Romanian Journal of Regional Science
Vol. 18, No. 1, Summer 2024

DOI: https://doi.org/10.61225/rjrs.2024.03

THE ROLE OF DIGITALIZATION IN INTERNATIONAL TOURISM INFLOW TO ROMANIA: A SPATIAL GRAVITY MODEL APPROACH

Irina Denisa Munteanu [a,b], Zizi Goschin[a,b]*

[a] Faculty of Economic Cybernetics, Statistics and Informatics, Bucharest University of Economic Studies, Romania

[b]Institute of National Economy, Romania

* Corresponding author

Address: 15-17 Calea Dorobanților, Bucharest, Romania

E-mail: zizi.goschin@csie.ase.ro

Biographical Notes

Irina Denisa MUNTEANU is PhD candidate at the Bucharest University of Economic Studies and Scientific Researcher at Institute of National Economy. Her research interests are on economic statistics and spatial analysis, with a focus on knowledge economy and education issues. ORCHID ID: https://orcid.org/0000-0002-0997-1538

Zizi GOSCHIN, PhD is Full Professor at the Bucharest University of Economic Studies, Department of Statistics and Econometrics. Her main research interests are centered on spatial statistics and spatial econometrics. ORCHID ID: https://orcid.org/0000-0002-9030-7772

Abstract

Tourism plays a crucial role in a country's economic development, offering opportunities for growth and alleviating regional disparities. This study focuses on the Romanian tourism sector, acknowledging its potential for development and recent resilience following the COVID-19 pandemic. There is a need for a deeper understanding of international tourism inflow to Romania, given its potential contribution to economic growth. To this aim, we employ gravity models, commonly used in international tourism research, but rarely in Romania, especially the spatial ones. It is noteworthy that spatial gravity models consistently outperform classical models in this context. Filling a gap in the literature, the paper introduces a novel approach by incorporating digitization as an additional factor of influence in the spatial gravity model. The results confirm the main hypotheses of the gravity models: the geographical distance, GDP, and population size are indeed significant

factors in explaining international tourist flows to Romania. Rather surprisingly, we found a negative impact of internet use by citizens in the countries of origin on tourist inflows to Romania. This suggests inadequate online promotion, indicating an urgent need for increased advertising of Romania's tourist attractions.

Keywords: spatial gravity model, spatial lag and spatial error models, digitalization, tourism
JEL Classification: C21; C31; C40; L83

1. Introduction

Tourism is one of the important economic activities of a country, as it can significantly contribute to its economic growth, and can reduce regional disparities, such as the urban - rural development gaps. It is a dynamic field, ongoing steady expansion, and offering good prospects for economic growth, as demonstrated by the resumption of its upward trend after the steep decline induced by COVID-19 pandemic (Maftei & Butnaru, 2023).

Romanian tourism is expected to have great developing potential. Through the variety of landscapes, numerous cultural and historical areas, tourism represents in Romania one of the most important branches of the service sector (Paicu & Hristache, 2013). In recent years, it has benefited from increasing investments and frequent reforms, as well as new programs that have allowed the creation of new jobs, higher turnover for economic agents and an ever-increasing flow of international tourists visiting the country. According to a report by the United Nations Tourism Organization (UNWTO, 2023), Romania is in the top 10 countries by the growth in receipts from international tourism in Central/Eastern Europe. Considering these aspects, it is very important to undertake an in-depth analysis of the current situation of international tourism in Romania, identifying the main influence factors for its steady expansion.

Among the econometric tools employed in international research on tourism, gravity models are very popular, given their many methodological advantages. They allow to consider distance and economic potential as main factors, alongside other various indicators. Spatial modelling upgraded the analysis, introducing spatial interaction elements impossible to capture with classical regression models. Nevertheless, in Romania the analyses carried out on tourism make limited use of these these methods. Although the gravity model is often employed in Romanian economic research, it was mainly focused on international trade and migration, not tourism, while spatial gravity models have not been applied at all.

In addition to traditional gravity variables, other influence factors have been introduced to capture the competitiveness of tourism destinations, such as natural and cultural resources, infrastructure, prices, etc. (Park and Jang, 2014; Lombana-Coy and Palacios-Chacón, 2022). An area left so far unexplored in tourism gravity models is digitization. Although numerous empirical studies

have already revealed the positive effects of digitization on tourism activity (Camilleri, 2018; Buhalis, 2020; Filipiak et al, 2020; De Lucia et al, 2021; Jiang and Phoong, 2023), until now analyses of this type failed to use the methodological advantages of the gravity model. To our knowledge, this is the first paper to address the link between tourism and digitization within the methodological framework of the spatial gravity model.

