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A Profitability Analysis of Air Navigation Service Providers in European Zone: COVID-19 Crisis

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Abstract

The civil aviation sector is important for the logistics system. Besides, Air Navigation Service Providers (ANSP) are one of the main parts of the total civil aviation system. This study is about their profitability structure and assessment of performance. Out of the general and classical ratios such as ROA and ROE, authors utilized 13 different profitability ratios to understand the general picture of ANSP in the context of profitability performance by using GRA and MABAC methods. Analysis were made for 34 airport service providers from different countries with annual data between 2017 and 2020. The findings show that COVID-19 crisis has got a deep impact on ANSP's profitability structures in general and by firms. Besides it is seen that the most profitable companies are Turkish, Georgian and Estonian ANSP.

1. Introduction

Participants in the civil aviation industry have got a lot of legal responsibilities towards different parties. From the context of the operational side, they should strictly and soundly follow the rules and regulations of international organizations such as ICAO (International Civil Aviation Organization), Eurocontrol, FAA (Federal Aviation Administration), ACI (Airport Council International) and national regulators. Otherwise, they should be transparent and accountable towards international, regional and national financial institutions. Financial profitability can be defined as the power of ensuring profit for a company in a sustainable manner. The financial statements of a company may give us a lot of insights about the financial structure of a company, also profitability.

In this paper, we aim to make a comprehensive analysis of profitability in air navigation service providers before, after and during the Covid-19 period. For this purpose, we determined 13 different profitability ratios in the first step of the analysis. In the determination process, we utilize EBITDA (Earnings Before Interest, Taxes, Depreciation and Amortization)-based ratios as it is discussed in the literature review section. And also, we form of sample including almost all of the Airport Navigation Service Providers in Europe. In the related section detailed information about sampling was given. We utilize GRA (Grey Relational Analysis) and MABAC (Multi-Attributive Border Approximation Area Comparison) methodologies. The rest of the present study proceeds as follows: Section 2 reviews the literature on the related topic, Section 3 involves the ratios used in the analysis, definitions and data structure, Section 4 introduces the methodology and provides details on the data and variables, Section 5 explains the findings and the last section presents discussions, conclusions and suggestions.

2. Literature Review

In this section the definitions and development of profitability ratios for different industries are explained. Particularly the importance, causes and distinction of EBITDA and EBIT (Earnings Before Interest and Taxes) for the aviation industry are discussed. Detailed information on Air Navigation Service Providers will be given in the last section.

According to financial statements analysis, there are several types such as liquidity, financial structure and profitability analysis. Profitability analysis shows the power of companies to generate profits at certain times by making use of costs, income, income, assets and all kinds of components in the statutory financial statements. In the following paragraphs, we try to analyze the importance of some financial profitability ratios in different industries and countries. In terms of different ratios, Hermawan & Mulyawan (2014) discussed the importance of ROA (Return on Asset), ROE

(Return on Equity) and net profit margin as profitability measures to measure the relationship between profitability and corporate social responsibility. ROA is the focal point of Javaid et al. (2011) analysis of banking profitability in Pakistan and Adelopo et al.'s (2017) in the West African States. Alarussi & Gao (2021) utilized ROA and EPS (Earnings Per Share) ratios as the profitability measures in their analysis. EPS and ROE are selected also by Alarussi & Alhaderi (2018) to determine profitability elements in Malaysia's financial industry. Tenas & Serrat (2018) used ROA to analyse profitability determinants in hospital companies in Spain. Malik (2011) stated the importance of ROA in the analysis of Pakistan insurance companies' profitability. In Sultan's Analysis (2014) Profit Margin (PM), Return on Assets (ROA), Return on Equity (ROE), Capital turnover ratio and Expense ratio are the main determinants of the Baghdad Soft-Drink Industry in Iraq. Pervan & Mlikota (2013) explained the profitability with variables such as EBITDA in the Croatian Food and Beverage Industry. Shaida et al. (2018) realized a profitability analysis of Palm Oil Companies in Malaysia that includes ROA as the main profitability variable. When the main profitability metrics are examined, it is seen that ROA, ROE and EBITDA are the main ones.

According to the analysis of Zeli & Mariani (2009) ROE, ROI (Return on Investment) and ROS (Return on Sales), asset turnover, fixed assets on total assets, leverage, profit margin, and profit on total assets are the main ratios in productivity analysis of Italian companies between the years of 1998-2002. Saleem & Rehman (2011) utilized the ratios of ROA, ROE and ROI to determine and measure the liquidity of Pakistan oil and gas companies, this analysis showed the importance of these ratios in also different financial analyses. Singh & Mogla (2010) utilized Operating Profit Margin (OPM), Net Asset Turnover Ratio (ATR), Net Profit Margin (NPM), Return on Capital Employed (ROCE), and Return on Net Worth (RONW) ratios as a part of their analyses. Scott & Arias (2011) argued the importance of ROA (Return on Asset) for banking profitability.

It is openly stated in the paper of Bezerra & Gomes's (2018), airport and airport performance analysis should include a lot of dimensions such as efficiency, service, safety, security, commercial, environmental, social, competition, economic-financial and operational measures. In economic and financial analysis, operation cost, revenue and expenditure structures, investments, debt, EBITDA, Cash Flow, Profit/Loss, ROA, ROE, ROI and operating margin are some of important measures. Richardson et al. (2014) showed the importance of Net Working Capital (Operating Liquidity) and Debt Ratio in the lease agreements of US hub airports. Ison et al. (2011) developed a framework showing the importance of Doganis's REVEX ratio (Operating Income/Operating Expenditure) to identify controlling airport costs and revenues. Hooper & Hensher (1997) stated that cost efficiency, cost-effectiveness and service effectiveness of airports should be considered for the airport financial performance analyses. Assaf (2009) highlighted the importance of capital investments for efficiency analysis of airports. Raghavan & Yu (2021) defined some clear insights related to operating metrics, leverage metrics and liquidity metrics for airports and their importance in analyzing airport performance. Vogel (2011) argued the importance of some financial ratios in privatized airports utilizing EBIT (Earnings Before Interest and Taxes) value.

Otherwise ANSP (Air Navigation Service Providers) finance their activities by charging airlines to use their airspace. In order to gain more profit, they should implement optimum usage policies in their airspace (Castelli et al., 2013). Tomova (2017) defined different business-making strategies in the ANSP industry according to different requirements of miscellaneous customers (airlines, airports, airports operators, civil aviation authorities and ministries) and develops an economic model. This model provides insights into the mechanisms through which regulation can drive air traffic management performance improvements, as well as its limitations. According to Blondiau et al. (2016), efficient politics in air traffic management provide increases in the revenue of ANSP. Bilokatch et al. (2014) and Dempsey-Brench & Volta (2018) criticized the cost-efficient politics in the European ANSP network. Adler et al. (2020) emphasized the importance of stakeholder policies, shareholder policies and economic structure of ANSP in terms of performance. Button & McDougall (2006) pointed out institutional and structural changes in ANSP Organizations and make conclusions about them. Grebensek & Magister (2012) measured the difference between ANSP due to seasonal traffic variability. With the explanations of Tomova (2016), it can clearly be understood that the role of commercial revenues can change with new paradigms.

