An economic analysis of sustainable tourism development in China

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Abstract

The threat of climate change and the advancement of sustainable development goals to control this threat have been among the countries priorities. The tourism sector can be essential in promoting sustainable development goals by implementing sustainable processes. The primary purpose of this research is to focus on 23 provinces of China to analyze the sustainable tourism modeling according to the annual data for 2010–2021. The findings confirm that for all Chinese provinces, the increase in the general level of prices has a significant and long-term adverse effect on the sustainable development of the tourism industry in the provinces of China. In contrast, the effect of this variable is not significant in the short term. Moreover, the impact of foreign direct investment on the sustainable development of the tourism industry in the short term and the long term is positive in high-income provinces and negative in low-income provinces. The recommended practical policies promote a green financing market and green FDI development.

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1 Introduction

Climate change is a threat that has become more and more serious for two centuries ago. The road map of many countries in the field of reducing the threat of climate change is to pay attention to sustainable development indicators. The discourse of "sustainable development" began at the United Nations Human Development Conference in 1972. It reached the evolution of epistemology in the 1987 Brundtland Report and the United Nations Conference on Environment and Development (UNCED) in 1992. In order to unify sustainable development goals (SDGs), in 2015, the United Nations defined 17 different goals so that countries can have political and operational planning by resorting to these goals. Based on the set goals, the tourism industry is one of the parts of the economy that can be turned into an environment-friendly and income-generating part of the country's national economy by focusing on sustainable development goals. By making a sustainable tourism sector, SDG#1 (No poverty), SDG#3 (Good health and well-being), SDG#7 (Affordable and clean energy), SDG#8 (Decent work and economic growth), SDG#9 (Industry, innovation, and infrastructure), SDG #11 (Sustainable cities and communities), and SDG#13 (Climate action) are accessible for the country.

Generally, the global size of the tourism industry has risen surprisingly from 1.5 trillion US dollars in 2011 to nearly 1.8 trillion US dollars in 2019. Under the COVID-19 consequences, the tourism industry market size collapsed and lowered to 1.09 trillion dollars in 2020, recovered in 2011, and reached over 1.6 trillion US dollars in 2022. Sigala (2020) believes that the outbreak of COVID-19 had unprecedented adverse impacts on the tourism industry and made the industry the most impacted economic sector by this disease. After the outbreak of the epidemic, many cities in China have introduced similar containment measures because increasing the participation of government authorities can mitigate the impact of the outbreak (Shang et al. 2021). Yang et al. (2021) express that despite the adverse impacts of COVID-19 on the tourism industry's activities, it provides the opportunity for sustainable development for this industry in the post-COVID era. The reason for this opportunity is that the processes before the stoppage of the tourism industry in the Corona era will be able to be reviewed and adjusted in the post-Corona era. Countries can promote sustainable tourism with new planning in the field of the tourism industry.

It is noteworthy that the capacity and necessity of dealing with sustainable tourism differ for the world's countries. Among the world's countries, China is an economy that can develop sustainable tourism and also needs more serious attention to the sustainable development category due to the volume of greenhouse gas emissions. According to the China National Tourism Administration (CNTO), incomes generated by the tourism industry in China amounted to over 8.7 billion US dollars in 1995 (1.2% of GDP). They reached approximately 40.3 and 11.3 billion US dollars in 2018 (0.29% of GDP) and 2021, respectively. Huang et al. (2021) found out that COVID-19 has reduced the potential of the tourism industry

in China owing to the pandemic restrictions provided by the Chinese government. The State Council of China announced on January 2022 that the country would seek to become a world tourism powerhouse by 2035 (The State Council of the People's Republic of China 2022). To this end, China's 14th Five-Year period (2021–205) includes a particular development plan for the tourism sector. In addition, the country has had successful experiences in ecotourism (e.g., Kanas Lake, Mount Kawa Karpo, Changqing National Nature Reserve, and Changbai Mountains) in the last decade that is not enough for the vast geographical surface of China (Haibo et al. 2020) and should be promoted in the post-COVID era.

