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Recreational Value of Tokyo vs. Nagasaki: A Travel Cost Analysis

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Abstract

Tourism plays a vital role in Japan's regional revitalization and economic sustainability. However, the sector faces dual challenges: overtourism in major cities and limited visibility of regional destinations. The COVID–19 pandemic further exposed the vulnerabilities of tourism–dependent economies and highlighted the importance of domestic travel, which accounts for most of the tourism-related spending in Japan. This study compares the recreational value of urban and regional tourist sites using the Zonal Travel Cost Method. Four attractions –Tokyo Skytree, Tokyo Dome City, Huis Ten Bosch, and Glover Garden – were analyzed. Mobile phone data provided prefecture-level visitation estimates, and travel costs were calculated based on transportation expenses and entrance fees. A log-log regression model was employed to derive consumer surplus and total recreational value. The results indicate that Tokyo's attractions generate substantially higher economic value, driven by broader geographic appeal, stronger brand recognition, and the ability to overcome distance-related barriers. In contrast, regional sites depend on localized demand and face accessibility and visibility limitations. These findings underscore the need for demand–side policies and targeted regional promotion. By integrating big data with spatial economic modeling, this study offers a replicable framework for enhancing spatial equity and evidence-based tourism planning.

Keywords: Zonal Travel Cost Method, Tourism Valuation, Mobile Location Data, Urban–Rural Disparities

1 Introduction

Tourism has played a central role in Japan's economic and cultural development strategy. Government initiatives, such as the Visit Japan Campaign launched in 2003, significantly increased visitor numbers and positioned tourism as a major contributor to GDP and employment by 2019[1]. However, the COVID–19 pandemic halted this growth, exposing the risks of reliance on inbound tourism and shifting attention back to the domestic market.

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Domestic travel has long constituted the foundation of Japan's tourism economy. In 2019, over 60% of tourism spending came from overnight trips by Japanese residents. Although resilient during the pandemic, domestic tourism remains concentrated in Tokyo, Osaka, and Kyoto, which together account for more than 70% of overnight stays. This spatial concentration raises concerns regarding efficiency and sustainability.

The revival of tourism has rekindled concerns about overtourism in urban centers, while many regional areas face low visibility and underused tourism assets due to infrastructure limitations. This urban–rural disparity highlights the need for a more balanced and inclusive tourism strategy[2].

In response, this study empirically examines differences in recreational value between urban and regional destinations. Using the Travel Cost Method, attractions in Tokyo and Nagasaki are compared based on consumer surplus and total economic benefit. Nagasaki Prefecture, with its rich heritage and modest national profile, offers a meaningful contrast to Tokyo. This framework enables analysis of how accessibility, cultural significance, and visitor demographics influence perceived tourism value.

2 Research Background

The Travel Cost Method (TCM) is a widely recognized non-market valuation approach used in environmental and tourism economics. Originally proposed by Hotelling[3] and formalized by Clawson and Knetsch[4], the method estimates recreational site value by treating travel expenses as a proxy for price. The resulting consumer surplus—defined as the gap between willingness to pay and actual expenditure—serves as an economic measure of site utility[5].

TCM has evolved into several variants, including the Individual Travel Cost Method (ITCM), the Zonal Travel Cost Method (ZTCM), and the Random Utility Model (RUM). ZTCM[6], adopted in this study, aggregates visit rates and travel costs by geographic units such as prefectures, and is particularly effective when individual-level data are unavailable.

Previous studies have applied TCM to evaluate the value of national parks, cultural heritage sites, and remote attractions. Examples include assessments of Japanese national parks[7] and island destinations like Amami Oshima and Tomonoura[8][9]. These applications highlight TCM's value in informing tourism policy and public investment.

Recent advancements in mobile phone location data and big data analytics have expanded TCM's applicability. Such data allow for more precise measurement of visitation behavior, reducing reliance on survey-based methods. Studies integrating GPS-based mobility data have demonstrated improved spatial resolution in TCM modeling.

International applications of TCM span diverse settings, from U.S. national parks to reef protection in Australia. Hybrid models that combine TCM with stated preference techniques have also been proposed to address multi–purpose travel and non-use value.

While ZTCM offers practical advantages, it assumes homogeneous preferences within zones and often neglects substitutes. It also requires reliable travel cost and visitation estimates. Nevertheless, ZTCM remains a robust tool for regional tourism valuation and policy analysis.

