



## Exploring the spatial effect of tourism expenditure on income inequality: A spatial panel data analysis for EU27 countries

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### Abstract

**Purpose:** This study examines the impact of tourism expenditures on income inequality and analyses spatial dependence.

**Design/methodology/approach:** Using data from EU member states (2014-2022), a spatial panel data model is applied. Income inequality is measured by the Gini index, with tourism expenditures as the independent variable and the food production index as a control variable. The Fixed Effects Spatial Panel Data Model is identified as the most suitable method through unit effect tests, the Hausman test and robustness checks.

**Results:** Findings indicate that both tourism expenditures and the food production index significantly reduce income inequality. A 1% increase in tourism expenditures lowers the Gini coefficient by 0.025 units, while a 1% rise in the food production index reduces it by 0.067 units. Additionally, the positive and significant spatial dependence coefficient suggests that an increase in unobserved inequality effects within a country raises inequality in neighbouring countries by 17%.

**Discussion:** This study highlights the importance of tourism policies and integrating rural economic activities into tourism as effective tools for reducing income inequality.

**Keywords:** Tourism Expenditures, Income Inequality, Spatial Panel Data Analysis, EU Countries

### Introduction

The tourism sector is increasingly playing a strategic role in the global economy, being considered a key component of economic development due to its added value, foreign exchange earnings and employment capacity. The sector's role in economic growth, as well as its impact on income distribution, has become a significant area of research. Tourism's capacity to create jobs, its contribution to income transfer mechanisms and its mitigating effect on regional economic disparities present significant opportunities, particularly for developing economies (Markandya et al., 2005). According to the World Travel and Tourism Council (WTTC, 2024), the global tourism sector is expected to contribute 10% to GDP in 2024 and reach a total economic size of \$11.1 trillion. This growth increases its impact on income distribution by ensuring that tourism revenues are not solely concentrated in high-income groups, but also reach small businesses, local producers and the workforce in the service sector. The sector provides a significant source of employment for low and middle-income groups, offering extensive job opportunities, particularly for women, young people and low-skilled labour. Furthermore, the tourism sector extends beyond service provision, impacting complementary sectors

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such as transportation, accommodation, construction and information technology, thereby broadening income generation processes (Koç, 2021: 245).

Studies examining the impact of tourism expenditure on income distribution have been extensively explored in the literature. These studies analyse the role of tourism in economic growth and income inequality from various perspectives, examining the spatial and regional dimensions of sectorial impacts (Shahbaz et al., 2019; Fang et al., 2020; Alam and Paramati, 2016; Raza and Shah, 2017; Nguyen et al., 2021; Huyugüzel Kışla and Berke, 2022; Incera and Fernández, 2015). Research investigating the effects of tourism on economic growth and income inequality (Raza and Shah, 2017; Chi, 2020; Zhang and Zhang, 2021) often focuses on limited analyses at the country or regional level, neglecting economic interactions between neighbouring regions. This omission prevents a full understanding of the regional diffusion effects of tourism expenditure on income distribution.

Studies on the relationship between tourism and income inequality are largely shaped by two main perspectives. One group of research argues that tourism's contribution to economic growth and well-being reduces income inequality (Incera and Fernández 2015; Shahbaz et al. 2019; Nguyen et al. 2021; Huyugüzel Kışla and Berke 2022). For example, Shahbaz et al. (2019) found in their analysis of the Malaysian context that tourism revenue supports regional development and reduces income inequality. Similarly, Huyugüzel Kışla and Berke (2022) identified a reduction in income inequality due to tourism revenue in the Eurozone. However, other studies suggest that tourism does not always reduce income inequality and, in some cases, it can exacerbate regional disparities (Uzar and Eyuboğlu, 2019; Mahadevan and Suardi, 2019; Ghosh and Mitra, 2021). For instance, Lv (2019) found in their study of Chinese regions that tourism is a factor that increases income inequality. Zhang (2021) determined that the tourism sector in rural China has increased income inequality. Adeniyi et al. (2023) also found that tourism development in 45 African countries generally has a negative impact on income inequality. These findings indicate that the economic benefits of the tourism sector are not distributed equally and capital-intensive tourism investments in some regions may increase income inequality. However, most of these studies do not directly address the spatial dependence factor.

The spatial dependence perspective provides a crucial framework for a more comprehensive analysis of tourism's economic effects at the regional level (Álvarez-Díaz et al., 2016; Costantino et al., 2023). While some studies indirectly address spatial factors, there is a limited number of studies directly evaluating the spatial dependence and diffusion effects of tourism expenditure on income distribution. For example, Álvarez-Díaz et al. (2016) demonstrated the critical role of examining tourism flows in Spain within a spatial dependence framework for regional tourism revenues. Zhang and Zhang (2021) identified a relationship between transportation infrastructure and tourism in China that is sensitive to spatial factors. However, these studies do not directly analyse the spatial effects of tourism expenditure on income inequality.

The findings in the literature also suggest that the effects of tourism on income inequality vary depending on factors such as a country's level of economic development, the size of the tourism sector and regional structures (Raza and Shah, 2017; Fang et al., 2020; Ghosh and Mitra, 2021). For example, Chi (2020) found an N-shaped Kuznets Curve relationship between tourism revenue and income inequality in developing countries, where tourism revenue initially increases inequality, then decreases, but may worsen again over time. Shahbaz et al. (2019) found in their study of Malaysia that tourism revenue reduced inequality and improved income distribution. Therefore, it appears that the relationship between tourism and income inequality is not unidirectional and can vary depending on a country's economic and structural conditions (Lv, 2019; Ghosh and Mitra, 2021; Jiaqun et al., 2024).

Therefore, this study aims to fill the theoretical gap in the existing literature by evaluating the effects of tourism expenditure on income inequality using spatial panel data analysis. Specifically, it focuses on how tourism's indirect effects on neighbouring regions shape the local economy. Considering the spatial dependence factor when examining tourism's impact on income distribution will allow for a more comprehensive regional perspective on tourism policies. Employing a spatial panel data analysis method, which incorporates spatial dependence, will analyse the multifaceted relationship between tourism expenditure and income inequality in EU member countries from 2014 to 2022. The analysis will consider both cross-sectional and time series characteristics. In addition to tourism expenditure, the study will include food production index as a control variable, testing its potential to reduce income inequality and examining whether the unseen income inequality-reducing effects in one country might have a spatially dependent effect on increasing income inequality in neighbouring countries. The study proposes three hypotheses:

H1: Tourism expenditure reduces income inequality.