This paper aims to model the sustainable tourism industry for 23 provinces of China (the study at the provincial level may bring insights and practical implications for provincial governments) over 2010–2021 through the panel data framework constructed based on the theory of change of tourism development. The necessity of developing sustainable development goals in China as a giant carbon emitter and its potential to promote sustainable tourism are two significant motivations for doing this research on the case of China. This paper seeks to make the following contributions to the earlier studies. First, sustainable tourism development is measured through the proxy of green innovation efficiency of the tourism industry proposed by Sun et al. (2022) for all provinces of China. It provides a reliable index to evaluate the sustainable tourism industry of the country. Second, the effect of the role of the income level of Chinese provinces on the pattern of sustainable tourism development is measured and compared by examining the coefficients of the variables for the group of provinces with a high-income level (top 7 provinces) and seven provinces with the lowest income level.

The primary findings confirm that for all Chinese provinces, the increase in prices has a significant and long-term adverse effect on the sustainable development of the tourism industry in the provinces of China. In contrast, the effect of this variable is not significant in the short term. Moreover, the impact of foreign direct investment on the sustainable development of the tourism industry in the short term and the long term is positive in high-income provinces and negative in low-income provinces. The recommended practical policies are promoting a green financing market, green FDI, establishment, and overflow of part of the government's income from sustainable tourism profits in high-income provinces to improve sustainable tourism in low-income provinces.

This paper has a research structure as follows: Section 2 provides a brief review of earlier literature to clarify the gaps the paper seeks to fill. Section 3 discusses the theoretical background, whereas Section 4 represents information about data and the empirical model. The next section argues the findings of estimations. Section 6 provides concluding remarks, practical policies, and recommendations for further research.

2 Literature review

Lele (1991) reviewed the literature and expressed that sustainable development is an efficient policy to lower environmental pollution and has yet to be consistent with its interpretation worldwide. The vagueness of sustainable development has been

addressed by Mebratu (1998), who declared that ambiguity in the dimensions of sustainable development is a severe risk to the effectiveness of this concept in future. In another study, White (2013) employed the tag cloud generators method for content analysis. He believed that scholars and international organizations should draw more attention to the challenge of interpreting sustainability. However, the UN's definition of sustainable development goals (SDGs) in 2015 was a significant step to make the consistency of global policies toward a zero-carbon economy. Pedersen (2018) reviewed the literature on global sustainable goals and addressed the UN SDGs as an excellent gift for enterprises and countries keen on greening economic activities. Through this gift by the UN, the mainstreams of developing sustainability have become apparent and made sustainable development more accessible. Vuuren et al. (2022) analyzed a streamlined set of science-based indicators of SDGs worldwide. They found that the SDGs defined by the United Nations can help countries to make unified policies and strategic plans regarding environmental concerns. In addition, they defined 36 different targets based on the SDGs as an operational environmental aim of countries. D'Adamo et al. (2022) investigated the consequences of sustainable development in European countries by the multicriteria analysis. They found a positive relationship between sustainable development and economic growth in these economies. Antony and Klarl (2022) explored the relationship between sustainable development and poverty in 180 countries. The findings confirmed that by enhancement of sustainability, the poverty rate lowers and economic flourishing happens. Vice versa, Filho et al. (2021) employed online survey research for a sample of 45 economies. They argued that poverty is a significant barrier to developing SDGs in countries. Therefore, countries' priority should be poverty alleviation and then try to reach SDGs.

A group of earlier studies has marked the influence of sustainable development on the tourism industry. For example, Sorensen and Grindsted (2021) focused on the case of the Danish nature park and evaluated different aspects of nature tourism development. They found that sustainable indicators have positive impacts on developing the tourism industry. Ahmad et al. (2022) studied the impacts of sustainable tourism in the G7 economies from 2000 to 2019. They concluded that green tourism accelerates entrepreneurship and job creation in a country. Focusing on the case of Nepal, Hong-Min et al. (2021) explored the impacts of tourism stakeholders' attitudes to sustainable tourism development. They concluded that green culture and green social capital are two major influential factors to make the positive attitude of tourism stakeholders regarding the environment-friendly tourism industry. Tang et al. (2011) studied China's characteristics of low-carbon tourism. The significant findings confirmed that tourism attractions and enterprises need to be revised by government support and policies to become more sustainable and environment-friendly. In another study, Ning and Hoon (2011) proposed the "exotic culture" as a sustainable development resource for the Weihai City of China. The findings highlighted the potential of this new tourism resource to develop sustainability in the city. Liu et al. (2017) analyzed 35 large- and medium-sized cities in China to explore the relationship between quality of life and sustainable tourism development. They concluded that urban livability is positively affected by the sustainable tourism industry. Weaver

