Has the digitization of the tourism industry promoted the export of tourism services?--Based on evidence at the provincial level of China

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Abstract: The rapid development of the digital economy has driven the digital transformation of the tourism industry, which will inevitably affect the development of China's tourism service trade. Based on the provincial panel data of China from 2009 to 2020, this paper constructs the "three new" evaluation system of China Provincial Tourism Digitalization, tests its impact on tourism service exports. The results indicate that the digitization of the tourism industry positively affects the export of tourism services by reducing transaction costs, which is more obvious in the central and eastern regions.

1 Introduction

The "China Digital Economy Development Report (2022)" released by the China Academy of Information and Communications Technology shows that the Digital Economy Scale in China will reach 45.5 trillion RMB in 2021, accounting for 39.8% of GDP, and a nominal increase of 16.2% year-on-year. Under the superimposed influence of the global economic downturn and the multi-point spread of the epidemic, the growth of the digital economy was 3.4 percentage points higher than the nominal GDP growth rate in the same period, showing the strong momentum of China's digital economy development. The development of the digital economy has promoted the digital transformation of the industry, and the traditional tourism industry is facing the opportunity and pressure of digital upgrading.

With 86 WTO members making substantial progress in e-commerce negotiations to reach agreement on most topics by the end of 2022, greater stability and predictability are brought to the fast-growing global digital economy and China's imports and exports of digital services. The development of tourism services trade can increase foreign exchange earnings, create employment opportunities, drive the transformation and upgrading of the tourism industry, and inject new momentum into China's high-quality economic development. Since 2020, The *COVID* Epidemic has brought shocks and challenges to the tourism industry, and trade in tourism services has declined significantly. The digitization of tourism services is an urgent practical issue.

In the context of the adjustment of epidemic prevention and control and border control policies China's tourism industry faces an important opportunity of how to itemize digital transformation and promote tourism service exports. This paper focuses on the theoretical mechanisms of tourism digitalization for export promotion and examines the impact of tourism digitalization level on China's tourism service exports.

2 Review of Related Studies

There is no strict definition of tourism digitalization in the existing literature, but there is still some consensus on its main connotation, i.e., tourism digitalization refers to the increase in output and efficiency brought by ICT products and inputs to tourism (Li Junyi, 2012; Xu Jinhai and Wang Jun 2016; Yu Tingting and Zuo Bing, 2022). According to the definition of the Chinese Academy of Communication about the digital economy, this paper defines the digitalization of tourism as the integration with surrounding industries with digital technology innovation as the core driver, optimizing digital infrastructure and accelerating the construction of a new tourism operation model.

2.1 The impact of digitalization on the development of the tourism industry

Most of the literature explores the causes of tourism industry development focusing on social environment and urban environment. Crouch (1999) and Robertico (2004) suggest that the social environment, income level of source countries and exchange rate are the main factors affecting the tourism industry. Zhang, Jiaqing (2009) showed that inbound tourism is more influenced by the endowment of production factors, and the long-term development of tourism is directly related to the cost of tourism factors. In contrast, studies on the impact of digitalization on the tourism industry are mainly

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centered on enterprises and industry integration digital construction, and a few scholars have studied the construction of a digital evaluation system, but the selected indicators are not sufficient to measure. Chen Linlin et al. (2022) proposed that digital technology empowers the tourism industry in three ways enhancing tourism efficiency, promoting tourism structure upgrading and promoting tourism business models.

2.2 Impact of industrial digital development on exports

Academic research on industrial digitization has mainly focused on manufacturing and less research has been conducted from tourism services. Fakhar (2017) argues that the integration of digital technology and industry can promote the digital development of related industries and reshape the value chain of industrial innovation. Huang Wensheng (2020) found that the depth and breadth of digital inclusive finance have a significant impact on inbound tourism. Wang Mengying (2021) showed that digital trade has significantly increased the technical complexity of service exports and promoted the upgrading of service exports, especially in emerging industries.

