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RESEARCH ARTICLE

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Is tourism specialisation a trap for economic growth? The case of the Italian regions

Bianca Biagi [a,b], Hasan Engìn Duran [c] and Manuela Pulina [a]

[a]Department of Economics and Business (DISEA) & CRENoS, University of Sassari, Sassari, Italy; [b]Gran Sasso Science Institute, L'Aquila, Italy; [c]Department of City and Regional Planning, Faculty of Architecture, Izmir Institute of Technology, Izmir, Turkey

ABSTRACT

Tourism activity is a pivotal driver of global economic growth in an era of globalisation. Yet, its ecological footprints call for urgent sustainable practices. This paper enriches intricate interconnections between tourism, economic growth, and sustainability. Novel insights bridge gaps in understanding the effects of domestic and international tourism, regional heterogeneities, and spill-over effects, focusing on Italian regions (2004–2019). Based on a new neoclassical model, this study integrates key indicators beyond Gross Domestic Product and physical capital, encompassing sustainability (renewable energy) and human capital within the KLEM (Capital, Labour, Energy, Materials) specification. These frameworks assess multifaceted dynamics and raise questions about whether high tourism specialisation can lead to a trap for economic growth, development and, ultimately, socio-economic inequalities. Significantly, the research uncovers notable regional heterogeneities, and spill-over effects, shedding light on distinct economic trajectories and challenges, triggering the pursuit of resilience strategies. By highlighting intricate tourism-economy-sustainability connections, this study advances sustainable tourism understanding, urging a delicate balance between tourism's economic benefits and ecosystem concerns. It emphasises the need for eco-conscious practices and economic diversification to ensure harmonious development, aligning with the SDG agenda (UN, 2024).

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TLGH; spatial hetereogeneity; spatial panel FM

1. Introduction

The analysis linking economic growth and tourism activity has evolved significantly since Balaguer and Cantavella-Jorda's seminal work in 2002 (Balaguer & Cantavella-Jorda, 2002). Recent literature supports the validity of the Tourism-Led Growth Hypothesis (TLGH) and identifies new venues for investigation (Ahmad et al., 2020; Brida et al., 2016; Eugenio-Martin & Patuelli, 2022). However, gaps remain in understanding feedback effects, economic regional impacts, and territorial spill-over effects (Alcalá-Ordóñez et al., 2023; Calero & Turner, 2020; Harb & Bassil, 2021; Watson & Deller, 2022). The effects of demand segmentation are also overlooked in the literature (Falk et al., 2023; Harb & Bassil, 2022; Llorca-Rodríguez et al., 2021). Considering the Sustainable Development Goals set by United Nations 2030 (SDGs; see UN, 2023, 2024; UNDP, 2023), the socio-economic role of tourism, amongst others, has included advancements in green growth (Cárdenas-García &

CONTACT Hasan Engìn Duran enginduran@iyte.edu.tr

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Alcalá-Ordoñez, 2023; Ozcan et al., 2021) and degrowth theories (Dwyer, 2023; Fletcher et al., 2020; Higgins-Desbiolles & Everingham, 2024).

In this paper, the traditional theoretical framework (from now on Model S), based on an augmented Cobb–Douglas function (Harb & Bassil, 2022; Kumar & Patel, 2024; Solow, 1956), is compared to a KLEM (Capital, Labour, Energy, Materials) specification (from now on Model K) that integrates renewable energy consumption (Işik & Radulescu, 2017; Martial et al., 2023; Shang et al., 2023). Core economic metrics include real gross domestic product (GDP) per capita (Moreno-Izquierdo et al., 2024) and per capita tourism overnights, with domestic tourism (Models 1) and inbound international tourism (Model 2) serving as separate approximations of tourism specialisation (Alcalá-Ordóñez et al., 2024; Fernández-Macho et al., 2024; Lanzilotta et al., 2024). Specifically, Model S includes physical capital (gross fixed capital formation) and human capital represented by tertiary higher education (Harb & Bassil, 2022; Mazzola et al., 2019). Additionally, in the context of ongoing debates about sustainable economic paradigms, Model K incorporates physical capital through renewable energy consumption as a production input (Alcalá-Ordóñez et al., 2023; Bekun et al., 2022; Brida et al., 2023a, 2023b; Ford & Olivera, 2024; Martial et al., 2023; Shan & Ren, 2023), while lifelong learning expresses human capital progress (Airey et al., 2017; Cuffy et al., 2012).

Methodologically, the analysis comprises two steps. A dynamic Mean-Group Vector Error Correction Mechanism (MGVECM; Blackburne & Frank, 2007a, 2007b) explores temporal short-run and long-run relationships, and feedback loops, between tourism and socio-economic indicators, controlling for regional heterogeneities, an important issue for the evaluation of tourism activity (Bassil et al., 2023; Brandano & Crociata, 2023; Firza et al., 2023; Harb & Bassil, 2022). Spatial spill-over effects are assessed, followed by a spatial long-run TLGH analysis using Fully Modified Ordinary Least Squares (FMOLS). To this aim, a regional panel framework for Italy covers the time frame 2004–2019. This country's continuing outstanding performance, even after the pandemic turmoil (UNWTO, 2021), is a sound setting to explore the interplay between tourism, economic growth, and sustainability trajectories, with a regional focus in the short – and long-run (Bassil et al., 2023). Italy still ranks fifth in international tourism arrivals (UNWTO, 2023) and ninth out of 119 countries for development and competitiveness (WEF, 2024).

The paper bridges gaps in the literature by addressing the following research questions: Do domestic and international tourism have an endogenous regional influence on socio-economic growth in the short and long run? (RQ1). Are these relationships confirmed within an economically sustainable framework? (RQ2). Are there any spatial spill-over effects amongst regions? (RQ3).

The structure of this paper is as follows. Section 2 presents an updated review of the relevant literature. Section 3 outlines the regional context and theoretical framework and highlights the indicators employed in the analysis. Section 4 comprehensively examines the empirical findings. Section 5 discusses the most significant findings, while the final section offers concluding remarks.

2. Literature review

Within a comprehensive literature review (2014–2022), Alcalá-Ordóñez et al. (2023) confirm TLGH, while less evidence for GLTH or a temporal bidirectional causality. Most studies focus on time series (57%) or panel data (43%) (Eugenio-Martin & Patuelli, 2022), and approximately 73% used the Granger causality test. European destinations account for 23% of the sample reviewed. Yet, in TLGH literature, although many empirical studies exist (Balsalobre-Lorente et al., 2020; Ertugrul & Mangir, 2013; Gholipour et al., 2020; Wong et al., 2024) several issues remain unexplored, such as demand segment breakdown, short-run and long-run effects, feedback loops, sustainability issues, and regional spill-over effects.

Most of the reviewed papers employ tourism receipts as the economic indicator, with less exploration of domestic and international demand as separate issues (Ahmad et al., 2020; De la Mata & Llano-Verduras, 2012; Goh et al., 2014; Paci & Marrocu, 2014). The positive externalities of domestic tourists, particularly repeaters, on local economies are well-established (Meleddu et al., 2015), influencing regional economic growth dynamics (Cortés-Jiménez, 2008; Li et al., 2016) and reducing inequalities (De Santana Ribeiro et al., 2023). The onset of the COVID-19 pandemic has raised interest in understanding the impact of exogenous shocks on international tourism and possible substitution effects with domestic tourism as a more resilient demand (Falk et al., 2023). As attention shifts to contemporary challenges, Llorca-Rodríguez et al. (2021) find the stronger pro-poor economic ties of domestic tourism compared to the international segment. Quintana-Romero et al. (2021) documented increased domestic, rural, and environmentally conscious tourists in Mexico during pandemics. In Indonesia, Rahmayani et al. (2022) find that the length of stay by the domestic segment acts as a driver of economic growth, also confirmed by Setiawati et al. (2023). Harb and Bassil (2022) reveal significant contributions from international and domestic segments in the EU-28 countries. While domestic tourism emerges as a key driver of regional growth, the positive impact of foreign tourism is discernible primarily in regions that have historically been destinations for international visitors (Harb & Bassil, 2022).

Most studies adopt a macroeconomic perspective at a country level with a standard TLGH framework (Brida et al., 2020; Kumar & Patel, 2024; Maneejuk et al., 2022; Pérez-Rodríguez et al., 2021). Although still limited, a further thread of the macroeconomic literature integrates the standard production function with other indicators to explore negative environmental externalities (Alcalá-Ordóñez & Segarra, 2023). Akadiri et al. (2020), through a panel of small islands, show that tourism and economic growth positively and unidirectionally drive carbon emissions. To minimise the tourism environmental trap, policymakers should diversify economies to address environmental issues. Ehigiamusoe (2020) uncovers a U-shaped trend in African countries, where initial tourism reduces degradation but later hampers growth. Liu et al. (2022) investigate tourism's global pollution role, revealing a nonlinear relationship. Oad et al. (2022) analyse the case of Pakistan, indicating sustainable growth through VECM and temporal Granger causality. A different result is obtained for the case of Australia by Khanal et al. (2022), who employ the number of air passengers, GDP, and other indicators to control economic progress. While the authors confirm TLGH, in the short – and long-run, undesirable effects on sustainable development are also addressed. Bekun et al. (2022) recommend clean, high-tech, and renewable energy-focused tourism. Sun et al. (2022) uncover a two-way interplay in Malaysia, emphasising a sustainable path in transportation and tourism. Indeed, these studies assess that tourism growth, especially overtourism, leads to ecosystems' exploitation, exceeding planetary boundaries and, ultimately, deep social injustice (e.g. Fletcher et al., 2020; Higgins-Desbiolles & Everingham, 2024).

