

# TP 10 Network Dea

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## Table of contents

Definição do Tp	1
data com x e y	3
data com xx e yy	3
eficiências do x e y como input/output	4
eficiências do xx, y e yy como input/output	4
comparação com modelos no arquivo ndea.py	5
eficiências do x, xx e yy como input/output	5

## List of Tables

### Definição do Tp

Vamos comparar as eficiências dos modelos CCR com o do DEA em rede de dois estágios:

- calcule a eficiência de cada estágio separadamente, estágio 1 com  $((X1, X2), Y1)$  e estágio 2 com  $((XX1, XX2, Y1), (YY1, YY2))$ , usando o modelo CCR.

Faça o produto deles para calcular a eficiência global, no qual  $((entradas), (saídas))$ .

- calcule a eficiência da DMU considerando  $X1, X2, XX1$ , e  $XX2$  como entradas e  $YY1$  e  $YY2$  como saídas.
- calcule a média ponderada das eficiências de cada estágio e global usando o modelo de média ponderada obtida via o arquivo ndea.py.
- calcule a eficiência global centralizada usando o modelo

centralizado obtida via o arquivo ndea.py.

- compare as soluções e explique os resultados. O que podemos observar? Analise os resultados obtidos detalhadamente.

#### Centralized Model Efficiency

dmu names	global	E1	E2	E1 x E2
0 Air Canada	0.77025221	0.87229492	0.88301810	0.77025221
1 ANA All Nippon Airwa	0.40842583	0.64986162	0.62848122	0.40842583
2 American Airlines	0.50502529	0.55348777	0.91244165	0.50502529
3 British Airways	0.56793679	0.62434424	0.90965330	0.56793679
4 Delta Air Lines	0.57627997	0.60155882	0.95797775	0.57627997
5 Emirates	0.87495528	0.87495528	1.00000000	0.87495528
6 Garuda Indonesia	0.00092865	0.62288658	0.00149089	0.00092865
7 KLM	0.94414220	0.94414220	1.00000000	0.94414220
8 Lufthansa	0.33594968	0.35558235	0.94478728	0.33594968
9 Malaysia Airlines	0.75583199	0.77402086	0.97650081	0.75583199
10 Qantas	0.48201454	0.48201454	1.00000000	0.48201454
11 SAS Scandinavian Air	0.57147779	0.58969638	0.96910512	0.57147779
12 Singapore Airlines	1.00000000	1.00000000	1.00000000	1.00000000
13 TAM	0.38705227	0.44149759	0.87668036	0.38705227
14 Thai Airways	0.19815456	0.22470183	0.88185557	0.19815456
15 United Airlines	0.90522918	1.00000000	0.90522918	0.90522918

#### Weighted Average Model Efficiency

dmu names	global	E1	(theta1)	E2	(theta2)	E1 x E2
0 Air Canada	0.8782	0.8723	(0.4509)	0.8830	(0.5491)	0.7702
1 ANA All Nippon Airwa	0.6361	0.6499	(0.3580)	0.6285	(0.6420)	0.4084
2 American Airlines	0.7121	0.5555	(0.0000)	0.7121	(1.0000)	0.3956
3 British Airways	0.7340	0.6243	(0.6156)	0.9096	(0.3844)	0.5679
4 Delta Air Lines	0.7641	0.6016	(0.5439)	0.9579	(0.4561)	0.5763
5 Emirates	1.0000	0.8750	(0.0000)	1.0000	(1.0000)	0.8750
6 Garuda Indonesia	0.3840	0.6229	(0.6162)	0.0006	(0.3838)	0.0004
7 KLM	0.9856	0.9441	(0.2585)	1.0000	(0.7415)	0.9441
8 Lufthansa	0.8320	0.2644	(0.0001)	0.8320	(0.9999)	0.2200
9 Malaysia Airlines	0.8624	0.7740	(0.5637)	0.9765	(0.4363)	0.7558
10 Qantas	1.0000	0.4819	(0.0000)	1.0000	(1.0000)	0.4819
11 SAS Scandinavian Air	0.7304	0.5897	(0.6290)	0.9691	(0.3710)	0.5715
12 Singapore Airlines	1.0000	1.0000	(0.5000)	1.0000	(0.5000)	1.0000
13 TAM	0.6403	0.4415	(0.0000)	0.6403	(1.0000)	0.2827
14 Thai Airways	0.7137	0.2247	(0.0000)	0.7137	(1.0000)	0.1604
15 United Airlines	0.9448	1.0000	(0.4180)	0.9052	(0.5820)	0.9052

