TRAFFIC VARIABILITY IN BENCHMARKING OF AIR NAVIGATION SERVICES PROVIDERS COST-EFFECTIVENESS

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Abstract: The European Air Navigation Services Providers (ANSPs) currently handle around 26,000 flights per day. According to forecasts, air traffic levels should probably double by 2020. Different benchmarking exercises have shown that European ATM costs, in comparison to other similar systems on the globe, additional € 2-3 billion per year. This strongly implies that European ATM needs to cut costs and improves its performance. Aeronautical organisations such as the European Organisation for the Safety of Air Navigation (EUROCONTROL) or Civil Air Navigation Services Organisation (CANSO) perform benchmarking studies and issue reports, but they both admit that their work is based on factual analysis and not on proper normative analysis and therefore are not entirely objective. Factual analysis is a good starting point, but as already recognized generally, proper methodology should be developed for proper normative analysis. To get a bit closer to objectivity of the results, this paper challenges one of the recognized endogenous factors, the traffic variability. Equalizing the calculations by different variability factors proved that benchmarking order of individual ANSPs changed. Showing an example on how seasonal variability can influence cost-effectiveness and ATCO-Hour productivity is only one small stone in a mosaic of potential future methodology for normative analysis.

Keywords: Air Navigation Services Provider (ANSP), Air Traffic Management (ATM), cost-effectiveness, Single European Sky (SES), ACE Report, capacity, seasonal variability, Performance Review Commission (PRC), Performance Review Unit (PRU), Civil Air Navigation Services Organisation (CANSO).

1. Introduction

Of all modes of transport, air transport has achieved the most impressive growth in Europe over the last twenty years. In terms of passenger-kilometres, traffic increased by an average of 7.4% per year between the years 1980 and 2008. Taking it from the ICAO data, the global passenger traffic increased by 8.7% in 2010, to approximately 2.5 billion passengers. On the other hand, the global traffic had declined by 0.7% in 2009 and 0.4% in 2008 (European Commission, 2011).

In order to establish new approach to ATM, the European Commission in 2005 stated the political vision and high level goals for the Single European Sky (SES) (SESAR Joint

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Undertaking, 2009). Further on, Single European Sky second package (SES II) made a significant step forward towards establishing targets in key areas of safety, network capacity, effectiveness and environmental impact (EUROCONTROL (EC-1), 2011).

To facilitate more effective management of the European ATM system, the Commission of EUROCONTROL established the Performance Review Commission (PRC) in 1998. PRC, supported by the Performance Review Unit (PRU), which was established at the same time, introduced strong, transparent and independent performance review and target setting and provided a better basis for investment analyses and, with reference to existing practice, provided guidelines to States on economic regulation to assist them in carrying out their responsibilities (EUROCONTROL (EC-2), 2011).

As a logical consequence, the European Commission adopted, in December 2010, a decision which has set the EU-wide performance targets for the provision of air navigation services for the years 2012 to 2014. The work of the PRU executed through the ATM Cost-Effectiveness (ACE) factual and independent benchmarking, has been recognized as one of the main inputs for determining the EU-wide cost-efficiency target and it will also have a major role in the assessment of national/FAB performance plans (EUROCONTROL, 2011).

2. Background

In order to improve their performance, airspace users constantly force the ANSPs. Different airline associations call for urgent deliverables and a faster progress towards the Single European Sky (ATC Global INSIGHT, 2011). As a result, the European Commission is now setting the first priority on the Member States to revise their individual performance plans.

Widely used and mutually accepted tools for self-assessment have been (among other) the EUROCONTROL PRU ATM Cost-Effectiveness Benchmarking Report, which is issued on a yearly basis from 2002, and to the smaller extend also CANSO Global Air Navigation Services Performance Report, issued this year for the second time in the row (CANSO, 2011).

Both reports are addressing similar issues, measuring and analysing similar factors, taking into account similar variables. The real major difference is in the collection of ANSPs, where ACE Benchmarking Report focuses on all European actors and CANSO on selected (the ones that volunteered) global actors. For the purpose of this study mostly ACE Benchmarking Report has been used and CANSO Global Air Navigation Services Performance Report only to the smaller extent.

3. Assumptions and Definitions

To set up the framework of the study, here are the necessary assumptions:

- Single European Sky packages I and II are defining the goals and targets;
- ACE Benchmarking is broadly accepted tool for benchmarking;
- The airspace covered by the SES and ACE Report is definite – limited in size;
- Traffic in the European airspace is constantly growing, but is again definite – also limited in the amount;

- Airspace users expect from ANSPs to have enough capacity to handle the traffic without delays also in peak periods of the day/month/year. The same expectation is shared by the public and/or politicians;
- Delays are in general not accepted as they induce costs in excess of €1 billion per year;

PRU has set up the following Key Performance Indicators (KPIs):

- Financial Cost-Effectiveness – The European ATM/CNS provision costs per composite flight hour with the sub-set of KPIs:
  - – ATCO hour productivity – efficiency with which an ANSP utilizes the ATCO man-power;
  - – ATCO employment costs per ATCO hour;
  - – ATCO employment costs per composite flight hour;
  - – Support costs per composite flight hour;
- Forward looking Cost-Effectiveness – forward looking plans and projections for the next five years;
- Economic Cost-Effectiveness, taking into account both financial cost-effectiveness and quality of service (Air Traffic Flow Management ground delays, airborne holding, horizontal flight-efficiency and the resulting route length extension, vertical flight-efficiency and the resulting deviation from optimal vertical flight profile).