2.1. The distinction between EBIT and EBITDA and other ratios

In a financial analysis, there are several types of revenue according to the literature. Especially, the main differences between EBIT and EBITDA can change depending on the industrial context. A criticism can be intensified here, for example, after stating their importance, Adiloğlu & Vuran (2017) explained that EBITDA can be more suitable for manufacturing companies versus service companies. Wandroski et al. (2016) used the net profit ratio to calculate the main distinctive variables such as ROA and EBITDA margin. Lukason (2015) utilized EBIT for European micro-level manufacturing companies. Andres (2008) utilized EBIT and EBITDA measures to understand founding-family ownership structures. When he realizes his analysis, he utilized especially these two distinctive values to calculate Return on Asset ratio. Lopez et al. (2018) utilized also EBITDA measures to calculate ROA in the profitability structures of cheese-producing companies in Spain. According to analyses of Bouwens et al. (2019), EBITDA-reporting firms are generally smaller, more leveraged, more capital intensive, less profitable and have longer operating cycles than non-EBITDA reporting firms.

3. The specific ratios in the analysis and data

There are five different groups of ratios in the analysis. The groups and related ratios can be seen in Table 1. To reach a comprehensive methodology, we utilize the values of EBITDA. When the financial statements of ANSP in Europe are analyzed, it is seen that depreciation and amortization values are relatively high in the certain period between 2017-2022 (www.eurocontrol, 2022). On the other side, that period is so catastrophic due to the COVID-19 crisis. Furthermore, the utilization of assets, debts, expenditures and activities to yield more returns and profits is part of this comprehensive analysis according to the general condition of the European ANSP's network.

The first group of ratios can be defined as expenditure analysis ratios. This group shows how the air navigation service providers utilized their capital or operational expenditures to retain profit and returns between the years of 2017 and 2022. The second group of ratios shows how their assets are utilized to yield more returns between related years. Differences between assets are of great importance due to the industrial nature of ANSP and their different structures. The third group of analyze ratios described the utilization of debts in order to take returns. As the analysis period is a catastrophic one, long- and short-term differences in debt should gain more insight. The ability to turn them into financial returns is a special ability especially for this term. In the fifth section, there are specific ratios related to the use of their investments and these values show the situations of ANSP. There are 36 European ANSP which were analyzed and data was taken from EUROCONTROL's ANSP website

Table 1. The Ratios Used in The Analysis

	RATIOS	
1.	**OPEX (Operational Expenditure) / CAPEX (Capital Expenditure) ANALYSES**	
	Profit/Opex	Profit per operational expenditure (POPEX)
	Profit/Capex	Profit per capital expenditure (PAPEX)
A.	POPEX/PAPEX	The ratio of POPEX to PAPEX
	Return on OPEX	Return (EBITDA) per operational expenditure (ROPEX)
	Return on CAPEX	Return (EBITDA) per capital expenditure (RAPEX)
B.	ROPEX/RAPEX	The ratio ROPEX to RAPEX
C.	OPEX/CAPEX	Operational expenditure per capital expenditure
2.	**ASSET ANALYSES**	
D.	ROA-1-	Return (EBITDA) on Fixed assets
E.	ROA-2-	Return (EBITDA) on Current assets
F.	ROA-3-	Return (EBITDA) on Total assets
3.	**DEBT ANALYSES**	
G.	ROD-1-	Return (EBITDA) on Short-Term Debts
H.	ROD-2-	Return (EBITDA) on Long-Term Debts
I.	ROD-3-	Return (EBITDA) on Total Debts
4.	**STOCK RETURN ANALYSES**	
J.	ROE-1	RETURN(EBITDA) on equity
K.	FCF/SE	Free cash flow/Shareholder equity
5.	**OPERATIONAL ANALYSES**	
L.	RONOA	Return (EBITDA) per an operational activity
M.	RONIA	Return (EBITDA) per an investment activity

4. Methodology

4.1. MABAC (Multi Attributive Border Approximation Area Comparison) Method

MABAC method which was developed by Pamučar & Ćirović (2015), evaluations are made by measuring the distance of the criteria functions of each alternative to the boundary approximation area (Ayçin & Çakın, 2019: 334). The method consists of seven steps. The first step is to form the decision matrix (X) as in Equation (1). m is number of alternatives and, n is number of criteria in this expression. Alternatives are shown with the vector as $A_i = (x_{i1}, x_{i2}, \dots x_{in})$ while x_{ij} is the value of decision unit i according to criteria j ($i = 1,2, \dots, m; j = 1,2, \dots, n$).

$$X = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix} \quad (1)$$

In the second step of the method, the matrix (X) is normalized. The normalized decision matrix (N) is stated in Equation (2).

$$N = \begin{bmatrix} t_{11} & t_{12} & \dots & t_{1n} \\ t_{21} & t_{22} & \dots & t_{2n} \\ \dots & \dots & \dots & \dots \\ t_{m1} & t_{m2} & \dots & t_{mn} \end{bmatrix} \quad (2)$$

For normalization processes, Equation (3) is used for beneficial criteria and Equation (4) is used for non beneficial

criteria. The x_i^+ in the equations represents the maximal and x_i^- the minimal values of the observed criteria by alternatives.

$$t_{ij} = \frac{x_{ij}-x_i^-}{x_i^+-x_i^-} \quad (3)$$

$$t_{ij} = \frac{x_{ij}-x_i^+}{x_i^--x_i^+} \quad (4)$$

In the third step of the method, the N matrix is weighted by using Equation (5). As a result of this process, the V matrix is obtained. w_i are the weight values of the relevant criteria.

$$v_{ij} = w_i * t_{ij} + w_i \quad (5)$$

The next step is to obtain the bordering approximative areas matrix (G). Equation (6) is used to calculate the matrix elements (g_i). In this expression, m represents the total number of alternatives. G matrix is as in Equation (7). n represents the total number of criteria.

$$g_i = \left(\prod_{j=1}^{m} v_{ij}\right)^{1/m} \quad (6)$$

$$G = (g_1, g_2, \dots . g_n) \quad (7)$$

The fifth step is the calculation of the distance matrix (Q) elements (q_{ij}) to the boundary approximative areas of the decision alternatives with Equation (8).

$$Q = V - G = \begin{bmatrix} q_{11} & q_{12} & \dots & q_{1n} \\ q_{21} & q_{22} & \dots & q_{2n} \\ \dots & \dots & \dots & \dots \\ q_{m1} & q_{m2} & \dots & q_{mn} \end{bmatrix} \quad (8)$$

With the values obtained in the fifth step, the status of each decision alternative (A_i) are determined according to the boundary approximative areas. In this context, alternatives can belong to the bordering approximative area (G), the upper bordering approximative area (G^+), or lower bordering approximative area (G^-). The values of the best alternative according to the criteria should mostly be found in (G^+). These areas are shown in Figure 1. Equation (9) is used to determine which area the alternative belongs to (Pamučar & Ćirović, 2015; Bozanic et al., 2016).

