

Research on the Value Accounting and Industrial Impact of Ecosystem Tourism Health Services in Xiamen City

Jiayi Yang^{1,2,a}, Haiyan Bu^{2,b}, Chaoyang Feng^{1,c}, Yanni Gao^{1,*d},
Xinyi Fu^{1,2,e}

¹State Environment Protection Key Laboratory of Regional Eco-process and Function Assessment, Chinese Research Academy of Environmental Sciences, Beijing 100012, China;

²College of Ecology, Lanzhou University, Lanzhou 730000.

^ajyyang0929@163.com, ^bhybu@lzu.edu.cn, ^cfengchy@craes.org.cn, ^dgaoyan@craes.org.cn, ^ekatharinafx@163.com

Abstract. The tourism health services provided by the ecosystem is one of the important components of ecological products and one of the main paths for the transformation from green waters and mountains to golden mountains and silver mountains. It not only achieves value transformation through tourist tourism health activities, but also drives the development of related sectors to indirectly transform value. This article uses the input-output method to calculate the value of ecosystem tourism health services in Xiamen City in 2017. Based on this, relevant sector impact analysis was conducted to provide support for improving the ecological product value evaluation technology system and expanding the value realization path. The results show that the value of ecosystem tourism health services in Xiamen in 2017 is 64,767 billion yuan, with a contribution rate of 14.88% to GDP; The added value of tourism health services is 7,292 billion yuan, contributing 12.85% to the GDP added value. The driving effect of tourism health services in Xiamen on the national economy is higher than its driving effect, with a reaction coefficient of 1.146 and an influence coefficient of 0.745, respectively. Among them, the impact on infrastructure construction, finance and high-tech sectors is relatively large. The complete consumption coefficient is 0.841, 0.408 and 0.102 respectively, and the complete distribution coefficient is 0.145, 0.243 and 0.533 respectively. The identification of the main influencing sectors can provide an important foundation for further carrying out sector contribution rate accounting, accurately quantifying the value of ecological products, and promoting model path innovation.

Keywords: Tourism health services; Value accounting; Input-output method; Sector impact; Xiamen City.

The realization of the value of ecological products is a key path to implement the concept of "green waters and mountains are golden mountains and silver mountains"^[1], which is of great significance for promoting comprehensive green transformation of economic and social development^[2,3]. Ecological products refer to the contribution of goods and services provided and used by ecosystems for economic and other human activities. Ecosystem tourism health services are one of the important components of ecological products^[4], and also one of the indicators with sufficient marketization paths^[5-7].

Tourism health services not only achieve value transformation through tourists' tourism health experience process, but also indirectly realize value transformation by driving the development of related sectors due to the beautiful ecological environment. The current body of research primarily focuses on accounting for the former, and popular approaches include the conditional value method and the travel cost method. The travel cost method is a nonmarket value evaluation method of tourism resources based on consumer choice theory, and it uses the direct cost of consumer ecological environment services plus consumer surplus to determine the price of the ecological product. This method was recognized as a priority method for evaluating recreational value by relevant institutions in countries such as the United States and the United States in the late 20th century^[8], and it has also been widely used in China^[9-11]; The conditional value method evaluates the use value of tourism resources by asking tourists' willingness to pay or accept compensation in

the form of a survey questionnaire [12,13]. The accuracy of the results is mainly influenced by the subjective willingness to pay or compensate of the respondents and the overall scope expansion [14].

The Input Output Method is a quantitative analysis method that studies the interdependence between input and output among various sectors or sectors in the economic system by compiling inter sectoral input-output tables [15]. At the national level and in various regions of China, input-output tables are compiled every five years. This method can be used to study the correlation between tourism health and other sector through sectoral subdivision. For example, Liu Xiaoxin et al. [16] used input-output tables in 2001 and 2007 to analyze the macroeconomic effects of the tourism sector. Artal Tur A et al. [17], Patandianan V M et al. [18], and Hyunae L et al. [19] scholars studied the impact of tourism on local economic development in Spain, Shizuoka Prefecture, Japan, and Seoul District, South Korea, respectively. In addition, the input-output method has also been applied to quantitative analysis of the tourism sector's correlation structure, sector efficiency, integrated development path, and economic contribution [20-22].

