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RURAL REVITALIZATION THROUGH TOURISM: SPATIAL ANALYSIS OF NOHAKU ACCOMMODATION DISTRIBUTION AND PRICING IN YAMAGUCHI PREFECTURE, JAPAN

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ABSTRACT

Research into the supply of tourism accommodations in rural areas is essential, given tourism's central role in rural revitalisation. Recent studies increasingly employ Geographical Information Systems (GIS) to analyse the distribution and determinants of rural accommodations. However, a significant gap remains in the literature addressing rural Japan specifically. This study investigates the spatial distribution and pricing dynamics of Nohaku accommodations in Yamaguchi Prefecture, Japan. A comprehensive database was compiled from multiple sources to document accommodations and their respective prices across Japanese prefectures. The analysis integrates spatial analysis and the Spatial Durbin Model (SDM) to assess spatial clustering and the determinants of accommodation pricing. Results reveal significant clustering of Nohaku accommodations around key tourism resources and identify regions with untapped tourism potential. Spatial econometric analysis shows that Nohaku accommodations command a price premium, and proximity to tourism resources positively affects pricing. The results offer a nuanced understanding of spatial patterns and pricing strategies, providing actionable insights for policymakers to optimise rural tourism development.

Keywords: *Farm-based accommodation; Price distribution; Rural tourism; Spatial econometrics*

INTRODUCTION

Tourism significantly drives regional socio-economic growth and development (Lane, 1994; Ohashi, 2002). Its impact is particularly pronounced in rural areas with geographical features such as mountainous terrain, cultural heritage, and agricultural traditions (Chakraborty & Asamizu, 2014; Lane & Kastenholz, 2015). This trend has intensified after the COVID-19 pandemic, as tourists increasingly seek nature-based and low-density travel experiences (Rosalina et al., 2021). The renewed interest in rural tourism has brought attention to the imperative for sustainable development (Khartishvili et al., 2019; Milán-García et al., 2019), and numerous cross-country studies identify rural tourism as

a mechanism to counter rural decline by generating economic opportunities and fostering local development (Gao & Wu, 2017; Xie et al., 2022). Nonetheless, much of the empirical literature has concentrated on countries such as Spain, Romania, and China (Ruiz-Real et al., 2022), leaving rural tourism in Asia, particularly Japan, relatively underexplored.

A critical dimension of rural tourism development is the provision of accommodation, which is a prerequisite for attracting and retaining visitors (Lane & Kastenholz, 2015; Pina & Delfa, 2005). The availability and quality of accommodation directly affect the viability of tourism enterprises (Daigaku & Nohguchi, 2019). Empirical studies have shown that sufficient and well-located accommodation can increase the length of stay, frequency of visits, and qualitative engagement between tourists and host communities (Tussyadiah & Pesonen, 2016; Volgger et al., 2019). Consequently, understanding the determinants of accommodation supply, particularly its spatial distribution, is essential for rural tourism planning and implementation. Walford (2001) identifies several key economic, social, and geographical influences that shape rural accommodation supply.

The demand for rural accommodations is often shaped by generational preferences, holiday duration, and urban–rural attitude differentials (Ohe, 2008). These demand-side dynamics are closely intertwined with the availability of tourism resources, which act as focal points for travel decisions (Benítez-Aurioles, 2022). Core tourism attractions such as scenic landscapes, cultural monuments, and museums are often unevenly distributed, creating geographical disparities in tourism potential (Lane & Kastenholz, 2015; Xie et al., 2022). The concentration of demand around key attractions frequently generates agglomeration effects that influence the spatial organisation of tourism services, including accommodations (Y. Zhang et al., 2022). These agglomerations, in turn, shape the decisions of investors and planners regarding where accommodations are developed (Janjua et al., 2021).

In addition to location, various factors have been found to affect the pricing of rural tourism accommodations, including proximity to attractions, service quality, accommodation type, and available

amenities (Ohe & Kurihara, 2013). These variables contribute to price formation and reflect potential guests' perceived value of accommodations. Accommodations near heritage or recreational sites tend to command higher prices due to their locational advantages (Benítez-Aurioles, 2022). However, the uneven spatial distribution of tourism resources often results in price disparities across regions (Lane & Kastenholz, 2015; Xie et al., 2022). Furthermore, tourism clusters can create positive externalities that elevate prices through increased competition and accessibility (Y. Zhang et al., 2022). These dynamics reflect the complex interplay between demand-side preferences and supply-side conditions in shaping rural tourism pricing (Janjua et al., 2021).

A growing body of literature confirms a tendency for accommodations to cluster spatially in areas with a high density of tourism resources or scenic value (Żakowska & Podhorodecka, 2018). These patterns suggest underlying spatial correlations, and possibly causal relationships, between the presence of tourism resources and accommodation development. In recent years, Geographic Information Systems (GIS) have become important tools for examining the spatial configuration of tourism infrastructure (Sánchez-Martín et al., 2023; T. Zhang & Li, 2021; Muryani et al., 2019). Studies employing GIS techniques have improved our understanding of how tourism activities are distributed and how spatial proximity influences tourism flows (Akhtari, 2021; Walford, 2001). However, most existing studies have either applied GIS-based mapping or econometric modelling in isolation, lacking a combined approach that simultaneously addresses spatial clustering and economic determinants.