## data com x e y

DMU	i0	i1	o0
Air Canada	0.45808	0.45648	0.74221
ANA All Nippon Airways	0.51761	0.92672	0.83648
American Airlines	2.2221	1.6641	1.9772
British Airways	0.92375	1.2194	1.2192
Delta Air Lines	1.3241	1.4773	1.5548
Emirates	0.69061	1.318	1.5592
Garuda Indonesia	0.020377	0.29956	0.16146
KLM	0.9689	0.42416	0.85968
Lufthansa	3.9547	2.0156	1.5386
Malaysia Airlines	0.75155	0.25003	0.41544
Qantas	1.2134	0.95622	0.98942
SAS Scandinavian Airlines	0.40893	0.18688	0.23657
Singapore Airlines	0.0875	1.4119	1.2126
TAM	0.55717	0.52586	0.44664
Thai Airways	0.92295	2.0964	0.5948
United Airlines	0.97829	0.77133	1.6558

## data com xx e yy

DMU	i0	i1	i2	o0	o1
Air Canada	0.74221	0.66795	0.78884	0.787	0.40643
ANA All Nippon Airways	0.83648	0.51816	0.65888	0.52537	0.72333
American Airlines	1.9772	1.8476	2.2306	2.1899	0.8493
British Airways	1.2192	1.3246	1.3671	1.2355	1.5589
Delta Air Lines	1.5548	1.3922	1.8943	1.786	0.58698
Emirates	1.5592	0.10821	1.2158	1.3822	2.2941
Garuda Indonesia	0.16146	1.7492	0.047596	4.2475e-05	0.00018054
KLM	0.85968	0.64788	0.78034	0.90055	1.4378
Lufthansa	1.5386	2.6622	1.4844	1.5197	2.4338
Malaysia Airlines	0.41544	0.41835	0.41414	0.36737	0.72781
Qantas	0.98942	0.97218	0.81339	1.2191	0.9215
SAS Scandinavian Airlines	0.23657	0.32358	0.28561	0.28247	0.12118
Singapore Airlines	1.2126	0.75713	0.90556	0.94796	2.304
TAM	0.44664	0.54463	0.51934	0.48244	0.054724
Thai Airways	0.5948	0.58974	0.62314	0.57923	0.75775

DMU	i0	i1	i2	o0	o1
United Airlines	1.6558	1.4763	1.971	1.7952	0.82211

### eficiencias do x e y como input/output

DMU	Ef
Air Canada	87.229%
ANA All Nippon Airways	64.986%
American Airlines	55.349%
British Airways	62.434%
Delta Air Lines	60.156%
Emirates	87.496%
Garuda Indonesia	62.289%
KLM	94.414%
Lufthansa	35.558%
Malaysia Airlines	77.402%
Qantas	48.201%
SAS Scandinavian Airlines	58.970%
Singapore Airlines	100.000%
TAM	44.150%
Thai Airways	22.470%
United Airlines	100.000%

### eficiencias do xx, y e yy como input/output

DMU	Ef
Air Canada	88.302%
ANA All Nippon Airways	62.848%
American Airlines	91.244%
British Airways	90.965%
Delta Air Lines	95.798%
Emirates	100.000%
Garuda Indonesia	0.149%
KLM	100.000%
Lufthansa	94.479%
Malaysia Airlines	97.650%

