Spatial dependence and the tourism-governance nexus in Vietnam: Insights from provincial-level data

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ABSTRACT

To simultaneously boost tourism revenue across provinces, the Vietnamese government emphasized strengthening the linkage and cooperation between regions. This study measures the effectiveness of that strategy, which is regional connectivity, or spatial spillover effect, on tourism revenue of 63 provinces in 2019 and 2022. In particular, the government also heavily invests in improving the quality of the administrative apparatus to improve the quality of locals' lives, one of the factors supporting tourism development for localities. Moreover, Vietnam is converging many factors to become a dynamic and fast-growing economy. Analysis of revenue growth is positively impacted by the economic environment, and government intervention to make adjustments is necessary in terms of industry policy and to fill the research gap for the academic side. Spatial regression models for both 2019 and 2022, with the participation of variables Tourists, Labor force, Enterprises, Income, Public service delivery, Environmental Governance, and E-Governance, all find spatial dependence between provinces, but in the negative direction. The factors that play an important role in raising tourism revenue are Tourists and Enterprises. The significance of variables related to the quality of life improvement policy was not found. In short, government interventions and efforts have not had a positive impact on Vietnam's tourism industry. Therefore, this study has discussed some policy implications for policymakers to connect the benefits of policies that the government develops for the tourism industry.

1. Introduction

The tourism industry worldwide and Vietnam, in particular, are carefully recovering after the Covid-19 pandemic's devastation (Burbano et al., 2022; Robina-Ramírez et al., 2021). From a different perspective, Covid-19 was a "necessary break" for the tourism sector to reflect on its shortcomings, has found new opportunities, and come up with sustainable development strategies in the new era (Seshadri et al., 2023; Shrestha & L'Espoir Decosta, 2021).

Numerous scientific conferences in Vietnam have aimed to quickly revive the tourism sector, focusing on a sustainable recovery. Key strategies included strengthening regional ties for provincial leaders to exchange experiences and support each other in overcoming losses. Discussions also covered restructuring the customer market and improving product quality. The government introduced policies to support localities in re-entering the market. Pre-pandemic, the tourism industry was growing rapidly, with a strong emphasis on regional connectivity. Post-pandemic, the recovery strategy prioritizes enhancing regional, local, and

economic ties. Localities must select unique products to integrate into a tourism value chain, allowing tourists to enjoy a seamless experience across multiple destinations.

In 2022, Vietnam's tourism rebounded post-pandemic with a surge in domestic tourists, surpassing 2019 levels, showcasing remarkable resilience. Provincial tourism revenues nearly recovered, with some surpassing 2019 figures. Google data showed Vietnam consistently ranked among the top global destinations for tourism information searches, with increased demand for accommodation. International tourists rated Vietnam highly for its easy entry procedures, safety, and popular attractions. This recovery reflects the collective effort of the tourism industry and government at all levels. The government, recognizing Vietnam's natural and cultural diversity, rising travel demand, and dynamic economy, has prioritized tourism growth through reforms, supportive policies, and increased investment.

Table 1

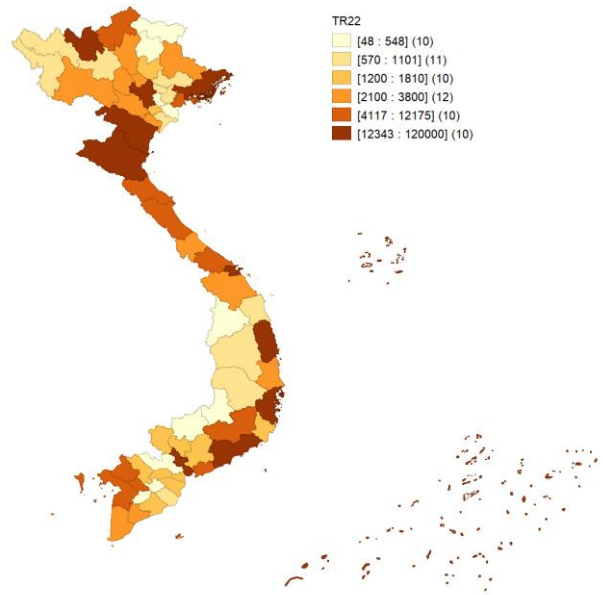
Vietnam's Tourism Industry in the Years of Dealing with the Health Crisis

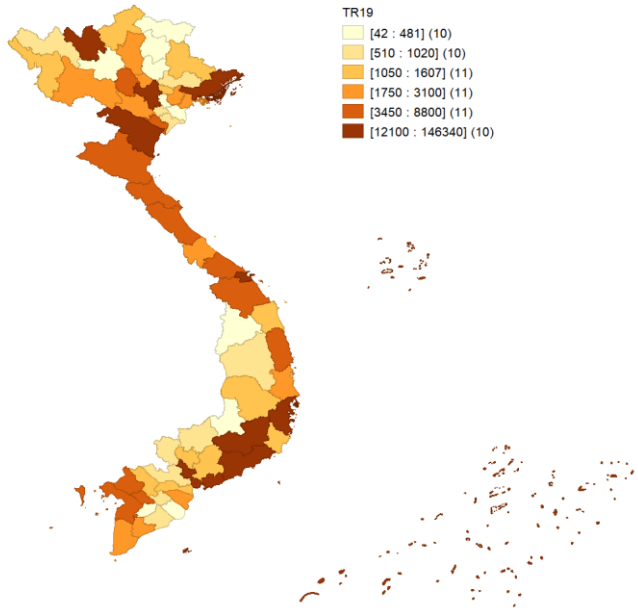
	2019	**2020**	**2021**	**2022**
International tourists (Millions)	18	3.7	0.149	3.66
Domestic tourist (Millions)	85	56	40	102
Total tourism revenue (Billions VND)	755,000	312,000	180,000	495,000
Tourism development capacity index	60/117		52/117	

Note. Vietnam National Administration of Tourism (https://www.vietnamtourism.gov.vn)

Figure 1

Tourism Revenue in 63 provinces in 2019 and 2022





Note. Vietnam National Administration of Tourism (https://www.vietnamtourism.gov.vn)