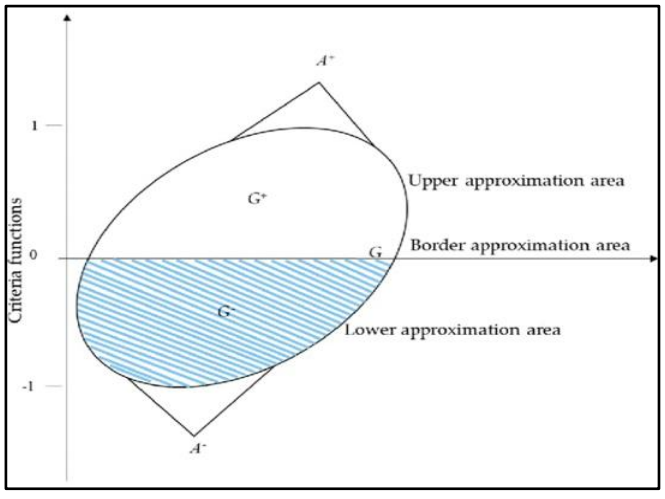

Figure 1. Representation of Bordering Approximative Areas

$$A_i \in \begin{cases} G^+ \; if \; q_{ij} > g_i \\ G \; if \; q_{ij} = g_i \\ G^- \; if \; q_{ij} < g_i \end{cases} \quad (9)$$

The final step of the MABAC method is the ranking of decision alternatives. This ranking is made according to Equation (10) (Vesković, 2018; Demir et al., 2021).

$$S_i = \sum_{j=1}^{n} q_{ij}, \; j = 1,2, \dots, n, \; i = 1,2, \dots m \quad (10)$$

4.2. Gray Relational Analysis (GRA) Method

Gray Relational Analysis (GRA) developed on the basis of GST is a ranking and classification technique (Wen, 2004; Yıldırım, 2014). This method is used as a reference to determine the degree of effect between factors and this degree is called as gray relational degree (Üstünışık, 2007). Similarities or differences between the analyzed elements are obtained by this measurement. The steps of the method are as follows.

The first step of the method is to form the decision matrix (X). This matrix with (mxn) dimension where the total number of alternatives is m and the number of criteria is n is as represented in Equation (11). x_{ij} is the value of decision unit i according to criteria j.

$$X = \begin{bmatrix} x_1(1) & x_1(2) & \dots & x_1(n) \\ x_2(1) & x_2(2) & \dots & x_2(n) \\ \dots & \dots & \dots & \dots \\ x_m(1) & x_m(2) & \dots & x_m(n) \end{bmatrix} i = 1,2, \dots, m; \; j = 1,2, \dots, n \quad (11)$$

In the second step, the reference series ($x_0 = (x_0(j))$ (difference values)) and the comparison matrix are determined. $x_0(j)$ is defined as the maximal value of the normalized criteria. The reference series is added to the first row of (X) to form the comparison matrix.

The third step is to normalize the X matrix. Different equations are used depending on whether the criteria is beneficial or non beneficial. Equation (12) is used for beneficial and Equation (13) is used for non beneficial criteria. In addition, Equation (14) is used if the values in the matrix contribute positively to the purpose according to the determined optimal value ($x_{ob}(j)$).

$$x_i^* = \frac{x_i(j)-min_j x_i(j)}{max_j x_i(j)-min_j x_i(j)} \quad (12)$$

$$x_i^* = \frac{max_j x_i(j)-x_i(j)}{max_j x_i(j)-min_j x_i(j)} \quad (13)$$

$$x_i^* = \frac{|x_i(j)-x_{ob}(j)|}{max_j x_i(j)-x_{ob}(j)} \quad (14)$$

The normalized decision matrix (X^*) is represented as Equation (15).

$$X^* = \begin{bmatrix} x_1^*(1) & x_1^*(2) & \dots & x_1^*(n) \\ x_2^*(1) & x_2^*(2) & \dots & x_2^*(n) \\ \dots & \dots & \dots & \dots \\ x_m^*(1) & x_m^*(2) & \dots & x_m^*(n) \end{bmatrix} \quad (15)$$

The next step is to form the absolute value matrix ($\triangle_{oi}$). The absolute value of the difference between x_0 and x_i^* is used to form this matrix. These calculations are made by means of

Equation (16) and the relevant matrix is formed as in Equation (17).

$$\triangle_{oi}(j)=|x_o(j)^* - x_i^*(j)| \quad i = 1,2,\dots,m;\ j = 1,2,\dots,n \qquad (16)$$

$$\triangle_{oi}=\begin{bmatrix} \triangle_{o1}(1) & \triangle_{o1}(2) & \dots & \triangle_{o1}(n) \\ \triangle_{o2}(1) & \triangle_{o2}(2) & \dots & \triangle_{o2}(n) \\ \dots & \dots & \dots & \dots \\ \triangle_{om}(1) & \triangle_{om}(2) & \dots & \triangle_{om}(n) \end{bmatrix} \qquad (17)$$

The fifth step is to calculate the gray relational coefficient matrix as stated in Equation (18). $\triangle_{max}$ represents the maximal value change in the sequence and calculated by $max_i max_j \triangle_{oi}(j)$. Besides $\triangle_{min}$ represents the minimal value change in the array and calculated by $min_i min_j \triangle_{oi}(j)$. ζ is expressed as the distinguishing coefficient and takes values in the range of 0-1. This coefficient, which is used as 0.5 in studies conducted in different fields in the literature, is used to expand or narrow the range of the gray correlation coefficient value. (Güneysu et al., 2015).

$$\gamma_{oi}(j) = \frac{\triangle_{min}+\zeta\triangle_{max}}{\triangle_{oi}(j)+\zeta\triangle_{max}} \qquad (18)$$

The last step of the method is to calculate gray relational grades. If the criteria weights (w_i) are equal, the gray relational grades are calculated by Equation (19), if different, by Equation (20). Each alternative is ranked according to these values and the first one is evaluated as the most suitable alternative (Demir et al., 2021).

$$\Gamma_{oi} = \frac{1}{n}\sum_{j=1}^{n}\gamma_{oi}(j) \qquad (19)$$

$$\Gamma_{oi} = \sum_{j=1}^{n}\left[w_i(j) * \gamma_{oi}(j)\right] \qquad (20)$$

5. Findings

In this analysis, we try to make a profitability analysis of 34 airport service providers from different countries in Europe. The period in which the analyzes were made covers the years between 2017 and 2020. It is also aimed to make a comprehensive analysis of impacts of COVID-19 with 13 different profitability ratios respecting airport service providers' profitability. The ratios of the relevant companies in the relevant years were evaluated together and as a single data set. The weights (w_i) of the criteria are accepted as equal. The data of decision units and the results of the analysis can be seen in Table 2 and Table 3 respectively.

