Small regional airport sustainability: Lessons from benchmarking

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Nicole Adler, Tolga Ülkü and Ekaterina Yazhemsky

Hebrew University of Jerusalem, Israel. E-Mail: msnic@huji.ac.il

Humboldt University of Berlin, Germany. E-Mail: tolgaul@yahoo.com

Hebrew University of Jerusalem, Israel. E-Mail: katy.y@mail.huji.ac.il

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Outline

- Motivation
- Methodologies
- Efficiency Measurement
  - ✓ airport observations
  - ✓ variables
- Results
  - ✓ DEA
  - ✓ break-even point
  - ✓ second stage regression
- Conclusions

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Motivation

"An efficient airport provides important economic catalysts that enable the local and regional economy to thrive and improve the quality of life in the region." (Oum et al., 2008)

Motivation

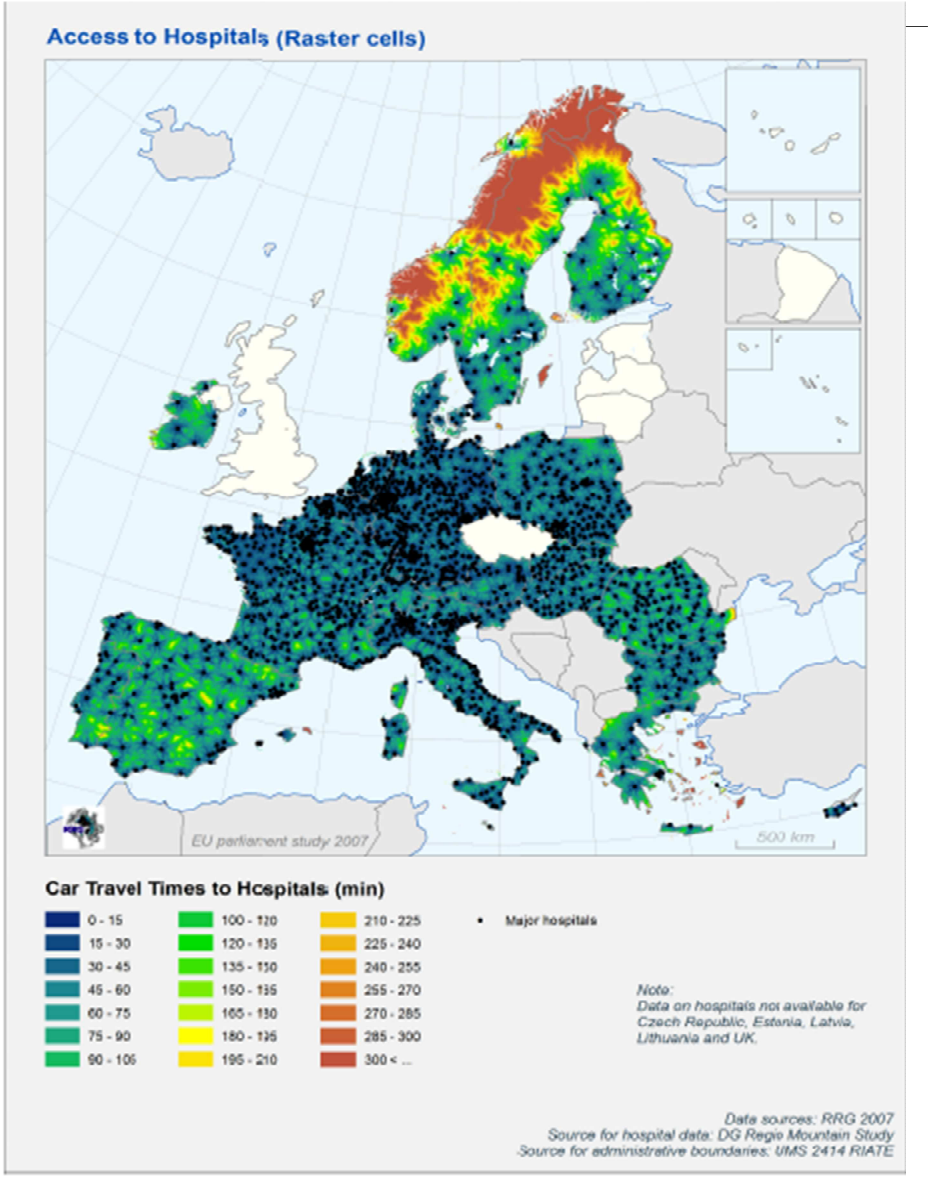
– Small and regional airports frequently suffer from:
  - limited traffic
  - fixed infrastructure requirements
  - insufficient revenues to cover their costs

