TOURISM REVENUE DYNAMICS IN XINJIANG: A SPATIO-ECONOMETRIC ANALYSIS OF SCALE, MOBILITY, AND REGIONAL STRUCTURE

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ABSTRACT

Against the backdrop of China's rapid economic development, Xinjiang's tourism sector has experienced substantial growth, emerging as an important engine of regional development. This study employs a theory-grounded econometric model to systematically evaluate the key determinants of tourism revenue in Xinjiang using annual data from 2009 to 2020. Integrating tourism demand theory and destination competitiveness frameworks, the analysis examines Total Tourism Revenue (Y) in relation to five explanatory variables: Tourist Volume (X_1), Passenger Traffic (X_2), Tourist Person-Days (X_3), Tourist Mobility Intensity (X_4), and Inbound Overnight Visitors (X_5). Initial regression diagnostics reveal severe multicollinearity among the explanatory variables, which is addressed through a stepwise regression approach. The refined model identifies Tourist Volume ($\beta = 1.108$, $p < 0.001$) and Tourist Mobility Intensity ($\beta = 0.409$, $p < 0.001$) as the dominant and statistically significant predictors of tourism revenue, jointly explaining 91% of the variance (Adjusted $R^2 = 0.91$). These findings indicate that Xinjiang's tourism economy remains primarily scale-driven and mobility-dependent. However, the results also expose critical structural inefficiencies. While tourist arrivals increased by 89.8% between 2009 and 2019, tourist person-days declined sharply by 71.5%, reflecting significantly shortened stays and weakened visitor engagement. Moreover, the observed negative correlation between tourism revenue and passenger traffic suggests potential infrastructural pressures and inefficiencies in transport utilization. Together, these patterns reveal a fundamental contradiction between quantitative expansion and qualitative depth, raising concerns regarding environmental pressure and limited per-capita value capture. The study concludes that Xinjiang must transition from a volume-based tourism growth model toward a quality-centered development pathway. This shift requires optimizing transport efficiency, extending visitor stays through enhanced cultural and ecological experiences, diversifying tourism products, and promoting sustainable tourism practices to support resilient, inclusive, and long-term regional development.

Keywords: *Econometric Modeling, Structural Transformation; Tourism Revenue; Tourist Mobility; Spatial Interaction; Regional Heterogeneity; Xinjiang.*

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1. INTRODUCTION

Tourism has become a central driver of regional transformation, economic diversification, and social development across emerging destinations. Globally, tourism research recognizes the sector as a catalyst for income generation, employment growth, infrastructure development, and cross-cultural exchange (Farid et al., 2016; Meyer & Meyer, 2015). In China, these dynamics are especially evident in western regions where national initiatives, such as the Western Development Strategy and the Belt and Road Initiative (BRI), have stimulated large-scale tourism investment and accelerated destination development (Ahmad & Ullah, 2023). Within this context, the Xinjiang Uyghur Autonomous Region has rapidly emerged as one of China's fastest-growing tourism destinations due to its distinctive natural landscapes, Silk Road heritage, ethnic diversity, and expanding transport infrastructure.

Over the past decade, Xinjiang has experienced sustained increases in tourist arrivals, tourism revenue, and mobility flows, supported by improved highways, airport expansion, and the growth of high-speed rail (Jiao et al., 2020; Kaijun et al., 2023). Despite this remarkable expansion, tourism development in Xinjiang faces persistent structural challenges, including short visitor stays, uneven regional development, infrastructure bottlenecks, and constrained service capacity (Wu & Wang, 2024). These issues highlight the importance of understanding the determinants of tourism revenue to support sustainable planning and effective policy design.

Although numerous studies have examined Xinjiang's tourism patterns, much of the existing work remains descriptive, lacking rigorous econometric assessment or a strong theoretical foundation. Previous research has highlighted tourism competitiveness (Liu et al., 2022), transport infrastructure (Zhang & Zhang, 2022), destination risks (Ding & Wu, 2022; Zhang et al., 2024), and ecological constraints (Jiang et al., 2025), yet few studies integrate these factors into a comprehensive, theory-grounded empirical model of tourism revenue. Additionally, the tourism mobility nexus, widely emphasized in international tourism demand literature (Song et al., 2019), remains understudied in Xinjiang.

This study addresses these gaps by developing a theoretically informed econometric model to examine how tourism volume, mobility, stay duration, and inbound visitation influence revenue in Xinjiang. Drawing on tourism demand theory, destination competitiveness frameworks, and transport-tourism interactions, the analysis evaluates annual data from 2009 to 2020 using multicollinearity diagnostics and stepwise regression. The goal is to identify the most influential drivers of tourism revenue and highlight structural constraints limiting high-quality, experience-based, and sustainable growth.

The findings contribute to tourism literature by (1) demonstrating how scale-driven growth dominates Xinjiang's tourism economy; (2) revealing the role of internal mobility in shaping revenue patterns; and (3) identifying the limitations linked to short stays and low conversion from mobility to spending. The study also offers evidence-based recommendations for extending visitor stays, improving transport efficiency, diversifying tourism products, and transitioning from quantity-driven to quality-driven development. These results provide valuable insights for tourism scholars, planners, and policymakers seeking to support sustainable tourism development in western China.

