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Ranking tourism market performance in EMU countries: results of PROMETHEE – GAIA approach

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Abstract: Using data from 19 countries of the European Monetary Union (EMU), this paper examines the nature of tourism performance and the ranking of countries according to given parameters in tourism in the period 2012-2017. As tourism cannot be analyzed as an isolated scientific discipline, it is necessary to use a multidimensional and multicriteria approach when studying and researching this field. For this reason, this paper implements a simple methodology for measuring tourism performance in EMU countries using the multicriteria PROMETHEE – GAIA decision model. The paper will, through the analysis of 8 parameters important for the development and evaluation of the tourism industries (number of foreign tourists, number of domestic tourists, quantity of hotel accommodation, cost of living, air pollution, population density, length of railway and number of airports), rank the mentioned countries and provide a deeper analysis of individual parameters. For the entire period of observing and reviewing the performance of the tourism industry, the results of the paper will outline the performance evaluation as well as policy recommendations and conclusions for further consideration and analysis.

Keywords: tourism, performance, European Monetary Union, PROMETHEE – GAIA model

JEL classification: Z32, Z38

Rangiranje performansi turističkog tržišta u zemljama EMU: rezultati PROMETHEE – GAIA pristupa

Sažetak: Koristeći podatke 19 zemalja Evropske monetarne unije (EMU), ovaj rad istražuje prirodu turističkih performansi i rangiranje zemalja prema zadatim parametrima u turizmu u periodu 2012-2017. godina. Kako se turizam ne može posmatrati kao izolovana naučna disciplina, pri izučavanju i istraživanju ove oblasti potrebno je koristiti multidimenzionalni i multikriterijumski pristup. Iz tog razloga, rad implementira jednostavnu metodologiju za merenje turističkih performansi na tržištu EMU zemalja koristeći multikriterijumski PROMETHEE – GAIA model za odlučivanje. U radu će se, kroz analizu 8 parametara važnih za razvoj i ocenu turističke industrije (broj stranih turista, broj domaćih turista, kvantitet hotelskog smeštaja, troškovi života, zagađenost vazduha, gustina naseljenosti, dužina železnica i broj aerodroma) izvršiti rang pomenutih zemalja i dublja analiza pojedinačnih parametara. Za čitav period posmatranja i sagledavanja performansi turističke

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privrede, rezultati rada će prikazati evaluaciju performansi, kao i preporuke politike i zaključke za dalja razmatranja i analizu.

Ključne reči: turizam, performanse, Evropska monetarna unija, PROMETHEE – GAIA model

JEL klasifikacija: Z32, Z38

1. Introduction

In recent years, the tourism sector has been expanding in most countries, especially in Europe. According to WTO data in 2018, the growth rate of international arrivals was 5% or around 1.5 billion arrivals worldwide ([UNWTO, 2019](#)). All those numbers prove that tourism is one of the most dynamic phenomena in the world ([Šušić & Đorđević, 2019](#)). Tourism with its performance has a multiple implications for one economy. Tourism is also recognized both as a multidimensional industry and as a rapidly expanding activity influencing other industries to grow. Europe is considered to be the most visited tourist destination in the world. In many European countries, there has been a significant increase in tourist arrivals in the last few years. According to the World Tourism Organization ([UNWTO, 2017](#)), Europe is the most attractive tourist destination, accounting for 51% of the world market.

The ten most visited tourist destinations in the world include the Mediterranean countries in Southern Europe such as: France, Spain, Italy, etc. As [Tekić \(2018\)](#) said, Europe is one of the most developed markets. The destinations such as Portugal and Greece are developing destinations based on increasing tourist numbers, as well as the Netherlands, Sweden and Austria ([UNWTO, 2019](#)). Tourists spend a lot while staying in these destinations, which is reflected in the economy ([Pestana et al., 2011](#)). As the tourism sector in EU has been developing over the last ten years, there were an estimated 510 million tourists in Europe and a total of 550 billion in tourism revenue in 2018 ([UNWTO, 2019](#)). In European countries, tourism ranks third in terms of export revenues worth \$ 1.5 billion. Tourism activity also affects the development of local economy so the countries are constantly investing in the development of tourist destinations. Therefore, it is important to measure the tourism performance of European countries. This performance can be measured by using official Eurostat statistics which includes number of tourist arrivals and overnight stays in tourist accommodations, availability of accommodation capacity, etc. ([Silva et al., 2018](#)). The aim of this analysis is to point out the possibilities of improving destinations and overcoming restrictions in the tourist development.