This study selects Xiamen City, which is rich in ecotourism resources, as the research area. Using the latest 2017 input-output table, the value of ecosystem tourism health services is calculated, and its correlation and impact with the overall national economy and various sectors are analyzed. The aim is to systematically grasp its impact on the social economy, provide support for further accounting for the contribution rate of related sectors, and improve the scope of ecological product value conversion accounting. At the same time, it provides reference for the integrated development and model path innovation of the tourism health and related sectors.

1. Research methods and data sources

1.1 Overview of the research area

Xiamen City is located in the southeast of Fujian Province, between 24°23' -24°54'N and 117°52'-118°26'E. It has six districts and a total area of 1700.61 km². Among them, Xiamen Island has a land area of 151.93 km² (including Gulangyu) and a sea area of approximately 355 km². Xiamen is a special economic zone approved by the State Council in China, as well as an important central city and scenic tourist city along the southeast coast [23]. There are numerous recreational resources such as subtropical scenery, seaside beaches, and natural scenic spots within the jurisdiction, including twenty-one 3A level or above scenic spots, ten mountains and sea corridors with northern mountainous areas as the main body, sixty-four green spaces with an area of more than 200 km², and fifty-six park green spaces (Figure 1).

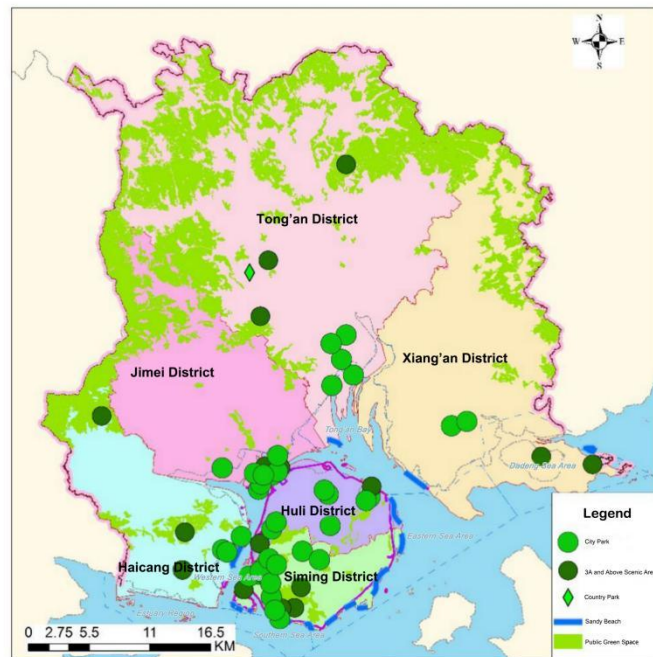


Fig.1 Spatial Distribution of Recreational Resources in Xiamen City

1.2 Research Methods

1.2.1 Introduction to input-output method

The input-output table is the core foundation of the input-output method [24], which reflects the relationship and degree of correlation between industrial sectors based on the distribution and flow of raw materials and original inputs consumed by each sector or sector in the national economic system over a certain period of time. According to different measurement units, it can be divided into value based input-output tables and physical based input-output tables[25]. This study used value based input-output tables, which are shown in Table 1. According to different research purposes, the sectors of the input-output table can be merged or split to form an extended input-output table. When dividing sectors, three principles are usually met: the assumption of "pure"sectors, the assumption of stability of direct consumption coefficients, and the assumption of proportionality [26].

