport Efficiency Excellence Awards

## Asia Pacific:

- Over 15 million passengers per year: Jeju International
- 3-10 million passengers per year: Gimhae International
- Under 3 million passengers per year: Guam
- Oceania Airports: Sydney Airport



# The Airport Efficiency Excellence Awards

## Europe:

- Over 20 million passengers per year: Madrid
- 10-20 million passengers per year: Athens
- 5-10 million passengers per year: Porto
- Under 5 million passengers per year: EuroAirport Basel-Mulhouse-Freiburg





# The Airport Efficiency Excellence Awards

## North America (Canada/US):

- Over 30 million passengers per year: Charlotte Douglas International Airport
  - <https://www.youtube.com/watch?v=Yhe7PcBzQQc>
- 15-30 million passengers per year: Detroit Metropolitan Airport
- 7 - 15 million passengers per year: Raleigh-Durham International Airport
- 3-7 Million passengers per year: Omaha Airport
- Under 3 million passengers per year: Richmond International Airport





# Airport Sustainability Benchmarking

- Seeking advice and/or Partnership
- Email: [yuc@erau.edu](mailto:yuc@erau.edu)



*Thank you!*