Geoda calculates

There have been numerous studies proving the spatial relationship between economic regions, that is, the economic growth of a region will be affected by neighboring areas. The tourism industry is not an exceptional circumstance. To illustrate, tourism is characterized by mobility, discovery, and association. The spatial regression model is an effective tool to analyze and test the spatial dependence of research areas. In many cases, the traditional OLS regression method will no longer be effective due to the lack of showing the relationship in space. To demonstrate that tourism had a positive impact on regional economic growth and its growth was spatially closely related in groups of countries that were geographically closer together, Paci and Marrocu (2014) developed spatial regression models for 179 European regions from 1999 to 2009. Shi et al. (2021) measured the influence of factors on the development of cultural tourism and then found a significant spatial relationship in 41 cities in China in 2019. Zhao and Yu (2021) investigated the spatial correlation of tourism in 16 Chinese cities and confirmed that tourism income in these cities was significantly positively affected by surrounding neighboring cities during the period 2011 - 2017. Ouchen and Montargot (2021) determined the factors that contributed to the significant increase in tourist arrivals in 43 countries between 2006 and 2016, namely, political stability, living standards, life expectancy, education, and safety. More importantly, the authors discover a spatially positive autocorrelation in these countries, implying that the significant increase in tourist arrivals is the result of a positive spillover effect.

Furthermore, observed from the pandemic crisis adaptation and recovery phase, the following factors are considered extremely important: rapid response from local government bodies, unified command national level, a comprehensive and accessible risk treatment system for all stakeholders, an emergency support package from the government, a self-improvement strategy of enterprises, a strong connection between localities, and a visible government orientation for next stages (Chen et al., 2020; Vaishar & Šťastná, 2020). Many studies also confirm that the labor force is a key factor determining the development of the tourism industry (Huang et al., 2020; Kramer & Kramer, 2020). In order to improve service quality and customer loyalty, employee skills need to be improved every year (Chingarande & Saayman, 2018; Hye & Lau, 2014; Li et al., 2022). Countries with developed tourism sectors

all confirm that a trained workforce rapidly increases business efficiency (Deng et al., 2014; Guetat et al., 2015).

Based on preliminary research, theoretical foundations, and the context of Vietnam, three questions come up (a) Is the policy related to region-connecting effective and helps increase tourism revenue between surrounding provinces? (b) What public service-related policies, such as digital adoption, sustainable environmental protection, and public service delivery, have a positive impact on provincial tourism revenue? and (c) A trained workforce, a dynamic economic environment, and labour's income also positively affect tourism revenue. The main purpose of this study is to look at the state of the tourism industry in the era of recovery, thereby assisting the government in thoroughly evaluating the policies and plans being implemented and making appropriate modifications for the future. In addition, the study compares the results of 2019 and 2022. In which, 2019 is the peak of the tourism industry pre-pandemic, and in 2022 is the first recovery year post-pandemic. Briefly, the study examines the effectiveness of the policy in both pre-pandemic and post-pandemic contexts. In other words, the author's goal is to deeply observe how the policy affects change in the two contexts with great differences in the environmental and social elements.

The study is structured into 05 main parts. Section 2 covers the ground theory in which the hypotheses are formulated. Section 3 describes the research methodology to achieve the stated objective. Section 4 presents the research findings and discusses policy implications. Lastly, Section 5 comes to conclusions.

2. Literature review and hypotheses developed

2.1. Spatial regression and the tourism industry

Research by Yang and Wong (2012) confirmed that factors including infrastructure, tourist attractions, community friendliness, and safety in disease control ability were significant determinants of the volume of domestic and foreign tourists in China in 2002 and 2009. In particular, the author used spatial econometric models to estimate the spillover effects of inbound and outbound tourism flows to 341 cities and towns in this country.

Using spatial econometric techniques, Chhetri et al. (2008) examined spatial patterns of tourism and the role of underlying geography in urban economic spaces across Southeast Queensland in Australia from 1991 to 2001. The results confirmed that areas with a high concentration of tourism activities and a strong spatial dependence will have "neighbors" with similar characteristics. Zhang (2009) investigated spatial economic dependence and spatial heterogeneity of domestic tourism in 31 provinces of China during the period from 2006 to 2013. Areas of high and low spatial correlation were distributed in eastern and western China, respectively. Chhetri et al. (2017) discovered that in rural areas, tourism revenue thrives on outdoor activities (hiking, camping), whereas in urban areas, the income is primarily derived from hotel services and entertainment. The study also revealed the formation of travel and hotel clusters in Australia based on the following factors: the availability of tourist attractions; proximity to the coast; public transportation network; access to jobs in Melbourne; and regional economy size. Furthermore, tourism development areas had a positive influence on the change in the tourism scale of neighboring regions, which was a significant finding. In the work of Romão and Saito (2017), exploratory spatial analysis and spatial econometric modeling were applied to the case of Japanese provinces in 2012. The results demonstrated the processes of accumulation and heterogeneity in the tourism development space in this country. Santos and Vieira (2020) measured the contribution of variables related to the development of the tourism industry in Portugal. In addition, the authors discovered strong

evidence of positive spatial autocorrelation of tourism in 278 municipalities of this country. The author reinforced the effectiveness of spatial econometric models highlighting spatial spillovers across regions.

Nguyen and Nguyen (2018) used panel data to reveal a positive correlation in tourism growth among neighboring provinces in Vietnam from 2013 to 2017. Building on their work, this study extends the analysis to 2019 and 2022 by incorporating new variables on economic development and quality of life. A spatial economic model is applied to assess how interprovincial tourism revenue correlations have evolved since their study. The findings aim to address prior limitations and enhance Vietnam's sustainable tourism development strategy. Notably, no updated spatial modeling research has been conducted since 2023. Therefore, to answer the first research question on whether regional connectivity policies foster tourism revenue across provinces, this study examines the spatial spillover effect of tourism revenue among Vietnam's 63 provinces in 2019 and 2022, forming the basis for the first hypothesis:

H1: There are spatial effects on tourism revenue among the 63 provinces in both 2019 and 2022

2.2. Factors that influence the tourism revenue

2.2.1. Quality of life

A key driver of tourism success is local community participation. Awareness of tourism benefits encourages residents' support for government programs (Ali, 2022). The industry generates jobs, diversifies livelihoods, and enhances quality of life (Munanura & Kline, 2023). Su et al. (2022) found that quality of life improves with tourism development, especially in cities with longer tourism histories. This unity strengthens sustainable tourism. Similarly, in northern India, quality of life significantly increased locals' support for sustainable tourism (Gautam, 2023). Woo et al. (2021) showed that higher life satisfaction motivates residents to support tourism through improved products, services, image promotion, and heritage protection.

