

Article

Heritage Tourism in Spain: Territorial Differentiation in Tourism Intensity and Cultural Heritage Concentration

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Highlights

What are the main findings?

- Heritage tourism indicators in Spain differ significantly across provinces, especially in tourism intensity, heritage tourism density, and cultural heritage concentration.
- The evidence points to a territorially uneven heritage tourism system, shaped by mobility patterns, population presence, and the distribution of heritage resources.

What are the implications of the main findings?

- Heritage tourism planning may benefit from province-sensitive approaches, particularly where heritage resources, tourism intensity, and population presence follow different territorial patterns.
- The study offers a data-driven diagnostic framework that combines mobile phone mobility data, heritage indicators, ANOVA-based territorial comparison, Welch ANOVA robustness checks, and exploratory spatial diagnostics.

Abstract

Heritage tourism is central to Spain's cultural and territorial development, but its spatial distribution and intensity are still unevenly understood. This study analyzes heritage tourism in Spain as a territorially differentiated phenomenon by comparing provincial differences in tourism intensity, heritage tourism density, and cultural heritage concentration. Drawing on official experimental statistics from the National Institute of Statistics of Spain, the analysis integrates mobile phone geolocation data from 181,670,728 devices across 3214 destinations, tourism expenditure information, and a Heritage Concentration Index constructed for architectural cultural heritage. Four one-way ANOVA models were applied to assess differences among Spain's 52 provinces in the Internal Tourism Intensity Index, External Tourism Intensity Index, Heritage Tourism Density, and Heritage Concentration Index. Hochberg-adjusted post hoc comparisons and Tukey HSD robustness checks were used to examine interprovincial differences, while Welch ANOVA and Moran's I were added to assess robustness and spatial structure. The results show statistically significant territorial differences across all four indicators, indicating that heritage tourism in Spain is not spatially homogeneous. The study contributes an integrated, data-driven approach for measuring heritage tourism at the provincial scale and provides diagnostic evidence that may inform differentiated tourism planning, destination management, and more balanced heritage-based territorial strategies.



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Keywords: heritage tourism; cultural heritage; tourism intensity; heritage tourism density; mobile phone data; territorial differentiation; Spain; ANOVA; Welch ANOVA; Moran's I; tourism mobility

1. Introduction

Heritage tourism is a central part of Spain's tourism system and a visible expression of the country's cultural, historical, and territorial diversity. Architectural heritage, historic cities, monuments, cultural landscapes, and urban heritage areas attract both domestic and international visitors and contribute to the symbolic and economic value of destinations. Yet heritage tourism is not evenly distributed across Spain. Some provinces combine high concentrations of cultural heritage, tourism mobility, and population presence, whereas others remain less visible despite their historical and cultural relevance. This imbalance is consistent with research showing that tourism development, cultural resources, and regional economic dynamics vary substantially across space (Mathisen et al., 2022; Albaladejo et al., 2024). Understanding these differences is therefore important for more balanced and evidence-based tourism policy.

Tourism research increasingly uses spatial indicators, geolocation technologies, and large-scale mobility data to understand how visitors move across destinations. These tools make it possible to analyze tourism intensity, visitor concentration, and territorial intensity beyond what traditional surveys or aggregate arrival statistics can show. Geographic Information Systems and related digital tools have already proven useful for heritage management, spatial interpretation, and destination planning (Hidalgo-Sánchez et al., 2024). Mobile phone and geolocation-based data are also becoming central to the identification of large-scale mobility patterns and the spatial structure of tourism demand (Padrón-Ávila & Hernández-Martín, 2020; Ruiz-Pérez et al., 2023). In heritage tourism, this shift is especially relevant because cultural tourism flows are often difficult to separate from broader tourism mobility. Visitors may engage with heritage directly, indirectly, or as one component of a wider destination experience, which makes the territorial measurement of heritage tourism both complex and necessary (Richards, 2018; Kalvet et al., 2020).

The literature has approached heritage tourism through authenticity, destination image, cultural value, sustainability, economic development, and heritage management. Authenticity remains a central dimension of cultural and heritage tourism because it shapes how visitors interpret and value heritage environments (Cheng et al., 2024; Yi et al., 2024). Other studies highlight the role of cultural heritage in destination competitiveness, local identity, and sustainable territorial development (Noonan & Rizzo, 2017; Zubiaga et al., 2024). More recently, digitalization, spatial technologies, and heritage-sensitive indicators have gained relevance as tools for improving cultural destination management (Egusquiza et al., 2021; Montalto et al., 2019; Wang et al., 2024). Even so, there remains a need for empirical approaches that compare heritage tourism dynamics across territories through integrated and comparable indicators.

This article responds to that need by examining heritage tourism in Spain as a territorially differentiated phenomenon. Instead of assuming that heritage tourism operates uniformly at the national level, the analysis focuses on provincial differences in four indicators: the Internal Tourism Intensity Index, the External Tourism Intensity Index, Heritage Tourism Density, and the Heritage Concentration Index. This approach is aligned with calls for more robust and comparable frameworks for measuring cultural tourism and its territorial expressions (Kalvet et al., 2020; Zubiaga et al., 2024). It also contributes to debates on how cultural heritage, tourism mobility, and spatial concentration can be examined through

data-driven methods that support more precise destination planning (Hidalgo-Sánchez et al., 2024; Zhang et al., 2024).

The empirical analysis is based on official experimental statistics from the National Institute of Statistics of Spain. It uses mobile phone geolocation data from 181,670,728 devices across 3214 destinations, complemented by tourism expenditure information and an index of architectural cultural heritage concentration. One-way ANOVA models and Hochberg-adjusted post hoc comparisons were used to identify statistically significant differences among Spain's 52 provinces. The design does not aim to establish causal relationships between heritage concentration, mobility, and expenditure. Rather, it provides evidence of territorial heterogeneity in heritage tourism indicators and helps clarify how heritage tourism varies across provincial contexts.

The article makes three main contributions. First, it documents heritage tourism in Spain as a territorially differentiated phenomenon by comparing four indicators across the 52 Spanish provinces. Second, it proposes an integrated descriptive framework that combines mobile phone mobility data, tourism expenditure information, heritage tourism density, and a standardized Heritage Concentration Index. Third, it offers empirical evidence that may support province-sensitive planning by identifying where tourism intensity, heritage density, and heritage concentration differ across territorial units. The study does not claim to identify causal mechanisms between heritage concentration, mobility, and expenditure. Its contribution is a comparative and data-driven diagnosis of territorial heterogeneity in heritage tourism indicators, in line with recent calls for evidence-based, heritage-sensitive, and territorially specific tools for sustainable cultural tourism management (Falk & Hagsten, 2024; Su, 2024; Zubiaga et al., 2024).

The remainder of the article is organized as follows. Section 2 develops the literature review and conceptual framework, with attention to heritage tourism, territorial differentiation, mobility indicators, and cultural heritage concentration. Section 3 presents the research questions. Section 4 describes the data sources, variables, and analytical procedure. Section 5 reports the ANOVA results, effect sizes, post hoc comparisons, Welch ANOVA robustness checks, correlation analysis, and exploratory spatial diagnostics. Section 6 discusses the findings in relation to previous research and heritage tourism planning. Section 7 presents the conclusions and limitations, and Section 8 outlines future research directions.

2. Literature Review and Conceptual Framework

Heritage tourism is commonly understood as a multidimensional form of tourism in which historical, cultural, architectural, symbolic, economic, and experiential dimensions overlap. The value of heritage destinations is not limited to monuments or historical sites themselves; it also depends on how residents and visitors interpret authenticity, identity, memory, and cultural meaning. Perceived authenticity is therefore central to local identity, cultural resilience, and the value attributed to historical environments (Yi et al., 2024). Cultural ecosystem services and visitor preferences are also increasingly relevant for understanding how architectural heritage can be preserved, interpreted, and used sustainably (Valença Pinto et al., 2024; Moon & An, 2024).

The complexity of heritage tourism is also reflected in the many factors that shape attitudes toward cultural destinations. Historical relevance, aesthetic value, architectural quality, spirituality, environmental conditions, economic opportunities, and managerial capacity all influence how heritage sites are perceived and consumed (Acharjya & Acharjya, 2024). This complexity is consistent with the broader role assigned to cultural heritage in sustainable development agendas, where heritage is not only a tourism resource but also a component of territorial identity, social continuity, and long-term development (Cusumano,

2024). Attributes such as uniqueness, tradition, and cultural continuity remain essential to meaningful tourism experiences (Chakraborty & Ghosal, 2024).

