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Determining the Degree of Connection between the Development of the Sports Industry and Economic Growth in the Regional Context: Evidence from 31 Provinces in China

Abstract. One of the components of the rapid development of China's economy is the development of the sports industry. The exacerbation of the COVID-19 epidemic has led to the introduction of quarantine measures and a significant reduction in the share of the sports industry in the structure of China's Gross Domestic Product. To form instruments that will lead to economic development, it is important to identify regions in which the promising direction of development is the sports industry. The aim of the article is determining the degree of connection between the development of the sports industry and economic growth in the regional context using coupling coordination model (Evidence from 31 Provinces in China). This paper uses the commercial entropy method and the coupling coordination model to calculate the coupling and coordinated development of the sports industry and high-quality economic development in 31 Provinces in China from 2010 to 2020. The results of research give a base for the distribution of regions for the degree of connection between the development of the sports industry and economic growth. Firstly, the degree of connection between the development of the sports industry and economic growth in the eastern region is in a state of primary coordination, good coordination and high-quality coordination, and Guangdong Province has achieved obvious performance. Secondly, as for the eastern region, it has witnessed rapid economic development, and the sports industry is obvious. Thirdly, the degree of connection between the development of the sports industry and economic growth in central provinces is in a state of barely coordination, on the verge of disorder and mild recession. It's confirmed that the development of the sports industry can provide impetus for China's economic growth, and the further development of economy can also promote the rapid development of the sports industry. The two are interconnected and promote each other, which is a benign circular industry system. Only by constantly optimizing the development mode of China's sports industry and creating a high-quality market operation mechanism the development of the sports industry and the Chinese economy can be realized. This research will be useful for the state-managers in a sphere of regional development. Also, the results of this research will be used by the top-managers of the sports industry when choosing a region for business development and expanding the network of sports services

Keywords: economic development; COVID-19; coupling coordination model; high-quality economic development

INTRODUCTION

China's socialist market economy continues to develop and grow, and the rapid development of the sports industry is gradually progressing steadily. The sports industry is gradually developing and has become an important supporting emerging industry to directly promote the healthy economic growth of China in the new era. COVID-19 outbreak brought adverse effects for China's sports industry development in order to promote the outbreak era of China's sports industry high quality development, accelerate the reform and innovation, opening up to the outside world, accelerate industrial transformation and development and upgrading of modern economic and social development innovation mode of important formation stage. The critical time is to promote the construction of contemporary

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sports revitalization as well as the rapid and healthy development of the sports industry at this important historical critical moment. It is conducive to promoting further development of China's sports industry to accelerate the in-depth development of the supply-side industrial structural restructuring reform, and realize high-quality economic development.

The increasingly prominent pillar function of the sports industry of the national economy of China has attracted great attention from all walks of life. According to statistics, from 2014 to 2018, the total scale of China's sports industry increased from 1.35 trillion yuan to 2.66 trillion yuan, with an average annual growth rate of about 18%. The added value of the sports industry accounted for exceeding 1% of GDP for the first time in 2018, increasing from 0.64% to 1.1%. The added value of the sports industry increased from 404.1 billion yuan (2014) to 1007.8 billion yuan (2018). Also, in 2018, the number of sports industry employees reached 4.439 million, and the per capita stadium area increased from 1.46 square meters to 1.86 square meters. Both the investment in manpower and infrastructure of the sports industry and the scale of industrial output have been greatly improved. The importance of the sports industry in the development of the national economy of China has been constantly highlighted. However, at the same time, it should be noted that the global sports industry accounts for about 1.8% of the global GDP, and the United States accounts for about 2.85%. There is still a gap between the development of the sports industry in China and in developed countries, and the proportion of the sports industry in the national economy is still low. With the period of the development and transformation of China's economy, the growth space of the sports industry will be further expanded, and promoting the high-quality development of the sports industry has become an important way to promote economic growth in all regions of China [1].

In December 2019, a pneumonia caused by novel coronavirus infection outbreak began in Wuhan, Hubei province, and quickly spread across the country. In order to control the spread of the epidemic, major public health emergencies have been launched at the first level across the country, and measures have been taken to cancel public activities, delay the resumption of work, and ensure quarantine control. Affected by this, the sports competition and performance industry has been fully closed for comprehensive adjustment, and the sports venues, sports education and training industry have been closed. Especially, the ice and snow tourism industry has bid farewell to the peak revenue season. Finally, the sports industry has suffered significant negative effects. That is why it is relevant and important to research the impact of the COVID-19 pandemic on the sports industry. In this context, the key direction of research is to define the profound changes brought by the epidemic to the sports industry. The evaluation of change in the regional context will help to ensure the sustainable and stable development of the sports industry and achieve rapid economic growth.

The aim of the article is determining the degree of connection between the development of the sports industry and economic growth in the regional context using coupling coordination model (Evidence from 31 Provinces in China).

The outlined trends indicate the importance of conducting in-depth research on determining the level of influence of the development of the sports industry on economic growth in China, taking into account the regional aspect.