Table 2. Annual Profitability Ratios of Decision Units

	2017												
ANSP	**POPEX/PAPEX**	**ROA-1-**	**ROA-2-**	**ROA-3-**	**ROE-1-**	**ROD-1-**	**ROD-2-**	**ROD-3-**	**RO- net operating activities**	**RO- net investing activities**	**OPEX/ CAPEX**	**Return on OPEX/Return on Capex**	**free cash flow/Shareholder Equity**
Albcontrol	0.39	0.18	0.57	0.14	0.17	1.31	1.78	0.76	1.03	-1.09	2.54	0.39	0.01
ANS CR	0.22	0.21	0.33	0.13	0.15	0.98	6.49	0.85	1.04	-1.34	4.57	0.22	0.03
Fintraffic	0.08	0.58	0.65	0.31	0.79	0.71	1.75	0.50	1.26	-1.51	13.02	0.08	0.36
ARMATS	0.08	0.66	0.75	0.35	0.41	3.91	6.48	2.44	1.18	-17.89	13.08	0.08	0.32
Austro Control	0.11	0.11	0.45	0.09	0.51	1.78	0.11	0.11	0.66	-0.57	9.09	0.11	0.48
Avinor Flysikring	0.17	0.00	0.01	0.00	0.03	0.01	0.00	0.00	0.02	-0.02	5.94	0.17	-0.12
BULATSA	0.16	0.23	0.25	0.12	0.15	0.67	3.62	0.57	1.74	-2.13	6.15	0.16	0.02
Croatia Control	0.15	0.42	0.32	0.18	0.30	1.69	0.61	0.45	1.12	-2.58	6.78	0.15	0.16
DFS	0.11	0.18	0.10	0.06	- 0.21	0.51	0.05	0.05	0.53	-1.28	9.20	0.11	- 0.23
DHMI	0.63	0.30	1.53	0.25	0.32	1.56	4.85	1.18	1.80	-2.29	1.58	0.63	0.04
DSNA	0.14	0.28	0.37	0.16	0.43	5.16	0.26	0.25	0.79	-1.13	7.32	0.14	0.16
EANS	0.37	0.45	1.98	0.37	0.70	1.77	1.36	0.77	1.11	-2.31	2.69	0.37	0.28
ENAIRE	0.13	0.71	0.71	0.35	0.45	3.46	3.00	1.61	0.53	0.32	7.92	0.13	0.77
ENAV	0.19	0.20	0.43	0.14	0.24	0.77	0.53	0.31	1.41	-2.71	5.18	0.19	0.07
HungaroControl	0.14	0.36	0.44	0.20	0.24	1.36	6.31	1.12	1.17	-1.88	7.03	0.14	0.13
IAA	0.09	0.48	0.18	0.13	0.23	1.31	0.39	0.30	0.70	-0.52	11.14	0.09	0.26
LFV	0.08	0.18	0.07	0.05	0.57	0.60	0.06	0.06	0.50	-1.93	12.30	0.08	0.85
LGS	0.25	0.32	0.61	0.21	0.23	2.52	16.81	2.19	1.01	-1.40	3.95	0.25	0.07

LPS	0.04	0.18	0.19	0.09	0.13	0.53	1.02	0.35	1.00	-12.6	26.28	0.04	0.09
LVNL	0.12	0.31	0.44	0.18	0.43	0.74	0.53	0.31	0.93	-1.92	8.46	0.12	0.24
MATS	0.13	0.42	0.27	0.17	0.20	2.97	1.62	1.05	1.37	-2.15	7.94	0.13	0.08
M-NAV	0.05	0.51	0.29	0.19	0.21	3.50	4.58	1.98	1.12	-5.77	19.57	0.05	0.15
MOLDATSA	0.02	0.26	0.27	0.13	0.16	3.00	1.17	0.84	4.02	-0.98	45.35	0.02	0.02
NATS	0.29	0.21	0.60	0.15	0.33	1.08	0.39	0.29	0.87	-1.58	3.46	0.29	0.18
NAV Portugal	0.10	0.15	0.10	0.06	0.19	0.25	0.14	0.09	0.46	-1.28	10.26	0.10	0.26
NAVIAIR	0.11	0.12	0.45	0.09	0.15	0.61	0.38	0.23	0.71	-1.10	9.04	0.11	0.10
Oro Navigacija	0.42	0.12	0.26	0.08	0.09	1.03	2.22	0.70	0.77	-1.39	2.37	0.42	-0.10
PANSA	0.22	0.17	0.32	0.11	0.21	0.63	0.40	0.24	1.18	-1.11	4.50	0.22	-0.01
ROMATSA	0.06	- 0.17	- 0.15	-0.08	- 0.21	- 0.29	- 0.24	- 0.13	5.97	1.86	17.59	0.06	-0.15
Sakaeronavigatsia	0.58	0.23	1.02	0.19	0.21	3.99	4.98	2.22	0.97	-1.06	1.73	0.58	0.02
Skyguide	0.18	0.11	0.19	0.07	0.14	0.39	0.21	0.14	1.91	-0.64	5.59	0.18	- 0.15
Slovenia Control	0.05	0.28	1.10	0.23	0.40	0.98	1.12	0.52	1.24	-4.79	18.72	0.05	0.24
SMATSA	0.22	0.15	0.54	0.11	0.15	0.93	1.23	0.53	1.08	-1.19	4.50	0.22	0.01
UkSATSE	0.12	0.10	0.15	0.06	0.06	1.43	3.05	0.97	0.46	-1.06	8.62	0.12	0.08

2018

ANSP	**POPEX/PAPEX**	**ROA-1-**	**ROA-2-**	**ROA-3-**	**ROE-1-**	**ROD-1-**	**ROD-2-**	**ROD-3-**	**RO- net operating activities**	**RO- net investing activities**	**OPEX/CAPEX**	**Return on OPEX/Return**	**free cash flow/Shareholder Equity**
Albcontrol	0.23	0.19	0.53	0.14	0.16	1.15	5.24	0.94	1.06	-1.67	4.39	0.23	0.06
ANS CR	0.34	0.21	0.41	0.14	0.16	1.38	5.10	1.09	1.14	-0.89	2.91	0.34	-0.04
Fintraffic	0.03	0.56	0.33	0.21	0.56	0.52	0.90	0.33	0.73	-5.04	34.44	0.03	0.65
ARMATS	0.16	0.62	0.62	0.31	0.36	3.57	6.53	2.31	1.30	-6.39	6.30	0.16	0.21
Austro Control	0.11	0.09	0.35	0.07	0.45	1.18	0.09	0.09	0.64	-0.72	8.72	0.11	0.37
Avinor Flysikring	0.13	0.18	0.37	0.12	1.09	0.52	0.18	0.13	1.49	-1.49	7.63	0.13	- 0.03
BULATSA	0.10	0.28	0.27	0.14	0.16	1.40	2.30	0.87	1.56	-3.62	10.31	0.10	0.06
Croatia Control	0.24	0.45	0.32	0.19	0.32	1.58	0.63	0.45	1.03	2.86	4.18	0.24	0.12
DFS	0.09	0.15	0.09	0.06	- 0.19	0.39	0.05	0.04	-0.69	-1.12	10.69	0.09	0.42
DHMI	0.51	0.42	1.10	0.30	0.43	1.54	3.18	1.04	1.51	-3.27	1.94	0.51	0.15
DSNA	0.15	0.24	0.40	0.15	0.34	6.00	0.28	0.27	0.84	-0.91	6.72	0.15	0.03
EANS	0.48	0.43	1.70	0.34	0.59	1.91	1.40	0.81	1.07	-1.47	2.08	0.48	0.15
ENAIRE	0.13	0.58	0.56	0.29	0.38	2.36	2.32	1.17	0.46	0.44	7.63	0.13	0.72
ENAV	0.20	0.22	0.38	0.14	0.25	0.83	0.49	0.31	0.93	-2.36	5.05	0.20	0.16
HungaroControl	0.15	0.29	0.44	0.17	0.21	1.35	6.40	1.11	1.13	-1.32	6.75	0.15	0.10
IAA	0.22	0.36	0.17	0.12	0.20	1.10	0.38	0.28	0.89	-1.07	4.61	0.22	0.08
LFV	0.11	0.10	0.04	0.03	0.36	0.31	0.04	0.03	0.42	-0.82	8.90	0.11	0.42
LGS	0.24	0.30	0.52	0.19	0.21	2.16	20.90	1.96	0.99	-1.32	4.18	0.24	0.05
LPS	0.07	0.19	0.20	0.10	0.13	0.58	1.01	0.37	1.07	-2.12	14.22	0.07	0.06
LVNL	0.30	0.10	0.19	0.07	0.18	0.27	0.16	0.10	0.54	-0.31	3.35	0.30	-0.26