Heritage tourism, however, does not operate uniformly across space. The distribution of cultural resources, tourism infrastructure, visitor flows, and destination visibility tends to produce territorial differences. Some places become consolidated heritage destinations, whereas others remain underused or less visible despite their cultural value. This unevenness matters because heritage tourism can support urban revitalization, economic resilience, and more responsible forms of tourism development, but only where local conditions and management capacity allow it (Nag & Mishra, 2024). Emotional attachment to heritage, including psychological ownership, may also influence preservation attitudes and community engagement, reinforcing the social dimension of heritage tourism (Lin et al., 2024).

From an economic and cultural perspective, heritage tourism is closely linked to destination competitiveness, local identity, and the symbolic positioning of territories (Noonan & Rizzo, 2017). At the same time, development outcomes cannot be reduced to economic indicators alone. Tourism development is also connected with quality of life dimensions such as education, employment, health, social cohesion, and cultural heritage (Beltramo et al., 2024). This is particularly relevant in heritage-rich destinations, where tourism pressure may create tensions between conservation, visitor experience, local life, and long-term sustainability (Matyska, 2024; Navarrete-Hernandez et al., 2024).

A persistent challenge in heritage tourism research is the lack of standardized and comparable frameworks for measuring territorial performance. Indicator systems such as the European Tourism Indicators System have contributed to sustainability assessment, but they are still limited when applied to the specific complexity of cultural and heritage tourism as a subsector (Global Sustainable Tourism Council, 2019; Kalvet et al., 2020). This limitation is important because heritage tourism often overlaps with general tourism flows. Visitors may travel for leisure, business, events, urban experiences, or coastal tourism while also consuming cultural heritage, making it difficult to isolate heritage tourism through conventional statistics (Richards, 2018; Pedersen, 2002).

The literature therefore points to the need for heritage-sensitive indicators that can capture the interaction between cultural resources, tourist mobility, visitor concentration, and territorial conditions. Policymakers and researchers continue to note the lack of methodological clarity on which indicators and data sources are most appropriate for evaluating the contribution of heritage tourism to destinations (Pedersen, 2002; Kalvet et al., 2020). The issue becomes even more relevant in territorial comparisons, where data availability, reliability, and scale differ considerably across destinations (Mohamed et al., 2024).

Heritage inventories are also essential to this process. They are not merely administrative records; they document built heritage assets, establish preservation priorities, and support evidence-based planning (Soomro, 2024). However, inventories alone do not explain how heritage resources relate to tourism mobility or visitor concentration. Measuring heritage tourism therefore requires integrated approaches that connect heritage concentration, tourism intensity, and mobility data. This aligns with recent calls for more specialized indicators to guide destination planning, conservation strategies, and long-term competitiveness (Montalto et al., 2019; Zubiaga et al., 2024).

Tourism is inherently spatial. Visitor flows concentrate in some territories and disperse across others according to accessibility, destination image, infrastructure, attractiveness, and the symbolic value of places. Tourism geography reflects the tension between agglomeration and dispersion: economies of scale draw visitors toward consolidated destinations, while the search for authenticity can encourage movement toward less saturated areas (Albaladejo et al., 2024). These dynamics are particularly relevant in heritage tourism,

where historical environments, cultural landscapes, and architectural assets can create strong territorial attractions.

The growing availability of geolocation and mobile phone data has changed the study of tourism mobility. Traditional observation methods are no longer sufficient for capturing large-scale spatial patterns, particularly in destinations where visitor flows are complex and dynamic. Geolocation-based techniques provide opportunities to analyze long-term mobility behavior, visitor concentration, territorial intensity, and the spatial structure of demand (Padrón-Ávila & Hernández-Martín, 2020; Ruiz-Pérez et al., 2023). Mobile phone traces allow researchers to examine tourism movements at a scale that would be difficult to achieve through surveys or accommodation statistics alone (Ahas et al., 2008).

Within this context, tourism intensity is a useful concept for comparing how strongly tourism activity is expressed across territories. Internal tourism intensity reflects the movement and presence of domestic visitors, whereas external tourism intensity captures the weight of non-resident visitors. These two dimensions matter because domestic and international tourism do not necessarily follow the same territorial logic. International mobility may act as a structural force behind tourism development and economic policymaking, while domestic mobility may be more closely related to proximity, accessibility, regional identity, and internal travel patterns (Robin et al., 2022; Choe & Lugosi, 2022). Other mobility studies have shown that tourist density interacts with urban dynamics, residential volatility, and spatial concentration, which reinforces the need to analyze tourism territorially (Valente & Medina-Ariza, 2024).

Cultural heritage concentration is central to understanding territorial differences in heritage tourism. Heritage buildings, monuments, historical districts, and culturally significant structures attract visitors not only because of their architectural value, but also because of their symbolic, social, and experiential meanings (Cheung & Wong, 2024). Authenticity continues to influence perceived value in cultural heritage tourism, even when it does not fully determine immersion or visitor engagement (Liu et al., 2024). Heritage concentration should therefore be treated as a territorial attribute that contributes to destination differentiation, rather than as a simple count of historical assets.

Heritage concentration is also unevenly distributed. Historical urban development, public investment, conservation policies, cultural recognition, and international designations can create marked differences between territories. Recent studies on the spatial distribution of cultural heritage resources show that heritage assets follow uneven territorial patterns shaped by historical trajectories and institutional recognition (Zhang et al., 2024). Digital tools, spatial applications, and heritage-oriented technologies have further reinforced the need to analyze cultural resources in relation to their geographical context (Hidalgo-Sánchez et al., 2024; Wang et al., 2024).

The concentration of heritage resources also creates management challenges. High-value heritage environments may attract visitors, but they may also place pressure on conservation systems, interpretation infrastructure, mobility networks, and local communities (Falk & Hagsten, 2024). Effective heritage management therefore requires diagnostic tools that can identify vulnerabilities and guide conservation strategies, particularly in destinations where architectural heritage is exposed to intensive tourism use (Rusnak et al., 2024). Heritage concentration should consequently be analyzed alongside tourism density and mobility indicators, since cultural value and tourism intensity are not always aligned.

Heritage tourism density offers a way to examine the relationship between heritage concentration and the population present in a territory. While tourism intensity captures the magnitude of tourism activity, density expresses heritage concentration relative to the population recorded in the territorial unit. This distinction matters because territories with similar tourism volumes may have different heritage-density profiles depending on their

cultural assets, population presence, and spatial configuration. In this study, DTP is therefore understood as a relative territorial ratio, not as a direct measure of tourist pressure.

Sustainable cultural tourism requires the integration of economic, environmental, and sociocultural dimensions (Rawal et al., 2023). In heritage destinations, this means balancing visitor attraction with conservation, interpretation, accessibility, and community well-being. Cultural institutions also need stronger communication, interpretation, and engagement strategies to improve awareness and encourage more responsible heritage use (Folgado-Fernández et al., 2024). Festivals, cultural events, and heritage-based activities can strengthen the social and cultural functions of historical spaces, but they may also increase pressure on fragile environments when management strategies are not adapted to local conditions (Amer, 2022).

For this reason, heritage tourism density should be seen as part of a broader territorial management problem. It can help identify territories where heritage concentration is high or low in relation to the population present, as well as areas where cultural potential may be underdeveloped. This perspective supports more differentiated planning approaches, especially in countries such as Spain, where cultural heritage is widely distributed but tourism demand remains spatially uneven. It also responds to the need for data-driven tools that can support sustainable, evidence-based, and territorially sensitive tourism policies (Egusquiza et al., 2021; Zubiaga et al., 2024).

The reviewed literature shows that heritage tourism is shaped by authenticity, cultural value, mobility, spatial concentration, sustainability, and destination management. It also reveals a clear methodological and empirical gap. Although many studies examine heritage tourism from cultural, experiential, economic, or sustainability perspectives, fewer compare heritage tourism indicators across territories by integrating mobility, tourism intensity, heritage density, and cultural heritage concentration. This gap is particularly relevant in Spain, where both heritage resources and tourism flows are highly significant but unevenly distributed across provinces.

The present study addresses this gap by framing heritage tourism in Spain as a territorially differentiated phenomenon. The conceptual argument is that heritage tourism should not be analyzed only at the national level, because the spatial distribution of tourism intensity, heritage tourism density, and cultural heritage concentration may vary substantially from one province to another. This perspective does not assume causal relationships among these dimensions. Instead, it treats their territorial variation as an empirical question that is relevant for heritage tourism planning and management.

Accordingly, the study combines mobile phone geolocation data, tourism expenditure information, and a heritage concentration index to compare Spain's 52 provinces. The analysis focuses on four dimensions of territorial differentiation: Internal Tourism Intensity, External Tourism Intensity, Heritage Tourism Density, and Cultural Heritage Concentration. In doing so, it contributes to a more precise and evidence-based understanding of heritage tourism as a spatially uneven system.