This study introduces a novel methodological approach by integrating GIS-based spatial analysis with spatial econometric modelling to investigate the distribution and pricing of Nohaku accommodations in Yamaguchi Prefecture, Japan. While these methods have been used independently in prior tourism studies, their combined application remains limited, particularly in rural Japan. This integration enables a more comprehensive understanding of the spatial structure of accommodation supply and its economic dynamics. Scientifically, this contributes to spatial tourism research by offering a dual lens on locational patterns and pricing

behaviour. Socially, it addresses critical challenges related to spatial inequality and resource allocation in rural development. By identifying under-accommodated areas with tourism potential, the study offers practical insights for policymakers aiming to support sustainable, inclusive, and geographically balanced rural tourism.

Moreover, the strategic importance of this investigation lies in its alignment with national and regional policies aimed at revitalising rural Japan. Amid challenges such as depopulation, ageing communities, and uneven tourism development, mapping the spatial distribution of Nohaku accommodations provides a critical evidence base for targeting investment and planning efforts. It allows for identifying both accommodation clusters and spatial voids, contributing to a more equitable and efficient development of tourism infrastructure. This makes the study timely and directly relevant to Japan's evolving approach to rural economic policy.

This research builds on foundational studies on spatial distribution in tourism, including the work of Walford (2001), Sarrión-Gavilán et al. (2015), and Sánchez-Martín et al. (2023). Walford (2001) observed that the presence of scenic areas in buffer zones tends to correlate with increased accommodation uptake in surrounding farming communities, indicating the presence of neighbourhood effects. Clustering phenomena have been widely documented in various tourism contexts, confirming the tendency of tourism infrastructure to concentrate geographically (Zhao et al., 2023). These patterns provide a relevant comparative context for analysing the Japanese case and the spatial configuration of Nohaku accommodations.

In response to the identified gap in the literature and the strategic importance of the topic, this study investigates the spatial distribution and pricing of Nohaku accommodations in Yamaguchi Prefecture. Specifically, it explores the spatial relationship between accommodation supply and tourism resources by integrating spatial statistical analysis with econometric modelling. The study draws on secondary data compiled from official websites, digital platforms, and printed brochures covering 2015 to 2024. Doing so contributes to the limited but growing body of empirical research on rural tourism in Japan (Ruiz-Real et al., 2022).

It offers valuable insights for both academic researchers and public decision-makers. Ultimately, this study enhances our understanding of how tourism accommodations are geographically distributed and how their location influences accessibility and pricing, thereby shaping the sustainability of rural tourism in Japan.

The remainder of this paper is organised as follows: the next section provides an overview of rural tourism and Nohaku accommodation in the context of Japan, followed by a description of the study area—Yamaguchi Prefecture—and its dynamics. The fourth section discusses the data collection process. The subsequent part outlines the methodologies employed in this study. Finally, the paper summarises the main findings, discusses key insights and implications for rural tourism development, and offers suggestions for future research.

MATERIALS AND METHODS

Rural Tourism in Japan

1. Study Area

Yamaguchi Prefecture, the focus of this study, is located in the western region of Japan, on the eastern side of the Chugoku region (see **Figure 1**). The modern administrative boundaries of the prefecture were established during the Meiji Era as part of the "Haihan-chiken" reforms, which dissolved feudal domains and reorganised them into prefectures. This reorganisation merged the former Yamaguchi, Iwakuni, Toyoura, and Seimatsu domains. As of 2010, the prefecture comprises 13 cities and six towns, totalling 19 municipalities. According to the Official Statistics of Japan (2024), the population declined from 1,435,018 in 2010 to 1,275,071 in 2023, reflecting an 11% decrease.

The prefecture is predominantly mountainous and hilly, with approximately 70% of its landscape comprising forested and agricultural areas. These environments support forestry, agriculture, and fisheries, which remain vital to the local economy and ecological sustainability.

Yamaguchi has gained increasing visibility in domestic and international travel media. In 2024, it was included in the New York Times' "52 Places to Visit," highlighting the region's appeal due to its natural

beauty and cultural heritage. Hagi City, in particular, is renowned for its preserved samurai-era townscape and pottery traditions (Louis-Frédéric, 2002). The prefecture also holds historical significance as the birthplace of prominent political figures, including eight Japanese prime ministers, among them the nation's first, Itō Hirobumi.

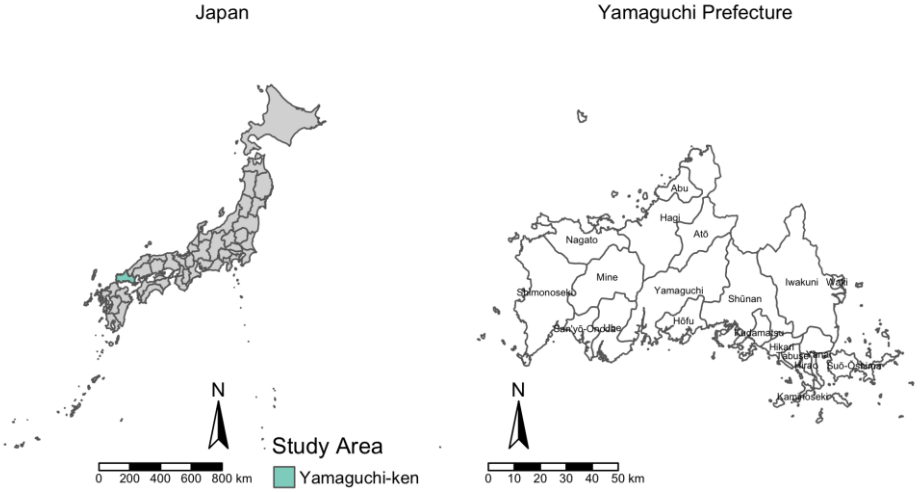

Figure 1. Study Area.