Recent studies also highlight the critical role of public service delivery in tourism development. Effective government policies, especially timely crisis interventions, can safeguard both residents and the economy (Chen et al., 2020). After Covid-19, Fernández et al. (2022) found that nations with robust public service systems such as transportation, healthcare, information networks, and tourism services recovered faster, showing stronger destination competitiveness. The pandemic's global spread required closer cooperation between governments and citizens. Strengthening public services became vital for resilience and recovery (Škare et al., 2021).

In Portugal, public services played a key role in tourism recovery and event organization (Palrão et al., 2021). Investments in public infrastructure also supported rural festivals, boosting community pride and tourism support (Bakas et al., 2019). However, early e-government efforts faced challenges, as locals needed time to adapt and perceived systems as inflexible (Mensah et al., 2020).

In Vietnam, the government aims to enhance governance efficiency and economic growth through improved public administration and quality of life policies. The Provincial Governance and Public Administration Performance Index (PAPI) - a collaboration between CECODES and UNDP since 2009 - measures eight components: Local participation, Transparency, Accountability, Corruption control, Administrative procedures, Public service delivery, Environmental governance, and E-governance. This study focuses on Public service delivery, Environmental governance, and E-governance as proxies for quality of life

improvements. Specifically, Public service delivery reflects health, education, infrastructure, and security; Environmental governance measures sustainable practices like clean water and air quality; and E-governance represents efficient administrative services and digital accessibility.

Based on the above findings and in order to fully answer the second research question, the following hypotheses are proposed for the study in Vietnam:

H2a: Public service delivery has a positive impact on tourism revenue in 63 provinces of Vietnam

H2b: Environmental governance has a positive impact on tourism revenue in 63 provinces of Vietnam

H2c: E-Governance has a positive impact on tourism revenue in 63 provinces of Vietnam

2.2.2. Economic development

The opportunity and boom of tourism are always supported by the economic environment. Many studies have been proving a positive synergistic relationship between the economy and tourism. Singapore, a developed country in Southeast Asia today, stands out for its highly qualified workforce with scientific and technical qualifications progressing over the years (Holik, 2016; Sara et al., 2018). Moreover, Singapore is also the center for attracting start-up capital and supporting the formation and development of enterprises. Singapore is also the most attractive tourist destination in Southeast Asia. In addition, Malaysia, Indonesia, and Thailand are also emerging countries in both economic and tourism sectors (Carfora et al., 2019; Lee & Fernando, 2015; Öztürk et al., 2019). The common characteristics are that these countries are upgrading the quality of their workforce and launching many policies to promote trade openness, to strengthen cooperation, and to become large-scale production hubs. In Asia, Japan is a powerful economy. Studies also find a positive impact from a dynamic economic environment, in which the diversity of businesses in providing goods and services becomes an opportunity for tourism to be expanded (Ohe & Ohe, 2020). In developed countries in Europe, the tourism-led growth hypothesis is also proven in many nations, and the driving force behind it is the dynamic economic environment and the support from the government through effective policies (Tugcu, 2014; Pérez-Rodríguez et al., 2021).

To measure the influence of economic development on tourism revenue, the studies use different proxies depending on the availability of data and research objectives. Shahzad et al. (2017), Sokhanvar et al. (2018), Raza et al. (2021) took GDP as a proxy; Wilson et al. (2016), Athanasopoulou (2013), Ohlan (2017), Shakouri et al. (2017) used the growth of enterprises; Biagi et al. (2017), Mustafa et al. (2017) used the income of labor, and the trained workforce. This is also a research gap in Vietnam that needs to be filled. Therefore, the hypotheses below are posed, and these outcomes are expected for the third research question:

H3a: The number of businesses that still operate effectively every year has a positive influence on tourism revenue in the provinces of Vietnam

H3b: The labor with training has a positive influence on tourism revenue in the provinces of Vietnam

H3c: The income of employees has a positive influence on tourism revenue in the provinces of Vietnam

3. Methodology and data

3.1. Spatial regression

Spatial modeling refers to a systematic method for examining how economic activities are arranged and distributed across geographic spaces from local to global contexts (Ploeckl, 2019). Spatial modeling is an important tool that provides a wealth of information about interactions in geospatial. The results of the spatial model regression support economists in formulating an effective inter-regional economic development strategy. The Spatial Regression Model represents an approach that integrates spatial analysis into regression techniques used in social science research. It encompasses several modeling concerns related to continuous dependent variables, such as mapping spatial data, constructing datasets from geographic information, conducting exploratory spatial data analysis, developing regression models with spatial dependence among predictors, and estimating models with spatially correlated error components (LeSage, 2004). The model of spatial regression is formed:

$$y = \rho W_1 y + X\beta + u \quad (1)$$

$$u = W_2 u + \varepsilon \quad (2)$$

$$\varepsilon \sim N(\delta^2 I)$$

where:

- *y:* the response variable vector is n × 1;
- *X:* The predictor variable matrix of size n × (k+1);
- *β:* The parameter vector of the regression coefficient is (k+1) × 1;
- *ρ:* The spatial lag coefficient parameter is the predictor variable;
- u: The error vector is n × 1;
- *ε:* The error vector is n × 1;
- $W_1 W_2$*:* Weight matrix of size n × n;
- *I:* Identity matrix of size n × n.