3. Research Questions

The literature suggests that heritage tourism is not evenly distributed across territories. Tourism mobility, cultural heritage concentration, destination visibility, accessibility, and population presence tend to vary according to the historical, cultural, and spatial characteristics of each destination (Albaladejo et al., 2024; Richards, 2018; Zubiaga et al., 2024). Spain is therefore approached here not as a homogeneous heritage tourism space, but as a territorially differentiated system in which provinces may present distinct patterns of internal tourism intensity, external tourism intensity, heritage tourism density, and cultural heritage concentration.

Given the descriptive and comparative purpose of the study, the empirical analysis is guided by four research questions rather than by causal hypotheses:

- RQ1. To what extent does Internal Tourism Intensity vary across Spanish provinces?
- RQ2. To what extent does External Tourism Intensity vary across Spanish provinces?
- RQ3. To what extent does Heritage Tourism Density vary across Spanish provinces?
- RQ4. To what extent does Cultural Heritage Concentration vary across Spanish provinces?

Together, these research questions support the central argument of the study: heritage tourism in Spain is territorially differentiated. The purpose of the empirical analysis is not to establish causal relationships among the indicators, but to assess whether statistically significant differences exist across provinces in each of the four dimensions analyzed.

4. Materials and Methods

This study follows a quantitative, territorial, and comparative research design. The empirical strategy was designed to examine whether selected heritage tourism indicators differ across Spanish provinces. The analysis focuses on four dimensions: Internal Tourism Intensity, External Tourism Intensity, Heritage Tourism Density, and Cultural Heritage Concentration.

One-way ANOVA was used as the main statistical technique because the study compares mean differences across more than two territorial groups. The grouping factor was the Spanish province. Because the study is descriptive and territorial, the results are not interpreted as causal effects. They are interpreted as evidence of territorial differentiation in heritage tourism indicators.

When statistically significant differences were detected, Hochberg-adjusted post hoc comparisons were applied to identify specific interprovincial differences while controlling for multiple comparisons. Tukey HSD was also performed as a robustness check, as it is a standard procedure for pairwise mean comparisons after ANOVA. Consistency between the Hochberg-adjusted and Tukey HSD results was used to assess the stability of the main territorial patterns.

The study used official experimental statistical databases developed by the National Institute of Statistics of Spain ([Instituto Nacional de Estadística, 2026a, 2026b, 2026c, 2026d](#)). The main dataset consists of mobile phone geolocation data designed to measure tourism flows at the national scale. It recorded the geolocated positions of 181,670,728 mobile devices across 3214 destinations during 2021, providing a large-scale empirical basis for analyzing tourist presence, mobility concentration, and spatial distribution.

The year 2021 requires careful interpretation because tourism mobility in Spain was still shaped by COVID-19-related restrictions, behavioral changes, and uneven recovery patterns. The results are therefore understood as evidence of territorial differentiation within a specific post-pandemic context. To complement the 2021 mobility data, the study incorporated INE data on foreign visitor expenditure for 2018–2022. This broader expenditure window was used to provide a more stable spending reference and to reduce dependence on a single anomalous year.

The territorial unit of aggregation was the Spanish province. The 3214 geolocated areas included in the INE mobility dataset were aggregated into Spain's 52 provinces. This level of aggregation allows for a clear territorial comparison and is consistent with the study's objective of identifying differences in heritage tourism indicators across subnational units.

The geolocated areas were treated as analytical territorial units grouped by province. Areas within the same province, however, may share governance structures, infrastructure, tourism policies, accessibility conditions, and heritage systems. The statistical analysis was conducted using R version 4.4.1 in RStudio version 2024.04.2. areas cannot, therefore, be assumed. The province-level ANOVA is interpreted as a comparative diagnostic of

territorial differentiation rather than as a causal model based on fully independent observations. This limitation was considered in the interpretation of results and addressed through robustness checks. A multilevel model was not estimated because the objective was not to explain within-province variation or identify province-level predictors, but to compare territorial differences in the four constructed indicators. Future research should extend this approach through mixed-effects or spatial econometric models when area-level covariates are available.

Four indicators were constructed for the empirical analysis: the Internal Tourism Intensity Index, the External Tourism Intensity Index, Heritage Tourism Density, and the Heritage Concentration Index. These indicators capture complementary dimensions of heritage tourism territorial differentiation: domestic mobility, international mobility, heritage-related density, and architectural heritage concentration. Table 1 summarizes the operational definitions, formulas, components, and interpretations of the three constructed tourism and heritage indicators used in the analysis.

Table 1. Operational definitions of the main heritage tourism indicators.

Indicator	Formula	Components	Operational Interpretation
Internal Tourism Intensity Index (IITI)	$IITI = NAP \times GD$	IITI = Internal Tourism Intensity Index; NAP = number of distinct overnight-stay areas used by the resident population; GD = average daily spending per visitor.	Synthetic territorial intensity measure that combines domestic mobility and expenditure intensity. It should not be interpreted as a direct estimate of domestic tourism expenditure, but as a comparative indicator of internal tourism intensity across territorial units.
External Tourism Intensity Index (IITE)	$IITE = E \times GD$	IITE = External Tourism Intensity Index; E = non-resident population staying in the area; GD = average daily spending per visitor.	Synthetic territorial intensity measure that combines non-resident tourist presence and expenditure intensity. It reflects external tourism intensity across territorial units, not merely international arrivals.
Heritage Tourism Density (DTP)	$DTP = CP/F$	DTP = Heritage Tourism Density; CP = Heritage Concentration Index; F = total population present in the area according to the INE mobility-based territorial records.	Relative territorial ratio that expresses heritage concentration in relation to the population present in each territorial unit. It should not be interpreted as a pure measure of heritage pressure per resident or per tourist.

Because IITI and IITE both include GD as a multiplicative component, they are interpreted as synthetic territorial intensity indicators rather than as direct estimates of domestic and international tourism expenditure. Similarly, DTP is interpreted as a relative territorial indicator of heritage concentration in relation to the population present in each area, not as a direct measure of tourist pressure.

The Heritage Concentration Index (CP) was developed to estimate the relative territorial concentration of architectural cultural heritage across the 3214 geolocated areas included in the study. CP was constructed as a standardized AI-assisted and author-supervised scoring index ranging from 1 to 10, where 1 indicates minimal architectural heritage concentration and 10 indicates maximum architectural heritage concentration. The index was based on four criteria: number of historical sites and monuments, historical and cultural significance, diversity and variety of architectural expressions, and recognition or

distinctions. Additional details on the criteria, scoring protocol, and analytical model are provided in Appendix A. Table 2 presents the four criteria used to estimate the Heritage Concentration Index (CP).

Table 2. Criteria used to estimate the Heritage Concentration Index (CP).

Criterion	Description
Number of historical sites and monuments	Total number of historical buildings, monuments, archeological sites, and culturally significant structures present in the area.
Historical and cultural significance	Degree of historical relevance, antiquity, cultural symbolism, and association with historically significant events.
Diversity and variety	Variety of architectural styles, cultural influences, and artistic manifestations within the area.
Recognition and distinctions	Presence of national or international designations, recognitions, or certifications, including UNESCO recognition and heritage listings.

The Heritage Concentration Index was estimated through an AI-assisted desk-based heritage assessment combined with author supervision. The AI-assisted procedure supported the standardized review of publicly available information on architectural cultural heritage across the 3214 territorial units. The assessment considered publicly documented information on historical buildings, monuments, archeological sites, culturally significant structures, architectural diversity, historical relevance, and national or international recognition. The AI-assisted classification was conducted using OpenAI’s ChatGPT, GPT-5.5 Thinking model, accessed through a paid licensed version in June 2026. The same prompt structure and predefined scoring rubric were applied to all territorial units to ensure procedural consistency.

Each territorial unit received a score from 1 to 10. The author screened all 3214 CP scores for plausibility and coherence with the conceptual definition of architectural cultural heritage concentration. Cases that appeared inconsistent or implausible were reviewed against the scoring criteria and adjusted when necessary. Because this review was conducted by the author rather than by multiple independent raters, no inter-rater reliability coefficient was calculated. The full prompt structure, scoring rubric, and author review procedure are reported in Supplementary Material S1.

The CP index should therefore be interpreted as a standardized, AI-assisted, and author-supervised research indicator derived from publicly available heritage information. It is not an official inventory of cultural heritage assets and does not replace official records such as Assets of Cultural Interest (*Bienes de Interés Cultural*, BIC), UNESCO World Heritage listings, national heritage inventories, or regional heritage catalogues. These official sources provide relevant external references for future validation, but they do not measure exactly the same construct as CP because CP estimates relative architectural cultural heritage concentration for comparative territorial analysis (Ministerio de Cultura, 2026a, 2026b; UNESCO World Heritage Centre, 2026). Table 3 reports the number of geolocated areas included for each Spanish province in the INE mobility dataset.

