Economic Modelling – the influence of ownership

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Competition for Air Traffic Management

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Outline presentation

- Ownership models today in ATM
- Influence of ownership
  - Literature
  - (Small) economic model
  - What does the data have to say?
- Conclusions

Effect of ownership?

Ownership and governance models

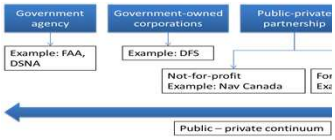
- A large variety over countries

Country	ANSP	Towers	Centers	Employees	Organization
Australia	Airservices Australia	29	2	4,204	Gov't-owned corporation
Belgium	Belgocontrol	5	1	919	Public company
Canada	NAV CANADA	42	7	4,832	Private company
Finland	Finavia Corporation	25	1	1,612	Gov't-owned public limited corporation
France	DSNA France	86	5	7,846	State agency
Germany	DFS Deutsche Flugsicherung GmbH	16	4	5,938	Gov't-owned company
Greece	Hellenic Civil Aviation Authority	18	2	680	Civil service agency
Ireland	Irish Aviation Authority	3	2	642	Commercial state-sponsored body
Italy	ENAV, S.p.A.	40	4	3,276	Joint-stock company
Mexico	SENEAM	58	4	2,254	Gov't agency
New Zealand	Airways New Zealand	29	1	761	Gov't-owned corporation
Poland	Polish Air Navigation Services Agency (PANSA)	13	1	1,771	"Certified legal entity"
Portugal	NAV Portugal	10	2	993	Gov't-owned company
Romania	Romanian Air Traffic Services Administration (ROMATSA)	16	1	1,516	Self-financed government administration
Russia	State ATM Corporation	250	57	9,500	Gov't-owned corporation
Slovenia	Slovenia Control, Slovenian Air Navigation Services, Ltd.	4	1	215	Independent gov't-owned company
South Africa	Air Traffic & Navigation Services (ATNS)	23	2	1,050	Gov't-owned corporation
Spain	AENA	22	5	4,249	Publicly owned company
Switzerland	skyguide	14	2	1,330	Nonprofit joint-stock company

Effect of ownership?

Ownership and governance models

- Continuum of governance models



- Increased involvement of ATM cust

The privatisation of the FAA: Does it go far enough?

David McMillan, the former DG of Eurocontrol, Chair of the ATM Policy Institute, argues that Trump's proposed privatisation of the ATM network is a good but improvable decision.

President Trump's recent announcement that he is to 'privatise' the air traffic management of the Federal Aviation Administration is a welcome development.

It is not a true privatisation, but, if it can be achieved, it will help to eliminate the current roundabout of political interference and management-accountable-to-political-whimsy to which the Air Traffic Office of the FAA is currently subject, when it should instead be focusing on its customers: the airlines.

Competition for Air Traffic Management

Literature is mixed

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- ANSPs
  - Elias (2015): no evidence one is better than the other
  - Button & Neiva (2014): DEA analysis: more efficient if closely linked to government ("counterintuitive")
  - Robyn (2015): "A cooperative approach, such as the NavCanada case, has shown to be superior, in theory and in practice"
- Airports
  - Adler & Liebert (2014): DEA analysis - public airports operated less cost efficiently than fully private airports (in absence of competition). If competition, equally efficient but private sets higher charges (EU & Australia)
- General economic literature
  - Focusses on incentives
  - Laffont & Tirole (1991), Armstrong & Sappington (2007) : Cannot know a priory which one is better
  - Sappington & Stiglitz (1987): role of transaction costs

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What does theory have to say? (1)

Assume the following mixed goal function for ANSP

$$Goal^{ANSP} = \gamma_1^{ANSP_i} CS + \gamma_2^{ANSP_i} \pi^{ANSP} + \gamma_3^{ANSP_i} NI$$

- With consumer surplus (CS), with weight parameter $\gamma_1^{ANSP_i}$
- Maximization of profits (π^{ANSP}), with weight parameter $\gamma_2^{ANSP_i}$
- National interest (NI), with weight parameter $\gamma_3^{ANSP_i}$
- Argue that weights depend on ownership form

ANSP has operating costs

$$OC_{ANSP} = D \cdot c(e) = D \cdot (a + \theta - e)$$

- With D demand
- a - fixed cost per flightkm controlled
- θ ANSP dependent cost – imperfectly observable (eg. Function of complexity)
- e imperfectly observable cost reduction potential – which comes at a cost $C_e = D \cdot \frac{\emptyset \cdot e^2}{2}$

ANSP receives income via charges – mix of price cap and cost-plus – B is weight of cost-plus

$$p_{charge} = A + Bc(e)$$

What does theory has to say? (2)

We can show by differentiating objective function:

The first order condition leads us to the following choice of efficiency

$$e^* = \frac{\gamma_2^{ANSP_i} + B(\gamma_1^{ANSP_i} - \gamma_2^{ANSP_i})}{(\gamma_2^{ANSP_i} + \gamma_3^{ANSP_i})\emptyset}$$

Hence we find that

- Effort is increasing in the weight attached to consumer surplus ($\gamma_1^{ANSP_i} > \gamma_2^{ANSP_i}$) and ($\gamma_1^{ANSP_i} > \gamma_3^{ANSP_i}$) – except if pure price cap.
- Effort is decreasing in the weight attached to national interest
- The effect decreases with the weight attached to profit

Assuming that public firms care more about national interest, this could lead to a lower effort level than a private firm with consumers in the board.

