

ACCELERATING CHANGE IN AIR TRAFFIC CONTROL?

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Motivation

- present ATC system in EU is composed of 37 national providers
- each system charges more or less average cost, hence:
 - weak incentives for cost-efficient operation
 - slow adaptation of cost saving technologies
- airlines choose flight paths to minimize costs without fully considering congestion on routes
- could this system be more efficient through changes in incentive schemes?
 - changes in ownership form
 - changes in price regulation
 - application of new technologies

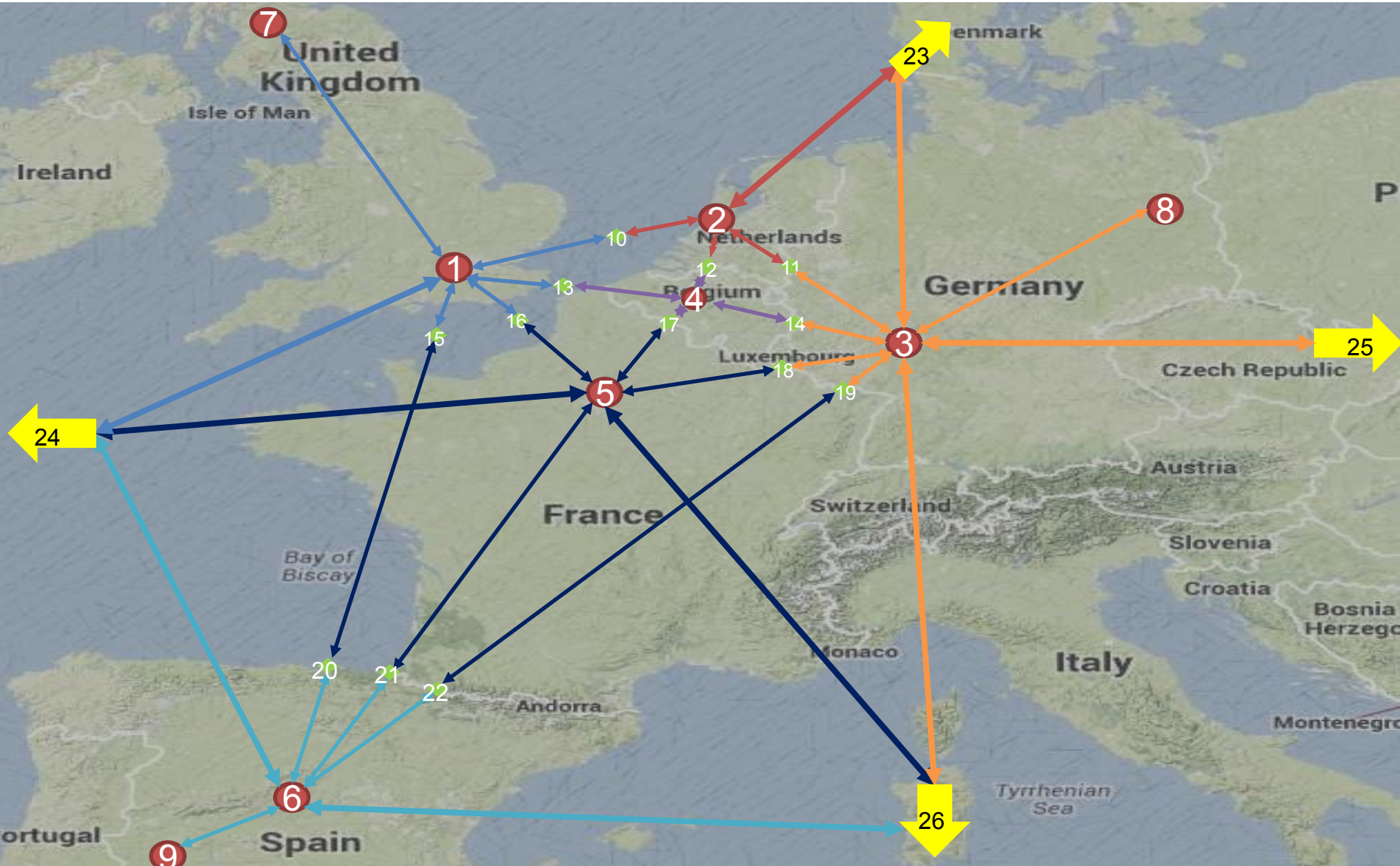
Content

- Modeling approach:
 - players: air traffic control providers & airlines
 - system versus user optimal
 - 2 stage congestion game
- Scenarios:
 - base-case: reproduction of equilibria outcome in 2011
 - price regulation
 - functional air space blocks
 - regional forerunners
 - technology: SESAR
- Empirical exploration:
 - 6 ANSP region in Europe covering 50% of traffic

2 stage game

- Stage 1 - **ANSPs** set **charges** according to regulatory rules
 - Cost recovery
 - Profit maximization
 - Incentive based price-caps
- Stage 2 - **Airlines** choose **flight paths** given schedules
 - *User optimal*: Airlines set flight paths to minimize own costs
 - *System optimal*: EUROCONTROL set flight paths to minimize sum of airline costs
 - 3 cost components: operational, congestion & ATC en-route charges
 - Option to 'not fly' necessary for demand elasticity

Case study of Europe



Players

- 6 Air navigation service providers:
 - NATS (U.K.)
 - LVNL (Netherlands)
 - DFS (Germany)
 - AENA (Spain)
 - BelgoControl (Belgium)
 - DSNA (France)
 - Together control 50% of the European traffic
- 5 Airlines:
 - 3 alliances: Star (Lufthansa), OneWorld (BA), Skyteam (AF-KLM)
 - Low cost carrier (Easyjet)
 - Unaligned carrier (Emirates)