2. Literature review

One of the most popular and successful empirical models in the regional economy, the gravity model, introduced by Tinbergen (Tinbergen, 1963), has been continuously extended and refined, finding many applications in various sectors of activity: international trade, capital flows, international migration, and tourism. Tourism is one of the fields that can be better understood using the tools of gravity theory, and the literature contains numerous empirical studies based on different variants of the gravity model. For example, Nadal and Gallego (2022) evaluated 143 key papers published in prestigious journals that apply the gravity model method to analyse tourism activity.

The gravity model explains the magnitude and direction of tourist flows by emphasizing the distance and economic potential (most often measured by GDP and population) of origin and destination localities as the main influencing factors (e.g., Anderson, 2011; Park and Jang, 2014; Nadal and Gallego, 2022; Xu et al, 2019). Moreover, in addition to traditional gravity variables, many other variables can be introduced to capture the competitiveness of destination localities, such as natural and cultural resources, general and tourism infrastructure, price competitiveness (Park and Jang, 2014; Lombana-Coy and Palacios- Chacón, 2022), the existence of heritage sites (Arshad et all, 2024), clime (Priego, et all, 2015), etc. These additional variables reflect factors with a positive role on tourist flows, having significant effects in increasing the capacity to attract domestic and international tourists.

Over time, increasingly sophisticated specifications of the gravity model were developed, expanding the number of explanatory variables, including some that allow the differentiation between the characteristics of the countries of origin and destination and the introduction of bilateral tourist flows derived from individual utility theory (Morley et al, 2014).

A gravity model analysis on the flow of foreign tourists coming to China during 1995-2014 showed that demand is both price and income elastic (Xu, et al., 2018). Analysing international tourism in Greece, a study states that income directly affects the number of foreign tourists, while distance and similar climate have a negative effect (Malaj & Kapiki, 2016).

Starting from the general framework of the gravity model, recent studies have shown that international tourism is negatively affected by the risk of infectious diseases, and the magnitude of

the adverse consequences is statistically and economically significant. In this context, the negative impact of the COVID-19 pandemic on tourist flows was also examined (Goswami et al, 2023).

Methodologically, the specifications of the gravity model have advanced towards the multidimensional panel, which accommodates several countries of destination (e.g., Tatoglu and Gul, 2019; Ibragimov et al, 2022). For instance, Khadaroo & Seetanah (2008) used a gravity panel model to carry out an analysis on a sample of 28 countries over the period 1990-2000, showing that the country's infrastructure has an essential role on tourism. Tourists appreciate efficient and safe transport, especially when it comes to countries in Africa or Asia (Khadaroo & Seetanah, 2008). This is confirmed by a study carried out in Spain on domestic tourism, using gravitational and spatial models (Alavrez-Diaz et al., 2020). Another gravity panel model was focused on tourist flows from Romania. Using GDP/GDP per capita and distance as explanatory variables, the results indicate that tourism is not a luxury good and that the variables included in the model have a significant effect on the number of tourists (Kadir & Sibel, 2014).

Inclusion of spatial variables in the model (e.g., Patuelli et al, 2016; Aleknavicius et al, 2020; Alvarez-Diaz et al, 2020; Ulucak et al, 2020) further increased the explanatory power of gravity spatial models compared to traditional models. Such models allow for spatial interactions among neighbouring countries/regions, revealing the competition between tourist destinations.

In sum, an extensive empirical literature shows that gravity models are largely employed in tourism research worldwide, due to their higher efficiency in understanding the underlying factors of this phenomenon.

3. Method

Introduction of the gravity model

The gravity model (Tinbergen, 1963) was inspired by Newton's Law of Universal Gravitation. The law states that the gravitational attraction between two objects increases with their masses and decreases with distance.

The model based on this gravitational principle was initially applied in regional studies to estimate trade flows between two countries (from country i to country j), depending on their GDPs (as a measure of economic mass) and the distance between them:

$$FC_{ij} = G\frac{Y_i^{\alpha}Y_j^{\beta}}{D_{ij}^{\delta}} \quad (1)$$

Where:

- FC_{ij} - value of trade flows from country (i) to destination countries (j);

- Y_i and Y_j are the sizes of the two countries' economies (usually measured as gross domestic product - GDP, or GDP per capita),
- D_{ij} - geographical distance between countries,
- G - a gravitational constant.

More recently, the gravity model has found new uses in empirical analysis of FDI, as well as in a better understanding of tourism and migration flows, phenomena significantly influenced by geographic location.

Our aim is to analyse tourism flows to Romania, focusing on distance as an influencing factor, therefore the gravity model is a suitable choice. The selection of explanatory variables is based on the literature (both national and international), in the context of the current limitations regarding official statistical data.