DMU	Ef
Qantas	100.000%
SAS Scandinavian Airlines	96.910%
Singapore Airlines	100.000%
TAM	87.668%
Thai Airways	88.186%
United Airlines	90.523%

## comparação com modelos no arquivo ndea.py

DMU	x*xx	E1*E2_CME	x	E1_CME	E2_CME	xx - y	Global_W
0	0.77025	0.77025	0.87229	0.87229	0.88302	0.88302	0.87818
1	0.40843	0.40843	0.64986	0.64986	0.62848	0.62848	0.63613
2	0.50502	0.50503	0.55349	0.55349	0.91244	0.91244	0.71208
3	0.56794	0.56794	0.62434	0.62434	0.90965	0.90965	0.73401
4	0.57628	0.57628	0.60156	0.60156	0.95798	0.95798	0.76411
5	0.87496	0.87496	0.87496	0.87496	1.0	1.0	1.0
6	0.00092865	0.00092865	0.62289	0.62289	0.0014909	0.0014909	0.38403
7	0.94414	0.94414	0.94414	0.94414	1.0	1.0	0.98556
8	0.33595	0.33595	0.35558	0.35558	0.94479	0.94479	0.83195
9	0.75583	0.75583	0.77402	0.77402	0.9765	0.9765	0.86236
10	0.48201	0.48201	0.48201	0.48201	1.0	1.0	0.99999
11	0.57148	0.57148	0.5897	0.5897	0.9691	0.96911	0.73044
12	1.0	1.0	1.0	1.0	1.0	1.0	1.0
13	0.38705	0.38705	0.4415	0.4415	0.87668	0.87668	0.64029
14	0.19815	0.19815	0.2247	0.2247	0.88186	0.88186	0.71373
15	0.90523	0.90523	1.0	1.0	0.90523	0.90523	0.94483

## eficiências do x, xx e yy como input/output

DMU	i0	i1	i2	i3	o0	o1
Air Canada	0.45808	0.45648	0.66795	0.78884	0.787	0.40643
ANA All Nippon Airways	0.51761	0.92672	0.51816	0.65888	0.52537	0.72333
American Airlines	2.2221	1.6641	1.8476	2.2306	2.1899	0.8493
British Airways	0.92375	1.2194	1.3246	1.3671	1.2355	1.5589
Delta Air Lines	1.3241	1.4773	1.3922	1.8943	1.786	0.58698

DMU	i0	i1	i2	i3	o0	o1
Emirates	0.69061	1.318	0.10821	1.2158	1.3822	2.2941
Garuda Indonesia	0.020377	0.29956	1.7492	0.047596	4.2475e-05	0.00018054
KLM	0.9689	0.42416	0.64788	0.78034	0.90055	1.4378
Lufthansa	3.9547	2.0156	2.6622	1.4844	1.5197	2.4338
Malaysia Airlines	0.75155	0.25003	0.41835	0.41414	0.36737	0.72781
Qantas	1.2134	0.95622	0.97218	0.81339	1.2191	0.9215
SAS Scandinavian Airlines	0.40893	0.18688	0.32358	0.28561	0.28247	0.12118
Singapore Airlines	0.0875	1.4119	0.75713	0.90556	0.94796	2.304
TAM	0.55717	0.52586	0.54463	0.51934	0.48244	0.054724
Thai Airways	0.92295	2.0964	0.58974	0.62314	0.57923	0.75775
United Airlines	0.97829	0.77133	1.4763	1.971	1.7952	0.82211

DMU	Ef
Air Canada	100.000%
ANA All Nippon Airways	63.606%
American Airlines	83.462%
British Airways	80.830%
Delta Air Lines	85.875%
Emirates	100.000%
Garuda Indonesia	0.149%
KLM	100.000%
Lufthansa	83.477%
Malaysia Airlines	93.272%
Qantas	100.000%
SAS Scandinavian Airlines	81.437%
Singapore Airlines	100.000%
TAM	71.455%
Thai Airways	71.374%
United Airlines	100.000%