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Structural Breaks, Convergence Clubs and Tourism Specialization: A Multi-Scale Analysis for Spain

Rupturas estructurales, clubes de convergencia y especialización turística: un análisis multiescalar para España

Luis Moreno Izquierdo, Universidad de Alicante, España
luis.moreno@ua.es

Aimée Torres-Penalva, Department of Applied Economics Analysis and Economics of Innovation and Artificial Intelligence Research Group (IEI), University of Alicante, Alicante, Spain
aimee.torres@ua.es

Salvatore Bimonte, Department of Economics and Statistics, University of Siena, Siena, Italy
bimonte@unisi.it

ABSTRACT

This paper investigates the role of tourism specialization –proxied by the share of employment in tourism-related activities– in shaping regional economic convergence dynamics in Spain. Using data for NUTS-2 and NUTS-3 regions over the period 2003–2023, we combine structural break detection (Bai–Perron), the Phillips and Sul convergence club methodology, and contingency table analysis to assess the relationship between economic performance and tourism specialization. First, the results reveal the presence of persistent structural heterogeneity in both regional development dynamics and sectoral structures. Second, no robust association is found between tourism specialization and economic convergence patterns, calling into question the idea that promoting this activity—similarly to other sectors—can act as a generalizable engine of regional convergence. Overall, the findings highlight the structural complexity of the territorial system and the critical role of spatial scale, showing significant differences between regional (NUTS-2) and provincial (NUTS-3) levels. These results suggest the need for cross-cutting policy approaches that go beyond sectoral specialization to foster convergence processes.

Keywords: Regional convergence, Convergence clubs, Tourism specialization, Phillips and Sul, Spain, Structural breaks.

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RESUMEN

Este artículo analiza el papel de la especialización turística –medida a través de la proporción del empleo en actividades relacionadas con el turismo– en la configuración de la convergencia económica regional en España. Utilizando datos para regiones NUTS-2 y NUTS-3 durante el periodo 2003–2023, combinamos la detección de quiebres estructurales (Bai–Perron), la metodología de clubes de convergencia de Phillips y Sul y el análisis mediante tablas de contingencia para evaluar la relación entre el desempeño económico y la especialización turística. En primer lugar, los resultados evidencian la existencia de una heterogeneidad estructural persistente tanto en la dinámica del desarrollo regional como en la estructura sectorial. En segundo lugar, no se detecta una asociación robusta entre la especialización turística y los patrones de convergencia económica, lo que cuestiona que la promoción de esta actividad —al igual que ocurre con otros sectores— pueda actuar como un motor generalizable de convergencia regional. En conjunto, los resultados ponen de manifiesto la complejidad estructural del sistema territorial, así como la relevancia de la escala espacial, mostrando diferencias significativas entre los niveles regional (NUTS-2) y provincial (NUTS-3). Estos hallazgos sugieren la necesidad de políticas transversales que vayan más allá de la especialización sectorial para promover procesos de convergencia.

Palabras clave: Convergencia regional, clubes de convergencia, especialización turística, Phillips y Sul, España, quiebres estructurales.

I. INTRODUCTION

Regional economic convergence constitutes one of the central pillars of applied economic analysis, particularly in contexts such as Europe, where reducing territorial disparities has been an explicit objective of economic policy for decades (Begg, 2008; Mascherini et al., 2018). Within this framework, a vast body of research has sought to assess whether a process of economic convergence has effectively taken place across countries in terms of income, development, and welfare. Representative contributions include Borsi and Metiu (2015), Chapsa and Katrakilidis (2014), and Yin et al. (2003), among others, who, using traditional approaches such as beta convergence, document a clear process of economic catching-up among European countries from the last decades of the twentieth century to the present.

However, the literature also shows that economic convergence has not been uniform across countries or over time and has often taken the form of group-specific dynamics (Chapsa and Katrakilidis, 2014; Cuadrado-Roura, 2001). Indeed, although most long-run European studies point to a process of income convergence among countries (Eckey and Türck, 2005), the empirical evidence reveals complex dynamics characterized by the formation of groups of territories with differentiated behavior (Cavenaile and Dubois, 2011; Mora, 2005; Suárez-Arbesú et al., 2023). In this context, the convergence clubs approach proposed by Phillips and Sul (2007, 2009) has become one of the most prominent frameworks for capturing the inherent heterogeneity of growth processes.

From a theoretical perspective, the literature has identified a range of factors associated with the formation of convergence clubs, such as initial and structural characteristics of economies, which may give rise to divergent growth trajectories and the

emergence of multiple long-run equilibria (Baumol, 1986; Quah, 1996; Phillips and Sul, 2007). In this regard, sectoral specialization and structural change play a central role in convergence processes, being closely associated with macroeconomic performance, reflecting differences in demand dynamics, innovation potential, and the capacity to generate inter-sectoral spillovers (Peneder, 2003).

Against this background, this article empirically assesses the role of tourism specialization in shaping regional economic convergence dynamics in Spain, through a comparative analysis across two geographical levels: NUTS-2 and NUTS-3 regions (corresponding to autonomous communities and provinces, respectively). To this end, the methodological strategy combines the identification of structural breaks (Bai–Perron), the analysis of convergence clubs (Phillips and Sul), and the assessment of the relationship between economic and sectoral dimensions through contingency table techniques. To guide the empirical analysis, this general hypothesis is specified for each spatial scale:

H1a: Tourism specialization is associated with regional economic convergence patterns at the NUTS-2 level.

H1b: Tourism specialization is associated with regional economic convergence patterns at the NUTS-3 level.

To the best of our knowledge, this is the first study to examine the relationship between tourism specialization and economic convergence clubs at the NUTS-3 level for Spain. While recent research has advanced the analysis of convergence clubs using highly disaggregated regional data and structural break techniques (Moreno-Izquierdo et al., 2026), the role of sectoral specialization—particularly tourism—remains largely unexplored within this framework. Existing work at the European or Spanish regional level has focused on NUTS-2 aggregates (Llorca-Rodriguez et al., 2021; Harb et al., 2024), which correspond to autonomous communities and may conceal substantial intra-regional heterogeneity. The provincial (NUTS-3) scale allows for a more granular identification of structural patterns and provides a more demanding test of the hypothesized relationship. Furthermore, by extending the analysis to other productive sectors as robustness checks, the article provides a broader assessment of whether sectoral specialization—beyond tourism—is systematically linked to convergence club membership in Spain.

The remainder of the paper is structured as follows. Section 2 reviews the theoretical and empirical literature on economic convergence, convergence clubs, and the role of sectoral specialization, with particular attention to the tourism sector. Section 3 describes the methodology employed, including the data, the structural break detection procedure, the convergence club analysis, and the contingency table approach. Section 4 presents the main results and robustness checks. Section 5 discusses the implications of the findings and outlines avenues for future research.

