Performance Review Commission

ANS Productivity, cost-effectiveness

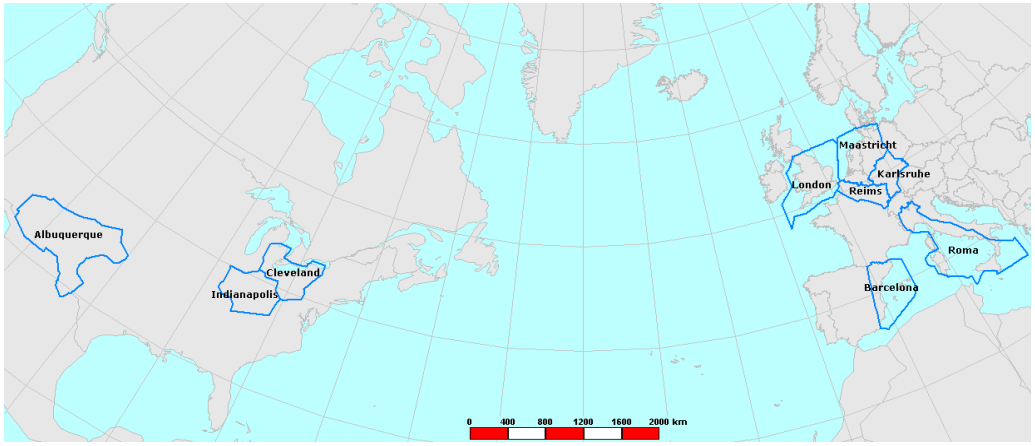
NAS Performance Workshop
5 September 2007

Xavier FRON

Performance Review Unit
EUROCONTROL

A cost-effective system?

US-Europe comparisons



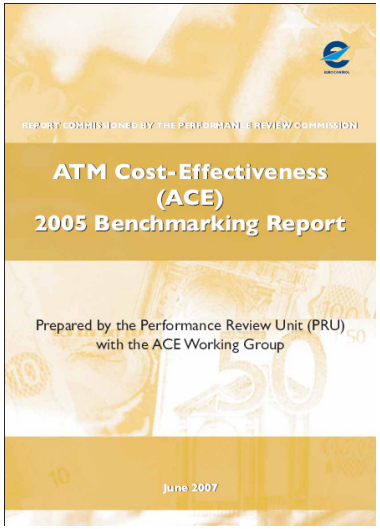
13.8 M km²
851 km/flight

10.8 M km²
826 km/flight

	US ATO (FY2005)	European Area (2005)
Gate-to-gate ANS costs (without MET)	US$ 8 900M	€7 100M
IFR flights	18.3M	9M
Costs per IFR flight	US$ 486	US$ ~ 1000

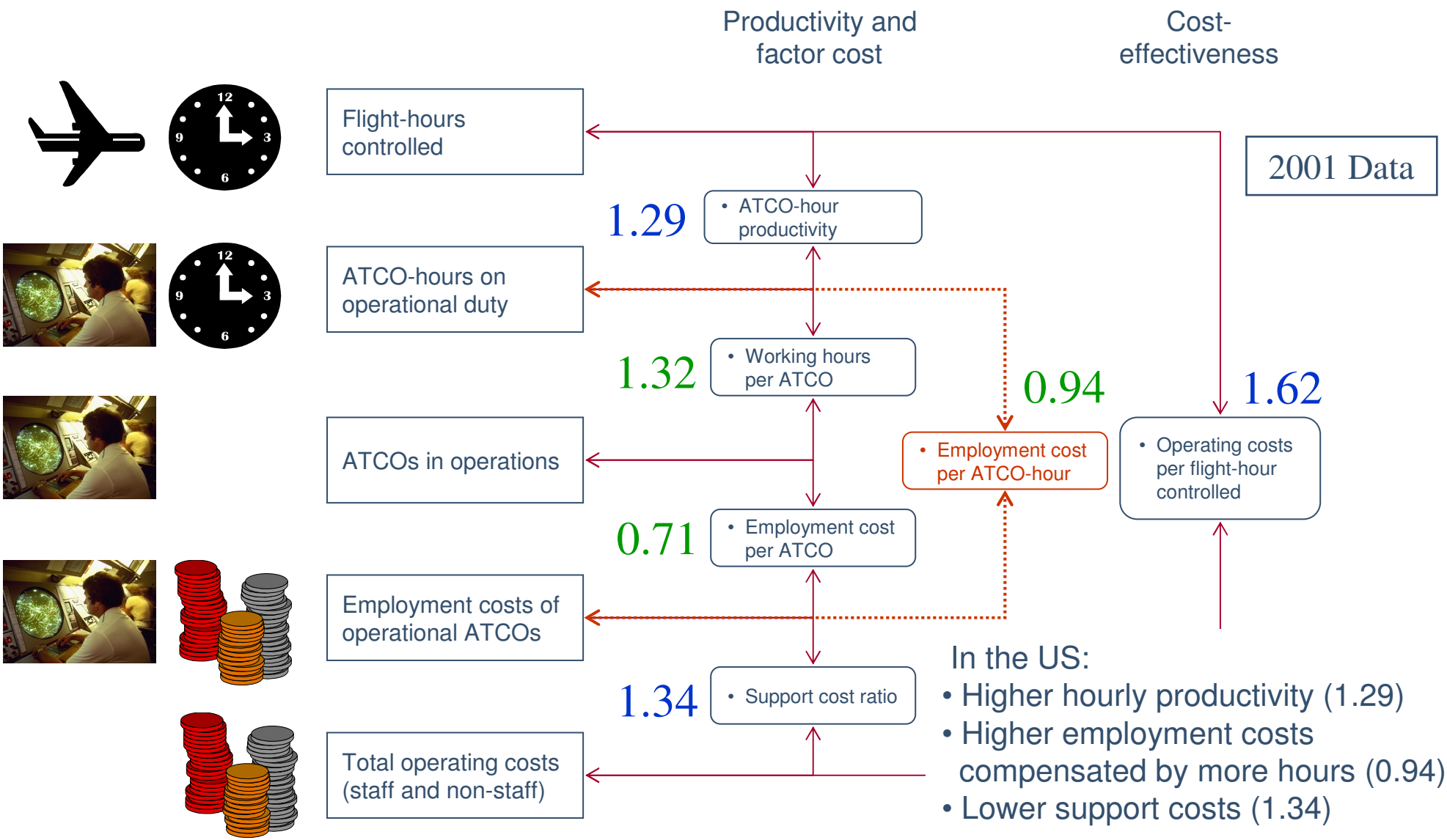
ANSP benchmarking

- **Analytic benchmarking**
  - What are the respective performance indicators?
  - Facts, no judgement
  - Detailed analytic benchmarking of European ANSPs in ACE reports
  - Outcome benchmarking (black box + information disclosure: ACE)
  - Insider benchmarking (white box, ANSPs, CANSO)



- **Normative benchmarking**
  - What are the actual and expected performance given specific circumstances (Cost of living, complexity, traffic variability, etc)
  - Econometric techniques tried, not conclusive so far NERA report available

Framework for cost-effectiveness analysis

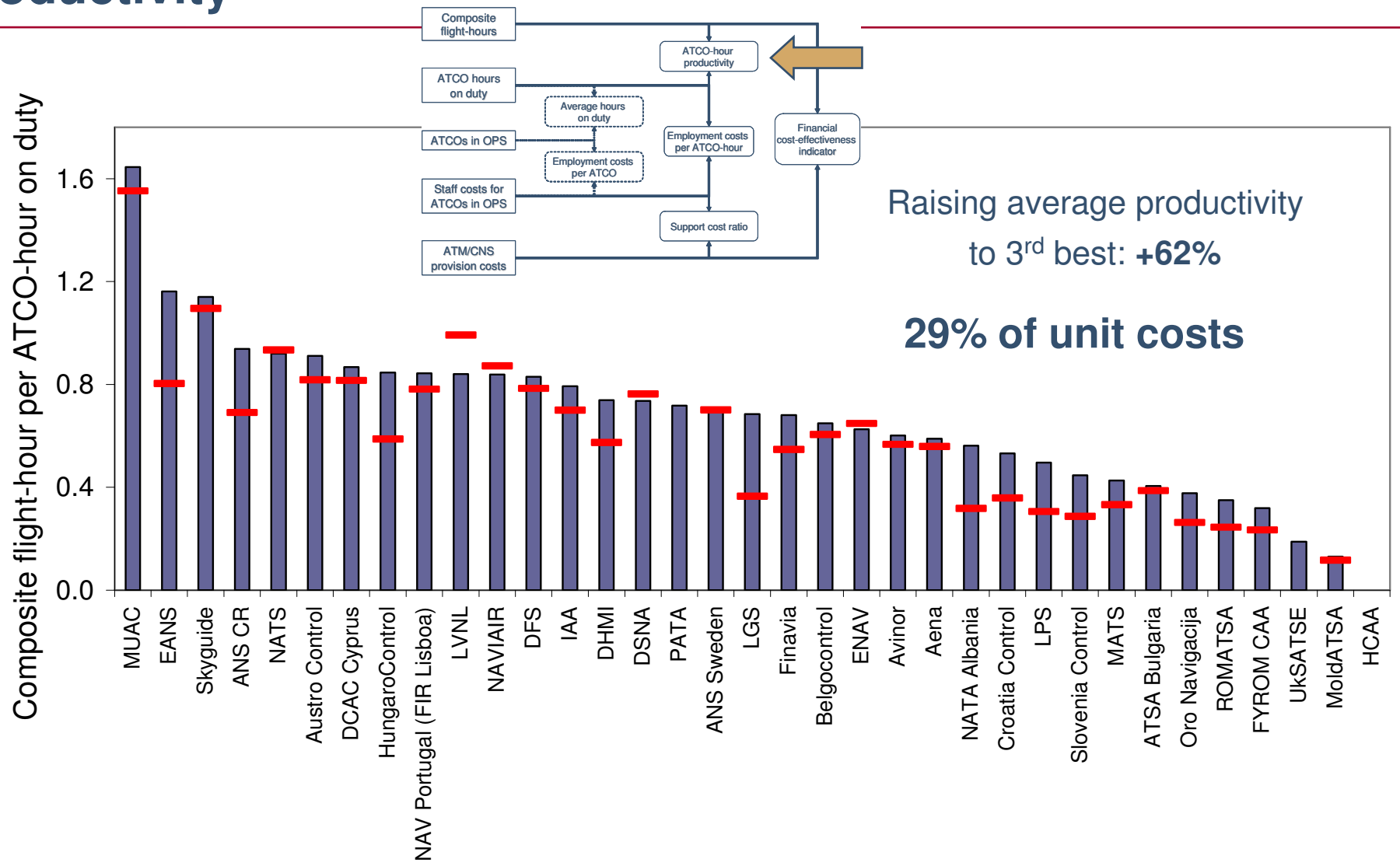


In the US:

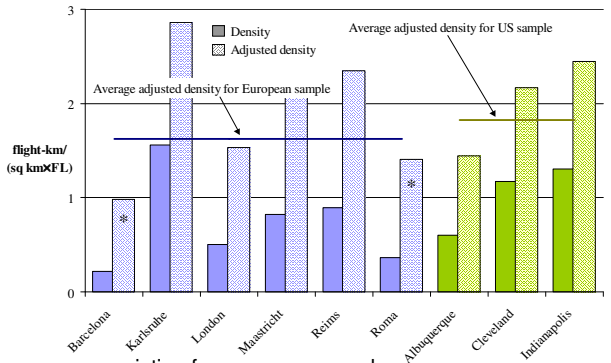
- Higher hourly productivity (1.29)
- Higher employment costs compensated by more hours (0.94)
- Lower support costs (1.34)