Table 1. Value based input-output table composition

		Input sectors					final product	Total output
		Sector1	Sector2	...	Sectorn	Total		
Output sectors	Sector1	x_{11}	x_{12}	...	x_{1n}	$\sum x_{1j}$	Y_1	X_1
	Sector2	x_{21}	x_{22}	...	x_{2n}	$\sum x_{2j}$	Y_2	X_2

	Sectorn	x_{n1}	x_{n2}	...	x_{nn}	$\sum x_{nj}$	Y_n	X_n
	Total	$\sum x_{i1}$	$\sum x_{i2}$...	$\sum x_{in}$	$\sum \sum x_{ij}$	$\sum Y_i$	$\sum X_i$
Initial input	consumption of fixed capital	D_1	D_2	...	D_n	$\sum D_j$		
	remuneration for workers and staff	V_1	V_2	...	V_n	$\sum V_j$		

	Net Taxes on Production	S_1	S_2	...	S_n	$\sum S_j$		
	Operating surplus	M_1	M_2	...	M_n	$\sum M_j$		
	Total input	X_1	X_2	...	X_n	$\sum X_j$		

1.2.2 Compilation of input-output table for tourism health expansion in Xiamen and calculation of the value of tourism health services

It is determined that the tourism health sector involves nine economic sectors, including accommodation and catering, finance, wholesale and retail, transportation, warehousing and postal services, public facility management, information transmission software and information technology, resident service repair, and water conservancy, based on the survey results of the leisure service questionnaire in Xiamen [27] and analysis of relevant economic sectors for tourism health consumption. According to the category of tourism consumption expenditure and the purpose of tourists' travel, the statistical items related to tourism health consumption are separated to form a tourism health sector. On this basis, based on the industrial characteristics of each sector, the forty-two sectors in the input-output table of Xiamen City are merged into seven sectors, including real estate sector, agriculture, forestry, animal husbandry and fisheries sector, high-tech sector, traditional manufacturing sector, finance sector, and other sector. Please refer to Table 2 for details.

Table 2. Input output table of Xiamen tourism health expansion division of sectors

Sector category	Corresponding to the sectors in the input-output table of forty-two sectors	Sector description
Agriculture, forestry, animal husbandry and fisheries sector	Agricultural, forestry, animal husbandry and fishing products and services	Agricultural, forestry, animal husbandry and fishing products and services
Real estate sector	Construction, real estate,	Construction and real estate sectors
High-tech sector	Computers and other electronic equipment, communication equipment, electrical machinery and equipment, information transmission, instruments and meters, software and information technology, specialized equipment,	sectors in the national economy including electronic components and digital economy+instruments and meters
Traditional manufacturing sector	Coal mining and processing products, chemical products, educational and sports goods, electricity Production and supply of heat, gas production and supply, metal mining and processing products, metal products, metal smelting and rolling processing products, non-metallic and other mining and processing products, paper printing and cultural, petroleum, coking products and nuclear fuel, petroleum and natural gas	The heavily polluting sectors include sixteen sectors, including cement, coal, chemical sector, thermal power, steel, electrolytic aluminum, metallurgy, petrochemicals, building materials, papermaking, textiles, brewing, pharmaceuticals, fermentation, tanning, and mining.

	mining and processing products, textiles, textiles, clothing, shoes, hats, leather, down and its products, wood processing products and furniture, non-metallic mineral products, processing products ^[28]	
Infrastructure sector	Transportation equipment, production and supply of water, transportation, water conservancy, warehousing and postal services, environmental and public facility management, metal products, sports and entertainment, health and social work, machinery and equipment repair services, education, leasing and business services, resident services, research and experimental development, public management, comprehensive technical services, repair and other services, culture, social security and social organizations	Infrastructure includes municipal public engineering facilities such as postal, water and power supply, transportation, and landscaping, telecommunications, commercial services, health services, cultural education, environmental protection, scientific research and technical services, and public life service facilities.
Finance sector	Finance	Finance
Other sector	Food and tobacco, other manufactured products and waste materials, general equipment, wholesale and retail, accommodation and catering ^[29]	Other sectors
Tourism health sector	Wholesale and retail, finance, accommodation and catering, transportation, warehousing and postal services, environmental and public facility management, software and information technology, leasing and business services, water conservancy, resident services, repair and other services, culture, information transmission, sports and entertainment	Economic sectors involved in tourism health consumption (after divestment)