LITERATURE REVIEW

As for the connotations of China's sports industry, the mainstream views can be found by consulting books and literature. The scholar Yan Zhang [2] believes that the sports industry refers to the comprehensive component of all the production, management and activity units related to sports. Guo Qiang [3] believes that in western developed countries, the sports industry has become the domestic pillar industry, accounting for a large proportion of the national economy. The American sports industry is more developed. It is represented mainly by fitness and entertainment industry, professional sports, sports industry and sports brokerage and several parts according to the needs of consumers and the market, to provide high-end consumer goods for sports. Germany is a major economic power in Europe, and the sports industry is also in a pillar position in the German national economy. Feng Wu [4] introduced the development experience of the sports industry in the United States, the United Kingdom, Germany and South Korea and other countries, and summed up the enlightenment for the development of China's sports industry. As for China, firstly, tax policies will be used to regulate the orderly development of the sports industry. Secondly, sports events will be developed vigorously to promote the rapid development of the sports industry. Thirdly, the development of the club will be used to improve the enthusiasm of residents to participate in sports. Finally, in China there will be used the "Internet + technology" to promote the development of the sports industry [5]. M. Sagas pointed out that under the new normal economy, the disadvantages of the traditional economic growth mode have gradually emerged, and accelerating the economic structural adjustment and reform is the focus of the current economic reform [6]. Jing Jinbo scholars believe that China's domestic sports industry market development started late and small scale due to China's economic, social and national economic stimulus. Therefore, the sports industry has also achieved a very good and rapid development [7]. Recently, the development scale of China's sports industry has also been expanding rapidly. From 2011 to 2014, the highest average annual economic growth rate of the economic added value of China's sports industry was 12.74%. Its growth rate was faster than its GDP growth rate in the same years [8]. The future rapid development of China's sports industry has gradually become an important strategic hot spot to directly promote the healthy development of China's domestic sports industry market [9].

On the theoretical basis of in-depth analysis of the development characteristics of China's sports industry, Peng Wang explained in detail that the sports industry plays a role in promoting the rapid development of China's social economy, which can then promote better, faster and healthy development of China's sports industry and obtain better social and economic benefits. It is believed that promoting the development of the sports industry will be conducive to promoting and driving the growth of the national economy, promoting and driving the adjustment and optimization of China's industrial structure, promoting the improvement of the employment level of social labor, and maintaining China's economic and social stability [10].

Junxi Li, Liyun Xu discuss the basic connotation of China's sports industry, the economic and social benefits and economic and ecological environment, on the basis of promoting the economic and social development between the industrial economic and social benefits and promoting the sustainable development of economic and social benefits of modern sports industry and problems, put forward the basic way to effectively promote the economic and social development [11].

MATERIALS AND METHODS

1. Entropy evaluation method. According to the comprehensive level of high-quality economic development, the data should be assigned with indicators (as shown in Table 1). In order to minimize the subjective consciousness of weight determination, the strong objective and operable entropy method is used to determine the weight of each index of the two systems (U_1 and U_2) respectively. The general procedure of the entropy method is as follows:
calculate the proportion of each index and the index:

$$Y_{ij} = \frac{Z'_{ij}}{\Sigma Z'_{ij}} \tag{1}$$

Y_{ij} is the proportion of item j in the i year, Z'_{ij} is the index data of the item *j* in the *i* year.
Calculate the index information entropy:

$$ej = -k \sum_{i=1}^{m}(Yij \times Yij) \tag{2}$$

e_{jis} the entropy of the item *j*, the *k* was correlated with the sample *m*.
Calculate the information entropy redundancy:

$$dj = 1 - ej \tag{3}$$

d_j is the difference coefficient of the item-j index
Calculate the index weight of item j:

$$Wj = \frac{dj}{\sum_{i=1}^{m} dj} \tag{4}$$

w_j is the weight of the j-item index
The weight of each index is calculated according to the above formula, and the specific system constructed is shown in the Table 1:

Table 1. Index system of sports industry and high-quality economic development

1 level	2 level	3 level	Unit	Mold	Weight
Sports industry U_1	Sports industry development scale	Gross value of the sports industry	100 million	+	0.12
	Sports industry development speed	Sports industry output value growth rate	%	+	0.08
		The added value of the sports industry	100 million	+	0.08
		Growth rate of added value of sports industry	%	+	0.09
		Per capita total sports industry	100 million	+	0.08
		The sports industry accounts for GDP	%	+	0.08
High-quality economic development U_2	Growth coordination	Per capita GDP	Yuan	+	0.09
		Industrial high polarization coefficient	%	+	0.05
		Retail sales of consumer goods accounted in GDP	%	+	0.11
		Fiscal self-sufficiency ability coefficient	%	+	0.08
	Open sharing	Total import and export volume accounted for	%	+	0.08
		Per capita disposable income	Yuan	+	0.05
		Y23 Internet broadband interface per capita	–	+	0.07
		Urban registered unemployment rate	%	+	0.09
		Per capita education expenditure	Yuan	+	0.08
		Medical institution beds per capita	–	+	0.07
		The public library holdings per capita	volume	+	0.08
		Per 10,000 people		+	0.09
	Green ecology	Urban greening coverage rate	%	+	0.08
		The per capita area has a park green area	centiare	+	0.09
		The harmless treatment rate of household waste	%	+	0.08

Source: the author's calculation

The sources of the data are from the National Bureau of Statistics from 2010 to 2020, China Yearbook of Science and Technology Statistics, China Statistical Yearbook, China Environmental Yearbook and China Statistical Yearbook of High-tech Industry, and the statistical Yearbook of all provinces (cities) [12]. The study subjects were 31 Chinese provinces (cities) and autonomous regions (excluding Hong Kong, Macao and Taiwan regions).