– Subsidize loss-making airports

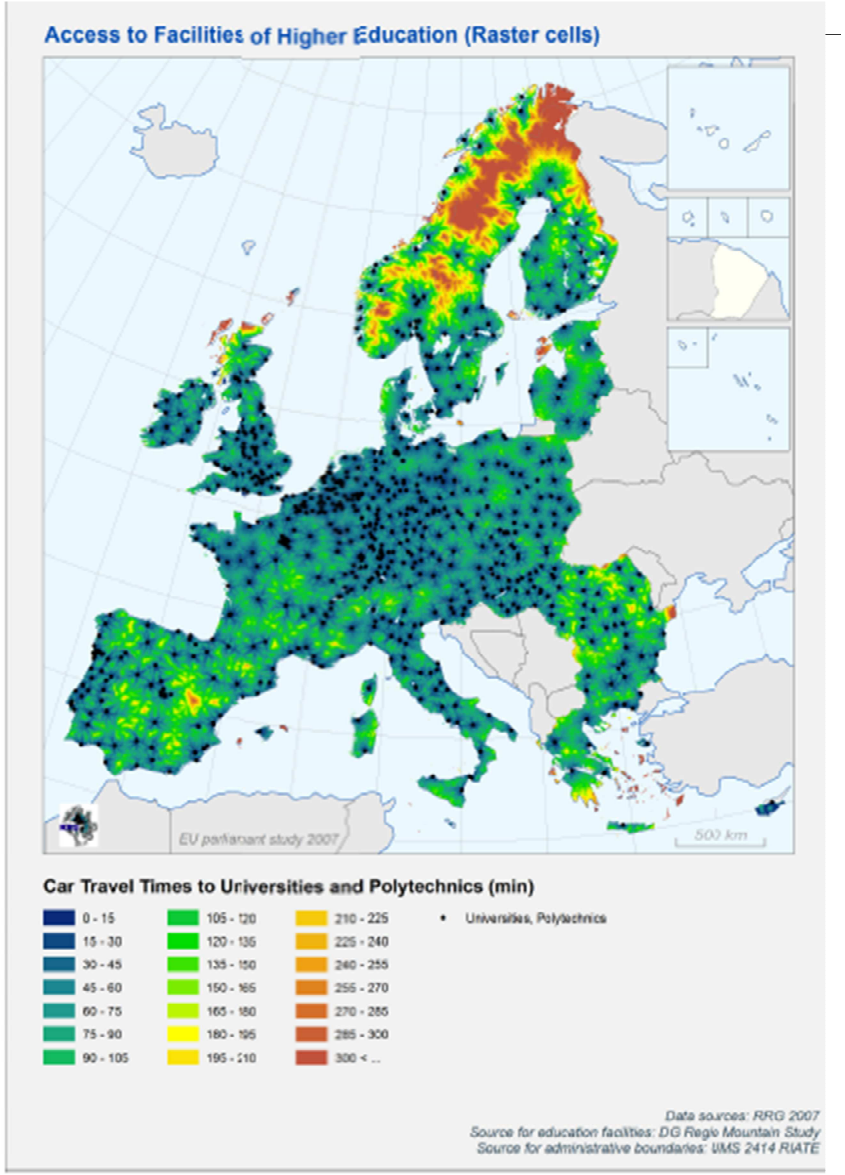
1. Direct subsidies from local or federal government
2. Cross-subsidization

– Question: how should such airports be structured, managed and financially supported in order to survive?

Regional accessibility and social development in Europe



Source: Dubois et al. (2007). Calculation by C. Schürmann (RRG).



Source: Dubois et al. (2007). Calculation by C. Schürmann (RRG).

Motivation

- Small regional airports should not be underestimated

  → In Europe*, in 2007,

  340 out of 491 airports < 1,5 million PAX

(Source: EUROSTAT)

*The EU, Croatia, Turkey, Iceland, Norway and Switzerland

- Airport benchmarking literature focuses on:

  → Main large hubs

  → Country level

Aims of research

- to estimate relative efficiencies of regional airports across Europe
- to analyze efficiency changes over time
- to examine reasons for poor performance
- to provide recommendations to airport managers, airport operators, civil aviation authorities and governments

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DEA model

$$\underset{\lambda,S}{Max}\quad Q = 1 - \frac{1}{m+s}\left(\sum_{i=1}^{m}\frac{S_{io}^{-}}{L_{io}^{-}} + \sum_{r=1}^{s}\frac{S_{ro}^{+}}{U_{ro}^{+}}\right)$$

$$s.t. \quad \sum_{j=1}^{n} x_{ij}\lambda_j + S_{io}^{-} = x_{io} \quad \forall \quad i = 1,\ldots, m$$

$$\sum_{j=1}^{n} x_{kj}^{ND}\lambda_j \le x_{ko}^{ND} \quad \forall \quad k = 1,\ldots, l$$

$$\sum_{j=1}^{n} y_{rj}\lambda_j - S_{ro}^{+} = y_{ro} \quad \forall \quad r = 1,\ldots, s$$

$$\sum_{j=1}^{n} y_{pj}^{ND}\lambda_j \ge y_{po}^{ND} \quad \forall \quad p = 1,\ldots, q$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j \ge 0 \quad \forall \quad j = 1,\ldots, n$$

$$S_{io}^{-} \ge 0 \quad \forall \quad i = 1,\ldots, m$$

$$S_{ro}^{+} \ge 0 \quad \forall \quad r = 1,\ldots, s$$

BAM(Cooper et al., 2011)