Alcalá-Ordóñez and Segarra (2023) also remarked on limited research on regional TLGH (Calero & Turner, 2020; Harb & Bassil, 2022; Rahmayani et al., 2022). Ahmad et al. (2020) report that only 6% of 100 reviewed papers employ spatial econometrics, further confirmed by Bassil et al. (2023) in their regional literature review. In this line of research, Takahashi (2022) analyses 113 Japanese islands, noting that coastal mega-cities attract more tourists. Watson and Deller (2022) study US spatial heterogeneities, suggesting tailored policies based on location. Tian et al. (2022) propose a method for 331 Chinese tourist cities, highlighting TLGH heterogeneity. De Siano and Canale (2022) find regional interdependency in Italy, noting tourism's beneficial effect on growth but environmental and social detrimental effects in adjacent areas. Centinaio et al. (2023), using a Granger causality framework, reveal the presence of TLGH and GLTH in approximately one-fifth of Italian provinces, with nonlinearities emerging beyond a certain threshold. Notably, socio-economic resilience is also important in the presence of shocks. For example, for 135 Wenchuan earthquake-affected counties, through a dynamic spatial Durbin model, Zhang (2023) shows an over-reliance on tourism activity can hamper economic growth if there is a scarce interlink with other economic sectors.

Overall, the most recent literature provides further evidence of the TLGH hypothesis. Yet, demand segment breakdown, regional heterogeneity, feedback loops for all the socio-economic indicators, sustainability issues, short-run and long-run impacts, and spill-over effects are still well under-researched (Alcalá-Ordóñez et al., 2023; Bassil et al., 2023).

3. Regional setting, theoretical framework and data

3.1. The regional setting

In Italy, twenty regions comprise fifteen ordinary statute regions (OSR) and five special autonomy regions (SSR), including, Friuli-Venezia-Giulia, Sardegna, Sicilia, Trentino Alto Adige (Bolzano and Trento as autonomous provinces), and Valle D'Aosta. The SSRs consist of linguistic and ethnic minorities, as well as insularity, posing potential socioeconomic and political challenges (Meleddu & Pulina, 2018; Woelk et al., 2008).

Since its unification in 1861, Italy has undergone disparate development. A more industrial and manufacturing economy characterises the Centre-Northern regions, while the Southern regions have historically experienced a less-performing economic structure, mainly based on the primary sector (Alesina et al., 2017; European Commission, 2022; Trigilia & Burroni, 2009).

The per capita GDP captures a persistent north–south dualism, relatively stable from 2004 to 2019. Domestic and international tourism intensity exhibits a similar spatial pattern in that it is higher in the Centre and Northern regions, except in Lombardia and Piemonte. The Southern regions display a lower domestic tourism intensity except for Sardegna (Figure 1). Firza et al. (2023) also confirm these features and find a remarkable north–south dualism in well-being, society and economy.

3.2. The methods

The methodology draws from the neo-classical growth framework; in such models, per capita income progress relies on technological progress, capital accumulation, and labour (e.g. human capital and population growth; Lucas, 1988; Solow, 1956). As emerged from the literature review in the regional TLGH, although several authors have employed new neo-classical model (Harb & Bassil, 2021; Llorca-Rodríguez et al., 2021; Paci & Marrocu, 2014), most studies assume tourism uniformly impacts growth, overlooking potential regional variations and possible short-run and long-run effects, as well as feedback loops amongst socio-economic and sustainability indicators (Bassil et al., 2023).

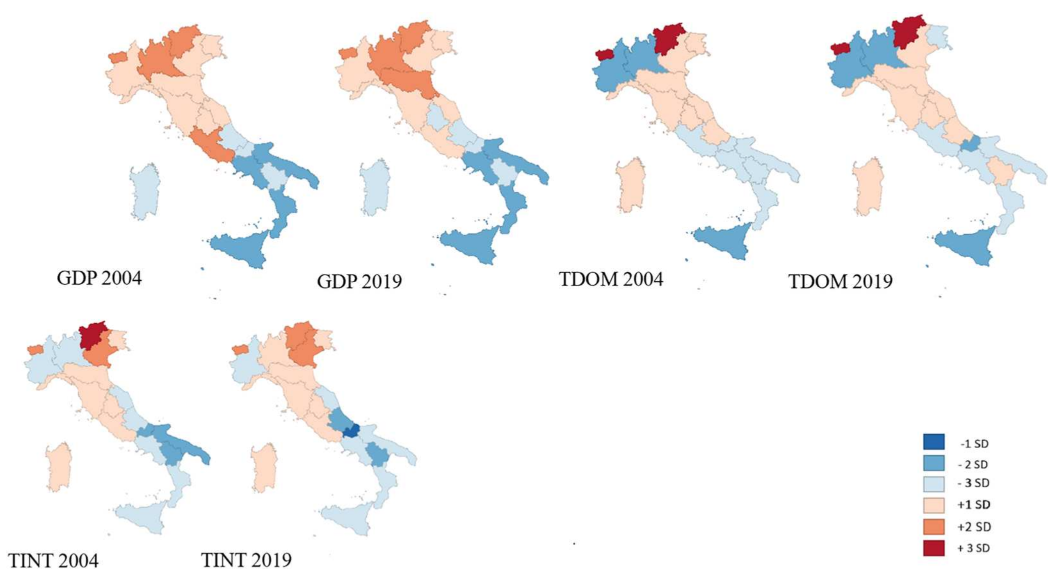

Figure 1. Geographical distribution of per capita GDP and tourism indicators – domestic and international overnights per capita (2004 versus 2019), the values are de-meaned and expressed in standard deviation (SD) units with respect to the cross-sectional mean.

Note: Values for Trentino-Alto Adige are calculated by taking the average of Bolzano and Trento Autonomous provinces, respectively.

Hence, renewable energy is integrated into the TLGH, aligning with the comprehensive KLEM models (Kasperowicz et al., 2020; Zemri, 2024). This extended framework endogenously identifies economic growth drivers and addresses the 'Solow residual' (Hudson & Jorgenson, 1974; Kasperowicz et al., 2020). Specifically, it offers a multidimensional perspective where GDP is influenced by technology and human capital advancements and the sustainable utilisation of natural resources and energy sources (Shan & Ren, 2023) that aligns with the SDGs.

Operationally, several steps are followed. First, the statistical features of the variables are addressed by assessing the order of integration (H_0: Panel unit root; H_1: No panel unit root) and cointegration (H_0: No panel cointegration; H_1: Panel cointegration). The second step employs a dynamic MGVECM (1,1) at a regional level (Bassil et al., 2023; Blackburne & Frank, 2007a, 2007b; Harb & Bassil, 2022). This method allows for exploring short-run and long-run relationships and feedback loops between tourism and socio-economic indicators (Blackburne & Frank, 2007a, 2007b; Pesaran et al., 1997a, 1997b; Pesaran et al., 1999; Pesaran & Smith, 1995; StataCorp, 2024). Besides, a Granger causality test (H_0: No Granger causality; H_1: Granger causality) highlights temporal relationships at an aggregate level (Engle & Granger, 1987; Granger, 1969; Maddala & Wu, 1999). The third step investigates spatial heterogeneities that are still under-researched (Wei et al., 2022). Specifically, after testing for spatial spill-over effects (H_0: No spatial correlation; H_1: Spatial correlation), a spatial long-run analysis through FMOLS is conducted for each demand segment and expanded further by using several controls for robustness check.

3.3. The econometric specification, indicators and data

Based on the literature review, the research questions are addressed through two main relevant functions. The first specification, Model S, explores the first research question (RQ1: Do domestic and international tourism have an endogenous regional influence on socio-economic growth in the short – and long-run?) and the related function is the following:

$$\mathrm{GDP} = \mathrm{F}\ (\mathrm{GFC}, \mathrm{HED}, \mathrm{TOU}) \tag{1}$$

The second specification, Model K, explores the second research question (RQ2: Are these endogenous relationships confirmed within an economically sustainable framework?), and the function is the following:

$$\mathrm{GDP} = \mathrm{F}\ (\mathrm{RE}, \mathrm{LLL}, \mathrm{TOU}) \tag{2}$$

The baseline equation takes the traditional dynamic form, as follows:

$$\ln y_{i,t} = \alpha + \beta_1 \ln y_{i,t-1} + \beta_2 \ln k_{i,t} + \beta_3 \ln l_{i,t} + \beta_4 \ln tou_{i,t} + \beta_5 DU_t + \varepsilon_{i,t} \tag{3}$$

where *i = 1, … .,21 regions, t = 2004, … ..,2019 years*.

These specifications are estimated for each demand segment: domestic tourism (Model 1) and inbound international tourism (Model 2). Specifically, *y* represents real *GDP* per capita, reflecting economic growth (Ahmad et al., 2020; Brida et al., 2020; Moreno-Izquierdo et al., 2024). This standard indicator addresses the 8th SDG ('Promotes sustained, inclusive and sustainable economic growth') (source: OECD, 2022; UN, 2023, 2024; UNDP, 2023; Euros, SNA, base year 2008). *k* represents physical capital and comprises two distinct components. For Model S, real gross fixed asset formation per capita (*GFC*; Harb & Bassil, 2021), aligns with the 9th SDG ('Seeks to build resilient infrastructure, promote sustainable industrialisation and foster innovation') (EUROSTAT, 2022; OECD, 2022; ISTAT, 2022; UN, 2023, 2024; UNDP, 2023, Marotrends.net). This indicator, also named investment, encompasses acquiring produced assets (excluding land and natural resources) that are input in the production process, arguably anchored to non-renewable sources. For Model K, renewable energy consumption relative to that of total is denoted as *RE* (Bekun et al., 2022; Martial et al., 2023; Shan & Ren, 2023) reflects progress toward sustainability as addressed by the 7th SDG ('Ensure access to affordable, reliable, sustainable, and modern energy for all') (UN, 2023, 2024; UNDP, 2023). Notably, *RE* encompasses infrastructure and natural resources used as raw materials from various sources (e.g. solar, wind, hydropower, bioenergy, geothermal). These two indicators off er valuable insights to address the impact of traditional inputs and the transition towards a more sustainable economy, respectively.

Human capital indicator l (Ahmad et al., 2020; Brida et al., 2020; Lucas, 1988; Tomasi et al., 2020) comprises two main variables. For Model S, higher education (*HED*) is the quota of tertiary education (age range 30–34) over the population with a specified education threshold (Source: EUROSTAT, 2022; ISTAT, 2022), that captures human capital accumulation (Harb & Bassil, 2022). For Model K, life-long learning (*LLL)* is the participation rate in non-formal education and training in the past 12 months (source: ISTAT (2022; EUROSTAT, 2022)). These indicators intercept human capital formation and accumulation at different education stages and job market engagement. They also relate to the 4th SDG ('Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all'; UN, 2023, 2024; UNDP, 2023).