Source: Figure created by the author using raw GIS data processed in R

2. Rural Tourism and Nohaku in Japan

Tourism initiatives in Yamaguchi have included projects targeting rural revitalisation since 1997. These include experiential tourism programs in farming, mountain, and fishing villages, focusing on school excursions and domestic travel. Local stakeholders, supported by NPOs such as the Yamaguchi Prefecture Mountainous Region Revitalisation Support Centre and the Yamaguchi Slow Tourism General Development Centre, have also hosted events like the Akamagaseki Kaido Walking and Hagi Ohkan festivals (Asamizu et al., 2015).

Recent trends indicate a surge in high-value experiential tourism, emphasizing the need for careful spatial and infrastructural planning to mitigate potential negative externalities. Yamaguchi's rich historical background, scenic attractions, and evolving tourism strategy make it a compelling case study for analyzing the spatial relationship between accommodations and tourism resources.

The concept of rural tourism encompasses a broad range of activities and interpretations, but most definitions share a common emphasis on geographical context. According to Lane (1994), rural areas suitable for tourism typically exhibit three key characteristics: (1) low population density and small-scale settlements; (2) landscapes shaped by farming, forestry, and nature-based resource use; and (3) social life oriented toward tradition and cultural heritage. These attributes make rural environments particularly attractive for tourism development.

Rural tourism gained momentum in Europe during the 1970s, when longer holidays allowed extended stays in natural and agricultural settings (Rustiadi et al., 2022). In Japan, this trend was adopted in the 1990s under "green tourism," a strategy to revitalise declining rural regions through nature- and culture-based tourism (Asamizu et al., 2015). Existing literature has established the role of rural tourism in economic diversification and regional revitalisation, particularly in peripheral areas facing demographic and industrial decline (Sharpley, 2002; Lane, 1994).

Traditionally, rural tourism in Japan focused on educational trips and short-term visits by domestic tourists, especially school groups. However, in recent years, there has been a marked shift toward attracting independent travellers and affluent international visitors (Calero & Turner, 2020; Syngellakis & Rodriguez, 2022). The COVID-19 pandemic further accelerated these changes, fostering the rise of micro-tourism and workcation travel. This evolution has broadened the market base for rural tourism, appealing to both older and younger demographics. Despite this growth, persistent challenges remain, including depopulation, ageing communities, and the low commercial viability of top-down tourism development models (Rustiadi et al., 2022).

The Japanese government launched the Nohaku project in 2017 in response to these structural challenges. This policy initiative, supported by the Ministry of Agriculture, Forestry, and Fisheries (MAFF), seeks to formalise and scale farm-based lodging (Nohaku) to boost

rural tourism. Nohaku accommodations include various facilities such as farmhouses, converted school buildings, vacant traditional homes, and even small inns and ryokans. These lodgings offer tourists immersive cultural, culinary, and nature-based experiences (Daigaku & Nohguchi, 2019).

Data from MAFF show a steady rise in participation, with the number of tourists engaging in Nohaku experiences increasing from 2.88 million in FY2016 to 3.66 million in FY2018. The policy framework emphasises the synergy between agriculture, rural life, and tourism to sustain rural communities (MAFF, 2020).

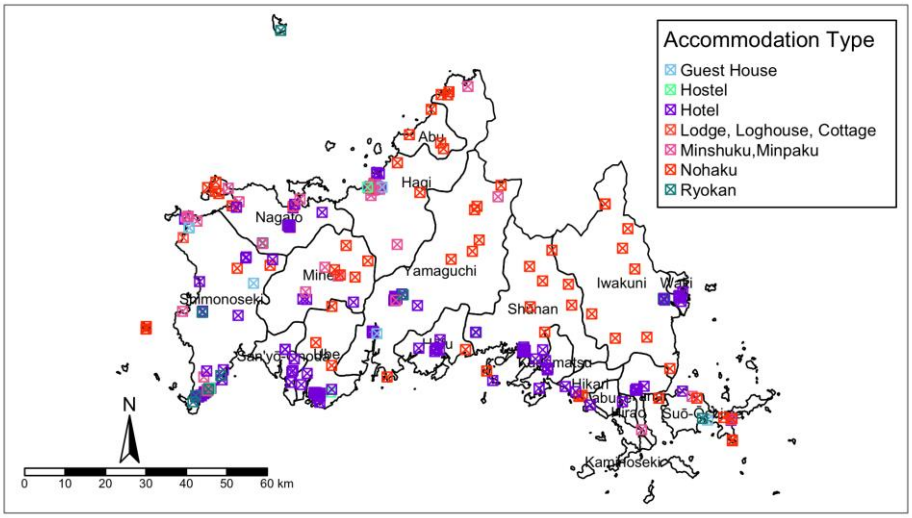

Figure 2. Tourism accommodations in Yamaguchi prefecture.
Source: Figure created by the author using raw GIS data processed in R

Figure 2 maps the spatial distribution of Nohaku and other accommodations across Yamaguchi Prefecture. A visual analysis reveals a concentration of hotels in coastal areas. At the same time, Nohaku accommodations are more prevalent in inland and central regions, particularly in municipalities such as Yamaguchi, Shunan, and Iwakuni. This suggests intentional geographic placement to complement local tourism resources.

This section underscores the significance of Nohaku accommodations within Japan's rural tourism landscape and sets the stage for a spatial and economic analysis of

their distribution, accessibility, and pricing in the following sections.