II. TOURISM AND ITS RELATIONSHIP WITH ECONOMIC CONVERGENCE

Tourism has traditionally been considered a driver of economic growth, as supported by the well-known Tourism-Led Growth Hypothesis (TLGH) (Balaguer and Cantavella-Jordá, 2002), which itself originates from the Export-Led Growth Hypothesis (ELGH). This theoretical framework has been extensively analysed in the literature over the past two decades, and while a positive relationship between tourism and economic progress is broadly assumed, the

causal direction of this relationship remains ambiguous and highly contingent on geographical and temporal factors (Alcalá-Ordóñez et al., 2023; Pulido-Fernández and Cárdenas-García, 2021). In this regard, the literature has progressively incorporated methodological improvements—such as controlling for non-linear relationships (Brida et al., 2016; Perles-Ribes et al., 2026)—and expanded the scope of analysis towards broader dimensions related to well-being (Cárdenas-García et al., 2024), rather than focusing exclusively on economic growth, which may mask the diseconomies generated by tourism when analysed through aggregate macroeconomic indicators.

This approach, which directly examines the relationship between tourism and economic progress, is complemented by the study of tourism as a factor of regional economic convergence, analysing whether tourism specialization is associated with the alignment of regional economic trajectories, independently of its effect on aggregate growth levels. This perspective, without denying the positive relationship between the variables, allows tourism to be contextualised in relation to comparative productivity. In this sense, tourism exhibits a dual nature: on the one hand, compared to manufacturing or knowledge-intensive sectors, tourism tends to be associated with lower labour productivity, high seasonality, and a prevalence of low-skilled, part-time employment (Casado et al., 2022; Ghosh & Mitra, 2021; Petit, 2017; Torres-Penalva et al., 2025); on the other, it may constitute a lever for diversification and relative development for regions coming from very traditional productive structures –such as agriculture or mining –where its emergence represents a qualitative leap in terms of employment, income, and openness to external markets (Cater, 1987; Nguyen et al., 2021; Saner et al., 2019; Subramaniam et al., 2022). This duality implies that the effect of tourism on convergence cannot be assessed homogeneously–as was the case with the TLGH– but depends critically on the structural starting point of each territory.

This structural ambiguity is reflected in the empirical evidence, which points in both directions. On the one hand, tourism has been shown to contribute positively to regional cohesion in certain contexts: Llorca-Rodriguez et al. (2021) find that domestic tourism acts as an instrument for enhancing territorial cohesion in less developed and transition EU regions, though inbound tourism produces the opposite effect, hindering convergence in those same regions. On the other hand, studies such as Haller et al. (2021) and Koudoumakis et al. (2019) have identified tourism as a sector associated with regional divergence, a finding consistent with the broader structural change literature, which emphasizes that the reallocation of productive resources towards knowledge-intensive activities tends to enhance convergence, whereas concentration in low-productivity sectors may obstruct it (McMillan and Rodrik, 2011). Moreover, beyond aggregate income dynamics, tourism has also been associated with the generation of inequalities in terms of labour market opportunities and worker well-being in developed economies –as documented for the United States (Lacher and Oh, 2012) and Spain (Torres-Penalva et al., 2026)– as well as with significant capital outflows from developing towards developed economies, further limiting its potential as a convergence mechanism (Garrido and Moreno-Izquierdo, 2025).

These considerations suggest that the relationship between tourism specialization and regional economic trajectories is unlikely to follow a single, uniform pattern. Rather than asking whether tourism converges or diverges in the aggregate, a more appropriate question is whether regions with similar levels of tourism specialization tend to cluster into distinct growth regimes –and, crucially, what position those clubs occupy in the overall income

distribution relative to regions with different productive structures. This is precisely the analytical space that the convergence clubs framework is designed to occupy. As noted by Galor (1996), sectoral and technological complementarities, together with the presence of demand spillovers and non-convexities, may generate multiple steady-state equilibria, implying that economies with similar fundamentals can nonetheless diverge if they are located in different basins of attraction.

From this perspective, the productive structure of the economy ceases to be a merely descriptive feature and becomes a key conditioning factor shaping long-run growth trajectories. Economies characterised by different productive structures would therefore be expected to follow heterogeneous growth paths, converging within relatively homogeneous groups rather than towards a common equilibrium. This interpretation finds empirical support in Cutrini and Méndez (2023), who show that spatial patterns of structural change significantly affect the probability of regions belonging to different convergence clubs, and is further reinforced by evidence that intra-national dynamics are nearly as relevant as international ones in explaining European economic convergence (Cuadrado-Roura, 2001; Qineti et al., 2011). Whether tourism specialization–given its structural ambiguity–is systematically linked to club membership, and whether this relationship holds consistently across spatial scales, constitutes the empirical question that the methodology of the following section is designed to address.

III. METHODOLOGY

3.1. Data used

As highlighted in the introduction, this article focuses on the specific case of Spain, using two levels of regional segmentation: NUTS-2 units, which correspond to autonomous communities, while NUTS-3 units refer to provinces. In order to answer the hypothesis introduced, Gross Domestic Product (GDP) in PPS (obtained from Eurostat: nama_10r_3gdp) is used as the economic indicator in our exercise. This variable has been commonly used in the literature on convergence clubs and regional economic convergence (see, for example, Cutrini, 2019; Kaitila, 2013; Pintera, 2024).

Tourism specialization is measured as the share of employment in tourism-related activities relative to total employment in each NUTS-2 or NUTS-3 region, obtained from the Eurostat employment distribution by sectors database (nama_10r_3empers). In the construction of this variable, however, two main limitations should be acknowledged: first, Eurostat does not provide a direct measure of regional tourism employment, so we use the aggregate that includes *wholesale and retail trade, transport, accommodation, and food services (WHO)*. This limitation is widely recognised in the literature, where tourism is typically proxied using hospitality-related activities (see Brida et al., 2008; Casado et al., 2020; García-Pozo et al., 2012; Oliver and Sard, 2021, among others). In this context, the WHO aggregate provides a consistent approximation that captures both core and complementary tourism-related activities.

A second limitation concerns the availability of the WHO variable for Spain. While WHO is directly available at both NUTS-2 and NUTS-3 levels for most European countries, Spain, Germany and Austria only report it in aggregated form as WHO2 = WHO + IC at the NUTS-3 level, where IC refers to information and communication activities. To recover the WHO

component for these countries, within-aggregate shares are estimated using data from the remaining European regions –where both WHO and WHO2 are available at NUTS-2 and NUTS-3 levels– through generalized linear models with a logit link, fitted on observations with complete information. The predicted shares are then used to impute the missing WHO values at the NUTS-3 level, ensuring internal consistency across sectoral aggregates. This procedure represents a methodological contribution, as previous studies at the NUTS-3 level typically lack this degree of sectoral detail for Spain. Descriptive statistics of the main variables are reported in Table 1.