Scenarios

- Base case
- Pricing: regulation versus profit maximization
- Technology: pilot common project & SESAR
- Horizontal Integration: FABs
 - BelgoControl (Belgium) & DSNA (France)
 - LVNL (Netherlands) & DFS (Germany)
- Vertical Integration: Regional forerunner
 - DFS & Lufthansa
 - DSNA & Air France

Base case: reproducing current equilibria 2011

- User optimal (cost recovery)

Airlines	Annual costs (€ M)	CASK
BA	6,545	0.067
LH	7,201	0.082
AF	4,779	0.082
LC	11,233	0.058
Rest	8,815	0.058

ANSP	Prices (€ /ASK)	Annual Revenues (€ M)	Annual Profits (€ M)
NATS	0.98	914	92
LVNL	0.82	273	21
DFS	0.89	589	(8)
Belgocontrol	0.95	180	14
DSNA	0.83	1,152	96
AENA	0.97	414	(40)
SUM TOTAL		3,522	174

Base case: reproducing current equilibria 2011

- User optimal:

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BA	6,545	0.067
LH	7,201	0.082
AF	4,779	0.082
LC	11,233	0.058
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TOTAL	38,573	

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DSNA	0.83	1,152	96
AENA	0.97	414	(40)
TOTAL		3,522	174

- System optimal:

Airlines	Annual costs (€ M)	CASK
BA	6,487	0.066
LH	7,104	0.081
AF	4,756	0.081
LC	11,260	0.057
Rest	8,868	0.057
TOTAL	38,475	


ANSP	Prices (€ /ASK)	Annual Revenues (€ M)	Annual Profits (€ M)
NATS	0.98	906	90
LVNL	0.82	282	22
DFS	0.89	596	(7)
Belgocontrol	0.95	195	16
DSNA	0.83	1,163	98
AENA	0.97	412	(40)
TOTAL		3,553	178

Pricing scenarios

- ANSP profit maximization

Airlines	Annual costs (€ M)	CASK
BA	9,549	0.111
LH	-	-
AF	247	0.103
LC	20,123	0.106
Rest	14,901	0.102

ANSP	Prices	Annual Revenues (€ M)	Annual Profits (€ M)
NATS	8.04	6,466	2,897
LVNL	9.06	1,723	790
DFS	10.47	3,987	1,764
Belgocontrol	11.25	1,302	599
DSNA	5.79	5,773	2,509
AENA	10.41	3,625	1,586

- Consequences compared to base-run
 - ANSP charges  by magnitude of 10
 - 3 legacy carriers almost stop flying
 - low cost carrier and non-European CASK doubles
 - hence insufficient competition to remove price regulation in current market

Technology: Pilot Common Project

- PCP cost = € 2.5 billion; 65% ANSP, 16% airlines
- Airlines: congestion ↓ operations costs ↓ (PCP vs fuel)
- ANSP: variable cost ↓ fixed cost ↑ constant price →

Airlines	Annual costs (€ M)	% change in costs over basecase
BA	6,435	-1.68%
LH	7,068	-1.85%
AF	4,682	-2.03%
LC	11,024	-1.86%
Rest	8,672	-1.63%

ANSP	Annual Revenues (€ M)	Annual Profits (€ M)
NATS	914	76
LVNL	273	27
DFS	589	-22
Belgocontrol	176	15
DSNA	1,153	102
AENA	414	-60

Results:

- airlines 😊 ANSPs 😞

Conclusions:

- ANSPs need to **INCREASE** charges by 10% for *win-win*

Technology: SESAR

- Stage 1 cost = € 30 billion; 16% ANSP, 50% airlines
- Airlines: congestion ↓ variable costs ↑
- ANSP: variable cost ↓ fixed cost ↑ price ↓

Airlines	Annual costs (€ M)	% change in costs over basecase
BA	6,267	-4.25%
LH	6,883	-4.41%
AF	4,546	-4.88%
LC	10,670	-5.01%
Rest	8,455	-4.08%

ANSP	Annual Revenues (€ M)	Annual Profits (€ M)
NATS	859	1
LVNL	257	15
DFS	551	-81
Belgocontrol	149	3
DSNA	1,087	32
AENA	389	-115

• Results:

- airlines 😊 ANSPs ☹️

• Conclusions:

- ANSPs need to **INCREASE** charges by 24% for *win-win*

Vertical Integration: Regional Forerunner

- ANSP cost recovery & PCP implementation

ANSP	Annual Revenues (€ M)	Annual Profits (€ M)	
		LH & DFS	AF & DSNA
NATS	914	92	92
LVNL	273	21	21
DFS	589	-22	-8
Belgocontrol	180	14	14
DSNA	1,152	96	101
AENA	414	-40	-40

- **Conclusions:**
 - Airlines: LH & AF benefit as a result of more direct routes
 - ANSPs: mixed effects
 - Higher profits for DSNA thus win-win for both airline and ANSP
 - Increased losses for DFS thus higher charges necessary to incentivize German vertical integration

Summary & Conclusions

- Modeling air traffic control via congestion game enables potential cost-benefit scenario evaluation
- Under user optimal approach:
 - insufficient competition to ensure ANSPs charge reasonable prices
- Technology
 - Pilot common project is positive for airlines but unlikely to be employed without permitting ANSPs to charge higher prices
 - SESAR even more unlikely to occur without increased demand and re-balancing of charges &/or subsidies
- Vertical Integration
 - Regional forerunner approach may be preferable to Functional Airspace Blocks but dependent on partnership

- Thank you for listening. This is a work in progress and any comments very welcome!