The tourism indicator comprises the following variables: the domestic overnights per capita (*TDOM*) and the inbound international overnights per capita (*TINT*) (EUROSTAT, 2022; ISTAT, 2022). As remarked by Lanzilotta et al. (2024), in the literature, there is no consensus on the most appropriate indicator to proxy tourism specialisation (see also, Fernández-Macho et al., 2024). Notably, the authors employ the per capita tourism arrivals as its proxy. Yet, tourism arrivals also reflect the attractiveness capacity of a destination rather than the retention capacity at a destination. In a literature review on tourism microeconomics, Brida and Scuderi (2013) found that length of stay is a proxy for tourism expenditure in several studies. Indeed, expenditure is influenced by the number of visitors and the duration of their stay, although the relationship may exhibit nonlinearity. These indicators are also relevant to the 12th SDG ('Ensuring sustainable consumption and production patterns') (UN, 2023, 2024; UNDP, 2023; data source: EUROSTAT, 2022; ISTAT, 2022).

DU encompasses diverse dichotomous variables. Two dummy variables account for the global economic crisis (*d_crisis_2008*; *d_crisis_20012*). A further set of dummies control for Italian high and low-development groups (*h_variation*; l_*variation*) that mirror socioeconomic and geographical heterogeneities. (see Table 1 for details).

The spatial panel FMOLS method is useful to model simultaneously the spatial dependence and non-stationary data (Engle & Granger, 1987; Hansen, 1992a, 1992b; Hamilton, 1994; Hayashi, 2000; IHS Markit 2017; Kao et al., 2000; Ogaki, 1993; Pedroni, 1996, 1999, 2000, 2001; Phillips & Hansen, 1990; Phillips & Loretan, 1991; Phillips & Moon, 1999; Saikkonen, 1992; Stock & Watson, 1993). We consider Equation 1 as a baseline model. However, to incorporate spatial connectivity, $\rho W \ln y_{i,t}$ represents the spatial variable, the neighbouring region's impact on the region *i.* The generic model takes the following form:

$$\ln y_{i,t} = \alpha + \delta \ln y_{i,t-1} + \rho W \ln y_{i,t} + \beta_1 \ln k_{i,t} + \beta_2 \ln l_{i,t} + \beta_3 \ln tou_{i,t} + \beta_4 DU_t + \varepsilon_{i,t} \quad (4)$$

Since this specification assumes spatial interaction in the dependent variable, it is termed the Spatial Autoregressive model (SARM) as preferred to the Spatial Error model (SEM). The latter only captures spatial dependence indirectly through the error term, while SARM allows a direct interpretation of the magnitude and statistical significance of spatial effects through the ρ parameter (Anselin, 1988). A positive and statistically significant estimated ρ indicates the presence of spatial spillovers, where the economic activity (GDP) in one region affects the economic activity in neighbouring regions *i* (for more details, see Anselin, 1988; Anselin et al., 1996, 2008; Anselin & Arribas-Bel, 2013; Anselin & Rey, 1991; Baltagi, 2013; Baltagi et al., 2003, 2007, 2012; Elhorst, 2003, 2010, 2014; Elhorst & Illy, 2009). Besides, the model is dynamic since it includes a one-year lagged dependent variable ($\ln y_{i,t-1}$), and δ as an autoregressive parameter. It represents the starting level of income that tests the convergence hypothesis across regions (Barro & Sala-i-Martin, 1992).

Table 1. Definition of Variables (in logarithm).

Variables	Acronym	Definition	Source	Unit
Dependent	GDP (y)	per capita real GDP, in (ln) National currency per head, constant prices (Euros, SNA, at 2008)	OECD (2022); ISTAT (2022) elaboration on labour market data (2004–2020) EUROSTAT (2022)	national currency
Physical & human capital	GFC	Real gross fixed capital formation per capita by NUTS 2 regions	OECD (2022); Macrotrends LLC (2022) (for Dollar/Euro currency information), EUROSTAT (2022); ISTAT (2022) elaboration on labour market data (2004–2020).	ln (real gfcf/ pop), deflator constructed: nominal/real gdp
	RE	Quota of Renewable Energy consumption	TERNA (2022); ISTAT (2022) elaboration on labour market data (2004–2020), EUROSTAT (2022); OECD (2022);	%
	LLL	Lifelong learning	ISTAT (2022) elaboration on labour market data (2004–2020), EUROSTAT (2022); OECD (2022);	%
	HED	Tertiary education (cluster 30–34 years old)	ISTAT (2022), elaboration on labour market data (2004–2020), EUROSTAT (2022); OECD (2022);	%
Tourism	TOT	Total overnights (domestic + foreigners) per capita	OECD (2022); ISTAT (2022); EUROSTAT (2022)	number
	TINT	International tourists overnights per capita (obtained by TOT-TDOM)	OECD (2022); ISTAT (2022); EUROSTAT (2022)	number
	TDOM	Domestic overnights per capita	OECD (2022); ISTAT (2022); EUROSTAT (2022)	Number
Dummies	d_crisis_2008	1 for crisis years 2008 and 2009, 0 for other years	Own construction	Own elaboration
	d_crisis_2012	1 for crisis years 2012-2013-2014, 0 for other years	Own construction	Own elaboration
	h_variation	1 for NUTS 2 with high GDP variation (i.e. Abruzzo, Bolzano, Emilia-Romagna, Friuli-Venezia-Giulia, Lazio, Liguria, Lombardia, Marche, Piemonte, Trento, Toscana, Umbria, Valle d'Aosta, Veneto), 0 otherwise	European Commission (2022, 2024)	Own elaboration
	l_variation	1 for NUTS 2 with low GDP variation (i.e. Basilicata, Calabria, Campania, Molise, Puglia, Sardegna, Sicilia), 0 otherwise	European Commission (2022, 2024)	Own elaboration

In this paper, the empirical analyses were implemented with Eviews 10, 'R' open Source programme, STATA 18 and GEODA programmes (Anselin, 2003; Anselin et al., 2009; IHS Markit, 2017; R Core Team, 2024; StataCorp, 2024).

The details of the variables are summarised in Table 1. The variables are expressed in natural logarithms. Table 2 reports the Pearson pairwise correlation matrix. As expected at a regional level of aggregation, the economic indicators tend to be highly correlated.

Table 2. Pearson pairwise correlation matrix.

Variables	GDP	GFC	RE	LLL	HED	TDOM	TINT
GDP	1						
GFC	0.924***	1					
RE	0.172***	0.260***	1				
LLL	0.436***	0.380***	0.239***	1			
HED	0.302***	0.201***	0.221***	0.662***	1		
TDOM	0.553***	0.579***	0.478***	0.353***	0.072	1	
TINT	0.709***	0.620***	0.298***	0.439***	0.125	0.706***	1

4. Empirical findings

4.1. Statistical properties

An important statistical concern is related to unit root properties of panel variables. If one/more variables are non-stationary, spurious regressions will likely occur. Hence, one needs to test for unit roots. Several types allow for different settings and assumptions (Table 3). Levin, Lin and Chiu test accepts unique unit root procession among spatial units, whereas Im, Pesaran, Shin, ADF-Fischer and PP-Fischer assume individual processes (Choi, 2001; Fisher, 1932; IHS Markit, 2017; Im et al., 2003; Levin et al., 2002; Maddala & Wu, 1999). Table 3A reports the results in the levels, while Table 3B shows the results in the first difference. Besides, both tables present the results separately under 'intercept, no trend' and 'intercept and trend' assumptions for the panel unit root processes. As an outcome for the levels, with a few exceptions, the unit root tests assess that most variables are robustly non-stationary and follow an I(1) process. Yet, the tests reveal that all the first differentiated variables are significantly and robustly stationary regardless of the deterministic components included in the auxiliary regression. As a further step, the long-run cointegrating relationships among I(1) variables are tested.

We perform the panel cointegration tests for all the specifications under analysis. The Kao Residual Cointegration and Pedroni Cointegration test assess that the alternative hypothesis holds, that is the cointegration of all variables (Table 4) (Amaluddin, 2019; Engle & Granger, 1987; Granger, 1969; IHS Markit, 2017; Kao, 1999; Maddala & Wu, 1999; Pedroni, 1999, 2004; Phillips & Ouliaris, 1990; Sargan, 1964). Hence, further empirical evidence shows that the data suit non-stationary models.

4.2. Regional heterogeneity

The next step assesses the role played by tourism specialisation in driving regional socio-economic growth and economic sustainability. The dynamic MGVECM (1, 1) is run for all 21 Italian regions, and a remarkable heterogeneity emerges in the short – and long-run (Tables 5 and 6) for domestic (Model 1) and inbound international tourism (Model 2).

Table 5 presents the results for Model S and explores RQ1. One can notice that domestic tourism significantly influences regional economic growth compared to international demand (38% versus 24%, respectively). Overall, these findings align with Harb and Bassil (2022). Yet, they also provide extra information on several interrelationships (RQ1). Specifically, domestic TLGH is confirmed in the Southern regions of Basilicata (short-run), Calabria (short and long-run), Campania (short-run) and Sicilia (long-run). Notably, Campania (short-run) and Sicilia (long-run) also denote a bidirectional relationship (TLGH – GLTH), together with the Centre and Northern regions of Liguria, Marche and Valle d'Aosta in the long-run. Overall, in 29% of cases, economic growth positively and significantly impacts domestic demand (i.e. unidirectional GLTH holds). Interestingly, international tourism is important in economic growth in the Centre and Northen regions, as found in Harb and Bassil (2022).

On the one hand, domestic demand fuels physical capital (*GFC*), either with a unidirectional impact (five regions in the short – and long-run) or with a bidirectional impact in the long-run (four regions). On the other hand, only in three regions (namely, Abruzzo, Marche and Piemonte), international tourism has a positive and statistically significant impact on physical capital. Arguably, the former outcome, transversal in the country (North–South), can also be reconducted to the construction sector of hospitality accommodation and, especially, second housing (Alonsopérez et al., 2022; Biagi et al., 2015, 2016). This finding aligns with Perles-Ribes et al. (2024), who find that in a highly touristic Spanish destination (Calp), tourism activity drives real estate growth in the long run.