To start this empirical study, an OLS regression will be run to check for the spatial dependence in this regression. Moran's test is first used to show places where significant spatial autocorrelation exists. Then, based on the value of the Lagrange Multiplier, a Spatial lag model or Spatial error model will be run for the final outcomes.

Moran's I

Moran's I coefficient is used to determine the spatial correlation between neighboring areas. This statistical value represents the spatial correlation results between the study areas in general. Moran's I value depends on the spatial weight matrix (Weights-W). This matrix reflects the strength of the geographical relationship between the areas in the study area. This is an indispensable statistical and observational tool in spatial regression to examine the correlation between variables. Moran's I statistical value is in the range [-1,1].

Moran's I statistic of the observed variable (x) is determined as follows:

$$I = \frac{n}{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}} * \frac{\sum_{i=1}^{n} \sum_{j-1}^{n} x_{ij}(x_i - \bar{x})(x_j - \bar{x})}{\sum_{i=1}^{n}(x_i - \bar{x})^2} \quad (3)$$

in which:

- x_i is the observed value in the space unit;
- $\bar{x}$ is the mean of x;
- n is the number of observed values of space units;
- w_{ij} is the value in row i, column j of the spatial weight matrix W.

Moran's I proposes the null hypothesis "H0: there is no spatial correlation in the data structure". Thus, when hypothesis H0 is rejected, the model initially proves the existence of

spatial correlation in the observed data.

Research of Rüttenauer (2019) shows that Moran's I statistic has an asymptotically distributed normal distribution. There will be cases when applying Moran's I coefficient as follows: (a) there is no spatial correlation, (b) there is a high-high correlation (H-H), (c) there is a high-low correlation (H-L), (d) has a low-low correlation (L-L), and (e) has a low-high correlation (L-H).

Spatial weight matrix

The spatial weight matrix plays an important role in spatial econometric analysis and incorporates spatial dependence into the research model. In this matrix, n is the number of space units, the spatial weight matrix (W) is asymmetric (n × n), with the element at position *i, j* is w_{ij}. The value w_{ij} is called as the spatial weight for each pair of positions *i, j* determines the correlation between two localities (i and j). And the convention that the elements lying on the principal diagonal of the weight matrix is zero, then $w_{ij} = 0$.

$$w = \begin{pmatrix} w_{11} & w_{12} \dots & w_{1n} \\ w_{21} & w_{22} \dots & w_{2n} \\ \vdots & \vdots & \\ w_{n1} & w_{n2} \dots & w_{nn} \end{pmatrix} \quad (4)$$

In empirical research, the spatial weighting matrix is built based on geographical distance or contiguity between localities. In this study, the author uses the adjacent weight matrix (Queen) calculation method, this method is used similarly in the studies of Vo et al. (2020), Santos and Vieira (2020), Esiyok and Ugur (2017), Hoang and Goujon (2014), Shi et al. (2021), Yang and Wong (2012), Ouchen and Montargot (2021). The use of the Queen contiguity matrix is particularly appropriate for Vietnam given its elongated geography, complex topography, and province-based administrative system.

The Spatial error model evaluates the extent to which the clustering of an outcome variable not explained by measured independent variables can be accounted for with reference to the clustering of error terms. In this sense, it captures the influence of unmeasured independent variables. The spatial error regression model incorporates the possibility that error terms in one geographic area are influenced by error terms in neighboring areas. In this context, spatial error autocorrelation occurs when the residuals are not independent across observations, meaning that the unexplained variation in one location is associated with the unexplained variation in surrounding locations (Darmofal, 2015; Matthews, 2006).

The spatial error model takes the form described by two equations:

$$y = X\beta + a \quad (5)$$

$$a = \rho W_a + \varepsilon \quad (6)$$

$$a = (I_n - \rho W)^{-1}\varepsilon \quad (7)$$

$$y = X\beta + (I_n - \rho W)^{-1}\varepsilon \quad (8)$$

The satisfaction spatial error model implies that it is unnecessary to posit distinctive effects of the lagged dependent variable. The observed spatial clustering in the outcome variable is accounted for simply by the geographic patterning of measured and unmeasured independent variables.

The spatial lag model, in contrast, incorporates the influence of unmeasured independent variables but also stipulates an additional effect of neighboring attribute values, the lag-dependent variable. The spatial lag regression model accounts for the influence of dependent variable values in one area on the corresponding values observed in related neighboring areas. The spatial lag model takes the form:

$$y = \rho W_{yt-1} + X\beta + \varepsilon_t \quad (9)$$

The spatial lag model allows for filtering out the potentially confounding effects of spatial autocorrelation in the variable under consideration. A motivation for using a spatial lag model is to obtain the proper inference on the coefficients of the other covariates in the model. This model is the model most compatible with common notions of diffusion processes because it implies an influence of neighboring attribute values that are not simply an artifact of measured or unmeasured independent variables. Rather, the outcome variable in one place increases the likelihood of the outcome variable in nearby locales.

3.2. Materials

Secondary data are collected from the Statistical Yearbook in 2019 and in 2022 for 63 provinces of Vietnam. The observed variables are presented in Table 2.

Table 2

List of Variables

	Variable	Sign	Definition of variable	Expected impact direction
Dependent variable				
	Tourism revenue	Rev	Revenue from the tourism industry of 63 provinces	
Explanatory variables				
1	Number of tourists	Tour	The number of tourists travel to 63 provinces	+
2	Labor with training	Labor force	Number of employees trained with sufficient skills and professional knowledge	
3	Enterprises	Enterprises	Number of businesses still operating effectively and having business reports at the end of the year	+
4	Income	Income	Employee's income	+
5	Public service delivery	Public service	Public service indicates the level of service supply that supports daily life related to health, education, infrastructure, and security.	+
6	Environmental Governance	Environment	Environmental governance scores include activities related to clean water supply, air quality control, and sustainable environmental practices.	+
7	E-Governance	E-Governance	E-governance shows a convenient working procedure with a system of receiving and processing dossiers using an electronic portal and free internet coverage for the community	+

Note. Tourism revenue, Tourists: https://www.vietnamtourism.gov.vn/. Labour with training, Enterprises, Income: https://www.gso.gov.vn/en/data-and-statistics/2020/09/statistical-yearbook-2019/. Public service delivery, Environmental Governance, E-Governance: https://papi.org.vn/eng/