2. Coupling coordination degree model. To analyze the coordinated development level of things. The degree of coupling refers to the influence of the interaction between two or more systems, achieving the dynamic correlation

of the coordinated development, which can reflect the degree of mutual restriction between the systems [13]. Coordination refers to the size of the degree of benign coupling in the coupling interaction relationship, which can reflect the coordination situation [14]. The phenomenon of sports industry and high-quality economic development interaction depends on the sports industry economic efficient growth coupling. The sports industry influences and interacts with economic development, and determines the level of connection between them. First of all, the development of the sports industry accelerates the development of sports industry scale and the speed of sports industry, which will surely drive the high-quality economy with coordinated economy and growth, innovation and opening up, sharing by all people, and green and sustainable economy.

First of all, the development of the sports industry has a direct impact on sustainable development of regions. Secondly, the sports industry can surely drive the high-quality economy that is based on innovation, green economy and opening up [15].

Therefore, it is necessary to build efficacy function to measure the sports industry and economic quality development of two subsystem development effect, then build the coupling function and coupling matching function respectively from pure quantitative and "qualitative quantitative". Two angles measure the sports industry and economic quality development coupling development efficiency [16].

Because the original data units are not the same, it is impossible to compare and compute directly. Standardized processing is required, as well as treatment utilizing (extremely standardized treatment). Also it is necessary to have forward indicators and reverse indicators, so get the following formula:

– forward indicators:

$$Y_{ij} = \frac{x_{ij} - x_{j_{min}}}{x_{j_{max}} - x_{j_{min}}} \qquad (5)$$

– reverse indicators:

$$Y_{ij} = \frac{x_{j_{max}} - x_{ij}}{x_{j_{max}} - x_{j_{min}}} \qquad (6)$$

x_{ij} is the value in i year, j region, $x_{j_{min}}$ is the minimum in region j, and $x_{j_{max}}$ is the maximum in region j, Y_{ij} is the value after normalization.

The coupling function. According to the n-dimensional system interaction coupling degree model:

$$C_n = n \left(\frac{U_1 U_2 \cdots U_n}{\prod (U_i + U_j)} \right)^{\frac{1}{n}} \qquad (7)$$

The dual coupling function between the sports industry and high-quality economic development is obtained:

$$C_2 = 2 \left(\frac{U_1 U_2}{(U_1 + U_2)(U_2 + U_1)} \right)^{\frac{1}{2}} \qquad (8)$$

C is the coupling between the sports industry and high quality economic development; between 0 and 1, when C tends to 0, is the coupling system of the development of the sports industry and high quality economic development, indicating that the development of the sports industry fails to promote high quality economic development; when C tends to 1, the development of the sports industry and high quality economic coupling system is in effective coupling state, indicating that the development of sports industry can promote high quality economic development.

Coupling matching degree function. The established coupling degree function can effectively calculate the coupling system composed of the development of the sports industry and high-quality economic development, but due to the lack of data, it does not better reflect the real economic state, and cannot reflect the actual economic significance between U_1 and U_2. In this case it is appropriate to build a coupling matching degree function [17; 18], performing exactly as follows:

$$\begin{cases} D = (CT)^K \\ T = aU_1 + bU_2 \end{cases} \qquad (9)$$

D is the coupling matching degree, and C is the coupling degree between the development of the sports industry and high-quality economic development; T is the matching and reconciliation index between the development of the sports industry and high-quality economic development, indicating the matching effect between the development of the sports industry and high-quality economic development; K, a, b is the pending coefficient, $K=0.5$, $a=0.6$, $b=0.4$.

RESULTS

According to the standardized index values and their weights, the comprehensive index of each subsystem and the comprehensive index of the sports industry and high-quality economic development system in each region are calculated using the above formula (5-8). Due to the limited length of the article, the data results of 2010 and 2020 are listed here. Details are given in Table 2.

Table 2. Comprehensive index of sports industry and high-quality economic development system in various provinces and cities in China

	Sports industry U$_1$			High-quality economic development of the U$_2$		
	2010	2020	Mean value	2010	2020	Mean value
Beijing	0.48	0.59	0.54	0.72	0.88	0.80
Tianjin	0.34	0.55	0.45	0.54	0.59	0.57
Hebei	0.36	0.56	0.46	0.34	0.35	0.35
Shanghai	0.58	0.58	0.58	0.8	0.85	0.83
Jiangsu	0.65	0.81	0.73	0.64	0.66	0.65
Zhejiang	0.49	0.69	0.59	0.57	0.69	0.63
Fujian	0.42	0.60	0.51	0.48	0.57	0.53