Conversely, international tourism is a drive of tertiary education (*HED*) in six out of 21 regions within a unidirectional relationship (of which half in the short-run) and in five regions within a

Table 3. Panel Unit Root Tests, Schwarz (1978) criterion, max.lag = 4, Eviews 10.

A. Levels.

	Intercept				Intercept, trend			
Levels	LLC	IPS	ADF-Fischer	PP-Fischer	LLC	IPS	ADF-Fischer	PP-Fischer
GDP	−2.73317***	0.40775	34.9552	21.2713	5.64514	3.88238	13.2652	15.4204
GFC	−1.18833	1.40277	28.0189	13.4281	0.14383	0.10299	30.1374	27.9741
RE	−7.69509***	−1.53784*	59.8167**	28.5161	0.47588	0.40489	38.8864	26.0497
LLL	0.98528	1.20507	37.2853	57.7918*	−2.83274***	−3.55847***	81.3051***	105.207***
HED	−2.84506***	1.11669	24.1578	35.661	−5.03472***	−4.52127***	94.8507***	96.507***
TDOM	−2.08526**	−1.01529	44.1761	31.0956	−0.02842	−0.72854	44.21	37.1213
TINT	5.24784	6.07491	17.3351	20.7111	−0.01420	−0.17544	53.8451	57.8487*

Notes: H_0: Panel unit root; H_1: No panel unit root; *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

B. First differences.

	Intercept				Intercept, trend			
first differences	LLC	IPS	ADF-Fischer	PP-Fischer	LLC	IPS	ADF-Fischer	PP-Fischer
GDP	−8.31548***	−5.11339***	101.268***	116.544***	−9.30825***	−4.9371***	103.517***	91.8704***
GFC	−12.5829***	−8.36772***	141.271***	154.93***	−7.77192***	−2.5688***	75.466***	98.9668***
HED	−11.5398***	−11.0446***	195.078***	280.7***	−5.46636***	−9.12421***	140.3***	226.306***
LLL	−29.6067***	−22.763***	361.883***	404.116***	−13.9512***	−12.6107***	240.649***	321.803***
RE	−8.42763***	−7.56031***	142.504***	192.477***	−2.66141***	−4.65978***	104.69***	183.848***
TDOM	−7.46081***	−7.43574***	130.725***	170.262***	−5.58813***	−5.15516***	105.35***	150.016***
TINT	−8.44870***	−8.52041***	162.742***	228.589***	−3.75747***	−4.16515***	104.948***	205.033***

Notes: H_0: Panel unit root; H_1: No panel unit root; *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1.

Table 4. Residual Cointegration Test (lag 1).

Test	Solow t-Statistic	KLEM t-Statistic
(Model 1, TDOM) Kao ADF	−2.98***	1.71**
Pedroni, Phillips – Perron	−4.62***	−3.201***
(Model 2, TINT)		
Kao ADF	−2.98***	−2.98***
Pedroni, Phillips – Perron	−1.99**	−3.53***

Notes: H_0: No cointegration; H_1: All panels are cointegrated; *** p-value < 0.01; lag length = 1, individual intercept but no deterministic trend involved in test.

long-run bidirectional effect. These findings further assess the role of inbound international tourism on human development and, specifically, on education attainments (Biagi et al., 2017). Moreover, in the long run, tertiary education exerts a relatively higher impact on international tourism in Valle d'Aosta (7.85), Toscana (4.69), Umbria (3.78), and Lazio (3.37). This outcome provides empirical evidence on the contextual setting proposed by Tomasi et al. (2020) who unveil the role of higher education institutions as drivers of international tourism.

Table 6 provides results for Model K and assesses RQ2. Specifically, for domestic tourism, in five out of 21, the unidirectional TLGH holds, of which in Campania (0.27) and Lazio (0.13) in the long run, while in Emilia Romagna (2.77), Puglia (17.66) and Valle d'Aosta (0.26) in the short run. Besides, in two regions (namely, Abruzzo and Trento), a bidirectional relationship (TLGH and GLTH) is detected only in the long run. For international tourism demand, a bidirectional long-run relationship is identified in six regions: Abruzzo, Bolzano, Emilia Romagna, Piemonte, and Toscana in the Centre-North, and Campania in the South. In the short run, this relationship is unveiled in Lazio, Sicilia and Toscana. Interestingly, a substantial difference emerges between Model S and Model K, especially for certain regions. As an example, Bolzano has long pursued sustainable development goals, thanks to taxation reductions and investment in the green economy, further reinforced by the 'Everyday for Future' policy based on the 2030 UN agenda (OECD, 2022, 2023; UN, 2023, 2024). Notably, in this Italian autonomous province, with the highest 'GDP per capita and lowest unemployment rate', only 7.7% of households have 'a net equivalent income below 60% of the national median, compared to an average of 19.5%' in the rest of the country (OECD, 2022, 2023; UN, 2023, 2024).[1] Overall, the relationship between international tourism and GDP appears stronger, especially in the long run, in regions that pursue sustainability rather than in those reliant on non-renewable resources (see Dogru et al., 2020).

Domestic tourism plays a positive and statistically significant role in driving renewable consumption (*RE*) in six regions. In the long run, the outstanding impact relates to the Southern region of Puglia (6.80), followed by Bolzano (2.45), Trento (1.48) and Lazio (1.39). However, international tourism demand has a relatively higher impact on driving renewables. In six out of 21 regions, a bidirectional relationship holds in the long run (Campania, Emilia Romagna, Piemonte, Puglia, Toscana and Veneto), while in two regions, in the short run (i.e. Sicilia and Trento).

A further picture emerges from the relationship between tourism activity and lifelong learning (*LLL*). Only Piemonte presents a long-run bidirectional relationship, with a stronger impact from tourism demand to LLL (1.20 versus 0.98). Interestingly, domestic tourism mainly exerts a positive and statistically significant effect in the short run, and the highest impacts are detected in Bolzano (7.28), Emilia Romagna (5.32), Valle d'Aosta (3.12) and Friuli Venezia Giulia (3.00).

Conversely, in Abruzzo, Emilia Romagna and Veneto, lifelong learning plays an important role in driving international demand in the long run. Overall, lifelong learning has a relatively higher impact on international demand than on domestic demand. This outcome also further validates the findings for tertiary education in Model S. Hence, human capital accumulation proves to be especially important in international tourism specialisation (Biagi et al., 2017).

Table 5. Model S: Interrelationships tourism demand (dynamic MGVECM (1, 1); NUTS 2).

	Model 1- Domestic		Model 2- International tourism		
Region	Short-run	Long-run	Region	Short-run	Long-run
Tourism and gross domestic production (GDP)					
1. Basilicata	**1. GDP ⇐ TDOM (2.80)**	1. GDP ⇒ TDOM (0.96)	1. Abruzzo	**1. GDP ⇐ TINT (0.42)**	
2. Calabria	**2. GDP ⇐ TDOM (0.76)**	**2. GDP ⇐ TDOM (0.46)**	2. Emilia R.	2. GDP ⇒ TINT (4.22)	
3. Campania	***3. GDP ⇔ TDOM (0.32;****16.05)*		3. Liguria	3. GDP ⇒ TINT (3.74)	
4. Emilia R.		4. GDP ⇒ DOM (2.80)	4. Marche	**4. GDP ⇐ TINT (0.23)**	***4. GDP ⇔ TINT (0.13;*** *6.21)*
5. Liguria		***5. GDP ⇔ TDOM (0.93;*** *0.73)*	5. Piemonte		***5. GDP ⇔ TINT (0.41;*** *0.40)*
6. Marche		***6. GDP ⇔ TDOM (0.20;*** *4.23)*	6. Umbria	***6. GDP ⇔ TINT (0.20;*** *16.1)*	
7. Piemonte	**7. GDP ⇐ TDOM (0.48)**		7. Valle d'Aosta	***7. GDP ⇔ TINT (0.03;*** *22.42)*	
8. Puglia	8. GDP ⇒ TDOM (4.57)		8. Veneto	8. GDP ⇒ TINT (11.42)	
9. Sardegna	9. GDP ⇒ TDOM (3.76)				
10. Sicilia		***10. GDP ⇔ TDOM (0.37;*** *2.66)*			
11. Umbria		11. GDP ⇒ TDOM (1.02)			
12. Valle d'Aosta	12. GDP ⇒ TDOM (0.34)	***12. GDP ⇔ TDOM (0.58;*** *1.25)*			
	Model 1- Domestic		Model 2- International tourism		
Region	Short-run	Long-run	Region	Short-run	Long-run
Tourism and gross fixed capital (GFC)					
1. Basilicata	***1. GFC ⇔ TDOM (2.89;*** *0.29)*	1. ***GFC ⇔ TDOM (7.66;*** *0.13)*	1. Abruzzo	**1. GFC ⇐ TINT (2.39)**	
2. Emilia R.		2. GFC ⇒ TDOM (1.27)	2. Basilicata	2. GFC ⇒ TINT (0.55)	
3. Lazio	**3. GFC ⇐ TDOM (0.50)**		3. Emilia R.		3. GFC ⇒ TINT (1.23)
4. Liguria		***4. GFC ⇔ TDOM (3.66;*** *0.73)*	4. Marche	**4. GFC ⇐ TINT (0.23)**	
5. Marche	**5. GFC ⇐ TDOM (1.06)**		5. Piemonte	**5. GFC ⇐ TINT (0.65)**	
6. Molise	**6. GFC ⇐ TDOM (0.42)**				
7.Piemonte		**7. GFC ⇐ TDOM (0.41)**			
8. Puglia		**8. GFC ⇐ TDOM (0.74)**			
9. Sardegna	9. GFC ⇒ TDOM (3.76)	***9. GFC ⇔ TDOM (0.71;*** *1.37)*			
10. Sicilia	10. GFC ⇒ TDOM (1.92)				
11. Trento		11. GFC ⇒ TDOM (2.66)			
12. Umbria	12. GFC ⇒ TDOM (0.45)				
13. Valle d'Aosta	13. GFC ⇒ TDOM (1.27)				
14. Veneto	14. GDP ⇒ TDOM (0.54)	***14. GFC ⇔ TDOM (2.12;*** *1.25)*			
	Model 1- Domestic		Model 2- International tourism		
Region	Short-run	Long-run	Region	Short-run	Long-run
Tourism and tertiary education (HED)					
1. Basilicata	**1. HED ⇐ TDOM (2.91)**	1. ***HED ⇔ TDOM (1.04;*** *0.96)*	1. Basilicata	**1. HED ⇐ TINT (5.28)**	

(*Continued*)

Table 5. Continued.