et al. (2020) studied the ways to facilitate sustainable tourism in China. They revealed that the endogenization of ecotourism culture is a golden policy for China to promote environment-friendly tourism. In new research, Birendra et al. (2021) studied ice-and-snow tourism (IST) as a critical factor in promoting sustainable development and poverty alleviation in China. Sun et al. (2022) measured the sustainable innovation efficiency of the tourism industry in China. The findings depicted the role of green R&D in making green innovations in the tourism industry. Chen (2022) employed the nonlinear autoregressive distributed lagged (NARDL) to model green tourism growth in China from 1990 to 2020. They concluded that tourism revenue and GDP (gross domestic product) positively impact the sustainable tourism growth of the country. Shang et al. (2023) evaluated the relationship between tourism and green growth recovery. The results revealed that tourism could not be considered a significant driver for green economic growth in low-income Asian countries. In another study, Shan and Ren (2023) explored the linkages between tourism development and renewable resource deployment in China. They found that the tourism industry needs to support green growth in the country.

The review of earlier studies clarifies that implementing sustainable development in various economic sectors, such as the tourism industry, has many benefits for the welfare and prosperity of economic production. However, an in-depth study has yet to be done on sustainable development modeling in China's tourism industry. This article evaluates the modeling of sustainable tourism development at the level of Chinese provinces and according to the level of per capita income of the provinces. The closest research done to this research is Chen (2022) which has many differences. For example, in this paper, instead of the country level of China, provincial level data are analyzed, which provide findings that are more impactful to policymakers. In addition, high-income and low-income provinces are examined separately, the results of which help China's sustainable development planning at the provincial level.

3 Theoretical background

Historically, the tourism industry and its development path have been the focus of the governments. However, since the 1850s, the price reduction in rail travel was an evolution point for developing the modern tourism industry. The second central evolutionary point for the tourism industry's flourishing happened in the 1950s with the advent of charter flights worldwide. The speech of the US president in 1949 about the priority of developing economic sectors and the US support (e.g., the establishment of World Tourism Development) (Rist 2014) was the initial step for a considerable enhancement in tourism development. Since the 1990s, scholars and policymakers have promoted "sustainable development" as an efficient alternative to conventional tourism. Because of various advantages for the life quality of communities, many countries have tried to improve sustainable (eco-) tourism's cultural, economic, and financial infrastructure.

The theory of change in tourism development is the primary approach of this research. Generally, ToC (Theory of Change), developed in the 1990s, provides

a conceptual framework to identify linkages between development barriers, progress, and outcomes. In order to make the development of sustainable tourism, the challenges of energy transition and environmental pollution should be addressed in the first step. The outcomes (primary goal) are to lower carbon emissions and reach sustainable development goals defined by the United Nations in 2015. In order to overcome the challenges and go toward the outcomes, the progress can include lower tourism costs (through a lower inflation rate) (Scarlett 2021), financing green projects (through issued green bonds and inward green FDI) (expressed by (Sheng 2011; Ahmed et al., 2022), and improving ICT infrastructure (highlighted by Nigg and Peters 2022). According to the aforementioned explanations, Fig. 1 shows the ToC of sustainable development in a country:

The need to pay attention to the concept of sustainable tourism development is due to the threat of climate change, which has two reasons: environmental pollution and the high rate of fossil fuel consumption. Despite the many efforts of the international community and different countries to eliminate the threat of climate change (e.g., the Kyoto Protocol 1997; the Paris Agreement 2015; Japan's Carbon Neutrality by 2050; China's 2060 Carbon Neutral Plan; the REPowerEU Plan 2022), the shadow of this threat exists on human life today and for future generations. Creating sustainable development capacities in the tourism industry will lead to achieving essential goals such as protecting the environment, increasing the quality of human life, reducing industrial and urban waste, saving energy, and reducing carbon dioxide emissions. However, to achieve sustainable development goals in the tourism industry, the transition process will need to control the inflation rate, finance green projects in the tourism industry, and upgrade information and communication technology infrastructure.