In order to assure objectivity of the analysis, PRU took into consideration both exogenous (factors outside the control of ANSP) and endogenous (factors entirely under the control of the ANSP) factors that can influence the ANSP performance.

When researching the literature, it was found that significant volume of work has been done regarding the ATM Performance optimization. Some examples are listed under (Castelli et al., 2003; Castelli et al., 2005; Castelli and Ranieri, 2007; Christien and Benkouar, 2003; Fron, 1998; Kostiuk and Lee, 1997; Lenoir and Hustache, 1997; Mihetec et al., 2011; Nero and Portet, 2007; Oussedik et al., 1998; Papavramides, 2009; Pomeret and Malich, 1997) (many more are available), however no paper could be found that would challenge one of the PRU recognized endogenous factor, the traffic variability.

Arguably, the traffic variability, taking into account also the assumptions above, can have a decisive effect on the objectivity of the results of any benchmarking study and will therefore be further elaborated.

Other endogenous factors, such as traffic complexity, also most definitely affect the overall performance of an individual ANSP and surely contribute to the objectivity of the results; therefore they by all means qualify for the future research.

4. ACE Benchmarking Report Facts and Figures

Among other PRU outputs in the ATM Cost-Effectiveness (ACE) 2009 Benchmarking Report, benchmarking the financial cost-effectiveness, is similar graph to the one in Fig. 1, showing the comparison of all 37 ANSPs with regards to the overall financial cost-effectiveness.

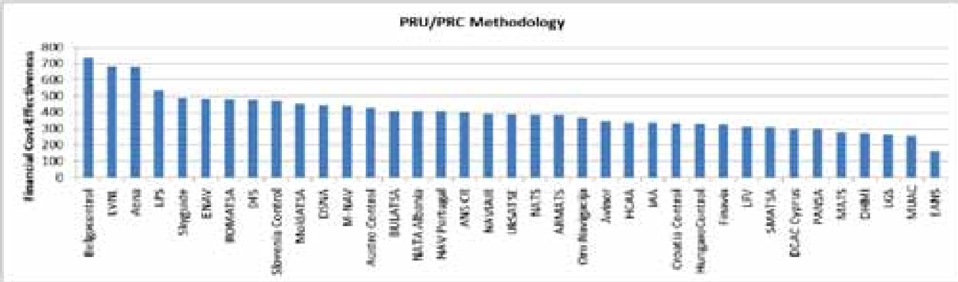

Fig. 1.
Overall Financial Cost-Effectiveness 2009

The overall financial cost-effectiveness is calculated by the ratio of Air Traffic Management/ Communication Navigation Surveillance (ATM/CNS) provision costs to the Composite flight hours (EUROCONTROL, 2011) (Eq. (1)):

$$Overall\ financial\ cost\ effectiveness\ = \frac{ATM/CNS\ provision\ costs}{Composite\ flight\ hours} \quad (1)$$

The ATM/CNS provision costs represent all costs of the ANSP for provision of the ATM/ CNS service. On the other hand, composite flight hours in Eq. (1) are the summation of the En-route flight hours and IFR airport movements weighted by a factor that reflects the relative (monetary) importance of terminal and en-route costs in the cost base (EUROCONTROL, 2011) (Eq. (2)):

$$Composite\ flight\ hours\ =\ Enroute\ flight\ hours\ +\ (0.26 \times\ IFR\ airport\ movements) \quad (2)$$

Another output of the ATM Cost-Effectiveness (ACE) 2009 Benchmarking Report is the Air Traffic Control Officer (ATCO)-hour productivity, shown in Fig. 2.

The ATCO-hour productivity is calculated by dividing Composite flight hours by Total ATCO-hours on duty (EUROCONTROL, 2011) (Eq. (3)):

$$ATCO\ hour\ productivity = \frac{Composite\ flight\ hours}{Total\ ATCO\ hours\ on\ duty} \quad (3)$$

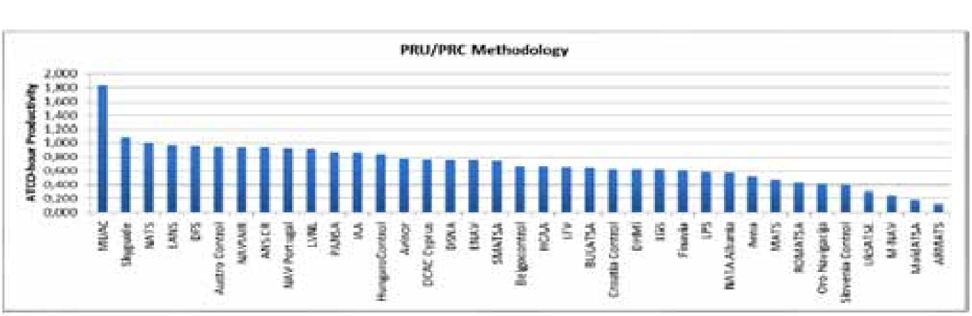

Fig. 2.
ATCO-Hour Productivity (Gate-to-Gate) 2009

Where Total ATCO-hours on duty in Eq. (3) are the multiplication of Total number of ATCOs and Average ATCO-hours on duty per ATCO per year (EUROCONTROL, 2011) (Eq. (4)):

$$Total\ ATCO\ hours\ on\ duty = Total\ number\ of\ ATCOs \times Average\ ATCO\ hours\ on\ duty\ per\ ATCO\ per\ year \quad (4)$$