MATS	0.19	0.13	0.16	0.07	0.09	0.96	0.54	0.35	0.65	-0.56	5.34	0.19	0.03
M-NAV	0.04	0.56	0.25	0.17	0.19	3.26	3.62	1.72	1.24	-6.89	24.84	0.04	0.13
MOLDATSA	0.12	0.20	0.20	0.10	0.12	1.55	0.86	0.55	- 5.28	2.22	8.34	0.12	- 0.12
NATS	0.25	0.19	0.59	0.14	0.34	0.81	0.37	0.25	0.89	- 1.22	4.02	0.25	0.18
NAV Portugal	0.12	0.20	0.14	0.08	0.27	0.23	0.25	0.12	0.67	-1.39	8.45	0.12	0.21
NAVIAIR	0.11	0.12	0.39	0.09	0.15	0.58	0.39	0.23	1.07	-0.76	8.85	0.11	0.03
Oro Navigacija	0.35	0.16	0.33	0.11	0.13	0.74	1.87	0.53	0.74	-1.48	2.88	0.35	0.03
PANSA	0.23	0.20	0.37	0.13	0.23	1.02	0.42	0.30	1.24	-1.31	4.33	0.23	0.01
ROMATSA	0.04	0.16	0.13	0.07	0.21	0.21	0.24	0.11	1.55	-3.04	24.83	0.04	0.05
Sakaeronavigatsia	0.51	0.20	0.83	0.16	0.17	4.11	5.58	2.37	0.90	-1.11	1.94	0.51	0.04
Skyguide	0.18	0.23	0.40	0.14	0.29	1.04	0.39	0.28	2.55	-1.37	5.55	0.18	-0.10
Slovenia Control	0.06	0.31	0.98	0.24	0.38	1.04	1.72	0.65	1.21	-4.23	16.33	0.06	0.22
SMATSA	0.22	0.11	0.52	0.09	0.11	0.94	0.73	0.41	1.83	-0.90	4.48	0.22	-0.06
UkSATSE	0.09	0.18	0.32	0.12	0.12	3.25	3.33	1.64	1.98	-2.89	10.77	0.09	0.02

2019

ANSP	POPEX/PAPEX	ROA-1-	ROA-2-	ROA-3-	ROE-1-	ROD-1-	ROD-2-	ROD-3-	RO- net operating activities	RO- net investing activities	OPEX/CAPEX	Return on OPEX/Return	free cash flow/Shareholder Equity
Albcontrol	0.26	0.18	0.55	0.14	0.15	1.51	75.38	1.48	2.59	-0.94	3.81	0.26	-0.06
ANS CR	0.26	0.14	0.33	0.10	0.12	0.65	4.86	0.57	0.90	-0.80	3.91	0.26	-0.02
Fintraffic	0.08	0.57	0.22	0.16	0.44	0.39	0.68	0.25	0.54	-0.76	13.28	0.08	0.56
ARMATS	0.06	0.55	0.44	0.25	0.28	2.99	5.83	1.98	1.24	-18.9	16.01	0.06	0.20
Austro Control	0.11	0.06	0.28	0.05	0.34	1.03	0.06	0.06	0.67	-0.56	9.28	0.11	0.17
Avinor Flysikring	0.22	0.01	0.05	0.01	0.11	0.05	0.02	0.01	0.08	-0.08	4.61	0.22	0.07
BULATSA	0.14	0.21	0.19	0.10	0.12	0.87	1.73	0.58	0.77	-1.42	6.97	0.14	0.07
Croatia Control	0.18	0.43	0.27	0.16	0.29	1.43	0.51	0.37	0.94	-1.01	5.43	0.18	0.18
DFS	0.11	0.07	0.04	0.03	- 0.04	0.13	0.02	0.02	0.77	-0.50	9.16	0.11	0.03
DHMI	0.51	0.47	0.91	0.31	0.43	1.55	4.05	1.12	2.39	-3.28	1.96	0.51	0.05
DSNA	0.13	0.18	0.78	0.14	0.29	5.22	0.30	0.28	0.91	-0.91	7.97	0.13	0.01
EANS	0.23	0.36	0.71	0.24	0.53	2.00	0.56	0.44	1.01	-2.66	4.33	0.23	0.29
ENAIRE	0.14	0.29	0.44	0.18	0.23	1.41	1.40	0.70	0.30	0.34	7.07	0.14	0.67
ENAV	0.19	0.21	0.35	0.13	0.25	0.73	0.47	0.29	0.82	-3.01	5.26	0.19	0.20
HungaroControl	0.20	0.23	0.30	0.13	0.19	1.44	0.58	0.42	1.08	-1.21	4.99	0.20	0.08
IAA	0.16	0.31	0.15	0.10	0.20	0.71	0.28	0.20	0.78	-1.15	6.34	0.16	0.15
LFV	0.17	0.05	0.03	0.02	0.24	0.18	0.02	0.02	0.25	-0.33	5.82	0.17	0.24
LGS	0.37	0.21	0.57	0.15	0.18	1.91	2.11	1.00	0.97	-0.74	2.71	0.37	-0.06
LPS	0.10	0.15	0.19	0.08	0.11	0.55	0.98	0.35	1.38	-1.22	9.84	0.10	-0.01
LVNL	0.28	0.05	- 0.21	-0.04	- 0.19	- 0.14	- 0.07	- 0.05	0.82	0.20	3.63	0.28	-1.15
MATS	0.13	0.24	0.28	0.13	0.33	1.61	0.25	0.21	1.31	-3.79	7.59	0.13	0.17
M-NAV	0.16	0.15	0.08	0.05	0.07	0.57	0.58	0.29	0.83	-0.49	6.17	0.16	-0.05