The different paths of sustainable development of the tourism industry can be determined through the transition process, comprising the digitalization of tourism services, financing sustainable tourism projects, and controlling the cost of the sustainable tourism industry.
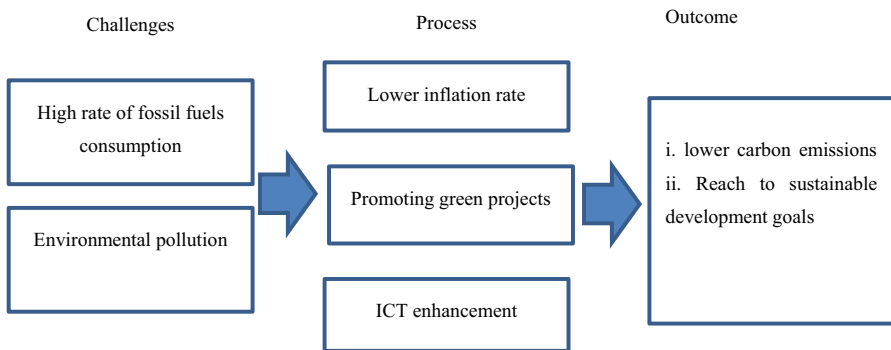
Fig. 1 Conceptual framework of ToC for sustainable tourism development. Source: Authors

4 Data description and model specification

This paper aims to analyze sustainable development patterns in 23 Chinese provinces from 2010 to 2021. In this research, sustainable tourism development is measured through the proxy of green innovation efficiency of the tourism industry proposed by Sun et al. (2022) for all provinces of China. Furthermore, as explanatory variables based on the aforementioned theoretical model, the consumer price index, digital economy index, and FDI are selected. Compared with other industries, the tourism industry is strongly affected by natural disasters, economic fluctuations, public health crises, loss of biodiversity, and other factors. Hence, the political stability index has been added to the model as the control variable. Furthermore, all variables are transformed into logarithm form.

The initial information of variables is reported in Table 1 as follows:

In order to estimate the coefficients, it is necessary to do some tests to find the most appropriate estimation technique. To this end, the cross-sectional dependency status is analyzed in the first stage. Since N (23 provinces) is large and T (2010–2021) is small, the Pesaran (2004)'s CD (cross-sectional dependence) test is suitable to employ as Eq. (1):

$$CD = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \left(\rho_{ij} \right) \right) \tag{1}$$

In the above equation, N and T are the cross-sectional element and the time period, respectively. ρ_{ij} denotes the correlation coefficients of the residuals. If the test confirms the existence of cross-sectional dependency, the panel unit root tests are conducted to check the stationary of the series. Levin, Lin, and Chu (LLC), proposed by Levin et al. (2002), and ADF-Fisher, proposed by Choi (2001), are employed in this paper. If the series is stationary, the panel co-integration test can be applied. The Pedroni-Johansen co-integration test comprises four within-dimension statistics and three between-dimension statistics. Considering the co-integration relationship among variables, the short- and long-term estimations can be done by conducting the ARDL (autoregressive distributed lag) model with the error correction pattern. Equation (2) represents the general form of the ARDL approach:

$$Y_{it} = \sum_{j=1}^{p} \alpha_{ij} y_{i,t-j} + \sum_{j=0}^{q} \beta_{ij} X_{i,t-j} + \mu_i + \varepsilon_{it} \tag{2}$$

In Eq. (2), Y is the dependent variable, while X represents the explanatory and control variables. μ_i shows the group-specific effect. Equation (2) does not include the error correction term (ECM), which is a sign of equilibrium. Hence, Eq. (2) can be rewritten as Eq. (3) as follows:

$$\Delta Y_{it} = \delta_i \left(y_{i,t-1} - \beta_i X_{i,t} \right) + \sum_{j=1}^{p-1} \gamma_{i,j} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \lambda_{i,j} \Delta X_{i,t-j} + \mu_i + \varepsilon_{it} \tag{3}$$

Table 1 Information of variables

Role in model	Variable	Symbol	Unit	Source
Dependent variable	Green innovation efficiency of tourism industry	ST	–	Calculated based on Sun et al. (2022) and Song and Han (2022)
Explanatory variable	The consumer price index	INF	–	National Bureau of Statistics of China
	Digital economic index	DEI	–	Calculated based on Xu and Li (2022)
	Foreign direct investment	FDI	Billion US dollars	Bulletin of FDI in China (Ministry of Commerce of the People's Republic of China)
Control variable	Political stability index	PSI	(−2.5 weak; 2.5 strong)	China Statistical Yearbook

Source: Authors

Table 2 Pesaran CD test' results

Variable	Stat	*P* value
LnST	67.53	0.00
LnINF	70.81	0.00
LnDEI	29.48	0.00
LnFDI	64.93	0.00
LnPSI	66.38	0.00