- Slack-based (additive)
- Non-radial
- Non-oriented
- Non-discretionary variables
- Variable Returns to Scale

DEA model

$$\underset{\lambda,S}{Max}\ Q = 1 - \frac{1}{m+s}\left(\sum_{i=1}^{m}\frac{S_{io}^{-}}{L_{io}^{-}} + \sum_{r=1}^{s}\frac{S_{ro}^{+}}{U_{ro}^{+}}\right)$$

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BAM(Cooper et al., 2011)

- DMU specific ranges

$$L_{io}^{-} = x_{io} - \underline{x}_i \quad \forall \quad i = 1,\ldots, m$$

$$U_{ro}^{+} = \overline{y}_r - y_{r0} \quad \forall \quad r = 1,\ldots, s$$

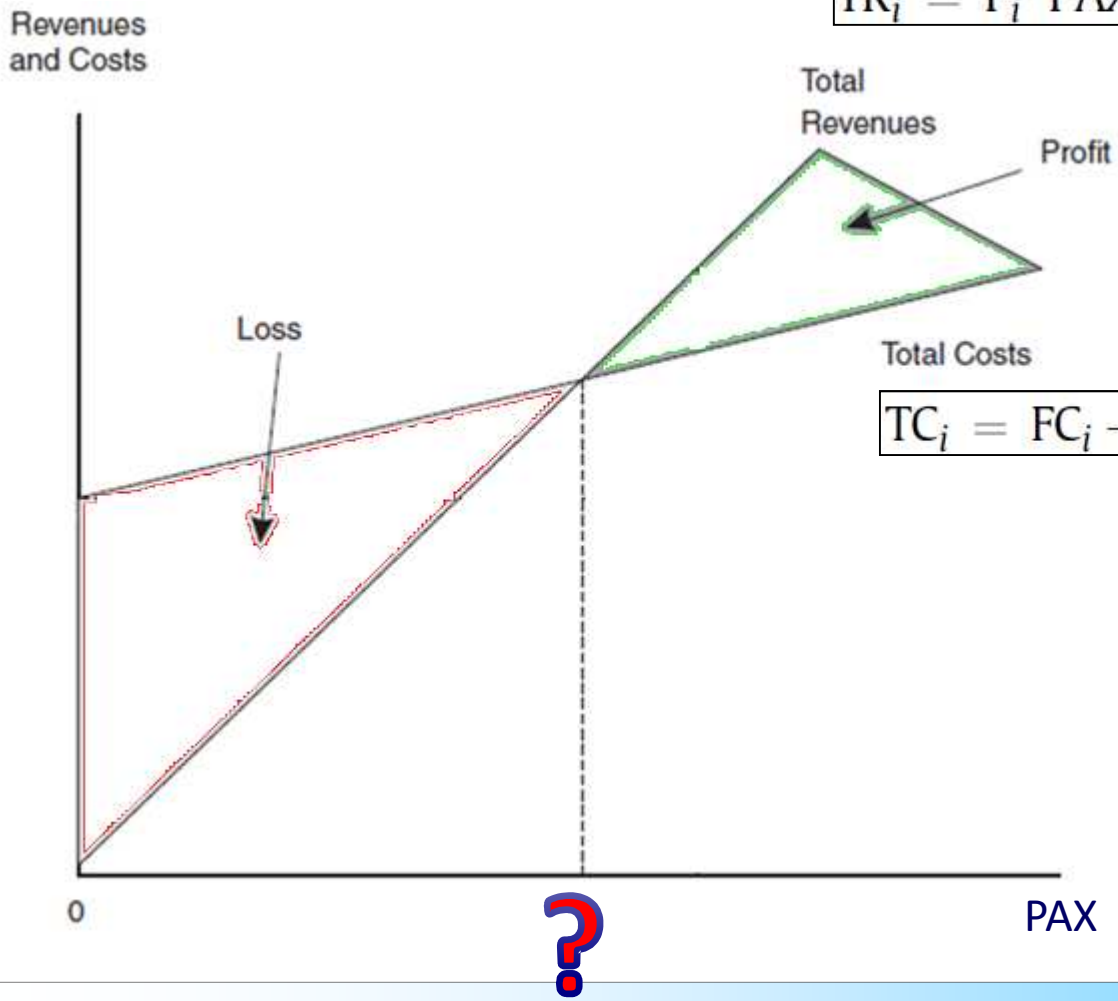
- Ideal point

$$\underline{x}_i = \min\{x_{ij} \quad \forall \quad j = 1,\ldots, n\}$$

$$\overline{y_r} = \max\{y_{rj} \quad \forall \quad j = 1,\ldots, n\}$$

Determination of break-even point

$$TR_i = P_i * PAX_i + u_i \qquad \forall \quad i = 1, \ldots, n$$



$$TC_i = FC_i + VC_i * PAX_i + e_i \qquad \forall \quad i = 1, \ldots, n$$

Second stage regressions

- OLS Regression
- Truncated Regression
- (Censored) Tobit Regression

Robust results

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Regional and small airport dataset

85 airports from 6 countries:

- Austria, France, Germany, Italy, Norway and UK
  (Avinor) (incl. HIAL)
- Between 3,000 - 1,600,000 passengers annually
- Time Period: 2002-2009

Input and output variables

Inputs:

- ***labor costs***
- ***other operating costs***
- total runway length (ND)

Monetary values: PPP and inflation adjusted

Outputs:

- ***non-aeronautical revenues***
- the number of passengers served (ND)
- commercial air traffic movements (ND)
- tons of cargo (ND)

ND: Non-discretionary

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Percentage reductions / increases at country and airport group level

Country / Airport Group	Number of Airports	Percentage Reduction in Staff Costs	Percentage Reduction in Other Operating Costs	Percentage Reduction in Total Costs	Percentage Increase in Non-aviation Revenues
Avinor	41	31%	56%	43%	23%
HIAL	9	58%	74%	65%	134%
UK	2	37%	28%	32%	-
Group	**52**	**36%**	**58%**	**46%**	**41%**
Austria	1	36%	12%	24%	-
France	22	47%	42%	45%	4%
Germany	2	72%	41%	58%	-