In summary, existing studies do not comprehensively model the digitization of tourism and less empirically analyze its impact on China's tourism service exports. Compared with previous studies, this paper expands the research by constructing a "three new" regional tourism digitalization index system, proposing a tripartite mechanism to explain the impact of tourism digitalization on tourism service exports.

3 The Mechanism of the Impact of Tourism Digitization on the Export of Tourism Services

3.1 The impact of digitization on tourism industry

The impact path of digitization on tourism industry has three levels: national, industrial and enterprise, through the new platform of digital tourism, new industry, a new mode of innovation and application, and finally conduct to tourism development, as shown in Figure 1.

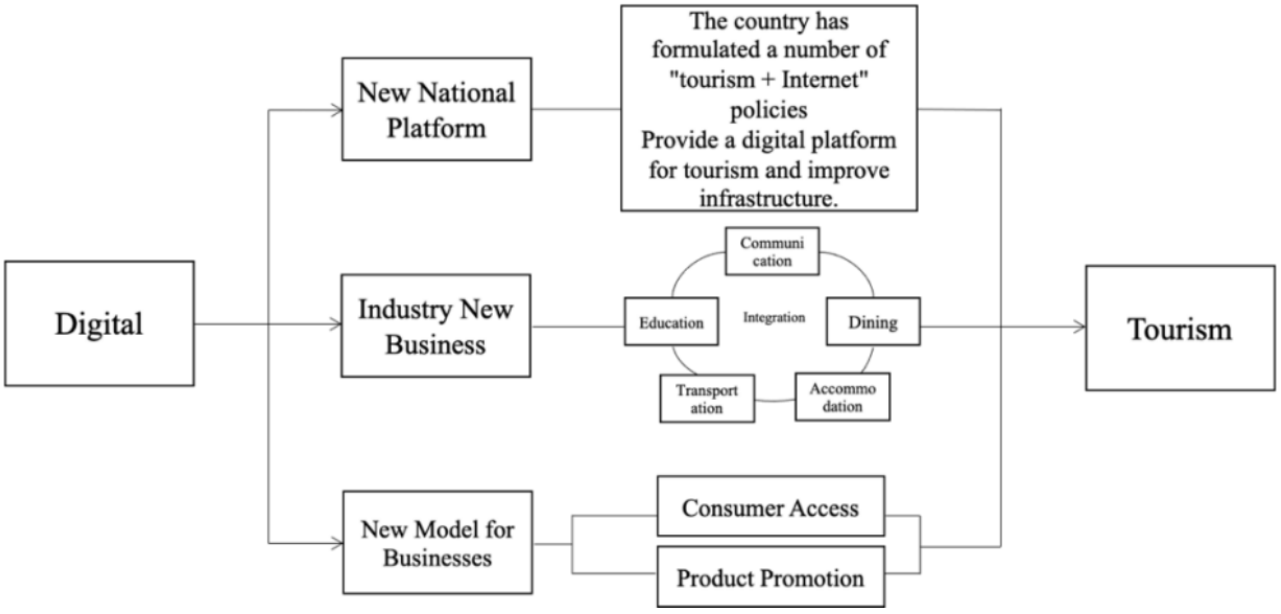

Figure 1 Roadmap of the impact of digitization on the tourism industry

First, the development of digitalization at the national level is reflected in the new platform of digital tourism. 2013, the National Standardization Management Committee issued specifications for the digital application of tourism scenic spots, after which the government issued a number of relevant policies to promote (see Table 1). On the one hand, with the "Internet + government services" deepening, the government fully uses big data for digital change, combined with smart city market supervision and service effectiveness, to create an orderly and innovative tourism environment. On the other hand, the government proposes to create a digital environment, vigorously promote mobile payment means, establish a new platform for intelligent search, promote precise and customized tourism services, and improve the autonomy of overseas travel. In tourism development, the government leads to increase investment in tourism talent training and technology platforms, which can realize the transformation, upgrading and innovative development of tourism.