The aim of this paper is to present a PROMETHEE based differential multi-criteria approach for objective measurement and assessment of tourism performance at EMU level presented by country. The paper is organized as follows: Section 1 describes literature about tourism in EMU. Section 2 briefly summarizes a description of applied PROMETHEE method of eight indicators for 19 countries in a 6-year period, while a discussion of the study's results is contained within Section 3. Section 4 draws some conclusions and recommendations on the research presented.

2. Theoretical background

Since Europe started to be the world's most visited regional destination, competitiveness analysis of European destinations has become a current topic in tourism literature. As [Mirčetić et al. \(2019\)](#) said, competition in tourism industry is rapidly increasing and tourism sector can generate notable social, economic and cultural benefits ([Gavrilović &](#)

[Maksimović, 2018](#)). In order to analyze the performance of tourist destinations, indicators of destination competitiveness are mostly used ([Mendola & Volo, 2017](#)). The comprehensive Data Envelopment Analysis (DEA) is one of the methods based on the management of tourist destinations. It points to destinations with the best performances as well as successful strategies for improving other destinations ([Pestana et al., 2011](#)).

Some studies ([Assaf & Tsionas, 2015](#)) apply different benchmarking methods to those tourism destinations that record the highest growth rates in tourism revenue to “determine the gap between their actual performance and optimal performance and to improve the performance by identifying best practices and worst practices”. These authors ([Assaf & Tsionas, 2015](#)) identified the model that captures the quality of tourism destination attributes, such as infrastructure, human resources, accommodation, service, etc. They are significant elements that influence the loyalty and the return of tourists to the same destination. Some other authors ([Silva et al., 2017](#)) analyzed cross-data from several EU countries to identify the impact of increased tourist arrivals in one country on tourism demand in a neighboring country.

Due to the impact of the global economic and debt crisis that hit some European countries a few years ago, there has been a significant decrease in the number of tourist arrivals and, consequently, of EU tourism revenue. In this regard, negative performance in some individual countries can be analyzed. However, after overcoming period of financial crisis, tourism has become a significant factor in increasing social and economic welfare of many European states ([Corbet et al., 2019](#)). Some of the destinations in Europe that experienced the wave of terrorism have also been the topic in many papers. The decline in tourist arrivals due to terrorist attacks has been reported in many countries (e.g. Spain, Italy, Nepal, Ireland, etc.) and regions (e.g. Mediterranean region) from the 1990s until today ([Seabra et al., 2020](#)). In addition to terrorist and financial influences, there is a significant impact of seasonality factor in increasing the number of tourist arrivals in individual countries. The authors ([Ferrante et al., 2018](#)) measured the degree of seasonality in tourist destinations by using the Gini index that measures the impact of seasonality on the number of overnight stays, by performing comparative analysis on several European countries.

The various researches investigate about European tourism performance or tourism sustainability using multi-criteria ranking PROMETHEE method ([Michailidis & Chatzitheodoridis, 2006](#); [Kovačić, 2010](#); [Andreopoulou et al., 2014](#); [Antanasijević et al., 2017](#); [Fura et al., 2017](#)). The empirical evidence about ranking countries in EU considering performance of sustainable tourism is of importance for this paper. Bearing that in mind, authors [Anastasijević et al. \(2017\)](#) applied Promethee method with the aim to determine the tourism sustainability progress in European countries by analyzing indicators such as existing infrastructure, extending the season, promoting alternative forms of tourism, eco tourism, health tourism in line with positive ecological performance, etc. This paper applies a similar methodology with author [Ranjan et al. \(2016\)](#) who used PROMETHEE to quantify the tourism potential of 29 Indian states.

Despite all the challenges facing tourist destinations in EU (such as seasonality, terrorism, financial crisis, etc.), the positive economic, social, environmental, cultural and other impacts from tourism are expected to increase in the future, as well.

3. Materials and methods

In our analysis we investigate the time period between 2012 and 2017 and our dataset is based on the 19 EMU countries – Belgium (BEL), Germany (GER), Estonia (EST), Ireland (IRE), Greece (GRE), Spain (ESP), France (FRA), Italy (ITA), Cyprus (CYP), Latvia

(LVA), Lithuania (LTV), Luxembourg (LUX), Malta (MLT), the Netherlands (NLD), Austria (AUT), Portugal (PRT), Slovenia (SVN), Slovakia (SVK), and Finland (FIN).