3. Data Collection

This study involved collecting a comprehensive set of secondary data sources to construct an extensive database detailing the distribution of accommodations in Yamaguchi Prefecture. The primary data on Nohaku accommodations were sourced from the Ministry of Agriculture, Forestry, and Fisheries (MAFF) Nohaku program. The MAFF defines the Nohaku project as encompassing three main components: cuisine, experience, and accommodation. Additional data were obtained from brochures and guidebooks, including the "Yamaguchi Countryside Experience Map Books," available at community centres throughout the prefecture, and electronic publications titled "Yamaguchi Countryside Travel." These resources provided detailed listings of farm-based accommodations (Taiken, Minshuku, and Minpaku) within their respective jurisdictions.

Furthermore, information was gathered from various private websites such as IKYU, Stay Japan, Rakuten Vacation Stay, Airbnb, and Agoda. Google Maps was also employed to verify the existence of these accommodations. The geo-referenced data obtained from these databases were cross-referenced with additional sources to enhance the accuracy and completeness of the database. One of the significant challenges faced during this process was the lack of a unified source encompassing all relevant information, necessitating the reconciliation of data from diverse sources to establish a cohesive and reliable database. While absolute completeness of the database cannot be guaranteed, it is deemed sufficiently comprehensive for this analysis.

Tourism resource data were sourced from statistical reports provided by the Yamaguchi Prefecture Statistical Agency, which periodically collects data on tourist visits to various attractions across the prefecture.

4. Methodology

This study adopts a multi-method spatial analytical framework to investigate the geographic

distribution of Nohaku accommodations and their relationship with tourism resources in Yamaguchi Prefecture. All analyses were conducted in the R statistical environment to ensure reproducibility and methodological transparency.

a. Buffer Analysis

To capture spatial interactions across scales, buffer zones of 1 km, 3 km, and 5 km were created around each Nohaku accommodation. 1 km buffer captures immediate walkable access to tourism resources. Prior studies have shown that tourists are more likely to visit attractions within walking distance from accommodation (Zhang et al., 2022; Shi et al., 2020). For instance, Shi et al. (2020) found that the density of attractions within 1 km significantly influenced hotel performance in urban tourism settings. At the same time, a 3km buffer represents a neighbourhood-scale distance, accessible via short drives or cycling. This range is commonly used in studies analysing proximity to transport infrastructure and tourism facilities (Jiang et al., 2023). Finally, 5km reflects a regional access scale, suitable for capturing broader spatial interactions, especially in rural tourism contexts. Studies such as those by Liu et al. (2023) and Zhao et al. (2023) used 5 km buffers to assess spatial clustering and the influence of resource availability on rural tourism flows. The count of tourism resources within these buffers was calculated and used as a predictor in spatial econometric models to evaluate their influence on accommodation pricing and clustering behaviour.

b. Penetration Index

The penetration index quantifies the share of tourism resources within defined buffer zones around accommodations. It is calculated as follows:

$$\text{Penetration Index} = \frac{\text{Number of tourism resource within buffer zone}}{\text{Total number of tourism resource}} \quad (1)$$

The index was aggregated at the municipal level to assess disparities in spatial accessibility and to identify areas with comparatively higher or lower integration between

accommodations and tourism resources.

c. Spatial Regression Analysis

To evaluate the determinants of accommodation prices and capture spatial spillover effects, the Spatial Durbin Model (SDM) was employed (Kopczewska, 2020; Anselin, 2022). This model extends the standard Spatial Lag Models (SLM) and Spatial Error Models (SEM) by including spatially lagged explanatory variables alongside direct covariates (Kopczewska, 2020). A log-linear specification was adopted, with the natural logarithm of accommodation price as the dependent variable.

One of the advantages of using this model is that it can reduce the biases related to omitted variables; the lagged values of the predictors can aid in teasing out the effect of omitted variables. Additionally, the SDM model has the advantage of reducing the effect of unobserved heterogeneity (Kopczewska, 2020). Hence, the SDM is advantageous over the SEM and SLM (Anselin, 2022).

The SDM was employed to analyse the determinants of tourism accommodation prices, focusing on distinguishing the impact of Nohaku accommodations. A log-linear specification was adopted to address the skewness in price data and interpret coefficients as elasticities. A dummy variable was included to capture the specific effect of Nohaku accommodations, enabling a comparison with other rural lodgings. Spatial dependence was modelled using a K-nearest neighbours (KNN) approach to define the spatial weight matrix, ensuring each accommodation has a fixed number of spatial neighbours.

d. Model Specification

The SDM takes the following functional form:

$$\ln(P) = \rho W \ln(P) + X\beta + NT\gamma + WX\theta + \epsilon \quad (2)$$

ln(P) is the natural logarithm of tourism accommodation prices (dependent variable). ρ is the spatial autoregressive parameter, capturing the influence of neighbouring accommodation

prices. W is the spatial weight matrix, constructed using the K-nearest neighbours approach, X is a Matrix of explanatory variables (e.g., distance of tourism accommodation to tourism assets, etc), and NT is a dummy variable distinguishing Nohaku accommodation (NT=1) from other lodgings (NT=0). β is the direct coefficient of X, and the γ coefficient captures the effect of the Nohaku dummy variable on prices. WX is the spatially lagged explanatory variable, accounting for neighbouring accommodations' spillover effect, and θ is the coefficient for spillover effects. Finally, ϵ is the error term, assumed to be normally distributed.