3 Methodology

3.1 Target Sites and Data Sources

Four sites – two in Tokyo (Tokyo Skytree and Tokyo Dome City) and two in Nagasaki (Huis Ten Bosch and Glover Garden)– were selected to represent contrasting urban and regional tourism dynamics. These locations differ in scale, accessibility, and cultural context.

Anonymized mobile phone location data were obtained from SoftBank Corporation[10], covering the period from November 2022 to October 2023. The dataset includes aggregated visitor counts by prefecture of origin. Data were anonymized through pseudonymization, generalization, and k-anonymity (k = 10), following guidelines published by SoftBank[11]. A correction factor ($\times 4.9$) was applied to adjust for SoftBank's market share and estimate total national visitation volumes.

3.2 Travel Cost Estimation

Travel costs were calculated by summing round-trip transportation expenses and entrance fees. Representative transportation costs were derived from publicly available sources including Yahoo! Transit, ANA, and JAL fare data. Travel modes were assigned according to the typical distance and transport availability for each prefecture: Shinkansen for inter–city rail, highway buses for regional access, and domestic flights for long–distance connections. These were averaged on a per prefecture basis. Entrance fees were fixed as follows: Tokyo Skytree: JPY 3,250, Tokyo Dome City (Ride Passport): JPY 4,550, Huis Ten Bosch: JPY 7,400, Glover Garden: JPY 620. For example, the travel cost to Tokyo Skytree is calculated as the sum of the round-trip transportation expenses from a representative city in each prefecture to Oshiage Station– the nearest station to Tokyo Skytree– and the entrance fee for the Skytree. In the case of travel from Kanagawa Prefecture, the total cost amounts to JPY 4,656, which consists of a round-trip train fare of JPY 1,406 from Yokohama Station to Oshiage Station and an entrance fee of JPY 3,250. In contrast, for travel from Saga Prefecture, the total cost amounts to JPY 100,520, comprising the bus fare from Saga Station to Saga Airport, the round-trip airfare from Saga Airport to Haneda Airport, the train fare from Haneda Airport Station to Oshiage Station, and the entrance fee for the Skytree. Seasonal variations in travel behavior were addressed by dividing visitation data into four quarters (spring, summer, autumn, winter), enabling the analysis to incorporate temporal patterns.

3.3 Concept of Consumer Surplus

Consumer surplus is defined as the difference between a visitor's maximum willingness to pay and the actual cost of travel[6]. It serves as a proxy for recreational value. In this context, surplus was estimated either through the inverse of the slope from a log–linear demand function or by integration as shown in (1):

$$SC_i = \int_{TC_i}^{\infty} D(x)\,dx \tag{1}$$

where, SC_i is the consumer surplus for prefecture i, TC_i is the travel cost from prefecture i, and $D(x)$ is the estimated demand function.

3.4 Estimation Method and Total Benefit Calculation

A log-linear regression was employed using the natural logarithm of visitation rate (visits per 10,000 residents) as the dependent variable and travel cost as the independent variable. The consumer surplus per visitor was calculated from the estimated demand function, and total benefit per prefecture was computed as shown in (2):

$$TB_i = SC_i \times V_i \tag{2}$$

where TB_i is the total benefit for prefecture i, SC_i is the consumer surplus per visitor, V_i is the estimated number of visitors from prefecture i.

Diagnostic checks for multicollinearity, heteroskedasticity, and outliers were conducted. Sensitivity analyses using $\pm 10\%$ variation in travel cost estimates were also performed. Statistical analysis was conducted using R (ver. 4.2.2) and Microsoft Excel. nsumer surplus is used as a proxy for the recreational value obtained by each visitor, calculated based on the estimated demand curve derived from travel cost and visitation data.

4 Results

4.1 Estimated Demand and Model Evaluation

Demand functions were first estimated for each site to evaluate model performance across different site types and time periods. To evaluate tourism demand across urban and regional attractions, regression models were estimated using both log-log and linear specifications. Demand was further analyzed by season, distinguishing between a regular travel period (November) and a peak period (December). Table 1 summarizes the estimated demand exponents and the model fit (R^2) for both functional forms across each site and timeframe.