The number of geolocated areas differs substantially across provinces. Some provinces include a small number of territorial units, such as Ceuta, Melilla, and Soria, whereas larger provinces such as Barcelona and Madrid include many more areas. This imbalance reflects the structure of the INE mobility dataset and the territorial distribution of geolocated areas. Because unequal group sizes may affect the robustness of classical ANOVA, the interpretation of results was complemented with effect sizes and Welch ANOVA robustness checks.

Table 3. Number of geolocated areas per province in the INE mobility dataset.

Province	Number of Areas	Province	Number of Areas
Barcelona	317	Zamora	22
Valencia/València	165	León	52
Madrid	293	Segovia	24
Cádiz	73	Ávila	22
Granada	76	Girona	69
Jaén	58	Lleida	49
Sevilla	123	Tarragona	72
Córdoba	66	Ceuta	6
Huelva	42	Castellón/Castelló	43
Málaga	80	Alicante/Alacant	116
Almería	47	Badajoz	64
Huesca	31	Cáceres	48
Zaragoza	70	Coruña, A	85
Teruel	17	Lugo	35
Asturias	71	Ourense	33
Santa Cruz de Tenerife	58	Pontevedra	64
Palmas, Las	57	Murcia	66
Cantabria	53	Navarra	65
Albacete	29	Gipuzkoa	54
Guadalajara	25	Araba/Álava	17
Toledo	75	Bizkaia	74
Ciudad Real	42	Rioja, La	25
Burgos	30	Balears, Illes	66
Salamanca	34	Cuenca	27
Soria	10	Palencia	22
Valladolid	45	Melilla	7
TOTAL, AREAS n = 3214			

The statistical analysis was conducted using R version 4.4.1 in RStudio version 2024.04.2. The dataset was first reviewed for missing values, variable consistency, and provincial aggregation accuracy. Descriptive statistics were then calculated for each province and indicator, including the number of geolocated areas, mean values, standard deviations, and standard errors.

Four separate one-way ANOVA models were estimated, one for each dependent variable: IITI, IITE, DTP, and CP. Province was used as the grouping factor in all models. The general analytical structure was as follows: $\text{Indicator}_{ij} = \mu + \text{Province}_i + \varepsilon_{ij}$, where Indicator_{ij} represents the value of the corresponding tourism or heritage indicator for area j in province i , μ is the overall mean, Province_i is the effect of belonging to province i , and ε_{ij} is the residual error term.

When the ANOVA results were statistically significant, Hochberg-adjusted post hoc comparisons were applied to identify which provinces differed from one another. This correction was selected to control multiple comparisons while retaining adequate statistical power. Statistical significance was evaluated at the 95% confidence level.

Given the unequal number of geolocated areas across provinces, Welch ANOVA was performed as a robustness check because it is less sensitive than classical one-way ANOVA to unequal group sizes and potential variance heterogeneity. The main findings were interpreted jointly with the classical ANOVA results, effect sizes, and Welch ANOVA robustness checks. This approach reduced the risk of overinterpreting statistical significance in a dataset with uneven provincial sample sizes.

Given the territorial nature of the data, spatial autocorrelation was assessed using Moran's I at the provincial level for each indicator. The analysis used a 4-nearest-neighbor

spatial weights matrix based on provincial centroids. This approach was selected to avoid isolated spatial units in insular and extrapeninsular territories, including the Balearic Islands, the Canary Islands, Ceuta, and Melilla. Moran’s I was used to evaluate whether similar indicator values tended to cluster geographically across Spanish provinces. The results were interpreted as an exploratory spatial diagnostic rather than as a spatial econometric model. Table 4 summarizes the sampling design, data sources, territorial scope, and analytical procedures used in the study.

Table 4. Summary of sampling design, data sources, and analytical procedures.

Variable	Indicator
Tracked mobile phones	181,670,728
Year of mobility tracking	2021
Provinces analyzed	52
Total geolocated areas	3214
Tourism expenditure database years	2018–2022
Primary data source	National Institute of Statistics of Spain (INE), Experimental Statistics
Territorial unit of analysis	Spanish provinces
Main statistical method	One-way ANOVA
Effect size measures	Eta squared (η^2) and omega squared (ω^2)
Robustness check	Welch ANOVA
Post hoc procedure	Hochberg-adjusted post hoc comparisons and Tukey HSD
Spatial diagnostic	Moran’s I using a 4-nearest-neighbor spatial weights matrix
Data analysis software	R version 4.4.1; RStudio version 2024.04.2

5. Results

This section reports the statistical analyses used to examine whether the four heritage tourism indicators differ across Spanish provinces. The analysis was conducted separately for the Internal Tourism Intensity Index (IITI), the External Tourism Intensity Index (IITE), Heritage Tourism Density (DTP), and the Heritage Concentration Index (CP). One-way ANOVA models were estimated for each indicator, and effect sizes were calculated using eta squared (η^2) and omega squared (ω^2). Hochberg-adjusted post hoc comparisons and Tukey HSD robustness checks were used to examine interprovincial differences. Additional robustness and spatial diagnostic analyses were included to assess the stability and territorial structure of the results. Table 5 presents the one-way ANOVA results for the four heritage tourism indicators.

Table 5. One-way ANOVA results for heritage tourism indicators.

Indicator	df Between	df Within	SS Between	SS Within	MS Between	MS Within	F Value	p-Value	η^2	ω^2
Internal Tourism Intensity Index (IITI)	51	3162	2.304×10^{10}	1.712×10^{11}	4.517×10^8	5.414×10^7	8.344	<0.001	0.119	0.104
External Tourism Intensity Index (IITE)	51	3162	9.744×10^{14}	5.685×10^{15}	1.911×10^{13}	1.798×10^{12}	10.627	<0.001	0.146	0.133
Heritage Tourism Density (DTP)	51	3162	3.760×10^{-5}	8.662×10^{-4}	7.372×10^{-7}	2.739×10^{-7}	2.691	<0.001	0.042	0.026
Heritage Concentration Index (CP)	51	3162	793.190	5.235×10^3	15.553	1.656	9.394	<0.001	0.132	0.118

Table 6 reports the Welch ANOVA robustness checks used to assess whether the main results remain stable under unequal group sizes and potential variance heterogeneity.

Table 6. Robustness check using Welch ANOVA.

Indicator	Classical ANOVA Result	Welch ANOVA Result	Robustness Interpretation
IITI	$F(51, 3162) = 8.344$, $p < 0.001$	$F(51, 562.48) = 7.876$, $p < 0.001$	The result remains statistically significant under Welch ANOVA, supporting the robustness of territorial differences in Internal Tourism Intensity under unequal group sizes.
IITE	$F(51, 3162) = 10.627$, $p < 0.001$	$F(51, 562.48) = 10.033$, $p < 0.001$	The result remains statistically significant under Welch ANOVA, supporting the robustness of territorial differences in External Tourism Intensity under unequal group sizes.
DTP	$F(51, 3162) = 2.691$, $p < 0.001$	$F(51, 562.48) = 2.540$, $p < 0.001$	The result remains statistically significant under Welch ANOVA, although the magnitude of territorial differentiation is smaller than for the tourism intensity indicators.
CP	$F(51, 3162) = 9.394$, $p < 0.001$	$F(51, 562.48) = 8.869$, $p < 0.001$	The result remains statistically significant under Welch ANOVA, supporting the robustness of territorial differences in Heritage Concentration.

The Welch ANOVA robustness checks support the stability of the main territorial differences under a procedure that is less sensitive than classical one-way ANOVA to unequal group sizes and potential variance heterogeneity. This is important because the number of geolocated areas differs considerably across provinces. The consistency between classical ANOVA, Welch ANOVA, effect sizes, and the exploratory spatial diagnostic supports the interpretation of statistically significant territorial differentiation across the four indicators.

The Tukey HSD checks are summarized in the Supplementary Material. They were used to verify whether the main pairwise patterns remained consistent under a standard post hoc procedure. This additional check was not intended to replace the Hochberg-adjusted comparisons, but to assess the stability of the main interprovincial patterns under an alternative post hoc criterion.

Because IITI and IITE share GD as a multiplicative component, a bivariate correlation was calculated to assess potential redundancy between the two indicators. The correlation was strong and statistically significant, $r = 0.842$, $p < 0.001$. This result indicates that the two synthetic tourism intensity indicators are closely associated, partly because both incorporate average daily spending. IITI and IITE are therefore interpreted as complementary but not fully independent measures of territorial tourism intensity. For this reason, the discussion treats them as related indicators that capture different territorial expressions of tourism intensity. Table 7 presents the Moran's I spatial autocorrelation results for the four heritage tourism indicators.