Table 1. Descriptive statistics

Scale	Variable	Mean	Min	Max	SD
NUTS-2	GDP2	1.000	0.689	1.452	0.198
NUTS-2	WHO	0.283	0.206	0.418	0.046
NUTS-3	GDP2	1.000	0.686	1.674	0.202
NUTS-3	WHO	0.281	0.058	0.557	0.067

3.2. Detecting structural breaks.

To avoid potential misspecification arising from the assumption of temporal stability in economic convergence processes, we incorporate the multiple structural break methodology proposed by Bai and Perron (1998, 2003), which endogenously identifies unknown breakpoints in time series without requiring a priori assumptions about the timing of regime shifts. This methodology has been widely applied across different fields, including the energy sector, sports, legal studies, and various economic and financial applications, and in tourism-related studies (e.g., Cró and Martins, 2017; Mérida and Golpe, 2016), supporting its suitability for our object of study, given that tourism is particularly sensitive to external shocks, including economic crises, geopolitical events, and health-related disruptions, with the intensity of its response further conditioned by the degree of tourism specialization and dependence of each region.

The Bai–Perron framework models the evolution of dispersion as a piecewise linear process:

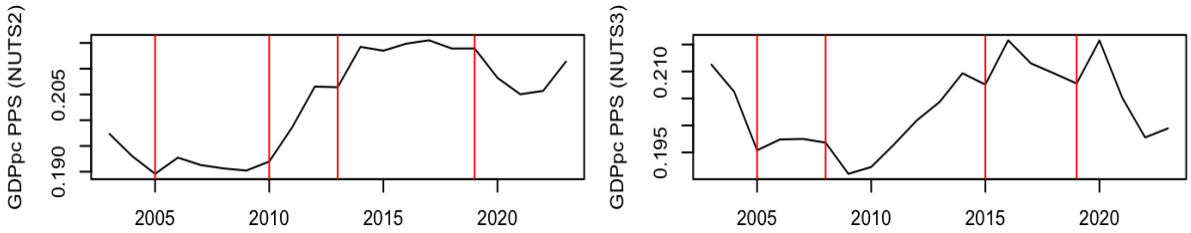
$$y_t = \alpha_j + \beta_j\, t + \varepsilon_t\,, \qquad t = T_{j-1} + 1, \ldots, \quad T_j$$

for j = 1,..., m + 1, where T_j represents the unknown break dates and m denotes the number of structural breaks. Parameters are allowed to vary across regimes, capturing changes in the dynamics of regional dispersion. Breakpoints are estimated by minimizing the sum of squared residuals, with inference based on supF tests and model selection guided by the Bayesian Information Criterion (BIC).

In our case, using the *strucchange* package (Zeileis et al., 2002), breakpoints are identified for GDP per capita (PPS) (Figure 1), with some variation in their timing between NUTS-2 and NUTS-3 levels. For the sake of parsimony and to ensure comparability across spatial scales, we retain a single breakpoint corresponding to the most prominent structural shift, located within the 2008–2010 interval depending on the level of aggregation.

Accordingly, 2010 is selected as a common break date, distinguishing between the pre-crisis period (2003–2010) and the subsequent adjustment and recovery phase (2011–2023). Although additional breakpoints were detected, they had less impact than the one provoked by the financial crisis. Moreover, retaining multiple breakpoints would generate subperiods of insufficient length for robust application of the Phillips and Sul procedure, given the trimming parameter required by the log-t test.

Figure 1. Structural breaks in sigma convergence for economic convergence



Although we are working with a short time series, previous studies have also applied the Bai–Perron methodology to similar periods. For instance, Cró and Martins (2017) apply the procedure to international tourism arrival series of approximately 20 observations across 25 countries, treating the limited sample size as an inherent constraint of the available data rather than a methodological shortcoming. Additionally, ignoring the break associated with the financial crisis in favour of a longer unified sample would introduce a more severe misspecification bias than the one associated with a shorter subperiod. Therefore, the results regarding the identified subperiods should be interpreted with caution.

3.3. Testing for overall convergence and identification of convergence clubs

To analyse regional convergence dynamics and identify potential convergence clubs, this study applies the methodology proposed by Phillips and Sul (2007, 2009) to the variables of interest. Specifically, the Phillips and Sul methodology is based on the idea that each region follows a common long-term growth path, while allowing for differences in short- and medium-term dynamics. Within this framework, regional trajectories are expressed relative to the cross-sectional average, making it possible to assess whether regions converge over time or instead follow divergent paths. The procedure relies on a regression-based framework that evaluates whether cross-sectional dispersion declines over time within each potential group of regions, following a sequential strategy that first tests for overall convergence and then identifies convergence clubs. From a methodological perspective, and following Phillips and Sul (2007), the trimming parameter is set to r = 1/3, implying that the regression is estimated over the final two-thirds of the sample period. Overall convergence is tested using the log-t regression, where the null hypothesis of convergence is rejected at the 5% significance level if the t-statistic of the coefficient is lower than −1.65. The empirical implementation follows the procedure operationalised in the R package *ConvergenceClubs* (Sichera and Pizzuto, 2019).

The club convergence approach has been widely used in empirical analyses of economic convergence, as well as in other fields such as Ecology, Energy, and Finance. In the context of tourism, relevant applications include Mérida et al. (2016) and Pizzuto and Sciortino (2021) for tourism source markets of Spain and Italy, respectively, Payne et al. (2023) for the

case of Croatia, and Abbott et al. (2012) for the case of Turkey. To the best of our knowledge, this article represents the first attempt to identify convergence clubs using a tourism specialization factor. Following this literature, we first test for the absence of overall convergence. In our case, as reported in the results section, overall convergence tests consistently reject the hypothesis of global convergence across both spatial scales (NUTS-2 and NUTS-3) and across the subperiods defined using the Bai–Perron structural break procedure.

However, an important methodological caveat must be acknowledged regarding the reliability of the log-t statistic. As discussed by Tomal (2024) in his comprehensive review of the Phillips and Sul methodology, the test was derived under asymptotic assumptions and its behaviour in small samples may exhibit distortions in size and power. In our case, this concern is most acute for the pre-crisis subperiod (2003–2010), where the effective sample used in the log-t regression –after applying the standard trimming described above– is reduced to approximately five observations. Results for this subperiod must therefore be interpreted with particular caution, and the identified clubs understood primarily as structural groupings rather than as statistically confirmed convergence processes.

3.4. Relationship between economic and tourism convergence clubs

Once convergence clubs for GDP per capita and tourism specialization have been identified, the relationship between both dimensions is analysed through a comparative approach based on the correspondence between clubs. In this regard, we first use contingency tables to identify, through concentration patterns, whether regions with higher levels of tourism specialization tend to cluster within specific income clubs. In addition, they allow for the detection of potential mismatches between both dynamics, as well as across NUTS-2 and their corresponding NUTS-3 regions, providing relevant insights for economic and policy decision-making.