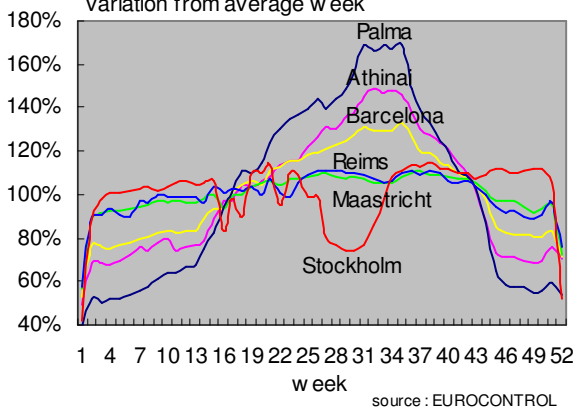
Ratios higher than 1: better performance in US
Ratios are multiplicative: 1.62=1.29 x 0.94 x 1.34

Productivity

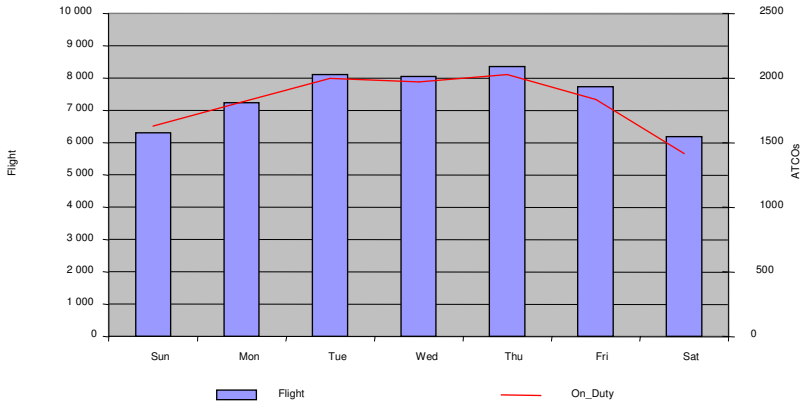


ATCO-hour productivity





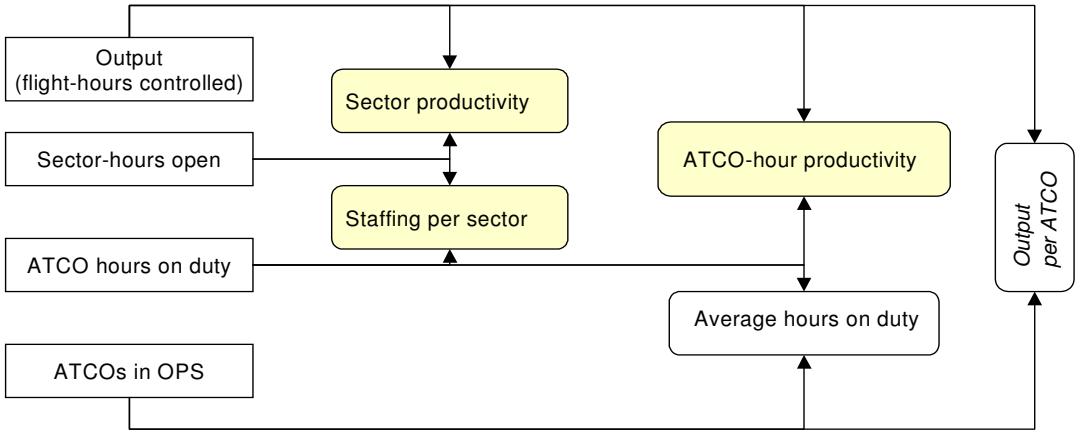
source : EUROCONTROL

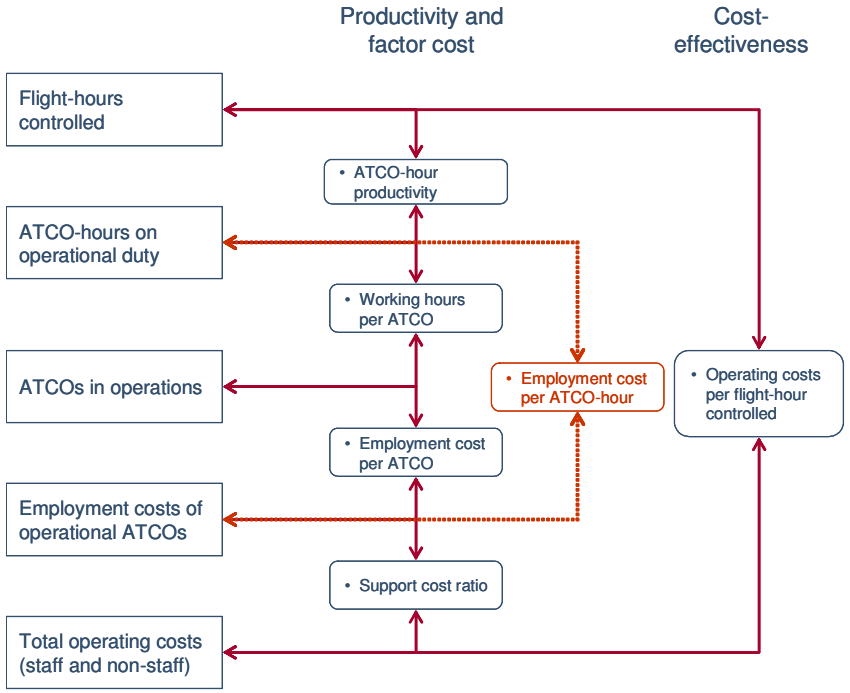


Traffic and staffing

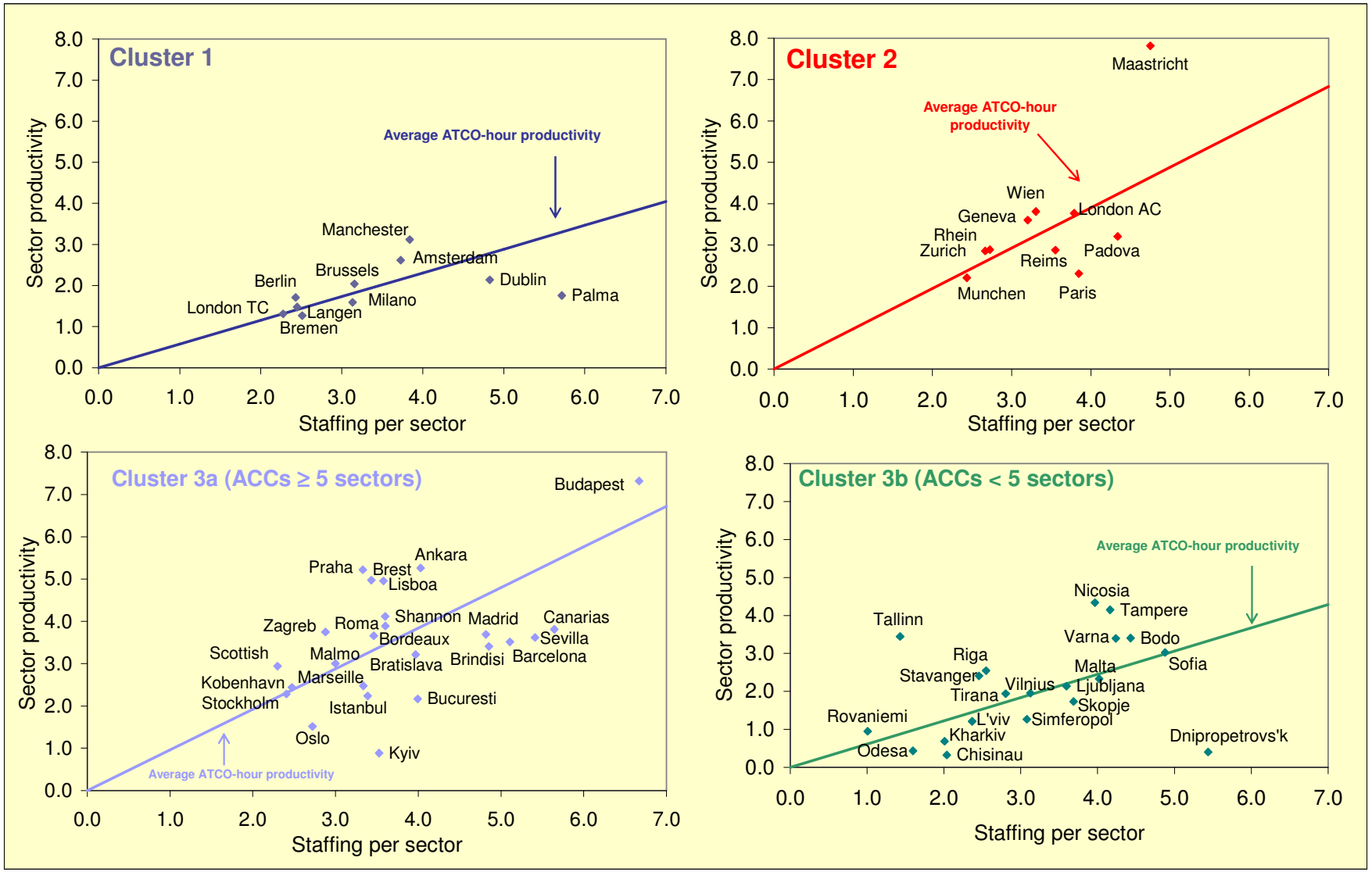
- **Equivalent densities measured in the sample of ACCs**
  Complexity is not a differentiating factor
- **Traffic variability**
  - Seasonal
  - Weekly
  - Daily
- **Match of resources and traffic appears to be a key driver of ATCO productivity**