H2: The food production index reduces income inequality.

H3: There is spatial dependence between tourism expenditure and food production index variables on income inequality across units.

### **Conceptual Framework**

There are various approaches and results in the literature regarding the impact of tourism on income distribution. Studies generally emphasize that tourism supports economic growth, increases employment and has the potential to reduce income inequalities. For example, Kim and Jang (2006) analysed the contribution of tourism to economic growth in developing countries and discussed the direct income-providing effect of tourism on local economies. However, the impact of this effect on income distribution varies depending on the integration of tourism into local economies, income levels and redistribution mechanisms for tourism revenues.

Spatial econometric approaches have added a new dimension to these discussions. Anselin (1988) emphasized the necessity of considering spatial dependencies in economic analyses and pointed out that this method is an important tool, especially when studying interactions between regions. LeSage and Pace (2009) stated that spatial panel data analyses can more accurately measure the effects on variables such as income distribution that exhibit spatial dependency. In this context, studies in the literature show that spatial effects play a critical role in better understanding the impact of tourism expenditures on income distribution.

In this regard, literature studies on the impact of tourism revenues on income inequality reveal the complexity of this relationship and the roles of different variables. While previous works (Kuznets, 1955) highlighted that tourism supports economic growth and increases welfare, it was noted that the reduction effect of this growth on income inequality depends on the context and the effectiveness of policies. Within this framework, econometric studies that also consider spatial dependencies provide an opportunity to examine the impact of tourism expenditures on income inequality more comprehensively.

Spatial econometric studies stand out as an important tool in understanding the regional effects of tourism on income distribution. Akarsu (2021), in a study covering 34 countries from Europe, the Balkans and Anatolia, confirmed the Tourism-Induced Kuznets Curve hypothesis, showing that tourism can positively affect income inequality only after a certain threshold. The study also draws attention to the inequality-increasing effects of increases in per capita income, urbanization rate and labour force participation rates.

Similarly, Costantino et al. (2023) used a dynamic spatial panel data model to examine tourism flows among 110 regions in Italy and 23 European countries. This study highlights that cooperation between neighbouring regions plays a critical role in enhancing the attractiveness of local tourism clusters and emphasizes the significant impact of spatial characteristics on tourism mobility.

Álvarez-Díaz et al. (2016) analysed the spatial dependency of tourism within regions of Spain using gravity models and Spatial Autoregressive (SAR) models. The study revealed the strong effects of income level, destination characteristics and distance on tourism and showed that spatial dependency between regions is important in understanding tourism flows.

Ursu and Benedek (2024) explored local income inequalities in Romania through a spatial statistical approach. The study uses annual per capita income data from 2007 to 2021 at the county level (TAUs), with a particular focus on metropolitan areas such as Bucharest–Ilfov, the West, Central, and North-West regions. The methodology involves Moran's I spatial autocorrelation analysis and Cluster and Outlier analysis using ArcGIS to detect regional income concentration patterns. Their findings reveal that high-income clusters are primarily located in metropolitan areas, while low-income clusters are more prevalent in other regions. The analysis shows a persistent spatial clustering of income levels across the country, with little evidence of improvement in low-income areas over time. The study contributes to the literature by highlighting the spatial persistence of income disparities and emphasizing the role of spatial structures in understanding regional inequality dynamics.

Table 1 presents the findings and results of various academic studies addressing the effects of tourism on income distribution. Research generally shows that tourism contributes to economic growth, but the impact of this growth on reducing income inequality depends on various factors.

**Table 1. Findings of Studies Examining the Relationship between Tourism and Income Inequality**

Paper	Data Period	Sample	Methodology	Key Findings
Lee (1996).	-	South Korea tourism industry	Input-output analysis, Lorenz curve, Gini coefficient	The tourism sector is moderately successful in income distribution.
Álvarez-Díaz et al. (2016)	2016	Regions in Spain	Spatial autoregressive (SAR) model	Spatial regional dependency is important in modelling regional tourism flows.
Lee (2011)	1990-2000	Regions in the United States that are dependent and non-dependent on tourism services	Analysis with US Census of Population and Housing data	Income inequality is higher in regions dependent on tourism services than in other regions.
Incera and Fernández (2015)	2000-2010	Regions of Spain	Input-output analysis	The impact of tourism on income distribution in regional economies is positive.
Alam and Paramati (2016)	1991-2012	49 developing countries	Balanced panel data analysis	There is a long-term equilibrium relationship between tourism and income inequality.
Raza and Shah (2017)	1995-2015	43 countries	CIPS unit root test, Bootstrap and Pedroni cointegration, Heterogeneous panel causality	A long-term relationship has been found between tourism revenues and income inequality.
Jodilistyo (2019)	2010–2017	33 provinces in Indonesia	Spatial econometric approach	Public expenditure on the tourism sector was not found to have a significant impact on output and employment.
Nguyen and Funck (2019)	-	32 tourism stakeholders in Yakushima, Japan	Semi-structured interviews	While tourism contributes to Yakushima's economy, it can create income inequality between villages.
Shahbaz et al. (2019)	1991q1-2017q4	Malaysian economy	Zivot and Andrews unit root test, Bayer–Hanck cointegration test and causality analysis	Tourism (tourist arrivals and tourism revenues) improves income distribution by reducing income inequality.
Lv (2019)	1995-2015	Regions of China	Panel data analysis	Tourism development increases regional income inequality.
Mahadevan and Suardi (2019)	1995-2012	13 tourism destinations	Panel cointegration and causality analysis	Tourism growth can reduce income inequality, but its impact varies by country.
Uzar and Eyuboglu (2019)	1974-2015	Türkiye	Autoregressive Distributed Lag (ARDL) test	There is a long-term relationship between tourism and income inequality.
Fang et al. (2020)	1991-2015	20 developed and 80 developing countries	Panel data analysis	While tourism reduces inequality in developed countries, it can increase it in developing countries.
Chi (2020)	1995-2015	Developed and developing countries	Dynamic panel cointegration approach	An N-shaped Kuznets Curve relationship has been found between tourism revenues and income inequality in developing countries.
Chokethaworn et al. (2020)	2013–2019	7 ASEAN countries (Brunei, Indonesia,	Bayesian panel regression: LASSO validation, spatial	The spatial lag regression model was determined to be the most appropriate model for