2. LITERATURE REVIEW

2.1. Tourism Development and Regional Transformation

Tourism is widely recognized as a significant driver of economic restructuring and regional development, particularly in peripheral or emerging regions (Farid et al., 2016; Meyer & Meyer, 2015). Tourism-led development frameworks emphasize the role of the sector in creating employment, generating local income, stimulating service industries, and improving public infrastructure. In China, large-scale regional strategies such as the Belt and Road Initiative have further accelerated tourism growth, especially in western provinces where tourism is positioned as a core engine of socioeconomic transformation (Ahmad & Ullah, 2023).

Xinjiang, characterized by vast landscapes and cultural diversity, has increasingly leveraged tourism as a strategic development priority. While visitor numbers have risen rapidly, research suggests uneven development, infrastructure gaps, and regional disparities (Liu et al., 2024). Understanding the determinants of tourism performance is therefore crucial for effective planning and management.

2.2. Tourism Demand Theory and Revenue Determinants

International tourism demand research provides a theoretical foundation for analyzing visitor flows, spending behavior, and revenue generation. Tourism demand models emphasize economic factors (income, prices, exchange rates), socio-cultural motivations, destination attributes, and accessibility as major determinants (Altinay & Kozak, 2021; Song et al., 2019). Within this framework, variables such as tourist volume, length of stay, transport efficiency, and mobility patterns are central components shaping tourism performance.

The length of stay, often measured through tourist person-days, is particularly important because longer visits generate higher per-capita revenue and greater engagement with local services. However, in many emerging destinations, including Xinjiang, visitor stays remain relatively short, limiting economic benefits (Wu & Wang, 2024). Tourism scholars argue that insufficient diversification of tourism products, inadequate service quality, and limited destination experience depth constrain stay duration (Assaf & Josiassen, 2016).

Similarly, transport accessibility and connectivity influence tourism by shaping mobility costs, convenience, and perceived travel barriers (Li et al., 2023). Efficient transportation can increase tourist arrivals and enhance spatial tourism flows. However, research also shows that when transportation infrastructure is congested, inefficient, or poorly integrated with tourism services, increased mobility may not translate into higher tourism revenue (Chen et al., 2022).

2.3. Destination Competitiveness and Mobility Dynamics

Destination competitiveness theory offers additional insights for assessing how infrastructure, service quality, cultural assets, and environmental factors influence tourism performance (Crouch, 2011). The role of spatial structure is particularly pronounced in regions like Xinjiang, where spatial fragmentation, core-periphery structures, and long travel distances mediate tourism flows, economic linkages, and destination competitiveness. Xinjiang's competitive advantages include its unique desert-steppe environments, Silk Road heritage, and ethnic cultural diversity. However, challenges such as seasonal fluctuations, vast geographic scale, environmental vulnerability, and service inconsistency weaken destination competitiveness (Ding & Wu, 2022; Zhang et al., 2024).

The mobility dimension has recently gained prominence in competitiveness and tourism flow research. Studies emphasize that intra-destination mobility, the extent to which tourists move within a region, affects expenditure levels, attraction visitation, and local economic linkages (Zhang & Zhang, 2022). Tourist Mobility Intensity (measured in kilometers traveled) thus provides insight into consumption potential beyond simple arrival numbers.

In Xinjiang, high geographic distances and dispersed attractions mean that mobility efficiency is essential. Poorly coordinated transport services or long travel times can reduce visitor satisfaction and spending opportunities (Chen et al., 2022). This necessitates examining mobility indicators in econometric models of tourism revenue.

2.4. Empirical Studies on Tourism in Xinjiang

Numerous studies have analyzed tourism growth, spatial patterns, and policy frameworks in Xinjiang. These include assessments of tourism resource distribution (Chen et al., 2022), tourism–ecology interactions (Jiang et al., 2025), tourism efficiency (Yang et al., 2022), tourist risk perception (Yingzhi et al., 2020), and tourism development under environmental constraints (Wang et al., 2023). Although valuable, most studies rely on descriptive data or qualitative assessments, with limited application of advanced econometric techniques.

Only a few studies apply regression-based approaches, and they often analyze narrower sets of variables or aggregate macroeconomic indicators (Li & Hou, 2025). Further, existing econometric studies seldom address multicollinearity among tourism variables or link empirical findings to tourism theory in a meaningful way. This gap limits both academic contributions and practical implications.

2.5. Research Gap and Contribution

The literature reveals three major gaps: Limited theory-driven empirical research on tourism revenue determinants in Xinjiang; Insufficient integration of mobility indicators, despite their theoretical importance; and Lack of models addressing multicollinearity, which is common among tourism indicators (tourist volume, person-days, tourist mobility intensity). To sum up, these gaps point to a limited understanding of how Xinjiang's distinctive geographical structure, its vastness, dispersal of attractions, and reliance on long-distance mobility, fundamentally shapes the relationship between tourism scale, movement, and revenue generation. This study contributes by: developing a theoretical framework grounded in tourism demand and destination competitiveness; applying a rigorous econometric model with multicollinearity diagnostics and stepwise selection; evaluating the combined effects of volume, stay duration, mobility, and inbound tourism; providing insights for policy, planning, and sustainable tourism development in western China.

2.6. Research Area Overview: Geographical Context and Primary Tourism Resources of Xinjiang

The Xinjiang Uyghur Autonomous Region, situated in northwestern China, constitutes the nation's largest provincial-level administrative division. It shares borders with eight countries, including Kazakhstan, Kyrgyzstan, Tajikistan, Pakistan, and Mongolia, granting it a strategic position at the heart of Central Asia and along the historic Silk Road corridors (Toops, 2013).