According to the assumption of "pure" sectors, based on the proportion of ecological tourism resources in Xiamen and the proportion of tourism health tourists to the total number of tourists, the tourism health consumption stripping coefficient^[30] is calculated, and the tourism health output part is stripped from the industrial output involved. The final consumption and export parts corresponding to "column decomposition" obtain the final consumption quadrant. According to the stability assumption and proportionality assumption of the direct consumption coefficient, the "column decomposition" intermediate input quadrant obtains the corresponding intermediate input splitting ratio. The "line breakdown" of various sectors includes tourism and non tourism health consumption lines. In the middle input quadrant, the tourism health consumption parts decomposed from each sector will be merged.

Based on the balance relationship of the input-output table and the decomposition vector of each total indicator, the matrix calculation is completed using the double proportional scale method to form the input-output table for the expansion of tourism health in Xiamen. The total output of the tourism health sector is the value of tourism health services in Xiamen City that year.

1.2.3 Analysis of the impact of Xiamen's tourism health sector

This study analyzes the impact of the tourism health sector from both sectoral and national economic perspectives. At the sectoral level, we mainly analyze the driving and promoting effects of tourism health on related sectors, using consumption coefficient and distribution coefficient to characterize [31]. Among them, the direct consumption coefficient represents the direct driving ability of tourism health to related sectors[32], while the complete consumption coefficient represents the sum of direct and indirect driving abilities; The direct distribution coefficient represents the direct driving ability, while the complete distribution coefficient represents the sum of direct and indirect driving abilities [33-36]. When the values of each indicator are close to or equal to 0, it indicates that there is no correlation between the two sectors. When they are between 0.001 and 0.01, they indicate a relatively close correlation. When they are greater than 0.01, they indicate a close correlation.

At the national economic level, the sensitivity coefficient and influence coefficient are selected to analyze the industrial spillover effect, that is, tourism health causes overall changes in the national economy by influencing directly related sectors. Among them, the sensitivity coefficient represents the driving ability of the final output of tourism health sector to the total output of the entire national economy, while the influence coefficient represents the degree to which the final demand for tourism health sector promotes the scale of social production [35-37]. The calculation method of sensitivity coefficient and influence coefficient is similar. When the value is greater than 1, it indicates that the sensitivity or influence ability of the sector is higher than the average level of each industrial sector. The larger the value, the stronger the sensitivity or influence ability. The calculation formulas and explanations for each indicator are shown in Table 3.

Tab 3 Xiamen tourism health sector impact analysis index introduction

index	Formula	Symbol Meaning
Direct consumption coefficient	$a_{ij} = \frac{x_{ij}}{X_j} (i, j = 1, 2, \dots, n)$	A_{ij} represents the direct consumption coefficient, x_{ij} is an element of the input-output table, and X_j represents the total input of each department that produces the products of the j th department[38]
Complete consumption coefficient	$B = (I - A)^{-1} - I$	B is the complete consumption coefficient matrix, A is the direct consumption coefficient matrix, and the elements in A are a_{ij}
Direct distribution coefficient	$h_{ij} = \frac{x_{ij}}{X_i + M_i} (i, j = 1, 2, \dots, n)$	H_{ij} is the direct distribution coefficient, $X_i + M_i$ represents the total supply of goods or services in the i -th sector (domestic production plus imports)[39]
Complete distribution coefficient	$W = (I - H)^{-1} - I$	W is the complete distribution coefficient matrix, H is the direct distribution coefficient matrix, and the elements in H are h_{ij}

influence coefficient	$F_j = \frac{\sum_i q_{ij}}{n \sum_j \sum_i q_{ij}} (i, j = 1, 2, \dots, n)$	Q_{ij} is the corresponding element of the Leontief inverse matrix $Q, Q=(1-A)^{-1}$
sense degree coefficient	$P_i = \frac{\sum_j q_{ij}}{n \sum_j \sum_i q_{ij}} (i, j = 1, 2, \dots, n)$	Q_{ij} ditto

1.3 Data sources

The 2017 input-output table (forty-two sectors) of Xiamen City used in this study was sourced from the Xiamen Municipal Bureau of Statistics, while other statistical data was sourced from the Statistical Yearbooks and Statistical Development Bulletin of Xiamen and Fujian Province. The questionnaire survey data was sourced from "Ecosystem Production Value Accounting and Business System Research: Taking Xiamen City as an Example" [27].

