MEASURING THE EFFICIENCY OF CERTAIN EUROPEAN COUNTRIES IN TOURISM: DEA WINDOW ANALYSIS

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Abstract: The purpose of the paper is to measure the efficiency of fifteen European countries in tourism over the period 2004-2013 using the Window analysis technique. Sample includes destinations which are competitors on the international tourism market. Two inputs are selected and they are: visitor exports and domestic travel and tourism spending, while travel and tourism total contribution to GDP and travel and tourism total contribution to employment are outputs. The results have been obtained using the software package DEA-Solver-Pro 7.0. According to them, there is no country that is efficient in every year in every window, and the least efficient country is Montenegro.

Keywords: Relative efficiency, data envelopment analysis, window analysis, European countries, tourism

1. INTRODUCTION

In this paper we measure the relative efficiency of 15 European countries in tourism, using the data envelopment analysis (DEA) methodology which was introduced by Charnes et al. (1978). DEA is a data-oriented approach (Cook and Zhu, 2008) for measuring the efficiency of homogenous entities which are known as decision making units (DMUs), and they use the same inputs and produce the same outputs.

DEA is frequently used method for evaluating the micro-and macro-efficiency in tourism. Some of the authors who have been dealing with this issue are Barros and Mascar, 2005; Bell and Morey, 1995; Sigala, 2004 etc. The results of these studies can not be compared because they use different DMUs, as well as different periods of time, but these works are interesting for understanding the selection of inputs and outputs to which DEA is extremely sensitive.

In our research two inputs and two outputs were selected and data was collected for a period of 10 years (2004-2013) that allow us to apply the DEA technique window analysis. This technique allows to observe the changes in the efficiency of DMUs i.e. countries over time.

The paper is organized as follows. Section 2 relates with tourism and its economic impacts. In section 3 methodology has been described, while in section 4 the data. The results are presented and discussed in Section 5 and the conclusion is given in Section 6.

2. TOURISM AND ITS ECONOMIC IMPACTS

Tourism has gained status as one of the biggest, most dynamic and complex socio-economic phenomena in modern world. Given that, tourism in generally interferes in

almost all spheres of social and economic development. Simultaneously it operates complexly and complementary and is deeply incorporated into the flows of everyday life. Due to the fact that tourism belongs to younger socio-economic phenomena, it has become the subject of severe scientific researches in mid-twentieth century, when begun its dynamic growth and development. At the same time, it has been recognized that tourism can only be studied as interdisciplinary scope, because with merely equal evaluation of its social and economic impact and research of its positive and negative influences it is possible to get into its essence (Cavlek et al., 2011, pp. 23-24).

Definitions of tourism exist almost as much as their authors from various scientific disciplines. One of the oldest is the one designed by the Swiss theoreticians of tourism W. Hunziker and K. Krapt in 1942, and it reads: “Tourism is the sum of the phenomena and relationships arising from travel and stay of non-residents, insofar as they do not lead to permanent residence and are not connected with any earning activity” (Markovic and Markovic, 1970, p. 10). The basic characteristics of this definition are reflected in the interpretation of tourism as a "tangle of relations with social and economic character" (Pirjevec, 1998, p. 20). So, there is a warning that tourism is not only the economic activity by which people achieve and promote their human qualities, either in their views and cognition, or in their relation with the world and nature (Alfier, 1977, p. 15).

Today, in most of the countries there is a general acceptance of conceptual definition of tourism proposed by UNWTO (1999) which states: “Tourism comprises the activities of persons traveling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes”. Whatever criteria we use in attempt to define tourism, the most common in all definitions is that tourism is placed in the general concept of traveling for pleasure outside the usual environment. From an economic point of view, the crucial is the act of consumption of financial assets obtained in domicile, and consumed in a tourism destination (Cavlek et al., 2011, p. 31).