The region's physiography is defined by a pronounced mountain-basin system, wherein the east-west trending Tianshan Mountain range bisects Xinjiang into two distinct macro-regions: Northern Xinjiang (Dzungarian Basin) and Southern Xinjiang (Tarim Basin). This structure is further framed by the Altai Mountains to the north and the Kunlun Mountains to the south (Wang et al., 2022).

As depicted in **Fig. 1.**, the spatial distribution of Xinjiang's principal tourism resources exhibits a strong correspondence with this underlying physical geography and regional structure. The Tianshan Mountains serve as a fundamental natural boundary, profoundly influencing tourism patterns and resource allocation.

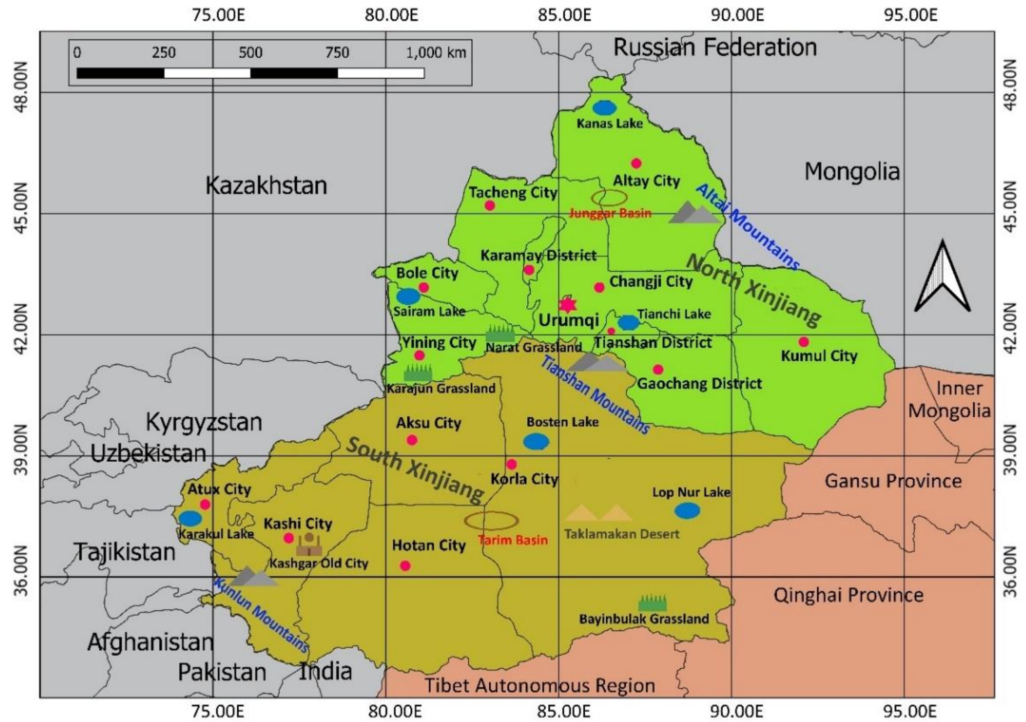

Fig. 1. Spatial Distribution of Major Tourism Resources and Physiographic Structure of Xinjiang Uyghur Autonomous Region, China.

3. DATA AND METHODS

3.1. Research Design

This study adopts a quantitative, theory-grounded research design to examine the determinants of tourism revenue in Xinjiang over the period 2009-2020. The analytical framework is informed by tourism demand theory and destination competitiveness models, emphasizing market scale, accessibility, visitor behavior, and mobility as key drivers of tourism revenue.

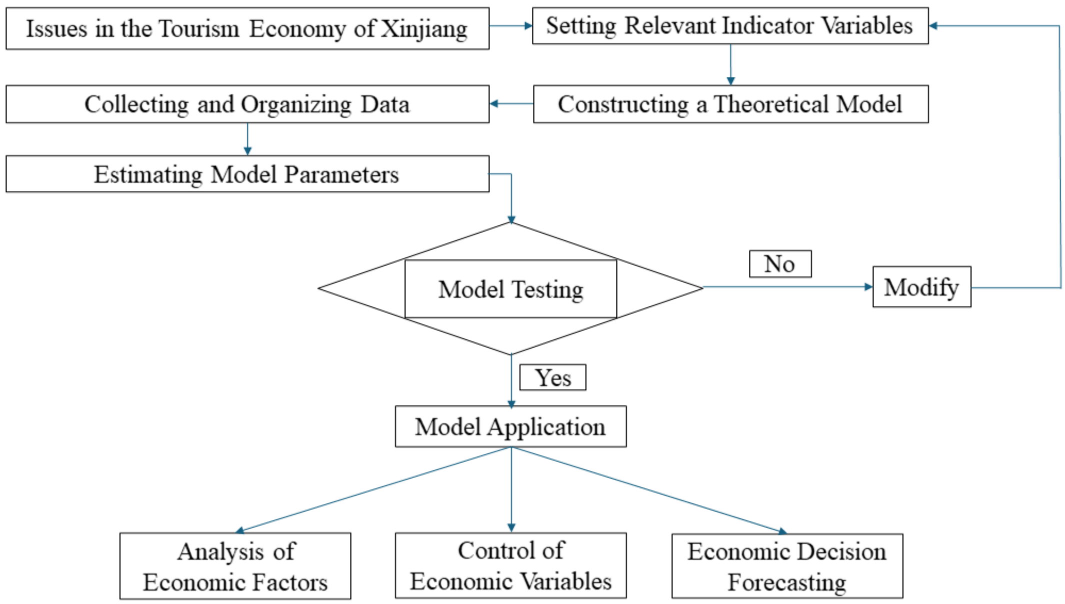

Fig. 2. Conceptual framework of tourism revenue determinants in Xinjiang.