Table 1 Tourism-related policies

Time	National policy documents and major adjustments	Summary of contents
August 2014	Several Opinions of the State Council on Promoting the Reform and Development of Tourism	Insist on integrated development, promote the integration of tourism development with new industrialization, informatization, urbanization and agricultural modernization, and realize the unification of economic, social and ecological benefits.
September 2015	"Notice on the Implementation of "Tourism + Internet" Action Plan"	The new round of technological revolution is changing the world's economic development and people's production life, the transformation and upgrading of tourism industry in the context of the Internet should give full play to its comprehensive advantages and driving effect, and vigorously develop online tourism.
March 2018	Integration of responsibilities of the former Ministry of Culture and National Tourism Administration	The Ministry of Culture and Tourism was established to promote the integrated development of culture and tourism, which will lead to a new upgrade of the culture and tourism sector and help to efficiently coordinate resources.
November 2020	"Opinions on Deepening "Internet+Tourism" to Promote High-Quality Development of Tourism"	In the context of the new development of "Internet+Tourism", it is proposed to seize new opportunities, increase efforts to cultivate and innovate various new consumption modes and new models, accelerate the Construction of intelligent tourism scenic spots, build tourism innovation and entrepreneurship platform, improve tourism governance, strengthen tourism supervision and services and other important tasks.
January 2022	The 14th Five-Year Plan for Tourism Development	Deepen the "Internet + tourism", adhere to the drive innovation development, promote the development of intelligent tourism, accelerate the use of new technologies and technological innovation, improve the comprehensive efficiency of the innovation chain; improve the tourism product supply system, promote "tourism +" and "+ tourism", the formation of a new situation of multi-industry integration development.

Source: Compiled by the author based on public information

Secondly, digitalization is integrated and innovated at the industry level to form a new digital tourism industry. The digital technology are used in various industries, gradually diluting inter-industry barriers, allowing different types of enterprises to coexist in the same ecosystem. "Cross-border integration" becoming the organizational norm (Li, Hai-ship and Li, Yan, 2019). Tourism is a comprehensive cluster industry with unique industrial characteristics, and its development cannot be separated from the cooperation of industries such as accommodation, catering, transportation, and communication. Recently, new industries such as tourism + culture, tourism + medical care, and tourism + education have been vigorously developed to meet the needs of consumers' lives, which is the basic driving force of tourism industry integration. In addition, with the building of sharing platform to promote "tourism +" the vertical and horizontal development of the new industry.

Third, the digital application of innovation at the enterprise level to form a new model of digital tourism. The cornerstone of the development of the tourism industry is the transformation and upgrading of tourism enterprises. While traditional tourism companies offer travelers more face-to-face offline promotion, modern tourism digital construction has transformed the company's operating model by transforming the process of creating brand value and the methods of acquiring resources. First, product promotion using an online marketing system, scenic spots open tourism IP cross-border innovation, giving tourism attractions unique characteristics. Second, the company to consumers from offline to a new mode of operation that combines online and offline.

3.2 The impact of the digitalization of the tourism industry on the export of tourism services

The traditional endogenous growth model (Solow, 1956) expresses the function of input and output as Y=AF(K,L). Yt measures economic growth, where A, K, and L represent technological progress, capital factor and labor factor inputs respectively.

In the digital economy, factors of production are no longer limited to traditional labor, capital and land, but data have become the "key factors of production" as digital knowledge and information [a]. Therefore, the digital transformation of industry reflects an expansion of the traditional endogenous growth theory system: Y=F(K,L,T,A,D), where T and D denote land resources and data factors, respectively. In this context, this paper discusses the mechanism of the impact of tourism digitization on tourism service exports as shown in Figure 2.

[a] On April 10, 2020, the "Opinions of the State Council of the Central Committee of the Communist Party of China on Building a More Perfect Institutional Mechanism for Market-Based Allocation of Factors" was officially announced, classifying for the first time the direction of reform in five-factor areas: land, labor, capital, technology, and data.