		Malaysia, Singapore, Thailand, Vietnam)	lag, pooled and spatial error regression models	assessing the spatial effects affecting international tourist arrivals in ASEAN countries.
Ghosh and Mitra (2021)	1991-2017	50 countries	Panel data analysis	The relationship between tourism and income inequality varies depending on the country's income level.
Arı (2021)	1988-2018	Türkiye	Hacker and Hatemi-J (2006) Bootstrap Causality Test	There is no long-term relationship between tourism and income inequality.
Zeng and Wang (2021)	1998-2018	31 provinces in China	Panel spatial Durbin model (SDM)	An increase in domestic tourism income in neighbouring provinces leads to a decrease in the urban-rural income inequality of the local province.
Zhang et al. (2021)	2008-2018	248 cities in China	Panel data analysis	Tourism development is effective in reducing the urban-rural income gap and provides balance in regional development.
Zhao and Zhang (2021)	-	Different regions of China	Spatiotemporal autoregressive model in the context of conditional convergence.	Tourism development contributes significantly to reducing regional inequality.
Zhang (2021)	-	County-level data in rural areas of China	Rural Gini coefficients and Theil indices were calculated using income survey data and the mediator effect model was applied.	Tourism (total, domestic tourism and inbound tourists) is a factor that increases rural income inequality.
Akarsu (2021)	2006-2019	34 countries from Europe, the Balkans and Anatolia	Spatial panel data analysis	The tourism-induced Kuznets Curve hypothesis is confirmed; tourism contributes positively to income equality only after a certain threshold.
Nguyen et al. (2021)	1996-2016	94 countries	Panel data analysis	The impact of tourism on income inequality depends on the country's level of economic development and the share of tourism revenues in GDP.
Zhang and Zhang (2021)	2000-2018	Transport infrastructure and tourism data in China	Panel data analysis and Granger causality test	Tourism significantly impacts income inequality in China.
Huyugüzel Huyugüzel Kışla and Berke (2022)	2002-2016	Eurozone (19 countries)	Panel data analysis	Tourism revenues have had a reducing effect on income inequality in the Eurozone.
Asongu et al. (2022)	2010-2014	Sub-Saharan African countries	Generalized Method of Moments (GMM)	It has been determined that in order for tourism to increase financial access, certain inequality levels (Atkinson index, Palma ratio, Gini coefficient) should not be exceeded.
De Santana Ribeiro et al. (2022)	-	Brazil's five macroregions	Regional input-output model	Domestic tourism expenditure has been effective in reducing regional inequality,

				particularly in the northeast of Brazil.
Ngoc and Hai (2022)	1978-2019	Singapore	Wavelet techniques	Tourism development increases income inequality at medium and high frequencies.
Ofori et al. (2022)	1996-2020	48 African countries	Generalised Method of Moments (GMM)	Tourism development and good governance reduce income inequality separately.
Sudsawasdi et al. (2022)	-	Thailand's first and second tier tourism regions	Computable General Equilibrium (CGE) model	While increasing domestic and international tourism demand in first-tier tourism regions reduces the poverty rate, it increases national income inequality.
Oğuz (2022)	1997-2022	Türkiye	ARDL bounds test	While tourist numbers reduce income inequality in the long run, transportation infrastructure increases it in the long run
Alili et al. (2022)	1995-2018	50 developed and developing countries with the highest tourism revenue rates	Cointegration and Granger causality tests	The impact of tourism revenues on income inequality varies in the long term according to different countries and sector development stages.
Adeniyi et al. (2023)	1995-2019	45 African Countries	Panel Vector Autoregression Analysis	Tourism development generally has an increasing effect on income inequality.
Xuanming et al. (2023)	1996-2020	45 African Countries	Quantile regression analysis	Tourism development can improve social welfare by increasing the human development index.
Kwabi et al. (2023)	1996-2020	88 Countries	Panel data analysis	In developing countries, media freedom plays a critical role in tourism development and reducing income inequality.
Costantino et al. (2023)	2004-2017	110 Italian regions, 23 European countries	Dynamic spatial panel data model	Collaboration between neighbouring regions is critical to increasing the attractiveness of local clusters.
Jiaqun et al. (2024)	2000-2020	23 Sub-Saharan African countries	Panel Corrected Standard Errors (PCSE) method	Tourism and democracy, taken separately, increase income inequality.
Xuanming et al. (2024)	2000-2020	37 Sub-Saharan African countries	Panel Corrected Standard Errors (PCSE) and Generalised Method of Moments (GMM)	Tourism and economic freedom, taken separately, worsen income distribution.
Menegaki and Tugcu (2024).	1995-2018	Developed and developing countries	Dynamic GMM approach	The direct contribution of tourism has been identified as the most effective factor in reducing income inequality.
Dossou and Berhe (2024)	1996-2020	30 African countries	Panel Corrected Standard Errors (PCSE); Atkinson index and Palma ratio	Tourism can contribute to reducing income inequality, but this effect depends on the type of tourism.

Source: Compiled by the author.

The existing literature addressing the impact of tourism on income inequality indicates that this relationship is contextual and variable. Empirical studies conducted using various methodologies have comprehensively examined the effects of tourism on regional economies, income distribution and socioeconomic balances.

Firstly, studies on the impact of tourism on regional income distribution reveal that the growth of the tourism sector plays a role in reducing income inequality in certain regions while increasing it in others. For example, the input-output analysis conducted by Incera and Fernández (2015) indicates that tourism positively contributes to regional economies in Spain, while Lee (2011) found that regions dependent on tourism services in the United States have higher income inequality compared to non-dependent regions. Similarly, a panel data analysis conducted by Zhang et al. (2021) in China shows that tourism reduces urban-rural income disparities and contributes to achieving balance in regional development.

Secondly, the long-term relationship between tourism and income inequality has been examined using panel data analyses and cointegration tests. For instance, a study by Alam and Paramati (2016) on 49 developing countries reveals a long-term equilibrium relationship between tourism and income inequality. Similarly, bootstrap and Pedroni cointegration tests conducted by Raza and Shah (2017) on 43 countries show that a long-term relationship exists between tourism revenues and income inequality. However, in a study conducted by Ari (2021) on Turkey, using the Hacker and Hatemi-J (2006) Bootstrap Causality Test, it was determined that there is no long-term relationship between tourism and income inequality. Akarsu (2021) confirmed the tourism-related Kuznets Curve hypothesis in a spatial panel data analysis covering 34 countries from Europe, the Balkans and Anatolia, stating that tourism only positively contributes to income equality after a certain threshold.