4. Main findings

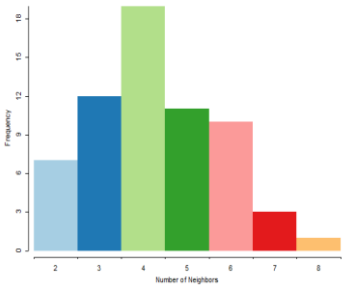
4.1. The weights

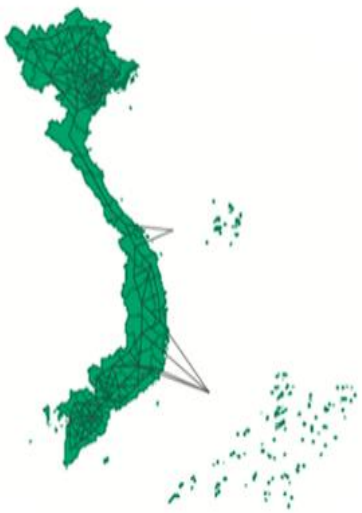
The most important work of this study is to examine whether the observed values affecting tourism revenue growth are related to spatial location, by performing spatial autocorrelation analysis using Geoda software. In order to observe this feature, the weight matrix needs to be taken first to incorporate into the spatial regression. The results of the adjacency weight matrix (Queen) indicate that each province has at least 2 neighbors and at most 8 adjacent neighbors in Vietnam (Figure 2).

Figure 2

Detail of Weights

Property	Value
type	Custom
symmetry	Unknown
file	queen.gal
id variable	POLY_ID
# observations	63
min neighbors	2
max neighbors	8
mean neighbors	4.29
median neighbors	4.00
% non-zero	6.80%





Note. Geoda analyses

4.2. The Moran test

The Moran scatterplot illustrates the relationship between a variable's value at each location and the average of that variable in neighboring areas. A positive Moran's Index indicates spatial clustering, where high (or low) values group together; a negative Index suggests dispersion, where high values are surrounded by low ones. The upper-right and lower-left quadrants show positive spatial autocorrelation (high-high or low-low clusters), while the other two quadrants indicate negative autocorrelation. The dominant pattern determines whether the overall spatial relationship is positive, negative, or neutral (Kelejian & Prucha, 2001).

The scatter plot of Moran's I coefficient of 63 provinces' tourism revenue is presented in Figures 3, 4 below.

Figure 3

The Scatter Plot of Moran's I in 2019

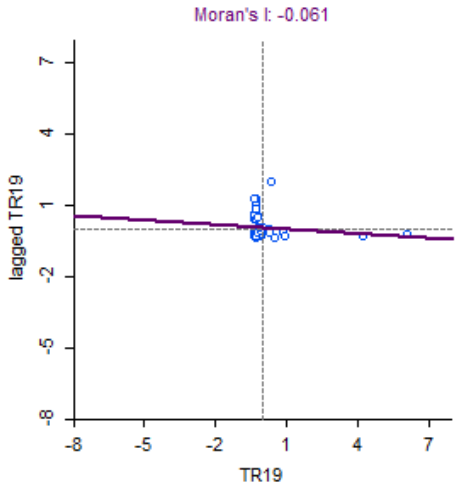
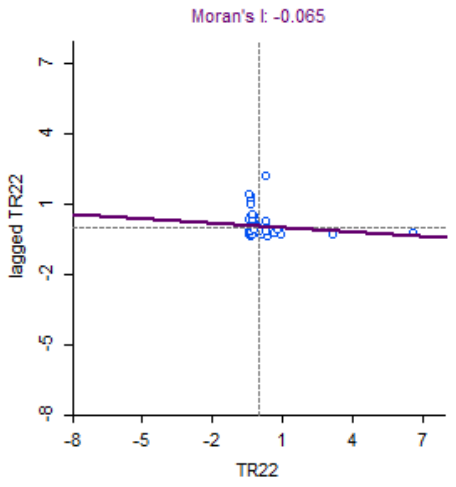


Figure 4

The Scatter Plot of Moran's I in 2022



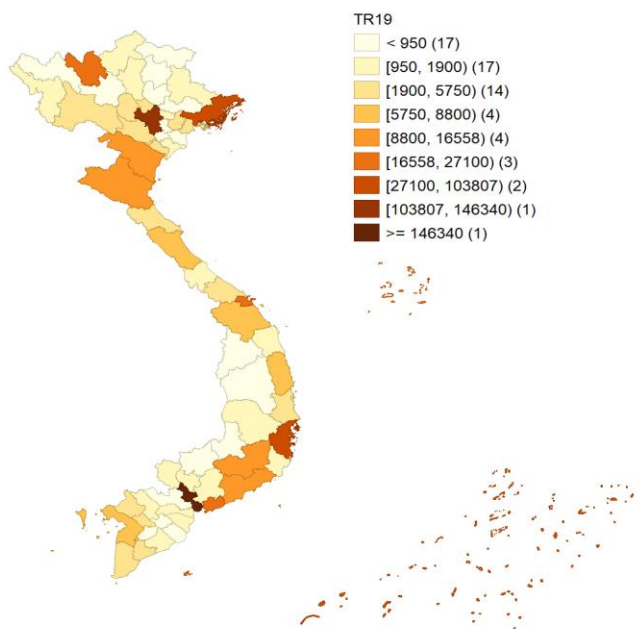
Note. Geoda analyses

Obviously, the map of Vietnam reveals that the number of provinces with high tourism revenue (located in the upper right quadrant) is less than the number of provinces with tourism revenue is smaller than the national average (located in the lower left quadrant). Therefore, it results in the value of Moran = -0.65, which indicates a negative spatial correlation in the tourism revenue of 63 provinces.

Figures 5, 6 categorize provinces based on revenue natural breakpoints. Supporting Moran I's results, there are 11/52 provinces that had higher revenue than the average in 2019, and the result for 2022 is 14/52.