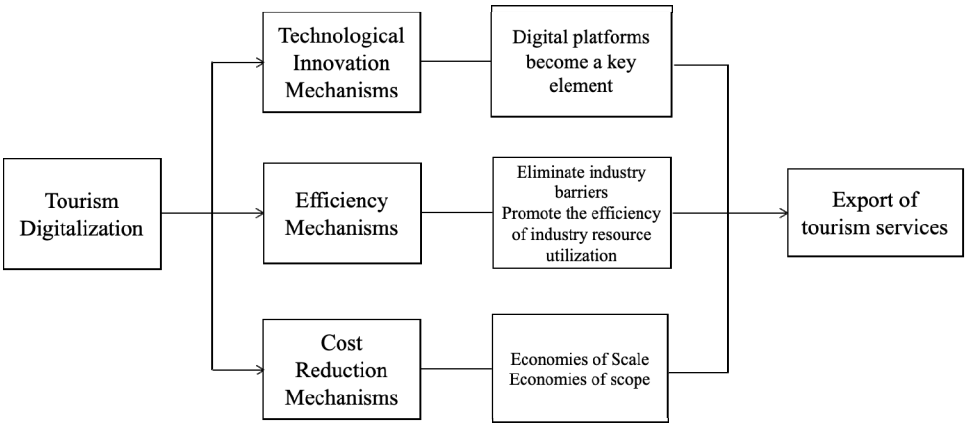

Figure 2 Roadmap of the mechanism of the impact of the digitalization of tourism on the export of tourism services

3.3 Tourism digitization promotes tourism service exports by fostering technological innovation

In the digital transformation of tourism, data has become a key production factor, and new tourism products in China are generated by relying on online platforms and modern digital information technology infrastructure, effectively promoting information spillover between places and enhancing the comparative advantage of tourism service exports. For offline tourism consumption, digital transformation promotes the efficiency and quality of innovation of cultural and creative products around tourism, and promotes the mass production of new equipment in the accommodation and transportation industries, while providing a new platform for online tourism. According to the report of Avery Consulting, the online tourism market transaction scale in 2021 grew 38.4% year-on-year. Through the online tourism space, the information coupling between tourism resource parties, integrated online tourism parties (Ctrip, Meituan), payment query service parties (Alipay, Baidu) and tourists has increased significantly, forming a virtual gathering that does not depend on geographic space (Wang Ruyu et al., 2018), becoming a new space for tourism information exchange, data sharing and reaching orders, thus enhancing tourism service exports.

3.4 Digitalization of tourism promotes exports by enhancing resource allocation efficiency

First, the development of digital technology will dilute industrial barriers, and its process is bound to be accompanied by the reconfiguration of resources. Secondly, internal organizational structure problems and information communication difficulties, resulting in low effectiveness of information resource allocation in tourism organizations, and the booming development of digital information technology also promote the reengineering and reform of business organizations, enhancing their ability to reflect and adapt to social changes through streamlined hierarchy and convenient information systems, and improving their management capabilities and organizational performance levels. On the one hand, the online visitor platform can serve tourists at any time, along with the use of big data analysis, cloud computing and other advanced technological means, not only can significantly improve the efficiency of resource sharing, but also promote a high degree of integration of various links in the tourism industry chain, forming a new mode of data realization, thus promoting the realization of the transformation and upgrading of the tourism industry to increase the value premium; on the other hand, the tourism industry through the establishment of Internet platforms will On the other hand, the tourism industry has realized the "tourismization" of many social resources through the establishment of Internet platforms, such as the development of "non-hotel accommodation" such as B&B in recent years.

3.5 Digitalization of tourism promotes the export of tourism services by reducing costs

With the penetration of digitalization into tourism enterprises, companies have developed economies of scale, enabling them to operate at scale across a wide range of products and services to suit different markets. For tourism suppliers, digital cooperative division of labor and resource sharing not only break the resource blockage brought, but also promote the free flow and integration of innovation factors. Thus improving market innovation efficiency and promoting regional minimization of inter-industry transaction costs (Huang, Peng, and Chen, Liang,2021). For travelers, digital technology uses information correlation to show scenic spots, traffic dynamics and weather conditions in real-time, reducing travelers' time costs, enhancing the efficiency and depth of transactions between tourism industry subjects, continuously improving the supply and demand structure of the tourism market, and attracting more tourists.