As the role of tourism derives from its economic functions, the theorists of tourism Markovic and Markovic (1972, p. 28) state that the economic functions of tourism comprehend all activities which are aimed to achieve the set of economic goals and which result in certain economic impacts. Economic impacts of tourism can be defined as changes that occur in the economic structure of tourism generating, transitive and receptive destinations as a result of tourism movement and spending, and ultimately tourism development (Cavlek et al., 2011, p. 316).

With analyse of the tourism economic impacts it is possible to understand the structure complexity and relationships that rule at the tourism market (Kesar, 2006, p. 499). In different socio-economic environments and circumstances economic impacts of tourism can be manifested in different ways, especially when it comes to their size, structure and intensity of the impacts which they have on the economy. For the macroeconomic analysis of tourism impact on the economy, commonly are used three approaches in classification of the economic impacts of tourism. According to the first approach, economic impacts of tourism can be divided into physical and financial impacts. Physical economic impacts are related with the quantitative indicators of development, such as the number of overnight stays, while financial economic impacts refer to those impacts that can be expressed in monetary value (e.g. travel and tourism total contribution to GDP). Second approach divides economic impacts of tourism to direct and indirect impacts. Direct economic impacts of tourism occur in the initial stage of economic development at the regional and national level as a result of direct tourist spending (e.g. increase in income). Indirect economic impacts of tourism arise as a result of the previously generated direct economic impacts of tourism, and for its recognition in practice is required a longer lapse of time

(e.g. influence on regional development). The third approach classifies the economic impacts of tourism on the positive and negative impacts which is considered to be the simplest classification. The example of the positive economic impact of tourism is its total contribution to employment, while the negative is excessive economic dependence on tourism (Cavlek et al., 2011, p. 320).

3. METHODOLOGY

The CCR model (Charnes et al., 1978) and the BCC model (Banker et al., 1984) are basic DEA models. The first one has been built on the assumption of constant, while the second one on the assumption of variable returns to scale (VRS) of activities.

The DEA model may be oriented on input reduction or may be oriented on output augmentation, the first type of model is known as the input-oriented model, while the second is known as output-oriented model. Within the paper is used window analysis under VRS assumption, based on BCC model.

The envelopment form of the output-oriented BCC DEA model is given in (1)-(5), (Cooper et al., 2007, p. 93):

$$(BCC\text{-}O_o) \qquad \max_{\eta_B,\lambda} \ \eta_B \tag{1}$$

$$\text{subject to} \qquad X\lambda \leq x_o \tag{2}$$

$$\eta_B y_o - Y\lambda \leq 0 \tag{3}$$

$$e\lambda = 1 \tag{4}$$

$$\lambda \geq 0 \tag{5}$$

where η_B is a scalar. The input data for DMU$_j$ (j=1,…,n) are $(x_{1j}, x_{2j}, \ldots, x_{mj})$, and the output data are $(y_{1j}, y_{2j}, \ldots, x_{sj})$; the data set is given by two matrices X and Y, where X is the input data matrix, and Y is the output data matrix, λ is a column vector and all its elements are non-negative, while e is a row vector and all its elements are equal to 1 (Cooper et al., 2007, p. 22, pp. 91-92). See more about the BCC DEA model in (Banker et al., 1984) and (Cooper et al., 2007, pp. 90-94).

The changes in efficiency of the decision making unit over time can be observed by using the window analysis technique. This DEA technique is explained in Cooper et al., 2007, p. 324-328; Neralic, 1995, p. 207; Savic et al, 2012, p. 6-7, and the used symbols and formulas in the paper are given in Cvetkoska, 2013, p. 3.

4. DATA

In this paper are covered fifteen European countries that appear to be competitors on the tourism market, i.e. Austria, Bosnia Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, France, Greece, Italy, Macedonia, Montenegro, Portugal, Serbia, Slovenia and Spain.

Authors select two inputs: visitor exports (input 1) and domestic travel and tourism spending (input 2), and two outputs: travel and tourism total contribution to GDP (output

1) and travel and tourism total contribution to employment (output 2). The description of inputs and outputs is given in table 1.