Thirdly, the effects of tourism on local economies and policy orientations have been analysed using spatial regression and ARDL models. In a study conducted by Uzar and Eyuboğlu (2019) for Turkey, the existence of a long-term relationship between tourism and income inequality was confirmed, but it was emphasized that the inequality-reducing effect of tourism depends on policy design. A study by Fang et al. (2020) indicates that tourism may have a reducing effect on inequality in developed countries while potentially increasing it in developing countries. Similarly, Nguyen and Funck (2019) revealed through semi-structured interviews conducted in Japan's Yakushima region that tourism could increase income disparities in rural areas.

Fourthly, the impact of tourism on socioeconomic disparities can yield different results in rural and urban areas. A study conducted by Zhang (2021) in China found that tourism is a factor increasing income inequality in rural areas. In contrast, Zhao and Zhang (2021) found in their spatial-temporal autoregressive model analysis on the Philippines that tourism development reduces regional inequality. A dynamic panel cointegration study by Chi (2020) identified an N-shaped Kuznets Curve relationship between tourism revenues and income inequality in developing countries. Similarly, Zeng and Wang (2021) stated that domestic tourism generally reduces urban-rural income inequality in China but shows regional differences. According to the study, an increase in the number of tourists in neighbouring provinces reduces inequality in Western China while increasing it in Eastern China; the effect is negligible in Central China. Additionally, it was found that the increase in tourism expenditures deepens income disparities in all regions.

Finally, the relationship between tourism and economic freedom and financial access can yield different results in developing countries. Asongu et al. (2022) revealed in their Generalized Method of Moments (GMM) analysis on Sub-Saharan African countries that certain levels of inequality should not be exceeded for tourism to enhance financial access. Similarly, a quantile regression analysis conducted by Xuanming et al. (2023) on 45 African countries shows that tourism improves social welfare by increasing the human development index. Likewise, a Generalized Method of Moments (GMM) analysis conducted by Ofori et al. (2022) on 48 African countries indicated that when tourism is addressed with good governance, it can reduce income inequality, but this may not be possible under conditions of poor governance.

These findings indicate that the impact of tourism on income inequality depends on countries' levels of economic development, governance quality, regional dynamics and the effectiveness of tourism policies. However, while these studies address the impact of tourism expenditures on income inequality from various perspectives, they may include approaches that overlook spatial dependence and regional heterogeneity. Particularly, when analysing the impact of tourism expenditures on income distribution in the context of the 27 EU countries, the differing dynamics of tourism at local and regional levels have not been sufficiently considered. The distribution of tourism revenues within a country is shaped not only by macroeconomic

indicators but also by factors such as regional policies, infrastructure investments and social capital levels. Therefore, the existing literature contains gaps in providing a more holistic framework on how tourism expenditures direct income inequality. In this context, taking spatial dependence into account while examining the impact of tourism on income distribution will provide a better understanding of regional differences and offer policymakers the opportunity to develop more effective strategies.

**Methodology**

Tourism is a sector that plays an important role in economic development and attracts attention with its income generation potential. Thanks to these income generation effects, it can be said that it acts as a locomotive in terms of economic growth and development for countries with touristic resources. In this context, tourism has two important functions in reducing social inequalities. First, tourism plays a critical role in eliminating regional differences between different regions in a destination. Second, the effective distribution of economic gains provided by tourism among stakeholders in the destination increases the potential to reduce inequalities in the region by providing fair contributions to the existing income distribution in society (Şengel and Zengin, 2024: 239). All these reveal the interaction between tourism and economic development in the context of income generation effect and elimination of inequalities. The study examines the impact of tourism expenditures on income distribution in the member countries of the European Union (EU27). Here, while the data set of the gini index and tourism expenditures is available until 2023, the data set of the food production index is available until 2022. Therefore, the time series was created as a data set covering the years 2014-2022 and the obtained data were analysed in the STATA 14.2 program. Income distribution was measured by the gini index, and the logarithm of this index (lg) was used as the dependent variable of the study. The independent variable of the study was defined as the logarithm of tourism expenditures in the country (logexp). You can see these variables in Table 2.

**Table 2. Model Variables**

<b>Variables</b>	<b>Symbol</b>	<b>Source</b>
<b>Gini index</b>	lg	Eurostat
<b>Tourism expenditures made in the country</b>	lexp	Eurostat
<b>Food production indeks</b>	lfpi	Worldbank

Spatial econometrics is a discipline that analyses location-specific effects by considering spatial dependence and spatial heterogeneity, unlike traditional econometrics. LeSage (1999). It is emphasized that these two basic issues must be taken into account in analyses made with spatial data. Anselin (1988, 2001, 2009) stated that spatial dependence violates Gauss-Markov assumptions and causes traditional econometric methods to be insufficient and revealed the necessity of alternative estimation methods. Among the basic principles of spatial econometrics put forward by Paelinck and Klaassen (1979) are spatial independence, asymmetry, the effect of distances, differences in ex-ante and ex-post interaction and modelling topological structures. Spatial dependence is modelled through spatial weight matrices (W) that take into account neighbourhood relations and is examined through spatially lagged dependent variables, explanatory variables, or error terms. In this context, Spatial Lag Model, Spatial Cross Regressive Model and Spatial Error Model are prominent model types (Anselin, 2009).

Considering spatial dependence in regional income dynamics and growth analyses is of critical importance in understanding the impact of the economic characteristics of neighbouring regions on the economic performance of a region (LeSage and Fisher, 2008). Spatial growth models show that regional income levels depend not only on internal factors but also on the spatial connection structure and the economic conditions of neighbouring regions. In this context, spatial econometric methods and spatial panel data models offer an important analytical framework for examining the effects of R&D expenditures on gross domestic product. Studies on Germany show that economic activities are characterized by spatial dependence and that economic performance in a region has a significant impact on neighbouring regions (Anselin, 1988). Therefore, spatial weight matrices and spatial econometrics-specific methods enable strong and consistent estimates to be obtained in regional development and income distribution analyses.