The statistical significance of these associations is assessed using the chi-square test of independence applied to the contingency tables. This test evaluates whether the observed distribution differs from what would be expected under the null hypothesis of independence between economic and tourism clubs. In addition, Cramér's V statistic is computed as a measure of the strength of the association, offering a complementary interpretation of its magnitude. Finally, standardized residuals from the chi-square test are analysed to identify specific combinations of clubs that are over- or under-represented. This is particularly useful for detecting structural patterns beyond the overall association, such as the concentration of regions within specific combinations of economic and tourism convergence.

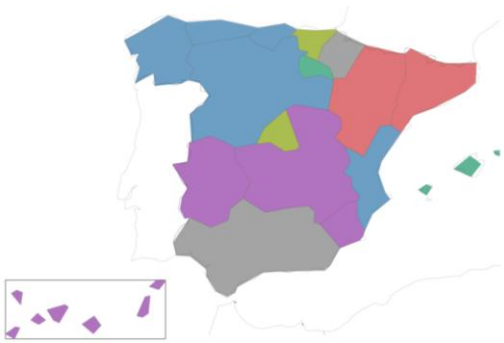
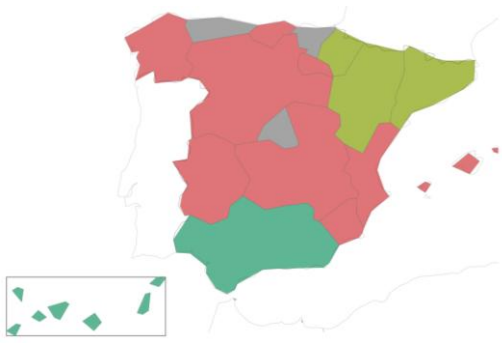
This analytical non-parametric approach has been previously employed to examine the relationship between economic and tourism variables (e.g., Marti and Puertas, 2025; Muler Gonzalez et al., 2018), given its strong descriptive power. However, our empirical design, based on subperiod analysis and reduced temporal dimension within each regime, weakens the reliability of causality tests as in the work of Brida et al. (2025). This limitation has been commented on in the last section of this paper.

IV. RESULTS

4.1. Convergence dynamics of economic performance and tourism specialization

The Phillips and Sul methodology reveals that regional economic dynamics in Spain do not follow a common trajectory but instead evolve through differentiated processes across groups of territories. This pattern is observed at both NUTS-2 and NUTS-3 levels, and in both subperiods (2003–2010 and 2011–2023), although with notable differences across scales and variables (Figures 2 and 3).

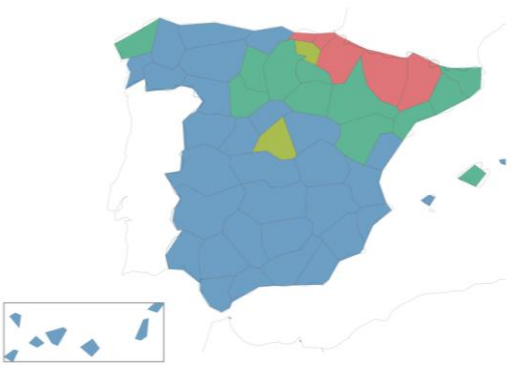
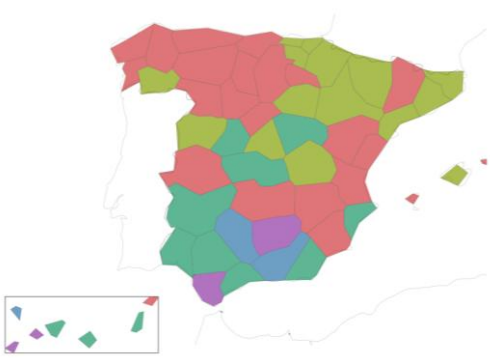
Figure 2. Convergence clubs of regional income in Spain (NUTS-2)

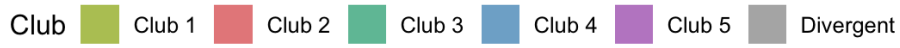
<table>
<tr><td>Period: 2003–2010</td><td>Period: 2011–2023</td></tr>
<tr><td>  </td><td>  </td></tr>
<tr><td colspan="2">Club Club 1 Club 2 Club 3 Club 4 Club 5 Divergent</td></tr>
</table>

Period: 2003-2010					
Club	N regions	b (SE)	t_b	mean (2003)	mean (2010)
Club 1	2	-0.291 (0.417)	0.70	1.302	1.352
Club 2	2	-0.428 (0.299)	-1.43	1.178	1.171
Club 3	2	3.074 (0.500)	6.14	1.174	1.109
Club 4	6	-0.469 (0.291)	-1.61	0.898	0.922
Club 5	5	0.141 (0.179)	0.78	0.843	0.827
Divergents	2	–	–	1.042	1.030

Period: 2011-2023					
Club	N regions	b (SE)	t_b	mean (2011)	mean (2023)
Club 1	3	0.823 (0.194)	4.23	1.207	1.212
Club 2	9	-0.359 (0.249)	-1.45	0.937	0.954
Club 3	3	0.423 (0.959)	0.44	0.826	0.787
Divergents	3	–	–	1.115	1.103

Figure 3. Convergence clubs of regional income in Spain (NUTS-3)

Period: 2003–2010	Period: 2011–2023
	



Period: 2003-2010					
Club	N regions	b (SE)	t_b	mean (2003)	mean (2010)
Club 1	2	-0.464 (0.750)	-0.62	1.456	1.518
Club 2	5	0.233 (0.285)	0.82	1.270	1.309
Club 3	12	0.010 (0.016)	0.66	1.160	1.163
Club 4	40	-0.040 (0.134)	-0.30	0.895	0.886
Period: 2011-2023					
Club	N regions	b (SE)	t_b	mean (2011)	mean (2023)
Club 1	15	-0.053 (0.228)	-0.23	1.216	1.248
Club 2	23	-0.396 (0.256)	-1.55	1.005	1.016
Club 3	13	-0.466 (0.357)	-1.30	0.858	0.841
Club 4	3	-1.417 (1.360)	-1.04	0.801	0.780
Club 5	5	-0.531 (0.838)	-0.63	0.812	0.721

The NUTS-2 analysis (Figure 2) shows a more aggregated and relatively stable structure, with five and three clubs in the pre- and post-crisis periods, respectively. This evolution suggests a reconfiguration of the club structure, with a relative concentration of regions in fewer groups over time. At the NUTS-3 level (Figure 3), a similar pattern emerges, but with substantially higher heterogeneity, as reflected in the increase from four to five clubs. Overall, these results point to the existence of multiple economic trajectories within Spain, as also documented by Montañés et al. (2018) for the Spanish case, and by other studies such as Fritsche and Kuzin (2011), Cavallaro and Villani (2021), and Cavenaile and Dubois (2011) for European regions and countries.