In order to estimate the gravity model, prior linearization of the previous relationship is necessary. To facilitate econometric estimates, the gravity equation (1) is logarithmized, resulting in a linear relationship:

$$ln\ FC_{ij} = ln\ G + \alpha\ ln\ Y_i + \beta\ ln\ Y_j - \delta\ ln\ D_{ij} + e_{ij} \quad (2)$$

where $ln\ G$ corresponds to the intercept and α, β and δ are elasticities.

Assumptions of the gravity model applied for tourism analysis.

- Larger economic size (captured by GDP) increases the bilateral flows of tourism between countries, meaning that large countries exchange more tourists with each other.
- Tourism flows increase when partners are geographically closer, so distance is a hindering factor.
- There is a positive relationship between differences in income per capita and bilateral flows (the more the countries are different from each other, enjoying some comparative advantage, the more the tourist flows tend to increase).

The extended gravity model incorporates a few additional influencing factors, allowing better understanding of territorial relationships.

$$ln\ FC_{ij} = ln\ G + \alpha\ ln\ Y_i + \beta\ ln\ Y_j - \delta\ ln\ D_{ij} + \rho\ (Y_i/L_i) + \eta\ (Y_j/L_j) + \varphi\ A_{ij} + e_{ij} \quad (3)$$

Where:

- Y_i and Y_j represent the GDP of country i and j respectively,
- (Y_i / L_i) and (Yj / L_j) are GDP per capita of country i and j, respectively; alternatively, DE_{ij} can be the difference between the GDP/inhabitant of country i and the GDP/inhabitant of country j in year t, a factor that reflects the *economic distance* between partners.
- D_{ij} - the geographical distance between the capitals or economic centres of the two partners (as a proxy for transport costs),

- A_{ij} - other variables, such as favourable factors (historical ties between the two countries, common or close language, etc.) or unfavourable factors (imposing tourist visas and other barriers), preference variables (e.g., seasonal tourism), etc. Also, in the category of favourable influencing factors can be included the degree of *digitalization* in a country, measured by various proxy variables.

Inclusion of spatial dependence in the gravity model

The gravity model was further developed by including spatial influences in the context of the principles and techniques of spatial econometrics. Spatial dependence in the gravity model can be justified by the so-called "third country effect" (in other words, the role of geographical neighbours).

The role of the third country effect is related to two opposite phenomena:

- the theory of the location factor that favours spatial dispersion effects: if a structural change occurs in a country that amplifies its commercial flow (or flows of another nature, such as tourist ones), due to the phenomenon of spatial dependence (neighbours are similar) it can also increase the flows to the neighbours; changes in location factors in one country are thus linked to changes in neighbouring countries.
- competition: a third country *k* can activate the competition effect, which is based on the relative trade cost between countries *i* and j compared to the cost between *i* and *k*; e.g., increasing the competitiveness of third country *k* lowers its trade cost and consequently increases the flow between countries *i* and *k* and decreases the flow between countries *i* and *j*. This principle seems particularly appropriate for tourism activities.

As empirical studies reveal, spatial dependence in the gravity model for tourism most often reflects a possible competition effect as neighbouring countries compete to attract foreign tourist flows, and regions or localities also compete to attract domestic tourists.

Although space has been considered since the beginning of the empirical use of the gravity model, using the distance variable and other variables relevant to the volume of flows between countries (such as geographic contiguity), modelling spatial dependence requires appropriate spatial regression models, models in which the spatial interdependencies are highlighted and measured explicitly, using the specific techniques of spatial econometrics. Among these, the most frequently used are:

- The gravitational model with spatial lag
- The gravity model with spatial errors

Spatial lag gravity model – spatial dependence is included in the model through the spatial lag of the dependent variable (as the average of the values of the neighbours for the dependent variable); it reflects a spatial dispersion process of the dependent variable.

$$ln\ FC_{ij} = ln\ G + \rho W\ ln\ FC_{ij} + \alpha\ ln\ Y_i + \beta\ ln\ Y_j - \delta\ ln\ D_{ij} + \omega(Y_i/L_i) + \eta\ (Y_j/L_j) + \varphi\ A_{ij} + e_{ij} \quad (4)$$

Where:

$WlnFC_{ij}$ – space lag (reflects the influence of foreign trade from neighbouring countries/regions on the reference country/region)

ρ – spatial lag coefficient.

Gravity model with spatial errors – spatial dependence is included in the autoregressive errors.

$$ln\ FC_{ij} = ln\ G + \alpha\ ln\ Y_i + \beta\ ln\ Y_j - \delta\ ln\ D_{ij} + \omega(Y_i/L_i) + \eta\ (Y_j/L_j) + \varphi\ A_{ij} + e_{ij} \quad (5)$$

$$e_{ij} = \lambda W\ e_{ij} + v_{ij} \quad (6)$$

Where:

We_{ij} – spatial lag of errors: reflects the influence of other factors (not included in the model) from neighbouring countries/regions;

λ – coefficient of spatial errors.