MOLDATSA	0.05	0.24	0.23	0.12	0.14	3.58	0.91	0.73	0.34	-3.99	19.76	0.05	0.37
NATS	0.24	0.16	0.34	0.11	0.28	0.95	0.21	0.17	1.17	-1.74	4.13	0.24	0.07
NAV Portugal	0.12	0.12	0.17	0.07	0.22	0.26	0.17	0.10	-0.58	-0.91	8.45	0.12	-0.63
NAVIAIR	0.11	0.09	0.25	0.06	0.11	0.42	0.26	0.16	0.86	-0.74	9.11	0.11	0.02
Oro Navigacija	0.10	0.17	0.28	0.11	0.15	0.68	0.69	0.34	1.56	-3.58	9.63	0.10	0.05
PANSA	0.27	0.14	0.27	0.09	0.18	0.69	0.25	0.19	0.90	-0.86	3.71	0.27	-0.01
ROMATSA	0.05	0.12	0.13	0.06	0.16	0.32	0.16	0.11	-1.02	-1.57	20.80	0.05	-0.25
Sakaeronavigatsia	0.47	0.10	0.62	0.09	0.09	1.96	3.09	1.20	0.95	-0.58	2.15	0.47	- 0.06
Skyguide	0.17	0.16	0.28	0.10	0.21	0.68	0.26	0.19	0.55	-1.02	5.82	0.17	0.19
Slovenia Control	0.19	0.33	0.86	0.24	0.37	1.14	1.73	0.69	1.23	-1.45	5.25	0.19	0.04
SMATSA	0.25	0.09	0.42	0.07	0.10	0.69	0.49	0.29	1.00	-0.67	4.03	0.25	-0.05
UkSATSE	0.09	0.22	- 0.82	-0.17	- 0.19	- 3.06	- 7.30	- 2.15	1.55	2.48	11.72	0.09	-0.20

2020

ANSP	POPEX/PAPEX	ROA-1-	ROA-2-	ROA-3-	ROE-1-	ROD-1-	ROD-2-	ROD-3-	RO- net operating activities	RO- net investing activities	OPEX/CAPEX	Return on OPEX/Return	free cash flow/Shareholder Equity
Albcontrol	0.10	0.06	0.16	0.04	0.05	0.41	2.13	0.34	0.87	-0.28	10.27	0.10	0.03
ANS CR	0.26	- 0.19	- 0.49	-0.14	- 0.21	- 1.23	- 0.58	- 0.39	1.22	1.34	3.79	0.26	-0.33
Fintraffic	0.03	- 0.78	- 0.59	-0.33	- 1.48	- 0.52	- 2.68	- 0.43	0.58	6.60	34.88	0.03	-2.76
ARMATS	0.23	- 0.16	- 0.33	-0.11	- 0.12	- 2.40	- 2.02	- 1.10	0.50	1.13	4.30	0.23	-0.35
Austro Control	0.11	- 0.07	- 0.65	-0.07	- 0.99	- 0.67	- 0.08	- 0.07	1.09	1.46	8.77	0.11	-1.45
Avinor Flysikring	0.27	- 0.09	- 0.18	-0.06	- 0.43	- 0.29	- 0.10	- 0.07	0.84	1.10	3.64	0.27	-1.28
BULATSA	0.18	0.09	0.21	0.06	0.08	0.53	1.99	0.42	-0.52	-0.91	5.44	0.18	-0.23
Croatia Control	0.16	- 0.03	- 0.05	-0.02	- 0.03	- 0.15	- 0.07	- 0.05	0.09	-0.64	6.34	0.16	-0.46
DFS	0.07	0.01	0.01	0.01	- 0.01	0.04	0.00	0.00	-0.04	-0.21	13.78	0.07	0.22
DHMI	0.26	0.07	0.15	0.05	0.08	0.14	0.68	0.12	5.61	-0.84	3.84	0.26	-0.08
DSNA	0.13	0.10	0.36	0.08	0.29	4.66	0.11	0.10	-0.24	-0.93	7.82	0.13	-1.51
EANS	0.14	- 0.04	- 0.09	-0.03	- 0.08	- 0.11	- 0.06	- 0.04	0.37	0.40	7.05	0.14	- 0.41
ENAIRE	0.15	- 0.42	- 1.09	-0.30	- 0.45	- 2.03	- 1.70	- 0.93	2.69	-0.60	6.47	0.15	-0.33
ENAV	0.15	0.11	0.31	0.08	0.17	0.42	0.26	0.16	- 1.02	-3.73	6.61	0.15	-0.25
HungaroControl	0.29	- 0.25	- 0.43	-0.16	- 0.28	- 1.07	- 0.58	- 0.37	1.15	-0.90	3.45	0.29	- 0.44
IAA	0.10	0.09	0.05	0.03	0.06	0.24	0.08	0.06	-0.30	0.12	10.39	0.10	-0.27
LFV	0.24	0.18	0.16	0.08	1.51	0.74	0.10	0.09	0.51	-1.14	4.20	0.24	2.03
LGS	0.18	- 0.12	- 0.28	-0.08	- 0.11	- 0.56	- 1.13	- 0.37	6.42	2.03	5.63	0.18	- 0.12
LPS	0.20	- 0.27	- 0.46	-0.17	- 0.22	- 1.65	- 1.60	- 0.81	1.36	1.61	5.12	0.20	-0.29
LVNL	0.21	- 0.26	- 0.86	-0.20	2.27	- 1.26	- 0.21	- 0.18	0.53	1.65	4.70	0.21	5.69
MATS	0.04	- 0.03	- 0.07	-0.02	- 0.07	- 0.21	- 0.04	- 0.03	0.75	-0.36	25.88	0.04	-0.12
M-NAV	0.07	- 0.57	- 0.60	-0.29	- 0.36	- 7.26	- 1.88	- 1.49	1.11	5.27	13.44	0.07	- 0.40
MOLDATSA	0.04	- 0.40	- 0.57	-0.24	- 0.25	- 5.34	- 8.98	- 3.35	1.45	9.70	24.28	0.04	-0.20
NATS	0.13	0.12	0.51	0.10	0.34	0.61	0.18	0.14	-0.78	-13.73	7.81	0.13	-0.56
NAV Portugal	0.19	- 0.01	- 0.05	-0.01	- 0.02	- 0.02	- 0.02	- 0.01	0.03	0.07	5.37	0.19	- 1.16

NAVIAIR	0.08	0.06	0.13	0.04	0.07	0.23	0.15	0.09	-0.25	0.98	12.09	0.08	-0.34
Oro Navigacija	0.09	- 0.04	- 0.08	-0.03	- 0.04	- 0.19	- 0.15	- 0.08	0.22	0.95	11.21	0.09	- 0.20
PANSA	0.21	0.01	0.03	0.01	0.01	0.03	0.01	0.01	-0.05	-0.06	4.79	0.21	- 0.39
ROMATSA	0.07	0.05	0.03	0.02	0.05	0.10	0.03	0.02	-0.05	-0.33	14.58	0.07	-1.21
Sakaeronavigatsia	0.04	- 0.09	- 0.23	-0.06	- 0.09	- 0.69	- 0.31	- 0.21	1.97	4.64	22.78	0.04	-0.06
Skyguide	0.14	- 0.22	- 0.40	-0.14	- 0.30	- 0.32	- 1.70	- 0.27	0.86	1.82	7.22	0.14	- 0.52
Slovenia Control	0.08	- 0.40	- 2.06	-0.33	- 0.99	- 0.88	- 1.19	- 0.50	0.94	4.39	11.92	0.08	-1.29
SMATSA	0.30	- 0.18	- 1.13	-0.16	- 0.31	- 1.29	- 0.42	- 0.32	1.79	1.41	3.39	0.30	-0.40
UkSATSE	0.06	- 0.25	- 2.15	-0.22	- 0.28	- 3.55	- 1.41	- 1.01	1.74	8.40	18.16	0.06	-0.20