	Model 1- Domestic			Model 2- International tourism	
Region	Short-run	Long-run	Region	Short-run	Long-run
2. Lombardia		2. HED ⇒ TDOM (0-15)	2. Emilia R.	2. HED ⇒ TINT (0.27)	*2.* ***HED*** ***⇔ TINT (1.82;*** *0.52)*
3. Puglia		**3.** ***HED ⇔ TDOM (2.37;*** *0.38)*	3. Friuli		**3. HED TINT (0.36)**
4. Sardegna	**4. HED ⇐ TDOM (1-05)**	4. ***HED ⇔ TDOM (1.24;*** *0.75)*	4. Lazio		4. HED ⇒ TINT (3.37)
5. Sicilia	5. HED ⇒ TDOM (1.49)	5. ***HED ⇔ TDOM (13.47;*** *0.07)*	5. Lombardia		*5.* ***HED ⇔ TINT (0.53;*** *0.51)*
6. Valle d'Aosta	**6. HED ⇐ TDOM (2.53)**		6. Puglia		**6. HED TINT (0.70)**
7.Veneto	7.HED ⇒ TDOM (0.25)		7.Sardegna		**7.HED TINT (0.23)**
			8. Sicilia		8. ***HED ⇔ TINT (0.55;*** *1.36)*
			9. Toscana		9. ***HED ⇔ TINT (0.25;*** *4.69)*
			10. Umbria	**10.HED ⇐ TINT (0.12)**	10. HED ⇒ TINT (3.78)
			11. Valle d'Aosta		*11.* ***HED ⇔ TINT (0.11;*** *7.85)*
			12. Veneto	**12.HED ⇐ TINT (0.18)**	

Notes: in parenthesis, the first figure is the overall effect of tourism demand (either domestic (*TDOM*) or international (*TINT*)) on each of the indicators under analysis, only based on a statistically significant and positive coefficient (at time *t* and t_{-1}, respectively) of at least 5%; bold: the overall effect of tourism on each of the relevant indicator; not bold: the impact of each relevant indicator on tourism demand; italic: a bidirectional effect holds.

4.3. Granger causality

A further analysis assesses Granger causality within a dynamic MGVECM (1,1). Comprehensive results are provided in the Appendix (Tables A1.AP and A2.AP). Regarding domestic demand, Model S does not reveal any statistically significant short-run Granger causality relationships. Conversely, in Model K, domestic tourism influences GDP and renewable energy growth, albeit with a negative coefficient on the first lag. This result has also been found by Harb and Bassil (2022) for some Italian regions, although the authors have not disentangled the short-run and long-run effects. Both model specifications reveal strong long-run temporal causality, with the GDP equation exhibiting the fastest convergence.

The results for international demand are detailed in Table A2.AP. In the short run, Model S shows a positive unidirectional Granger causality from GDP growth to tourism demand. Additionally, Model K presents long-run strong temporal causality in all equations except for the renewable energy (*RE*) equation. The tertiary education (HED; – 1.384) and lifelong learning (LLL; – 1.037) equations present the fastest convergence, corroborating the findings obtained for the individual regions.

4.4. Local indicators of spatial association (LISA)

Possible spatial spill-over effects are identified (RQ3) by employing GEODA program (Anselin, 2003; Anselin et al., 2009). We plot the main variables of interest (in demeaned form), that is, the per capita real GDP and domestic and international tourists (i.e. *TDOM* and *TINT*). The evolution is exemplified for the initial and the end year (i.e. 2004 and 2019, respectively). We apply Moran's I test to unveil the overall degree of spatiality (Moran, 1950; Rey & Montouri, 1999). A Moran scatterplot that depicts a steeper positive (negative) slope represents a high spatial positive (negative) association. Spatial positive (negative) association in spatial econometrics refers to the tendency for nearby locations to have similar (dissimilar) values for a given variable (Anselin, 1988; Moran, 1950; Rey & Montouri,

Table 6. Model K: Interrelationships Tourism demand (MGVECM, 1, 1, NUTS2).

	Model 1- Domestic			Model 2- International tourism	
Region	Short-run	Long-run	Region	Short-run	Long-run
Tourism and gross domestic product (GDP)					
1. Abruzzo		***1. GDP ⇔ TDOM (0.20; 4.83)***	1. Abruzzo		***1. GDP ⇔ TINT (0.22; 4.38)***
2. Campania		**2. GDP ⇐ TDOM (0.27)**	2. Bolzano		***2. GDP ⇔ TINT (0.01; 4.83)***
3. Lazio		**3. GDP ⇐ TDOM (0.13)**	3. Campania	3. GDP ⇒ TINT (3.17)	***3. GDP ⇔ TINT (0.11; 7.97)***
4. Emilia R.	**4. GDP ⇐ TDOM (2.77)**		4. Emilia R.		***4. GDP ⇔ TINT (0.27; 2.88)***
5. Puglia	**5. GDP ⇐ TDOM (17.66)**		5. Friuli	5. GDP ⇒ TINT (2.61)	
6. Trento		***6. GDP ⇔ TDOM (0.26; 3.88)***	6. Lazio	**6. GDP ⇔ TINT (0.37)**	
7. Valle d'Aosta	**7. GDP ⇐ TDOM (0.26)**		7. Piemonte		***7. GDP ⇔ TINT (0.13; 6.60)***
			8. Puglia		8. GDP ⇒ TINT (1.89)
			9. Sicilia	***9. GDP ⇔ TINT (0.51; 3.64)***	
			10. Toscana	***10. GDP ⇔ TINT (0.59; 37.53)***	***10. GDP ⇔ TINT (0.06; 16.19)***
			11. Trento	11. GDP ⇒ TINT (20.38)	
	Model 1- Domestic			Model 2- International tourism	
Region	Short-run	Long-run	Region	Short-run	Long-run
Tourism and renewable energy (RE)					
1. Bolzano		**1. RE ⇐ TDOM (2.45)**	1. Campania		***1. RE ⇔ TINT (0.76; 1.04)***
2. Lazio		**2. RE ⇐ TDOM (1.39)**	2. Emilia R.		***2. RE ⇔ TINT (2.32; 0.33)***
3. Molise	**3. RE ⇐ TDOM (4.18)**		3. Lazio	**3. RE ⇐ TINT (1.11)**	
4. Puglia		**4. RE ⇐ TDOM (6.80)**	4. Piemonte		***4. RE ⇔ TINT (0.75; 1.22)***
5. Trento		**5. RE ⇐ TDOM (1.48)**	5. Puglia	**5. RE ⇐ TINT (1.08)**	***5. RE ⇔ TINT (4.64; 0.22)***
6. Valle d'Aosta	**6. RE ⇐ TDOM (1.17)**		6. Sicilia	***6. RE ⇔ TINT (1.52; 0.29)***	
			7. Toscana		***7. RE ⇔ TINT (0.18; 5.39)***
			8. Trento	***8. RE ⇔ TINT (4.88; 2.49)***	
			9. Veneto		***9. RE ⇔ TINT (0.39; 2.45)***
	Model 1- Domestic			Model 2- International tourism	
Region	Short-run	Long-run	Region	Short-run	Long-run
Tourism and lifelong learning (LLL)					
1. Bolzano	**1. LLL ⇐ TDOM(7.28)**		1. Abruzzo		1. LLL ⇒ TINT (0.38)
2. Emilia R.	**2. LLL ⇐ TDOM(5.32)**		2. Emilia R.	**2. LLL ⇐ TINT(2.80)**	2. LLL ⇒ TINT (1.15)
3. Friuli	**3. LLL ⇐ TDOM(3.00)**		3. Lazio	**3. LLL ⇐ TINT(0.81)**	
4. Lazio		**4. LLL ⇐ TDOM(0.39)**	4. Puglia	**4. LLL ⇐ TINT(1.40)**	
5. Molise	***5. LLL ⇔ TDOM (0.93;2.43)***		5. Sicilia	5. LLL ⇒ TINT (0.36)	**5.LLL ⇐ TINT(0.98; 0.90)**
6. Piemonte		***6. LLL ⇔ TDOM (1.20; 0.98)***	6. Toscana		**6. LLL ⇐ TINT(0.76; 1.19)**
7. Sicilia	**7. LLL ⇐ TDOM(1.92)**		7. Trento	**7. LLL ⇐ TINT(1.25; 6.05)**	
8. Toscana	**8. LLL ⇐ TDOM(1.91)**		8. Veneto		8. LLL ⇒ TINT (2.22)
9. Valle d'Aosta	**9. LLL ⇐ TDOM(3.12)**				

Notes**:** in parenthesis, the first figure is the overall effect of tourism demand (either domestic (*TDOM*) or international (*TINT*)) on each of the indicators under analysis, only based on a statistically significant and positive coefficient of at least 5%; bold: the overall effect of tourism on each of the relevant indicator; not bold: the impact of each relevant indicator on tourism demand; italic: a bidirectional effect holds.

1999). An increase in the Moran statistic, a measure of spatial autocorrelation, indicates a stronger spatial pattern of association between neighbouring locations, whether positive or negative (Anselin, 1988; Moran, 1950; Rey & Montouri, 1999). This suggests a heightened importance of spatial effects in the analysis, highlighting the need for accounting for spatial dependencies when interpreting results and making policy recommendations. Regarding the spatial weight matrix, the k-nearest neighbours' scheme is adopted, along with inverse distance (Anselin, 1988; Burridge & Fingleton, 2010; Herrera-Gomez et al., 2012). The Global Moran I shows a strongly positive spatial association in the per capita GDP (Figure 2). The Moran I statistic rose from 0.69 in 2004 to 0.721 in 2019. The spatiality is moderate in the domestic and international tourism variables. *TDOM* had a Moran I statistic of 0.034 in 2004, which rose to 0.405 in 2019. Similarly, the *TINT* variable had a Moran I statistic of 0.367 in 2004, which decreased to 0.071 in 2019.