Validation of the spatial models is achieved when:

• the spatial coefficients are statistically significant

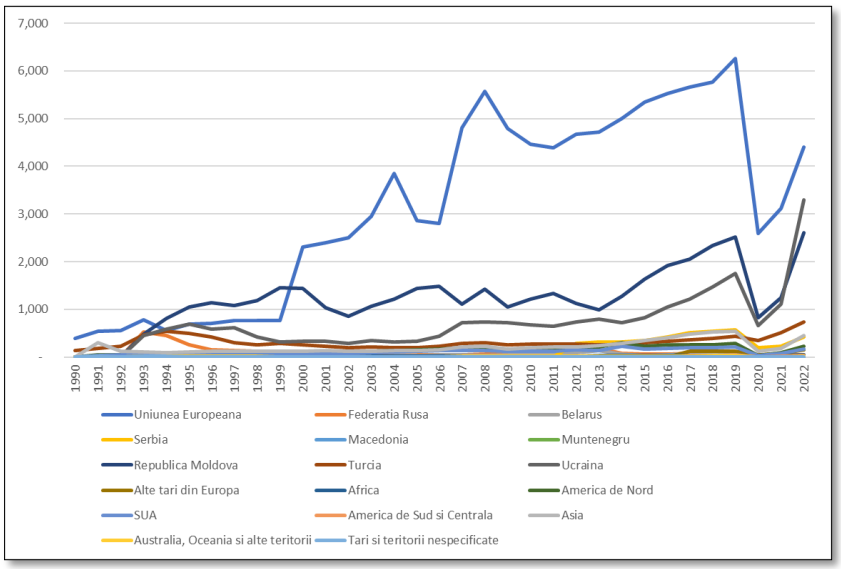
• the Likelihood Ratio test rejects the null hypothesis => the spatial model is better than the classical one.

4. Results and Discussion

Descriptive data analysis

The official data available (as provided by the National Institute of Statistics) are for the period 1990-2022 and show the number of foreign tourists coming from Europe, but also America, Asia, Africa, and other unspecified territories. Most were registered in 2019, and the fewest in 2020, which is normal and expected considering the context of the COVID-19 pandemic. The number of foreign tourists recorded in the year 2022 is very close to the value of 2019, indicating that tourism sector recovered and managed to reach the values before the pandemic. Moreover, starting from 2009, there was an increasing trend, in opposition to the period 1991-2002. This is normal considering the political and economic climate of Romania. In addition, after the accession to the European Union, Romania experienced faster development in all sectors of the economy, as was the case with tourism. The evolution of the number of foreign tourists arriving in Romania depending on the country of origin is illustrated in the graph below.

Figure 1. The number of foreign tourists arriving in Romania (thousands of persons) by country of origin, 1990-2022



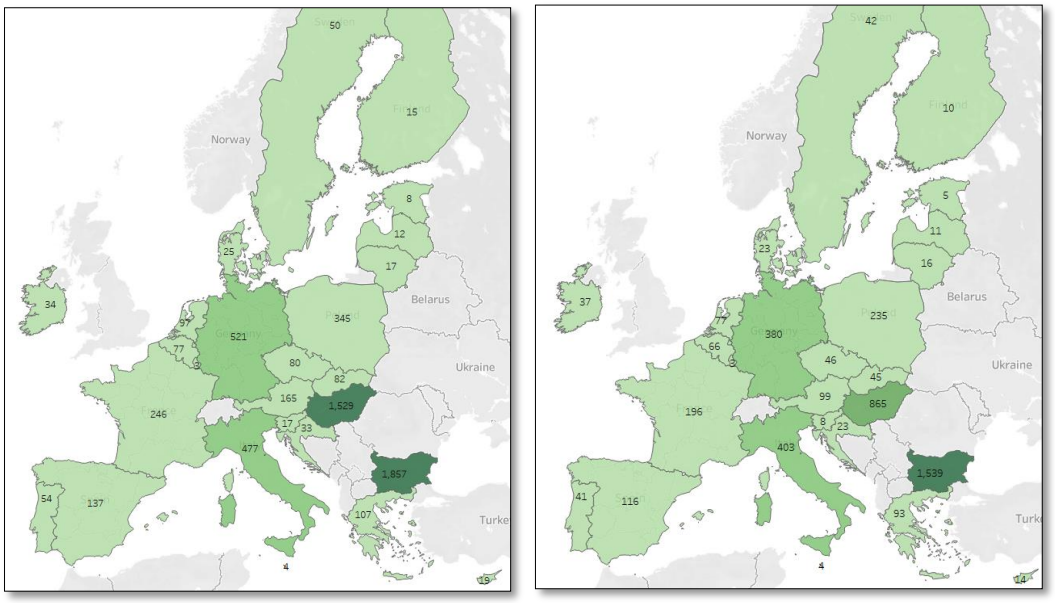
Source: Authors' own processing based on NIS data

Most foreign tourists come from European Union member countries. In the absence of travel restrictions, tourism within the EU is easy and does not involve high costs. In second place are tourists from the Republic of Moldova, and in third place are those from Ukraine.