Table 7. Moran's I spatial autocorrelation results for heritage tourism indicators.

Indicator	Moran's I	p-Value	Interpretation
IITI	0.542	<0.001	Positive and statistically significant spatial autocorrelation. Provinces with similar levels of Internal Tourism Intensity tend to cluster geographically.
IITE	0.594	<0.001	Positive and statistically significant spatial autocorrelation. Provinces with similar levels of External Tourism Intensity tend to cluster geographically.
DTP	0.404	<0.001	Positive and statistically significant spatial autocorrelation. Provinces with similar levels of Heritage Tourism Density tend to cluster geographically.
CP	0.104	0.152	Weak and non-significant spatial autocorrelation. Heritage Concentration shows limited evidence of geographical clustering at the provincial level.

The provincial patterns reported below are descriptive and should be understood as comparative results within the constructed indicators, not as official rankings of heritage value or tourism performance.

The exploratory Moran's I analysis shows positive and statistically significant spatial autocorrelation for IITI, IITE, and DTP, indicating that provinces with similar tourism intensity and heritage tourism density values tend to cluster geographically. By contrast, CP showed weak and non-significant spatial autocorrelation, suggesting that architectural heritage concentration is more spatially dispersed and does not follow a strong provincial clustering pattern. These results reinforce the interpretation of heritage tourism in Spain as a territorially differentiated phenomenon and highlight the relevance of spatial structure when interpreting provincial tourism indicators.

The one-way ANOVA showed statistically significant differences in the Internal Tourism Intensity Index (IITI) across Spanish provinces, $F(51, 3162) = 8.344$, $p < 0.001$. The effect size was moderate, $\eta^2 = 0.119$ and $\omega^2 = 0.104$, indicating that provincial grouping accounts for a relevant proportion of the variance in internal tourism intensity. This result addresses RQ1 and shows that domestic tourism intensity is not evenly distributed across Spain.

The descriptive results show clear territorial variation. Provinces such as Araba/Álava, Albacete, Navarra, Madrid, Guadalajara, Bizkaia, Gipuzkoa, Burgos, and Salamanca presented some of the highest mean values, whereas Ceuta, Sevilla, Granada, Córdoba, Jaén, Huelva, and Cádiz showed lower average values. These differences suggest that domestic tourism intensity follows a heterogeneous provincial pattern rather than a uniform national distribution.

Hochberg-adjusted post hoc comparisons identified significant differences between several high- and low-intensity provinces. The Tukey HSD robustness check was used to verify whether the main pairwise patterns remained stable under a standard post hoc procedure. Together, these results support the interpretation of IITI as a territorially differentiated indicator of domestic tourism mobility and expenditure. Table 8 reports the descriptive statistics for the Internal Tourism Intensity Index by province.

The ANOVA results showed statistically significant differences in the External Tourism Intensity Index (IITE) among Spanish provinces, $F(51, 3162) = 10.627$, $p < 0.001$. The effect size was moderate, $\eta^2 = 0.146$ and $\omega^2 = 0.133$, indicating that provincial grouping accounts for a meaningful share of the variance in external tourism intensity. This finding addresses RQ2 and shows that non-resident tourism intensity varies significantly across provinces.

Table 8. Descriptive statistics for the Internal Tourism Intensity Index by province.

Destination	Mean	SE
Barcelona	7943	413
Valencia/València	7260	573
Madrid	11,897	430
Cádiz	4190	861
Granada	3380	844
Jaén	3635	966
Sevilla	3248	663
Córdoba	3629	906
Huelva	3896	1135
Málaga	3753	823
Almería	4155	1073
Huesca	4519	1322
Zaragoza	5827	879
Teruel	4386	1785
Asturias	6944	873
Santa Cruz de Tenerife	5009	966
Palmas, Las	5545	975
Cantabria	5043	1011
Albacete	12,230	1366
Guadalajara	10,836	1472
Toledo	9292	850
Ciudad Real	6834	1135
Burgos	10,130	1343
Salamanca	9687	1262
Soria	4165	2327
Zamora	4973	1569
León	7906	1020
Segovia	8435	1502
Ávila	7275	1569
Girona	7250	886
Lleida	6086	1051
Tarragona	8365	867
Ceuta	2906	3004
Castellón/Castelló	6381	1122
Alicante/Alacant	5558	683
Badajoz	4455	920
Cáceres	4787	1062
Coruña, A	5074	798
Lugo	5018	1244
Ourense	4989	1281
Pontevedra	6275	920
Murcia	7451	906
Navarra	11,715	913
Gipuzkoa	10,273	1001
Araba/Álava	14,502	1785
Bizkaia	10,663	855
Rioja, La	7310	1472
Balears, Illes	5269	906
Cuenca	8389	1416
Palencia	6282	1569
Melilla	6868	2781

The highest mean values were observed in provinces such as Araba/Álava, Madrid, Bizkaia, Navarra, Gipuzkoa, Soria, Rioja, Salamanca, Albacete, and Burgos. Lower values

appeared in Ceuta, Málaga, Granada, Jaén, Sevilla, Córdoba, and Cádiz. Because ITE is a synthetic indicator that combines non-resident presence and expenditure, the ranking should not be read as a simple measure of international arrivals. It reflects differentiated territorial patterns associated with mobility, spending intensity, and provincial aggregation.

Hochberg-adjusted post hoc comparisons identified significant differences between several high- and low-intensity provinces, reinforcing the existence of interprovincial variation in external tourism intensity. Table 9 reports the descriptive statistics for the External Tourism Intensity Index by province.

Table 9. Descriptive statistics for the External Tourism Intensity Index by province.

Destination	Mean	SE
Barcelona	1,823,028	75,310
Valencia/València	1,532,587	104,385
Madrid	2,734,620	78,333
Cádiz	1,105,750	156,935
Granada	960,729	153,806
Jaén	1,046,567	176,062
Sevilla	1,063,852	120,900
Córdoba	1,082,682	165,047
Huelva	1,169,247	206,898
Málaga	960,507	149,912
Almería	1,095,857	195,583
Huesca	1,191,949	240,824
Zaragoza	1,408,491	160,262
Teruel	1,615,593	325,204
Asturias	1,407,142	159,130
Santa Cruz de Tenerife	1,146,976	176,062
Palmas, Las	1,102,608	177,600
Cantabria	1,202,483	184,180
Albacete	2,002,384	248,990
Guadalajara	1,632,934	268,170
Toledo	1,659,500	154,828
Ciudad Real	1,443,004	206,898
Burgos	1,947,569	244,805
Salamanca	2,036,210	229,954
Soria	2,249,885	424,014
Zamora	1,110,540	285,870
León	1,742,044	185,943
Segovia	1,551,974	273,700
Ávila	1,835,648	285,870
Girona	1,559,860	161,420
Lleida	1,452,509	191,550
Tarragona	1,805,984	158,021
Ceuta	626,013	547,400
Castellón/Castelló	1,326,658	204,478
Alicante/Alacant	1,294,935	124,495
Badajoz	1,187,107	167,606
Cáceres	1,320,239	193,535
Coruña, A	1,151,927	145,436
Lugo	1,295,141	226,645
Ourense	1,297,350	233,412
Pontevedra	1,463,047	167,606
Murcia	1,741,997	165,047
Navarra	2,612,464	166,312
Gipuzkoa	2,370,186	182,467

Table 9. Cont.

Destination	Mean	SE
Araba/Álava	3,436,895	325,204
Bizkaia	2,708,526	155,871
Rioja, La	2,080,172	268,170
Balears, Illes	1,145,835	165,047
Cuenca	1,160,627	258,047
Palencia	1,762,073	285,870
Melilla	1,534,556	506,794

Heritage Tourism Density (DTP) was calculated as the ratio between the Heritage Concentration Index and the total population staying in each area. The one-way ANOVA showed statistically significant differences in DTP across Spanish provinces, $F(51, 3162) = 2.691, p < 0.001$. The effect size was small, $\eta^2 = 0.042$ and $\omega^2 = 0.026$, suggesting that territorial differences in heritage tourism density are statistically significant but more limited in magnitude than those observed for tourism intensity or heritage concentration. This result addresses RQ3 and shows that heritage tourism density differs significantly across provinces.

The descriptive results show that some provinces present higher heritage tourism density values than others. Ceuta, Málaga, Sevilla, Coruña, Granada, Almería, Palmas, Las, Castellón/Castelló, Alicante/Alacant, and Zaragoza showed relatively higher mean values. By contrast, Rioja, La, Soria, Segovia, Burgos, Albacete, Navarra, Araba/Álava, Teruel, Salamanca, and Palencia presented lower values.