e. Estimation Strategy

Maximum likelihood estimation (MLE) was employed to ensure robust inference in the analysis. The spatial weight matrix (W) was constructed using a k-nearest neighbours (KNN) approach, linking each accommodation to its k closest neighbours based on geographic distance. This method effectively captures localised spatial interactions, which are critical in rural tourism markets where proximity influences competition and guest preferences. The dependent variable, accommodation prices, was log-transformed to stabilise variance, reduce skewness, and facilitate the interpretation of coefficients as elasticities, a practice widely supported in econometric literature for modelling economic phenomena such as pricing (Wooldridge, 2013; Greene, 2018). Log transformation is particularly valuable in this context, as it mitigates the impact of extreme price values often observed in heterogeneous tourism markets, ensuring more reliable estimates of spatial effects (Anselin & Le Gallo, 2006). Combined with level-scale independent variables, this approach provides a robust and interpretable framework for analyzing the determinants of accommodation prices. The KNN-based spatial weight matrix ensures that spatial dependencies reflect localized competition and influence, while the dummy variable (NT) distinguishes pricing

strategies between Nohaku and other rural lodgings, capturing unique market dynamics.

f. Variables

The natural logarithm of tourism accommodation prices was utilised as the dependent variable. Independent variables included proximity to key tourism resources, distance to roads, and railways, which collectively capture accommodation accessibility. Additionally, tourism density in the cities where accommodations are located was considered. A dummy variable was incorporated to assess the impact of hotels on the pricing of other accommodation types. Furthermore, spatial lagged explanatory variables, such as the average values of tourism resources or density among k-nearest neighbours, were included to account for spatial dependencies.

g. Interpretation Of Results

The Spatial Durbin Model (SDM) enables the decomposition of effects into three components. The direct effect represents the percentage change in accommodation prices resulting from a one-unit change in an explanatory variable for a given accommodation. The indirect effect, or spillover effect, captures the percentage change in the prices of neighbouring accommodations (defined by the KNN relationship) due to changes in the explanatory variables of the focal accommodation. The dummy variable highlights the price premium or discount associated with Nohaku accommodations relative to other types. Finally, the total effect combines the direct and indirect effects, providing a comprehensive understanding of the price dynamics for tourism accommodations in general and Nohaku accommodations in particular.

RESULTS AND DISCUSSION

This study examines the spatial patterns of rural accommodations in Yamaguchi Prefecture and their connection to tourism resources. A cohesive set of methods—buffer analysis and penetration index calculation—was

applied to investigate these relationships. The subsequent sections detail the findings of this research.

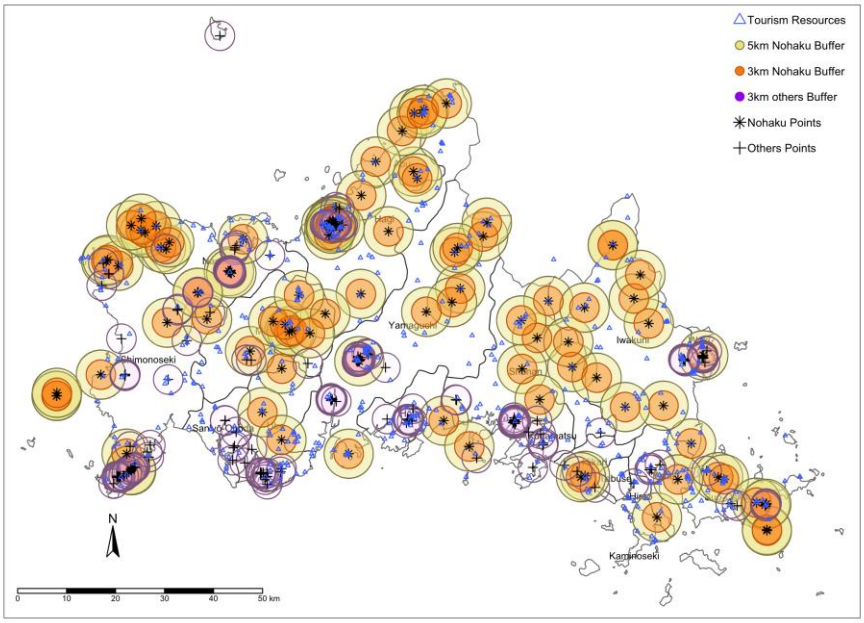

Figure 3. Rural accommodation buffer zones in Yamaguchi Prefecture.
Source: Figure created by the author using raw GIS data processed in R

1. Buffer Zone Analysis Results

Figure 3 illustrates the outcomes of the buffer zone computation. The buffer zones, represented by circles around accommodation facilities, are colour-coded: light yellow and orange circles indicate 5 km and 3 km radii from Nohaku accommodation facilities, respectively, while blue triangles denote the locations of tourism resources.

The 3 km and 5 km buffer zones around Nohaku accommodations reveal the catchment areas, providing a visual depiction of the accessibility of these accommodations for tourists visiting resources within these zones. The presence of overlapping buffer zones suggests hotspot areas where tourists have multiple accommodation options within proximity. The alignment of accommodation facilities with key tourism resources indicates strategic planning, likely aimed at leveraging the potential user base of these accommodations. Proximity to tourism resources can significantly enhance the appeal of these rural lodgings, underscoring the importance of spatial distribution and

coverage. This analysis offers critical insights for planning tourism accommodation development in Yamaguchi Prefecture.