	Sports industry U₁			High-quality economic development of the U₂		
	2010	2020	Mean value	2010	2020	Mean value
Shandong	0.24	0.62	0.43	0.45	0.58	0.52
Guangdong	0.89	0.85	0.87	0.48	0.57	0.53
Hainan	0.14	0.53	0.34	0.34	0.46	0.40
Shanxi	0.2	0.58	0.39	0.32	0.39	0.36
Anhui	0.37	0.59	0.48	0.3	0.43	0.37
Jiangxi	0.16	0.59	0.38	0.31	0.42	0.37
Henan	0.17	0.57	0.37	0.29	0.4	0.35
Hubei	0.17	0.58	0.38	0.34	0.45	0.40
Hunan	0.16	0.58	0.37	0.32	0.5	0.41
Nei Monggol	0.12	0.37	0.25	0.33	0.4	0.37
Guangxi	0.13	0.37	0.25	0.31	0.39	0.35
Chongqing	0.15	0.54	0.35	0.41	0.51	0.46
Sichuan	0.22	0.59	0.41	0.35	0.47	0.41
Guizhou	0.14	0.55	0.35	0.26	0.28	0.27
Yunnan	0.12	0.55	0.34	0.32	0.43	0.38
Xizang	0.11	0.34	0.23	0.3	0.36	0.33
Shaanxi	0.17	0.56	0.37	0.37	0.46	0.42
Gansu	0.12	0.53	0.33	0.17	0.34	0.26
Qinghai	0.09	0.58	0.34	0.31	0.33	0.32
Ningxia	0.09	0.34	0.22	0.38	0.47	0.43
Xinjiang	0.12	0.43	0.28	0.41	0.38	0.40
Liaoning	0.46	0.55	0.51	0.4	0.51	0.46
Jilin	0.24	0.53	0.39	0.29	0.43	0.36
Heilongjiang	0.37	0.53	0.45	0.29	0.44	0.37

Source: the author's calculation

According to the standardized index values and their weights, the comprehensive index of each subsystem is calculated using the above formula (9), and the coupling and coordination degree between the sports industry and the high-quality economic development is calculated using the formula. The calculation results are in Table 3.

Table 3. Calculation results of the coupling degree of China's sports industry and economic development from 2010-2020

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Mean value
Beijing	0.78	0.89	0.87	0.83	0.94	0.89	0.93	0.94	0.95	0.9	0.89	0.89
Tianjin	0.53	0.59	0.6	0.64	0.83	0.73	0.67	0.64	0.61	0.66	0.65	0.65
Hebei	0.46	0.44	0.43	0.47	0.61	0.61	0.58	0.55	0.53	0.53	0.53	0.52
Shanghai	0.72	0.70	0.72	0.79	0.99	0.87	0.8	0.84	0.75	0.81	0.8	0.80
Jiangsu	0.69	0.81	0.87	0.81	0.8	0.93	0.85	0.92	0.83	0.85	0.83	0.84
Zhejiang	0.61	0.67	0.69	0.69	0.81	0.84	0.78	0.81	0.78	0.76	0.75	0.74
Fujian	0.54	0.56	0.56	0.58	0.96	0.71	0.7	0.7	0.68	0.68	0.66	0.67
Shandong	0.45	0.59	0.62	0.63	0.83	0.76	0.7	0.71	0.68	0.68	0.67	0.67
Guangdong	0.71	0.85	0.94	0.87	0.91	0.98	0.95	0.97	0.98	0.93	0.9	0.91
Hainan	0.35	0.43	0.44	0.47	0.46	0.6	0.56	0.52	0.55	0.51	0.5	0.49
Shanxi	0.38	0.41	0.39	0.43	0.47	0.58	0.53	0.48	0.49	0.48	0.47	0.46
Anhui	0.45	0.44	0.46	0.45	0.63	0.61	0.56	0.56	0.56	0.54	0.54	0.53
Jiangxi	0.35	0.43	0.45	0.43	0.57	0.6	0.55	0.56	0.55	0.52	0.51	0.50
Henan	0.34	0.41	0.42	0.41	0.65	0.59	0.53	0.52	0.53	0.51	0.51	0.49
Hubei	0.36	0.46	0.49	0.47	0.89	0.63	0.58	0.61	0.56	0.58	0.57	0.56

Table 3, Continued

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Mean value
Hunan	0.35	0.44	0.46	0.47	0.7	0.63	0.58	0.63	0.57	0.56	0.54	0.54
Guangxi	0.33	0.40	0.41	0.41	0.43	0.54	0.5	0.46	0.49	0.46	0.46	0.44
Nei Monggol	0.39	0.47	0.48	0.52	0.6	0.67	0.61	0.59	0.59	0.57	0.55	0.55
Chongqing	0.4	0.48	0.51	0.51	0.74	0.65	0.61	0.61	0.59	0.58	0.56	0.57
Sichuan	0.31	0.37	0.39	0.35	0.51	0.55	0.51	0.47	0.49	0.45	0.45	0.44
Guizhou	0.33	0.39	0.39	0.41	0.42	0.54	0.5	0.46	0.5	0.46	0.45	0.44
Yunnan	0.38	0.29	0.48	0.49	0.77	0.64	0.6	0.56	0.55	0.55	0.56	0.53
Xizang	0.25	0.16	0.33	0.35	0.33	0.45	0.41	0.42	0.46	0.4	0.39	0.36
Shaanxi	0.29	0.21	0.35	0.35	0.32	0.51	0.48	0.43	0.46	0.45	0.42	0.39
Gansu	0.33	0.24	0.4	0.41	0.41	0.58	0.48	0.51	0.54	0.45	0.43	0.43
Qinghai	0.33	0.24	0.41	0.43	0.47	0.53	0.53	0.48	0.5	0.57	0.55	0.46
Ningxia	0.39	0.47	0.48	0.52	0.6	0.67	0.61	0.59	0.59	0.58	0.56	0.55
Xinjiang	0.4	0.48	0.51	0.51	0.74	0.65	0.61	0.61	0.59	0.46	0.44	0.55
Liaoning	0.53	0.53	0.52	0.52	0.68	0.67	0.63	0.61	0.61	0.6	0.58	0.59
Jilin	0.38	0.42	0.43	0.46	0.47	0.58	0.54	0.47	0.53	0.63	0.6	0.50
Heilongjiang	0.45	0.42	0.44	0.44	0.54	0.59	0.54	0.5	0.51	0.64	0.62	0.52