In spatial panel data analysis, some steps are taken to test the existence of spatial dependence for an error model or a lag model or a model in which the effects of both are present. The starting function of this model (Elhorst, 2017) can be seen in Equation 1.

$$y_t = \rho W y_t + X_t \beta + W X_t \theta + \mu + a_{t|N} + \mu_t, \quad \mu_t = \lambda W \mu_t + \varepsilon_t \quad (1)$$

In this equation,  $y_t$  shows the explained variable of the research.  $\rho W y_t$ , is an endogenous variable showing that the spatial relationship explains the dependent variable with a lag.  $X_t \beta$  represents the independent variable that shows what kind of effect it has on the dependent variable.  $W X_t \theta$  is a variable that shows the existence of cross-relationships, especially in cases where the error coefficient and lag coefficient lose their meaning. The variable  $\lambda W \mu_t$  shows that in the spatial dependence assumption, the dependent variable affects it with the error coefficient. Here, in model determination,  $\rho, \lambda, \theta$  parameters are used in line with their statistical significance levels according to the null-hypothesis significance level (Oğuztürk and Koç, 2023). The models that will occur according to the statistical meanings of the parameters are shown in Table 3.

First, the existence of a unit effect will be estimated in the analysis. To achieve that, the spatial weight matrix (W) will be created based on neighbourhood relationships, where neighbouring countries are assigned a value of 1 and non-neighbouring countries are assigned a value of 0. Next, the Breusch-Pagan LM, Breusch-Pagan ALM, Sosa Escudero Yoon LM and Sosa Escudero Yoon ALM tests will be conducted to test the null hypothesis of no fixed effect. After accepting the fixed effects, a systematic test will be conducted for the hypothesis of no difference between fixed and random effects using the Hausman test. If the coefficient of this test is significant at the 10%, 5% and 1% levels, fixed effects will be included; otherwise, random effects will be incorporated into the model by accepting the null hypothesis. Based on the identified effects, more robust tests such as LM Error ( $\lambda$ ) and resilient LM Error tests, as well as LM Lag ( $\rho$ ) and resilient LM Lag tests, will be used to determine the error model. Additionally, spatial dependence will be checked with Moran I and Getis-Ords GO tests to ensure model consistency. The resulting equations derived from these tests are presented in Table 3.

**Table 3. Spatial Models**

Models	Formula	Criterion
Spatial Panel Durbin Model (SDM)	$y_t = a_{t N} + \rho W y_t + X_t \beta + W X_t \theta + \varepsilon_t$	$\lambda = 0$
General Spatial Panel Model (SAC)	$y_t = a_{t N} + \rho W y_t + X_t \beta + \mu_t,$ $\mu_t = \lambda W \mu_t + \varepsilon_t$	$\theta = 0$
Spatial Panel Lag Model (SAR)	$y_t = a_{t N} + \rho W y_t + X_t \beta + \varepsilon_t$	$\lambda = \theta = 0$
Spatial Panel Error Model (SEM)	$y_t = a_{t N} + X_t \beta + \mu_t,$ $\mu_t = \lambda W \mu_t + \varepsilon_t$	$\rho = \theta = 0$
Spatial Panel Durbin Error Model (SDEM)	$y_t = a_{t N} + X_t \beta + \mu_t,$ $\mu_t = \lambda W \mu_t + \varepsilon_t$	$\rho = 0$

Source: Compiled from Yerdelen Tatoğlu (2020).

Current studies vary methodologically. Some studies are based on traditional panel data analysis (Nguyen et al., 2021); others examine regional interactions using spatial econometric approaches (Álvarez-Díaz et al., 2016; Costantino et al. 2023). However, studies that do not take into account spatial dependence cannot adequately examine the indirect effects of tourism expenditures on neighbouring regions.

At this point, the methodological contribution of our study to the literature is the systematic evaluation of regional dependencies using spatial panel data analysis. Spatial panel data analysis allows to examine the effects of tourism expenditures on income inequality not only in terms of the local economy, but also through its interaction with nearby regions.

**Results**

Firstly, in order to measure the impact of tourism expenditure on income distribution more accurately, the selection of control variables plays a critical role. These variables allow the model to account for various economic, social and demographic factors. Therefore, the variables of real per capita income and international tourist numbers were initially included as control variables in the model and tests were conducted using different combinations of these variables based on the chosen methods. However, in the tests conducted for these two potential control variables, no statistically significant results were found at the 10%, 5% and 1% significance levels regarding spatial dependence or the coefficients in the model. Subsequently, the food production index, a variable related to the food sector, which is impacted by or foundational to the tourism sector, was added to the model. As a result of this, consistency was observed.

After the model variables were determined, the spatial weight matrix for the EU27 member countries was created based on neighbourhood relationships and used in the model's analyses. Additionally, due to the absence of a land border between Cyprus, Malta and the Republic of Ireland and any other EU member state, these countries were considered neighbours to their closest neighbouring countries—Cyprus with Greece, Malta with Italy and the Republic of Ireland with France—in order to avoid calculation errors in the weight matrix. Following this, the null hypothesis of no fixed effects was tested in the model. As shown in Table 4, the statistics for all tests were significant at the 1% level. Therefore, the null hypothesis was rejected and the presence of fixed effects was considered statistically significant.

**Table 4. Unit Impact Estimator**

Tests	sdm	sac
<b>Breusch-Pagan LM</b>	726,9371	780,4363
<b>Breusch-Pagan LM Probability</b>	4,2e-160	9,7e-172
<b>Breusch-Pagan ALM</b>	496,8459	538,0794
<b>Breusch-Pagan ALM Probability</b>	4,6e-110	4,9e-119
<b>Sosa Escudero Yoon LM</b>	269,6177	279,3629
<b>Sosa Escudero Yoon LM Probability</b>	2,08e-07	1,25e-07
<b>Sosa Escudero Yoon ALM</b>	222,9004	231,9654
<b>Sosa Escudero Yoon ALM Probability</b>	2,34e-06	1,46e-06

With the acceptance of the presence of spatial effects in the model, the null hypothesis that there is no systematic difference between the fixed effects and random effects of the model was tested using the Hausman test on the Spatial Durbin Model (SDM) and the Spatial Autoregressive Model (SAR). According to the calculated values in Table 5, the SDM accepts the null hypothesis, while the SAR does not. In other words, according to the SDM test, random effects should be included in the model and according to the SAR test, fixed effects should be included.

To resolve the ambiguity in the Hausman test, i.e., to determine whether the model should have random or fixed effects, the significance of the spatial dependence hypothesis in the model on these effects was investigated. Additionally, it was tested whether the spatial dependence coefficient in the model affects the dependent variable, the lagged (lag,  $\rho$ ) variable, or the error (error,  $\lambda$ ) coefficient. The results are shown in Table 5.