2. Results and Analysis

2.1 The value of ecosystem tourism health services in Xiamen City

The value of ecosystem tourism health services in Xiamen calculated using the input-output method is 64.767 billion yuan, which contributed 14.88% to the regional gross domestic product (GDP) of Xiamen that year; The output of tourism health accounted for 5.35% of the total output of various sectors in the input-output table for the year, which is higher than that of the finance sector, agriculture, forestry, animal husbandry, and fisheries sector (Figure 2). The added value of tourism health services is 7.292 billion yuan, accounting for 12.85% of the GDP added value and 11.26% of the total output of tourism health services; The added value of tourism health output accounted for 1.78% of the total output added value of each sector in the input-output table that year, which is higher than that of the agriculture, forestry, animal husbandry, and fisheries sector.

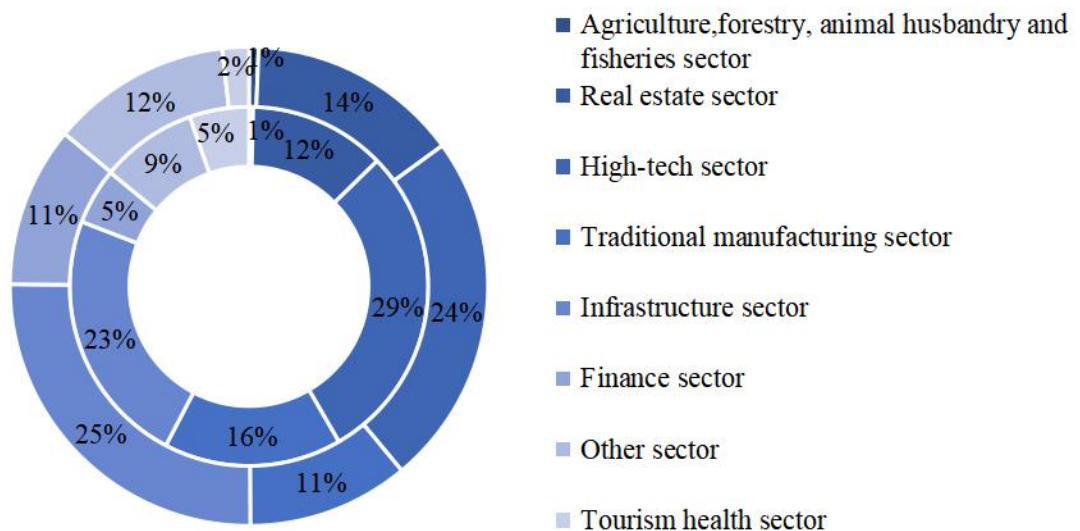


Fig.2 Contribution rate of each sector to the total output (internal) and added value (external)

l) of the input-output table

2.2 The impact of Xiamen's tourism health sector on related sectors

Xiamen's tourism health have a strong direct driving effect on infrastructure construction, finance, other, and high-tech sectors, with direct consumption coefficients of 0.446, 0.259, 0.168, and 0.014, respectively. Among them, the direct driving effect on the infrastructure construction sector is significantly greater than that of other sector (Figure 3). It has a strong direct driving effect on the financial, other, and infrastructure construction sectors, with direct distribution coefficients of 0.273, 0.094, and 0.093, respectively. If indirect effects are considered, the driving and promoting effects of tourism health in Xiamen on infrastructure construction, finance, other and high-tech sectors have significantly increased, with complete consumption coefficients of 0.841, 0.408, 0.282, 0.292, and complete distribution coefficients of 0.145, 0.243, 1.023, and 0.533, respectively. In addition, it is closely related to traditional manufacturing sector, real estate sector, agriculture, forestry, animal husbandry, and fisheries sector, with complete consumption coefficients of 0.292, 0.067, and 0.013, respectively. The complete distribution coefficients with traditional manufacturing and real estate are 0.134 and 0.091, respectively.