Italy	5	43%	42%	43%	6%
UK	3	59%	46%	52%	5%
Standalone	**33**	**49%**	**41%**	**46%**	**4%**
Average		**41%**	**51%**	**46%**	**27%**

Break-even point

Break-even point for 85 sample airports.

	(1) Based on current data		(2) Based on hypothetically efficient airports	
	Coeff.	*t*-Stat.	Coeff.	*t*-Stat.
2002				
Fixed cost	1,500,222	4.2	810,138	2.7
Variable cost	8.13	10.2	7.61	11.2
Revenue	15.60	16.7	15.63	16.7
2009				
Fixed cost	2,558,790	7.2	1,266,699	4.9
Variable cost	10.47	16.5	9.61	20.7
Revenue	15.99	21.1	17.23	23.2

	Critical level of passenger throughput	
2002	200,832	101,015
2009	463,549	166,233

Second stage regression

Second stage regression results explaining efficiency estimates.

Ln(efficiency estimate)	Explanatory variables	OLS		Truncated	
		Coef.	*t*-stat.	Coef.	*z*-stat
Managerial Variables	Commercial rev >50%	0.03	3.38	0.04	3.67
	Ground handling or fuel sales in-house	−0.03	−5.96	−0.03	−6.16
Non-Discretionary Variables	Belongs to airport system	−0.05	−5.41	−0.05	−5.50
	PSO served	0.03	4.53	0.04	4.46
	Military involvement	0.02	1.76	0.02	1.74
	Remote area	−0.03	−3.07	−0.03	−3.03
	STOL	0.00	−0.21	0.00	−0.18
	Public	0.01	1.19	0.01	1.13
Partially discretionary	Log EBIT	0.02	4.86	0.02	4.67
Time dummies	d2003	−0.04	−3.30	−0.05	−3.71
	d2004	−0.07	−5.52	−0.08	−5.74
	d2005	−0.08	−6.63	−0.10	−6.79
	d2006	−0.08	−6.93	−0.10	−7.08
	d2007	−0.08	−7.07	−0.10	−7.34
	d2008	−0.09	−7.66	−0.11	−7.92
	d2009	−0.10	−8.29	−0.12	−8.34
	Constant	−0.45	−5.68	−0.42	−5.14

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Conclusions

- Reduce costs & increase commercial revenues

  → Potential for some airports even to achieve break-even point (144 out of 696 obs.)

- Operational costs increasing in Europe over decade

  → Need to further analyze security management

- Airport groups are **less** efficient

  → Individual management better utilizes resources according to regional needs

- Subsidies should be performance based

  → Improve incentives for productive efficiency

- Outsource all ground handling activities

- Need for continuous benchmarking

Thank you for your attention.

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