The data have been taken from World Travel and Tourism Council for a period of ten years (2004-2013) (WTTC, 2014). WTTC is the forum for business leaders in the travel and tourism industry. It works to raise awareness of travel and tourism as one of the world's largest industries, which advocates partnership between the public and private sectors, delivering results that match the needs of economies, local and regional authorities and local communities with those of busines.

Statistics on input/output data for the observed period obtained using the software package DEA-Solver-Pro 7.0[9] is given in appendix 1.

Table 1. Description of inputs and outputs (WTTC, 2012)

Inputs	**Description**
Visitor exports	Spending within the country by international tourists for both business and leisure trips, including spending on transport, but excluding international spending on education. This is consistent with total inbound tourism expenditure in table 1 of the TSA: RMF 2008.
Domestic travel and tourism spending	Spending within a country by that country's residents for both business and leisure trips. Multi-use consumer durables are not included since they are not purchased solely for tourism purposes. This is consistent with total domestic tourism expenditure in table 2 of the TSA: RMF 2008. Outbound spending by residents abroad is not included here, but is separately identified according to the TSA: RMF 2008.
Outputs	**Description**
Travel and tourism total contribution to GDP	Total contribution to GDP – GDP generated directly by the travel and tourism sector plus its indirect and induced impacts (see below). Direct contribution to GDP – GDP generated by industries that deal directly with tourists, including hotels, travel agents, airlines and other passenger transport services, as well as the activities of restaurant and leisure industries that deal directly with tourists. It is equivalent to total internal travel & tourism spending within a country less the purchases made by those industries (including imports). In terms of the UN's Tourism Satellite Account methodology it is consistent with total GDP calculated in table 6 of the TSA: RMF 2008.
Travel and tourism total contribution to employment	Total contribution to employment – the number of jobs generated directly in the travel and tourism sector plus the indirect and induced contributions (see below). Direct contribution to employment – the number of direct jobs within the Travel & Tourism industry. This is consistent with total employment calculated in table 7 of the TSA: RMF 2008.
	Indirect and induced impacts Indirect contribution – the contribution to GDP and jobs of the following three factors: • Capital investment – includes capital investment spending by all sectors directly involved in travel and tourism. This also constitutes investment spending by other industries on specific tourism assets such as new visitor accommodation and passenger transport equipment, as well as restaurants and leisure facilities for specific tourism use. This is consistent with total tourism gross fixed capital formation in table 8 of the TSA: RMF 2008. • Government collective spending – general government spending in support of general tourism activity. This can include national as well as regional and local government spending. For example, it includes tourism promotion, visitor information services, administrative services and other public services. This is consistent with total collective tourism consumption in table 9 of TSA: RMF 2008. • Supply-chain effects – purchases of domestic goods and services directly by different sectors of the Travel & Tourism sector as inputs to their final tourism output. Induced contribution – the broader contribution to GDP and employment of spending by those who are directly or indirectly employed by travel & tourism.

TSA – Tourism Satellite Account

[9] http://www.saitech-inc.com/

5. RESULTS AND ANALYSIS

The sample consisted of 15 European countries (n=15), ten years are considered (k=10), the length of the window is 5 years (p=5), and the number of windows is 6 (w=6). In each window there are 75 (= np = 15× 5) DMUs, and the number of "different" DMUs is 450 (= npw = 15 × 5 × 6).

Each of the windows cover 5 years and they are presented below:

window 1	2004	2005	2006	2007	2008				
window 2		2005	2006	2007	2008	2009			
window 3			2006	2007	2008	2009	2010		
window 4				2007	2008	2009	2010	2011	
window 5					2008	2009	2010	2011	2012
window 6						2009	2010	2011	2012	2013

In appendix 2 are presented the relative efficiency results for each country in every year in every window, and the results of overall efficiency. The results of overall efficiency are calculated using the average of efficiency in 6 windows for every country and also we used the average of annual efficiency.

According to the results it can be seen that there is no country that is efficient in every year in every window, and the least efficient country overall is Montenegro.