The variables used in the analysis are from several sources: 1) from the [Eurostat \(2019a; 2019b; 2019c; 2019d\)](#) we gathered data regarding Number of foreign tourists (FT), Number of domestic tourists (DT), Hotels, holiday and other short-stay accommodation (H), Cost of living - Comparative price levels (CPL); 2) from the World Development Indicators - [World Bank \(2019a; 2019b; 2019c\)](#) we obtained data on air pollution (AP), Population density (PD) and Rail lines (RL), and 3) from [World Aero Data \(2019\)](#), Airports by Country (NA). Analysis is done according to average data collected from 2012 to 2017, because the data for this period are available for all countries. The exception is only Number of airports data which is shown as an absolute number in 2019.

Table 1 presents the descriptive statistics for the full sample.

Table 1: Descriptive statistics from all selected variables

	FT	DT	H	AP	PD	RL	CPL	NA
Mean	88,488,866.03	142,269,977.83	20,619.35	12.79	209.24	6,531.21	94.30	37.89
Standard Error	38,611,729.29	60,152,470.90	9,148.87	0.79	70.80	2,127.27	4.25	12.54
Standard Deviation	168,304,626.01	262,198,541.84	39,879.02	3.45	308.60	9,272.58	18.52	54.64
Kurtosis	13.78	5.01	12.09	-0.50	12.60	3.29	-1.09	4.01
Skewness	3.55	2.31	3.29	-0.22	3.38	1.98	-0.04	2.08
Range	735,914,304.67	966,727,921.00	170,528.67	12.32	1,361.68	33,430.00	59.62	198.00
Minimum	2,736,291.67	116,126.67	176.50	6.19	17.99	0.00	62.65	1.00
Maximum	738,650,596.33	966,844,047.67	170,705.17	18.52	1,379.67	33,430.00	122.27	199.00
Sum	1,681,288,454.50	2,703,129,578.83	391,767.63	243.07	3,975.48	124,092.95	1,791.78	720.00
Count	19.00	19.00	19.00	19.00	19.00	19.00	19.00	19.00

Source: Authors calculation

Furthermore, to achieve a more complete analysis through studying the tourism performance impact in each EMU country, we decided to apply a PROMETHEE – GAIA approach. The use of PROMETHEE – GAIA approach, in the context of EMU, is useful multicriteria approach, and it provides country-specific results of all analyzed indicators.

Given that the issue of tourism market performance falls within multicriteria analysis domain, a set of criteria needs to be reduced to a single criterion in order to properly compare data. Such a possibility is provided by PROMETHEE & GAIA methodology, developed by the Canadian company Visual Decision by Brans and Mareschal ([Brans et al., 1986](#)). PROMETHEE introduces a MCDM (Multiple-criterion decision-making) methodology based on the analysis of criteria and alternatives so that one alternative is better than the other with the best alternative consequently being the most appropriate choice according to the given criteria.

PROMETHEE method starts with the following decision (evaluation) matrix ([Ranjan et al., 2016](#)):

$$\begin{bmatrix} g_1(a_1) & g_2(a_1) & \dots & g_j(a_1) & \dots & g_n(a_1) \\ g_1(a_2) & g_2(a_2) & \dots & g_j(a_2) & \dots & g_n(a_2) \\ \dots & \dots & \dots & \dots & \dots & \dots \\ g_1(a_i) & g_2(a_i) & \dots & g_j(a_i) & \dots & g_n(a_i) \\ \dots & \dots & \dots & \dots & \dots & \dots \\ g_1(a_m) & g_2(a_m) & \dots & g_j(a_m) & \dots & g_n(a_m) \end{bmatrix} \quad (1)$$

where $g_j(a_i)$ shows the performance of i^{th} alternative on j^{th} criterion, m is the number of alternatives and n is the number of criteria.

The usage of PROMETHEE method requires defining the appropriate preference function and assigning the weight criteria to each input variable. In this method, it is possible to choose one out of six forms of the preference function (Usual, U-shape; V-shape; Level, Linear, Gaussian) where each form could be described with two thresholds (Q and P). The indifference threshold (Q) represents the largest deviation that the decision-maker considers not to be important, while the preference threshold (P) represents the smallest deviation that is considered to be crucial for decision making. The P value should not be smaller than Q. The Gaussian threshold (s) represents the average value of P and Q thresholds ([Brans, 1982](#); [Brans et al., 1984](#); [Brans & Vincke, 1985](#); [Obradović et al., 2012](#)).