Sector productivity and staffing

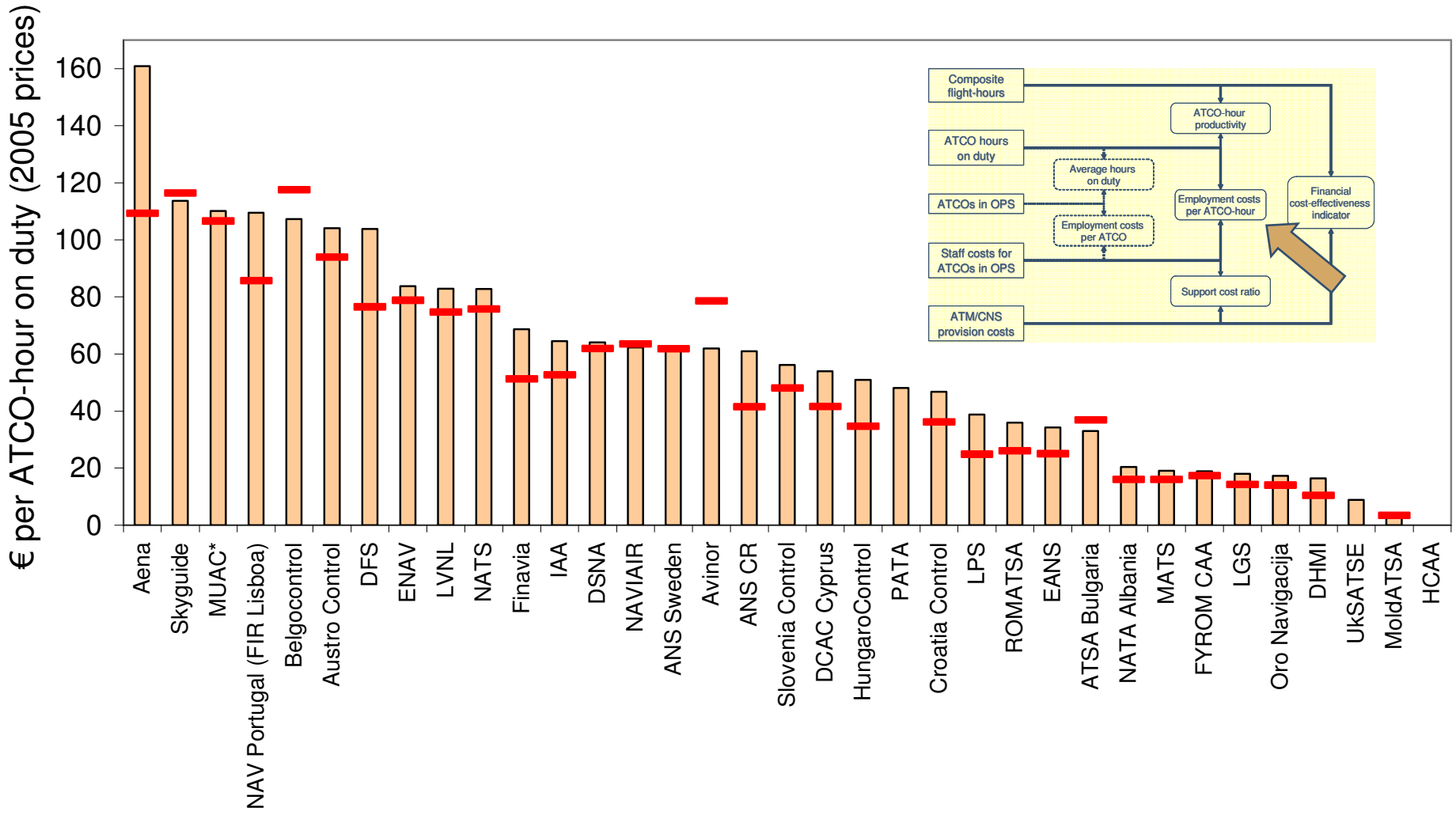




Sector productivity and staffing

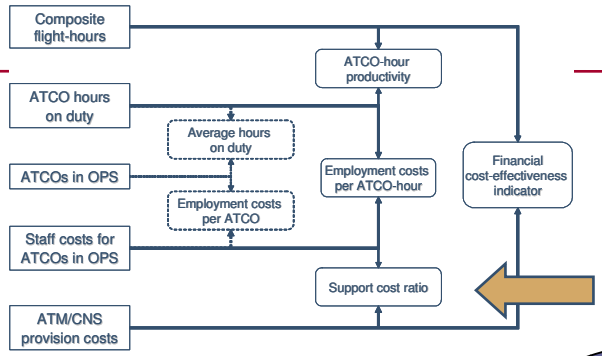


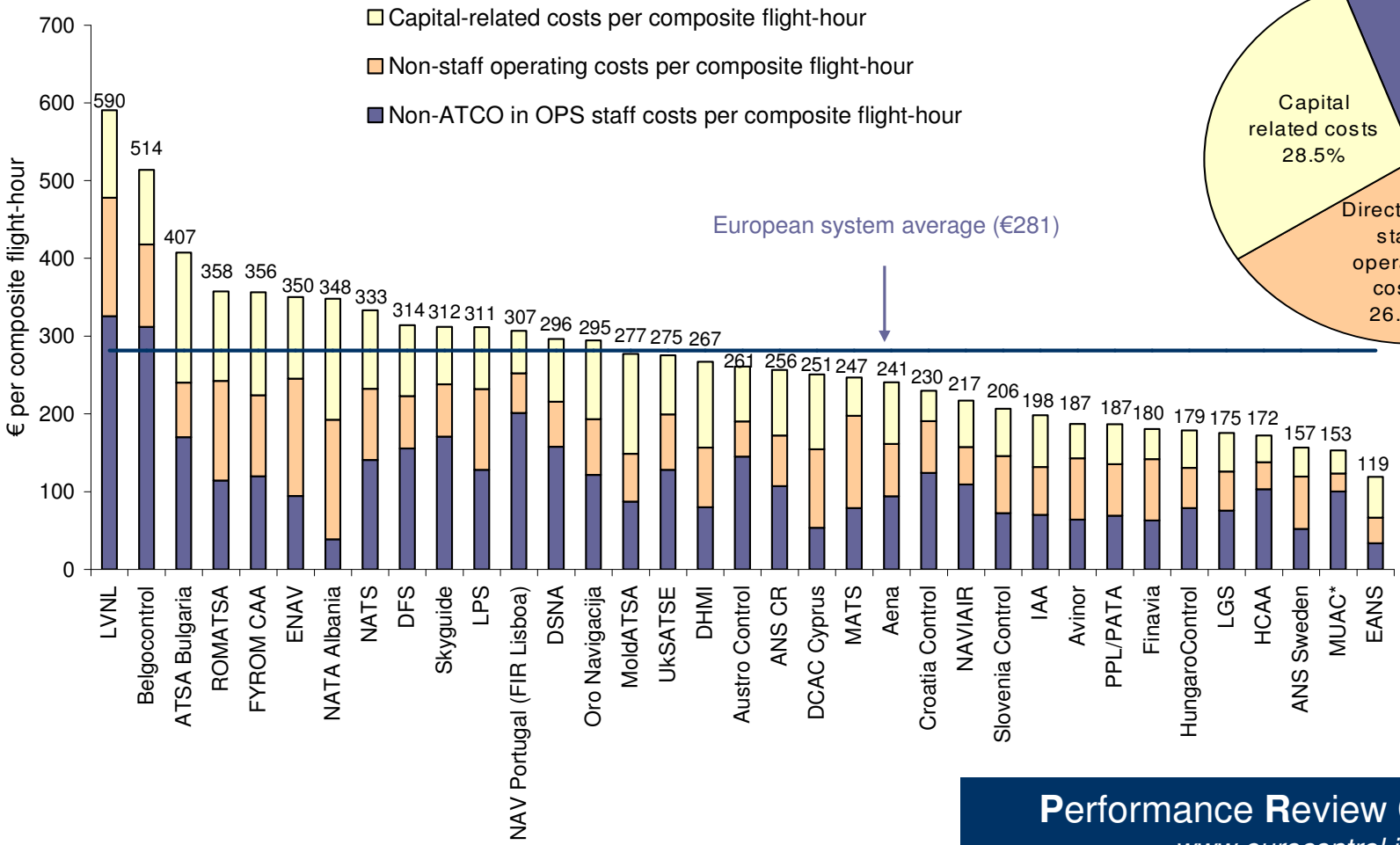
Employment costs per ATCO-hour (2005, gate-to-gate)