We also apply a LISA analysis to reveal the heterogeneous local spatial clusters (Anselin, 1995; Rey & Montouri, 1999). Through the Local Moran's I analyses, we produced maps for the three variables; of interest for 2004 and 2019 (Anselin, 1995; Rey & Montouri, 1999). The LISA results confirm the north–south spatial dualism in income and international tourism intensity. In per capita GDP, Local Moran I in Figure 3 shows a strong high-high club in Northern regions and low-low club in Southern regions that mirror the heterogeneous socioeconomic characteristics of the two macro-areas. Such a remarkable dualism further confirms Firza et al. (2023). Regarding the domestic tourism variable, we observe no distinct spatial clubs. However, regarding the international tourism intensity, we observe a low-low club in the Southern regions and a high-high club in the Northeastern regions.

4.5. Spatial Lagrange multiplier (LM) tests

Spatial autocorrelation that may be present in the panel regression model is a crucial matter in estimation. The spatial panel regression is applied in several studies investigating regional growth determinants (Crescenzi & Rodriquez-Pose, 2012; Islam, 1995, 2003). In case spatiality is evident, driven by several substantial and nuisance factors, OLS estimation is likely to give misleading results, it is also important to distinguish the source of spatial dependence that may be observed in dependent variable or error terms (Anselin, 1988). To test the severity of spatial autocorrelation, we apply LM tests to the panel regression (i.e. Equation 3 for models S and K, and domestic and international tourism, respectively). We apply two LM tests: LM-error and LM-lag-test: the former assumes spatial connectivity in errors, while the latter considers it in the dependent variable. Besides, we use pooling, fixed effect and random effect models as competitive specifications (Anselin, 1988; Anselin & Arribas-Bel, 2013; Anselin & Rey, 1991; Anselin et al., 1996, 2008; Baltagi, 2013; Baltagi et al., 2003, 2007, 2012; Elhorst, 2003, 2010, 2014; Elhorst & Illy, 2009). We programmed and performed the tests in the R SPLM package (Bivand et al., 2021, 2023; Millo & Piras, 2012; R core team, 2024). Regarding spatial weights, we use a raw standardised matrix of inverse distance. The matrix has been calculated as follows (Anselin, 1988; Burridge & Fingleton, 2010; Herrera-Gomez et al., 2012). Firstly, coordinates of the Italian NUTS 2 regions, based on their largest city, were obtained from Geodatos (2022). Hence, a distance matrix (in 21×21 form) between these largest cities was computed with the R Geosphere package (Hijmans, 2022; Hijmans et al., 2022). Finally, we calculated the inverse distance and standardised it in Excel.

The spatial autocorrelation tests indicate significant spatial autocorrelation regardless of the regression and test type (Table 7). It is significant for all models and the two test specifications. Hence, one has to incorporate such spatial dependence in regression analysis to avoid misleading results.

4.6. Spatial panel FMOLS Estimation

As an outcome of the FMOLS, tourism specialisation generally has a heterogeneous impact on economic growth. When sub-modals (S and K) are considered, only international tourism (*TINT*) in model S

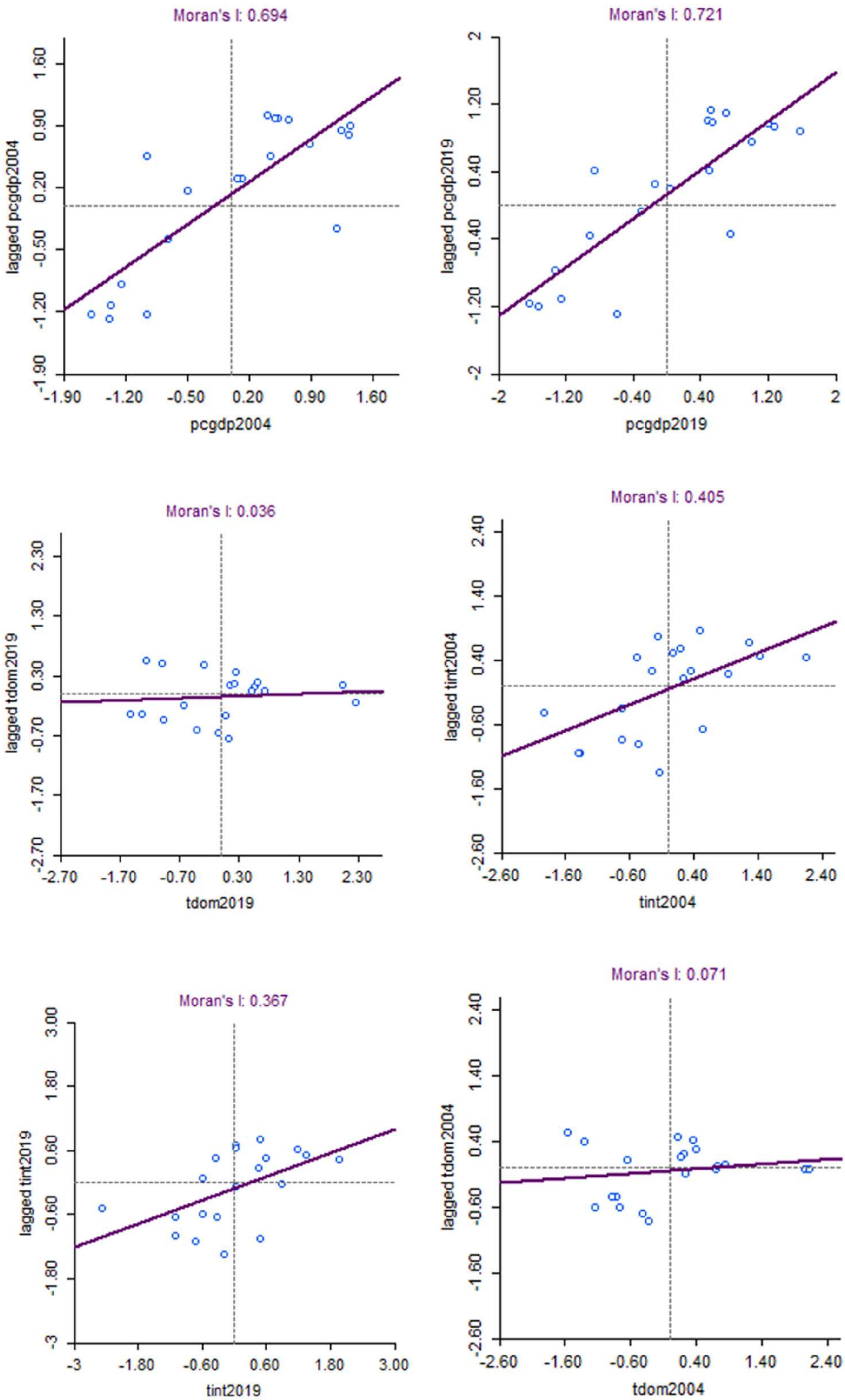

Figure 2. Moran I Scatterplots.

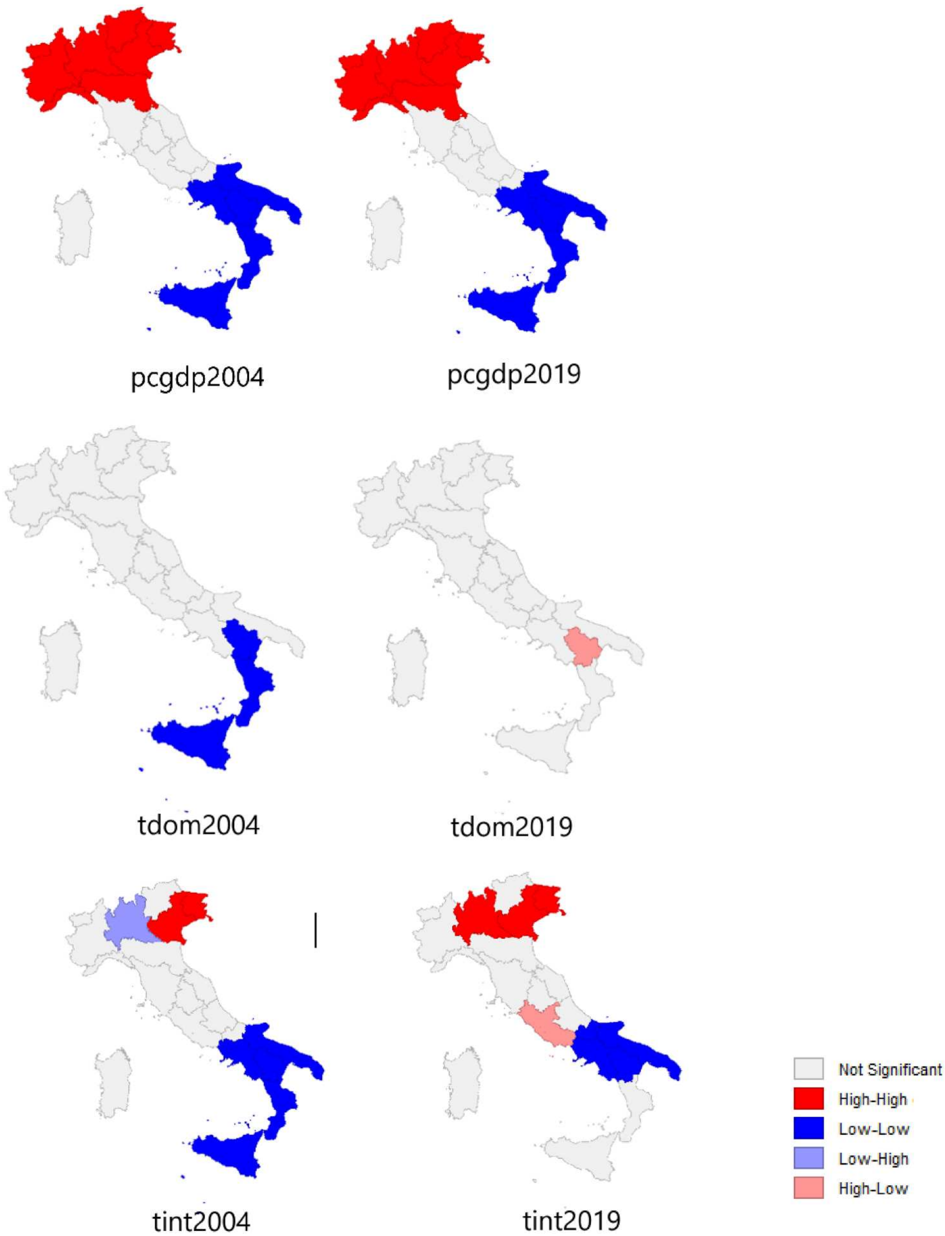

Figure 3. LISA Maps.

and domestic tourism (*TDOM*) in model K present positively statistically significant coefficients, although the effect is not strong (Tables 8 and 9).