For the spatial analysis, two years were chosen, 2019 and 2022 (this being the last year with available data). In 2022, most foreign tourists from the European Union came from Bulgaria (1539 thousand people), followed by those from Italy (403 thousand people), Germany (380 thousand people), and Poland (235 thousand people). This suggests that the immediate proximity between the countries or a large diaspora contributes to a rising number of tourists. The fewest come from Luxembourg (3000 people). The situation in 2019 is not much different from the one presented for 2022 (Figure 2).

Data on the other variables of interest included in the econometric models were downloaded from the Eurostat database. These variables refer to the population and GDP of the European Union countries and digitalization. In the Eurostat database, the section dedicated to digitization includes a series of variables, such as: the percentage of people who use the Internet, the percentage of households that have access to the Internet, the speed of the Internet, the frequency of Internet use, the percentage of Internet use to find information or the level of digital competences. To ensure comparability between the two years, for the spatial models the variable "percentage of individuals using the Internet" was chosen.

Figure 2. The number of EU tourists arriving in Romania in 2019 and 2022 (thousands of persons)

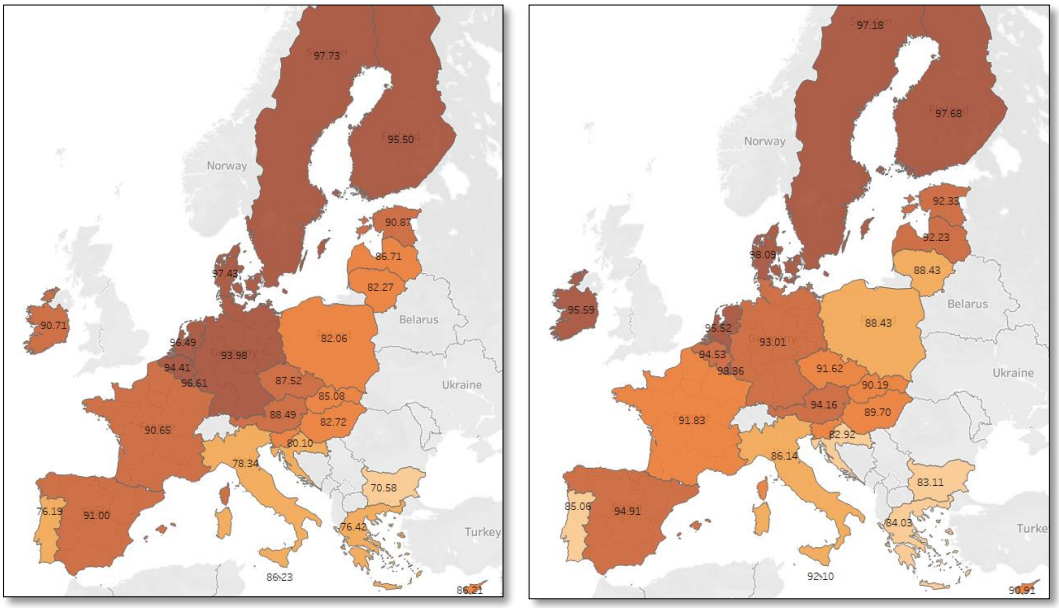


2019 2022

Source: Authors' own processing based on NIS data

Its values at European country level, in 2019 and in 2022, can be seen in Figure 3. It shows that Finland has the highest percentage of internet users.

Figure 3. Percentage of citizens using the Internet in 2019 and 2022 (%)



2019 2022

Source: Authors' own processing based on Eurostat data

Here, almost 98% of citizens have access to and use the Internet on dedicated devices. On second place is Sweden with 97%. It should also be noted that all countries register values above 80%. This is due to the advanced technology and infrastructure present. The high percentages indicate a high degree of digitization among European countries, which is beneficial for citizens, but also for the economy. Especially in the current context where the Internet is present in all fields, citizens' access to it is relevant for overall development of society. In 2019, the percentages are lower in most of the countries, except for the Netherlands. Considering the context of the COVID-19 pandemic, during which many of the economic and social activities have gone online, the use of the Internet has become a necessity. Thus, the number of users increased.