Table 3. Profitability Performance Values According to MABAC and GRA Method

MABAC			GRA		
RANKINGS	**DMU**	**PERFORMANCE VALUES**	**RANKINGS**	**DMU**	**PERFORMANCE VALUES**
1	DHMI-2017	0.6205	1	DHMI-2017	0.6345
2	Sakaeronavigatsia-2017	0.6095	2	Sakaeronavigatsia-2017	0.6185
3	EANS-2018	0.6002	3	EANS-2018	0.6059
4	DHMI-2019	0.5957	4	EANS-2017	0.6015
5	DHMI-2018	0.5894	5	Sakaeronavigatsia-2018	0.5969
6	Sakaeronavigatsia-2018	0.5885	6	DHMI-2019	0.5961
7	EANS-2017	0.5832	7	DHMI-2018	0.5910
8	Albcontrol-2019	0.5658	8	ENAIRE-2017	0.5881
9	ENAIRE-2017	0.5438	9	ARMATS-2017	0.5835
10	LGS-2017	0.5335	10	ARMATS-2018	0.5769
11	ARMATS-2018	0.5310	11	Albcontrol-2019	0.5726
12	Sakaeronavigatsia-2019	0.5276	12	MOLDATSA-2017	0.5627
13	LGS-2018	0.5236	13	LGS-2017	0.5518
14	MOLDATSA-2017	0.5201	14	ENAIRE-2018	0.5500
15	LGS-2019	0.5141	15	Fintraffic-2017	0.5416
16	ENAIRE-2018	0.5126	16	LGS-2018	0.5410
17	Albcontrol-2017	0.5101	17	M-NAV-2017	0.5402
18	ANS CR-2018	0.5055	18	Sakaeronavigatsia-2019	0.5391
19	ARMATS-2017	0.5052	19	M-NAV-2018	0.5379
20	EANS-2019	0.4999	20	ARMATS-2019	0.5370
21	Croatia Control-2018	0.4993	21	LVNL-2020	0.5331
22	Fintraffic-2017	0.4986	22	Fintraffic-2018	0.5291
23	Oro Navigacija-2017	0.4943	23	DSNA-2018	0.5285
24	M-NAV-2017	0.4922	24	LGS-2019	0.5283
25	Slovenia Control-2019	0.4905	25	Croatia Control-2018	0.5266
26	M-NAV-2018	0.4905	26	EANS-2019	0.5262
27	LFV-2020	0.4884	27	Albcontrol-2017	0.5243
28	Fintraffic-2018	0.4867	28	Slovenia Control-2019	0.5227
29	NATS-2017	0.4828	29	ANS CR-2018	0.5220
30	Oro Navigacija-2018	0.4798	30	DSNA-2017	0.5216
31	DSNA-2018	0.4791	31	DSNA-2019	0.5213
32	HungaroControl-2017	0.4783	32	MATS-2017	0.5184
33	DSNA-2017	0.4762	33	Slovenia Control-2018	0.5159
34	MATS-2017	0.4758	34	HungaroControl-2017	0.5156
35	Albcontrol-2018	0.4745	35	Oro Navigacija-2017	0.5147
36	DSNA-2019	0.4734	36	Slovenia Control-2017	0.5144
37	HungaroControl-2018	0.4732	37	UkSATSE-2018	0.5143
38	Slovenia Control-2018	0.4717	38	LFV-2020	0.5130
39	NATS-2018	0.4705	39	HungaroControl-2018	0.5108
40	Croatia Control-2019	0.4705	40	Fintraffic-2019	0.5099
41	Slovenia Control-2017	0.4699	41	DHMI-2020	0.5096
42	ANS CR-2017	0.4681	42	Croatia Control-2019	0.5090
43	ENAIRE-2019	0.4675	43	NATS-2017	0.5085
44	DHMI-2020	0.4672	44	Croatia Control-2017	0.5084
45	UkSATSE-2018	0.4666	45	ENAIRE-2019	0.5075
46	ARMATS-2019	0.4660	46	Albcontrol-2018	0.5061
47	Croatia Control-2017	0.4657	47	Oro Navigacija-2018	0.5049
48	Skyguide-2018	0.4627	48	NATS-2018	0.5023
49	PANSA-2018	0.4618	49	IAA-2017	0.5021
50	ANS CR-2019	0.4613	50	ANS CR-2017	0.5018

51	IAA-2018	0.4599	51	Skyguide-2018	0.5017
52	Fintraffic-2019	0.4597	52	MOLDATSA-2019	0.5016
53	SMATSA-2017	0.4592	53	LVNL-2017	0.4995
54	HungaroControl-2019	0.4586	54	IAA-2018	0.4992
55	SMATSA-2018	0.4566	55	HungaroControl-2019	0.4980
56	NATS-2019	0.4563	56	PANSA-2018	0.4980
57	PANSA-2019	0.4548	57	Avinor Flysikring-2018	0.4970
58	LVNL-2017	0.4537	58	BULATSA-2018	0.4970
59	Avinor Flysikring-2018	0.4529	59	SMATSA-2017	0.4970
60	ENAV-2017	0.4523	60	ANS CR-2019	0.4956
61	ENAV-2018	0.4523	61	SMATSA-2018	0.4954
62	PANSA-2017	0.4519	62	LGS-2020	0.4940
63	LVNL-2020	0.4519	63	ENAV-2017	0.4939
64	IAA-2017	0.4508	64	DSNA-2020	0.4939
65	MOLDATSA-2019	0.4504	65	ENAV-2018	0.4937
66	SMATSA-2019	0.4495	66	NATS-2019	0.4934
67	BULATSA-2017	0.4495	67	BULATSA-2017	0.4934
68	LVNL-2018	0.4485	68	PANSA-2017	0.4922
69	BULATSA-2018	0.4474	69	PANSA-2019	0.4919
70	ENAV-2019	0.4463	70	MATS-2019	0.4911
71	MATS-2019	0.4422	71	ENAV-2019	0.4904
72	Austro Control-2017	0.4413	72	Austro Control-2017	0.4901
73	IAA-2019	0.4401	73	SMATSA-2019	0.4899
74	BULATSA-2019	0.4373	74	IAA-2019	0.4892
75	Skyguide-2019	0.4359	75	ROMATSA-2017	0.4884
76	MATS-2018	0.4343	76	LVNL-2018	0.4880
77	Skyguide-2017	0.4330	77	BULATSA-2019	0.4877
78	Austro Control-2018	0.4308	78	UkSATSE-2017	0.4852
79	UkSATSE-2017	0.4294	79	Skyguide-2019	0.4848
80	NAVIAIR-2018	0.4275	80	MATS-2018	0.4838
81	DSNA-2020	0.4271	81	Austro Control-2018	0.4835
82	ROMATSA-2018	0.4269	82	Skyguide-2017	0.4833
83	Oro Navigacija-2019	0.4266	83	NAVIAIR-2018	0.4827
84	NAVIAIR-2017	0.4256	84	ROMATSA-2018	0.4825
85	LPS-2018	0.4253	85	Oro Navigacija-2019	0.4825
86	LFV-2017	0.4249	86	LPS-2018	0.4823
87	LPS-2019	0.4243	87	NAVIAIR-2017	0.4817
88	M-NAV-2019	0.4241	88	MOLDATSA-2018	0.4814
89	NAV Portugal-2018	0.4224	89	LPS-2019	0.4812
90	Austro Control-2019	0.4201	90	LFV-2017	0.4801
91	BULATSA-2020	0.4201	91	M-NAV-2019	0.4792
92	NAVIAIR-2019	0.4152	92	NAV Portugal-2018	0.4791
93	Avinor Flysikring-2019	0.4138	93	Austro Control-2019	0.4780
94	LGS-2020	0.4133	94	BULATSA-2020	0.4766
95	Albcontrol-2020	0.4130	95	LPS-2017	0.4762
96	LFV-2019	0.4124	96	NAVIAIR-2019	0.4757
97	NAV Portugal-2017	0.4124	97	Albcontrol-2020	0.4747
98	LFV-2018	0.4117	98	NAV Portugal-2017	0.4740
99	LPS-2017	0.4078	99	LFV-2018	0.4726
100	ROMATSA-2017	0.4043	100	Sakaeronavigatsia-2020	0.4725
101	ENAV-2020	0.4042	101	LFV-2019	0.4713
102	MOLDATSA-2018	0.4040	102	Avinor Flysikring-2019	0.4711
103	PANSA-2020	0.4034	103	DFS-2017	0.4707
104	DFS-2017	0.4031	104	ROMATSA-2019	0.4705
105	ROMATSA-2019	0.4022	105	NAV Portugal-2019	0.4698
106	NAV Portugal-2019	0.4018	106	ENAV-2020	0.4695
107	LVNL-2019	0.4000	107	NAVIAIR-2020	0.4687
108	DFS-2019	0.3997	108	DFS-2018	0.4679
109	DFS-2018	0.3982	109	DFS-2019	0.4675
110	NAVIAIR-2020	0.3981	110	PANSA-2020	0.4669
111	Avinor Flysikring-2017	0.3978	111	IAA-2020	0.4664
112	Sakaeronavigatsia-2020	0.3960	112	MATS-2020	0.4660
113	IAA-2020	0.3951	113	LVNL-2019	0.4657
114	MATS-2020	0.3938	114	Avinor Flysikring-2017	0.4648
115	Avinor Flysikring-2020	0.3904	115	NATS-2020	0.4635
116	DFS-2020	0.3900	116	DFS-2020	0.4630
117	NAV Portugal-2020	0.3879	117	Avinor Flysikring-2020	0.4627
118	Croatia Control-2020	0.3834	118	NAV Portugal-2020	0.4612
119	EANS-2020	0.3831	119	ROMATSA-2020	0.4611
120	NATS-2020	0.3826	120	EANS-2020	0.4592
121	ROMATSA-2020	0.3819	121	Oro Navigacija-2020	0.4588