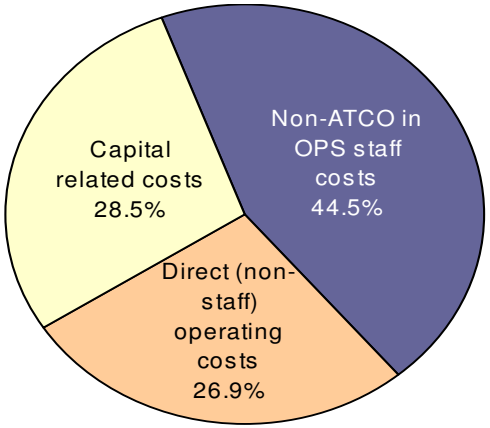


Support costs

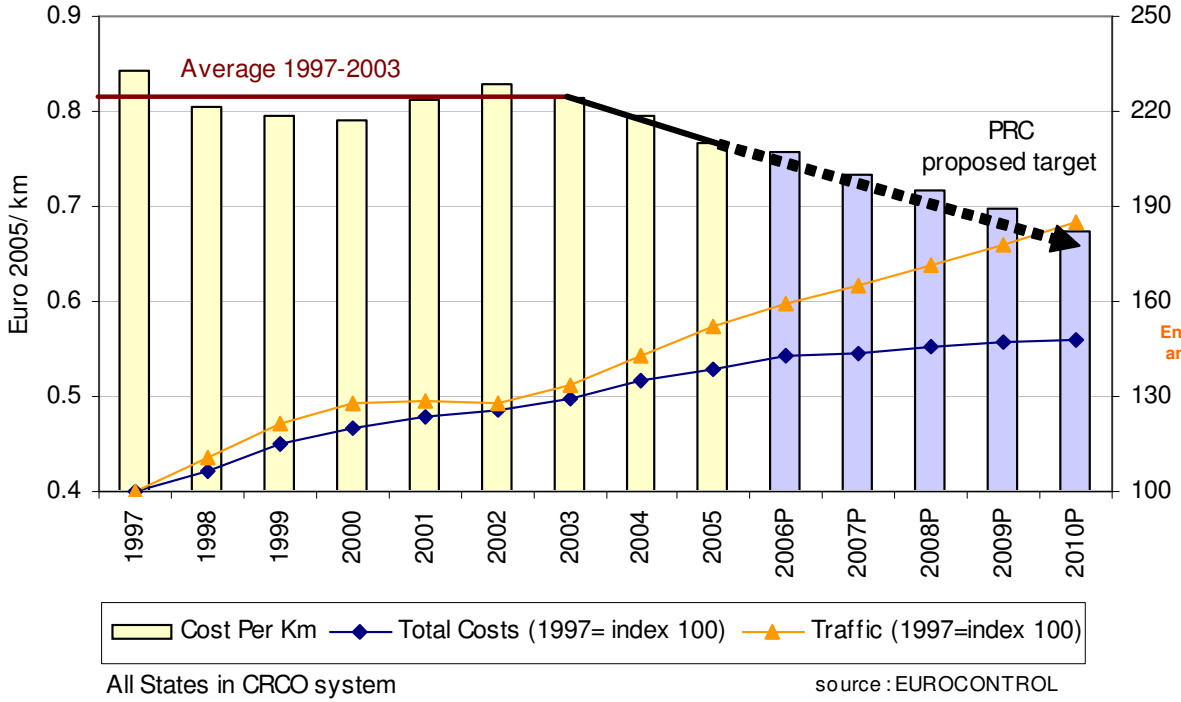
- **71% of unit costs**





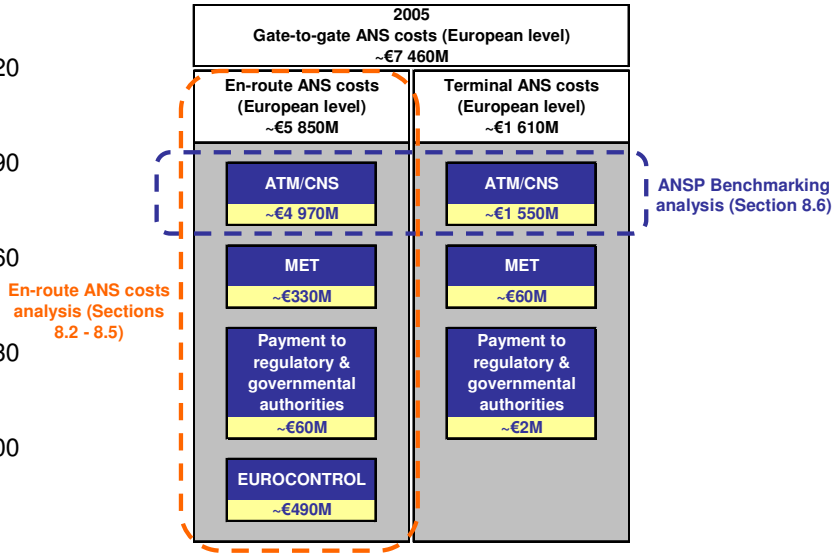


Cost-effectiveness target



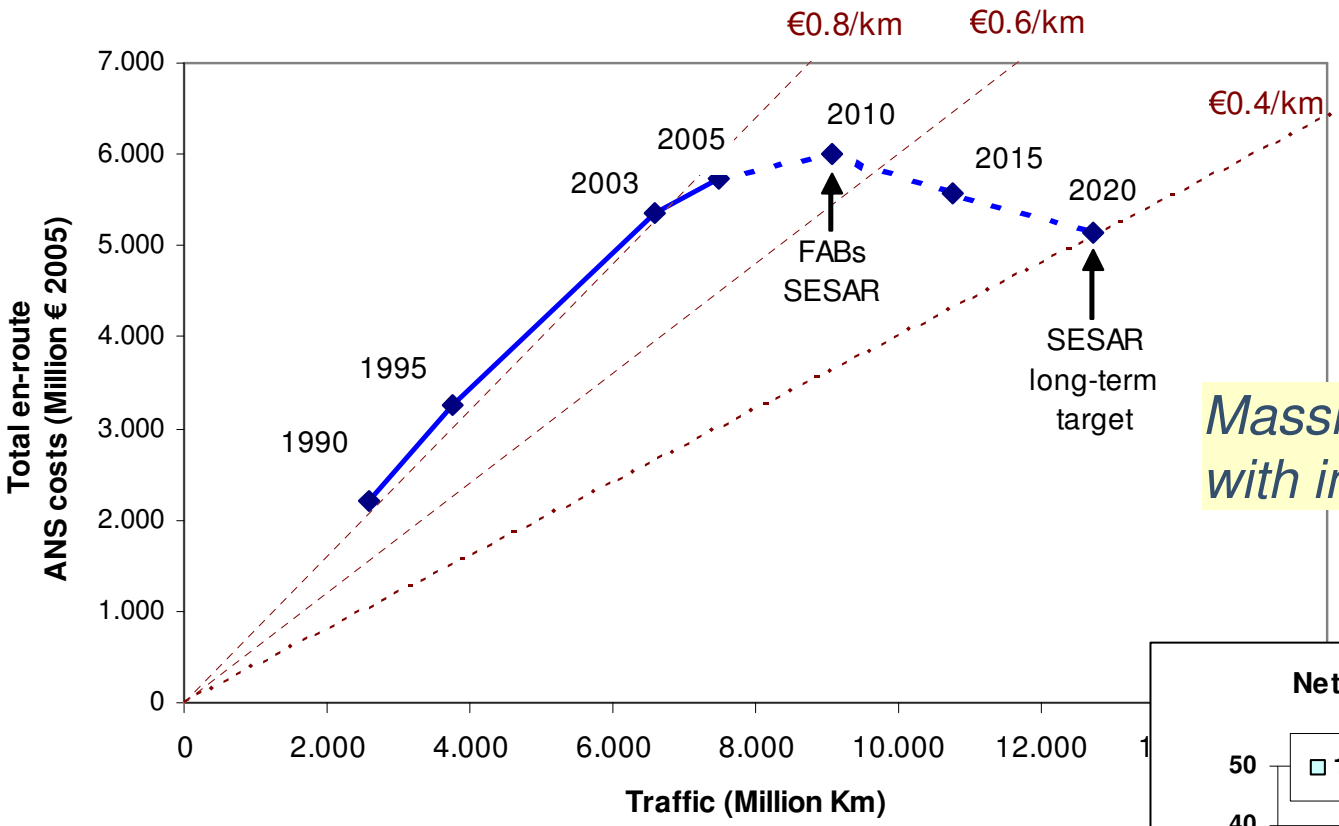
All States in CRCO system

source : EUROCONTROL

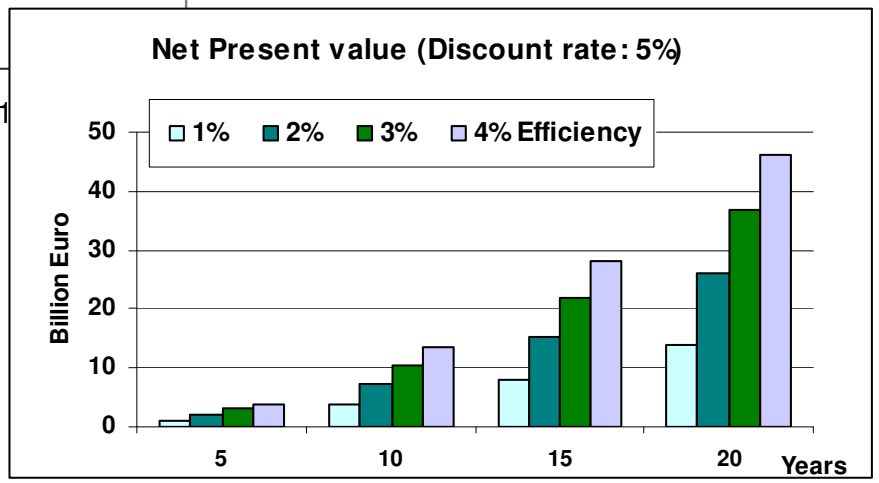


- Cost-effectiveness: A major European ATM performance issue
- Clear break in the en-route unit cost trend since 2003
- PRC recommends the formal adoption of a cost-effectiveness target at European system level to reduce average real unit costs by 3% p.a. until 2010.

Cost-effectiveness improvements from future developments



Massive value can be generated with improved cost-effectiveness



Improving economic performance

- New generation ATM
- Rationalisation of service provision!

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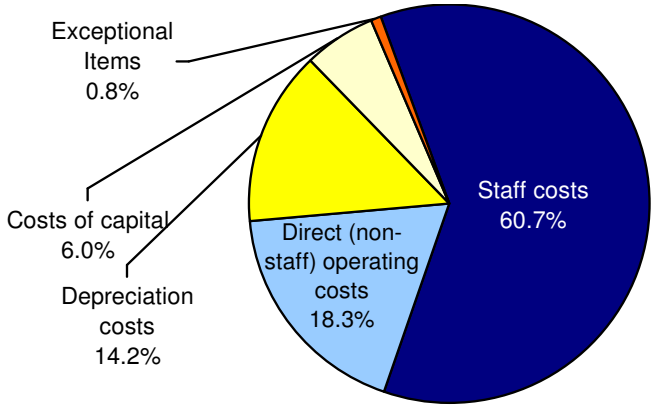
Improvements through rationalisation of service provision



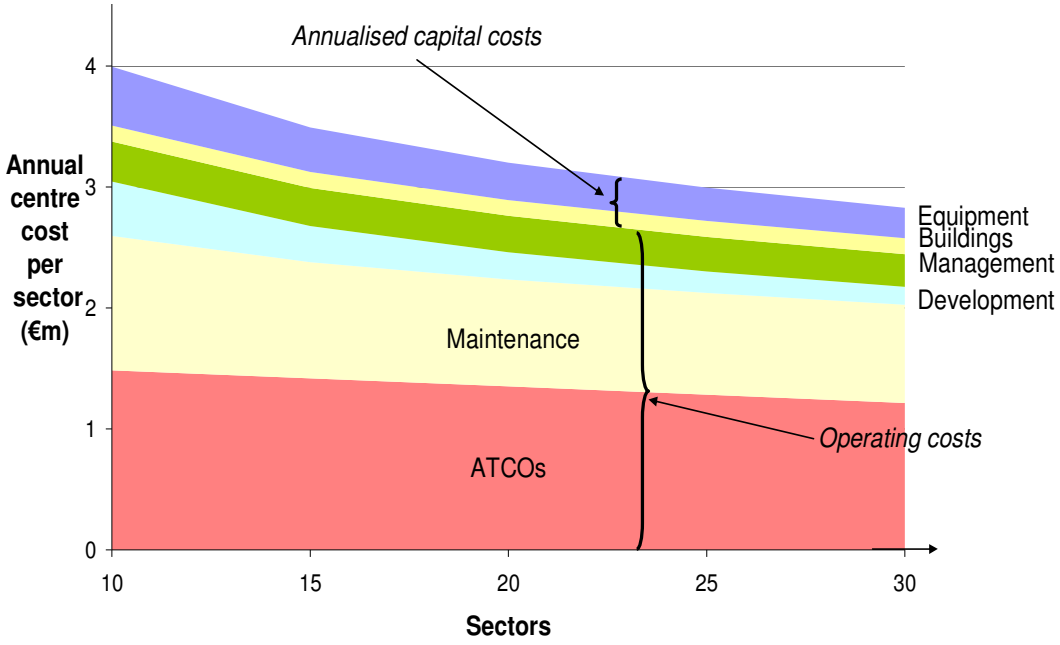
ATM/CNS provision costs (€ M)	Total	%
Staff costs	3 960	60.7%
Direct (non-staff) operating costs	1 194	18.3%
Depreciation costs	923	14.2%
Costs of capital	392	6.0%
Exceptional Items	52	0.8%
Total	6 520	100.0%

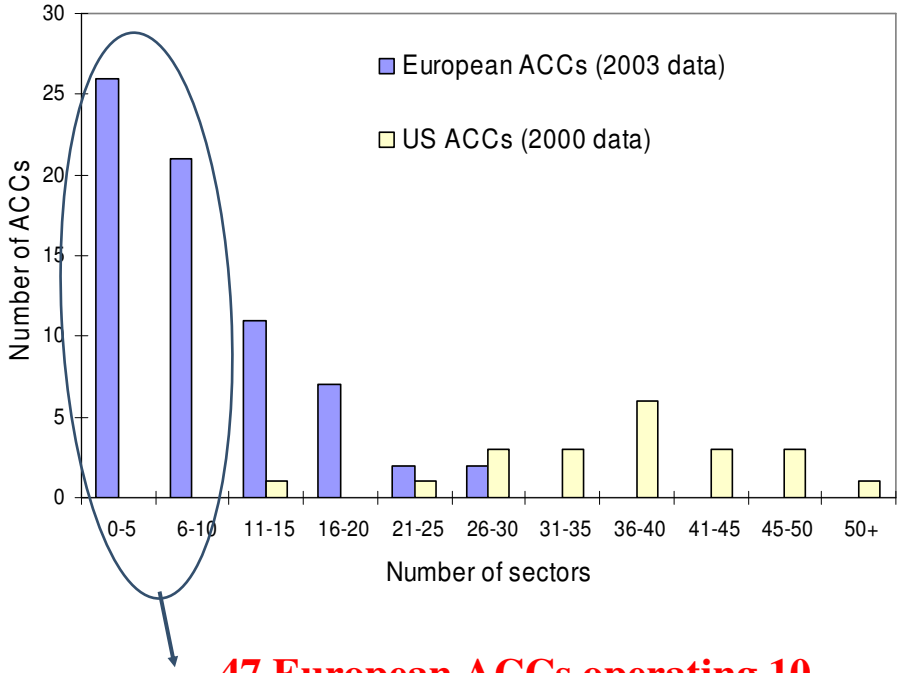
2005 data

- **Rationalising support staff (35% of costs)**
  - Opportunity for pooling resources (maintenance teams, etc)
  - Costs should not grow in line with traffic
- **Improving ATCO Productivity (25% of costs)**
  - e.g. better use of resources in low traffic, at night
- **Pooling investments (20% of costs)**
  - Major opportunity for scale effects in ATM infrastructure (currently 60% of investment)
    - Approximately 80% of new systems costs is non-recurring cost (software, certification)
      - Joint development (SESAR)
      - Joint procurement (in FABs, ANSP groupings)
  - Opportunity for scale effects in CNS infrastructure
    - SATNAV, joint procurement/outsourcing of CNS infrastructure
- **Rationalising non-staff operating costs (18% of costs)**
  - Number of facilities, etc

Scale effects?