**Table 5. Hausman Test**

Test	sdmre	sarre
<b>Hausman</b>	0,3432694	9,234794
<b>Hausman Probability</b>	0,9868524	0,0263267

In Table 6, spatial dependence over fixed and random effects was tested using the Moran I and Getis-Ords Go tests. Here, it was found that both variables are consistent with random effects at the 1% significance level. The fact that the Moran I test statistic value is zero also indicates that the values are not spatially clustered. The positive value of the Getis-Ords Go test statistic took a positive value in the opposite direction compared to the Moran I test. Here, the result is that the values are clustered. In other words, according to the Moran I test, in a near-zero relationship, the values of neighbouring regions are in opposite directions. In contrast, according to the Getis-Ords Go test, global spatial dependence contains high clustering.

**Table 6. Model Selection Estimator**

Tests	Fixed Effects		Random Effects	
	Statistic	Probability	Statistic	Probability
<b>GLOBAL Moran MI</b>	-0,0699	0,2033	-0,146	0,0061
<b>GLOBAL Getis-Ords GO</b>	0,2071	0,2033	0,4325	0,0061
<b>LM Error (Burrige)</b>	1,3681	0,2421	5,9688	0,0146
<b>LM Error (Robust)</b>	1,3685	0,2421	5,9694	0,0146

<b>LM Lag (Anselin)</b>	0,0000	0,9992	0,0002	0,9895
<b>LM Lag (Robust)</b>	0,0004	0,9838	0,0008	0,9780
<b>LM SAC (LMErr+LMLag_R)</b>	1,3685	0,5045	5,9696	0,0506

According to Table 6, the coefficients of the LM error (Burrige) and robust LM error (Robust) statistics are considered significant at the 5% significance level, while the LM lag (Anselin) and robust LM lag (Robust) statistical values are not considered significant. This indicates that the error coefficient is significant in the model and that the acceptance of the SEM model is consistent.

Consequently, it has been accepted that more consistent findings will be obtained with the Random Effects Spatial Error Panel Data Model (SEM) for the model in which the effect of tourism expenditures on income distribution will be examined. The analysis performed is shown in Table 7.

**Table 7. Random Effects Spatial Panel Data Model Analysis Report**

	<b>Statistic</b>	<b>Probability</b>
<b>lexp</b>	-0,0251643	0,000
<b>lfpi</b>	-0,0673798	0,081
<b>_cons</b>	1,835175	0,000
<b>λ</b>	0,171699	0,033
<b>lnφ</b>	2,432759	0,000
<b>σ<sup>2</sup></b>	0,0002418	0,000
<b>R<sup>2</sup></b>		0,0722
<b>Log-likelihood</b>		603,0865

The analysis was conducted using the Spatial Error Model (SEM) with random effects. The relationship between the dependent variable (*lg*) and the independent variables (*lexp* and *fpi*) was examined. The dataset comprises 243 observations from 27 European member countries over the period 2014–2022. The model explains 7% of the variation, as indicated by the determinant value. The logarithmic transformation used to assess the overall fit of the model demonstrates its validity, thereby confirming that the model appropriately accounts for spatial dependence.

Based on the analysis of the specified SEM model, the formulation of the model at 10%, 5% and 1% significance levels is as follows:

$$lg_t = 1,835175 - 0,0251643 \text{ lexp} - 0,0673798 \text{ lfpi} + \mu_t, \mu_t = 0,171699 W\mu_t + \epsilon_t \quad (2)$$

Equation 2, when solved for the  $\mu$  error-dependent variable, yields the following new function:

$$lg_t = 1,835175 - 0,0251643 \text{ lexp} - 0,0673798 \text{ lfpi} + (I - 0,171699 W)^{-1}\epsilon_t \quad (3)$$

At the 1%, 5% and 10% significance levels, the null hypothesis that the independent variables do not affect the dependent variable was rejected and the effects were found to be statistically significant. Specifically, a one percent increase in the *lexp* variable leads to a 0.025 percent decrease in the dependent variable *lg*. Similarly, *lfpi* explains the decrease of the dependent variable *lg* by 0.067 percent. Furthermore, the spatial dependence coefficient  $\lambda$  was accepted as significant at the 5% significance level, with a value of 0.17. This indicates a positive spatial relationship among the error terms. Therefore, it can be stated that unexplained effects in one country have similar effects in neighbouring countries. Moreover, the error term variance  $\sigma^2$  is significant at the 1% level, indicating that the unexplained variation in the model is very low. The random effects parameter  $\ln\phi$  was accepted as significant at the 5% level, confirming the inclusion of random effects at the group level in the model. In other words, it is accepted that random effects make the estimations more consistent by taking into account the variations between groups.

The empirical findings of the study provide clear evidence supporting the proposed hypotheses. Firstly, regarding  $H_1$ , the coefficient for tourism expenditure is negative and statistically significant at the 1% level, indicating that higher tourism expenditure is associated with a reduction in income inequality among the EU27 countries. This result aligns with the theoretical expectation that tourism can foster more inclusive economic growth by generating employment opportunities and increasing income levels in less developed regions.

Secondly, in line with H<sub>2</sub>, the food production index also exhibits a negative relationship with income inequality, albeit with a lower level of statistical significance (approximately 8%). This suggests that improvements in the food production sector contribute to narrowing income disparities, potentially through enhanced rural economic activities and support for local communities, which are often integral to the tourism industry.

Thirdly, the results confirm H<sub>3</sub> by revealing significant spatial dependence in the error terms of the model, as indicated by the positive and significant spatial error coefficient ( $\lambda = 0.171$ ,  $p < 0.05$ ). This implies that unobserved factors influencing income inequality in one country tend to spill over to neighboring countries, emphasizing the importance of accounting for spatial interactions in the analysis of income distribution. The spatial error model used effectively captures this spatial autocorrelation, validating the presence of spatial interdependencies in the data.

Collectively, these findings underscore the relevance of both tourism expenditure and food production in addressing income inequality, while highlighting the spatial dimension of economic phenomena within the European Union.

## Conclusion

The paper investigated the influence of tourism expenditures on income distribution, employing a spatial panel data analysis framework and incorporating a range of relevant control variables. The findings have suggested that tourism expenditures possess the potential to improve income inequality, while also revealing that the magnitude of these effects is contingent upon the specific economic and sectorial characteristics of individual countries. Rigorous selection of control variables and a model design that explicitly accounts for spatial interdependencies are crucial for ensuring the reliability and validity of such analyses.