122	Oro Navigacija-2020	0.3796	122	Croatia Control-2020	0.4582
123	ANS CR-2020	0.3752	123	ANS CR-2020	0.4549
124	SMATSA-2020	0.3702	124	SMATSA-2020	0.4549
125	HungaroControl-2020	0.3690	125	HungaroControl-2020	0.4511
126	ARMATS-2020	0.3551	126	MOLDATSA-2020	0.4482
127	Skyguide-2020	0.3502	127	UkSATSE-2020	0.4474
128	LPS-2020	0.3458	128	Skyguide-2020	0.4470
129	Austro Control-2020	0.3385	129	Fintraffic-2020	0.4467
130	UkSATSE-2020	0.3043	130	ARMATS-2020	0.4454
131	UkSATSE-2019	0.2994	131	Austro Control-2020	0.4445
132	ENAIRE-2020	0.2983	132	LPS-2020	0.4436
133	MOLDATSA-2020	0.2852	133	UkSATSE-2019	0.4294
134	Fintraffic-2020	0.2801	134	ENAIRE-2020	0.4281
135	Slovenia Control-2020	0.2639	135	Slovenia Control-2020	0.4241
136	M-NAV-2020	0.2609	136	M-NAV-2020	0.4229

According to the results shown in Table 3, DHMI-2017, Sakaeronavigatsia-2017 and EANS-2018 were in the first three ranks in both of the analysis methods. Besides, the same 8 decision units take place within first-ten decision units according to both of the analysis methods. For these reasons, the results are parallel in MABAC and GRA methodologies. In addition, the companies with the worst three performances according to the MABAC methodology are Fintraffic-2020, Slovenia Control-2020 and M-NAV-2020, while the companies with the worst three performances according to the GRA methodology are ENAIRE-2020, Slovenia Control-2020 and M-NAV-2020. Nevertheless, the average performance values of first-ten decision units and annually average profitability performance values were shown in Table 4. The average performance values are the geometric means of the values obtained according to the two methods.

Table 4. Top 10 Decision Units and Average Profitability Performance Values by Years

DMU	Average Performance Values
DHMI-2017	0.6275
Sakaeronavigatsia-2017	0.6140
EANS-2018	0.6030
DHMI-2019	0.5959
Sakaeronavigatsia-2018	0.5927
EANS-2017	0.5924
DHMI-2018	0.5902
Albcontrol-2019	0.5692
ENAIRE-2017	0.5659
ARMATS-2018	0.5539
2017	**0.4963**
2018	**0.4928**
2019	**0.4739**
2020	**0.4191**

According to Table 4, the annual values decreased constantly in the period between 2017 and 2020. Comparing the year 2017 (when the highest performance was experienced) and 2020 (when the effects of COVID-19 were experienced the most) the decrease was around 16%.

6. Conclusion

As in the dependent organizations of aviation industry, the most interesting one is Air Navigation Service Providers (ANSP). Their financial structures which are compulsive to understand and important for effectiveness of air transportation and logistics systems. EBITDA is used in this analysis, depending on the high values of amortization and depreciation in the financial tables of ANSP. In general, this study is the first comprehensive analysis on profitability measures of ANSP, also it is the first one in terms of using 13 different criteria regarding profitability. Two different methods are utilized, and it is found possibility of making comparative analysis. To the best knowledge of the authors, this is the first study that investigates the profitability performances of European ANSP in this context.

Findings show that DHMI-2017, Sakaeronavigatsia-2017 and EANS-2018 were in the first three ranks in both of the analysis methods. Besides it has been observed that the overall profitability performances decrease every year between 2017-2020. Besides, it is seen that COVID-19 has deeply affected ANSP industry as other industries. It is also seen in the analyzes that 2020, when the effects of COVID-19 were most intense, was the year with the lowest performance. Compared to 2017, a 16% decrease was observed. The findings show that quality, efficiency, and effectiveness of the airspace management and ANSP' financial management in these countries for the period of 2017-2020 are decent. Also, the density and strategical importance of these countries' airspaces in that period may be other reasons.

The foremost limitation of this study is the inaccessibility and timespan of all relevant data for the companies, another one is that there is no comprehensive literature about ANSP financial management. The findings of the research are quite normal when focusing on the developing structure of Turkish aviation and the importance of Turkish airspace (Toydemir & Mutlu, 2019). Also, the importance of Georgian Airspace and Sakaeronavigatsia emerged in this period. The performance of EANS suggests that more studies should be conducted on Estonian Baltic aviation industry. In addition, the authors consider expanding this study to cover a longer period.

Ethical approval

Not applicable.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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