ANSPs covered in PRU (Fig. 1 and Fig. 2) or CANSO report significantly vary per size and business. Therefore, it is hard to make an objective comparison of their performances. In order to come closer to objective peer comparisons, CANSO decided to group the ANSPs per number of IFR flight hours (Table 1). But even within the group there are ANSPs that have at least twice the traffic than the other ones. Within the group A, the United States of America ANSP (FAA ATO) has twenty times more traffic than the Mexican ANSP (SENEAM). If the assumption is that the economy of scale contributes to the overall cost-effectiveness of the ANSPs, then any type of comparison by pure facts only could not be considered as objective.

Additionally, PRU reports that their benchmarking is based purely on factual analysis and that many further factors would need to be considered in a normative analysis in order to make the results more comparable.

Table 1
CANSO Grouping of ANSPs per Number of IFR Flight Hours

Grouping	ANSP	Total IFR Flight Hours
A (More than 1 million)	FAA ATO (USA)	25,106,283
	NAV CANADA	3,230,049
	AAI (India)	2,163,958
	NATS (UK)	1,731,274
	DFS (Germany)	1,366,637
	AENA (Spain)	1,358,390
	SENEAM (Mexico)	1,241,091
B (250,000 - 1 million)	NAV Portugal	468,728
	LFV (Sweden)	410,242
	Airways New Zealand	351,680
	AEROTHAI (Thailand)	320,360
	ROMATSA (Romania)	286,944
	ATNS (South Africa)	281,255
	IAA (Ireland)	256,550
C (100,000 - 250,000)	GCAA (UAE)	246,041
	ANS Czech Republic	231,079
	SMATSA (Serbia & Montenegro)	217,675
	NAVIAIR (Denmark)	209,917
	HungaroControl (Hungary)	197,909
	LVNL (The Netherlands)	151,592
	DCAC (Cyprus)	130,669
	Finavia (Finland)	114,645
D (0 - 100,000)	LPS (Slovak Republic)	82,382
	LGS (Latvia)	63,951
	NAATC (Netherlands Antilles)	55,623
	EANS (Estonia)	54,417

Source: CANSO (2011)

5. Traffic Variability

Since delays are counted in millions of euros per year, any airspace user, especially those which perform scheduled flights, would expect from any ANSP to have enough capacity available to meet their demand at any period of the year. ANSPs therefore need to constantly enhance their capacity through upgrade of their technical facilities, technology and methods of work and by employment of additional staff, in particular ATCOs.
This all contributes to additional "fixed" costs on a yearly basis, regardless of the actual demand in a particular period of the year. In other words, due to the nature of business and required competency of the ANSPs staff, the personnel needed to cope with peak demand, usually in summer period, cannot be fired in October and re-employed in May next year. ANSPs rather need to keep them on their payroles throughout the whole year. The greater the variability of traffic the more the resources are underutilized and therefore contribute to cost ineffectiveness of particular ANSP. So called "wasted resources" are presented in Fig. 3 as a blue area.

As already assumed in Chapter 3, the airspace and traffic volumes are definite in size. Therefore, it is not possible to optimize the business by purely attracting more traffic in the quiet periods of the year as, firstly, there is obviously no additional demand from the airspace users at those times and, secondly, traffic flow can only be re-shifted at the expense of another ANSP. Traffic variability thus needs to be considered as a contributing factor that cannot be avoided.

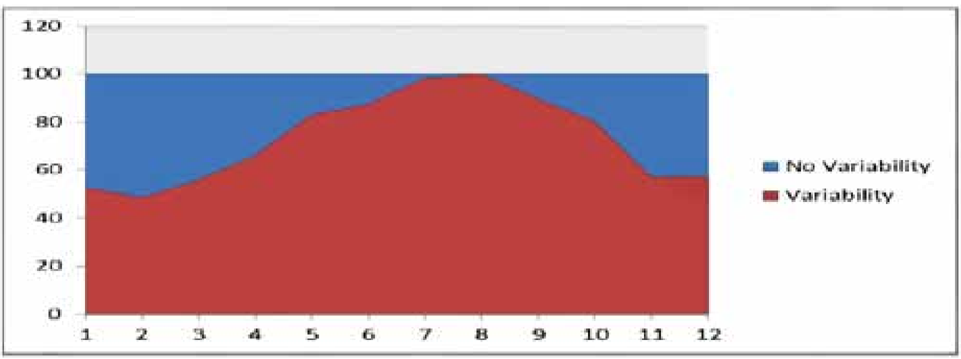

Fig. 3.
Traffic Variability on a Yearly Basis

PRU recognizes seasonal traffic variability in their ATM Cost-Effectiveness (ACE) 2009 Benchmarking Report. It is calculated as ratio of traffic in the peak week and the average weekly traffic (EUROCONTROL, 2011) (Eq. (5)):

$$Seasonal\ traffic\ variability = \frac{Traffic\ in\ the\ peak\ week}{Average\ weekly\ traffic} \quad (5)$$

Seasonal traffic variability factors, calculated with Eq. (5) for each ANSP are reported in the ATM Cost-Effectiveness (ACE) 2009 Benchmarking Report, however, they are only used to display the level of seasonal traffic variability at each particular ANSP and are not directly used as corrective factors in the calculations.