Fig. 2. presents the conceptual framework of the study, illustrating the hypothesized relationships between tourism revenue and its key determinants, including tourist volume, passenger traffic, tourist person-days, tourist mobility intensity, and inbound overnight visitors.

Throughout this manuscript, terms such as "predictor," "associated with," and "related to" are used to describe statistical relationships identified through regression analysis. These expressions should not be interpreted as implying causal effects, given the observational design, limited sample size, and potential omitted variables.

3.2. Data and Variable Selection

Annual regional-level tourism data for 2009–2020 were obtained from the Xinjiang Tourism Bureau and the National Bureau of Statistics of China. All variables are officially published and reported on an annual basis.

Total tourism revenue (Y) is measured in 100 million yuan at current prices. Explanatory variables include tourist volume (X_1; total tourist arrivals, 10,000 persons), passenger volume (X_2; total passenger traffic, 10,000 persons), tourist person-days (X_3; cumulative days spent by tourists), tourist mobility intensity (X_4; billion passenger-kilometers traveled by tourists across all transport modes within Xinjiang), and inbound overnight visitors (X_5; foreign tourists staying at least one night, 10,000 persons).

Tourist mobility intensity captures the spatial extent of tourist movement within the region rather than simple arrival counts. It is derived from observed transport statistics aggregated across road, rail, and air modes and reflects realized rather than modeled mobility.

3.3. Analytical Procedures

Given the limited time-series length (12 annual observations), model parsimony was prioritized to reduce overfitting risks. A two-stage analytical strategy was adopted. First, a full multiple regression model was estimated to assess overall explanatory power and diagnose multicollinearity. Second, stepwise regression was employed as a variable-selection and diagnostic tool to identify the most stable predictors under severe collinearity constraints.

Although stepwise regression has recognized limitations, it remains a pragmatic approach in small-sample regional studies when complemented by robustness checks. Accordingly, sensitivity analyses were conducted using alternative model specifications, exclusion of the COVID-19 year, and predictive validation.

To account for the exogenous shock associated with the COVID-19 pandemic, a dummy variable for 2020 was introduced in an alternative specification. In addition, all core regressions were re-estimated excluding 2020. Results remained qualitatively consistent, with tourist volume and tourist mobility intensity retaining statistical significance, indicating that the findings are not driven by pandemic-related outliers.

3.4. Model Specification and Validation

Model Specification. Given the multifactor nature of tourism revenue, this study employs regression analysis to quantify the relationship between tourism revenue and its key determinants. Multiple linear regression is applied to examine the effects of tourist volume, passenger traffic, tourist person-days, tourist mobility intensity, and inbound overnight visitors on tourism revenue in Xinjiang. The objective is to assess the statistical significance, magnitude, and direction of these effects, thereby supporting forecasting and evidence-based policymaking.

Independent variables were selected based on tourism demand theory and destination competitiveness frameworks and are supported by consistent annual data for the period 2009-2020. To ensure model validity, diagnostic tests were conducted, including unit root tests for stationarity, variance inflation factors (VIFs) for multicollinearity, Durbin-Watson statistics for autocorrelation, and normality tests of residuals.

The simple linear regression model (Sen & Srivastava, 2012) is expressed as:

$$y = \beta_0 + \beta_1 x + \varepsilon \tag{1}$$

where: y is the dependent variable, x is the independent variable, β_0 and β_1 are unknown parameters and ε is the random error term. Parameters are estimated using the ordinary least squares method.

Multiple Linear Regression Model (Sen & Srivastava, 2012) which extends the simple model to multiple explanatory variables, is specified as:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_p x_p + \varepsilon, \tag{2}$$

where: y denotes tourism revenue, x_1, x_2, …, x_p represent explanatory variables, β_0 is the intercept, β_1, …, β_P are regression coefficients, ε is the error term.

In the context of this study, a predictive model for tourism development in Xinjiang is constructed using tourism revenue, tourist volume, and tourist person-days as core variables. Holding other factors constant, the estimated coefficients measure the marginal effect of each explanatory variable on tourism revenue. Positive coefficients indicate that increases in tourist volume or tourist-days are associated with higher tourism revenue, consistent with theoretical expectations.

The regression modeling procedure follows a structured sequence, including variable definition, correlation analysis, model estimation, and comparison of predicted and observed values to assess model performance. These steps are summarized in **Fig. 2**, which presents the logical flow of the regression modeling process applied in this study.

Model Validation. Model adequacy was assessed using unit root tests for stationarity, variance inflation factors (VIFs) for multicollinearity, Durbin–Watson statistics for autocorrelation, and residual normality tests. Heteroskedasticity was examined using the Breusch–Pagan test, and influential observations were assessed using Cook's distance.

Predictive performance was evaluated using mean absolute error (MAE) and root mean squared error (RMSE) under leave-one-out cross-validation. Models including tourist mobility intensity consistently produced lower prediction errors, confirming its additional explanatory value.

4. RESULTS AND EMPIRICAL ANALYSIS

4.1. Data and Variable Specification

This study conducts an empirical analysis of the determinants of tourism development in Xinjiang using annual data from 2009 to 2020 obtained from the Xinjiang Tourism Bureau and the National Bureau of Statistics of China. Variable selection is guided by tourism demand theory and destination competitiveness frameworks, capturing key dimensions of tourist activity, infrastructure, and destination appeal.