Source: the author's calculation

From 2010 to 2019, the coupling degree of China's sports industry and high-quality economic development tends to increase, and in 2020, the influence of novel coronavirus tends to decline. Before 2020, the eastern region was in a state of high coupling. The central and western regions ranging from imbalance and moderate coordination to good coordination show that the overall level of coupling between China's sports industry and high-quality economic development is high. Then the authors analyze the spatial and temporal evolution from the coupling degree of the sports industry and high-quality economic development.

Analysis of the time evolution. Based on the statistical data from 2010-2020 and the above coupling model, the relationship between the sports industry and high-quality economic development in provinces and cities was calculated. It is divided into economic development levels: eastern region, central region, western region, northeast region. The authors analyze them in accordance with the regional time change level, the Figure 1:
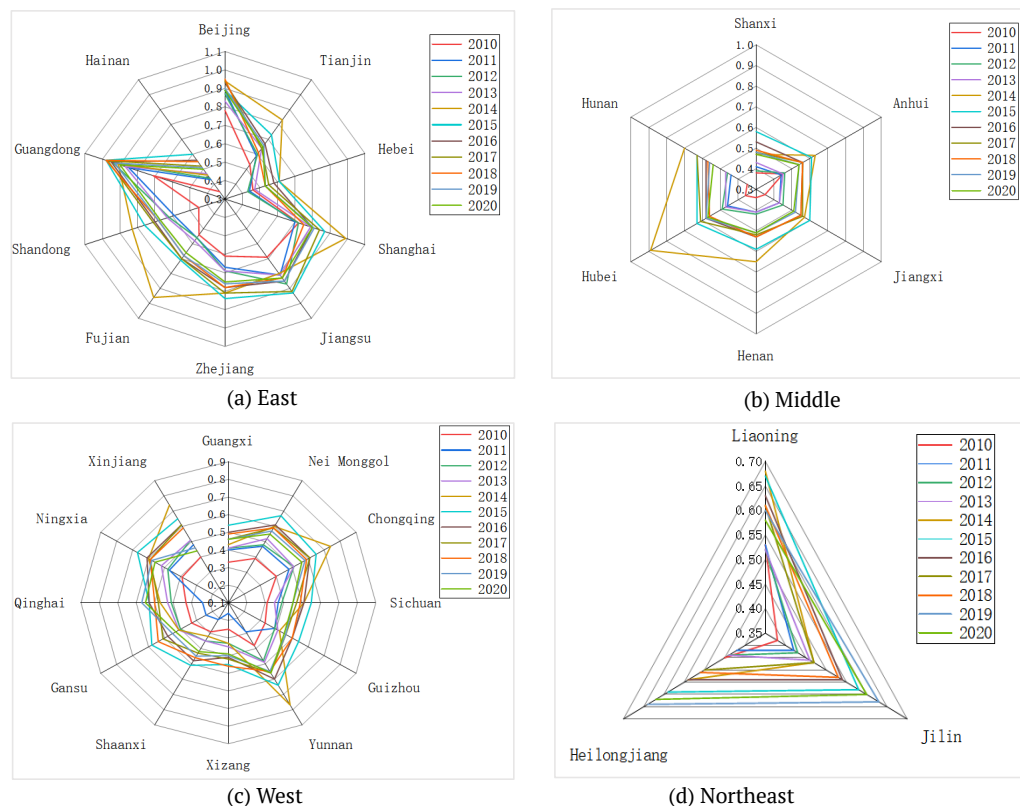

(a) East

(b) Middle

(c) West

(d) Northeast

Figure 1. Statistical diagram of the coupling degree of sports industry and high-quality economic development in four regions (a – graphical results for the East region of China, b – graphical results for the Middle region of China, c – graphical results for the West region of China, d – graphical results for the Northeast region of China)

Source: own elaboration

As can be seen from Figure 1a, the coupling degree of the sports industry and high-quality economic development in eastern China shows an overall trend of increasing year by year, among which the coupling degree of Hainan Province was the lowest in 2010 and slowly increased year by year. In 2019, the coupling value of the sports industry and high-quality economic development exceeded that of Hebei Province. The coupling degree of the sports industry and high-quality economic development in central China is generally between 0.4 and 0.7 (Fig. 1b). Among the central provinces and cities, the sports industry and economy are well-developed in Hubei Province, and in 2010 the index was 0.88, which was a good breakthrough and leap. From 2010 to 2014, the coupling index of the sports industry and high quality economic development in all provinces in western China was lower than 0.5; from 2014 to 2019, it was in barely coordination and loss coordination (Fig. 1c). The coupling index of the sports industry and high-quality economic development in the three northeastern provinces was on the rise. From 2010 to 2014, the coupling index of the sports industry in northeastern China was between 0.45 and 0.5 (Fig. 1d); from 2014 to 2018 it grew rapidly. Between 2019 and 2020 it was in a downward trend, further proving that COVID-19 has a great impact on the sports industry.