Fixed costs to build, equip, and operate ACCs





47 European ACCs operating 10 sectors or fewer at maximum configuration

- ➔Generic study on fragmentation
- ➔Some evidence of scale effects
- ➔But some small ANSPs are efficient
- ➔Other sources of inefficiencies and factors influencing economic performance

ATM infrastructure: How big is it? (2003 data)

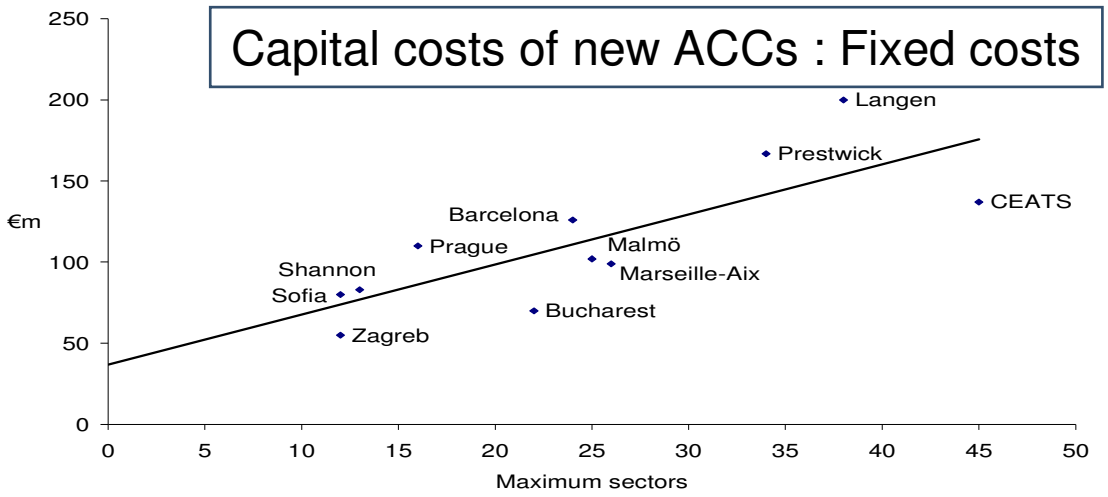
		Number
COM	VHF ground stations	1123
	Ground-ground voice links	2246
	ACC links (inter-State)	160
	ACC links (intra-State)	386
NAV	DME	601
	NDB	349
	VOR	617
SUR	En-route primary plus Mode S	63
	En-route Primary plus MSSR	5
	Approach primary plus MSSR	92
	Approach primary only	43
	MSSR only	140
ATM	ACCs	68
	Sectors	792

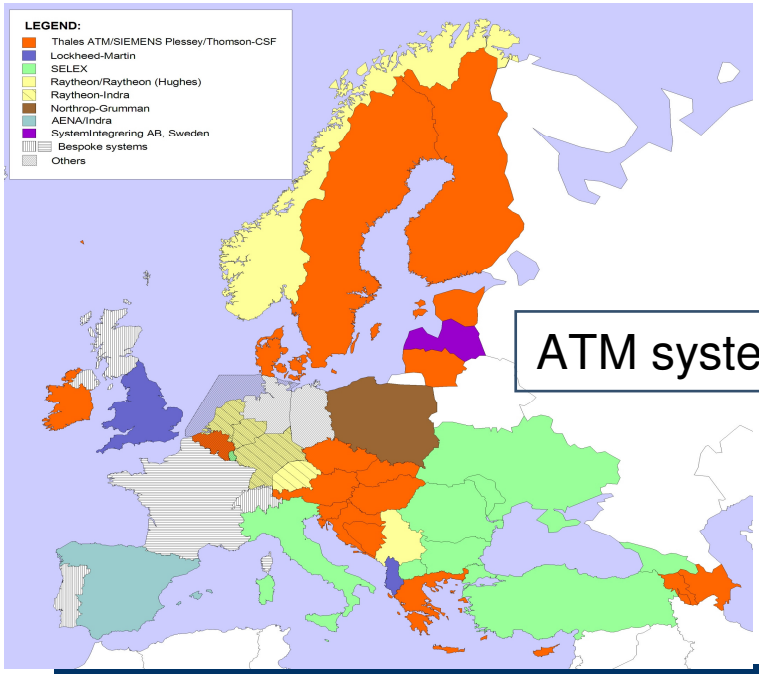
	Capital replacement costs	Annual operating costs	Total annual costs
COM (outside ACC)	€560m	€60m	€110m
NAV (en-route)	€230m	€10m	€30m
SUR (en-route)	€3,000m	€210m	€500m
ACCs & ATM systems	€4,900m	€2,100m	€2,500m
Associated support	€1,000m	€1,100	€1,200m
Total	**€9,690m**	**€3,480m**	**€4,340m**

Replacement of the current system worth ~ €10B

Total annual en-route service provision costs ~ €4.4B

Capital costs of new ACCs : Fixed costs





ATM systems

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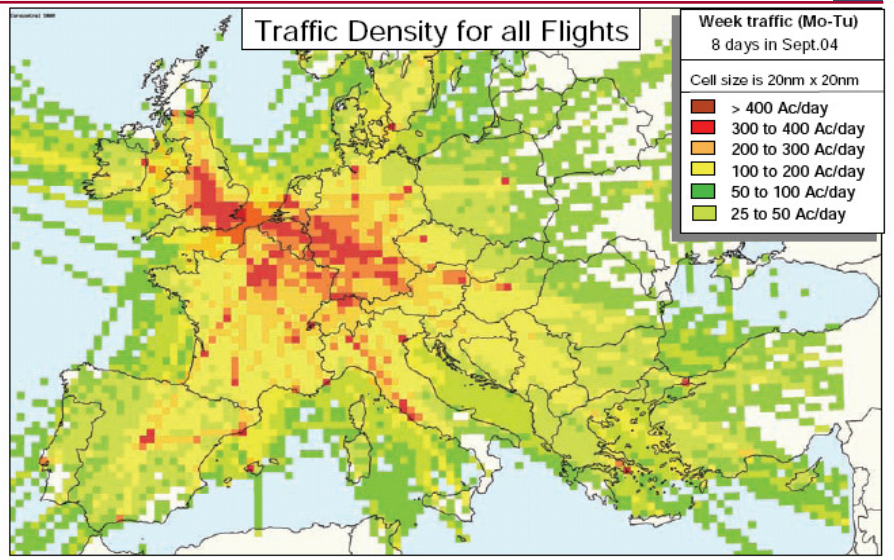
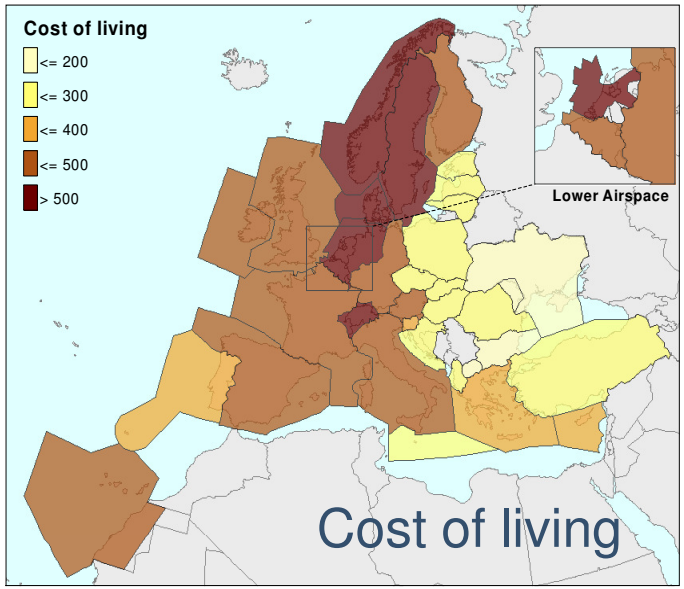
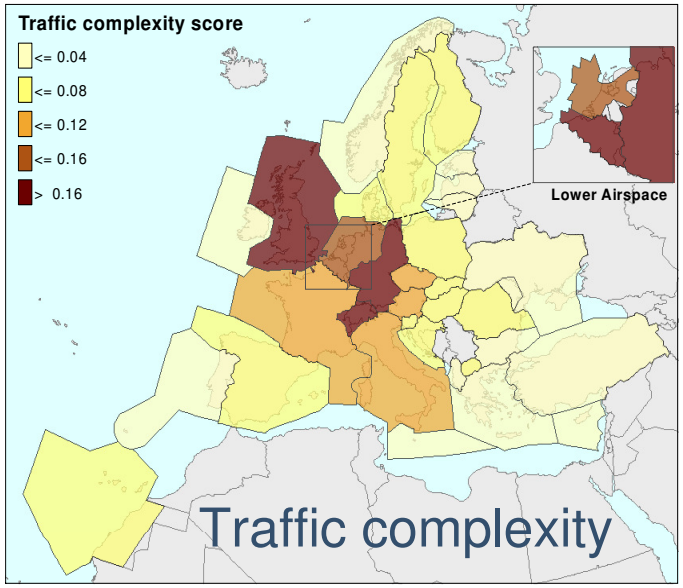
Some factors affecting performance

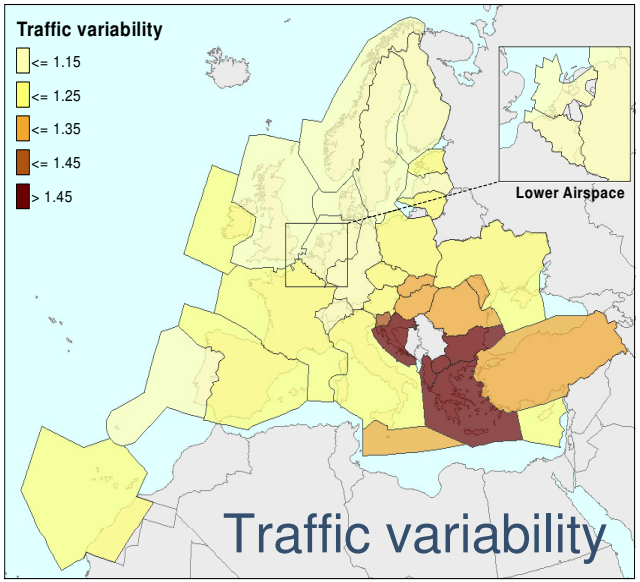
Fragmentation of service provision, infrastructure, airspace, regulation, decision making
Fragmentation report (2006)