ST, INF, DEI, FDI, and PSI represent green innovation efficiency of tourism industry, the consumer price index, digital economic index, foreign direct investment, and political stability index, respectively. Source: Authors

Table 3 Panel unit root tests' findings

	LLC		ADF−Fisher	
	level	First difference	level	First difference
LnST	−5.03 (0.00)	–	100.49 (0.00)	–
LnINF	−0.69 (0.15)	−12.58 (0.00)	56.48 (0.52)	177.48 (0.00)
LnDEI	2.83 (0.84)	−14.93 (0.00)	57.33 (0.27)	199.33 (0.00)
LnFDI	4.65 (0.96)	−10.33 (0.00)	30.68 (0.95)	165.39 (0.00)
LnPSI	2.04 (0.58)	−12.88 (0.00)	35.55 (0.11)	144.75 (0.00)

ST, INF, DEI, FDI, and PSI represent green innovation efficiency of tourism industry, the consumer price index, digital economic index, foreign direct investment, and political stability index, respectively

Numbers in () show *p* values. Source: Authors

where Y shows green innovation efficiency of tourism industry (ST) for province i at time t in China, while X comprises explanatory variables of consumer price index (INF), digital economic index (DEI), and foreign direct investment (FDI), and the control variable of political stability index in Chinese province of i at time t. β represents long-term relationship between variables, whereas λ depicts short-run relationship.

5 Empirical results and discussion

As the first step, the Pesaran CD test is employed to check the existence of cross-sectional dependency. The results are reported in Table 2 as follows:

The findings listed in Table 2 confirm the presence of cross-sectional dependency. Next, the stationary of variables is evaluated through two-panel unit root tests. Table 3 represents the results of LLC and ADF-Fisher tests:

The two-panel unit root tests reveal that LnST is stationary at level, while the other three variables become stationary at the first difference. Therefore, all variables of the model are I (0) or I (1). Due to the nature of stationary variables, the

Table 4 Pedroni-Johansen panel co-integration test

	Stat	Probability
Within-dimension		
Panel v-statistic	3.7544	0.0003
Panel rho-statistic	1.5043	0.9554
Panel PP-statistic	− 1.8543	0.0439
Panel ADF-statistic	− 4.0654	0.0000
Between-dimension		
Group rho-statistic	2.8842	0.9947
Group PP-statistic	− 1.9843	0.0439
Group ADF-statistic	− 3.04588	0.0029

Source: Authors

Table 5 Estimation of coefficients

Explanatory variable	Coefficient	*P* value
	Long-term approach	
LnINF	− 0.039	0.0053
LnDEI	0.043	0.0182
LnFDI	− 0.029	0.0074
LnPSI	0.339	0.094
	Short-term approach	
ECT	− 0.0392	0.0023
D (LnINF)	− 0.115	0.2833
D (LnDEI)	0.2273	0.0011
D (LnFDI)	− 0.0435	0.3804
D (LnPSI)	0.0384	0.003
Intercept	− 0.2293	0.0723

Likelihood ratio statistic: 149.339, *P* value (0.000)

Hausman test: 4.43, *P* value (0.294)

INF, DEI, FDI, and PSI represent the consumer price index, digital economic index, foreign direct investment, and political stability index, respectively. Source: Authors

panel co-integration test can be carried out. The results of the Pedroni-Johansen co-integration technique are reported in Table 4. For five out of seven, statistics show that the co-integration relationship exists among variables.

According to the panel unit root and co-integration tests, the coefficients of variables are estimated through the pooled mean group (PMG) technique in the ARDL framework. Table 5 reports the results of the estimations.

According to the obtained results, the increase in the general level of prices has a significant and long-term adverse effect on the sustainable development of the tourism industry in the provinces of China. In contrast, the effect of this variable is not significant in the short term. The increase in the price level of goods and services increases the cost of the activities of tourist companies. Also, the high price of goods