By using these calculated factors to equalize the composite flight hours (Eq. (6)), the order of classification of the financial cost-effectiveness of the benchmarked ANSPs changes (Fig. 4b). The ones with lower traffic variability move to the left towards less cost-effective ANSPs and the ones with higher traffic variability to the right, towards more cost-effective ANSPs.

$$Adjusted\ overall\ financial\ cost\ effectiveness = \frac{ATM/CNS\ provision\ costs}{Composite\ flight\ hours \times variability\ factor} \quad (6)$$

In order to get only one seasonal traffic variability factor per ANSP, the factors were averaged for the ANSPs that in the ATM Cost-Effectiveness (ACE) 2009 Benchmarking Report, have FIRs divided in more sections with different variability factors. Results with regards to Financial Cost Effectiveness are presented in Fig. 4a and to Rank change in Fig. 4b.

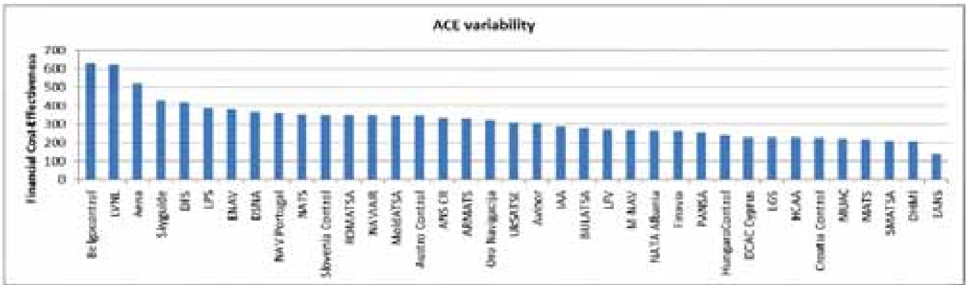

Fig. 4a.
Financial Cost-Effectiveness Corrected by ACE Variability Factors

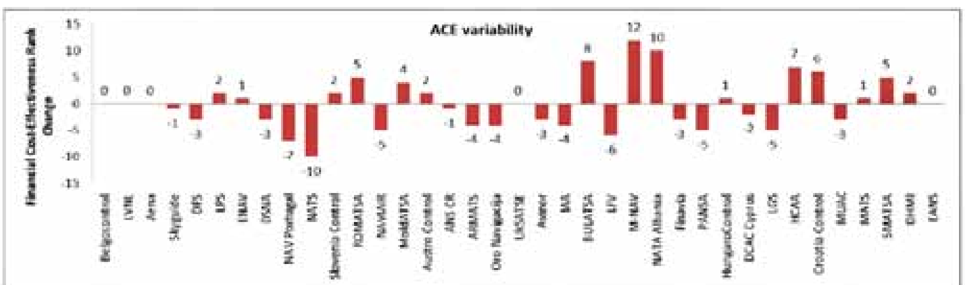

Fig. 4b.
Financial Cost-Effectiveness Rank Change by ACE Variability Factors

To get the total objectiveness of the traffic variability ratio of traffic in the peak week to the average weekly traffic (Eq. (5)) is not enough. In order to calculate the ratio of the de-facto time when ATCO is utilized to the time that ATCO could be utilized, providing that there is traffic demand, the real variability factor needs to be calculated, based on the traffic statistics.

The only source of data available for general public is the EUROCONTROL Air Traffic Statistics and Forecasts (STATFOR) data on actual amount of traffic per country per month (EUROCONTROL (EC-3), 2001).

To calculate the variability factor, the ratio of the fictitious yearly traffic to the ratio of actual yearly traffic has been used as shown in the STATFOR traffic variability below (Eq. (7)). The fictitious yearly traffic has been calculated as multiplication of maximum monthly traffic by 12 (months):

$$STATFOR\ traffic\ variability = \frac{Max.monthly\ traffic \times 12}{Actual\ yearly\ traffic} \quad (7)$$

Since STATFOR data are not readily available for MUAC (Maastricht Upper Area Control Centre), for the purpose of this research, PRU calculated seasonal variability factor has been also used on this occasion. Data used for calculations are presented in Table 2. By using these factors to equalize the composite flight hours, the order of classification of the financial cost-effectiveness of the benchmarked ANSPs changes even more (Fig. 5b). The ones with lower traffic variability move even more to the left towards less cost-effective ANSPs and the ones with higher traffic variability move even more to the right, towards more cost-effective ANSPs. Results with regards to Financial Cost Effectiveness are presented in Fig. 5a and to Rank change in Fig. 5b.