Spatial evolution analysis. In order to further explore the spatial differences in the development level of the sports industry and high quality economic development, it is proposed the visual analysis of the sports industry and economic development in 2010, 2016, 2019 and 2020. The coupling coordination development index is as follows (Fig. 2):
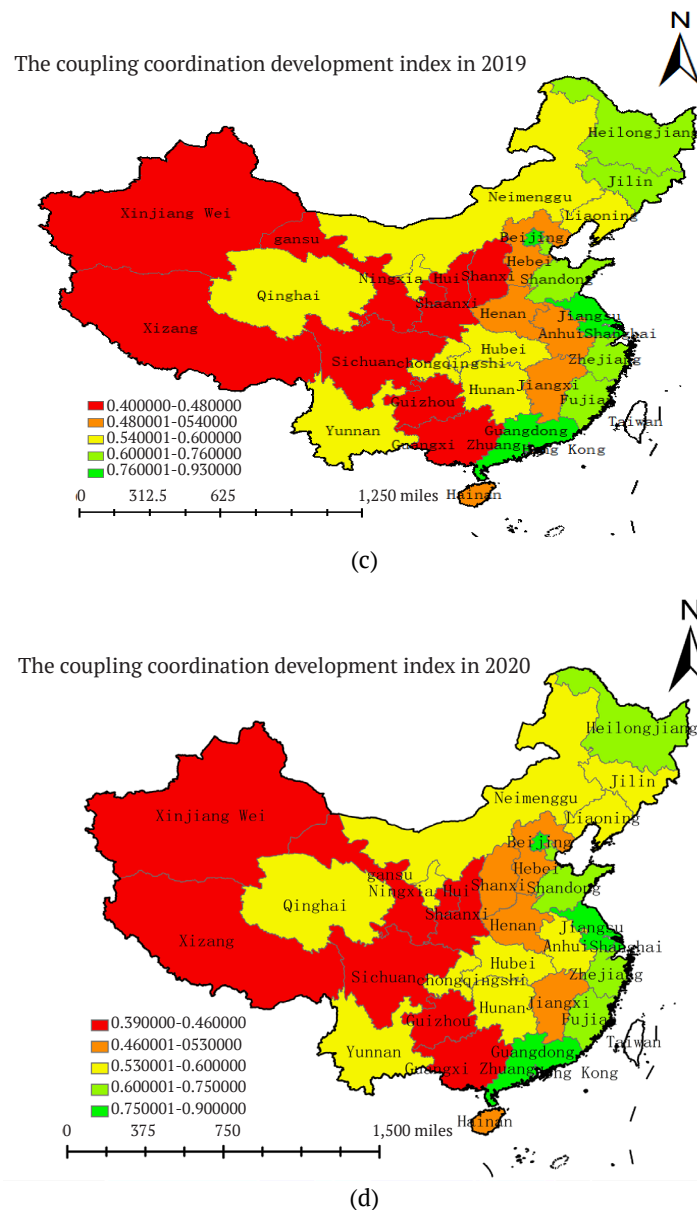

(a)

(b)

The coupling coordination development index in 2019

(c)