and services increases the cost of travel and transport for individuals, which reduces the desire of people to do tourism in a country with a high price level. Improving the level of information and communication technology (digital economy index) has a positive and significant coefficient in the short and long term. In other words, with a 1% improvement in the digital economy index, the sustainable development of tourism in China's provinces will increase by 0.43% and 0.22% in the short and long term, respectively. Improving the digital economy index will reduce many of the costs of tourist companies and therefore increase their financial strength to advance sustainable tourism development goals. Improving the digital economy index will reduce many of the costs of tourist companies and therefore increase their financial strength to advance sustainable tourism development goals. In addition, foreign tourists will learn about sustainable tourism more easily and without a time limit through the electronic platform, and it will become more attractive to sustainable tourism. Foreign direct investment has a negative and significant long-term effect on the sustainable development of the tourism industry in Chinese provinces. However, the impact of this variable in the short term is not statistically significant. The negative sign of the coefficient of the foreign direct investment variable is that the share of green foreign direct investment, which can be the driving factor of green projects in tourism, is low. Therefore, the improvement of foreign direct investment leads to an increase in the consumption of fossil fuels and to make the lack of progress in environment-friendly tourism in Chinese provinces. The coefficient of the political stability index is positive and significant, expressing that any improvement in political stability throughout China may promote the sustainable development of the tourism industry.

The two diagnostic tests are conducted to ensure the validity of the empirical model. The likelihood ratio statistic and Hausman test confirm the homogeneity of slopes in the long term.

The coefficients have been estimated for 23 Chinese provinces. However, it should be noted that the level of per capita income can lead to a difference in the relationship between the variables (Taghizadeh-Hesary et al. 2021; Rasoulinezhad & Mostaghimi Ghomi 2022). To this end, the effect of the role of the income level of Chinese provinces on the pattern of sustainable tourism development is measured and compared by examining the coefficients of the variables for the group of provinces with a high-income level (Beijing (183,900 RMB), Shanghai (173,800 RMB), Jiangsu (137,300 RMB), Fujian (117,500 RMB), Zhejiang (113,900 RMB), Tianjin (113,200 RMB), and Guangdong (98,700 RMB)) and seven provinces with the lowest income level, in 2021. The data for the income levels of Chinese provinces in 2021 are gathered from China Briefing (2022). The estimation results for two groups of Chinese provinces are represented in Table 6:

Regarding the high-income provinces in China, the estimated coefficients confirm the statistically significant impacts of all variables in the short and long term. Despite the negative impact of inflation and the digital economic index, FDI positively impacts the sustainable tourism process in these provinces. In addition, the magnitudes of long-term variables' impacts are more extensive than those in the short term. In other words, the efficiency of examined explanatory variables' impacts is more long term.

Table 6 Estimation results for high-income and low-income Chinese provinces

Explanatory variable	High-income provinces		Low-income provinces	
	Coefficient	*P* value	Coefficient	*P* value
	Long-term approach		Long-term approach	
LnINF	−0.0032	0.0008	−0.2832	0.0019
LnDEI	0.5832	0.0239	0.148	0.0064
LnFDI	0.0039	0.0039	−0.1930	0.0238
LnPSI	0.0175	0.0011	0.4832	0.0042
–	Short-term approach		Short-term approach	
ECT	−0.0699	0.0018	−0.02819	0.0003
D (LnINF)	−0.0118	0.0002	−0.6163	0.0211
D (LnDEI)	0.2900	0.02811	0.0993	0.0002
D (FDI)	0.0003	0.0482	−0.0211	0.0029
D (PSI)	0.075	0.0018	0.0113	0.0381
Intercept	−0.3922	0.0482	−0.0274	0.0038

INF, DEI, FDI, and PSI represent the consumer price index, digital economic index, foreign direct investment, and political stability index, respectively. Source: Authors

The estimations for low-income provinces depict that the impacts of all explanatory variables are statistically significant in both the short and long term. The digital economy index has an accelerated role in promoting the sustainable tourism process in these provinces, while FDI negatively influences this process.

The comparison of impacts of the examined independent variables on the sustainable tourism process in the high-income and low-income provinces in China shows that:

First, the adverse effect of inflation on the sustainable development of the tourism industry in low-income provinces is greater than the inappropriate impacts of inflation in high-income provinces in China. When a province's level of per capita income is low, there is undoubtedly enough capital to compensate for the increase in the price of goods and services. In other words, "financial and economic resilience" is low in such a province. Therefore, the process of sustainable tourism faces more problems with the increase in inflation than the province with high income (having more financial and economic resilience).