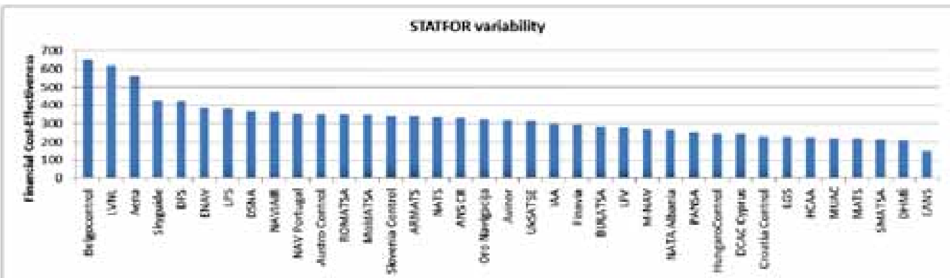

Fig. 5a.
Financial Cost-Effectiveness Corrected by STATFOR Variability Factors

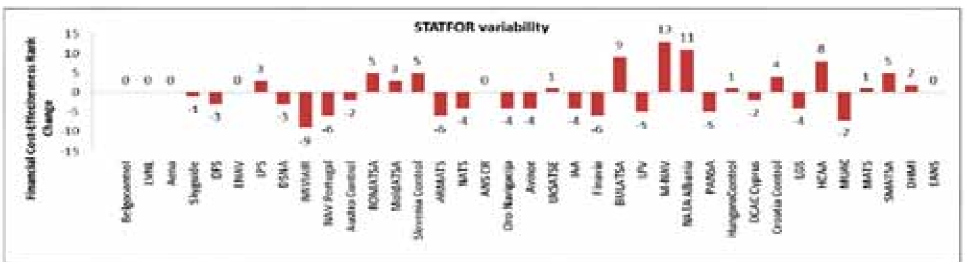

Fig. 5b.
Financial Cost-Effectiveness Rank Change by STATFOR Variability Factors

Similar research has been done with ATCO-hour productivity. The composite flight hours have initially been equalized by PRU calculated seasonal traffic variability factors using the ATCO hour productivity (Eq. (8)). The immediate effect of this research is not as great as with the financial cost effectiveness, although the classification order of particular ANSPs changes here as well. Results with regards to ATCO-Hour Productivity are presented in Fig. 6a and to Rank change in Fig. 6b.

$$ATCO\ hour\ productivity = \frac{Composite\ flight\ hours \times variability\ factor}{Total\ ATCO\ hours\ on\ duty} \quad (8)$$