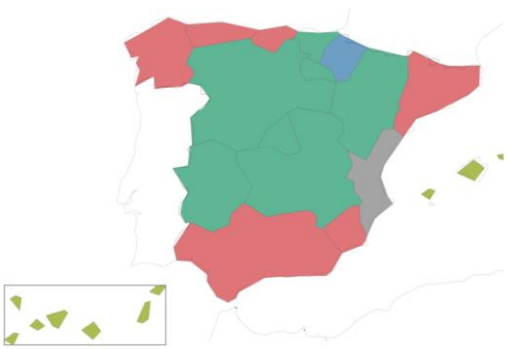
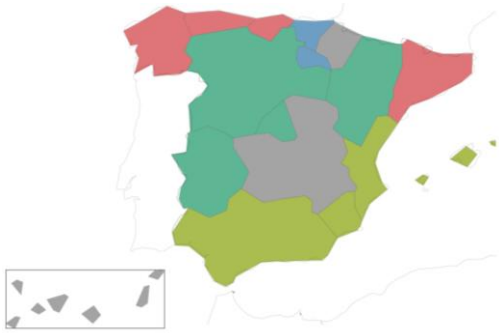
However, the lack of statistically significant coefficients across clubs indicates that there is no robust evidence of convergence within them. Consequently, these groups should be interpreted primarily as differentiated regimes rather than as clear convergence processes towards common steady states.

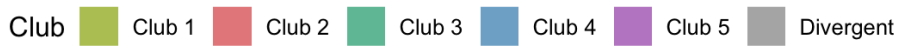
Turning to tourism specialization, the results also reveal a high degree of heterogeneity across both spatial scales and time periods. This heterogeneity—observed in Spain as a highly diverse tourism system unevenly distributed across the territory (Figures 4 and 5)—has also been documented in other contexts, including Croatia (Payne et al., 2023), Italy (Pizzuto and

Sciortino, 2021), and Turkey (Abbott et al., 2012), as discussed in the methodology section. As in the case of income convergence, the NUTS-3 analysis of tourism specialization amplifies this heterogeneity, while the number of clubs at the NUTS-2 level remains relatively stable. However, the evolution of tourism specialization presents some distinctive features. While at the NUTS-2 level the pre- and post-break structures remain relatively stable, the NUTS-3 level exhibits greater heterogeneity, with a general reallocation of regions across specialization clubs over time, alongside a few notable cases (e.g., Ibiza and Lanzarote/Fuerteventura). This suggests that, at finer spatial scales, tourism dynamics are more sensitive to local conditions and may follow more diverse trajectories.

More generally, while tourism remains predominantly concentrated in coastal and island regions, the spatial distribution of clubs becomes more dispersed over time, indicating processes of territorial adaptation and diversification. This pattern is reflected in the reallocation of traditionally tourism-oriented NUTS-3 regions such as Valencia or Seville into lower-ranked clubs, as well as the emergence of divergent cases—including Madrid, Barcelona, and Asturias—whose trajectories cannot be clearly assigned to any convergence group.

Figure 4**.** Convergence clubs of tourism specialization in Spain (NUTS-2)

Period: 2003–2010	Period: 2011–2023
	



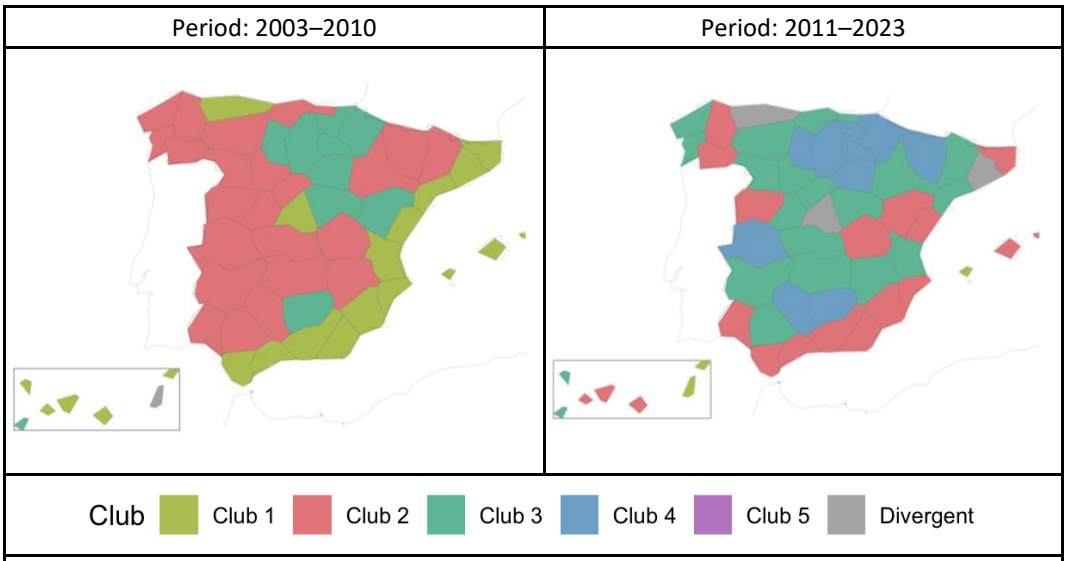
Period: 2003-2010

Club	N regions	b (SE)	t_b	mean (2003)	mean (2010)
Club 1	2	3.284 (3.704)	0.88	0.383	0.401
Club 2	6	-0.213 (0.954)	-0.22	0.268	0.292
Club 3	8	-0.148 (0.292)	-0.50	0.240	0.262
Club 4	2	1.194 (1.075)	1.11	0.224	0.242
Divergents	1	–	–	0.284	0.320

Period: 2011-2023

Club	N regions	b (SE)	t_b	mean (2011)	mean (2023)
Club 1	4	-0.426 (0.260)	-1.63	0.323	0.335
Club 2	4	0.888 (0.479)	1.85	0.290	0.295
Club 3	5	0.103 (0.207)	0.49	0.255	0.266
Club 4	2	0.062 (1.717)	0.03	0.244	0.255
Divergents	3	–	–	0.280	0.291

Figure 5. Convergence clubs of tourism specialization in Spain (NUTS-3)



Period: 2003-2010					
Club	N regions	b (SE)	t_b	mean (2003)	mean (2010)
Club 1	21	-0.206 (0.271)	-0.75	0.295	0.322
Club 2	25	-0.849 (0.638)	1.33	0.345	0.266
Club 3	12	-0.787 (0.777)	-1.01	0.211	0.232
Divergents	1	–	–	0.466	0.528
Period: 2011-2023					
Club	N regions	b (SE)	t_b	mean (2011)	mean (2023)
Club 1	3	0.038 (0.224)	0.16	0.514	0.483
Club 2	19	0.070 (0.208)	0.33	0.314	0.315
Club 3	21	-0.357 (0.245)	-1.45	0.276	0.267
Club 4	14	0.744 (0.633)	1.17	0.242	0.231
Divergents	3	–	–	0.232	0.203

Beyond these results, the comparison across spatial scales highlights the critical role of territorial disaggregation. While the NUTS-2 analysis suggests relatively stable patterns, the NUTS-3 results reveal a much more fragmented structure, capturing local dynamics that remain hidden at higher levels of aggregation. The case of the Valencian Community illustrates this clearly: although it does not form a coherent group at the aggregate level in the pre-crisis period, all its NUTS-3 regions belong to the highest tourism specialization club. Similarly, Andalusia appears to move towards higher tourism specialization at the NUTS-2 level over time, masking the internal divergence of its inland NUTS-3 regions, which shift towards lower-ranked clubs.