One-year lagged GDP impact is captured by δ as an autoregressive parameter; the coefficient is positively and highly significant. Its value is around $0.8 < 1$, indicating a decline in regional disparities and the tendency for regional convergence. This outcome aligns with the 8th SDG. Besides, the spatial indicator ρ is positively significant, indicating spill-over of growth among the neighbouring regions (Odeleye et al., 2022).

Traditional physical and human capital also prove to strongly impact the Italian economy, confirming the disaggregated results. Regarding physical capital, the accumulation of real gross fixed

Table 7. Spatial LM Tests, $N = 336$.

Modal S	Tourism variable: TDOM		
Model Type	Pooling	Fixed Effect	Random Effect
LM-lag	12.413***	83.056***	12.413***
LM-error	494.65***	341.26***	494.65***
Model 2	Tourism variable: TINT		
Model Type	Pooling	Fixed Effect	Random Effect
LM-lag	7.6132***	81.737***	7.6132***
LM-error	452.07***	288.7***	452.07***
Modal K	Tourism variable: TDOM		
Model Type	Pooling	Fixed Effect	Random Effect
LM-lag	12.038***	121.6***	12.038***
LM-error	801.86***	595.95***	801.86***
Model 2	Tourism variable: TINT		
Model Type	Pooling	Fixed Effect	Random Effect
LM-lag	11.785***	128.71***	11.785***
LM-error	800.64***	549.18***	800.64***

Notes; H_0: No spatial correlation; H_1: Spatial correlation; *** p-value < 0.01, ** p-value < 0.05, *** p-value < 0.01.

asset formation per capita (*GFC* in Model S) positively influences the economy (Harb & Bassil, 2021). Yet, no impact is detected for renewable energy consumption (Model K). Hence, the 7th SDG (affordable and clean energy) is still lagging and challenging for the Italian economy, at least across the time under investigation. Furthermore, higher education (*HED*, Model S) and lifelong learning (*LLL*, Model K) also have a positive and substantial impact on the Italian economy. These human capital indicators align with the 4th SDG, but with a different level of skills and also as a continuous process of acquiring novel and flexible skills often developed through on-the-job training. Adapting to changes within a dynamic environment is pivotal for the economy (Van Laar et al., 2017). Besides, the global financial crisis is negatively significant. All the results are congruent with the more parsimonious specification, which signals robustness.

4.7. Robustness checks

Following the European Commission classification (2022), the same models have been estimated controlling for the two different regional clusters: high and low variation (Table 1) (European Commission, 2022, 2024). The Southern regions rely relatively more on domestic and international tourism; all tourism variables have a positive and highly significant impact. Moreover, the positive influence of the tourism variable is at a relatively lower magnitude for the developed regions (Tables 10 and 11). A positive and statistically significant coefficient consistently holds for all the other explanatory variables, but renewable energy consumption (*RE*) further assesses the findings' robustness.

As a further robustness check, a non-linear specification is incorporated by adding the squared term of the tourism variable to the regression specification in Equation 3 separately for models S

Table 8. Panel FMOLS Model with Spatial lag of dependent variable (GDP, 2004–2019), Model S.

	Model 1 Domestic Tourism	p-value	Model 2 International Tourism	p-value
GDP(−1)	0.822***	0.000	0.805***	0.000
SL_GDP	0.169***	0.000	0.172***	0.000
GFC	0.028***	0.001	0.034***	0.000
HED	0.020***	0.003	0.015**	0.032
d_crisis_2008	−0.044***	0.000	−0.043***	0.000
d_crisis_2012	−0.025***	0.000	−0.025***	0.000
TDOM	0.009	0.353		
TINT			0.013**	0.045

Statistical significance at *** 1%; ** 5%; * 10%; $N = 294$.

Table 9. Panel FMOLS Model with Spatial lag of dependent variable (GDP, 2004–2019). Model K.

	Model 1 Domestic Tourism	p-value	Model 2 International Tourism	p-value
GDP(−1)	0.8674***	0.0000	0.8681***	0.0000
SL_GDP	0.1950***	0.0000	0.2000***	0.0000
RE	−0.0024	0.4085	−0.0044	0.1665
LLL	0.0171***	0.0010	0.0137**	0.0150
d_crisis_2008	−0.0408***	0.0000	−0.0400***	0.0000
d_crisis_2012	−0.0232***	0.0000	−0.0235***	0.0000
TDOM	0.0179*	0.0526		
TINT			0.0100	0.1147

Statistical significance at *** 1%; ** 5%; * 10%; $N = 294$.

Table 10. Panel FMOLS Model with Spatial lag of dependent variable (GDP; 2004–2019), Model S.

Variable	Model 1 high variation Coefficient	p-value	Model 2 high variation Coefficient	p-value	Model 1 low variation Coefficient	p-value	Model 2 low variation Coefficient	p-value
GDP(−1)	0.944***	0.000	0.925***	0.000	0.955***	0.000	0.938***	0.000
SL_GDP	0.027**	0.011	0.038	0.002	0.029**	0.025	0.036**	0.010
GFC	0.023***	0.004	0.030***	0.000	0.009	0.358	0.020*	0.055
HED	0.027***	0.001	0.031***	0.000	0.020**	0.049	0.027***	0.008
d_crisis_2008	−0.034***	0.000	−0.033***	0.000	−0.013***	0.000	−0.012***	0.000
d_crisis_2012	−0.020***	0.000	−0.019***	0.000	−0.009***	0.001	−0.008***	0.000
TDOM	0.007**	0.017			0.007**	0.016		
TINT			0.005***	0.005			0.006***	0.004

Table 11. Panel FMOLS Model with Spatial lag of dependent variable (GDP; 2004–2019), Model K.

	Model 1 high variation		Model 2 high variation		Model 1 low variation		Model 2 low variation	
Variable	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
GDP(−1)	0.972***	0.000	0.979***	0.000	0.967***	0.000	0.963***	0.000
SL_GDP	0.023**	0.022	0.017	0.126	0.029**	0.019	0.034**	0.010
RE	−0.004**	0.024	−0.003	0.100	−0.003*	0.098	−0.002	0.333
LLL	0.023***	0.000	0.020***	0.001	0.019**	0.027	0.017**	0.043
d_crisis_2008	−0.033***	0.000	−0.032***	0.000	−0.013***	0.000	−0.012***	0.000
d_crisis_2012	−0.020***	0.000	−0.021***	0.000	−0.008***	0.001	−0.009***	0.001
TDOM	0.008***	0.004			0.009***	0.007		
TINT			0.003	0.182			0.006***	0.007

Notes: Statistical significance at the * (10%), ** (5%) and *** (1%), $N = 294$.

and K (see Appendix Tables A3.AP and A4.AP). In general, the non-linearity is rejected except for one specification (i.e. model S and domestic tourism). Notably, the remainder coefficients consistently confirm previous outcomes, which supports further estimation robustness.

5. Discussion

This paper examines the interplay between tourism, economic growth, and sustainable development within the Italian regional context. Socio-economic indicators, aligned with the UN 2030 SDGs, expand upon the TLGH literature by exploring complex dynamics associated with domestic and international demand specialisation. The TLGH posits that tourism can stimulate economic growth, yet it often overlooks regional heterogeneities, feedback loops, and sustainability concerns (Alcalá-Ordóñez et al., 2023). Alternative perspectives, such as those advocating for balanced regional development strategies and degrowth theories, challenge this traditional framework. These new theoretical advances address the importance of ad hoc policies that integrate sustainable practices and promote social equity across regions (Dwyer, 2023; Firza et al., 2023; Fletcher et al., 2020; Higgins-Desbiolles & Everingham, 2024).

The theoretical settings proposed in this paper are grounded in a robust empirical framework. Unit root tests confirm that most panel variables, although initially non-stationary, become stationary by first differencing. Their I(1) nature is further validated by the cointegration tests, ensuring the robustness of the dynamic MGVECM (1,1) models, that prevent spurious regressions.

A significant divergence emerges between domestic and international tourism segments, highlighting their heterogeneous influence on socio-economic indicators in the traditional TLGH (RQ1). The findings further validate that domestic tourism significantly drives economic growth in several Northern and Southern regions, confirming the TLGH (Harb & Bassil, 2022). Notably, a long-run bidirectional relationship between tourism and growth emerges in regions like Liguria, Marche, Sicilia and Valle d'Aosta, suggesting that economic growth also stimulates domestic demand. In contrast, international tourism predominantly fuels economic growth in the Centre-North regions, aligning with the findings of Harb and Bassil (2022). These regions also have high GDP variation (European Commission, 2022, 2024) and robust agglomeration economies. Hence, it is likely that the influence of tourism on growth becomes self-reinforcing thanks also to spillover effects from inbound origin visitors (e.g. business, education, sport and cultural tourism).

Besides, there is empirical evidence that several Italian regions, from North to South, rely on traditional physical capital, also linked to the second-home construction sector that especially serves domestic tourism (Perles-Ribes et al., 2024). Arguably, in regions with restricted agglomeration and lower dynamism, tourism activity's capacity to steer the overall economy remains limited, primarily manifesting through traditional channels, such as the construction sector. Such an outcome also aligns with previous research. Dogru et al. (2020) find that Italy can be associated with other OECD tourist destinations that rely on non-renewable energy, deforestation, and inefficient equipment products to support mass tourism. Land use with illegal construction is often associated with tourism-driven coastline settings where local institutions cannot contrast formal and informal market pressures (Troisi, 2022). In these settings, localised economic distortions may arise, including increased demand for goods and services and inflationary pressures, potentially straining natural resources and exacerbating socio-economic inequalities (Alonsopérez et al., 2022; Biagi et al., 2015, 2016).