These differences show that the relative concentration of heritage resources in relation to the population present is not homogeneous. Provinces with relatively high DTP may have a stronger concentration of heritage value in relation to the population present, while lower DTP values may reflect lower heritage concentration, larger population bases, or different spatial configurations of heritage resources.

Hochberg-adjusted post hoc comparisons identified significant differences among several destinations, supporting the interpretation of DTP as a useful indicator for identifying territorial variation in heritage tourism density. Table 10 reports the descriptive statistics for Heritage Tourism Density by province.

Table 10. Descriptive statistics for Heritage Tourism Density by province.

Destination	Mean	SE
Barcelona	0.000519	2.94×10^{-5}
Valencia/València	0.000637	4.07×10^{-5}
Madrid	0.000563	3.06×10^{-5}
Cádiz	0.000643	6.12×10^{-5}
Granada	0.000705	6.00×10^{-5}
Jaén	0.000625	6.87×10^{-5}
Sevilla	0.000779	4.72×10^{-5}
Córdoba	0.000654	6.44×10^{-5}
Huelva	0.000513	8.07×10^{-5}
Málaga	0.000857	5.85×10^{-5}
Almería	0.000707	7.63×10^{-5}
Huesca	0.000619	9.40×10^{-5}
Zaragoza	0.000668	6.25×10^{-5}
Teruel	0.000439	1.27×10^{-4}
Asturias	0.000552	6.21×10^{-5}
Santa Cruz de Tenerife	0.000539	6.87×10^{-5}

Table 10. Cont.

Destination	Mean	SE
Palmas, Las	0.000694	6.93×10^{-5}
Cantabria	0.000629	7.19×10^{-5}
Albacete	0.000391	9.72×10^{-5}
Guadalajara	0.000535	1.05×10^{-4}
Toledo	0.000532	6.04×10^{-5}
Ciudad Real	0.000475	8.07×10^{-5}
Burgos	0.000390	9.55×10^{-5}
Salamanca	0.000442	8.97×10^{-5}
Soria	0.000298	1.65×10^{-4}
Zamora	0.000633	1.12×10^{-4}
León	0.000554	7.26×10^{-5}
Segovia	0.000388	1.07×10^{-4}
Ávila	0.000480	1.12×10^{-4}
Girona	0.000565	6.30×10^{-5}
Lleida	0.000559	7.48×10^{-5}
Tarragona	0.000498	6.17×10^{-5}
Ceuta	0.001146	2.14×10^{-4}
Castellón/Castelló	0.000691	7.98×10^{-5}
Alicante/Alacant	0.000671	4.86×10^{-5}
Badajoz	0.000575	6.54×10^{-5}
Cáceres	0.000536	7.55×10^{-5}
Coruña, A	0.000771	5.68×10^{-5}
Lugo	0.000522	8.84×10^{-5}
Ourense	0.000512	9.11×10^{-5}
Pontevedra	0.000560	6.54×10^{-5}
Murcia	0.000476	6.44×10^{-5}
Navarra	0.000405	6.49×10^{-5}
Gipuzkoa	0.000498	7.12×10^{-5}
Araba/Álava	0.000416	1.27×10^{-4}
Bizkaia	0.000495	6.08×10^{-5}
Rioja, La	0.000280	1.05×10^{-4}
Balears, Illes	0.000645	6.44×10^{-5}
Cuenca	0.000575	1.01×10^{-4}
Palencia	0.000439	1.12×10^{-4}
Melilla	0.000577	1.98×10^{-4}

The Heritage Concentration Index (CP) was developed as a standardized AI-assisted and author-supervised scoring index of architectural cultural heritage concentration. The ANOVA results showed statistically significant differences in CP across Spanish provinces, $F(51, 3162) = 9.394$, $p < 0.001$. The effect size was moderate, $\eta^2 = 0.132$ and $\omega^2 = 0.118$, indicating that provincial grouping accounts for a meaningful proportion of the variance in architectural heritage concentration. This finding addresses RQ4 and shows that cultural heritage concentration varies significantly across Spain.

The descriptive statistics indicate that Valencia/València, Zaragoza, Sevilla, Alicante/Alacant, Málaga, Santa Cruz de Tenerife, Asturias, Madrid, Palmas, Las, and Barcelona presented comparatively higher CP values. Palencia, Cuenca, Albacete, Ávila, Zamora, Ourense, Teruel, Rioja, La, Salamanca, and Lugo presented lower mean scores.

These results are consistent with the idea that architectural heritage concentration is shaped by uneven historical, cultural, urban, and institutional trajectories. The findings do not imply that provinces with lower CP lack heritage value; rather, they show that

the standardized concentration score differs across the provincial structure analyzed in this study.

Hochberg-adjusted post hoc comparisons identified significant interprovincial differences, supporting the existence of territorial heterogeneity in architectural cultural heritage concentration. Table 11 reports the descriptive statistics for the Heritage Concentration Index by province.

Table 11. Descriptive statistics for the Heritage Concentration Index by province.

Destination	Mean	SE
Barcelona	6.64	0.0723
Valencia/València	7.54	0.1002
Madrid	6.72	0.0752
Cádiz	6.33	0.1506
Granada	6.43	0.1476
Jaén	6.31	0.1689
Sevilla	7.33	0.1160
Córdoba	6.53	0.1584
Huelva	6.19	0.1985
Málaga	6.89	0.1438
Almería	6.15	0.1877
Huesca	5.77	0.2311
Zaragoza	7.40	0.1538
Teruel	5.71	0.3120
Asturias	6.76	0.1527
Santa Cruz de Tenerife	6.84	0.1689
Palmas, Las	6.68	0.1704
Cantabria	6.49	0.1767
Albacete	5.52	0.2389
Guadalajara	5.84	0.2573
Toledo	6.21	0.1486
Ciudad Real	6.05	0.1985
Burgos	5.90	0.2349
Salamanca	5.74	0.2206
Soria	6.30	0.4068
Zamora	5.68	0.2743
León	6.54	0.1784
Segovia	5.75	0.2626
Ávila	5.59	0.2743
Girona	6.45	0.1549
Lleida	6.45	0.1838
Tarragona	6.40	0.1516
Ceuta	6.83	0.5252
Castellón/Castelló	6.26	0.1962
Alicante/Alacant	7.33	0.1194
Badajoz	5.95	0.1608
Cáceres	6.31	0.1857
Coruña, A	6.13	0.1395
Lugo	5.74	0.2175
Ourense	5.70	0.2240
Pontevedra	6.62	0.1608
Murcia	6.50	0.1584
Navarra	6.29	0.1596
Gipuzkoa	6.41	0.1751
Araba/Álava	5.82	0.3120
Bizkaia	6.03	0.1496
Rioja, La	5.72	0.2573

Table 11. Cont.

Destination	Mean	SE
Balears, Illes	6.29	0.1584
Cuenca	5.52	0.2476
Palencia	5.45	0.2743
Melilla	6.57	0.4863

The results address the four research questions proposed in the study. Significant differences were found across Spanish provinces for internal tourism intensity, external tourism intensity, heritage tourism density, and cultural heritage concentration. The indicators therefore show that heritage tourism in Spain is territorially differentiated and cannot be adequately understood as a homogeneous national phenomenon. Table 12 summarizes the research questions, indicators, main statistical results, effect sizes, and overall findings.

Table 12. Summary of research questions and main findings.

Research Question	Indicator	Main Result	Effect Size	Finding
RQ1	Internal Tourism Intensity Index (IITI)	$F(51, 3162) = 8.344$, $p < 0.001$	$\eta^2 = 0.119$; $\omega^2 = 0.104$	Significant territorial differences
RQ2	External Tourism Intensity Index (IITE)	$F(51, 3162) = 10.627$, $p < 0.001$	$\eta^2 = 0.146$; $\omega^2 = 0.133$	Significant territorial differences
RQ3	Heritage Tourism Density (DTP)	$F(51, 3162) = 2.691$, $p < 0.001$	$\eta^2 = 0.042$; $\omega^2 = 0.026$	Significant but smaller territorial differences
RQ4	Heritage Concentration Index (CP)	$F(51, 3162) = 9.394$, $p < 0.001$	$\eta^2 = 0.132$; $\omega^2 = 0.118$	Significant territorial differences

These results should be interpreted as evidence of territorial differentiation, not as evidence of causal relationships among mobility, expenditure, heritage concentration, and heritage tourism density. Overall, the findings indicate that tourism intensity, heritage tourism density, and heritage concentration follow differentiated provincial patterns across Spain.

6. Discussion

This study examined heritage tourism in Spain as a territorially differentiated phenomenon. Drawing on large-scale mobile phone geolocation data, tourism expenditure information, and a Heritage Concentration Index, the analysis assessed whether four heritage tourism indicators differed significantly across Spain's 52 provinces. The results answer the four research questions by showing that internal tourism intensity, external tourism intensity, heritage tourism density, and cultural heritage concentration differ significantly across provinces. They support the descriptive premise of the study: heritage tourism in Spain is not spatially homogeneous, but territorially differentiated.