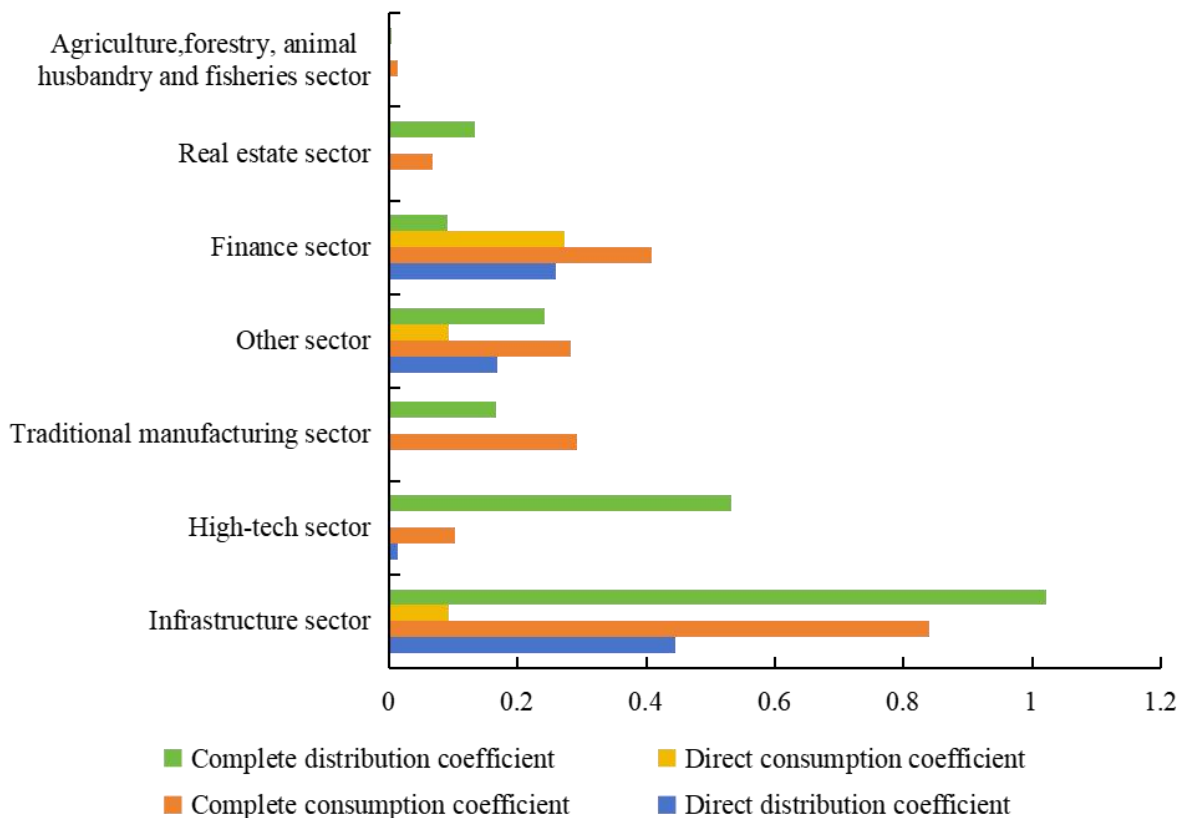


Fig3 The correlation effect of tourism health on relevant sectors in Xiamen

Overall, the direct driving effect of tourism health in Xiamen on various sectors is stronger than the direct driving effect, and the comprehensive driving effect is stronger than the comprehensive driving effect. Among them, the direct and comprehensive driving effects on the infrastructure construction sector rank first among all sectors, followed by the financial sector. The traditional manufacturing sector leapt to third place after considering the indirect driving effect. The direct

driving effect on the financial sector ranks first among all sectors, and the comprehensive driving effect ranks third, lower than other and high-tech sectors. The direct driving effect of tourism health in Xiamen on other and high-tech sectors is stronger than the direct driving effect, but the comprehensive driving effect is significantly stronger than the comprehensive driving effect.