Ranking using preferences is the most commonly used method in making multi-criteria decisions. For each alternative (country), the alternative value is expressed in preferences, which have a positive and negative flow. Based on the calculated preference, the net flow of preference that synthesizes all indicators is calculated, and, based on that, the given alternative (country) is ranked ([Despotović & Durkalić, 2017](#)).

The net outranking flow for each alternative can be obtained using the following equation:

$$\varphi(a) = \varphi^+(a) - \varphi^-(a) \tag{2}$$

where $\varphi(a)$ is the net preference flow for each alternative. The value of the net flow of preferences ranges from -1 to 1, where the best ranked alternative will have the largest positive net preference flow, and the worst ranked alternative has the largest negative net flow of preference. The higher the value of $\varphi(a)$ means the better alternative.

4. Results and discussion

In order to reach the final ranking of EMU countries in terms of tourism performance, it is necessary to consider the output of the whole model. In this case, the weight coefficients assigned to the criteria are equal to 12.5%, in order to avoid a subjective assessment of the significance of each of the indicators. Also, depending on the purpose of the preference function, some criteria will be minimized (AP, PD, CPL), while some criteria will be maximized (FT, DT, H, RL, NA). The weights, preference and indifference flow of the indicators are shown in Table 2.

Table 2: Preference and indifference function of analyzed data

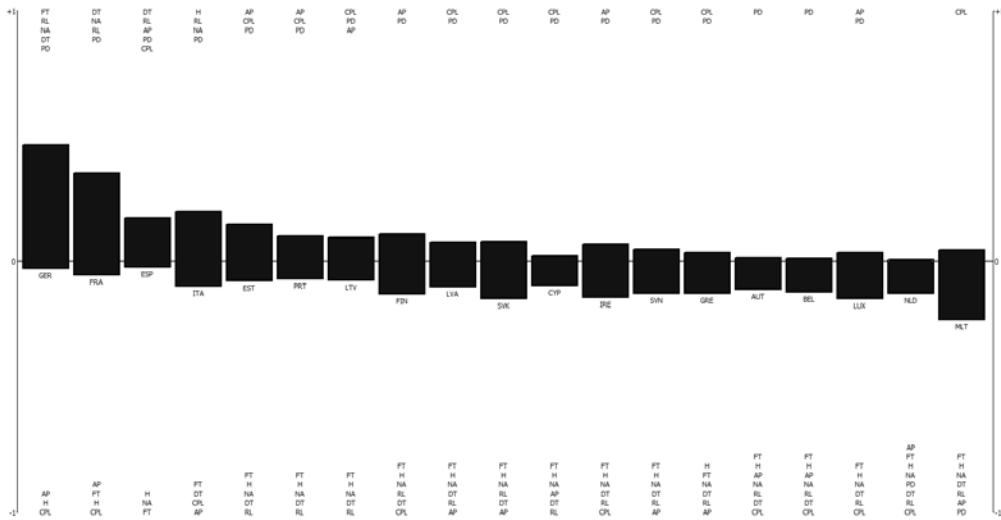
	FT	DT	H	AP	PD	RL	CPL	NA
Direction of preference	max	max	max	min	min	max	min	Max
Weight	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
Q: Indifference	200,497,219.53	293,869,961.37	46,587	2.80	361.00	9,796.44	15.52	57.40
P: Preference	328,769,427.07	520,003,984.68	78,372	6.79	606.28	18,513.73	36.31	109.14

Source: Authors calculation

The PROMETHEE rainbows diagram shows the final ranking of countries in measuring the tourist market performance. This diagram represents a synthesized view of the net flow values. In this diagram, alternatives (countries) are shown from the left to the right side according to their rank. Each alternative is represented by a vertical bar consisting of parts - criteria. Each part of the vertical line shows the contribution of a single criterion in the formation of the total net flow value for a given alternative. The height of the vertical line represents the net flow multiplied by the corresponding weight of the given criterion, where

the net flow represents the difference between the positive and the negative preference flows. Indicators that have the highest positive values of one alternative are on the top of the vertical bar, while the indicators with the highest negative values of one alternative are at the bottom of the vertical bar. Based on this, PROMETHEE rainbow diagram shows the profile of all alternatives and criteria, taking into account the weight of each of the criteria (Lakićević & Durkalić, 2018).