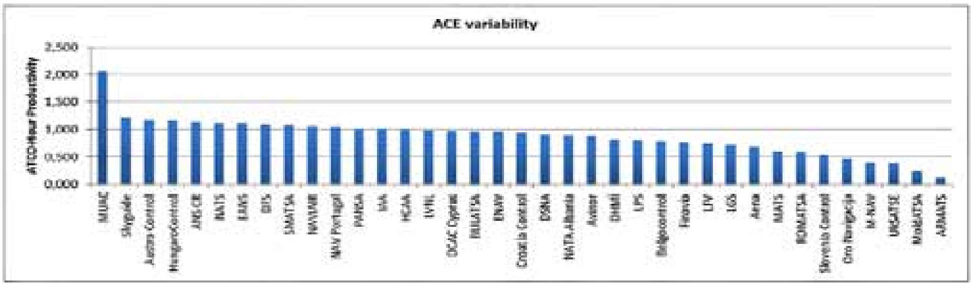

Fig. 6a.
ATCO-Hour Productivity Corrected by ACE Variability Factors

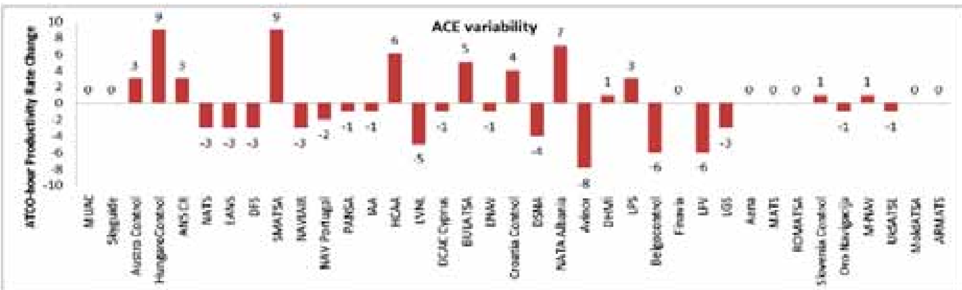

Fig. 6b.
ATCO-Hour Productivity Rank Change by ACE Variability Factors

Table 2
Monthly Traffic and Variability 2009 Based on STATFOR Data

Country / Month	Variability	January	February	March	April	May	June
Albania	1,539	8828	7875	9035	11644	14905	15820
Armenia	1,125	3729	3350	3930	3633	3699	4219
Austria	1,223	77315	71142	81879	88006	101501	104914
Belgium/Luxembourg	1,131	75447	72150	83189	84942	90765	91978
Bulgaria	1,439	27834	25450	30201	34667	42519	48596
Croatia	1,458	24580	22215	25719	31039	40068	42233
Cyprus	1,224	18944	16772	20312	22775	22420	22877
Czech Republic	1,230	46217	41849	49275	51262	57464	60855
Denmark	1,074	44871	42368	48746	46660	48704	51540
Estonia	1,101	12554	10441	12015	12508	13156	13362
F.Y.R. Macedonia	1,633	5942	5105	6095	8373	12462	13991
Finland	1,103	19296	19098	22102	20162	20434	20695
France	1,195	199101	190219	220642	235078	253667	259415
Germany	1,119	214930	205012	237418	240437	260488	263971
Greece	1,501	35534	32616	38784	47500	59794	65275
Hungary	1,366	38600	34489	40917	45658	53868	60201
Ireland	1,119	41821	39189	43427	43892	47763	49042
Italy	1,267	107647	102424	120813	134928	152834	157052
Latvia	1,137	15673	13410	15699	17035	18104	18477
Lisbon FIR	1,148	32347	29376	33160	34801	32971	32616
Lithuania	1,129	14951	13075	15284	15201	16459	17110
Malta	1,245	6127	5336	6316	6839	7056	7294
Moldova	1,286	2954	2523	2974	3203	3738	4409
MUAC							
Netherlands	1,105	76480	70983	81779	82828	87706	88578
Norway	1,082	41158	39519	45566	41292	44116	47149
Poland	1,169	43637	38667	44380	44608	48869	51801
Romania	1,359	28648	26067	30769	32588	37530	43040
Serbia & Montenegro	1,443	29921	26795	31148	37563	47220	50989
Slovakia	1,407	21447	19206	22447	24457	29407	34002
Slovenia	1,370	18874	17324	19952	23581	29636	31228
Spain	1,213	109804	107018	121956	132087	141671	143372
Sweden	1,101	50273	49489	57372	53529	56390	58236
Switzerland	1,138	75582	71518	82412	84809	91923	92159
Turkey	1,292	53827	48871	58369	65249	75034	80326
UK	1,150	173903	160514	184865	186877	203077	207942
Ukraine	1,247	26738	23279	26882	28423	32490	36349

July	August	September	October	November	December	Total	Max. Total
18871	20694	17411	15057	10641	10621	161402	248328
4474	4308	3883	4262	4367	4536	48390	54432
113404	112163	105581	99566	80003	77041	1112515	1360848
96126	91283	91713	90733	78221	73689	1020236	1153512
57196	56543	48275	43630	31696	30355	476962	686352
48875	51269	44516	38761	26495	26251	422021	615228
26194	27292	23580	24611	21067	20755	267599	327504
66390	63676	59680	57455	47745	45739	647607	796680
50164	50285	51259	50927	47397	42838	575759	618480
13740	14030	13852	13600	11996	11699	152953	168360
16117	17030	14569	11874	6640	6955	125153	204360
17469	19730	21811	21748	19230	18684	240459	265224
278850	267820	257263	245162	199958	193400	2800575	3346200
273206	262986	266628	263640	228413	212985	2930114	3278472
73736	79814	67265	57184	40323	40102	637927	957768
69153	67847	59887	54349	42276	40268	607513	829836
49424	48465	45791	45118	37663	38248	529843	593088
173872	171021	156085	143623	116517	110574	1647390	2086464
19529	19527	18871	18410	15952	15410	206097	234348
37838	38885	33936	34493	32644	33391	406458	466620
18051	17983	16903	16779	15170	14826	191792	216612
8400	8822	7784	7605	6684	6767	85030	105864
4418	4693	4136	3922	3428	3379	43777	56316
91745	88828	89058	88179	76856	73178	996198	1100940
43056	46079	47382	46579	43943	39846	525685	568584
55120	53193	52111	48815	42613	42078	565892	661440
49122	46927	41049	37662	31082	29369	433853	589464
58884	61707	54068	48211	33569	33104	513179	740484
39506	37898	33190	29932	23374	22188	337054	474072
35084	35759	32067	28702	20439	20503	313149	429108
159822	158716	143341	138240	113950	110514	1580491	1917864
51795	56619	60052	58103	53531	48894	654283	720624
96558	94133	93451	89723	74154	71965	1018387	1158696
90782	92279	81927	80189	65781	64227	856861	1107348
218193	212895	205848	197511	165116	160895	2277636	2618316
38777	39226	35793	33140	28500	28018	377615	470712

Table 3
Data Used for Calculations

ANSP name	Fin. Cost-eff.	ACE Adj. Fin. Cost-eff.	STATFOR Adj. Fin. Cost-eff.	ATM/CNS provision costs	Composite flight-hours	Variability
Aena	678	520	559	1187505000	1751600	1,304
ANS CR	404	334	329	107636000	266155	1,210
ARMATS	385	332	342	6284000	16326	1,160
Austro Control	429	346	351	165934000	386571	1,240
Avinor	343	304	317	158022000	461124	1,126
Belgocontrol	738	631	653	150222000	203500	1,170
BULATSA	414	280	288	76951000	185907	1,480
Croatia Control	336	227	231	64323000	191291	1,480
DCAC Cyprus	295	231	241	40717000	137863	1,280
DFS	477	418	426	887594000	1860706	1,140
DHMİ	271	207	209	242508000	896279	1,305
DSNA	444	367	371	1157658000	2608943	1,208
EANS	163	143	148	9826000	60218	1,140
ENAV	487	380	384	648610000	1332441	1,282
Finavia	326	262	296	57118000	175159	1,245
HCAA	339	229	226	178065000	525775	1,480
HungaroControl	331	240	242	74035000	223735	1,380
IAA	337	291	301	106922000	317166	1,160
LFV	312	275	283	166213000	533250	1,135
LGS	262	230	231	20134000	76768	1,140
LPS	536	389	381	46367000	86442	1,380
LVNL	684	622	619	178864000	261508	1,100
MATS	275	219	221	13499000	49004	1,260
M-NAV	440	270	270	10722000	24362	1,630
MoldATSA	452	347	351	6630000	14680	1,300
MUAC	253	224	224	134603000	531873	1,130
NATA Albania	411	265	267	16462000	40038	1,550
NATS	386	353	336	686714000	1780323	1,093
NAV Portugal	411	360	358	134269000	326994	1,140
NAVIAIR	395	349	368	112009000	283701	1,130
Oro Navigacija	364	325	322	18708000	51375	1,120
PANSA	295	255	253	117984000	399485	1,160
ROMATSA	480	350	353	147767000	307889	1,370
Skyguide	488	428	429	217815000	446306	1,140
Slovenia Control	470	351	343	24224000	51524	1,340
SMATSA	310	214	215	69502000	224356	1,450
UkSATSE	391	306	313	137114000	350897	1,278