Second, the impact of foreign direct investment on the sustainable development of the tourism industry in the short term and the long term is positive in high-income provinces and negative in low-income provinces. In other words, high-income provinces have a more excellent attitude toward sustainable development because, on the one hand, the people of the society have a higher-income level and can participate more in the fields of sustainable development. On the other hand, "FDI-attracting industries" have adequate capabilities in technology transfer and greening of their activities. Haque et al. (2022) expressed that it is possible to create green foreign direct investment in high-income economies, and in middle-income and low-income economies, attracting foreign direct investment is considered a significant challenge.

Third, in both income groups of provinces in China, ICT development (proxy of the digital economy index) has a more significant positive effect in the long term. The estimated coefficients of this variable confirm that the magnitude of impact on the sustainable development of the tourism industry is more remarkable in high-income and low-income provinces. Based on Kabir et al. (2022), higher income makes more people willing to use electronic platforms in the field of economy.

6 Conclusions and policy recommendations

6.1 concluding remarks

The threat of climate change and the advancement of sustainable development goals to control and reduce this threat have been among the priorities of the countries of the world in recent decades. The tourism sector can play an essential role in promoting sustainable development goals by implementing sustainable processes (under the title of sustainable tourism) due to the potential of foreign exchange income, social interactions, and the wide range of services (transportation, hospitality, etc.). This research focused on 23 provinces of China and sustainable tourism modeling according to the annual data of 2010–2021. Also, the effects of explanatory variables in sustainable tourism modeling were done based on two groups of high-income and low-income provinces to obtain more accurate results for sustainable tourism policy in different provinces of China. According to the obtained results, for all Chinese provinces, the increase in the general level of prices has a significant and long-term adverse effect on the sustainable development of the tourism industry in the provinces of China. In contrast, the effect of this variable is not significant in the short term.

Furthermore, improving information and communication technology (digital economy index) has a positive and significant coefficient in the short and long term. Foreign direct investment has a negative and significant long-term effect on the sustainable development of the tourism industry in Chinese provinces. However, the impact of this variable in the short term is not statistically significant. Furthermore, the concluding remarks of sustainable tourism modeling for high-income and low-income Chinese provinces are that the adverse effect of inflation on the sustainable development of the tourism industry in low-income provinces is greater than the inappropriate impacts of inflation in high-income provinces in China. Moreover, the impact of foreign direct investment on the sustainable development of the tourism industry in the short term and the long term is positive in high-income provinces and negative in low-income provinces. In addition, in both income groups of provinces in China, ICT development (proxy of the digital economy index) has a more significant positive effect in the long term. The estimated coefficients of this variable confirm that the magnitude of impact on the sustainable development of the tourism industry is extraordinary in high-income and low-income provinces.

6.2 Policy implications

According to the concluding remarks, the following practical policies are recommended:

- For low-income Chinese provinces, developing a green financing market is recommended to promote green projects regarding sustainable tourism. Due to the lack of sufficient capital in these provinces, green projects need private participation, which can be increased through green financing tools that lower investment risk and improve return on investment. Zhou and Xu (2022) found a positive impact of green finance on promoting environmental protection in China's regions.
- Improving the business environment of small- and medium-sized enterprises in the field of sustainable tourism in China's low-income provinces is considered an effective practical policy. It will improve the business environment by creating various incentives such as tax exemptions and green loans, reducing administrative bureaucracies of economic activities, and amending the rules of small and medium enterprises in low-income provinces of China.
- In high-income provinces, creating a digital green financing market (recommended by Wang et al. 2022) is an effective practical policy. Due to the development of digital economy infrastructure in these provinces, it is possible to digitize the green financing market for the better promotion of sustainable tourism projects.
- Another critical strategic and practical policy is the overflow of part of the government's income from sustainable tourism profits in high-income provinces to improve the level of sustainable tourism in low-income provinces. Such a practical policy will narrow the sustainable development gap in the tourism sector in low-income and high-income provinces in China.

6.3 Suggestions for future research expansions

Despite this research's practical and innovative contributions to the existing literature, some limitations prevented the results from being complete. Therefore, it is suggested that in future research, efforts should be made to remove these limitations and complete the findings for a more effective policy in the field of the sustainable tourism industry in China. First, in future research, the effect of Corona disease on the sustainable development of China's tourism industry should be considered and analyzed. Corona disease, which started in the Chinese city of Wuhan in late 2019, profoundly impacted the tourism activities of China and countries around the world. Therefore, it is recommended to study this work in modeling sustainable tourism in China. In future research, the data of the variables should be expanded so that it is possible to perform a time series analysis for different provinces of China.

Declarations

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