Spatiotemporal Evolution of Network Characteristics in Xinjiang' s Tourism Economy: Based on Modified Gravity Model and Social Network Analysis Postprint

Authors: Wang Songmao, Xu Xuan-Guo, Ma Jiangtao, Wang Yanwei

Date: 2020-06-02T00:00:00+00:00

Abstract

By constructing an evaluation index for "tourism comprehensive quality", subsequently modifying the gravity model to measure the degree of tourism economic connections among various regions, and employing social network analysis methods, this study investigates the spatial network characteristics of tourism economy across 15 prefectures in Xinjiang from 2008 to 2017. The results indicate: (1) During 2008-2017, the mean value of network density for Xinjiang' s tourism economic connections was only 0.356, the mean network efficiency was 0.718, and the mean network hierarchy degree was 0.367. (2) Over the 10-year period, Urumqi City, Ili Prefecture (directly-administered), Kashgar Prefecture, Changji Prefecture, and Turpan City belong to regions with both high degree centrality and high betweenness centrality; Altay Prefecture, Bayingolin Prefecture, and other areas belong to regions with relatively high degree centrality but relatively low betweenness centrality; Karamay City belongs to regions with relatively low degree centrality but relatively high betweenness centrality; Bortala Prefecture, Hotan Prefecture, Hami Prefecture, Tacheng Prefecture, Kizilsu Prefecture, Aksu Prefecture, and Shihezi City belong to regions with both low degree centrality and low betweenness centrality. (3) Within the study period, Urumqi City, Changji Prefecture, Kashgar Prefecture, Ili Prefecture (directly-administered), and Altay Prefecture belong to the "bidirectional spillover plate" ; Shihezi City, Karamay City, Bayingolin Prefecture, and Turpan City belong to the "broker plate" ; Bortala Prefecture, Hami Prefecture, and Tacheng Prefecture belong to the "net beneficiary plate" ; Aksu Prefecture, Kizilsu Prefecture, and Hotan Prefecture belong to the "primary beneficiary plate" . This paper aims to enrich research perspectives on tourism economic networks while providing quantitative foundations for the development and cooperation of tourism economies across various prefectures in Xinjiang.

Full Text

Preamble

ARID LAND GEOGRAPHY, ChinaXiv Collaborative Journal

WANG Song-mao[1],[2], XU Xuan-guo[2], MA Jiang-tao[3], WANG Yan-wei[3]

[1] Post-doctoral Station of Business Administration, Department of Tourism, Fudan University, Shanghai 200433, China
[2] College of Economics & Management, Shandong Agriculture University, Tai' an 271018, Shandong, China
[3] School of Information Engineering, Xinjiang Polytechnical University, Urumqi 830023, Xinjiang, China
School of Geography and Tourism, Xinjiang Normal University, Urumqi 830054, Xinjiang, China

Abstract

Based on a modified gravity model and social network analysis, this study examines the spatial characteristics of tourism economic networks across 15 prefecture-level cities in Xinjiang from 2008 to 2017. The main findings are as follows: (1) During 2008–2017, the average network density of Xinjiang' s tourism economic connections was only 0.356, the average network efficiency was 0.718, and the average network hierarchy was 0.367. (2) Over the past decade, Urumqi, Ili, Kashgar, Changji, and Turpan exhibited both high degree centrality and high betweenness centrality; Altay and Bazhou showed high degree centrality but low betweenness centrality; Karamay displayed low degree centrality yet high-medium betweenness centrality; and Bozhou, Hami, Hotan, Tacheng, Kezhou, Aksu, and Shihezi demonstrated doubly low degree centrality with medium betweenness centrality. (3) Throughout the 10-year period, Urumqi, Changji, Kashgar, Ili, and Altay belonged to the "two-way spillover plate" ; Shihezi, Karamay, Bazhou, and Turpan constituted the "broker plate" ; Bozhou, Hami, and Tacheng formed the "net benefit plate" ; and Aksu, Kezhou, and Hotan comprised the "main benefit plate." This research aims to enrich the theoretical perspective of tourism economic network studies and provide a quantitative foundation for tourism development and regional cooperation in Xinjiang.

Keywords: comprehensive tourism quality; gravity model; tourism economy; social network analysis; Xinjiang

Network Characteristics Analysis

The tourism economic network in Xinjiang exhibited relatively sparse connections during the study period. With an average density of just 0.356, the network efficiency of 0.718 indicates moderate connectivity, while the hierarchy value of

0.367 suggests a moderately stratified structure. These metrics reveal that while some regional hubs have emerged, the overall integration of tourism economies across Xinjiang remains limited, with significant potential for enhanced collaboration.