Total tourism revenue (Y), measured in 100 million yuan, serves as the dependent variable. The explanatory variables include tourist volume (X_1; 10,000 persons), representing market scale; passenger volume (X_2; 10,000 persons), reflecting transport infrastructure capacity; tourist person-days (X_3), capturing visit depth and duration; tourist mobility intensity (X_4; billion passenger-kilometers), measuring the spatial extent of tourist movement within the region and it is derived from observed transport statistics aggregated across road, rail, and air modes and reflects realized tourist mobility rather than modeled distances.; and inbound overnight visitors (X_5; 10,000 persons), indicating international tourism capacity.

Table 1.

Factors affecting tourism development in Xinjiang.

Year	y	x_1	x_2	x_3	x_4	x_5
2009	186.08	2133.49	29886	969.611	386.68	350
2010	281	3100	31937	2227.224	420.82	510
2011	351	3078.57	35130	1110.346	488.53	560
2012	576	4860	38331	1539.582	535.81	620
2013	673.24	5205.59	40926	1846.55	544.46	690
2014	830	4952.69	37176	1529.808	500.00	540
2015	985	6097	35948	1265.487	477.29	530
2016	1340	8102	32148	1971.213	458.06	580
2017	1751.6	10725.51	27083	1936.617	428.54	770
2018	2579.71	15024.89	21204	946.982	405.76	990
2019	3593.5	21329.54	20276	859.446	414.53	350
2020	991.03	15811.46	6960	276.1	184.97	320
Data Source: *Department of Culture and Tourism of Xinjiang Uygur Autonomous Region (https://wlt.xinjiang.gov.cn/) and the National Bureau of Statistics of China (https://www.stats.gov.cn/).*						

Table 1 presents annual data (2009-2020) for six major tourism indicators in Xinjiang, including revenue, tourist numbers, and passenger volume. Most indicators rise steadily until 2019, reflecting sustained sector growth, followed by a sharp decline in 2020 due to pandemic-related travel disruptions. This dataset underpins the study's econometric analysis.

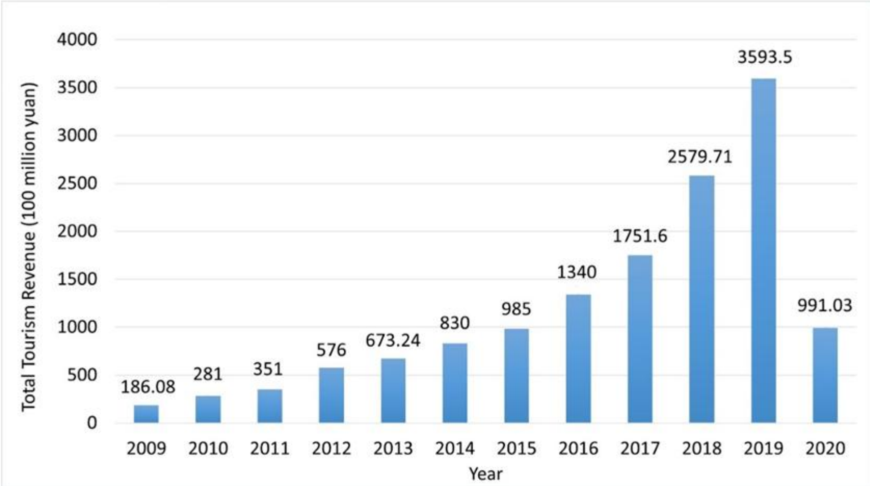

Fig. 3. Xinjiang's Total Tourism Revenue from 2009 to 2020.
Data Source: Department of Culture and Tourism of Xinjiang Uygur Autonomous Region (https://wlt.xinjiang.gov.cn/) and the National Bureau of Statistics of China (https://www.stats.gov.cn/).

Fig. 3. illustrates Xinjiang's annual tourism revenue from 2009 to 2020. Revenue shows a steady and significant increase from 2009 to 2019, peaking in 2019, followed by a sharp decline in 2020 due to COVID-19 disruptions. The figure highlights both long-term growth and short-term external vulnerabilities in the tourism sector.