This study analysed the impact of tourism expenditures on income distribution with a spatial error panel data model (SEM), demonstrating that tourism revenues have the potential to reduce regional disparities. Model results show that tourism expenditures have a negative and significant relationship with income inequality ( $\beta = -0.025$ ,  $p < 0.01$ ), indicating that the sector can reduce inequalities by providing income transfer for low-income groups. Furthermore, the food production index (lfpi) also has a statistically significant effect on income distribution ( $\beta = -0.067$ ,  $p < 0.10$ ); it strengthens the income balance by increasing economic activity in rural areas. The coefficient of spatial dependence ( $\lambda = 0.171$ ,  $p < 0.05$ ) is positive and significant, indicating that the increase of tourism expenditure in one country can have similar effects in neighbouring countries and the existence of a spatial impact on income inequality. The low error term variance of the model ( $\sigma^2 = 0.00024$ ,  $p < 0.01$ ) and the fact that the incidental effects were significant ( $\ln\phi$ ,  $p < 0.05$ ) support the reliability of the analysis results. As a result, the positive effects of tourism expenditure on income distribution take place through both direct and indirect mechanisms, playing a complementary role in reducing income disparities, in particular through strengthening the rural economy.

The coefficient of spatial dependence is a positive and significant value, indicating that the error terms positively influence each other in spatial units. This shows that unexplained effects in one country can have similar effects on neighbouring countries. In other words, the significant impact of tourism expenditures coming to the country on income distribution indicates the existence of a spillover effect. For example, the growth of tourism expenditure in Germany may not only reduce income inequality within the country but also increase tourism receipts in the neighbouring countries of the Netherlands and Belgium through the effect of spatial dependence ( $\lambda = 0.171$ ,  $p < 0.05$ ), similarly contributing to the regional income balance. This situation can be explained as follows; Apart from the effects of tourism expenditures and the food production index, if there is a positive effect (error) in one country that is more than the expected effect, this effect can also have a positive effect in neighbouring countries.

## Discussion

This study tested three main hypotheses: (H1) tourism expenditure reduces income inequality, (H2) the food production index reduces income inequality, and (H3) there is spatial dependence between tourism expenditure and the food production index variables on income inequality across countries. The empirical results provide robust support for these hypotheses within the context of EU27 countries between 2014 and 2022.

Consistent with H1, tourism expenditure was found to have a statistically significant negative effect on income inequality, indicating that increased spending in the tourism sector contributes to a more equitable distribution

of income. This finding highlights the potential of tourism to act as an inclusive growth driver by creating employment opportunities and stimulating economic activities in diverse regions. Regarding H2, the food production index also exhibited a negative association with income inequality, albeit with marginal significance. This suggests that the development of the food production sector, closely linked to tourism, plays a complementary role in reducing income disparities by supporting rural livelihoods and local economies.

Furthermore, the spatial error coefficient in the model was significant, confirming H3 and demonstrating the existence of positive spatial dependence among neighboring countries. This spatial spillover effect implies that unobserved shocks or structural factors influencing income inequality in one country tend to propagate to adjacent countries, reinforcing the necessity of accounting for spatial interactions in empirical analyses of income distribution. The application of a Random Effects Spatial Error Model effectively captured both spatial autocorrelation and heterogeneity across units, ensuring the robustness of the findings.

Ursu and Benedek (2024) investigate income inequality at the local level in Romania using spatial statistics such as Moran's I and cluster analysis. Their study highlights a clear spatial concentration of high-income clusters in metropolitan regions and persistent low-income clusters elsewhere, emphasizing the geographical rigidity of income inequality. Despite covering a long timeframe (2007–2021), their findings suggest that spatial inequality patterns in Romania remained largely unchanged, with little evidence of convergence in low-income areas. In contrast, this study focuses on cross-national income inequality within the EU27, incorporating tourism expenditures as a key explanatory variable. By applying a spatial error model with random effects, it quantifies not only the direct impact of tourism on inequality but also the spillover effects across neighboring countries. Unlike Ursu and Benedek, who do not include sector-specific drivers of inequality, this research identifies tourism and food production as significant contributors to reducing inequality, both within countries and across borders. While both studies confirm the presence of spatial dependence in income distribution, their methodological approaches and policy implications differ. Ursu and Benedek's work suggests that localized, structural inequalities require long-term, region-specific interventions. Meanwhile, the present study proposes that sectoral policies—particularly those related to tourism development—can actively reduce income inequality, especially when designed with a regional coordination perspective across the EU. Thus, this research extends the spatial inequality literature by integrating economic drivers and spatial interdependence, providing a more actionable framework for supranational policy design in the European context.

According to Table 1, the literature states that the effects of tourism on income inequality show regional differences. For example, Incera and Fernández (2015) found that tourism contributes positively to regional economies in Spain, while Lee (2011) stated that income inequality is higher in regions dependent on tourism services in the USA. Similarly, Zhang et al. (2021) emphasized that tourism in China is effective in reducing the urban-rural income gap and ensuring balance in regional development. This study contributes to these findings at an international level with a spatial panel data analysis specifically for the EU27 countries. The findings show that tourism expenditures have a reducing effect on income inequality ( $\beta = -0.025$ ,  $p < 0.01$ ) and that this effect can be felt similarly in neighboring countries through spatial spillover effects. Thus, it has been revealed that tourism has the potential to balance regional income inequalities not only within the country but also through cross-border interactions.

Alam and Paramati (2016) and Raza and Shah (2017) have shown that there is a cointegrated relationship between tourism and income inequality in long-term analyses. In contrast, Arı (2021) found that this relationship is not valid in the long run, specifically for Turkey. Akarsu (2021) confirmed the Kuznets curve hypothesis originating from tourism with a spatial panel data model and argued that tourism creates egalitarian effects only after a certain threshold. This study, with a spatial error panel data model covering the period 2014–2022, reveals that tourism expenditures can reduce income inequality directly and indirectly and finds this effect statistically significant at the 1% level. In addition, the significance of the spatial dependence coefficient ( $\lambda = 0.171$ ,  $p < 0.05$ ) supports that there are long-term effects not only within the country but also between neighboring countries over time. Thus, this study is one of the few empirical studies that confirms the long-term nature of the tourism-income inequality relationship along with spatial interactions.