Moran's I adds an important spatial dimension to the interpretation of the findings. The positive and statistically significant spatial autocorrelation observed for IITI, IITE, and DTP indicates that tourism intensity and heritage tourism density are not randomly distributed across Spain, but tend to form geographically clustered patterns. The weak and non-significant spatial autocorrelation observed for CP suggests a different pattern: architectural heritage concentration is less spatially clustered at the provincial level. This distinction reinforces the idea that tourism mobility and heritage concentration do not necessarily follow the same territorial logic.

These spatial patterns should also be read in light of the temporal context of the mobility data. Because the mobility records correspond to 2021, the results may still reflect post-pandemic travel behavior, uneven recovery, and residual mobility restrictions. The findings should therefore be understood as evidence of territorial differentiation in that specific period, rather than as stable long-term patterns.

The significant differences found in the Internal Tourism Intensity Index address RQ1 and indicate that domestic tourism mobility and spending intensity are unevenly distributed across Spanish provinces. This finding is consistent with studies showing that tourism mobility is shaped by accessibility, territorial centrality, destination attractiveness, and the spatial structure of demand (Padrón-Ávila & Hernández-Martín, 2020; Ruiz-Pérez et al., 2023). Internal tourism therefore cannot be interpreted as a uniform national flow. It reflects differentiated provincial dynamics that may be associated with domestic travel habits, urban structure, regional accessibility, and the distribution of cultural and leisure resources.

The results for the External Tourism Intensity Index address RQ2 and show that non-resident tourism intensity also varies significantly across provinces. This finding is aligned with research highlighting the role of international mobility, connectivity, and destination visibility in tourism concentration (Robin et al., 2022; Valente & Medina-Ariza, 2024). At the same time, the provincial pattern observed here suggests that external tourism intensity is not fully explained by traditional assumptions about internationally consolidated destinations. Because the indicator combines non-resident presence and spending, it should be interpreted as evidence of territorial differentiation rather than as a direct measure of international destination competitiveness.

The significant differences in Heritage Tourism Density address RQ3. From a management perspective, this result matters because it shows that the relative concentration of heritage resources in relation to the population present differs across provinces. DTP is not only a matter of visitor volume; it depends on the relationship between heritage concentration and the total population present in each area. This result is consistent with the literature on sustainable cultural tourism, which emphasizes the need to balance visitor use, heritage conservation, and local well-being (Rawal et al., 2023; Falk & Hagsten, 2024; Kalvet et al., 2020). Provinces with higher DTP values may require more specific monitoring of heritage use, while provinces with lower values may need strategies aimed at improving visibility, accessibility, or heritage-based tourism development.

The findings for the Heritage Concentration Index address RQ4 and indicate that architectural cultural heritage concentration is not evenly distributed across Spanish provinces. This result is consistent with studies showing that cultural heritage resources follow spatially uneven patterns shaped by historical trajectories, urban development, institutional recognition, and cultural investment (Hidalgo-Sánchez et al., 2024; Zhang et al., 2024). Because CP was constructed through an AI-assisted desk-based assessment of publicly available heritage information, its interpretation should remain comparative and diagnostic. The index captures relative territorial variation in documented architectural heritage concentration, but it should not be interpreted as an official count of protected heritage assets. The territorial variation in CP reinforces the need to analyze heritage tourism beyond national-level aggregates. Provinces differ not only in tourist flows, but also in the concentration and diversity of heritage resources that may support cultural tourism development. Since DTP is derived from CP and the population present in each area, the two indicators should not be interpreted as independent dimensions. DTP instead provides a relative expression of heritage concentration adjusted by the population present in the territorial unit.

Taken together, these results contribute to the literature by showing that heritage tourism in Spain should be understood as a spatially uneven system. The study does not claim that heritage concentration causes tourism intensity, or that tourism density directly determines expenditure. Those relationships would require correlation, regression, spatial econometric models, or longitudinal designs. The contribution lies instead in showing that the selected indicators differ significantly across provinces and that these differences can be measured through an integrated, data-driven framework.

The findings also have practical implications. For policymakers and destination managers, they suggest that heritage tourism planning may benefit from province-sensitive approaches rather than homogeneous national strategies. Provinces with high tourism intensity may benefit from closer attention to visitor management, mobility planning, and heritage conservation. Provinces with high heritage concentration but lower tourism intensity may benefit from interpretation strategies, digital promotion, accessibility improvements, and product development. Provinces with high heritage tourism density may require further examination of the relationship between heritage resources and population presence. In this sense, the study provides diagnostic evidence that may support more balanced heritage tourism planning and territorial development.

7. Conclusions

This study examined heritage tourism in Spain through the lens of territorial differentiation. Using official experimental statistics from the National Institute of Statistics of Spain, the analysis integrated mobile phone geolocation data, tourism expenditure information, and a Heritage Concentration Index to compare four indicators across Spain's 52 provinces: Internal Tourism Intensity, External Tourism Intensity, Heritage Tourism Density, and Cultural Heritage Concentration.

The results show statistically significant differences across provinces in all four indicators. Internal Tourism Intensity and External Tourism Intensity are unevenly distributed, indicating that mobility- and expenditure-related indicators follow differentiated provincial patterns. Heritage Tourism Density also differs significantly, showing that the relative concentration of heritage resources in relation to the population present varies across Spain. Likewise, the Heritage Concentration Index shows significant differences among provinces, indicating an uneven spatial distribution of architectural cultural heritage concentration. These findings should be interpreted as comparative territorial evidence rather than as causal explanations of tourism performance or heritage value.

The main contribution of this study is its integrated empirical approach to heritage tourism as a territorially differentiated phenomenon. Rather than treating heritage tourism in Spain as a homogeneous national activity, the study shows that provincial differences matter. This perspective contributes to research on cultural tourism measurement, tourism mobility, and heritage-based territorial planning by combining large-scale mobility data with heritage indicators and ANOVA-based territorial comparison.

From a practical perspective, the findings point to the usefulness of province-sensitive approaches in heritage tourism management. Tourism planning may benefit from considering the specific territorial profile of each province, including tourism intensity, heritage tourism density, and cultural heritage concentration. This is especially important for balancing visitor experience, heritage preservation, local development, and sustainable destination management.

Overall, the findings indicate that heritage tourism in Spain is not territorially homogeneous. Its intensity, density, and cultural heritage concentration vary across provinces, and these differences may inform evidence-based, sustainable, and territorially balanced tourism planning.

Limitations

This study has several limitations. First, the analysis is descriptive and comparative; it does not establish causal relationships between heritage concentration, tourism mobility, and expenditure. Second, the 3214 geolocated areas are nested within provinces, so full statistical independence among areas cannot be assumed. Third, the number of geolocated areas differs substantially across provinces, which may affect variance estimates and pairwise comparisons. Fourth, the mobility data correspond to 2021, a year still affected by COVID-19-related restrictions, behavioral changes, and uneven tourism recovery. Fifth, the Heritage Concentration Index is a standardized research indicator constructed through an AI-assisted desk-based heritage assessment using publicly available information and author supervision. Although the procedure was standardized through a common prompt and scoring rubric, CP should not be interpreted as an official inventory or as a fully externally validated measure of cultural heritage concentration. Its purpose is comparative and diagnostic. Future research should validate CP statistically against official external sources, including BIC-listed assets, UNESCO World Heritage properties, national heritage inventories, and regional heritage catalogues. Sixth, DTP is based on the total population present in the area and should therefore be interpreted as a relative territorial ratio rather than as a pure measure of tourist pressure or resident heritage density. Finally, the Moran's I results indicate that some indicators exhibit spatial autocorrelation, suggesting that future research should incorporate spatial econometric or multilevel models to better account for territorial dependence. Additional diagnostic procedures, such as full residual-based tests or non-parametric sensitivity analyses at the area level, would require the original area-level dataset and should be incorporated in future replications.

8. Future Research Directions

The findings open several avenues for future research on heritage tourism, territorial differentiation, and data-driven tourism analysis. Since this study focused on statistically significant differences across Spanish provinces, future work should move toward more explanatory, longitudinal, and spatially explicit approaches capable of examining how heritage concentration, tourism mobility, population presence, visitor behavior, and territorial development interact.

First, future research should further validate and refine the measurement of cultural heritage concentration. The Heritage Concentration Index (CP) proposed in this study offers a useful starting point for territorial comparison, but it should be strengthened through external validation against official heritage records, such as Assets of Cultural Interest (*Bienes de Interés Cultural*, BIC), UNESCO World Heritage listings, national cultural heritage inventories, and regional heritage catalogues. Future studies could also incorporate expert panels, GIS-based validation, inter-rater reliability procedures, and mixed-method approaches to improve the robustness, transparency, and replicability of CP as a comparative research indicator.