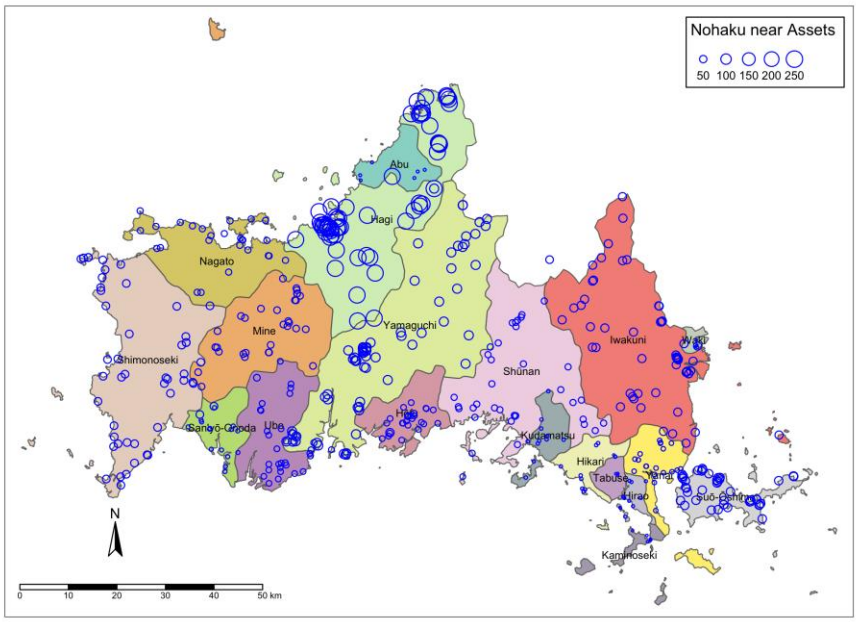

Figure 4. Number of tourism resources in the proximity of tourism accommodation.
Source: Figure created by the author using raw GIS data processed in R

Figure 4 further illustrates the proximity of tourism resources to accommodations using a circle plot, where the size of blue circles represents the number of tourism resources near Nohaku accommodations. Notably, in regions like Hagi City, the prevalence of larger circles indicates a higher concentration of tourism resources close to accommodation facilities.

2. Penetration Index Results

The penetration index for each city in Yamaguchi Prefecture was calculated using the buffer zone analysis results shown in **Figure 5**. This index was determined by dividing the number of tourism resources within the buffer zones by the total number of tourism resources in the prefecture. This metric measures the concentration and accessibility of tourism resources within each city's buffer zone, enabling a comprehensive assessment of resource distribution across Yamaguchi Prefecture.

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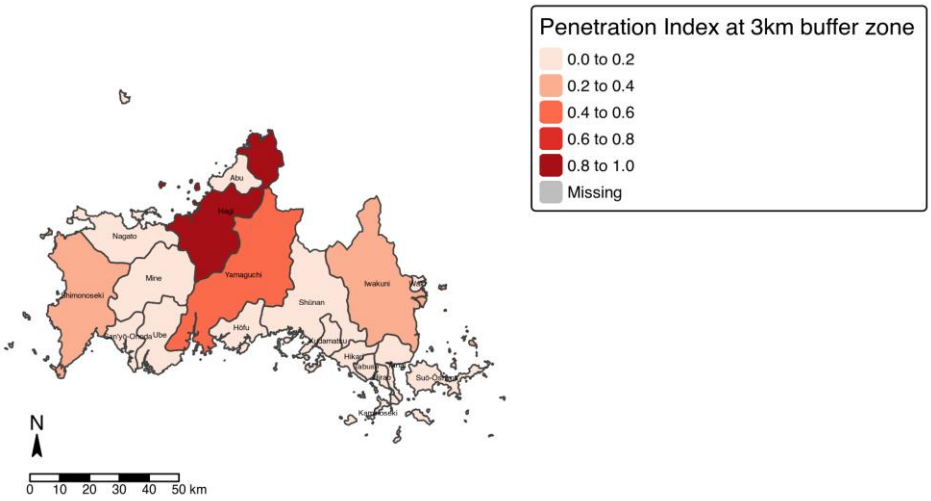

Figure 5. Penetration index across Yamaguchi Prefecture.

Source: Figure created by the author using raw GIS data processed in R

The penetration index, a measure of the concentration of touristic resources within a three-kilometre radius of touristic accommodations, identifies Hagi as the city with the highest density of touristic assets, followed by Yamaguchi City and Iwakuni. This index quantifies the number of tourist resources—cultural landmarks, natural attractions, historical sites, or recreational facilities—close to accommodations like hotels, guesthouses, or vacation rentals. A higher penetration index reflects greater attractiveness and accessibility for tourists, as it indicates a rich availability of points of interest within a convenient distance, facilitating more leisurely exploration and enhancing the overall tourism experience. From a policy and planning perspective, these findings highlight Hagi as a model for tourism development, with Yamaguchi City and Iwakuni as strong contenders that could further leverage their spatial advantages to enhance tourism infrastructure and promotion. In contrast, the result also indicates cities where more investment is required to increase their tourist potential, given their lower score on the penetration index.

3. Spatial Regression Analysis Results

The Spatial Durbin Model (SDM) results provide critical insights into

the determinants of accommodation prices, accounting for spatial dependencies and the interaction effects among explanatory variables. The model was estimated with log-transformed accommodation prices as the dependent variable, while independent variables, including locational and contextual attributes, were retained in their original levels. A K-nearest neighbours (KNN) approach was used to define the spatial weight matrix.

4. Model Comparison

The results of the model comparison are presented in the table below, evaluating three distinct spatial econometric models: the Spatial Lag Model (SLM), which incorporates spatial dependence through a lagged dependent variable; the Spatial Error Model (SEM), which accounts for spatial autocorrelation in the error terms; and the Spatial Durbin Model (SDM), which extends the SLM by including both spatially lagged dependent and explanatory variables to capture complex spatial interactions and spillover effects. These models were assessed using Log-Likelihood (LogLik), Akaike Information Criterion (AIC), and Bayesian Information Criterion (BIC) to determine their relative performance in terms of fit, complexity, and explanatory power, and to identify the model best suited for capturing the underlying spatial relationships in the data.