The results indicate that the log-log models consistently outperformed the linear models in terms of explanatory power. R^2 values were notably higher for log-log specifications, particularly for regional attractions such as Glover Garden and Huis Ten Bosch. For example, during the regular period, the R^2 for Glover Garden increased from 0.37 in the linear model to 0.60 in the log-log model, while during the peak period, it improved from 0.47 to 0.77. These findings validate the choice of the log-log model as more appropriate for capturing variations in visitation behavior based on travel cost.

In terms of demand elasticity, urban sites such as Tokyo Skytree and Tokyo Dome City showed relatively inelastic behavior, with estimated exponents around -0.6, indicating that visitation rates remain relatively stable despite changes in travel cost. In contrast, regional sites exhibited more elastic demand, particularly during the peak period. Huis Ten Bosch, for example, had an exponent of -1.329 in December, suggesting greater cost sensitivity among long-distance travelers.

These findings confirm both the functional and temporal robustness of the log-log specification, supporting its use in the subsequent estimation of consumer surplus and total recreational value.

4.2 Estimated Consumer Surplus and Total Recreational Value

Consumer surplus was estimated by integrating the log-log demand function obtained for each site. For each prefecture, the demand function $D(x) = ax^b$ was integrated with respect

Table 1: Comparison of Log-Log and Linear Regression Models by Site and Period

Site	**Period**	**Log-Log Exponent (b)**	**Log-Log R^2**	**Linear R^2**
Glover Garden	Regular (Nov)	−1.006	0.5996	0.3681
	Peak (Dec)	−0.911	0.7651	0.4717
Huis Ten Bosch	Regular (Nov)	−1.035	0.7518	0.4794
	Peak (Dec)	−1.329	0.8316	0.5294
Tokyo Skytree	Regular (Nov)	−0.607	0.5985	0.3919
	Peak (Dec)	−0.569	0.5750	0.3263
Tokyo Dome City	Regular (Nov)	−0.629	0.5818	0.3459
	Peak (Dec)	−0.586	0.5557	0.3186

to travel cost x, from the observed cost TC_i to infinity, as shown in Equation (1). This approach captures the full extent of visitors' willingness to pay above the actual travel cost.

The average consumer surplus per visitor was then multiplied by the estimated number of visitors from each prefecture to compute the total recreational value (TRV). Table 2 summarizes the aggregated results across all prefectures for each tourist site.

Table 2: Total Recreational Value and Consumer Surplus of Four Major Tourist Spots

Site	**Prefecture**	**Total Recreational Value (Billion JPY)**	**Consumer Surplus (JPY/person)**
Glover Garden	Nagasaki	0.0034	64
Huis Ten Bosch	Nagasaki	4.7	1,503
Tokyo Skytree	Tokyo	109.9	6,265
Tokyo Dome City	Tokyo	225.4	4,107

These results indicate significant disparities in recreational value between urban and regional destinations. Tokyo Skytree and Dome City generated 20 to 500 times more economic benefit than Huis Ten Bosch and Glover Garden, respectively. This reflects not only the larger visitor base, but also higher willingness to pay associated with urban sites that enjoy national recognition, superior accessibility, and inclusion in broader travel itineraries.

To further explore regional disparities, the next section compares inter-prefectural visitor flows between Tokyo and Nagasaki based on consumer surplus estimates from specific origin–destination pairs.

4.3 Inter-Regional Visitor Flow Analysis

To complement the site-specific analysis, inter-regional visitor flows between Tokyo and Nagasaki were examined. Table 3 summarizes the estimated total recreational value for visitors traveling across the two regions.

The results reveal that visitors from Nagasaki Prefecture to Tokyo attractions generated approximately twice the total recreational value compared to visitors from Tokyo to Nagasaki sites. This asymmetry suggests that the perceived attractiveness and national branding of Tokyo's destinations can outweigh the deterrent effects of long travel distances, while regional sites face greater challenges in appealing to distant visitors.

Table 3: Consumer Surplus and Total Recreational Value for Inter–Regional Visitor Flows between Tokyo and Nagasaki

Origin and Destination	Total Recreational Value (JPY/person)	Consumer Surplus (JPY)
Tokyo → Huis Ten Bosch	277,469,931	1,503
Tokyo → Glover Garden	339,640	64
Nagasaki → Tokyo Skytree	158,243,273	6,265
Nagasaki → Tokyo Dome City	97,090,826	4,107

4.4 Visitor Patterns and Seasonality

Seasonal trends were analyzed by aggregating visitation data quarterly. Urban sites such as Tokyo Skytree and Dome City recorded peaks in spring and summer, aligning with national holidays and school breaks. Huis Ten Bosch showed increased demand in autumn, possibly due to its open-air layout and seasonal events. Glover Garden did not display a consistent seasonal pattern.