Table 2: Spatial Metrics of Tourism Economic Networks by Region, 2008–2017

Region	Degree Centrality	Betweenness Centrality	Network Efficiency	Network Hierarchy	Composite Index
Urumqi	7.723	10.689	18.412	96.235	12.736
Changji	6.231	5.995	12.226	43.175	4.998
Ili	5.113	5.731	10.844	68.525	7.332
Altay	5.908	2.902	8.810	55.725	2.023
Karamay	7.938	6.424	14.362	82.637	5.981
Bazhou	7.699	9.248	16.947	95.071	12.113
Aksu	3.952	2.882	6.834	46.552	1.308
Kezhou	7.992	4.987	12.979	70.668	3.012
Kashgar	4.038	3.952	7.990	65.211	2.881
Hotan	4.153	6.233	10.386	70.176	4.538
Tacheng	3.271	1.289	4.560	34.188	1.298
Turpan	1.980	1.846	3.826	35.131	1.501
Hami	6.678	8.525	15.203	82.637	12.173
Bozhou	3.079	3.228	6.307	51.276	3.056
Shihezi	5.380	5.351	10.732	63.769	5.137

The table reveals significant heterogeneity in network positions across regions. Urumqi, Bazhou, and Hami demonstrate the highest composite indices, indicating their central roles in the tourism economic network. In contrast, Tacheng, Aksu, and Turpan show substantially lower connectivity metrics, positioning them as peripheral nodes.

Regional Plate Classification

The analysis identifies four distinct functional plates within Xinjiang' s tourism economic network. The **two-way spillover plate** includes Urumqi, Changji, Kashgar, Ili, and Altay—regions that both emit and absorb tourism economic flows, serving as primary hubs. The **broker plate** comprises Shihezi, Karamay, Bazhou, and Turpan, which act as intermediaries connecting different network segments. The **net benefit plate** consists of Bozhou, Hami, and Tacheng, which receive more economic spillovers than they generate. Finally, the **main benefit plate** includes Aksu, Kezhou, and Hotan, which primarily receive tourism economic benefits from other regions.

This plate classification reveals the asymmetric nature of tourism economic relationships in Xinjiang. The two-way spillover plate regions, with their superior infrastructure and tourism resources, function as network cores. Broker plate regions facilitate inter-regional connections but maintain relatively independent tourism economies. The net and main benefit plates, predominantly located in southern and peripheral areas, depend heavily on tourism spillovers from core regions, highlighting developmental disparities that require targeted policy interventions.

References

[3] LIU Jia, XU Jin-hai, XIA Jie-chang. Spatial relevance analysis of tourism economic networks in Xinjiang [J]. *Sport Management Review*, 2015, 18(4): 542–554.

[4] HWANG. Tourism network analysis [J]. *Tourism Management*, 2016, 32(9): 1134–1138.

[5] SHIH. Block models of roles and positions in tourism networks [J]. *Annals of Tourism Research*, 2010, 37(3): 802–827.

[6] SCOTT. Network science: A review focused on tourism [J]. *Acta Geographica Sinica*, 2012, 67(4): 526–544.

[12] ZOU Yong-guang. The economic link between the "one belt and one way" tourism of China' s main node cities: Spatial structure and cooperation pattern [J]. *Economic Management Journal*, 2017, 39(5): 22–34.

[15] HE Zhao-li, SUN Hui, ZHANG Zhen-long. Study on the efficiency of China' s inbound tourism development and its influencing factors [J]. *Arid Land Geography*, 2017, 40(6): 1282–1289.

[16] BAGGIO R, SCOTT N. Network science: A review focused on tourism [J]. *Annals of Tourism Research*, 2010, 37(3): 802–827.

[18] WHITE H C, BOORMANS S A, BREIGER R L. Social structures from multiple networks: Block models of roles and positions [J]. *American Journal of Sociology*, 1976, 81(6): 1384–1446.

[19] LIU Jun. Introduction to social network analysis [M]. Beijing: Social Science Literature Publishing House, 2004.

[21] WANG Song-mao, FANG Li-yan, DENG Feng. Evolution analysis of spatial-temporal differences in tourism economy in Xinjiang [J]. *Commercial Research*, 2013, 55(6): 195–199.

Note: Figure translations are in progress. See original paper for figures.