Cost of living, Traffic complexity, variability
Benchmarking report ACE 2005 (2007)









Complexity indicators

	Complexity Dimension	Indicator	Description
Density effect	Traffic density	Adjusted density	A measure of the potential number of interactions between aircraft in a given volume of airspace
Structural effect	Traffic in evolution 	Potential vertical interactions (VDIF)	Captures the potential interactions between climbing, cruising and descending aircraft
	Flow structure 	Potential horizontal interactions (HDIF)	Provides a measure of the potential interactions based on the aircraft headings
	Traffic mix 	Potential Speed interactions (SDIF)	Provides a measure of the potential interactions between aircraft of different performances

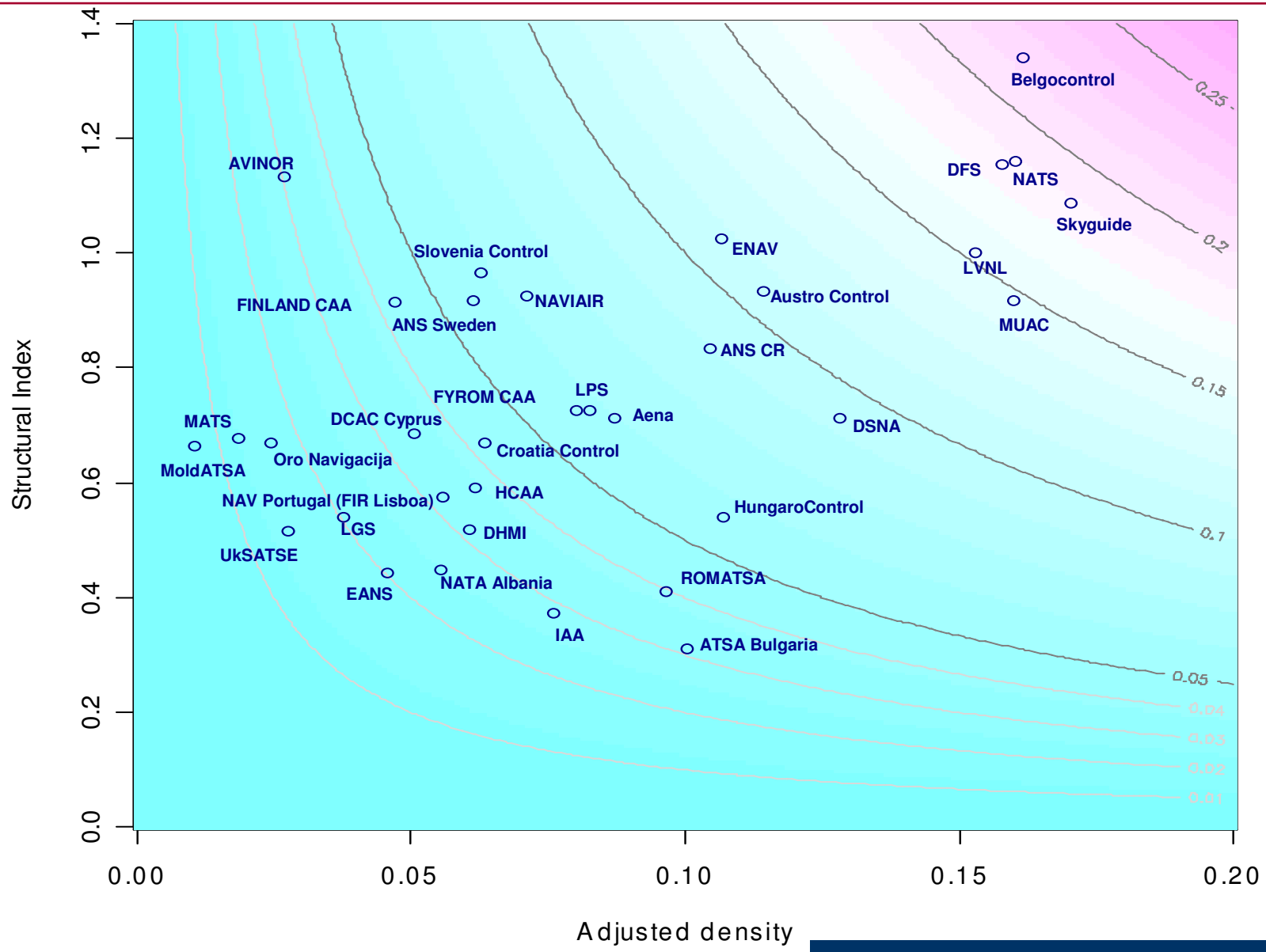
How are they computed?

- **Interaction : simultaneous presence of 2 aircraft in a same cell of 20NMx20NMx3000ft**

  - Vertical interaction: aircraft in different flight phase (cruise- climb – descent)
  - Horizontal interaction: aircraft with different heading (difference > 20°)
  - Speed Interaction: aircraft with different speed (differences > 35 knots)

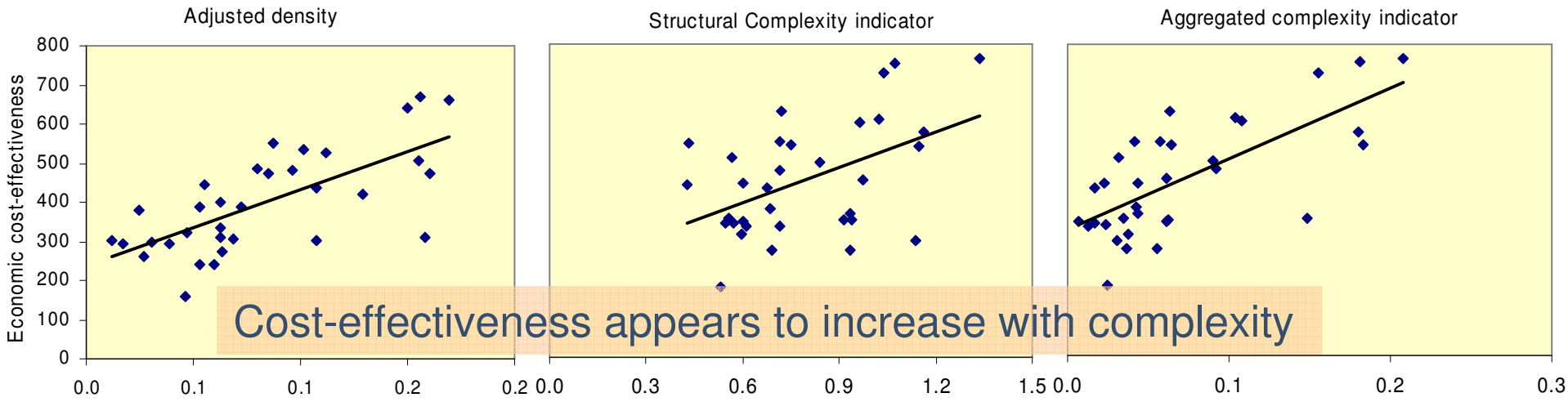
- **Metrics computed at ACC and ANSP level (all airspace 85#FL#405)**
  - Results at ANSP level is a consolidation from results at ACC & APP level
  - Oceanic airspace excluded

Breakdown of traffic complexity indicator at ANSP level (2004 data)



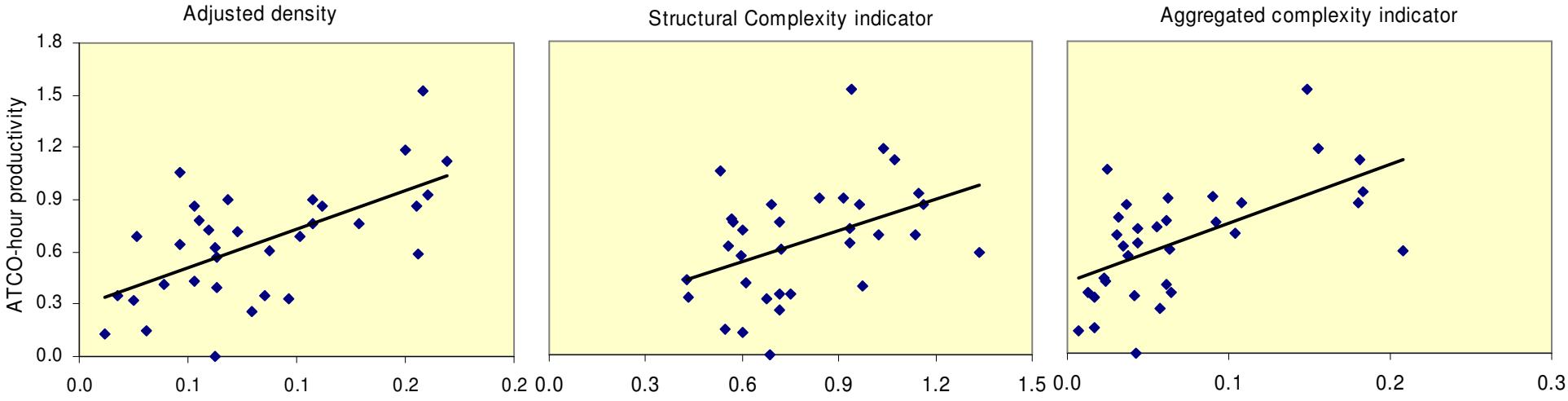
Any influence of complexity on cost-effectiveness? (1/3)