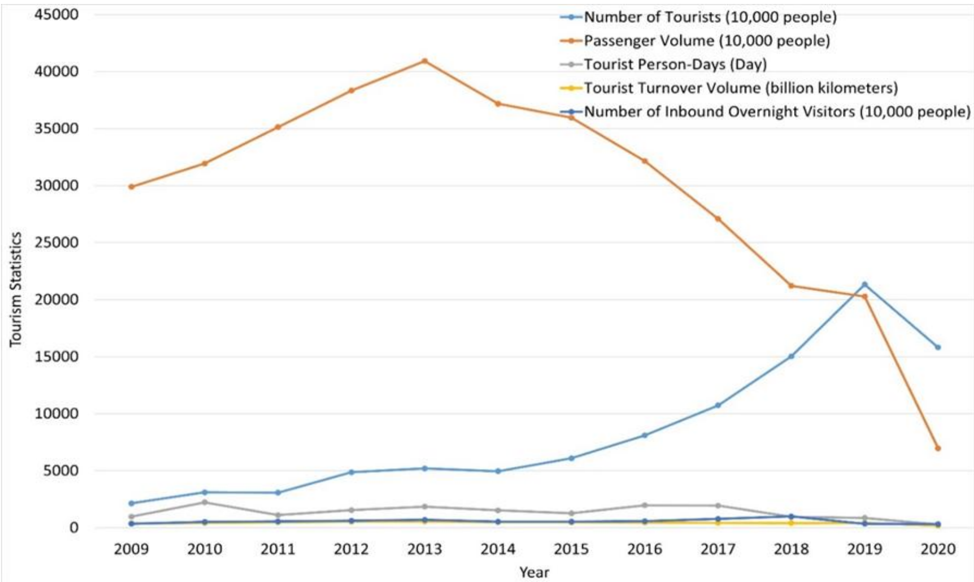

Fig. 4. Tourism Dynamics in Xinjiang: Trends in Tourist Flows, Transport, and Visitor Stays (2009-2020).
Data Source: Department of Culture and Tourism of Xinjiang Uygur Autonomous Region (https://wlt.xinjiang.gov.cn/) and the National Bureau of Statistics of China (https://www.stats.gov.cn/).

Fig. 4. illustrates trends in five key tourism indicators in Xinjiang (2009-2020): tourist numbers, passenger volume, tourist person-days, tourist mobility intensity, and inbound overnight visitors. Most indicators rise steadily over the decade, reflecting growing tourism activity and mobility, followed by sharp declines in 2020 due to pandemic restrictions, highlighting interconnected tourism dynamics over time.

4.2. Diagnostic Tests and Model Estimation

Pearson correlation analysis (**Table 2**) reveals a strong positive correlation between total tourism revenue (Y) and tourist volume (X_1) (r = 0.897, p < 0.01). Tourism revenue exhibits negative correlations with passenger volume (X_2: r = −0.489, p = 0.106), tourist person-days (X_3: r = −0.271, p = 0.394), and tourist mobility intensity (X_4: r = −0.164, p = 0.610); however, these correlations do not reach statistical significance at conventional levels. A weak positive correlation with inbound overnight visitors (X_5: r = 0.200, p = 0.532) is likewise not statistically significant.

Table 2.

Analysis Results of Pearson Correlation Coefficients.

	y	x_1	x_2	x_3	x_4	x_5
y	1 (0.000***)	0.897 (0.000***)	-0.489 (0.106)	-0.271 (0.394)	-0.164 (0.610)	0.2 (0.532)
x_1	0.897 (0.000***)	1(0.000***)	-0.779 (0.003***)	-0.51 (0.090*)	-0.518 (0.085*)	-0.005 (0.987)
x_2	-0.489 (0.106)	-0.779 (0.003***)	1 (0.000***)	0.68 (0.015**)	0.93 (0.000***)	0.236 (0.460)
x_4	-0.271 (0.394)	-0.51 (0.090*)	0.68 (0.015**)	1 (0.000***)	0.634 (0.027**)	0.362 (0.248)
x_5	-0.164 (0.610)	-0.518 (0.085*)	0.93 (0.000***)	0.634 (0.027**)	1 (0.000***)	0.401 (0.196)

Note: **** p < 0.01, ** p < 0.05, * p < 0.10. Values without asterisks are not statistically significant at conventional levels.*

Among the explanatory variables, several significant intercorrelations are observed. Tourist volume correlates negatively with passenger volume (r = −0.779, p < 0.01), tourist person-days (r = −0.510, p < 0.10), and tourist mobility intensity (r = −0.518, p < 0.10). Passenger volume correlates positively with tourist person-days (r = 0.680, p < 0.05) and tourist mobility intensity (r = 0.930, p < 0.01). These intercorrelations indicate potential multicollinearity, which is addressed in subsequent regression analysis.

Table 3 presents descriptive statistics and normality test results for all variables, including measures of central tendency and dispersion as well as skewness, kurtosis, and Shapiro-Wilk and Kolmogorov-Smirnov tests. Most variables satisfy normality assumptions, while tourist mobility intensity exhibits a significant deviation from normality. These diagnostics inform subsequent model specification and confirm the overall suitability of the data for linear regression analysis.

Table 3.

Normality test analysis results.

Variable name	Sample size	Median	Mean	Standard deviation	Skewness	Kurtosis	S-W test	K-S test
y	12	907.5	1178.18	1019.698	1.478	1.84	0.848 (0.034**)	0.239 (0.430)
x_1	12	5651.295	8368.395	6083.339	1.083	0.197	0.867 (0.060*)	0.229 (0.486)
x_2	12	32042.5	29750.417	9633.659	-1.278	1.632	0.896 (0.141)	0.173 (0.807)
x_3	12	1397.648	1373.247	569.968	-0.288	-0.457	0.965 (0.852)	0.13 (0.971)
x_4	12	443.3	437.121	94.324	-1.762	4.533	0.838 (0.026**)	0.213 (0.576)
x_5	12	550	567.5	190.412	0.785	1.004	0.93 (0.377)	0.141 (0.943)

Normality was assessed using the Shapiro-Wilk test, which is appropriate for small samples (N < 5000). The test results indicate that tourist volume (X_1), passenger volume (X_2; p = 0.060), tourist person-days (X_3; p = 0.141), and inbound overnight visitors (X_5; p = 0.377) do not significantly deviate from normality, as the null hypothesis of normal distribution cannot be rejected.

In contrast, tourist mobility intensity (X_4) exhibits a significant Shapiro-Wilk test result ($p < 0.05$), leading to rejection of the null hypothesis and indicating a departure from normality.