Taken together, these findings point to two key insights. First, the more granular NUTS-3 analysis brings to light the complex nature of territories and communities, which are composed of diverse institutional settings, tangible and intangible resources, infrastructures, and productive structures. As a result, regions may exhibit differentiated responses to exogenous factors. A similar logic applies to tourism. Destinations often display a hybrid character, combining a variety of products and services, and integrating attractions, infrastructure, and supporting industries. They cater to different tourism segments with distinct characteristics, which require differentiated organizational and supply-side structures.

This complexity helps explain the observed heterogeneity in both economic and tourism dynamics across Spain, as well as the absence of global convergence patterns. Importantly, much of this richness is lost when analysis is conducted at more aggregated spatial levels.

Regarding within-club dynamics, the results do not provide robust evidence of convergence in either dimension. This suggests that, in this context, Phillips and Sul clubs are better interpreted as structural groupings reflecting persistent differences across territories, rather than as statistically supported convergence processes. This complexity is consistent with the view that tourism operates within territorial systems characterized by interdependent dynamics involving multiple actors, sectors, and institutional arrangements (Mulej et al., 2006; Sedarati et al., 2019), whose aggregate weight within the regional productive structure is not sufficient, on its own, to explain patterns of relative convergence.

4.2. Relationship between economic and tourism convergence clubs

Tables 2 and 3 report the joint distribution of club membership, allowing us to evaluate the extent to which common patterns of evolution exist between economic convergence clubs (GDP per capita, PPS) and tourism specialization clubs, both at the NUTS-2 and NUTS-3 levels and across the two subperiods considered. Rows correspond to economic convergence clubs (G1–G5, ordered from higher to lower income levels), while columns represent tourism specialization clubs (T1–T4, ordered from lower to higher levels of tourism specialization). Each cell reports both the absolute frequency and its relative distribution within each economic club (row percentages), indicating how regions within a given economic club are distributed across different levels of tourism specialization.

At the NUTS-2 level (Table 2), the results do not provide evidence of a statistically significant relationship between the two dimensions in either period. This result is confirmed by both the chi-square test and the Fisher's exact test, which fail to reject the null hypothesis of independence in both periods (pre-crisis: $\chi^2 = 10.00$, Fisher's exact $p = 0.826$; post-crisis: $\chi^2 = 2.88$, Fisher's exact $p = 1.000$). This is also reflected in the relatively higher values of Cramér's V in the first period, although these remain insufficient to support a statistically meaningful association between both dimensions.

Table 2. Joint distribution of economic (G: GDP per capita in PPS) and tourism (T: tourism specialization) convergence clubs (NUTS-2)

	Frequencies *(Distribution)* 2003/2010					Frequencies *(Distribution)* 2011/2023				
GDP \ Tour	T1	T2	T3	T4	Total	T1	T2	T3	T4	Total
G1 (highest)	0 *(0.00)*	0 *(0.00)*	2 *(1.00)*	0 *(0.00)*	2 *(0.12)*	0 *(0.00)*	1 *(0.50)*	1 *(0.50)*	0 *(0.00)*	2 *(0.17)*
G2	0 *(0.00)*	1 (0.50)	1 *(0.50)*	0 (0.0)	2 *(0.12)*	3 *(0.38)*	2 *(0.25)*	2 *(0.25)*	1 *(0.12)*	8 *(0.67)*
G3	1 *(0.50)*	0 *(0.00)*	1 *(0.50)*	0 *(0.00)*	2 *(0.12)*	1 *(0.50)*	0 *(0.00)*	1 *(0.50)*	0 *(0.00)*	2 *(0.17)*
G4	0 *(0.00)*	3 *(0.60)*	2 *(0.4)*	0 *(0.00)*	5 *(0.31)*					

G5	1 *(0.20)*	1 *(0.20)*	2 *(0.4)*	1 *(0.20)*	5 *(0.31)*					
Total	2 *(0.12)*	5 *(0.31)*	8 *(0.5)*	1 *(0.06)*	16 *(1.00)*	4 *(0.33)*	3 *(0.25)*	4 *(0.33)*	1 *(0.08)*	12 *(1.00)*
	χ^2 = 10.00 df = 12 p-value = 0.616 Cramer's V = 0.456 Fisher's exact p = 0.826					χ^2 = 2.88 df = 6 p-value = 0.824 Cramer's V = 0.346 Fisher's exact p = 1				

Note: G refers to economic convergence clubs (based on GDP per capita in PPS), ordered from higher (G1) to lower (G5) income levels. T refers to tourism specialization convergence clubs, ordered from lower (T1) to higher (T4) levels of specialization. Values in parentheses indicate row percentages. Blank cells indicate that no regions fall into the corresponding combination of clubs in that period.

The analysis at the NUTS-3 level offers a more nuanced perspective. For the period 2003–2010, a relatively stronger association between economic and tourism clubs can be observed (χ^2 = 10.92; p = 0.091; V = 0.307; Fisher's exact p = 0.028). Notably, while the chi-square statistic does not reach conventional levels of statistical significance at the 5% level, Fisher's exact test –which is more reliable given the small expected frequencies in several cells– does reject the null hypothesis of independence at that threshold. This result should nonetheless be interpreted with caution, given the moderate effect size (V = 0.307) and the absence of replication across other periods and spatial scales. In particular, territories belonging to lower-income clubs (G4) exhibit a relatively high concentration in the upper levels of tourism specialization. However, this relationship is no longer observed in the period 2011–2023 (χ^2 = 9.04; V = 0.232; Fisher's exact p = 0.633), where the distribution of NUTS-3 regions becomes more dispersed and heterogeneous, with no evidence of systematically over- or under-represented combinations of clubs.

This pattern may be indicative of a closer alignment between tourism specialization and economic trajectories in earlier stages, while this relationship appears to weaken as regions evolve and diversify. However, this interpretation should be treated with caution, as it may depend on the type of tourism and the characteristics of destinations (e.g., cultural versus coastal tourism), as well as on the degree of interconnection with other local economic activities, including the presence of economic leakages.