4 Model Setting and Data Description

The above theoretical analysis suggests that digital transformation is likely to promote tourism service exports by generating comparative advantages, promoting industry integration, reducing costs. This paper will empirically test the relationship between digital transformation and tourism service exports through econometric analysis.

Explanatory variable: Digitalization of tourism (*DIG*). For the measurement of the new platform of digital tourism, based on the digital progress proposed at the policy level to support the industry's basic payment method and official platform construction, the guideline layer is set as the digital tourism infrastructure. For the measurement of the new industry of digital tourism, considering the synchronous digital support of multiple industries from the industry, the new service of digital tourism is selected as the guideline layer. For the new mode of digital tourism, considering the tourism scenic spot's digital personalized service to the experience of touring depth, digital tourism experience depth is selected as the guideline layer. The weights of each indicator determined by the analysis are shown in Table 2.

Table 2 Digitization index system and weights

	Criteria layer	Indicator layer	Weights
Travel Tourism Industry Number of Digital Digitalization	Digital Tourism Infrastructure U1	Website work of the Department of Culture and Tourism U11	0.0843
		Online Mobile Payment Level U12	0.0347
		Tourism Industry R&D U13	0.0491
		Scenic official website construction U14	0.1130
		Scenic area publicity platform U15	0.1150
	New Digital Tourism Service U2	Competitiveness of Cultural and Creative Industries U21	0.0578
		Number of Star-rated Hotels U22	0.0247
		Development of Internet U23	0.0852
		Breadth of Digital Financial CoverageU24	0.1108
		Volume of Telecommunications Business U25	0.0838
		E-commerce situation of tourism enterprisesU26	0.0956
	Digital Tourism Experience Depth U3	Number of interactive digital parks U31	0.0936
		Travel word search rate U32	0.0525

Explained variable: exports of tourism services. The data were selected from the foreign exchange earnings of tourism in each province, and the average income from international tourism (foreign exchange) was used to explain exports, and the treated variables are noted as EX.

Control variables: Since there are many factors affecting tourism service exports, it is difficult to take all variables into account. According to the relevant research on tourism service export, this paper selects several representative control variables to control other influencing factors of tourism service export, which are counted as tourism environment impact and urban environment impact.

Mediating variables: Technical innovation capacity, resource allocation efficiency and transaction cost are selected as mediating variables. The level of technological innovation is chosen to be measured by the number of patent applications granted in the tourism industry. Resource allocation is measured by the TFP of tourism industry. In terms of reducing transaction costs, we choose telecommunications services to portray transaction costs. The main variables in the model and the source method are shown in Table 3.

Table 3 Main variables and source methods

Variable Category	Variable Name	Variable Selection	Variable Source
Explained variables	*EX*	Average revenue from international tourism (foreign exchange)	Ministry of Culture and Tourism of China
Explanatory variables	*DIG*	Composed of 13 secondary indicators	Provincial cultural and tourism government websites, the Ministry of Science and Technology of China, the National Bureau of Statistics, CSMAR and the author's collation
Intermediate variables	*M1*	Number of granted patent applications in the tourism industry	Percentage of tourism output value*Total number of patents granted
	M2	Tourism TFP	National Bureau of Statistics of China
	M3	Telecommunications business volume	National Bureau of Statistics of China
	SE	Number of tourism higher education institutions *ED,* the total number of travel agencies *TA,* number of 5A scenic spots *FA*	Ministry of Culture and Tourism of China
Control variables	*NE*	*Rgdp*、Harmless treatment rate of urban domestic waste *MSW*、Transportation Infrastructure Development *TI*、Information service industry output value *IS*	National Development and Reform Commission, Ministry of Transport, Ministry of Industry and Information Technology and National Bureau of Statistics

5 Analysis of the empirical results

5.1 Full-sample estimation results

According to the Hausman test results, this paper selects the fixed-effects model for regression analysis, and the covariance test of the model finds that the VIF value of the control variable Rgdp reaches 15.05, so this variable is deleted and the stepwise regression tests the impact of the digitalization level of tourism on its service exports, and the specific results are shown in Table 4.