Figure 5

Tourism Revenue of 63 Provinces in 2019



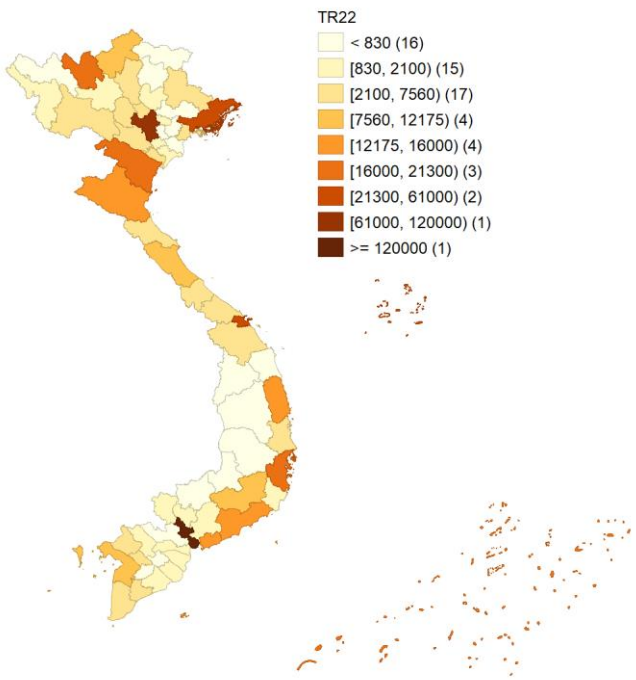
Explain:

- The average tourism revenue in 2019 is 8183 billion VND
- Provinces with lower-than-average tourism revenue: 52
- Provinces with higher-than-average tourism revenue: 11

Note. Geoda analyses

Figure 6

Tourism Revenue of 63 Provinces in 2022



Explain:

- The average tourism revenue in 2019 is 7167 billion VND
- Provinces with lower-than-average tourism revenue: 49
- Provinces with higher-than-average tourism revenue: 15

Note. Geoda analyses

Table 3

Moran Test of 2019

	MI/DF	Value	Prob.
Moran's I (error)	0.1170	1.7642	0.07770
Lagrange Multiplier (lag)	1	13.0618	0.00030
Robust LM (lag)	1	17.9100	0.00002
Lagrange Multiplier (error)	1	1.7008	0.19219
Robust LM (error)	1	6.5490	0.01049
Lagrange Multiplier (SARMA)	2	19.6108	0.00006

Note. Geoda analyses

Furthermore, the regression model also shows the spatial correlation through the value of the Moran test. Moran's I results have statistical significance at the 1% level, confirming the spatial correlation in the research data of 63 provinces in Vietnam in 2019. In other words, the implementation of the OLS model will give inaccurate results because it ignores the spatial correlation of the studied provinces. Based on the statistical significance of the Lagrange Multiplier (lag) and Robust LM (lag) at 1% (Table 3), showed that the Spatial Lag Model (SLM) is better fitted for this year.

Table 4

Moran Test of 2022

	MI/DF	**Value**	**Prob.**
Moran's I (error)	0.1009	1.8417	0.06552
Lagrange Multiplier (lag)	1	9.4129	0.00215
Robust LM (lag)	1	14.4511	0.00014
Lagrange Multiplier (error)	1	1.4663	0.22593
Robust LM (error)	1	6.5045	0.01076
Lagrange Multiplier (SARMA)	2	15.9174	0.00035

Note. Geoda analyses

Likewise, the Moran test for the year 2022 shows that Lagrange Multiplier (lag) and Robust LM (lag) at 1% (Table 4), therefore, Spatial Lag Model (SLM) is fitted for this year.

Table 5

Spatial Regression

	2019		**2022**	
	OLS	SLM	OLS	SLM
Conts	1439.38	304.932	4213.49	-565.43
Tourists	**1105.87*** **	**1125.18*** **	**1352.64*** **	**1401.31*** **
Enterprises	**0.424*** **	**0.391*** **	**0.270*** **	**0.2586*** **
Labor with training	90.99	24.177	15.707	-43.707
Income	0.4677	**0.948** **	-0.03	0.2795
Public services	-2430.46	-1393.44	-930.406	-205
Sustainable Environment	2373.58	374.411	554.079	-147
E-Governance	43.047	306.798	-262.836	531
W-REV		**-0.234**		**-0.226**
R-squared	0.95	0.96	0.94	0.93
AIC	1265.94	1250.35	1229.45	1238.79
SC	1283.09	1269.64	1248.59	1255.81

Note. Geoda analyses

The first research objective is to examine the spatial spillover effects among

provinces. The results reveal negative spillover effects in both 2019 and 2022; a 1% increase in tourism revenue in one province corresponds to a decline of 0.23% in neighbouring provinces in 2019 and 0.22% in 2022. Despite Vietnam's strong tourism growth, particularly in 2019, and the government's emphasis on regional cooperation, with 'leader provinces' guiding others, the findings suggest that tourism development remains largely independent across provinces. Even major hubs such as Hanoi, Da Nang and Ho Chi Minh City demonstrate no positive spatial linkage. This suggests that, while provinces are actively enhancing their own competitiveness, success in one area often diverts tourists from neighbouring regions rather than promoting shared growth.

The second objective assesses the impact of government policies designed to improve quality of life through public services, environmental protection and e-government. Regression analyses for both 2019 and 2022 show no significant impact of these PAPI indicators on tourism revenue. While the PAPI index (which has been fully available since 2018) reflects better governance in economically advanced provinces, this has not resulted in higher tourism revenue.

In contrast, tourism revenue was positively influenced by visitor numbers, enterprise numbers, and employee income in 2019, and by visitor numbers and enterprise numbers in 2022. Across both years, tourist arrivals remain the strongest determinant of revenue. In short, Vietnam's tourism growth continues to depend primarily on internal resources, such as tourism products, services, and economic vitality, rather than government policy interventions.