In addition, structural constraints—such as capacity limits or environmental pressures—may restrict the ability of tourism to sustain long-term growth. As a result, beyond a certain level of specialization, tourism may generate externalities that affect its own development dynamics.

Table 3. Joint distribution of economic (G: GDP per capita in PPS) and tourism (T: tourism specialization) convergence clubs (NUTS-3)

	Frequencies *(Distribution)* 2003/2010				Frequencies *(Distribution)* 2011/2023				
GDP \ Tour	T1	T2	T3	Total	T1	T2	T3	T4	Total
G1 (highest)	1 *(0.50)*	0 (0.00)	1 *(0.50)*	2 *(0.03)*	0 *(0.00)*	5 *(0.38)*	3 *(0.23)*	5 (0.38)	13 *(0.25)*
G2	0 *(0.00)*	3 (0.60)	2 (0.40)	5 *(0.09)*	2 *(0.09)*	5 *(0.23)*	11 *(0.50)*	4 (0.18)	22 *(0.42)*
G3	4 *(0.33)*	3 (0.25)	5 (0.42)	12 *(0.21)*	1 *(0.08)*	6 *(0.46)*	5 *(0.38)*	1 (0.08)	13 *(0.25)*
G4	16 *(0.41)*	19 (0.49)	4 (0.10)	39 *(0.67)*	0 *(0.00)*	1 *(0.33)*	1 *(0.33)*	1 (0.33)	3 *(0.06)*
G5					0 *(0.00)*	2 *(0.40)*	1 *(0.20)*	2 *(0.40)*	5 *(0.10)*
Total	21 (0.36)	25 (0.43)	12 (0.21)	58 *(1.00)*	3 *(0.05)*	19 *(0.34)*	21 *(0.38)*	13 *(0.23)*	56 *(1.00)*
	χ^2 = 10.92 df = 6 p-value = 0.091 Cramer's V = 0.307 Fisher's exact p = 0.028				χ^2 = 9.04 df = 12 p-value = 0.699 Cramer's V = 0.232 Fisher's exact p = 0.633				

Note: G refers to economic convergence clubs (based on GDP per capita in PPS), ordered from higher (G1) to lower (G5) income levels. T refers to tourism specialization convergence clubs, ordered from lower (T1) to higher (T4) levels of specialization. Values in parentheses indicate row percentages.

Taken together, these findings reinforce the idea that the relationship between tourism and economic convergence is inherently complex, scale-dependent, and subject to structural change, as also highlighted by Llorca-Rodriguez et al. (2021). Rather than constituting a uniform or systematic mechanism of economic growth or convergence, tourism specialization appears to interact with territory-specific factors, generating heterogeneous and, in many cases, non-systematic patterns across regions.

4.3. Robustness checks: alternative sectors and full-period analysis

To assess the robustness of the main results, a first robustness check consists of repeating the same exercise by extending the time horizon to the full period (2003–2023). The results remain consistent with those obtained in the baseline analysis. Beyond potential changes in the grouping of NUTS-2 and NUTS-3 regions (with a total of 3 clubs for NUTS-2 and 5 for NUTS-3), the chi-squared tests do not allow us to reject the null hypothesis of independence between economic and tourism convergence clubs (for NUTS-2: $\chi^2 = 4.389$; for NUTS-3: $\chi^2 = 19.819$).

As a second robustness check, the analysis is extended to other sectoral dimensions (Table 4), initially focusing on the most technology-intensive sector available in the Eurostat database (IC, referring to Information and Communication technologies). Specifically, Table 4

compares the allocation of regions across economic convergence clubs (based on GDP per capita in PPS) with their corresponding allocation across sectoral convergence clubs across sectors, spatial scales, and time periods. For each sector and period, the table reports the number of regions classified as divergent in both dimensions, together with the associated chi-square test statistics for the corresponding contingency tables. This allows us to assess whether regions sharing similar economic trajectories also exhibit similar patterns of sectoral specialization. Once again, no consistent evidence of statistically significant association is found across territorial levels and periods. At the NUTS-2 level, the pre-crisis period (2003–2010) yields $\chi^2 = 20.267$, while in the post-crisis period (2011–2023) the statistic decreases to $\chi^2 = 2.821$, without rejecting independence in any case. At the NUTS-3 level, the results are similarly weak and do not reveal consistent patterns.

Table 4. Joint distribution of economic convergence (GDP per capita in PPS) and sectoral specialization across sectors

		NUTS-2					NUTS-3				
Sector	Period	N	Divergent regions		χ^2	df	N	Divergent regions		χ^2	df
			GDP	Sector				GDP	Sector		
Tourism	2003–2010	16	2	1	10.00	12	58	0	1	10.91	6
	2011–2023	12	4	4	2.87	6	56	0	3	9.04	12
ICT	2003–2010	16	2	1	20.26	20	57	0	2	NA	NA
	2011–2023	12	4	4	2.82	4	54	0	5	39.81	16
Industry	2003–2010	17	2	2	23.42	20	58	0	1	48.16	30
	2011–2023	10	4	7	12.38	8	56	0	3	15.68	16
Construction	2003–2010	16	2	1	7.33	8	59	0	0	7.48	9
	2011–2023	14	4	1	7.65	4	59	0	0	8.81	8

Note: The results for the remaining sectors have been obtained, as in the case of tourism, from the Eurostat database [nama_10r_3empers]. Tourism corresponds to WHO; ICT to IC; Industry to IND; and Construction to CON. N refers to the number of regions included in each contingency table. NA values indicate cases in which the chi-square test could not be computed due to insufficient variation in the contingency table. Specifically, after excluding divergent regions, all remaining observations fell within a single club in one of the two dimensions, resulting in a one-row or one-column table for which the test of independence is not defined.

Other sectors analysed, such as industry and construction, also fail to show statistical significance across all specifications. Although relatively high chi-squared values are observed in some cases—particularly for industry at the NUTS-3 level—these are associated with a large number of degrees of freedom and do not translate into stable or systemically interpretable patterns. Consistently, standardized residuals do not indicate any systematically over- or under-represented combinations of clubs.

While previous studies at the European country level have identified specific industries whose specialization is associated with economic convergence patterns (Cavallaro and Villani, 2021; Petrović and Gligorić Matić, 2023), this does not appear to be the case for Spain. In this context, tourism exhibits a broadly similar pattern to other sectors. Overall, the robustness checks reinforce the view that convergence dynamics are driven by complex and heterogeneous mechanisms that cannot be attributed solely to sectoral structure. Furthermore, the results appear to be sensitive to both the geographical scale and the temporal segmentation adopted.