Table 4 Analysis of model stepwise regression results

Variables	(1) lnex	(2) lnex	(3) lnex	(4) lnex	(5) lnex	(6) lnex	(7) lnex
dig	0.477***	0.398***	0.324***	0.263***	0.306***	0.302***	0.326***
lnta		0.058***	0.055***	0.052***	0.055***	0.049***	0.052***
lnis			0.025***	0.024***	0.024***	0.025***	0.022***
lnti				0.061*	0.085**	0.077**	0.083**
lnfa					-0.029*	-0.033**	-0.026*
lned						0.015	0.020*
lnmsw							-0.077***
Constant	5.152***	4.803***	4.680***	4.234***	4.058***	4.115***	4.376***
R^2	0.626	0.638	0.647	0.650	0.656	0.658	0.668
Observations	372	372	372	372	372	372	372

Note: *, ** and *** denote 10%, 5% and 1% significance levels respectively, same below

The results show that the level of digitalization of tourism has a significant contribution to inbound tourism. The goodness of fit of the model is 0.631, which indicates that overall the explanatory variables have a good interpretation of the explained variables. From the core explanatory variables, the coefficient of the effect of tourism industry digitization on tourism service exports is 0.326 and is significant at 1% level of significance, indicating that the development of tourism and peripheral industry digitization can enhance tourism service exports and attract foreign travelers' consumption, which has a positive guiding and promoting effect on inbound tourism.

In terms of control variables, the number of travel agencies TA and information service industry output IS are significantly positive, indicating that the intermediary role of travel agencies still exists. Tourism service exports are more connected to domestic tourism through tourism product distribution and online ordering platforms. Information service industry, as an industry with deep integration of digital economy and service industry which helps to expand the demand and supply of the industry. The negative coefficient in MSW indicates that MSW does not promote the export of tourism services. The increase of MSW disposal rate reflects the increase of total urban waste, and the policy of recycling is not fully implemented, which leads to the waste occupying too much land. This has led to the formation of a bad environment of garbage surrounding the city.

5.2 Sub-regional estimation results

In order to explore the impact of tourism digital transformation on tourism service trade under different economic development levels in different provinces, this paper refers to the document of the State Council of the People's Republic of China[b], and divides the full sample into four sub-samples of East, Central, West and Northeast according to the level of economic development. Table 5 indicates the estimation results of the sub-regional tourism service export decision equation.

[b] According to the "Opinions on the Implementation of Certain Policy Measures for the Development of the West" issued by the State Council and the spirit of the report of the 16th Party Congress, China's economic regions are now divided into four major regions: the East, the Central, the West and the Northeast. The East includes Beijing, Hebei, Tianjin, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong, and Hainan; the Central includes Shanxi, Anhui, Jiangxi, Henan, Hubei, and Hunan; the West includes Guangxi, Inner Mongolia, Chongqing, Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Ningxia, Qinghai, and Xinjiang. The northeast includes Liaoning, Jilin, and Heilongjiang.

Table 5 Regression results by region

Variables	East lnex	Middle lnex	West lnex	Northeast lnex
dig	0.514***	0.552***	0.318***	0.475***
Control Variables	YES	YES	YES	YES
Constant	5.207***	6.457***	4.367***	8.115***
R^2	0.784	0.694	0.715	0.647
Observations	120	72	144	36

Using the data in Table 5, the effect of tourism digitalization on tourism service exports is positive regardless of the region and is significant at the 1% level. By region, there are regional differences in the effect of regional tourism digitalization on tourism service exports, showing a "high in the east and low in the west" trend. This is partly due to the imbalance in economic

development between the east and west. With the western region having weaker infrastructure, lagging economic development, and a lack of quality human resources, so the digital development of tourism is not immediately reflected in tourism foreign exchange earnings and arrivals. Secondly, because the western region of Tibet, Xinjiang, and Gansu are mostly natural scenery, which requires less digital construction than human attractions, so the digitalization of tourism in the west does not have a significant impact on the export of tourism services.