Figure 1: PROMETHEE rainbow diagram

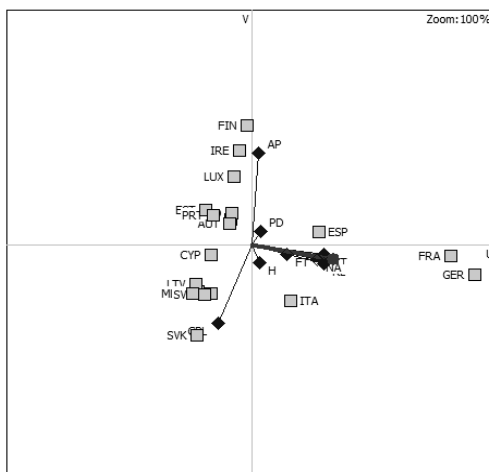


Source: Authors calculation

The result of the ranking based on the given parameters is shown in Figure 1. As it can be noticed, looking at the period 2012-2017, the three best ranked tourist destinations are Germany, France and Spain. Just behind them is Italy. For France, Italy and Spain it is clear that they are the leading broadcasting and receptive countries, which is in line with the statements on the Mediterranean countries in the introductory part of this paper. Although it is not an absolute leader in tourism activities, Germany is ranked like first EMU country in our analysis. Our opinion is that it is because of the largest number of airports and because Germany is the leading country when we talk about rail lines.

The worst ranked EMU19 countries are Malta, the Netherlands and Luxembourg. Over a 6-year period, the Netherlands had a negative net preference flow for all parameters, Malta with only one positive (CPL), while Luxembourg achieved a positive net preference flow in only two parameters (AP and PD).

Figure 2: GAIA diagram



Source: Authors calculation

The final set of actions and alternatives also we can show in the positions in GAIA plane. GAIA plane indicates how well actions perform on different criteria. Actually, the Decision Axis is the projection of the weight vector (Decision Stick) on the GAIA plane. All parameters close to the decision stick (line with circle at the end) are the best ranked. Parameters opposite to the decision stick indicate that these actions (in our case EMU countries) have lower net preference flow.

5. Conclusion

Over the last decade, tourism has become increasingly important industry, and there are different approaches to defining and measuring the performance of a tourist destination. The purpose of this paper was to analyze, on the one hand, the impact of several tourism variables on tourism performance, and, on the other hand, to assess the rank of the 19 EMU countries during 2012–2017 period.

Bearing in mind that the hotel industry is one of the important segments of tourism industry (Jovanović, 2019), the paper also considered an indicator that measures the number of hotels and other types of tourist accommodation. Results show the average number of hotels and similar accommodation in the EMU19 in the period 2012-2017 amounted to 391,768. The largest percentage is concentrated in Italy (44%) Germany (13%) and Spain (12%). When it comes to the number of international foreign tourist arrivals in the period 2012 to 2017, it has grown in every observed country from 2012 to 2017, except Latvia. As the number of domestic tourists' nights is concerned, the situation is slightly different, i.e. in the period 2012 to 2017 this indicator increased most in Estonia (43%). Therefore, the number of international trips is higher, which may be related to the opinion of Gil-Pareja et al. (2007) that Euro has increased tourism activity, with an effect of about 6.5%.

In addition to the mentioned parameters, in terms of rail line indicators, the average length of rail lines in the EU19 is 124,093 km, with Germany and France taking the share of 47%. When we look at the total number of airports in the EU19 (720), France has 199, Germany has 154 and Spain 66. As for the lowest ranking countries, Malta and Luxembourg have a lower number of airports (1 airport per country).

This paper separates in a unique way the theoretical and empirical framework for analyzing and ranking the tourist performance of individual destinations. The used PROMETHEE - GAIA decision model shows the ranking and alternatives of individual countries, as well as the positive and negative net flows of the preference function. All these parameters highlight the indicators on which individual countries should pay more attention in the future and which carry competitive advantages. Considering tourism is a multidisciplinary science, a large number of parameters of economic and non-economic nature can participate in the process of evaluating tourism performance. In this regard, future research may be prone to include more parameters in the analysis. Certainly, this analysis shows the stronger and weaker performance of individual EMU countries on the basis of which countries can shape future development policy.

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