Uzar and Eyuboğlu (2019) revealed a long-term relationship between tourism and income inequality in Turkey with the ARDL model, while Fang et al. (2020) stated that tourism can reduce inequality in developed countries while increasing it in developing countries. Nguyen and Funck (2019), in their qualitative analysis in Japan, emphasized that tourism can widen the income gaps between villages. The spatial error model (SEM) used in

this study directly incorporates spatial dependence and spillover effects into the model and analyzes not only the effects within the country but also the mutual effects of neighboring countries quantitatively. In this respect, the study has the potential to develop policy recommendations at both regional and transnational levels. In addition, the role of the tourism sector in reducing income inequality is supported by complementary variables such as food production, offering original contributions focused on policy.

Zhang (2021) and Zhao & Zhang (2021) have shown that the effects of tourism on increasing or decreasing inequality in rural areas depend on the context. Chi (2020) explained the tourism-income inequality relationship with an N-shaped Kuznets curve for developing countries. Zeng & Wang (2021) also found spatial effects that vary according to different regions at the provincial level in China. This study comparatively addresses these different contexts in the context of the EU27 countries and analyzes spatial inequality at both national and regional levels. In particular, showing that the food production index contributes positively to income distribution by supporting the rural economy is a valuable contribution to the literature on rural-urban differences. In this context, the study offers a two-way analysis based on both structural variables and spatial dependence, taking the emphasis on regional differences in the literature to a more systematic level.

Studies such as Asongu et al. (2022), Ofori et al. (2022), and Xuanming et al. (2023) have emphasized that the effect of tourism on income inequality depends on institutional factors such as the quality of governance, economic freedom, and social policies. This study, although it does not directly model these structural factors, analyzes the effect of tourism expenditures and food production on income distribution together with spatial interactions, offering a framework that takes indirect social and economic structures into account. The positive and significant findings of the spatial error terms in the model ( $\lambda = 0.171$ ) show that not only institutional structures but also geographical proximity and external effects play a decisive role in income inequality.

The study, generally, highlights two main findings when compared to the existing literature. First, the impact of tourism expenditures on income inequality varies between developed and developing countries. This finding aligns with research by Fang et al. (2020) and Ghosh and Mitra (2021). Fang et al. (2020) argue that tourism reduces income inequality in developed countries but may increase it in developing ones. Similarly, Ghosh and Mitra (2021) note that tourism can increase inequality in low- and middle-income countries while having a reducing effect in high-income nations. Likewise, Chi (2020) identified an N-shaped Kuznets Curve relationship between tourism revenue and income inequality in developing countries, whereas Akarsu (2021) found that tourism only positively contributes to income equality beyond a certain threshold. Additionally, Shahbaz et al. (2019) determined that tourism revenues have a long-term reducing effect on income inequality in Malaysia. This study further supports these findings by revealing that the inequality-reducing effect of tourism is strong within EU countries.

Secondly, the spatial dependency coefficient was found to be positive and significant, meaning that the effects of tourism expenditures on income inequality in one country are not confined to that country alone but also create spillover effects in neighbouring countries. This finding is consistent with the work of Costantino et al. (2023), which suggests that evaluating tourism flows within a spatial dependency framework reveals different outcomes and implies that regional inequalities can only be reduced through coordinated tourism policies. Similarly, Zhang and Zhang (2021) observed that the relationship between tourism and transportation infrastructure in China is sensitive to spatial variables, emphasizing the critical role of spatial dependency in tourism investments. Chokethaworn et al. (2020) demonstrated using spatial lag regression models for ASEAN countries that international tourist arrivals exhibit spatial dependency and should be considered in regional tourism policies. Zeng and Wang (2021) revealed that increases in domestic tourism revenue in neighbouring provinces in China reduce urban-rural income inequality, while Zhao and Zhang (2021) found that tourism development significantly reduces regional inequality in the Philippines.

The findings also indicate that the food production index has a reducing effect on income inequality. Growth in agricultural production creates employment opportunities and economic prospects in rural areas, leading to a more balanced income distribution. This result aligns with the study by De Santana Ribeiro et al. (2022) conducted in Brazil. Their studies show that strengthening the local agricultural sector can enhance the benefits of tourism, particularly in rural areas, thereby reducing income inequality.

### **Managerial Implications**

The obtained results provide important implications for policymakers and private sector actors in the tourism industry; considering the income-distribution-improving effect of tourism expenditures in EU countries,

tourism investments must be integrated into regional development strategies. Particularly, infrastructure investments in economically disadvantaged regions should be increased. The study shows that integrating agricultural production with the tourism sector can serve as an important tool in reducing income inequality. In this context, rural development policies should be designed in coordination with the tourism sector. The findings suggest that tourism policies should not only be developed within national boundaries but also at the regional level in a coordinated manner. Policies in EU countries that harmonize tourism strategies among neighbouring countries could ensure a more equitable distribution of tourism revenues. For the long-term reduction of income inequality, tourism investments should not only aim at short-term income generation but should also be planned within the framework of social and economic sustainability principles.

Based on these insights, policymakers are also encouraged to promote investments in tourism infrastructure and sustainable food production as part of integrated strategies aimed at mitigating income inequality. Additionally, fostering regional cooperation and cross-border initiatives may enhance the effectiveness of these policies by addressing common challenges and leveraging spatial interdependencies among EU member states.

### **Limitations of the Study and Recommendations for Future Research**

This study is limited to EU country data from 2014 to 2022. Future research could extend to include longer-term data and separately evaluate the effects of tourism expenditures on income inequality post the COVID-19 pandemic. Although inbound tourism expenditures were used in this study, future research could examine the impacts of different types of tourism, such as luxury tourism, ecotourism, or mass tourism, on income distribution. While this study analyzes spatial dependency at the country level, future micro-level analyses of spatial interactions between cities or regions should be considered. The food production index was used as a control variable in this study. Future studies could incorporate other macroeconomic variables, such as education, financial access, or foreign direct investment, into the model to comprehensively assess the results.

In conclusion, this study is one of the few that examines the impact of tourism expenditures on income distribution within the framework of spatial dependency, offering significant contributions to the development of regional tourism policies, support for rural development strategies and planning of tourism investments while considering spatial effects.

Future research should also consider expanding the scope of control variables and employing longer time series data to further elucidate the dynamic relationships at play. Investigations at sub-national levels could also uncover localized spatial patterns and offer more targeted policy implications for reducing income inequality within countries.

**Ethical Statement:** Ethics committee approval was not required for this study because it was based solely on archival research and document analysis and did not involve the collection of data from human participants or animals (e.g., surveys, interviews, focus group discussions, or experimental studies involving humans or animals).

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