The coupling coordination development index in 2020

(d)
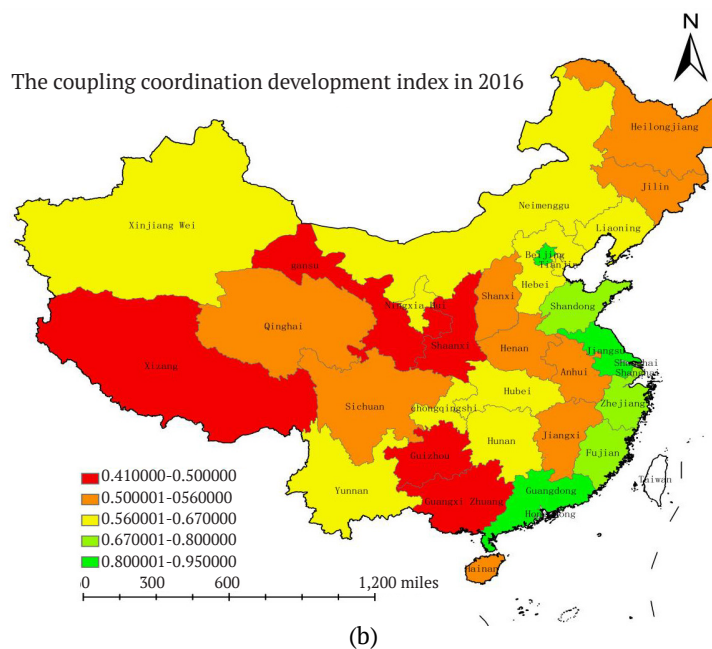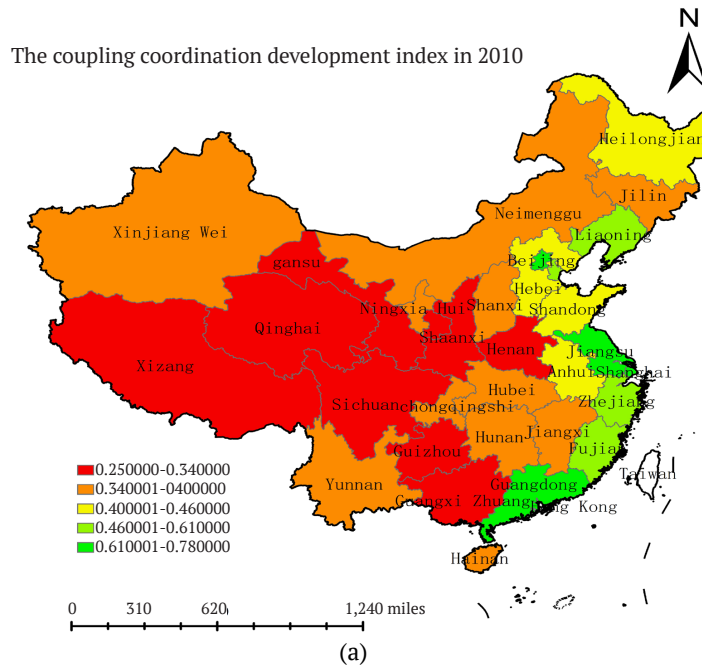
Figure 2. High-quality coupling coefficient between Chinese regional sports industry and economy in the four years
(a – graphical results for 2010 year, b – graphical results for 2016 year, c – graphical results for 2019 year,
d – graphical results for 2020 year)

Source: own elaboration

The spatial coefficient of coupling with high-quality economic development in Chinese provinces and cities changed significantly in 2010, 2016 and 2019, which further shows that the coupling coordination between regions is obvious. It's researched the sports industry and economic development in Beijing, Guangdong, Jiangsu Province in 2010 (Fig. 2a); the eastern region was at a high level, while the central and northeast regions were at the second level, which further shows the rapid economic development in the central and eastern regions. In 2016 (Fig. 2b), the coupling coefficient of high-quality development of the sports industry and economic development was at a high level in Beijing, Guangdong Province, Jiangsu Province, Shandong Province, etc. In 2019 (Fig. 2c), the coupling coefficient of the sports industry and high-quality economic development in China was higher than 0.5, but the changes between provinces and

regions were obvious. The investment in green science and technology in the eastern region was still at the first level, in the central and northeast regions were at the second level, and the development of the western region was at the last level. In 2020 (Fig. 2d), the coupling coefficient of the sports industry and high-quality economic development in all provinces was lower than that in 2019. The COVID-19 has an obvious impact on the high-quality development of China's sports industry and economy.

By using the coupled coordination model, selecting the data for the period 2010-2020 to calculate the coordination degree between the sports industry and high-quality economic development system between 31 provinces and cities in China, and the mean coordination value of the high-quality economic development in 11 years, the authors obtained the following results (Table 4).

Table 4. Calculation results of the coupling degree of China's sports industry and economic development
for the period 2010-2020

Region	Mean value	Rank	Coupling coordination values	Coordination level
Guangdong	0.91	1	0.9<D≤1	High quality and coordinated development
Beijing	0.89	2	0.8<D≤0.9	Good coordinated development
Jiangsu	0.84	3		
Shanghai	0.80	4	0.7<D≤0.8	Intermediate coordinated development
Zhejiang	0.74	5		
Fujian	0.67	6	0.6<D≤0.7	Primary coordinated development
Shandong	0.67	7		
Tianjin	0.65	8		
Liaoning	0.59	9	0.5<D≤0.6	Barely coordinated development
Chongqing	0.57	10		
Hubei	0.56	11		
Xinjiang	0.56	12		
Ningxia	0.55	13		
NeiMonggol	0.55	14		
Hunan	0.54	15		
Yunnan	0.53	16		
Anhui	0.53	17		
Hebei	0.52	18		
Shaanxi	0.51	19		
Heilongjiang	0.51	20		
Jiangxi	0.50	21	0.4<D≤0.5	The verge of dysregulation and recession
Jilin	0.50	22		
Henan	0.50	23		
Hainan	0.49	24		
Shanxi	0.49	25		
Qinghai	0.45	26		
Guangxi	0.44	27		
Sichuan	0.44	28		
Guizhou	0.44	29		
Gansu	0.44	30		
Xizang	0.36	31	0.3<D≤0.4	Mild dysregulation decline

Source: the author's calculation

The results of coordination between the sports industry and high quality economic development show that the coupling coordination is between 0.9 and 1 in Guangdong province. In Beijing and Jiangsu Province the coupling coordination is between 0.8 and 0.9. In Xizang the coupling coordination is between 0.3 and 0.4, indicating the great difference between the provinces.

DISCUSSION
In order to realize the coordinated development of the sports industry between regions, and thus promote the high-quality economic development between regions, the following countermeasures are put forward.