Econometric data analysis

The econometric analysis consists in the creation of spatial models, as presented in the methodology, to carry out a detailed analysis of the flows of foreign tourists arriving in Romania. A separate analysis was carried out for each of the two years: 2019 and 2022, with the aim of comparing the situation from the year before the pandemic with the recent reality and identifying possible structural changes. For each year, several models were created, both classic and spatial ones, as follows:

1. The variation in the number of foreign tourists arriving in Romania explained by the distance between the countries of origin and Romania and by GDP.

2. The variation in the number of foreign tourists arriving in Romania explained by the distance between the countries of origin and Romania, by GDP, as well as by the percentage of internet users.

3. The variation in the number of foreign tourists arriving in Romania explained by the distance between the countries of origin and Romania, by population.

4. The variation in the number of foreign tourists arriving in Romania explained by the distance between the countries of origin and Romania, by population and by the percentage of internet users.

Since GDP and population are two highly correlated variables, they cannot be included simultaneously in the model.

The results for the first two models for 2019 are summarized in the tables below.

Table 1. The variation in the number of foreign tourists arriving in Romania explained by the distance between the countries of origin and Romania and by GDP – 2019

Models – 2019		
Variable	**Coefficients OLS**	**Spatiality effect coefficients**
Constant	10.0851***	12.3948***
Distance	-2.1754***	-2.36138***
GDP	0.847231***	0.846778***
W Tourists	-	-0.205994**
Spatial diagnosis		
P-value spatiality test (Robust LM lag)	0.0519	
Loglikelihood	-30.1021	-28.3728
Akaike	66.2041	64.7457
Schwartz	69.9784	69.778
Loglikelihood Ratio Test – p-value	0.06293	

** Significant for 10%*

*** Significant for 5%*

**** Significant for 1%*

Source: Own data processing in Geoda

Table 2. The variation in the number of foreign tourists arriving in Romania explained by the distance between the countries of origin and Romania, by GDP and by the percentage of internet users – 2019

Models – 2019		
Variable	**Coefficients OLS**	**Spatiality effect coefficients**
Constant	34.7077***	35.6437***
Distance	-1.61661***	-1.81014***
GDP	0.905014***	0.901919***
Internet usage percentage	-6.60787***	-6.30066***
W Tourists	-	-0.185572**
Spatial diagnosis		
P-value spatiality test (Lagrange Multiplier lag)	0.06881	
Loglikelihood	-24.4298	-22.3457
Akaike	56.8596	54.6914
Schwartz	61.892	60.9819
Loglikelihood Ratio Test – p-value	0.04119	

** Significant for 10%*

*** Significant for 5%*

**** Significant for 1%*

Source: Own data processing in Geoda

The results from the 2019 models show that all the coefficients, both for the classic and for the spatial models, are statistically significant for 1% or 5%. Also, the output of the spatial lag model shows that this model is better than the classic one: higher Log likelihood, lower Akaike and Schwartz. The spatial lag variable is significant, confirming that the spatial model is appropriate for tourism analysis. In addition, the Likelihood Ratio Test confirms that the spatial lag model is better than the classical one.

Note that all variables have the expected sign, according to the theory of gravitational models. Thus, the number of tourists coming to Romania increases with the size of the GDP of the country of origin and decreases with the distance from Romania.

Somewhat surprising is the effect of the "Internet usage" variable, which has a negative influence on the number of foreign tourists. Thus, the more citizens there are who use the Internet in a country, the lower the flow of tourists from that country to Romania. This is interesting precisely because the use of the Internet should normally lead to easier finding of information and the facilitation of international tourism. However, it is this easy use of the Internet that can lead to a convenience among people. Nowadays there are countless platforms where complete information about a country is available: places, experiences, heritage, etc. For example, through the YouTube platform, users can watch images and videos from well-known but also lesser-known areas of a country, see the main objects of cultural heritage, learn about traditional culinary dishes, and much more. All this creates a unique tourism experience from the comfort of your own home. Another explanation may be the insufficient presence on the internet of Romania's tourism promotion materials, in the context of the abundance of information and the strong competition between countries to attract as many foreign tourists as possible. The Internet is an important channel for promoting countries/regions/localities to attract tourists. However, this kind of promotion involves high costs, and the distribution is likely to be uneven. A study carried out by the Ministry of Tourism (Ministry of Economy, Entrepreneurship and Tourism, 2018) supports the fact that Romania's image on social networks has gradually improved, but it is still lesser known than many other competing destinations. The Ministry claims that it currently does not have the necessary tools to monitor and evaluate the implementation of the campaigns. In the absence of performance indicators, attracting foreign tourists through digital platforms remains a challenge for Romania.

The spatiality variable, which reflects in the model the spatial interactions between neighbouring countries and can be considered in our case as an indicator of competition between countries, is also significant and indicates a negative influence, suggesting that a large number of tourists coming to a country leads to a decrease in the number of tourists arriving in a neighbouring country.