V.DISCUSSION, POLICY IMPLICATIONS AND CONCLUSIONS

5.1. Main findings and theoretical implications

The results obtained in this study provide several relevant implications for the literature on regional convergence and sectoral specialization, particularly in the context of economies with a strong tourism component, such as Spain. First, the findings confirm that regional dynamics do not follow a uniform path of economic convergence for Spanish regions but rather evolve through differentiated regimes depending on initial conditions, in line with previous evidence for Europe (e.g., Cavallaro and Villani, 2021; Mora, 2005; Suárez-Arbesú et al., 2023). In our case, these heterogeneous trajectories are observed not only across regions, but also across sectors, including tourism and those considered in the robustness analysis.

A key contribution of this study concerns the interpretation of convergence clubs. While previous research such as Bartkowska and Riedl (2012), Von Lyncker and Thoennessen (2017), Borsi and Metiu (2015) typically finds significant convergence or divergence patterns within most clubs, our results do not provide robust evidence of within-club convergence in the Spanish case. Although the Phillips and Sul methodology identifies groups of regions that follow similar transition paths, the associated log-t statistics do not support the existence of convergence towards a common steady state within these groups. Consequently, the identified clubs are more appropriately interpreted as structural regimes reflecting persistent similarities in regional trajectories, rather than as statistically supported convergence processes.

This reinterpretation has direct implications for understanding the role of sectoral specialization—particularly tourism—in shaping regional convergence dynamics. In particular, our findings do not provide consistent evidence of a statistically significant association between tourism specialization and membership in economic convergence clubs, either at the NUTS-2 or NUTS-3 level. Importantly, this result is not specific to tourism: the robustness checks show that other sectors, including technology-intensive activities, industry, and construction, exhibit broadly similar patterns. Taken together, these findings suggest that sectoral specialization, by itself, is not sufficient to explain convergence dynamics in contexts characterized by strong territorial heterogeneity.

From a theoretical perspective, these results are consistent with the view that productive structure influences growth trajectories through complex and context-dependent mechanisms, rather than through uniform or generalizable effects. While tourism may act as a driver of growth in certain contexts—particularly in regions transitioning from traditional sectors such as agriculture or mining—its contribution to long-term convergence appears to depend critically on broader structural conditions. These include the level of economic diversification, institutional capacity, and the degree of integration with other sectors, as highlighted in previous studies (e.g., Llorca-Rodríguez et al., 2021, for Europe; Garrido and Moreno-Izquierdo, 2025, for Latin America).

The findings can also be interpreted considering the changing role of tourism across different stages of development. While tourism is often associated with positive growth effects in early stages, its relative contribution may diminish as regions mature and diversify. In more advanced contexts, structural constraints—such as environmental pressures, congestion effects, and limited productivity gains—may restrict its capacity to sustain long-term development. This is consistent with the notion of a ceiling effect in tourism specialization (Perles-Ribes and Moreno-Izquierdo, 2024) whereby further specialization does not necessarily translate into higher levels of economic performance or convergence.

5.2. Policy implications

From a tourism policy perspective, these results highlight the limitations of one-size-fits-all strategies based on promoting specific sectors. In particular, they call into question the idea that tourism specialization can serve as a generalizable engine of regional convergence. Instead, effective development strategies appear to require a more comprehensive approach, combining sectoral policies with investments in infrastructure, institutional quality, human capital, and intersectoral linkages. The Spanish experience suggests that successful trajectories have typically involved diversified development paths rather than exclusive reliance on a single sector (Ivars-Baidal, 2004; Pack, 2008).

In this regard, one of the central contributions of this study concerns the role of spatial scale. The comparison between NUTS-2 and NUTS-3 levels reveals that aggregate analyses may mask substantial internal heterogeneity, leading to potentially misleading conclusions regarding both convergence dynamics and the role of sectoral specialization. This is closely related to the existence of “false winners” and “false losers” in convergence processes, whose trajectories may remain hidden due to aggregation effects across space or time. As highlighted by Gagliardi and Percoco (2017), the choice of spatial and temporal units is not merely technical, but has direct implications for policy decisions, including the allocation of European cohesion funds.

5.3. Limitations and future research

The results shown in this document should be interpreted in light of several limitations. First, the analysis relies on proxy variables and reconstructed data for tourism specialization, particularly at the NUTS-3 level, due to limitations in data availability. While these approaches are consistent with the existing literature, they may affect the precision of the estimates and highlight the need for more detailed regional data. Second, the time dimension of the analysis is relatively limited, especially after accounting for structural breaks. The Phillips and Sul log-t test relies on asymptotic properties that are better satisfied in longer time series, and the subdivision of the sample into subperiods—particularly the pre-crisis phase—may affect the

statistical power of the test. This reflects a necessary trade-off: ignoring structural breaks in favour of a longer unified sample would introduce a misspecification bias we consider more damaging than the reduction in sample length. In addition, the heterogeneity of tourism itself represents an important dimension that is not fully captured in the current analysis. Previous studies have shown that different types of tourism—such as coastal versus inland tourism, or domestic versus international tourism—are associated with distinct economic dynamics and convergence patterns (Cortés-Jiménez, 2008; Carrascal and Fernández, 2015; Llorca-Rodríguez et al., 2021). This suggests that the contribution of tourism to regional development may depend not only on its intensity, but also on its composition, pointing to the relevance of incorporating tourism typologies in future research.

Future research could address these limitations by incorporating richer datasets and alternative methodological approaches. In particular, further work could advance this line of inquiry by incorporating additional variables that capture dimensions not covered in our design, as well as by employing logistic models to assess the extent to which tourism and other sectors facilitate transitions between convergence clubs. Although integrating these approaches falls beyond the scope of the present study, such approaches could help clarify how tourism—within a complex productive structure capable of generating significant indirect and induced effects (see Bunghez, 2016; Li et al., 2018)—influences economic development from a convergence perspective.

These future developments could also contribute to testing key theoretical assumptions in tourism economics, such as the existence of optimal levels of tourism specialization proposed by Perles-Ribes and Moreno-Izquierdo (2024) under the Tourism as Optimal Choice Hypothesis, or the Dutch disease (or “beach disease”) hypothesis (Inchausti-Sintes, 2015; Balado-Naves, 2024), which suggests that excessive specialization in tourism may constrain long-term growth potential.

Finally, these findings also highlight the limitations of commonly used spatial units in capturing the complexity of tourism dynamics. Even the NUTS-3 level may still be too aggregated to fully reflect the economic functioning of tourism, which often operates at the destination level. In this sense, our results support the argument by Demblans et al. (2020), who warn that “one size fits all solutions cannot effectively grasp the complexity and diversity of territories at international, national and subnational levels” (p. 225), with important implications for the design of territorial and cohesion policies.

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CONTRIBUCIONES DE LOS AUTORES

Author 1: Conceptualization, methodology, software, validation, formal analysis, resources, writing – review & editing, visualization, supervision, project administration.

Author 2: Conceptualization, methodology, software, formal analysis, resources, data curation, writing – original draft, writing – review & editing, visualization, project administration, funding acquisition.

Author 3: Conceptualization, methodology, formal analysis, resources, writing – review & editing, visualization.

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