The row-wise averages of results for every country in the sample are presented in Figure 1, while in Figure 2 are presented the column-wise averages of results for each of the fifteen countries. The highest and the lowest efficiency results are achieved in 2004 and 2011 respectively.

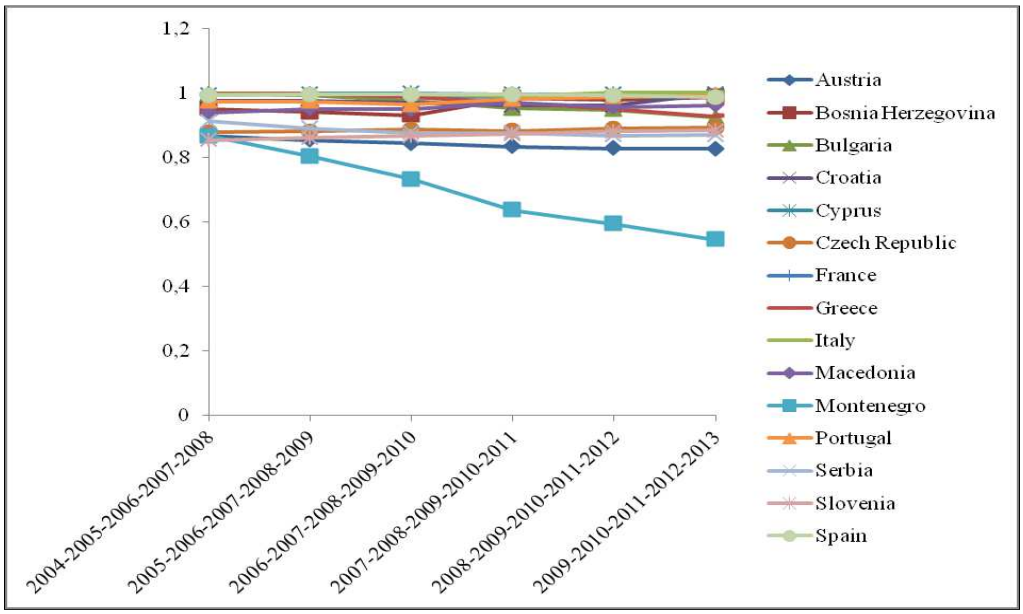

Figure 1. Variations through Window

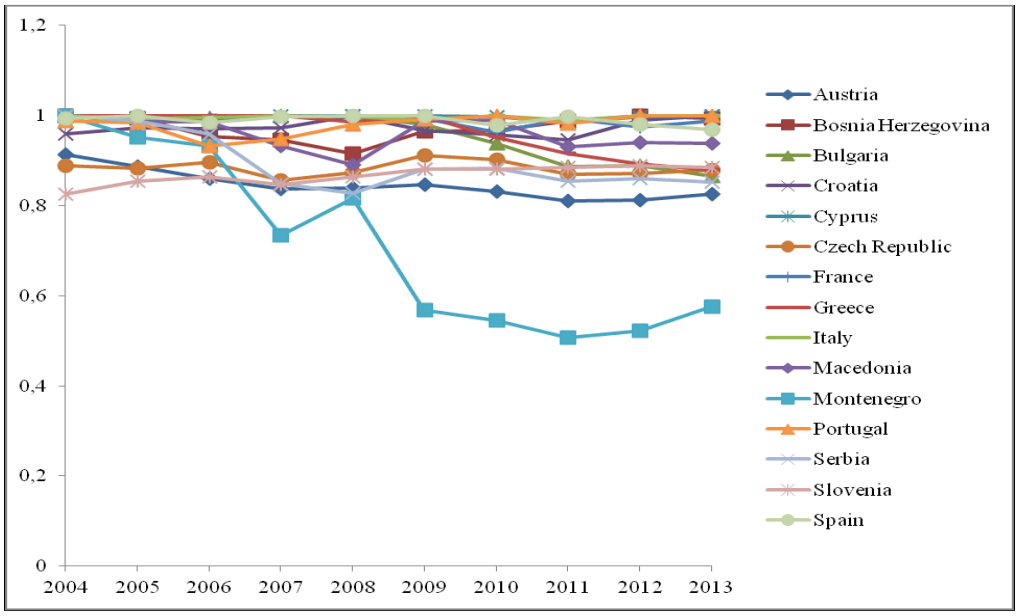

Figure 2. Variations by Term

6. CONCLUSION

In order to measure the efficiency of 15 entities, i.e. European countries in tourism in the period of ten years (2004-2013) the window analysis technique is used. The sample consists of the following countries: Austria, Bosnia Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, France, Greece, Italy, Macedonia, Montenegro, Portugal, Serbia, Slovenia and Spain. Visitor exports and domestic travel and tourism spending are inputs and travel and tourism total contribution to GDP and travel and tourism total contribution to employment are outputs.

The software package DEA-Solver-Pro 7.0 is used to obtain the results. In the paper are shown the relative efficiency results for each of the fifteen countries, the results of overall efficiency (by windows and by years), and also are presented the row and column-wise averages of results for each country in the sample.

According to the obtained results it can be concluded that no one of the countries is efficient in every year in every window. In 2004 are achieved the highest efficiency results, and in 2011 are achieved the lowest efficiency results. Based on the presented results of overall efficiency (by years) it has been found that 10 of 15 countries show efficiency results over 95%. Montenegro is identified as the least efficient country, while the following 4 countries: Italy, Cyprus, France and Spain show the highest efficiency results.