5.3 Further analysis

The above benchmark model verifies the enhancing effect of tourism digitization on tourism service exports through stepwise regression and sub-regional analysis. The following tests the mechanisms by which tourism digitization affects China's tourism service exports, using a mediating effects model for three mechanisms that promote technological innovation, optimize resource allocation, and reduce transaction costs. The results are presented in Table 6.

Table 6 Mechanism test estimation results

Variables	(1) m1	(2) lnex	(3) m2	(4) lnex	(5) m3	(6) lnex
dig	0.816**	0.213***	1.132**	0.311***	0.373***	0.244***
	(2.56)	(3.62)	(2.42)	(5.67)	(5.02)	(4.51)
m1		0.041***				
m2				0.014**		
m3						0.037***
Control Variables	YES	YES	YES	YES	YES	YES
Constant	-0.078	4.147***	-0.125	4.412***	-0.271	4.435***
R^2	0.811	0.702	0.577	0.672	0.812	0.698
Observations	372	372	372	372	372	372

The results of the regressions in Table 6 show that all digitalization of tourism significantly contributes to technological innovation, optimization of resource allocation and reduction of transaction costs in tourism at the 5% level. The significant positive effect of tourism digitalization on tourism services exports remains unchanged when these three variables are added separately in the baseline regression. The effects of technological innovation, resource optimization and investment costs on tourism services trade are all significantly positive at the 5% level, indicating that R&D expenditures, investment in technicians, optimized resource allocation and enhanced marketization significantly contribute to tourism services exports.

In order to verify the accuracy of the previous conclusions, robustness analysis of the model is conducted. Considering the time lag of the policy's role and the impact cycle of the digital construction of tourism scenic spots and surrounding industries, the lagged terms of the explanatory and explanatory variables are introduced for discussion, and the results are shown in Figure 7. For some of the control variables, the results of the lagged terms are not as significant as the results of the current period, but the empirical evidence of the one-period lagged terms of both the independent and dependent variables shows that the digitization of tourism has a significant positive impact on the export of tourism services, which is consistent with the results related to Table 4.

Table 7 Robust type tests of the impact of tourism digitization on tourism service exports

Variables	(1) L.lnex	(2) L.lnex	(3) lnex
dig	0.330***		
L.dig		0.351***	0.445***
Control Variables	YES	YES	YES
Constant	4.904***	4.948***	4.980***
R^2	0.604	0.611	0.613
Observations	341	341	341

6 Conclusion and suggestions for countermeasures

This paper constructs a system of indicators to empirically test the impact of tourism digitalization on tourism service exports and its transmission mechanism. First, the greater impact of tourism digitalization indicators is the establishment of a promotional platform. Second, the digitalization of tourism enhances tourism service exports through three mechanisms: promoting technology spillover, promoting resource allocation, and reducing transaction costs, and this promotion effect is particularly significant in the Middle East. Third, in addition to the direct effect, the number of travel agencies, information services output will promote tourism services exports.

Based on the above conclusions, to accelerate the development of digital transformation of the service industry and enhance China's tourism service exports,

specific countermeasures should be implemented from the level of enterprises, industries and governments.

First, from the enterprise level: grasp the opportunity of "digital + tourism" in the new era. Pay attention to the impact of intermediary variable technology spillover, increase the introduction of digital talent, further enhance the scenic information network, and create digital attractions.

Second, from the industrial level: clarify the path of industrial integration. Strengthen the mobile sharing of data and information among tourism-related industries, accelerate the process of integration of peripheral industries, especially to strengthen the development of accommodation and catering industry and the integration of tourism industry.

Finally, from the government level: first, increase efforts to promote the pace of digital industrialization and tourism digitization, and strengthen the regional coordinated development of tourism digitization. The indicator system in this paper indicates that the government needs to promote the construction of new infrastructure such as online mobile payment and 5G base stations at the current development stage, and to promote information technology innovation form an efficient and low-cost digital environment. Second, improve the tourism digital service platform, and improve the management structure and system construction of tourism industry. Strengthen the digital investment and platform building of scenic spots in the tourism industry in the western region, and strive to form a balanced pattern of domestic digital tourism development.

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