5. Discussion and conclusion

5.1. Practical implications

Studies using spatial models for tourism are not prevalent in Vietnam. Observing spatial interdependence between provinces aims to assist policymakers in making appropriate adjustments or incentives. In addition, the spatial model visualizes data in a hierarchical and visual way. This helps to consolidate the regression results and results in a multidimensional observation. Also, it is necessary to observe the factors that directly affect tourism revenue, even in both periods of development and crisis. The tourism industry requires high adaptability in terms of rapidly changing market needs and a complicated pandemic environment. To have a holistic picture, it requires a lot of research with multiple regression models, explanatory variables, and study periods. This study bridges the gap in methodology by using spatial regression and taking some new variables related to the government into a model. The main findings serve as a reference for policymakers.

The number of tourists, enterprises, and employees' income are critical drivers of tourism revenue, as they reflect demand and supply dynamics within the sector (Mustafa et al., 2017; Shakouri et al., 2017). A higher number of tourists directly increases the consumption of tourism-related goods and services, thereby expanding revenue. At the same time, a greater number of enterprises increases competition, service diversity and innovation, thereby improving destination attractiveness and stimulating additional spending. Furthermore, higher employee income reflects better service quality and productivity in the tourism industry, and generates a multiplier effect as higher purchasing power supports local businesses and reinvestment in tourism services. Together, these factors create a cycle of growth that reinforces itself and contributes positively to overall tourism revenue.

Although skilled labour was expected to have a positive effect on tourism revenue, no

such effect has been observed. Skilled labor in the tourism industry does not immediately translate into revenue growth because demand-side factors such as tourist arrivals, spending capacity, and external shocks (e.g., economic downturns, political instability, pandemics) play a more decisive role in shaping short-term revenues. While human capital theory suggests that a highly trained workforce enhances service quality, customer satisfaction, and long-term competitiveness, these effects are often indirect and lagged, manifesting through repeat visitation and positive word-of-mouth rather than instant financial returns. Moreover, in many developing destinations, skilled employees are underutilized due to limited managerial strategies, cost-cutting practices, or competition based on low prices, which constrain the potential of human capital to generate immediate value. Thus, the contribution of skilled labor to revenue growth is best understood as a strategic, long-term driver rather than a short-term determinant (Xia et al., 2021).

The insignificant effect of public services, environmental initiatives, and e-governance on tourism revenue lies in the temporal and structural nature of these policies. While such measures can enhance destination sustainability, governance efficiency, and residents' quality of life in the long term, their immediate impact on tourism demand and spending patterns is limited. In many emerging destinations, these policies may not yet be mature or strongly enforced enough to measurably influence tourists' perceptions or behaviours. Furthermore, in the short term, tourism revenue is more directly influenced by market-oriented factors such as destination image, accessibility, pricing strategies and promotional activities, which tend to overshadow the gradual outcomes of institutional and quality-of-life improvements. Thus, while these policy factors are essential for ensuring long-term competitiveness and resilience, their limited statistical significance in the short term does not diminish their strategic importance in sustaining tourism growth (Hoang & Bakucz, 2024).

Positive spatial impact on tourism revenue between provinces is not found in the two research years 2019 and 2022. However, Nguyen and Nguyen (2018) conducted a study for the period 2013 - 2018 with different observed variables and found a positive spatial correlation between provinces. Thus, initially, it can be said that this spatial correlation changes based on the studied period, and continuous research is needed to observe how the correlation changes over the years. This study uses cross-sectional data; future studies may develop towards using panel data for more complete observations of this spatial interaction.

5.2. Policy implications

To make the strategy more meaningful, the formulation of the strategy must include both the process of putting the strategy into practice and the system of solutions to arising situations (Poister, 2010). In practice, each province of Vietnam will have different administrative system characteristics. Government officials in each province ought to have early access to these strategies, conduct insight research, and collaborate with the leader to develop a solution system to ensure that new strategies can be applied in the most appropriate manner for local characteristics, thereby enhancing the efficacy of policies (Hoang & Bakucz, 2024). On the other hand, it is necessary to have a system to monitor the strategic objectives and the performance of the strategy in practice. Thus, the adjustment or intervention will be timely and help businesses access the maximum benefits that the tourism development strategy is aimed at.

The tourism economy usually faces a complex and fast-changing market; therefore, it needs a labor force with creative and flexible elements, and leaders with quick and bold

decisions. According to Mutonyi et al. (2020), empowered employees are more flexible and creative. Additionally, a strong team-up will encourage each other, foster a learning mindset, and increase productivity. Hence, decisions consequently have a high likelihood. The process of putting strategies into practice or launching a new policy calls for dynamic, supportive, and empowering. In order to reach out to the parties involved in tourism operations and help policy fulfill its potential, provinces in Vietnam need to be more positive in empowering and creating groups of professionals in charge of policy support-related activities.

The formulation of development policies should be based on the vision and orientation of the government initially (Burbano et al., 2022). However, to achieve efficiency and sustainability, it is essential to focus on priorities (a) involving local stakeholders in a shared vision and activities for tourism development; (b) each locality needs to capitalize on its own strengths and opportunities, while also taking advantage of opportunities to link with surrounding provinces; and (c) balancing "high-end" and "low-cost" tourist services to increase the capacity for serving all types of visitors. To have the target market segment in line with their resources and revenue targets, localities need to make the necessary calculations. Policy making is first based on its own strengths, and secondly on referencing neighboring provinces. In short, the growth of tourism is part of the overall trajectory of development for the country, but it still has to emphasize the competitive advantage of the local area.

In some regions of Vietnam, neighboring provinces share a common feature of having available resources to develop rural tourism. However, they lack direction and supportive policies from the government. They are still struggling with common tourism products, such as destinations to visit and relax. Their products lack attractiveness and duplication. This resulted in their tourism revenue increasing very slowly over the years, while the resource is not being exploited efficiently. The trend of tourism recovery post-pandemic has been determined; rural tourism is a product that meets the needs of reducing mass tourism and is more environmentally friendly. Many studies have proved that rural tourism is a perfect alternative, and many areas are emerging from this type of tourism at the time of tourism reopens (Vaishar & Šťastná, 2020). Therefore, the government of Vietnam must act fast to support these regions in building strategies for developing rural tourism and assisting these communities in effectively increasing tourism revenue in the future.