The results for the following two models for the year 2019 are summarized in tables 3 and 4. All regressors are significant and have the expected sign: the number of tourists coming to Romania increases with the size of the population of the country of origin and decreases with the distance from Romania. The basic assumptions of the theory of gravitational models are also verified in this case. The exception is the variable that expresses the use of the Internet among citizens, which is not statistically significant in the classic regression model. Spatiality tests indicate its presence in the errors, and the output of the model with spatial errors shows that it is better than the classical one: Log likelihood higher, Akaike and Schwartz lower, and the Likelihood Ratio Test has prob. < 0.05. Compared to the first two models, the latter shows a greater influence of population than GDP and a reduction in the influence of Internet use.

Table 3. The variation in the number of foreign tourists arriving in Romania explained by the distance between the countries of origin and Romania and by population – 2019

Models – 2019		
Variable	**Coefficients OLS**	**Spatiality effect coefficients**
Constant	8.17455***	10.3823***
Distance	-1.67756***	-1.8521***
Population	0.959958***	0.954995***
W Tourists	-	-0.193613***
Spatial diagnosis		
P-value spatiality test (Lagrange Multiplier lag)	0.03241	
Loglikelihood	-22.0605	-19.2949
Akaike	50.1209	46.5898
Schwartz	53.8952	51.6222
Loglikelihood Ratio Test – p-value	0.01868	

** Significant for 10%*

*** Significant for 5%*

**** Significant for 1%*

Source: Own data processing in Geoda

Table 4. The variation in the number of foreign tourists arriving in Romania explained by the distance between the countries of origin and Romania, by population and by the percentage of internet users – 2019

Models – 2019		
Variable	**Coefficients OLS**	**Spatiality effect coefficients**
Constant	16.6478***	16.8243
Distance	-1.47481***	-1.36814***
Population	0.952836***	0.934798***
Internet usage percentage	-2.22307	-2.41109***
λ	-	-0.652427***
Spatial diagnosis		
P-value spatiality test (Lagrange Multiplier error)	0.03185	
Loglikelihood	-21.0275	-16.59447
Akaike	50.0549	41.189
Schwartz	55.0873	46.2213
Loglikelihood Ratio Test – p-value	0.00291	

** Significant for 10%*

*** Significant for 5%*

**** Significant for 1%*

Source: Own data processing in Geoda

The next models are for the year 2022. The results for the first two models are summarized in the table below.

Table 5. The variation in the number of foreign tourists arriving in Romania explained by the distance between the countries of origin and Romania and by GDP – 2022

Models – 2022		
Variable	**Coefficients OLS**	**Spatiality effect coefficients**
Constant	8.19528***	10.1843***
Distance	-2.00839***	-2.15268***
GDP	0.865013***	0.85695 ***
W Tourists	-	-0.195491*
Spatial diagnosis		
P-value spatiality test (Robust LM lag)	0.05493	
Loglikelihood	-30.3926	-19.2949
Akaike	66.7853	46.5898
Schwartz	70.5596	51.6222
Loglikelihood Ratio Test – p-value	0.08789	

** Significant for 10%*

*** Significant for 5%*

**** Significant for 1%*

Source: Own data processing in Geoda

Table 6. The variation in the number of foreign tourists arriving in Romania explained by the distance between the countries of origin and Romania, by GDP and by the percentage of internet users – 2022

Models – 2022		
Variable	**Coefficients OLS**	**Spatiality effect coefficients**
Constant	46.0515***	47.0739***
Distance	-1.55832****	-1.71033***
GDP	0.893766***	0.885184***
Internet usage percentage	-9.20935***	-8.98507***
W Tourists	-	-0.191101**
Spatial diagnosis		
P-value spatiality test (Lagrange Multiplier lag)	0.08925	
Loglikelihood	-26.7077	-24.9039
Akaike	61.4155	59.8079
Schwartz	66.4479	66.0983
Loglikelihood Ratio Test – p-value	0.05751	

** Significant for 10%*

*** Significant for 5%*

**** Significant for 1%*

Source: Own data processing in Geoda

All coefficients are statistically significant for both the classical and spatial regression models. As with 2019, the output of the spatial lag model shows that this model is better than the classic one: higher Log likelihood, lower Akaike and Schwartz. The spatial lag variable is significant, confirming that the spatial model is appropriate for tourism analysis. In addition, the Likelihood Ratio Test confirms that the spatial lag model is better than the classical one.

The number of tourists coming to Romania increases with the size of the GDP of the country of origin and decreases with the distance from Romania. Regarding the use of the Internet, it has a negative influence on the number of foreign tourists. The explanation may be the same as that discussed previously, for the year 2019. It should be noted that the influence of internet use is greater, this being normal in the context of accelerated digitalization during the COVID-19 pandemic.