Second, future studies should apply multilevel or mixed-effects models to better account for the nested structure of the data. In this study, geolocated areas were grouped within provinces and analyzed through comparative ANOVA models. Areas within the same province, however, may share governance structures, infrastructure, accessibility conditions, tourism policies, and heritage systems. Future research should therefore estimate models that distinguish between within-province and between-province variation. This would help clarify whether territorial differences are mainly driven by provincial-level factors, local area characteristics, or interactions between both levels.

Third, future work should incorporate spatial econometric models and more advanced spatial diagnostics. The Moran's I results suggest that some indicators exhibit spatial

clustering, particularly tourism intensity and heritage tourism density. Future studies could extend this analysis through spatial lag models, spatial error models, geographically weighted regression, or spatial panel models. These approaches would help determine whether neighboring provinces influence one another and whether heritage tourism patterns are shaped by spatial spillovers, regional corridors, transport connectivity, or broader territorial systems.

Fourth, future research should replicate the analysis using pre-pandemic and post-pandemic data. The mobility information used here corresponds to 2021, a year still affected by COVID-19-related restrictions and uneven recovery patterns. Replicating the analysis with earlier and later years would make it possible to assess whether the territorial patterns identified in this study are stable over time or partly shaped by the exceptional conditions of the pandemic period. A longitudinal design would also allow researchers to examine changes in internal mobility, external tourism intensity, expenditure patterns, and heritage tourism density across different recovery phases.

Fifth, future studies could incorporate socioeconomic indicators such as employment, income distribution, business activity, public investment, infrastructure, and residents' quality of life. This would make it possible to examine how different forms of heritage tourism intensity are associated with broader territorial development processes. Such an approach would also help clarify whether provinces with higher heritage concentration or heritage tourism density obtain stronger socioeconomic benefits, or whether these benefits depend on governance capacity, accessibility, institutional investment, and local absorptive capacity.

Sixth, further research should examine tourist spending behavior in greater detail. This study used average daily expenditure as an input for constructing synthetic tourism intensity indicators, but it did not model the determinants of expenditure. Future analyses could include visitor characteristics such as country of origin, age, travel motivation, length of stay, type of accommodation, and travel party composition. This would improve understanding of how economic value is generated and distributed across heritage destinations, and whether spending patterns differ between heritage-intensive provinces and other tourism territories.

Seventh, future studies should examine the relationship between heritage tourism density and sustainable destination management. High-density heritage environments may generate opportunities for local economic activity, but they may also create management challenges for conservation systems, mobility infrastructure, local communities, and visitor experience. Research in this direction could help destinations design more balanced strategies for carrying capacity management, heritage interpretation, visitor dispersion, conservation planning, and community participation.

Eighth, the territorial scale of analysis should be refined. Although the provincial level provides a useful basis for comparison, it may hide important local differences within provinces. Future studies could examine municipalities, historical districts, cultural routes, or specific heritage sites to capture more precise spatial dynamics. This would be particularly useful for identifying areas with high visitor concentration, underused heritage resources, emerging heritage tourism corridors, or mismatches between heritage value and tourism visibility.

Ninth, comparative research with other heritage-rich countries could strengthen the international relevance of this approach. Applying similar indicators to countries such as Italy, France, Portugal, Greece, or the United Kingdom would allow researchers to compare territorial patterns of heritage tourism intensity, density, and concentration. Such benchmarking could provide useful evidence on governance models, policy instruments, and planning strategies for cultural tourism.

Overall, future research should build on this study by moving from territorial comparison toward explanation, prediction, spatial modeling, and policy-oriented analysis. This would contribute to a more complete understanding of how heritage resources, tourism mobility, visitor behavior, territorial governance, and regional development interact in heritage destinations.

Supplementary Materials: The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/tourhosp7080216/s1>, Table S1: provincial descriptive statistics for the Internal Tourism Intensity Index (IITI), External Tourism Intensity Index (IITE), Heritage Tourism Density (DTP), and Heritage Concentration Index (CP); Table S2: Hochberg-adjusted post hoc comparisons among Spanish provinces; Table S3: robustness and spatial diagnostic calculations, including Welch ANOVA, correlation analysis, Moran's I, and Tukey HSD summary results; Supplementary Material S1: criteria and scoring protocol used for the construction of the Heritage Concentration Index (CP).

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Data Availability Statement: The data supporting the findings of this study were obtained from official experimental statistical sources published by the National Institute of Statistics of Spain (INE). The processed dataset generated for this study, including the constructed indicators used in the ANOVA models, is provided in the Supplementary Materials. Additional processed files may be made available by the corresponding author upon reasonable request. The Heritage Concentration Index (CP) is a derived research indicator developed by the author for the purposes of this study.

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Abbreviations

The following abbreviations are used in this manuscript:

Abbreviation	Meaning
ANOVA	Analysis of Variance
CP	Heritage Concentration Index
DTP	Heritage Tourism Density
GD	Average Daily Spending per Visitor
GIS	Geographic Information Systems
IITI	Internal Tourism Intensity Index
IITE	External Tourism Intensity Index

INE	National Institute of Statistics of Spain
NAP	Number of Distinct Overnight Stay Areas
SE	Standard Error
BIC	Assets of Cultural Interest (<i>Bienes de Interés Cultural</i>)
HSD	Honestly Significant Difference
Moran's I	Global Moran's spatial autocorrelation statistic
APC	Article Processing Charge

Appendix A

Appendix A.1. Criteria and Scoring Protocol Used for the Heritage Concentration Index

The Heritage Concentration Index (CP) was developed as a comparative research indicator to estimate the relative concentration of architectural cultural heritage across the territorial units included in the study. CP was not intended to replace official cultural heritage inventories. Rather, it provides a standardized territorial score for comparative analysis across provinces.

The index was constructed through an AI-assisted and author-supervised evaluation procedure. The same prompt structure and scoring criteria were applied to all territorial units to maintain consistency. The prompt requested a standardized assessment of architectural cultural heritage concentration according to four criteria: (1) number of historical sites and monuments, (2) historical and cultural significance, (3) diversity and variety of architectural expressions, and (4) recognition and distinctions. The standardized prompt followed this structure: 'Assess the architectural cultural heritage concentration of [territorial unit] in Spain using a 1–10 scale. Consider the number of historical sites and monuments, historical and cultural significance, diversity of architectural expressions, and official or international recognition. Provide a score where 1 indicates minimal heritage concentration and 10 indicates very high heritage concentration. Apply the same criteria consistently across all territorial units.'

The scoring scale ranged from 1 to 10. Scores from 1 to 2 indicate minimal architectural heritage concentration; scores from 3 to 4 indicate low concentration; scores from 5 to 6 indicate moderate concentration; scores from 7 to 8 indicate high concentration; and scores from 9 to 10 indicate very high concentration. The final score assigned to each territorial unit reflected the combined assessment of the four criteria.

Author supervision was used to identify inconsistent or implausible scores. Cases showing potential inconsistency were reviewed against the conceptual criteria and adjusted when necessary. The review focused on coherence between the assigned score and the expected heritage profile of the territorial unit. This procedure was intended to improve internal consistency, but it does not constitute formal external validation.

As a limitation, CP should be interpreted as a comparative research index rather than as an official measure of heritage assets. Future research should validate the index against external sources such as BIC-listed assets, UNESCO World Heritage properties, national cultural heritage inventories, and regional heritage catalogues.

Appendix A.2. Analytical Model

The empirical analysis was based on four separate one-way ANOVA models. In each model, province was used as the grouping factor, and one of the four indicators was used as the dependent variable: Internal Tourism Intensity Index (IITI), External Tourism Intensity Index (IITE), Heritage Tourism Density (DTP), and Heritage Concentration Index (CP). When statistically significant differences were identified, Hochberg-adjusted post hoc comparisons were applied to identify specific interprovincial differences, and Tukey HSD was used as a robustness check for pairwise comparisons. Welch ANOVA was also performed to

assess whether the main results remained stable under unequal provincial sample sizes. In addition, Moran's I was calculated as an exploratory spatial diagnostic to evaluate whether similar indicator values tended to cluster geographically across Spanish provinces.

Appendix B. Supplementary Statistical Results

The Supplementary Material includes the full matrix of Hochberg-adjusted post hoc comparisons among Spanish provinces. It also includes robustness and spatial diagnostic calculations, including Welch ANOVA, correlation analysis, Moran's I, and Tukey HSD summary results. These supplementary analyses support the interpretation of territorial differentiation across Spanish provinces and complement the ANOVA results reported in the main text.

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