Figures 7, 8 show that there is a connection in some areas; the link is in groups of 2, 3, and 4 of adjacent provinces. Connectivity in 2019 is better than in 2022. Vietnam is identified with 03 regions: North, Center, and South. The central region has the least alignment. Meanwhile, the Center houses the most world heritage sites and architectural complexes of dynasties left by history. Thus, the leaders of the tourism sector in this area need to discuss with each other more to have effective options in the future. In fact, in order to have connectivity and facilitate links between regions, the first requirement is infrastructure, especially transportation and information systems. Many localities in Vietnam are primitive in terms of tourism resources, with the potential to be an attractive destination but with limited accessibility in terms of transportation. These are the difficulties for link building. In addition, in order for the alignment to be effective, managers need to sit at roundtables and share positions in the value chain. Thus, the products and services will be perfect for each other, not duplicated, and provide value-added product packages for customers.

Figure 7

The Connectivity of Provinces in 2019

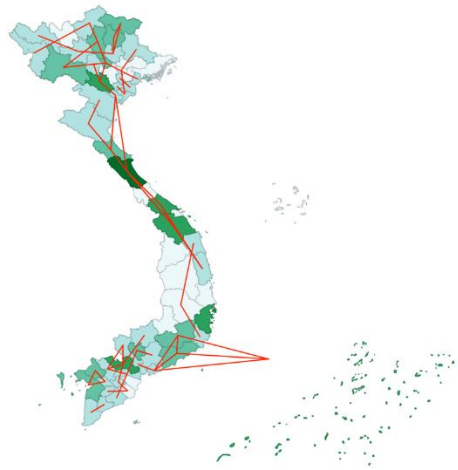


Figure 8

The Connectivity of Provinces in 2022

Note. Geoda analyses

Annual training is essential for the tourism workforce. Government reports show a persistent labour shortage, with many workers coming from unrelated fields. Policies are needed to attract and retain skilled labour, and universities should update their curricula and strengthen their partnerships with businesses to ensure a competent workforce. A qualified, motivated and multi-skilled workforce is crucial for the effective implementation of government strategies and the empowerment of the sector.

The government should also support underdeveloped destinations that lack strategic direction. This support should include investment, expert consultation and destination branding. Setting up expert groups to advise on policy, strategy and market analysis could help these provinces to build a foundation for cooperation and expand their tourism economies. Once localities have established strong foundations, interprovincial collaboration becomes more feasible and effective.

In line with global recovery trends, Vietnam's tourism strategy should focus on market diversification and product innovation to improve resilience and competitiveness. Overreliance on a few international markets makes the industry vulnerable to external fluctuations, so it is important to expand into broader, higher-value segments through targeted marketing and experience-based offerings. Simultaneously, strengthening the domestic market is essential for establishing a stable foundation for sustainable growth (Álvarez-Díaz et al., 2024). This requires renewed attention to product differentiation, service quality and creating year-round attractions that encourage local travel and spending. Ultimately, strategic restructuring and innovation will enable balanced development, greater adaptability and long-term sustainability in Vietnam's tourism industry.

Vietnam could learn from Japan, Singapore, Thailand and Indonesia in terms of optimising public transport to improve connectivity between provinces. The current concentration of transport infrastructure in major cities restricts access to more remote areas. Strengthening these connections would make travel more convenient and stimulate demand. With a population of 100 million and a growing high-income demographic, Vietnam's domestic tourism market holds great potential for generating stable and sustainable revenue, which will be the central focus of the country's tourism development in the coming years.

6. Conclusion

In the comprehensive tourism development strategy, the Vietnamese government has prioritised regional cooperation and invested in improving governance and quality of life. This study examines the effectiveness of these policies on tourism revenue in the 63 provinces of Vietnam in the pre- and post-Covid-19 pandemic. Spatial regression models for both years reveal that provincial tourism development has not had a positive impact on neighbouring provinces. Tourists and enterprises are key drivers of revenue growth, whereas variables linked to public services, environmental governance and e-governance show no significant effect. Although Vietnam is an emerging, fast-growing economy, the results highlight the need for more targeted government interventions to align policies with industry dynamics.

The policy implications point to the need for more systematic processes to implement and monitor national policies at the provincial level, as well as greater autonomy for local management bodies. Strengthening interregional connectivity requires investment in infrastructure, the design of location-specific tourism products and the development of a skilled workforce. Overall, although national policies exist in principle, a more concrete and practical implementation strategy is needed to generate measurable benefits for the tourism industry.

Many studies focus on assessing the damage to the tourism industry pre-pandemic and suggesting solutions for recovery post-pandemic. However, studies using econometric tools to measure the effectiveness of policies for development or recovery are not popular in Vietnam. Therefore, the results of this study call for more studies with diverse observed variables for comparison. Due to the novelty of the government dataset, the model runs on cross-sectional data. As the data becomes more updated, the panel data should be checked to add new findings. The study only used the Queen matrix for spatial regression. Other spatial matrices such as the Haversine or Inverse-distance spatial-weighting matrix should also be applied to check for differences and find the most efficient model. Applying alternative spatial matrices such as the Haversine or inverse-distance weighting may yield different results by capturing spatial interactions based on geographic proximity rather than administrative borders. These approaches can be particularly relevant in Vietnam's elongated territory, where transport corridors and market-driven linkages sometimes extend beyond contiguous provinces. While Queen contiguity reflects policy and administrative diffusion, distance-based matrices may highlight travel flows and spatial spillovers, and testing multiple specifications would enhance the robustness and efficiency of the model.

SCIENTIFIC CONTRIBUTION

The manuscript clearly identifies a research gap; the manuscript presents statistically and practically significant findings; the manuscript offers policy/managerial/technological implications; the manuscript opens new directions for further research.

AUTHOR CONTRIBUTIONS

CRediT: **Hoang Thi Phuong Thao**: Conceptualization, Methodology, Software, Validation, Formal Analysis, Investigation, Resources, Data Curation, Writing - Original Draft, Writing - Review & Editing, Visualization.

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