Cost-effectiveness vs Complexity



Cost-effectiveness appears to increase with complexity

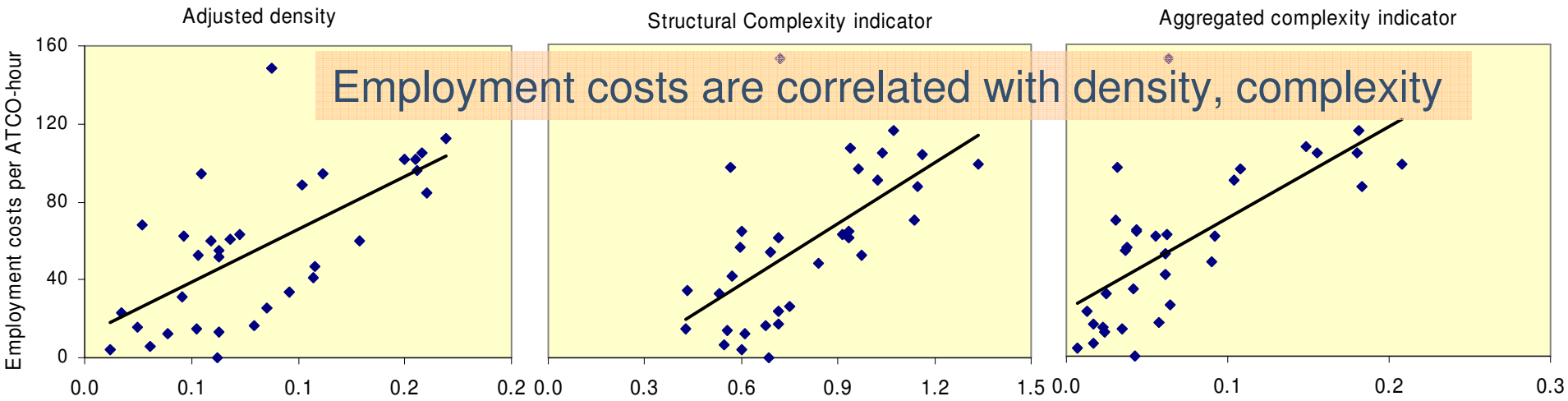
Productivity vs Complexity



But productivity increases with complexity

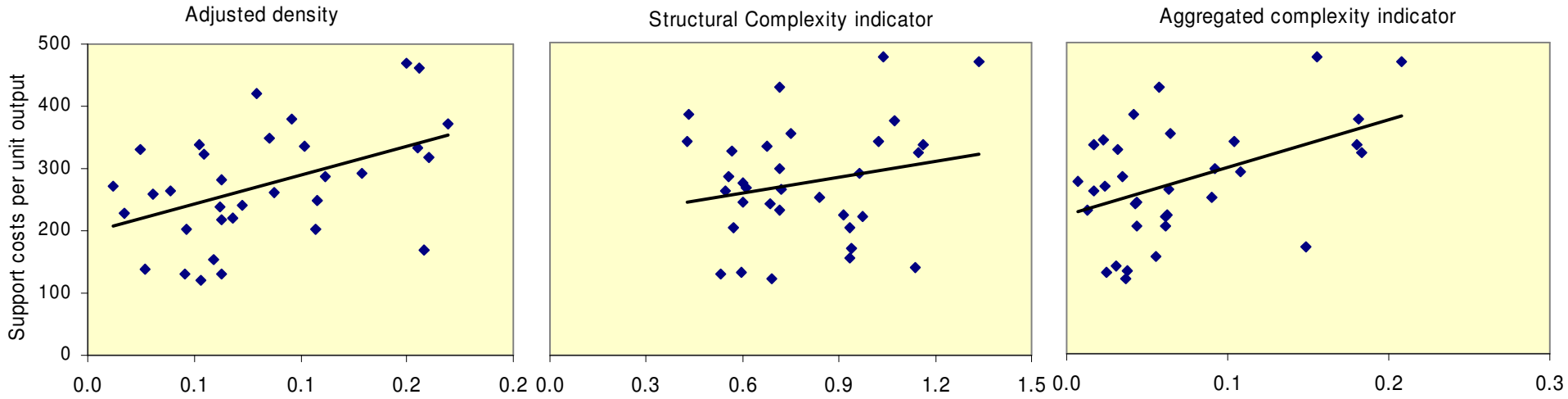
Any influence of complexity on cost-effectiveness? (2/3)

Employment costs vs Complexity



Employment costs are correlated with density, complexity

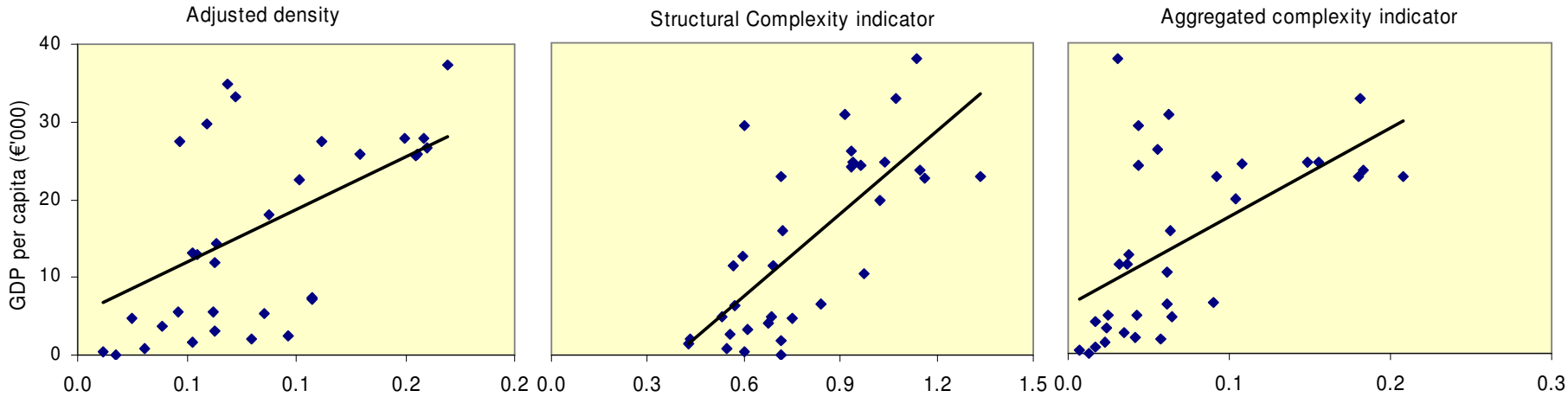
Support costs vs Complexity



Weak link between complexity and support costs

Any influence of complexity on cost-effectiveness? (3/3)

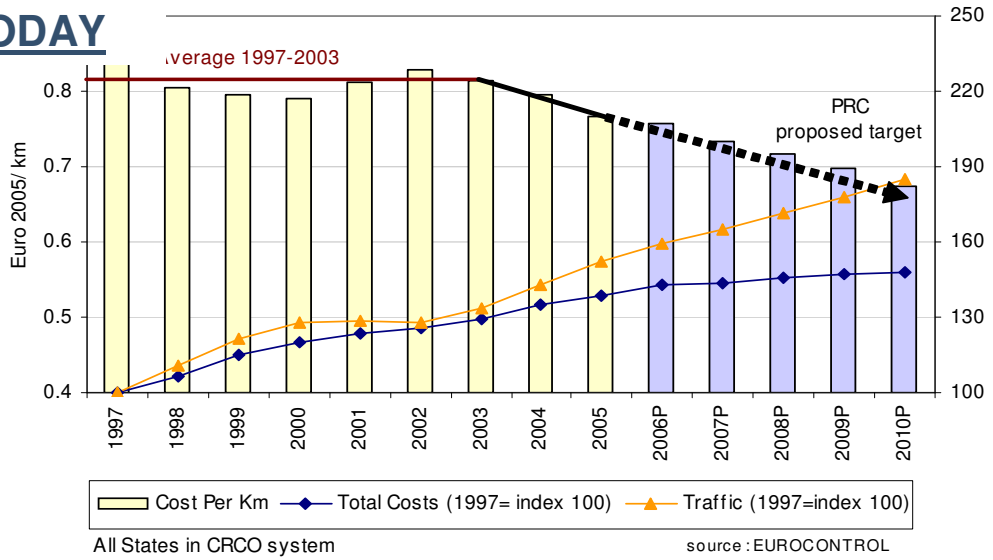
GDP per capita vs Complexity



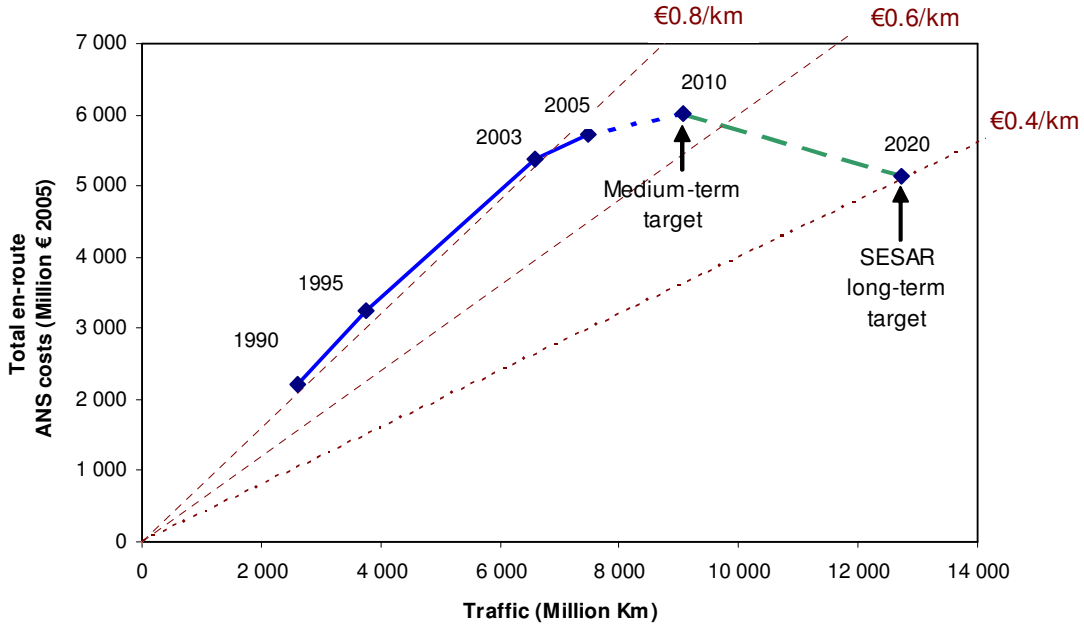
- Cost-effectiveness is significantly influenced by cost of living
  - Cost of living influences employment costs (60% of costs)
  - but some high cost of living ANSPs are cost-efficient (Nordic States)
- Link with complexity is apparent: Complexity is correlated with cost of living, and cost of living with cost-effectiveness
- Mixed influence of complexity
  - Higher density enables better use of human resources, infrastructure
  - Higher complexity increases work load, but also productivity…
- Econometrics: failed to determine statistically significant influence of complexity on Costs
- Empirical analysis of influence of Complexity, Cost of living, …

ANS/ATM Cost-effectiveness Performance

TODAY



OUTLOOK



Performance to date

- European ANS costs ~ $10.5 billion
- Clear break in unit cost trend since 2003 (Benchmarking has a role!)
- Similar ANS costs in US, but two times more traffic!

Analysis of performance

- Econometrics: unsuccessful so far
- Empirical analysis of influence of Complexity, Cost of living

Targets

- Cost-effectiveness target recommended (reduce average real unit costs by 3% p.a. until 2010) but not adopted yet
- SESAR targets in line with PRC's, more aggressive beyond 2010 (5%)

Performance improvements

- Rationalisation of service provision
- New generation: one step further!