1. The government should strengthen support policies and support measures. As the sports industry is an emerging industry, many start-ups and small companies have limited capital reserves and weak risk resistance. On the other hand, enterprises operating in various sports venues and sports goods stores bear high cost pressure during the epidemic. Industry entities look forward to a new round of policy support, greater and greater urban land use tax and property tax reduction, increased hydropower fee subsidies, reduction, exemption or VAT reduction, coordinate with financial institutions to increase credit supply to the related enterprises in the sports industry, appropriately relax credit loans, and allow financial institutions to float interest rate standards within a certain range.

2. Encourage the innovative development of sports industry enterprises. China's state institutions will encourage enterprises to use new technologies such as big data, cloud

computing, artificial intelligence, 5G, blockchain and so on to promote the digitalization and intelligence of the sports industry, promote the integration, superposition and innovation of online and offline sports products and services, cultivate new models and new business forms of the sports industry, and help improve the quality and upgrading of the sports industry.

3. Promote the healthy and sustainable development of China's sports economy, provide more impetus for China's economic growth, and constantly expand the new areas of the sports economy development. Develop a new field of sports economy development, form new development projects with the integration and agglomeration of sports, science and technology, culture, talents, brands and other elements, enrich the content and forms of new fields of sports economy, and generate more vitality and vitality in the field of sports economy.

4. The integration of online and offline industries will help us participate in the transformation and upgrading of the sports industry. Under the COVID-19 epidemic, the sales of sports education products and related products lines occupy the mainstream of the market, and the number of online fitness users continues to rise. This new "Internet" sports model has promoted the provision of sports consumption services by e-commerce platforms, and has played a greater role in promoting the development of China's sports industry. The epidemic has spawned the hot

spot of online and offline integration of the sports industry, enabled the rapid development of new models such as online training and live broadcast and fitness, and cultivated the online consumption habits of sports consumers.

CONCLUSIONS

From 2010 to 2020, the coupling degree (C) and the coordinated degree of development values (D) between the sports industry and the high-quality economic development system of various provinces and cities are steadily increasing year by year, indicating that the correlation and closeness between the systems are getting closer and closer. In terms of the spatial gathering situation, 31 provinces and cities are manifested as the spatial development pattern of the eastern region> western region> northern region> northeast region> western region. This research can be oriented on urban district of provinces but it is necessary to conduct a survey and form of the data from currently selected indicators.

Finally, the development of sports industry can provide impetus for China's economic growth, and the further development of economy can also promote the rapid development of sports industry. The two are interconnected and promote each other, which is a benign circular industry system. Only by constantly optimizing the development mode of China's sports industry and creating a high-quality market operation mechanism it is possible to achieve common development of sports industry and the Chinese economy.

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Визначення ступеня зв'язку між розвитком спортивної індустрії та економічним зростанням у регіональному контексті: дані 31 провінції Китаю

Анотація. Однією зі складових стрімкого розвитку економіки Китаю є розвиток спортивної індустрії. Загострення епідемії COVID-19 призвело до введення карантинних заходів і значного скорочення частки спортивної індустрії в структурі валового внутрішнього продукту Китаю. Для формування інструментів економічного розвитку важливо визначити регіони, в яких перспективним напрямком розвитку є спортивна галузь. Метою статті є визначення ступеня зв'язку між розвитком спортивної індустрії та економічним зростанням у регіональному контексті за допомогою моделі зв'язаної координації (дослідження проводилось за даними 31 провінції Китаю) У дослідженні було використано метод комерційної ентропії та модель координації зв'язку для розрахунку зв'язку та скоординованого розвитку спортивної індустрії та високоякісного економічного зростання 31 провінції Китаю з 2010 по 2020 рік. Результати дослідження дали підстави для розподілу регіонів за ступенем зв'язку між розвитком спортивної галузі та економічним зростанням. По-перше, ступінь зв'язку між розвитком спортивної індустрії та економічним зростанням у східному регіоні знаходиться в стані первинної координації, хорошої координації та високоякісної координації, і провінція Гуандун досягла очевидних результатів. По-друге, що стосується східного регіону, то тут спостерігається швидкий економічний розвиток, і вплив спортивної галузі на досягнення результативності є очевидним. По-третє, ступінь зв'язку між розвитком спортивної індустрії та економічним зростанням у центральних провінціях перебувають у стані ледь помітної координації, на межі розладу та легкого спаду. Підтверджено, що розвиток спортивної індустрії може дати поштовх для економічного зростання Китаю, а подальший розвиток економіки, відповідно, може сприяти швидкому розвитку спортивної індустрії. Доведено, що обидва досліджувані складники, взаємопов'язані та сприяють один одному, що є доброякісною циклічною галузевою системою. Тільки шляхом постійної оптимізації режиму розвитку китайської спортивної індустрії та створення високоякісного механізму функціонування ринку можна реалізувати подвійний розвиток щодо спортивного напряму економічної діяльності та економіки Китаю. Дане дослідження буде корисним для державних менеджерів у сфері регіонального розвитку. Також результати цього дослідження можуть будуть використані топ-менеджерами спортивної галузі при виборі регіону для розвитку бізнесу та розширення мережі спортивних послуг

Ключові слова: економічний розвиток; COVID-19; модель зв'язаної координації; якісний економічний розвиток