These findings suggest that seasonality influences visitor behavior differently across site types. Urban attractions benefit from timing tied to national vacation schedules, while regional destinations may require targeted seasonal promotions to leverage unique environmental or cultural features.

5 Discussion

This study reveals substantial disparities in recreational value between urban and regional tourist destinations in Japan. These differences arise from unequal access, brand visibility, and the spatial distribution of tourism demand. This section discusses the implications of these findings in three areas: economic geography and tourism equity, demand–side policy and destination branding, and methodological considerations for future research.

5.1 Urban–Regional Disparities in Recreational Value

The findings confirm substantial disparities in recreational value between urban and regional destinations in Japan. Tokyo's attractions, particularly Tokyo Skytree and Dome City, generated far greater consumer surplus and total benefit than Huis Ten Bosch and Glover Garden in Nagasaki. This result reflects not only larger visitor volumes but also stronger demand persistence due to brand power and infrastructure.

Urban sites benefit from superior accessibility, national visibility, and incorporation into popular travel itineraries. Tokyo's media presence and perception as a modern, prestigious destination enhance its appeal, especially among domestic travelers. In contrast, regional attractions, despite cultural and historical value, struggle to attract visitors from distant prefectures.

Notably, demand elasticity differed by site type. Urban attractions showed relatively inelastic behavior, meaning changes in travel cost had a limited impact on visitation. Conversely, regional sites like Huis Ten Bosch displayed more elastic demand, suggesting their visitor base is more sensitive to cost.

These patterns highlight structural inequalities in Japan's tourism landscape. Without strategic intervention, high–value tourism will continue to concentrate in major cities, deep-

ening regional disparities. Policymakers should promote balanced tourism by supporting local branding, improving transport links, and enhancing digital outreach for lesser–known destinations.

5.2 Demand–Side Strategies and Regional Branding

The analysis underscores the importance of demand-side policies in promoting regional destinations. While supply-side investments such as infrastructure development are essential, they are insufficient on their own to attract long–distance visitors. Regional sites must be actively positioned in the tourism market through strategic promotion, storytelling, and content design.

Digital marketing tools including social media campaigns, influencer outreach, and search engine optimization, can significantly boost visibility and appeal. Government-led efforts like "Japan Heritage" or the "Go To Travel" campaign offer potential frameworks for promoting lesser–known sites. However, without clear narratives or recognizable brands, these destinations risk being overlooked.

Successful branding requires more than visibility; it must communicate authenticity, uniqueness, and relevance. Integrating tourism planning with local cultural resources can help create compelling experiences that resonate with both domestic and international travelers.

5.3 Methodological Considerations and Future Research

This study demonstrates the feasibility of using the Zonal Travel Cost Method (ZTCM) in conjunction with mobile phone location data to estimate site-level recreational value. Compared to traditional survey-based approaches, this method offers scalability and objectivity. Nevertheless, several limitations remain.

First, ZTCM assumes homogenous preferences within zones and may oversimplify individual travel motivations. Second, the log–log model specification, while statistically superior in this context, does not account for nonlinear effects from other factors such as income, age, or travel purpose. Third, the analysis focuses only on revealed preference; incorporating stated preference methods could provide richer insight into latent demand.

Future research could expand the number and type of sites analyzed, explore hybrid modeling frameworks, and examine post-pandemic behavioral shifts. Additionally, combining machine learning techniques with economic modeling may enhance predictive power and support more responsive tourism planning.

6 Conclusion

This study used the Zonal Travel Cost Method (ZTCM) with mobile phone data to estimate and compare the recreational value of four major tourist sites in Tokyo and Nagasaki. Results showed that Tokyo's attractions generated substantially greater economic benefit, reflecting urban–rural disparities in tourism demand.

Regional sites attracted lower consumer surplus, despite cultural value, due to limited accessibility and visibility. Visitor flows also revealed asymmetries: Tokyo sites drew more benefit from Nagasaki visitors than the reverse, underscoring the role of perceived appeal over distance.

To address these imbalances, regional destinations require strategic support through branding, infrastructure, and targeted promotion. Future research should explore qualitative factors, behavioral changes, and hybrid valuation methods to improve tourism analysis and policy design.

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