Adj. Composite flight-hours	Variability STATFOR	Adj. Composite flight-hours STATFOR	Total ATCO-hours on duty	ACE ATCO-h. prod.	ACE Adj. ATCO-h. prod.	STATFOR ATCO-h. prod.
2284086	1,213	2125498	3374412	0,519	0,677	0,630
322048	1,230	327421	284748	0,935	1,131	1,150
18938	1,125	18364	140460	0,116	0,135	0,131
479348	1,223	472860	408592	0,946	1,173	1,157
519226	1,082	498754	593808	0,777	0,874	0,840
238095	1,131	230084	300804	0,677	0,792	0,765
275142	1,439	267522	285039	0,652	0,965	0,939
283111	1,458	278867	304169	0,629	0,931	0,917
176465	1,224	168725	181384	0,760	0,973	0,930
2121205	1,119	2081923	1943240	0,958	1,092	1,071
1169644	1,292	1158289	1432518	0,626	0,816	0,809
3151603	1,195	3117233	3491423	0,747	0,903	0,893
68649	1,101	66284	62160	0,969	1,104	1,066
1708189	1,267	1687573	1783287	0,747	0,958	0,946
218073	1,103	193199	287052	0,610	0,760	0,673
778147	1,501	789386	779100	0,675	0,999	1,013
308754	1,366	305612	265716	0,842	1,162	1,150
367913	1,119	355025	364632	0,870	1,009	0,974
605239	1,101	587319	814920	0,654	0,743	0,721
87516	1,137	87291	123073	0,624	0,711	0,709
119290	1,407	121582	148217	0,583	0,805	0,820
287659	1,105	289003	288156	0,908	0,998	1,003
61745	1,245	61011	103663	0,473	0,596	0,589
39710	1,633	39780	98088	0,248	0,405	0,406
19084	1,286	18885	82734	0,177	0,231	0,228
601016	1,130	601016	291265	1,826	2,063	2,063
62059	1,539	61601	69919	0,573	0,888	0,881
1945893	1,150	2046617	1761911	1,010	1,104	1,162
372773	1,148	375394	356202	0,918	1,047	1,054
320582	1,074	304751	303519	0,935	1,056	1,004
57540	1,129	58023	125208	0,410	0,460	0,463
463403	1,169	466936	456766	0,875	1,015	1,022
421808	1,359	418320	716758	0,430	0,588	0,584
508789	1,138	507796	414866	1,076	1,226	1,224
69042	1,370	70603	129794	0,397	0,532	0,544
325316	1,443	323731	301184	0,745	1,080	1,075
448446	1,247	437407	1152216	0,305	0,389	0,380

As the last part of this research, composite flight hours have been equalized by STATFOR based data, calculated seasonal traffic variability factors, which again resulted in some changes in classification order. Results, based upon input data of Table 3, with regards to ATCO-Hour Productivity are presented in Fig. 7a and to Rank change in Fig. 7b.