Table 4.

Linear regression analysis results (n=14).

Variable name	Sample size	Median	Mean	Standard deviation	Skewness	Kurtosis	S-W test	K-S test
y	12	907.5	1178.18	1019.698	1.478	1.84	0.848 (0.034**)	0.239 (0.430)
x_1	12	5651.295	8368.395	6083.339	1.083	0.197	0.867 (0.060*)	0.229 (0.486)
x_2	12	32042.5	29750.417	9633.659	-1.278	1.632	0.896 (0.141)	0.173 (0.807)
x_3	12	1397.648	1373.247	569.968	-0.288	-0.457	0.965 (0.852)	0.13 (0.971)
x_4	12	443.3	437.121	94.324	-1.762	4.533	0.838 (0.026**)	0.213 (0.576)
x_5	12	550	567.5	190.412	0.785	1.004	0.93 (0.377)	0.141 (0.943)

The initial multiple linear regression model including all explanatory variables (**Table 4**) exhibits strong explanatory power ($R^2 = 0.933$) and is statistically significant (F = 16.816, p = 0.002). The estimated regression equation is expressed as:

$$y = -2151.723 + 0.148 \times x_1 - 0.065 \times x_2 + 0.147 x_3 + 8.776 x_4 - 0.028 x_5 \tag{3}$$

Despite the good overall fit, the Variance Inflation Factor (VIF) values for tourist volume (X_1), passenger volume (X_2), and tourist mobility intensity (X_4) exceed the critical threshold of 10, indicating severe multicollinearity and reducing the reliability of individual coefficient estimates.

To address this issue, a stepwise regression procedure was applied. The resulting parsimonious model (**Table 5**) excludes collinear variables and retains only the most statistically robust predictors. The final model remains highly significant (F = 56.696, $p < 0.001$) and demonstrates excellent explanatory power ($R^2 = 0.926$; Adjusted $R^2 = 0.910$). Importantly, all VIF values in the refined specification fall below 10, confirming that multicollinearity has been effectively mitigated and that the coefficient estimates are more stable and credible.

Table 5.

Stepwise regression model results (n=14).

	Unstandardized coefficients and Standardized coefficients			*t*	*p*	VIF	R²	Adjustment R²	F
	B	Standard error	*Beta*						
Constant	-2311.11	596.315	-	-3.876	0.004***	-	0.926	0.91	F=56.696 P=0.000***
x_1	0.186	0.018	1.108	10.492	0.000***	1.366			
x_4	4.425	1.142	0.409	3.875	0.004***	1.366			
y: Dependent Variable									

Table 5 reports the final stepwise regression results, identifying tourist volume and tourist mobility intensity as the primary determinants of tourism revenue in Xinjiang. Both variables are statistically significant at the 1% level. Multicollinearity is effectively controlled, as all Variance Inflation Factor (VIF) values fall below the conventional threshold of 10. The model demonstrates strong explanatory power, as indicated by the high R^2 and adjusted R^2 values.

The overall model is highly significant (F-test, $p < 0.001$), leading to rejection of the null hypothesis that all regression coefficients are jointly equal to zero. These results confirm the statistical validity and robustness of the final specification.

4.3. Analysis of Empirical Findings

The stepwise regression results identify tourist volume and tourist mobility intensity as the primary determinants of tourism revenue in Xinjiang. Tourist volume (X_1) exerts a strong and statistically significant positive effect on tourism revenue ($B = 0.186$, standardized $\beta = 1.108$, $p < 0.001$), confirming that visitor arrivals remain the most influential direct driver of revenue growth. Tourist mobility intensity (X_4) also shows a significant positive impact ($B = 4.425$, $\beta = 0.409$, $p = 0.004$), underscoring the importance of internal tourist movement and associated economic activity within the destination.

The exclusion of passenger volume (X_2), which initially exhibited a negative association, suggests inefficiencies in transport infrastructure utilization. This result may reflect congestion effects and modal mismatches, whereby general passenger flows do not effectively translate into productive tourist mobility and may even generate disutility. Likewise, the insignificance of tourist person-days (X_3) and inbound overnight visitors (X_5) points to structural limitations in the tourism system, indicating a continued reliance on domestic visitor volume rather than high-value, long-stay, or diversified international markets.

Overall, the results demonstrate that Xinjiang’s tourism revenue growth is primarily driven by visitor scale and internal mobility rather than stay duration or international demand. While this pattern explains recent revenue expansion, it also reveals structural vulnerabilities that must be addressed to support a more sustainable and resilient tourism development strategy.

5. DISCUSSION

The empirical results show that tourism revenue in Xinjiang is closely related to the volume of tourist flows and the intensity of internal mobility. In addition to scale effects, the statistical significance of mobility intensity suggests that spatial circulation within a region plays an important role in generating revenue. In geographically large and structurally fragmented destinations, revenue generation depends not only on the number of visitors but also on how tourists move between nodes. Spatially, Xinjiang’s tourism system exhibits a core-periphery configuration built around major nodes, corridors, and last-mile connections (**Fig. 5**). Urumqi serves as the main central node, where transportation networks, accommodation capacity, and service aggregation are concentrated. Secondary nodes such as Turpan and Aksu function as regional hubs, and many small attractions are located along the corridors connecting these centers.

This configuration raises an important conceptual question: if many peripheral attractions are located along major mobility corridors, why do corridor flows not automatically generate significant spillover effects? The answer lies in the distinction between geographical proximity and functional integration in the tourism system.