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APPENDIX 1

Statistics on Input/Output Data

Time period 2004

	Input 1	Input 2	Output 1	Output 2
Max	49.123.000.000,00	122.046.000.000,00	239.391.000.000,00	3.344.400,00
Min	102.000.000,00	20.000.000,00	262.000.000,00	19.600,00
Average	12.596.466.666,67	22.402.533.333,33	50.696.733.333,33	895.540,00
SD	16.530.355.289,05	39.568.418.728,18	79.497.159.145,44	1.125.949,67

Time period 2005

	Input 1	Input 2	Output 1	Output 2
Max	52.302.000.000,00	124.247.000.000,00	235.251.000.000,00	3.242.200,00
Min	115.000.000,00	30.000.000,00	289.000.000,00	21.500,00
Average	13.171.066.666,67	23.061.600.000,00	52.123.533.333,33	907.620,00
SD	16.947.270.590,34	40.206.318.879,50	80.198.289.747,24	1.128.667,71

Time period 2006

	Input 1	Input 2	Output 1	Output 2
Max	56.693.000.000,00	130.543.000.000,00	243.447.000.000,00	3.202.100,00
Min	154.000.000,00	116.000.000,00	340.000.000,00	26.400,00
Average	14.211.733.333,33	24.420.133.333,33	54.507.533.333,33	909.706,67
SD	18.151.218.205,09	42.379.186.081,32	83.428.187.666,49	1.131.562,12

Time period 2007

	Input 1	Input 2	Output 1	Output 2
Max	64.024.000.000,00	144.233.000.000,00	270.709.000.000,00	3.229.200,00
Min	215.000.000,00	134.000.000,00	423.000.000,00	27.400,00
Average	16.389.733.333,33	27.342.600.000,00	61.600.066.666,67	899.500,00
SD	20.662.624.091,07	47.203.588.279,99	93.968.856.629,89	1.139.117,48

Time period 2008

	Input 1	Input 2	Output 1	Output 2
Max	69.337.000.000,00	154.369.000.000,00	285.665.000.000,00	3.234.000,00
Min	259.000.000,00	168.000.000,00	516.000.000,00	28.700,00
Average	17.933.000.000,00	29.109.533.333,33	66.017.600.000,00	884.546,67
SD	22.187.986.443,12	49.681.807.230,77	99.077.115.443,68	1.107.185,89