2.3 The impact of Xiamen's tourism health sector on the national economy

The sensitivity coefficient of the tourism health sector in Xiamen is higher than the influence coefficient, with a sensitivity coefficient of 1.146 and an influence coefficient of 0.745. The former is higher than the average level of each sector, while the latter is lower than the average level of each sector, indicating that the tourism health sector has a stronger driving effect on the overall national economy than a driving effect (Figure 5). From the numerical results of various sectors, it can be seen that the sensitivity coefficient of the tourism health sectors in Xiamen is lower than that of traditional manufacturing and high-tech sectors, and is approximately equivalent to the values of the real estate and infrastructure construction sectors. The coefficient of influence is only higher than that of the agriculture, forestry, animal husbandry, and fisheries sector, as well as the real estate sector, slightly smaller than that of the financial sector. Compared with other sector, the numerical difference is relatively large, indicating that the integration and development ability of Xiamen's tourism health sector with other sector still needs to be strengthened. In the future, further efforts should be made to enhance the innovation of tourism health development paths, expand the integration mode of tourism health sector, and enhance the impact of tourism health on the national economy.

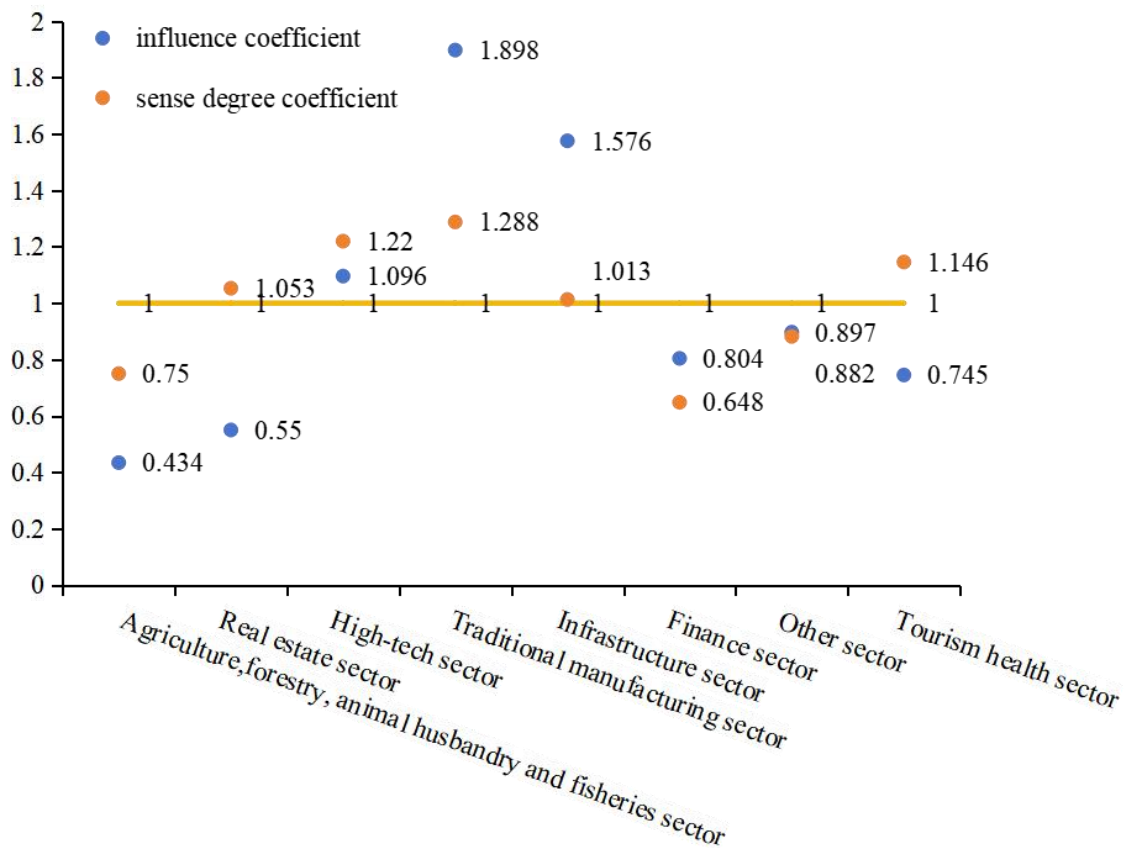


Fig.4 The ripple effect of tourism health sector on national economy in Xiamen

3. Discussion

This article includes tourism health as an independent sector in the input-output table. On the one hand, it can carry out the value accounting of tourism health services under the national economic accounting system, making it consistent with the national economic accounting data; On the other hand, it can identify the impact of tourism health on related sectors, and promote precise quantification of the value of ecological products. There is still uncertainty in the following aspects of this article, which needs to be further studied and improved.

3.1 Impact of sector division

This study obtained independent tourism health sectors and related sectors through the classification, restructuring, and divestment of forty-two sectors in the input-output table. In the process of sector reclassification, the correlation between other sector and tourism health was ignored, which had a certain impact on the accuracy of the calculation and analysis results. In subsequent research, a more in-depth analysis of the internal connections between various sectors should be conducted to further improve the pertinence of sector re division, and thereby improve the accuracy of ecosystem tourism health service value evaluation and industrial impact analysis.

3.2 Assessing the impact of the area