Although many attractions are geographically close to major transport corridors, they often serve as transit points rather than destination nodes. Their peripheral status is determined not by physical distance but by their limited integration into the tourism value chain. Several mechanisms explain this functional marginality:

First, limited service capacity limits value capture. Many destinations located close to corridors lack adequate accommodation, catering, guide services, and interpretive infrastructure. As a result, visitors, although staying for short periods, do not generate significant overnight stays or spending.

Fig. 5. Conceptual spatial structure of tourism development and internal mobility in the Xinjiang Uygur Autonomous Region, China.

Second, despite proximity to the corridor, gaps in last-mile accessibility persist. Poor road signage, poor secondary road conditions, limited public transport connections and insufficient parking can all hinder meaningful travel.

Third, route structures in large areas often prioritize efficiency over depth. Tour operators and independent travelers who follow multi-destination itineraries may spend minimal time at peripheral destinations, creating "pass-through" tourism rather than deep consumption.

Fourth, information asymmetries reduce functional visibility. Without effective marketing and interpretation, geographically accessible destinations remain economically marginal.

This distinction is consistent with Friedmann (1966) core-periphery theory, which defines peripheral status not by absolute location but by asymmetric exchange relations with central regions. Brown et al. (2000) emphasize in their research that tourism development in peripheral regions depends not only on infrastructure but also on service capacity. They link the difference between transit points and destination nodes to the degree of service concentration. Song et al. (2013), developing the tourism value chain theory, argue that the economic exclusion of peripheral points occurs due to their incomplete integration into the value chain due to insufficient service infrastructure. Value accumulation, service concentration, and economic retention occur in central nodes, where tourism services are packaged and consumed. Although peripheral locations are located along corridors, they remain economically marginal if they function primarily as transit routes rather than as service-capable stops.

The policy message is that improving corridor infrastructure alone is not enough to integrate peripheral regions. Additional investments are needed in service development, last-mile connections, interpretive infrastructure, and route design to transform transit points into economically integrated destination hubs.

6. CONCLUSIONS

This study develops a theory-grounded econometric framework to examine the key drivers of tourism revenue in Xinjiang using annual data from 2009 to 2020. Integrating tourism demand theory, destination competitiveness frameworks, and rigorous diagnostic testing, the analysis provides clear evidence that tourism revenue formation in Xinjiang is primarily driven by two interrelated factors: tourist volume and tourist mobility intensity. These findings align with established tourism research while offering new insights into the spatial structure of tourism development in western China.

The results confirm that visitor scale remains the most influential determinant of tourism revenue, reinforcing theoretical perspectives that emphasize market size as a core driver of destination performance. At the same time, tourist mobility intensity, capturing internal movement and spatial travel, emerges as a significant contributor to revenue generation. This suggests that beyond attracting tourists, the circulation of visitors within the destination plays a critical role in stimulating spending and supporting regional economic linkages. In contrast, the insignificance of passenger volume, tourist person-days, and inbound tourism points to structural weaknesses, including short visitor stays, limited product diversification, and weak penetration of high-value international markets.

These findings carry important policy implications for sustainable tourism development. Xinjiang should move beyond a predominantly volume-driven growth model toward a quality-oriented strategy that emphasizes longer stays and higher per-capita expenditure. Enhancing experiential tourism products, such as nature-based, heritage, winter sports, and rural tourism, alongside improvements in internal mobility efficiency and last-mile connectivity, will be essential. Destination planning should also promote more balanced regional development by extending tourism benefits to rural, peripheral, and minority areas through community-based tourism and localized value creation.

From a theoretical perspective, the study demonstrates that tourism growth in large, emerging destinations like Xinjiang is shaped more by scale and mobility effects than by depth-of-experience effects. While this dynamic can generate rapid revenue growth, it may constrain long-term competitiveness unless experiential quality and stay duration are strengthened.

Despite offering meaningful insights, this study is subject to several limitations. The size of the annual time series ($n = 12$) limits the complexity of the model and does not allow for causal inferences. Annual aggregation may obscure seasonal and intra-regional heterogeneity. In addition, the mobility intensity indicator, although theoretically sound, aggregates different transport modes and is likely to contain measurement inaccuracies.

We believe that future research can extend this analysis in several directions: First, spatial network analysis could incorporate structural metrics such as node centrality, betweenness, and corridor itinerary length to quantify how destinations' positions within tourism networks influence revenue capture. Second, spatial econometric models (including spatial autoregressive models, spatial error models, and spatial Durbin models) could be estimated using travel-time-based or network-based spatial weights matrices. Such models would allow direct testing of corridor spillover effects and assessment of whether mobility-driven revenue concentrates in core nodes or diffuses to peripheral areas. Third, high-frequency mobility data derived from mobile positioning systems, GPS traces, or smart transport cards could enable fine-grained analysis of tourist movement patterns, dwell times at specific sites, and spatial expenditure linkages. Fourth, panel data across multiple regions would facilitate stronger causal inference and allow examination of spatial heterogeneity in mobility-revenue relationships. These extensions would provide a more rigorous empirical basis for evaluating how spatial structure mediates tourism value capture in large, corridor-based destinations.

In conclusion, although Xinjiang's tourism sector has experienced rapid growth, its long-term success will depend on improving experience quality, enhancing mobility efficiency, and diversifying high-value tourism offerings. Addressing these challenges will support a transition toward a more resilient, inclusive, and internationally competitive tourism economy.

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