If the private firm is mainly interested in profit, it is not clear if the effort would be larger or smaller than in the case of a public firm/private firm with board.

And if we look into the data?

Estimation of
- Cost function
- Production function

Separately for En Route & Terminal
Using a dataset 2006-2014
- Data quality testing
- Missing data
- Construction of variables

Used STATA – Stochastic Frontier Analysis
- Different specifications
- Different explanatory variables/sets of explanatory variables

En route

Enroute, cost

Para.	Label	Model 1 Estimate		SE	Model 2 Estimate		SE
Elasticities							
β_1	x_1 (Total IFR flight hours controlled)	0.919	**	0.016	0.905	**	0.018
β_2	x_2 (Labor cost)	0.385	**	0.035	0.417	**	0.041
β_3	x_3 (Capital cost)	0.216	**	0.021	0.218	**	0.022
Environmental variables							
β_{Z1}	Z_1 (Seasonality)	1.379	**	0.192	1.686	**	0.214
β_{Z2}	Z_2 (Complexity)				0.700	**	0.153
Exogenous inefficiency determinantsa							
δ_1	Z_{u1} (Complexity)				-0.846	**	0.133
δ_2	Z_{u2} (Ownership gov/corp)				1.596	**	0.337
δ_3	Z_{u3} (Ownership agency)				1.563	**	0.344
	sigma_u	**0.080**		**2.463**	**0.296**	**	**0.025**
	sigma_v	**0.327**	**	**0.013**	**0.181**	**	**0.022**
	lambda	**0.246**		**2.466**	**1.633**	**	**0.041**
	Log Likelihood	**-97.510**			**-57.280**		

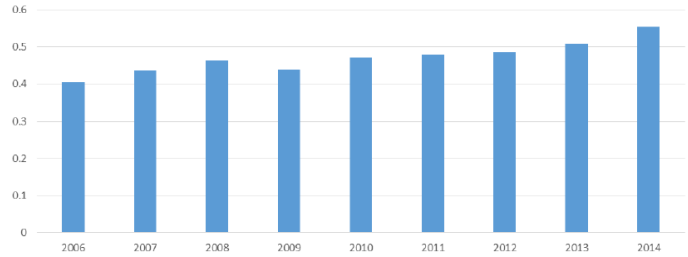
Enroute, production

Para.	Label	Model 1 Estimate		SE	Model 2 Estimate		SE
β_1	x_1 (Labor)	0.451	**	0.074	0.423	**	0.060
β_2	x_2 (Capital)	0.582	**	0.084	0.520	**	0.064
β_{Z1}	Z_1 (Seasonality)	-1.017	**	0.232	-2.492	**	0.200
β_{Z2}	Z_2 (Complexity)				-0.989	**	0.102
δ_1	Z_{u1} (Complexity)				-1.553	**	0.102
δ_2	Z_{u2} (Ownership gov/corp)				2.935	**	0.225
δ_3	Z_{u3} (Ownership agency)				2.623	**	0.232
	sigma_u	**3.723**		**25.244**	**0.340**	**	**0.023**
	sigma_v	**0.271**	**	**0.029**	**0.142**	**	**0.019**
	lambda	**13.745**		**25.237**	**2.395**	**	**0.037**
	Log Likelihood	**-150.271**			**-59.249**		

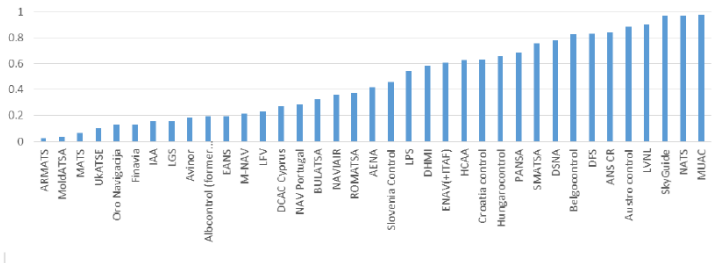
A */** next to coefficient indicates significance at the 5%/1% level.

[a] A positive efficiency score parameter estimate shows that the variable has a negative effect on efficiency

Average production efficiency for en-route ANSPs from 2006-2014



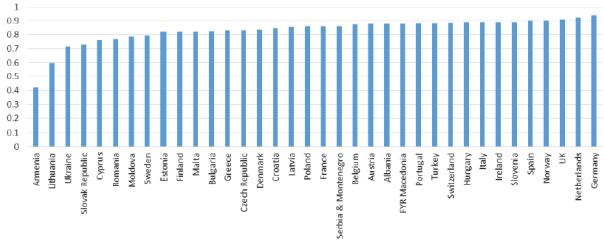
Average production efficiency estimate per en-route ANSP



And for terminals?

- Problem that terminals are reported at national level – aggregate of small and large airports
- All variables are statistically significant and with expected sign
  - Ownership significant for cost function
  - But not for the production function

Average production efficiency



Conclusion

In theory, one would expect positive effects (higher effort to control costs) of

- privatisation with stakeholders as shareholders
- inclusion of a board of stakeholders (public company)
- Impact of strong national interests (buying local, unions) decrease efficiency.

We also find this back in the data

-> ownership matters!

Questions?

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