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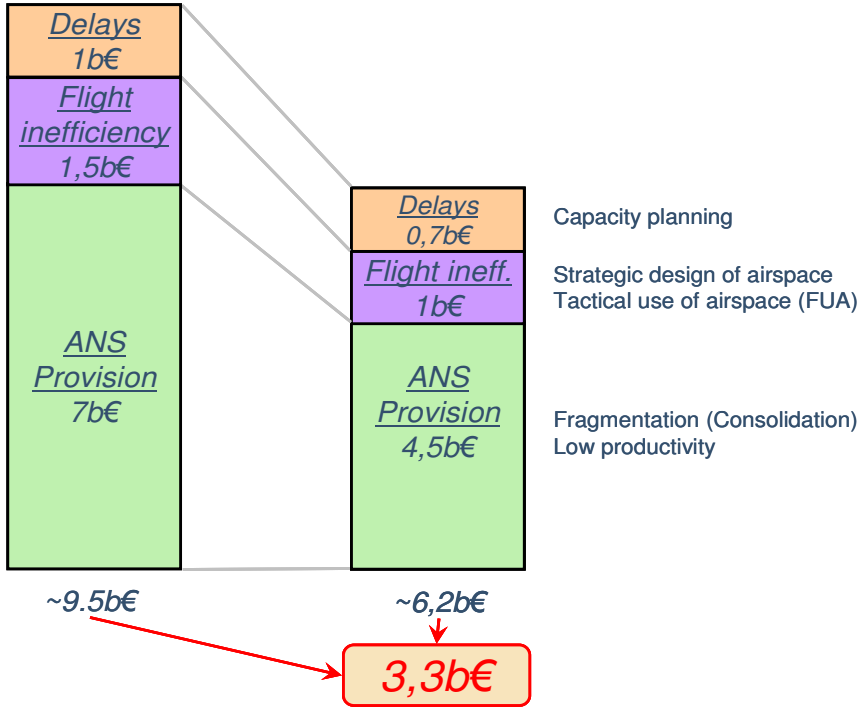
ANS/ATM economic performance

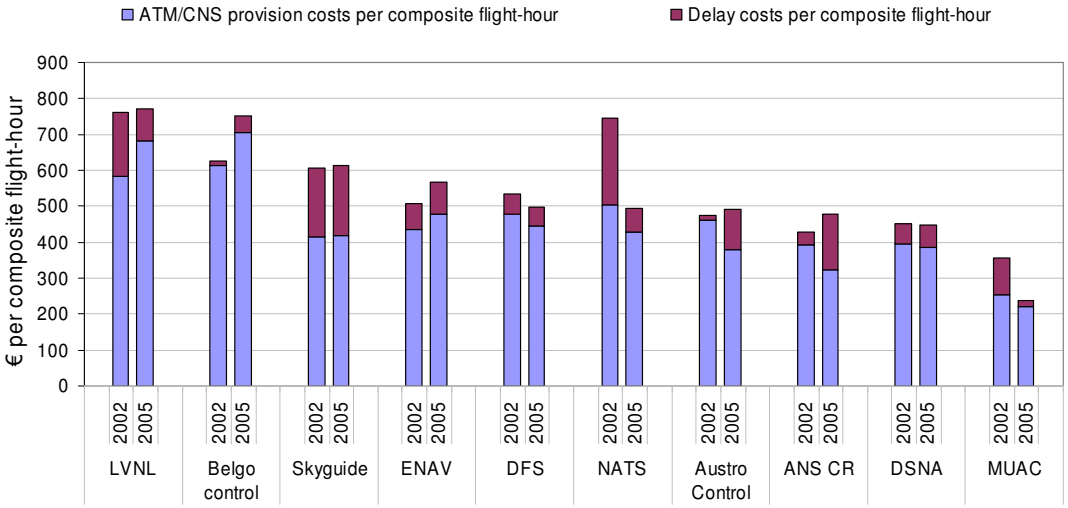


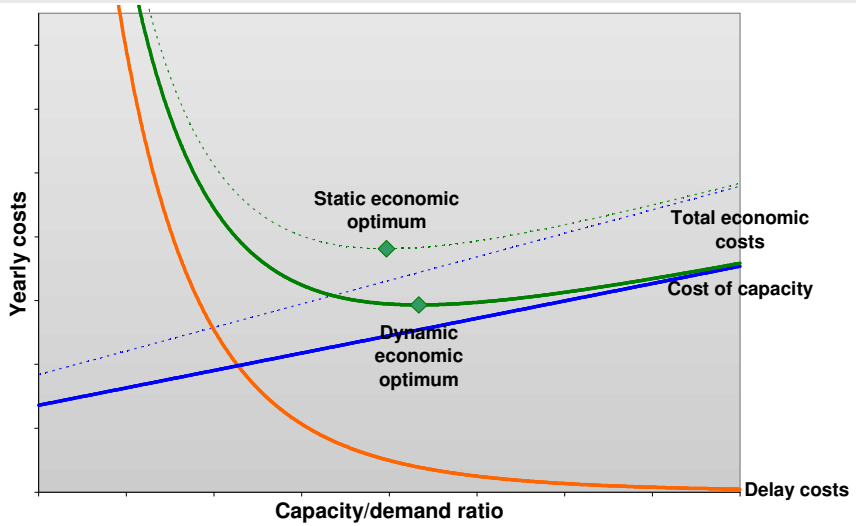
Economic cost

- Total economic cost =
  - **Direct cost of the service**
  - **+ Indirect costs (delays, non-optimum flight profiles, externalities e.g. environmental impact)**
- In Europe,
  user pays both, wants minimum total cost
- In the US, disconnect between ATM costs (federal budget) and what the user pays makes the link more remote

Analysis of performance

- Poor quality of service may compromise benefits from excessive cost savings





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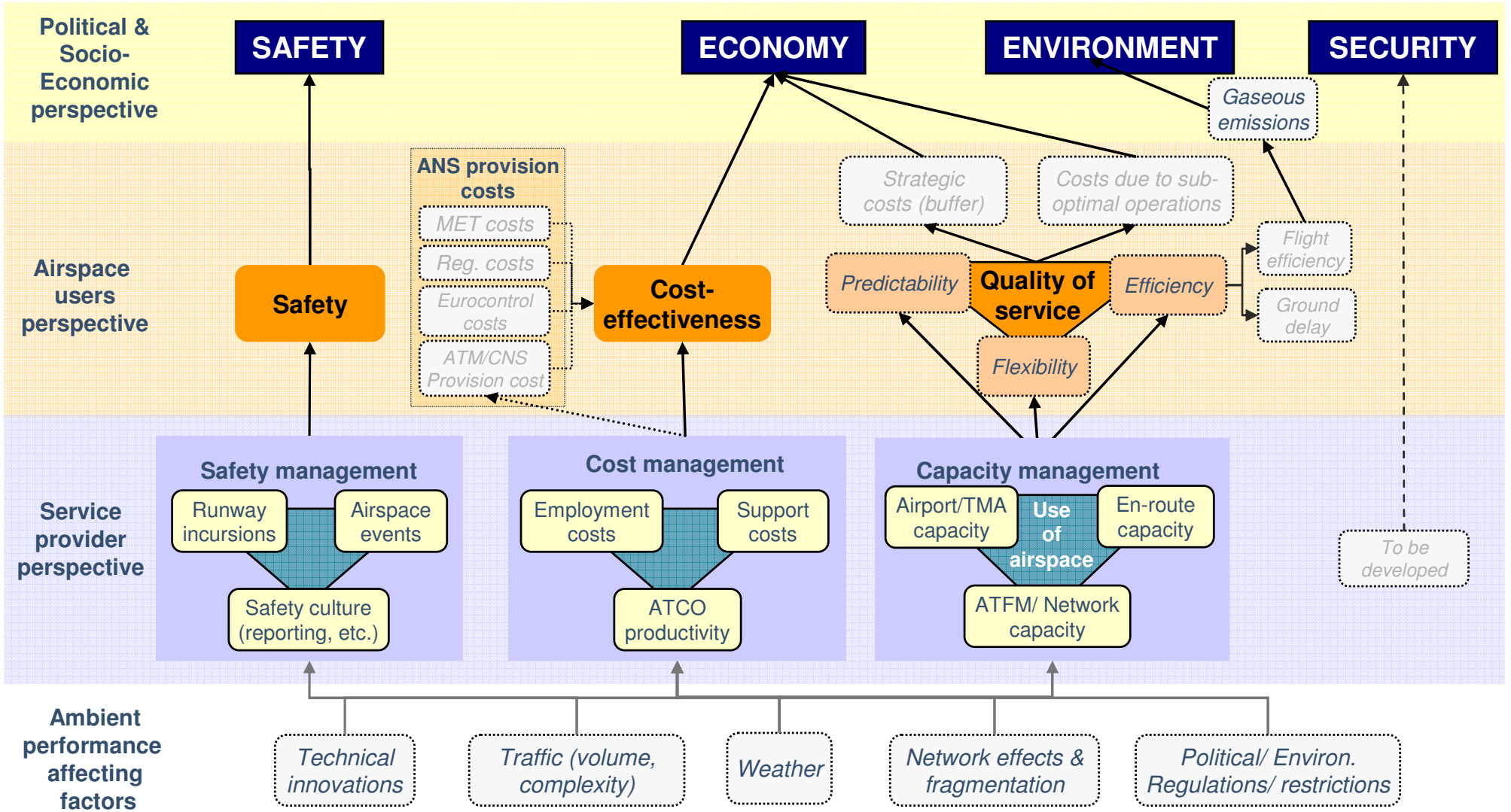
Framework for analysis of ATM performance



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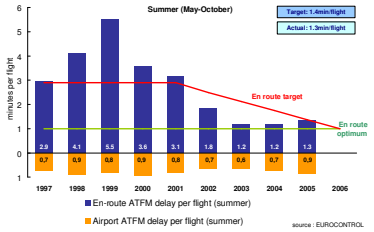
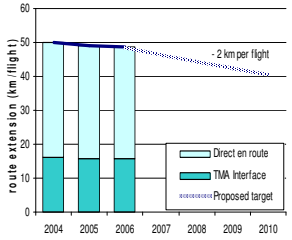
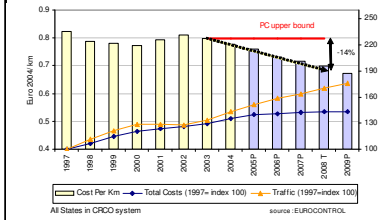
ANS Performance status (2006)

Performance Processes	Safety	Delays	Flight efficiency	Cost-effectiveness
Performance targets	-	√	None	Development agreed
Data flow	-	√	√	√
Performance indicators				
Regulation	Well advanced, not fully applied	Minimal Incentives in UK only	Single Europ. Sky Functional airspace blocks	Cost recovery Benchmarking Incentives (UK)
Performance management	Safety Action Plan	Co-operative capacity management	European Co-ordination	Individual plans Benchmarking
Achieved performance	No conclusive information	Strong improvement Target nearly met	Very slow improvement	Progressive improvement

A quantum jump in ATM performance

Short-term improvements

- Safety, flight-efficiency, productivity, etc

A quantum jump in performance in medium term

- Safety: x5 for traffic x2, x10 for traffic x3 => **SESAR, NEXGEN**
- Capacity: x2 (15 years), x3 (30 years)
  - Linked with safety for en-route
  - Linked with traffic spread for airports
- Cost-effectiveness: >2

At least one solution known: US!

Traffic density and complexity ≥ Europe
Capacity and cost-effectiveness targets met
Equivalent aviation safety levels

Co-operation is required from all parties

Driving ATM performance

Operational and technical improvements

- SESAR, NEXGEN

Service provision

- Organisation, Managerial, Governance, Human resources

Regulation

- Single European Sky, …

Co-operation & co-ordination

- EUROCONTROL
- Improved ATM/Airlines/airports interactions

Conclusions

- **High stakes in ANS performance**
  - **Safety**
  - **Economic impact (billions of € per annum)**
  - **Environmental impact**
- **Experience with performance-oriented approach in Europe since 1998**
- **Prerequisites for efficient performance-oriented strategies**
  - *Reliable information flow*
  - *Target setting, performance monitoring*
  - *Adequate regulation*
  - *Performance management processes*
  - *Independent performance review (with permanent support)*
  - *Strong governance of monopoly service providers*
  - *Accountability for performance*
- **ANS "Performance" is the "end product" of a complex interrelated system, involving a large number of airspace users, airports and ATM units**
- **Factors driving performance need to be better understood and measured**