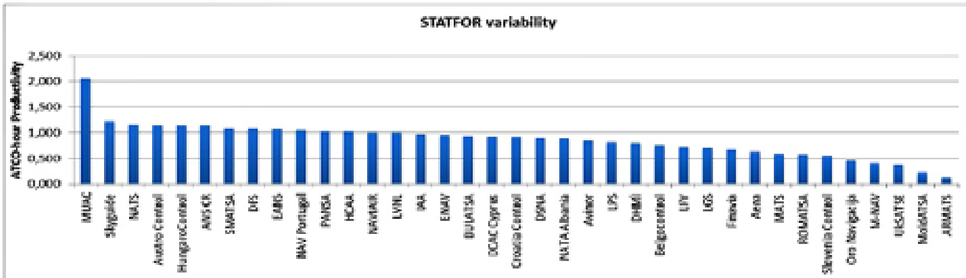

Fig. 7a.
ATCO-Hour Productivity Corrected by STATFOR Variability Factors

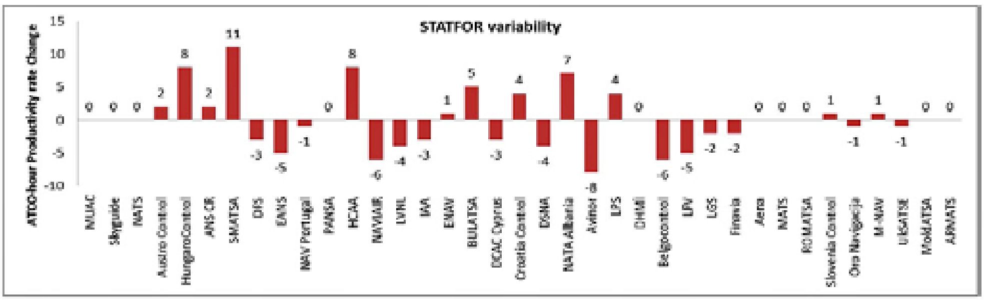

Fig. 7b.
ATCO-Hour Productivity Rank Change by STATFOR Variability Factors

6. Conclusion

The ATM environment is specific and a complex one. The logic of standard economy does not always directly fit into the picture. Aviation is ruled globally, regionally and nationally by sets of rules, standards, recommended practices and legal papers. On the one hand, everyone expects that operations are, beyond any doubt, safe and efficient. On the other hand, they should be as much as possible inexpensive. The inputs and the outputs of the process are globally the same. The ways on how to run the business are normally affected by local particularities and therefore are usually somewhat different. Some factors that are affecting the business can be influenced, but some have to be taken on board as granted; meaning that even if we get another ANSP to render the services in one particular part of the globe, they would still have to overcome the same constraints as the original ANSP from that particular part of the globe.

It is also safe to assume that economy of scale does not necessarily optimize the performance and enhances cost-effectiveness, but somehow flattens out the peaks and valleys in the graph of performance and cost-effectiveness. The larger the geographical area of business, the more chance there is that particular ANSP would cover areas with heavy traffic flows and areas with little traffic, or areas with high seasonal variability and low seasonal variability, or high traffic complexity and low traffic complexity and so on. Using this reasoning, usual statement that smaller ANSPs can never be as efficient as bigger ones, does not hold entirely. Providing that bigger ANSP takes over the smaller one, by default this does not mean that bigger ANSP and smaller ANSP would now become more efficient all together, but would rather mean that bigger one would probably become a bit less efficient. The reasoning for this is based on assumptions defined in Chapter 3.

PRU offers a set of suggestions on how to optimize the business such as change of pension schemes for new recruits, increase of retirement age, review of staffing needs for support functions, postponement of recruitment, postponement of training, improved procurement processes, extension of life of technical systems, revision of investment plans, rationalisation of ACCs and other operational units, seeking improvements through cooperation (FABs), etc.

All the proposed above is sensible and worthwhile looking at, but in order to have proper starting point for optimization, proper benchmarking exercise needs to be executed, where apples are compared to apples and not to pears. Factual analysis is therefore good starting point, but as already recognized, proper methodology should be developed for proper normative analysis.

Showing an example on how seasonal variability can influence cost-effectiveness is only one small stone in a mosaic of potential future methodology for normative analysis. This area of work offers a great deal of opportunities for future research work. By taking into account seasonal variability when performing the calculations, it could be easily stated that results become a bit more objective. An ANSP that is situated in such part of the world, where seasonal variability is high, could probably try to optimize all the areas proposed by the PRU and would hardly become more efficient than an ANSP which has no problems with traffic variability. The same goes for all the other factors that are already recognized and described by the PRU and CANSO and are not elaborated in this paper.

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PROMENE SAOBRAĆAJA PRI IZRADI UPOREDNE PROCENE EKONOMIČNOSTI PRUŽALACA USLUGA U VAZDUŠNOJ PLOVIDBI

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Sažetak: Evropski pružaoci usluga u vazdušnoj plovidbi (ANSP) u proseku opslužuju oko 26.000 letova dnevno. Prema aktuelnim prognozama, očekuje se će se nivo kapaciteta vazdušnog saobraćaja do 2020. godine udvostručiti. Upotrebom različitih uporednih procena ekonomičnosti, pokazano je da su troškovi usluga upravljanja vazdušnim saobraćajem (ATM) u Evropi, u poređenju sa sličnim sistemima u svetu, na godišnjem nivou veći za oko 2-3 milijarde evra. Ova činjenica ukazuje na potrebu za smanjenjem troškova usluga upravljanja vazdušnim saobraćajem (ATM) u Evropi kao i na poboljšanje njegovih karakteristika. Vazduhoplovne organizacije, kao što su Evropska organizacija za bezbednost vazdušne plovidbe (EUROCONTROL) i Organizacija pružalaca usluga u vazdušnoj plovidbi (CANSO), sprovode istraživanja uporednih procena ekonomičnosti i objavljuju izveštaje, na osnovu analize faktičkog stanja. U cilju postizanja objektivnijih rezultata, potrebno je razviti odgovarajuću metodologiju koja će omogućiti primenu normativne analize. Objektivnost rezultata u ovom radu je opravdana korišćenjem jednog od unutrašnjih faktora sistema – promene saobraćaja. Izjednačavanje vrednosti različitih varijabilnih faktora pokazuje da se redosled uporednih procena ekonomičnosti individualnih pružalaca usluga u vazdušnoj plovidbi (ANSP) menja. Prikazivanje primera uticaja sezonske promene saobraćaja na rentabilnost i produktivnost sata rada kontrolora letenja (ATCO) predstavlja osnov za razvoj buduće metodologije normativne analize.

Ključne reči: ANSP - Pružalac usluga u vazdušnoj plovidbi, ATM - usluga upravljanja vazdušnim saobraćajem, rentabilnost, SES - Jedinstveno evropsko nebo, ACE izveštaj (European ATM Cost-Effectiveness (ACE) Report), kapacitet, sezonske promene saobraćaja, PRC - Performance Review Commission, PRU - Performance Review Unit, CANSO - Organizacija pružalaca usluga u vazdušnoj plovidbi.