The current research area covers the entire city of Xiamen. Due to significant regional differences in the distribution of recreational resources and uneven economic development among different districts, subsequent research should be conducted based on the types and distribution characteristics of recreational resources, as well as economic development characteristics, to further carry out relevant research in different regions and improve the precise identification ability of the impact of tourism health related sectors, Provide more comprehensive basic support for promoting the integrated development of tourism health sectors and innovating model paths in various regions according to local conditions.

3.3 Assessment of the impact of time

The preparation cycle of China's input-output table is five years. Due to the fact that the Xiamen Municipal Bureau of Statistics has not yet completed the preparation of the input-output table for 2022, there is a certain time lag in the research results based on the input-output table for 2017. In further research, data from other years should be expanded, and long-term series comparative analysis should be carried out through the preparation of multiple tourism health extension input-output tables to achieve more accurate analysis and trend prediction.

4. Conclusion

(1) The value of ecosystem tourism health services in Xiamen calculated using the input-output method is 64.767 billion yuan, accounting for 5.35% of the total output of various sectors in the input-output table for that year, and contributing 14.88% to the regional gross domestic product (GDP) of Xiamen in that year. The added value of tourism health services is 7.292 billion yuan, accounting for 11.26% of the total output of tourism health services, and contributing 12.85% to the GDP added value.

(2) Xiamen's tourism health have a strong direct driving effect on infrastructure construction, finance, other and high-tech sectors, and have a strong direct driving effect on the finance, other and infrastructure construction sectors among them. If indirect effects are considered, the driving and promoting effects of tourism health in Xiamen on these four sectors have significantly increased. Overall, the direct driving effect of tourism health in Xiamen on various sectors is stronger than the direct driving effect, and the comprehensive driving effect is stronger than the comprehensive driving effect.

(3) The driving capacity of tourism health in Xiamen to the national economy is relatively strong, higher than that of agriculture, forestry, animal husbandry, fisheries, finance, other sector, real estate, and infrastructure construction, and above the average level of each sector. However, the driving effect on the national economy is relatively low, lower than the average level of various sectors, and only higher than the agriculture, forestry, animal husbandry, and fisheries sector and the real estate sector.

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