Table 1. Model Comparison

	LogLik	**AIC**	**BIC**
SLM	-257.4088	532.8176	565.1700
SEM	-256.9648	531.9297	564.2821
SDM	-242.5585	515.1171	569.0377

When comparing models using LogLik, a higher value indicates a better fit to the data. Based on the provided **Table 1**, the SDM model has the highest LogLik (-242.5585) compared to SEM (-256.9648) and SLM (-257.4088), suggesting it best captures the data's structure. The second criterion, AIC, favours models with a lower value, reflecting a better balance between fit and complexity. SDM's AIC (515.1171) is the lowest, significantly outperforming SEM (531.9297) and SLM (532.8176), confirming SDM's superior trade-off between model fit and complexity. However, the BIC, which penalizes model complexity more stringently to prevent overfitting, shows SDM with the highest value (569.0377)

compared to SEM (564.2821) and SLM (565.1700). This suggests SDM may be considered too complex relative to the sample size. Despite this, the SDM model is chosen for its strong explanatory power, predictive accuracy, and ability to capture complex spatial effects, as its substantial LogLik and AIC advantages outweigh the moderate BIC penalty, aligning with the model's ability to model intricate spatial relationships effectively.

5. Regression Result

This study employed a spatial Durbin model (SDM) to examine the spatial distribution of Nohaku accommodations in Yamaguchi Prefecture, Japan, and their impact on accommodation prices, while assessing their relationship with tourism resources and other spatial factors. The analysis utilised Geographic Information Systems (GIS) to integrate geo-referenced data on accommodations, tourism attractions, roads, railways, and tourist density, enabling a comprehensive spatial perspective. The SDM allowed for estimating direct, indirect, and total effects, capturing local and spillover impacts of key variables on accommodation prices. **Table 2** below presents the direct, indirect, and total effects and their statistical significance.

Table 2. Direct, indirect, and total effects on Log (Price)

Variable	Effects		
	Direct Effect	**Indirect Effect**	**Total Effect**
Nohaku	0.1217***	-0.3576	0.3763
Distance to Attraction	-0.0358***	-0.1223**	-0.1199***
Distance to Road	0.0387***	-0.1266*	-0.1152
Distance to Railways	-0.0191	0.0261	-0.0177
Tour Denst	0.0001	0.0002	0.0001
Hotel	0.1064	-0.2843**	-0.3166**

Note. Significance: *** p<0.001, ** p<0.01, * p<0.05
Source: Table created by the author in R

The results reveal distinct spatial patterns in the distribution of Nohaku accommodations and their pricing dynamics. Nohaku accommodations significantly directly affect local prices, increasing by 0.1217(p<0.001), which translates to a 12.2% price premium for Nohaku-type accommodations compared to other types. However, the indirect effect, while large in magnitude (-0.3576, a 35.8% price reduction in

neighbouring areas), is not statistically significant (p=0.3214), leading to a non-significant total effect (0.3763, p=0.9160). Similarly, hotels show a significant negative indirect effect (-0.2843, p=0.0019), reducing prices in neighbouring areas by 28.4%, and a significant negative total effect (-0.3166, p=0.0073), but their direct effect on local prices is not significant (0.1064, p=0.3802).

Spatial proximity to tourism resources and infrastructure also plays a critical role in pricing. The variable distance_to_attraction has significant negative effects across all measures: a direct effect of -0.0358($p<0.001$), an indirect effect of -0.1223(p=0.0019), and a total effect of -0.1199($p<0.001$). This indicates that for every 1 km increase in distance from tourist attractions, local prices decrease by 3.6%, and neighbouring prices decrease by 12.2%, resulting in an overall price reduction of 11.9%. In contrast, distance_to_road shows a significant positive direct effect (0.0387, $p<0.001$), increasing local prices by 3.9% per km, but a significant negative indirect effect (-0.1266, p=0.0413), reducing neighbouring prices by 12.7%, leading to a non-significant total effect (-0.1152, p=0.3709). The effect of distance_to_railway is marginally significant locally (-0.0191, p=0.0920) but not significant for indirect (0.0261, p=0.3716) or total effects (-0.0177, p=0.5250). Finally, tour_denst (tourist density) has negligible and non-significant effects across all measures (direct: 0.0001, p=0.9660; indirect: 0.0002, p=0.4025; total: 0.0001, p=0.2252), likely due to its scale (visitors per km^2).

6. Discussion

In the context of sustainable rural tourism development, understanding the spatial dynamics of accommodation offerings is crucial for fostering meaningful interactions between tourists and rural communities (Ikeji & Nagai, 2021; Ohe, 2016). This study aimed to explore the development of rural accommodation facilities, specifically Nohaku, in Yamaguchi Prefecture, Japan, and to assess their relationship with the distribution of tourism resources and pricing dynamics. Recent studies have increasingly utilised spatial analysis to examine tourism dynamics, focusing on the spatial distribution of

accommodations and their interactions with tourism resources (Yuanyuan, Wang et al., 2021). Our findings contribute to this growing body of literature by highlighting the spatial clustering of Nohaku accommodations and their economic impacts through a spatial econometric approach.