Time period 2009

	Input 1	Input 2	Output 1	Output 2
Max	58.546.000.000,00	136.848.000.000,00	259.336.000.000,00	3.004.800,00
Min	228.000.000,00	137.000.000,00	472.000.000,00	28.000,00
Average	15.196.333.333,33	25.829.733.333,33	59.253.533.333,33	843.293,33
SD	18.924.463.520,94	43.847.147.033,71	89.035.217.573,62	1.054.765,18

Time period 2010

	Input 1	Input 2	Output 1	Output 2
Max	57.497.000.000,00	130.092.000.000,00	241.612.000.000,00	2.834.700,00
Min	206.000.000,00	133.000.000,00	429.000.000,00	25.300,00
Average	14.902.866.666,67	24.866.066.666,67	56.168.333.333,33	813.593,33
SD	18.197.762.048,73	42.151.561.888,76	83.613.907.987,18	1.007.639,68

Time period 2011

	Input 1	Input 2	Output 1	Output 2
Max	65.759.000.000,00	139.073.000.000,00	269.510.000.000,00	2.933.000,00
Min	247.000.000,00	152.000.000,00	490.000.000,00	25.100,00
Average	16.887.533.333,33	26.732.800.000,00	61.064.866.666,67	814.813,33
SD	21.120.494.911,71	45.636.334.097,88	92.387.293.785,72	1.032.179,69

Time period 2012

	Input 1	Input 2	Output 1	Output 2
Max	60.749.000.000,00	130.379.000.000,00	253.639.000.000,00	2.924.600,00
Min	242.000.000,00	154.000.000,00	485.000.000,00	28.700,00
Average	16.082.666.666,67	24.383.400.000,00	56.199.866.666,67	805.120,00
SD	19.804.879.996,83	41.881.652.633,42	84.779.714.044,39	1.011.816,01

Time period 2013

	Input 1	Input 2	Output 1	Output 2
Max	58.925.000.000,00	130.199.000.000,00	256.230.000.000,00	2.935.800,00
Min	255.000.000,00	168.000.000,00	523.000.000,00	29.800,00
Average	16.144.733.333,33	24.171.266.666,67	55.812.466.666,67	801.160,00
SD	19.595.800.806,86	41.579.901.164,65	84.101.834.487,22	1.001.889,87

APPENDIX 2

Window analysis results:

	Relative efficiency results										Overall efficiency	
Country	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	by windows	by years
Austria	0.9143	0.8875	0.8602	0.8376	0.8388							
		0.8863	0.8586	0.8363	0.8388	0.8455						
			0.8590	0.8368	0.8407	0.8456	0.8313					
				0.8368	0.8407	0.8456	0.8313	0.8130				
					0.8373	0.8466	0.8324	0.8097	0.8121			
						0.8464	0.8322	0.8095	0.8119	0.8267	0.8417	0.8464
Bosnia Herzegovina	1	0.9866	0.9480	0.9264	0.8923							
		1	0.9525	0.9299	0.8952	0.9256						
			0.9612	0.9362	0.9003	0.9325	0.9233					
				0.9935	0.9438	0.9960	0.9922	1				
					0.9434	0.9852	0.9774	0.9824	1			
						0.9856	0.9774	0.9825	1	0.9934	0.9621	0.9723
Bulgaria	1	1	0.9903	1	1							
		1	0.9903	1	1	0.9662						
			1	1	1	0.9675	0.9101					
				1	1	0.9678	0.9103	0.8768				
					1	1	0.9656	0.8853	0.8851			
						1	0.9656	0.8964	0.8924	0.8663	0.9645	0.9553
Croatia	0.9602	0.9736	0.9709	0.9723	1							
		0.9736	0.9709	0.9723	1	0.9591						
			0.9709	0.9724	1	0.9594	0.9440					
				0.9724	1	0.9594	0.9440	0.9267				
					1	0.9540	0.9434	0.9264	0.9790			
						1	1	0.9873	1	1	0.9731	0.9738
Cyprus	1	0.9901	0.9815	1	1							
		1	0.9848	1	1	1						
			1	1	1	1	0.9969					
				1	1	1	0.9972	0.9849				
					1	1	0.9973	0.9860	0.9994			
						1	0.9975	0.9833	0.9966	1	0.9965	0.9964
Czech Republic	0.8897	0.8824	0.8951	0.8512	0.8679							
		0.8824	0.8952	0.8512	0.8680	0.9012						
			0.9014	0.8574	0.8731	0.9053	0.8947					
				0.8631	0.8746	0.9058	0.8961	0.8707				
					0.8807	0.9239	0.9076	0.8682	0.8699			
						0.9240	0.9077	0.8715	0.8737	0.8784	0.8844	0.8832
France	1	0.9786	0.9850	0.9996	1							
		1	1	1	1	0.9907						
			1	1	1	0.9907	0.9533					
				1	1	0.9907	0.9533	0.9912				
					1	1	0.9710	0.9919	0.9694			
						1	0.9717	1	0.9816	0.9881	0.9902	0.9899
Greece	0.9988	1	1	1	0.9859							
		1	1	1	0.9859	1						
			1	1	0.9866	1	0.9507					
				1	0.9866	1	0.9517	0.9153				
					0.9812	1	0.9511	0.9158	0.8926			
						1	0.9510	0.9155	0.8922	0.8787	0.9713	0.9622
Italy	1	0.9888	0.9884	1	0.9963							
		1	1	1	0.9963	0.9839						
			1	1	0.9963	0.9839	0.9952					
				1	0.9963	0.9840	1	0.9708				
					1	1	1	1	1			
						1	1	1	1	1	0.9960	0.9967
Macedonia	1	0.9729	0.9614	0.8966	0.8655							
		1	0.9945	0.9129	0.8781	0.9653						
			1	0.9228	0.8865	0.9753	0.9606					
				1	0.9112	1	1	0.9305				
					0.9101	1	1	0.9305	0.9400			
						1	1	0.9305	0.9400	0.9388	0.9541	0.9583
Montenegro	1	0.9016	0.8881	0.7308	0.8141							
		1	0.9097	0.7312	0.8120	0.5625						
			1	0.7340	0.8149	0.5645	0.5424					
				0.7403	0.8203	0.5688	0.5460	0.5058				
					0.8210	0.5706	0.5468	0.5068	0.5218			
						0.5722	0.5475	0.5077	0.5230	0.5762	0.6960	0.7153
Portugal	0.9886	0.9857	0.9354	0.9590	0.9957							
		0.9825	0.9361	0.9595	0.9960	0.9936						
			0.9289	0.9311	0.9728	0.9843	1					
				0.9402	0.9724	0.9883	1	1				
					0.9677	0.9941	1	0.9749	1			
						0.9941	1	0.9743	0.9994	1	0.9785	0.9808
Serbia	1	0.9776	0.9303	0.8350	0.8177							
		1	0.9454	0.8364	0.8128	0.8588						
			1	0.8411	0.8163	0.8631	0.8603					
				0.8827	0.8509	0.9013	0.8927	0.8516				
					0.8436	0.8928	0.8879	0.8546	0.8596			
						0.8928	0.8881	0.8553	0.8601	0.8519	0.8820	0.8954
Slovenia	0.8263	0.8560	0.8651	0.8511	0.8694							
		0.8545	0.8630	0.8458	0.8631	0.8798						
			0.8653	0.8465	0.8634	0.8803	0.8798					
				0.8474	0.8640	0.8810	0.8804	0.8849				
					0.8640	0.8810	0.8805	0.8849	0.8889			
						0.8810	0.8806	0.8849	0.8889	0.8847	0.8696	0.8678
Spain	0.9928	1	0.9763	0.9941	1							
		1	0.9776	0.9975	1	1						
			1	1	1	1	0.9744					
				1	1	1	0.9780	0.9952				
					1	1	0.9793	0.9952	0.9808			
						1	0.9793	1	0.9807	0.9683	0.9923	0.9899