Hence, this empirical analysis (Model S) indicates potential drawbacks of tourism specialisation, echoing concerns regarding the 'Dutch disease' and natural resource curse (Calero & Turner, 2020; Corden & Neary, 1982; Deng et al., 2014; Deng & Ma, 2016; Ghalia & Fidrmuc, 2018; Gylfason, 2001; Gylfason et al., 1999; Gylfason & Zoega, 2001; Jiao et al., 2019; Llorca-Rodríguez et al., 2021; Santos & Vieira, 2020). While tourism can bring economic benefits (e.g. job creation, revenues, infrastructure), over-reliance on tourism activity may suppress other more diversified and resilient sectors, limiting innovation. For Australia, Schmallegger and Carson (2010) unveil that tourism in remote central regions is locked into a 'staples trap'. Tourism as a single activity is vulnerable to bust phases and shutdowns, hindering adaptation to changing trends. The tourism trap can add to cultural commodification and unreversible environmental degradation, as tourism growth can compromise cultural integrity and drive ecosystem exploitation. This vulnerability is worsened when a region lacks economic diversification, making it more vulnerable to the adverse effects of endogenous and exogenous shocks.

Yet, when exploring the alternative KLEM specification (Model K), the role of sustainable practices in reinforcing the TLGH emerges (RQ2). Regions like Bolzano and Trento offer compelling examples of balanced pro-environment economies. With the highest GDP per capita and the lowest unemployment rates in Italy, they exhibit strong long-term relationships between tourism and economic growth only within a sustainability setting. Specifically, the empirical findings indicate that, in the long run, Trento relies more on domestic tourists, while Bolzano depends on international visitors, particularly from neighbouring countries (see Brida & Giuliani, 2013; OECD, 2022, 2023). This outcome suggests that these autonomous provinces can serve as benchmarks for regions with low GDP growth variation over time, primarily located in the south of Italy (European Commission, 2022, p. 2024). Integrating sustainable strategies across various sectors of the welfare state, such as transport, land use, and education, would enhance long-term socio-economic benefits.

Although tourism is a low-technology, labour-intensive sector (Colacchio & Vergori, 2022), the empirical analysis emphasises the severity of education in different parts of life and the job market. Indeed, higher education and related activities have a critical influence on enhancing tourism activity, especially international flows (RQ1, RQ2). Soft–hard skills and knowledge spillovers can promote cultural understanding and adaptability. Investing in education becomes pivotal for fostering resilient, inclusive, and environmentally tourism-dependent economies (see also Biagi et al., 2017; Tomasi et al., 2020 for a theoretical contextualisation). The present research also complements Chattopadhyay et al. study's mixed results for a panel of 133 countries over more than two decades. The authors encourage further research within specific geographical clusters to establish the nexus between human capital development and tourism activity. Besides, as highlighted by Ali et al. (2023), in the case of Italy, educated and wealthier individuals, particularly among younger demographics, are more environmentally conscious.

6. Conclusions

This study contributed to the tourism and economic growth discourse by integrating sustainability considerations into traditional economic models and addressing best practices. Remarkable regional heterogeneities emerged within the socio-economic interrelationships in the short and long run.

The empirical findings suggest that regions investing in sustainable practices and education at all life stages may drive more sustainable trajectories while attracting tourism flows. Policy implications to achieve a long-run sustainable path include a more holistic vision and the need for reforms in local institutions to drive pro-ecosystem innovation. Policymakers should consider alternative perspectives to formulate comprehensive strategies that balance socio-economic and forthcoming ecosystem challenges. Integrating education and lifelong learning into tourism policies to manage scarce resources would ensure equitable growth benefits within host communities while mitigating negative externalities on ecosystems as a shared value maximisation objective. Regions like Bolzano and Trento prove that pro-environmental balanced economies can succeed economically while reducing social inequalities. This outcome aligns with the green growth theory that seeks to harmonise economic growth with environmental sustainability through innovation, CO2 reduction policies and efficient resource use. The spatial spill-over effects and spatial heterogeneity detected in the impact of tourism also highlight the interconnectedness of regions. This outcome suggests that regional policies must account for these dynamics to maximise tourism benefits while mitigating shared environmental challenges.

Future research should explore alternative theories, such as degrowth, for tourism-driven economies with a multidisciplinary perspective. Empirically, diverse socio-economic and environmental metrics would capture other influencing indicators that can better address ecological limits and social well-being over economic growth as pursued by the degrowth framework (e.g. waste/recycling management, freshwater usage, common resources regulations, community involvement). Besides, the theoretical setting may be generalised further by comparative studies, and the potential for cooperative regional policies and cross-border initiatives should be further explored (OECD, 2022, 2023).

Note

1. Source of the statement: OECD (2023) https://www.oecd.org/content/dam/oecd/en/publications/reports/2023/11/a-territorial-approach-to-the-sustainable-development-goals-in-bolzano-bozen-italy_d14219ee/fb8e8ee0-en.pdf.

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ORCID

Bianca Biagi http://orcid.org/0000-0002-8913-1239
Hasan Engìn Duran http://orcid.org/0000-0002-0743-9943
Manuela Pulina http://orcid.org/0000-0002-2975-1786

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APPENDIX A

Table A1. AP Domestic tourism.

Explanatory Variables → / Dependent Variables ↓	DGDP	DGFC	DRE	DLLL	DHED	TDOM	ECM
	Short-run						Long-run
Model 1S							
DGDP	--	-0.109 (-0.17)	--	--	-0.010 (+0.01)	0.082 (+1.06)	**-1.180 (13.46***)**
DGFC	0.068 (+0.16)	--	--	--	-0.083 (-0.92)	-0.327 (+0.12)	**-0.836 (4.94**)**
DHED	0.736 +(0.45)	-0.349 (-0.56)	--	--	--	0.231 (+0.00)	**-0.920 (25.60***)**
DTDOM	-0.300 (-0.22)	0.089 (+1.17)	--	--	-0.131 (+0.00)	--	**-1.145 (33.41***)**
Model 1K							
DGDP	--	--	0.037(-0.46)	-0.051(-0.77)	--	**-0.374 (-7.01***)**	**-1.226 (54.56***)**
DRE	1.781 (+1.94)	--	--	-0.276(-1.29)	--	**-1.591 (-5.52**)**	**-0.783 (12.52***)**
DLLL	0.518 (-0.23)	--	0.318(+2.24)	--	--	0.524(+0.65)	**-1.087 (30.34***)**
DTDOM	0.600 (+0.15)	--	0.182(+1.53)	-0.272**(-3.53*)**	--	--	**-0.858 (11.70***)**

Temporal Panel Granger Causality, dynamic MGVECM (1, 1) – (aggregate NUTS 2; 2004–2019).

Table A2. AP. International tourism.

Explanatory Variables → / Dependent Variables ↓	DGDP	DGFC	DRE	DLLL	DHED	TINT	ECM
	Short-run						Long-run
Model 2S							
DGDP	--	-0.026 (+0.03)	--	--	**0.150 (+3.04*)**	0.0447 (+0.93)	***-1.055 (14.11***)***
DGFC	**-1.762 (-9.12***)**	--	--	--	**-0.351** (-0.92)	0.296 (+1.83)	***-1.065 (13.65***)***
DHED	1.485 (+0.13)	-0.182 (-0.06)	--	--	--	-0.040 (+0.05)	***-1.384 (66.19***)***
DTINT	**6.809 (+4.07**)**	-1.537 (-2.32)	--	--	-0.375 (+0.01)	--	***-0.495 (8.78***)***
Model 2K							
DGDP	--	--	**0.104** (+2.17)	-0.020 (+0.53)	--	0.041 (+0.03)	***-1.105 (11.32***)***
DRE	-0.732 (-0.03)	--	--	-0.019 (-1.08)	--	-0.116 (-2.54)	-0.388 (0.57)
DLLL	-0.032 (-0.95)	--	-0.220 (-0.77)	--	--	-0.089 (+0.28)	***-1.037 (15.14***)***
DTINT	-1.019 (+0.07)	--	-0.611 (**-5.32****)	-0.403 (+0.61)	--	--	***-0.405 (3.09*)***

Temporal Panel Granger Causality, dynamic MGVECM (1, 1) – (aggregate NUTS 2; 2004–2019).

Notes: The first letter *D* = first difference. The first number before the parenthesis represents the short-run impact coefficient (at time t) and, in bold, indicates a statistical significance. In parenthesis, the sign – positive or negative – refers to the coefficient of the first lag, and the χ^2 statistic for the Wald test (H_0: No Granger causality; H_1: Granger causality); in bold, statistical significance at the * (10%), ** (5%) and *** (1%). In bold and italics, a positive bidirectional temporal Granger causality holds.

Table A3. AP Panel FMOLS Model with Spatial lag of dependent variable (GDP; 2004–2019), Model S, non-linear specification.

	Coefficient	*p*-value	Coefficient	*p*-value
GDP(−1)	0.8064***	0.0000	0.8104***	0.0000
SL_GDP	0.1938***	0.0000	0.1863***	0.0000
GFC	0.0255***	0.0015	0.0299***	0.0004
HED	0.0188***	0.0049	0.0196**	0.0102
d_crisis_2008	−0.0429***	0.0000	−0.0431***	0.0000
d_crisis_2012	−0.0247***	0.0000	−0.0243***	0.0000
TDOM	0.0396**	0.0296		
TDOM^2	−0.0141**	0.0457		
TINT			0.0108*	0.0982
TINT^2			−0.0030	0.2182

Notes: Statistical significance at the * (10%), ** (5%) and *** (1%), *N* = 294.

Table A4. AP Panel FMOLS Model with Spatial lag of dependent variable (GDP; 2004–2019), Model K, non-linear specification.

	Coefficient	*p*-value	Coefficient	*p*-value
GDP(−1)	0.8593***	0.0000	0.9908***	0.0000
SL_GDP	0.2117***	0.0000	0.0082	0.1436
RE	−0.0018	0.5516	−0.0012	0.2796
LLL	0.0161***	0.0025	0.0110**	0.0135
d_crisis_2008	−0.0405***	0.0000	−0.0459***	0.0000
d_crisis_2012	−0.0234***	0.0000	−0.0333***	0.0000
TDOM	0.0359**	0.0487		
TDOM^2	−0.0082	0.2547		
TINT			0.0000	0.9987
TINT^2			0.0008	0.1066

Notes: Statistical significance at the * (10%), ** (5%) and *** (1%), *N* = 294.