The results indicate a significant clustering of Nohaku accommodations around key tourism resources, such as natural landscapes, mountains, and hot springs, as evidenced by the negative effect of distance_to_attraction on prices. This aligns with prior research identifying a tendency for tourism accommodations to cluster around tourism resources (Walford, 2001; Y. Zhang et al., 2022). The significant negative effect of distance to attractions (-0.1199 total effect, $p<0.001$) suggests that proximity to attractions is a key driver of price premiums, with accommodations farther from attractions experiencing a 11.9% price reduction overall. This reflects tourists' preference for accessible rural and natural experiences (Sánchez-Martín et al., 2023), which likely motivates the strategic placement of Nohaku accommodations near tourism resources to enhance appeal and occupancy rates.

The significant direct effect of Nohaku accommodations (0.1217, $p<0.001$) underscores their economic value in rural tourism markets, commanding a 12.2% price premium locally. This finding supports the notion that Nohaku, a traditional rural lodging option, caters to tourists seeking authentic rural experiences, thereby increasing local tourism revenue. However, the non-significant indirect effect (-0.3576, $p=0.3214$) suggests uncertainty in their spillover effects on neighbouring areas, possibly due to high variability in spatial dependence or competition with other accommodation types, such as hotels, which exhibit a significant negative spillover (-0.2843, $p=0.0019$). The negative indirect effect of hotels indicates a competitive dynamic, where hotel presence in one area reduces prices in neighbouring areas by 28.4%, potentially due to substitution effects or oversupply.

The mixed effects of distance_to_road highlight a complex

spatial trade-off. The positive direct effect (0.0387, $p<0.001$) suggests that accommodations farther from roads command a 3.9% price premium locally, possibly appealing to tourists seeking seclusion or tranquillity in rural settings. However, the significant negative indirect effect (-0.1266, $p=0.0413$) indicates that this remoteness reduces prices in neighbouring areas by 12.7%, likely due to decreased accessibility or perceived isolation, resulting in a non-significant total effect (-0.1152, $p=0.3709$). This pattern underscores the importance of considering both local and spillover effects in spatial planning, as the benefits of remoteness in one area may come at the expense of neighbouring regions.

The negligible effect of tourist density (tour_denst) across all measures suggests that this variable, as currently measured, may not be a significant driver of accommodation prices in Yamaguchi. This could be due to its scale (visitors per km^2), which may mask its impact. Future research could explore rescaling this variable or examining its interaction with other factors, such as accommodation type or attraction proximity.

From a theoretical perspective, these findings reinforce the dual role of Nohaku accommodations as both tourism assets and agglomeration externalities. Their presence enhances the attractiveness of surrounding areas (through proximity to attractions) while benefiting from spatial synergies with other tourism resources. The significant indirect effects of variables like distance_to_attraction and Hotel highlight the importance of spatial spillovers in shaping rural tourism markets, supporting the need for regional coordination in tourism development strategies. The application of GIS and spatial econometric methods in this study provides a nuanced understanding of these dynamics, offering a methodological advancement over traditional analyses.

Despite the clustering around tourism resources, Nohaku accommodations remain sparse in some regions of Yamaguchi Prefecture, as indicated by the spatial analysis. This uneven distribution points to potential opportunities for expanding Nohaku

accommodations in underrepresented regions. By identifying these gaps, local authorities and stakeholders can develop targeted strategies to distribute tourism demand more evenly, alleviating pressure on popular areas and promoting regional economic development. For instance, investments in transportation infrastructure (e.g., improving road access) could mitigate the negative spillovers associated with remoteness, as seen with road distance, while enhancing accessibility to underrepresented areas.

CONCLUSION

This study elucidates the spatial distribution of Nohaku accommodations and their impact on accommodation prices in Yamaguchi Prefecture, Japan, highlighting their relationship with tourism resources and spatial factors. The findings reveal a distinct clustering pattern of Nohaku accommodations around key tourism resources, driven by proximity to attractions, significantly influencing pricing strategies. Nohaku accommodations command a 12.2% local price premium, underscoring their strategic importance in rural tourism, while hotels exhibit strong competitive spillovers, reducing prices in neighbouring areas by 28.4%.

Empirically, this research represents a novel attempt to examine the associations between accommodations, tourism resources, and pricing dynamics through a spatial econometric approach. Integrating GIS technology and the SDM framework provided a nuanced understanding of spatial patterns, capturing local and spillover effects that shape rural tourism markets. The findings highlight the interplay between spatial clustering, pricing strategies, and regional equity, offering actionable insights for policymakers and tourism stakeholders. The theoretical contributions of this study add to the growing body of literature on spatial analysis in tourism (Sugimoto & Kikuchi, 2014), emphasising the role of spatial spillovers in rural development.

From a practical perspective, the results suggest the need for strategic spatial planning to optimise tourism development in Yamaguchi Prefecture. Investments in underrepresented regions, coupled with improved accessibility to transportation hubs and attractions, can enhance regional equity and sustainability. For instance, promoting Nohaku development in areas closer to

attractions can capitalise on their price premiums, while addressing the negative spillovers of remoteness (e.g., through better road access) and mitigating impacts on neighbouring areas. Also, managing hotel development to reduce competitive spillovers can help maintain regional price stability.

Future research should explore the role of tourist preferences, accommodation quality, and alternative spatial weight specifications to deepen insights into rural tourism dynamics. Additional variables, such as star ratings or urban/rural distinctions, could further clarify the counterintuitive effects of distance variables (e.g., distance to the road). Moreover, rescaling variables like tourist density or examining nonlinear effects (e.g., distance squared) may uncover hidden relationships, providing a more comprehensive understanding of rural tourism markets in Japan.

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