The results for the next two models for the year 2022 are summarized in the tables below.

Table 7. The variation in the number of foreign tourists arriving in Romania explained by the distance between the countries of origin and Romania and by population – 2022

Models – 2022		
Variable	**Coefficients OLS**	**Spatiality effect coefficients**
Constant	6.9348***	8.99529***
Distance	-1.53787***	-1.69116***
Population	0.950618***	0.941732***
W Tourists	-	-0.20152***
Spatial diagnosis		
P-value spatiality test (Lagrange Multiplier lag)	0.04344	
Loglikelihood	-24.1556	-21.7059
Akaike	54.3113	51.4118
Schwartz	58.0856	56.4442
Loglikelihood Ratio Test – p-value	0.02686	

** Significant for 10%*

*** Significant for 5%*

**** Significant for 1%*

Source: Own data processing in Geoda

Table 8. The variation in the number of foreign tourists arriving in Romania explained by the distance between the countries of origin and Romania, by population and by the percentage of internet users – 2022

Models – 2022		
Variable	**Coefficients OLS**	**Spatiality effect coefficients**
Constant	14.053	15.4077
Distance	-1.44967***	-1.61066***
Population	0.942778***	0.934709***
Internet usage percentage	-1.70736	-1.541
W Tourists	-	-0.20033***
Spatial diagnosis		
P-value spatiality test (Lagrange Multiplier lag)	0.04157	
Loglikelihood	-23.9783	-21.5287
Akaike	55.9566	53.0573
Schwartz	60.989	59.3478
Loglikelihood Ratio Test – p-value	0.02687	

** Significant for 10%*

*** Significant for 5%*

**** Significant for 1%*

Source: Own data processing in Geoda

The results do not differ much from the first two models for the year 2022. All regressors are significant and have the expected sign: the number of tourists coming to Romania increases with the size of the population of the country of origin and decreases with the distance from Romania. The exception is the variable that expresses the use of the Internet among citizens, which is not statistically significant in any model, classical or spatial. However, the output of the spatial lag model shows that it is better than the classical one: Log likelihood higher, Akaike and Schwartz lower, and the Likelihood Ratio Test has prob. < 0.05. It is possible that for this model, in which the distance between countries has a stronger influence on the number of foreign tourists arriving in Romania, the influence of the Internet no longer matters.

5. Conclusion

As expected, all the hypotheses of the gravity model were confirmed, revealing geographical distance, GDP and population size as essential influencing factors in sizing tourist flows to Romania. In addition, confirming the results of previous empirical studies presented in the literature for other countries, the spatial dependence in the gravity model for foreign tourism to Romania reflects a possible competition effect in attracting international tourist flows. Regarding the use of the Internet by the citizens of a country, this variable has a negative influence. Although, at first glance, it is an unexpected result, it can be explained by the fact that Romania does not use the Internet and modern means of communication enough to capitalize on the tourist potential it possesses, to promote tourist attractions that are less or not at all known internationally, to establish itself as a preferred tourist destination in the regional context.

In all the variants analysed, the spatial gravity models proved their superiority over the classical models.

Considering the results obtained from the estimation of gravity models enriched with the spatial component that clearly reveal the negative impact of tourist competition from neighbouring countries, the main recommendation that can be made to decision-makers is to invest more in the online promotion of Romania's tourist attractions. For example, Spain and Italy attract the largest number of foreign tourists from the European Union. To reach the top of the ranking, Spain has an intense promotion policy, and each region has its own strategy to attract tourists, which implies significant spending on advertising.

To stimulate the tourism industry and local economies, authorities should invest in infrastructure, protect heritage sites, stabilize prices, and implement effective marketing strategies (Arshad et all, 2023). Following such policies, the tourism economic sector can accelerate its development, contributing furthermore to the economic well-being of the country.

In sum, Romania needs to increase markedly its presence on online platforms and find better ways to be visible to foreign tourists. An example would be promotion through artistic materials or through influencers able to reach a wide audience with their messages. For instance, The Flavors of Romania series represents a very good way for the most important cultural heritage areas of Romania to be discovered by more international viewers. Through such means of increasing visibility on digital platforms, Romania can rise in the ranking of the countries most visited in the European Union.

A potential future research direction might be an extended analysis by means of spatial panel data. While the panel allows for the combination of cross-sectional and time series data in the gravity model for tourism (e.g., Park and Jang, 2014), the spatial panel adds spatial interactions between neighbouring localities. For phenomena that are influenced by location or that vary spatially, such as tourism, spatial panel data models are essential to adequately address these issues and obtain more relevant results.

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