



Research on the Coordinated Development of China's Internet and Commercial Circulation Industry Based on Coupling Coordination Model

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ABSTRACT

With the overflow of the "Internet +" effect, the commerce and trade circulation industry, as the basic industry of China's national economy, is constantly integrating with the Internet industry. Taking China as an example, this paper builds a comprehensive evaluation system of the Internet industry and the commercial and trade circulation industry, and uses the entropy method to determine its weight. Finally, the comprehensive development index of China's Internet industry and commerce and trade circulation industry from 2016 to 2020 is obtained, and the coupling coordination degree model is used to evaluate its coupling development status. The research shows that: since 2016, the level of coupling and coordination between China's Internet and commercial circulation industries has gradually transitioned from an unbalanced stage to a coordinated development stage, and the development of the two seems to be out of sync.

Keywords: *Internet, commerce and trade, coupling coordination model, entropy weight method*

1. INTRODUCTION

The development of the commercial and trade circulation industry ensures social supply, promotes agricultural production, facilitates people's lives, and stimulates economic growth. At the same time, it acts as a link between production and consumption, industry and agriculture, urban and rural areas. Today, the Internet is driving changes in China's economy, society, business innovation, and even lifestyle. With the popularization and wide application of technological innovation, the value of Internet popularization and sharing has become the theme of the new era. From the external point of view of industrial development, the Internet is accelerating its cross-border integration with traditional industries such as industry, agriculture, commerce, finance, transportation, tourism, education, and medical care, and the industrial boundaries are increasingly blurred. In the "Government Work Report" of the National "Two Sessions" in 2015, Keqiang Li pointed out: "To formulate the "Internet +" action plan, to promote the integration of mobile Internet, cloud computing, big data, Internet of Things " In order to implement the action and deployment of the State Council, accelerate the in-depth integration of the Internet and the circulation industry and the transformation and upgrading of the commercial

circulation industry to release potential consumption power. The Ministry of Commerce has formulated the "Internet + Circulation" plan to further promote the integration of information technology and modern circulation, and promote the transformation and upgrading of China's economy. It can be seen that "Internet + commercial circulation" has become a new measure to promote innovation in the circulation industry and promote consumption upgrades.

In recent years, China's research on "Internet + Circulation" mainly includes Cong Yan (2017) based on the data of 11 provinces and cities in the Yangtze River Economic Belt to empirically study the "Internet + Business Circulation" industry integration development model^[1]. Weiwei Fang (2017) pointed out that it is necessary to integrate the advantages of the "online + offline" business circulation mode, optimize the structure of the business circulation industry, strengthen the cooperation in the construction of regional logistics infrastructure, and give full play to the role of the business circulation industry in promoting my country's GDP growth^[2]. Cheng Yu (2018) proposed a collaborative innovation strategy on the basis of discussing the main problems in the development of the commerce and circulation industry under the background of "Internet +" ^[3]. Xingchi Li (2019) explored the

coupled development of the Internet industry and the commercial circulation industry in Guizhou Province from 2010 to 2016 [4]. Lili Zhang (2019) takes "Internet +" as the background, and conducts research on the high-quality development of my country's rural commercial and trade circulation industry[5]. Peng Xu (2019) pointed out the severe challenges faced by China's traditional commercial and trade circulation industry, and proposed countermeasures to promote the transformation and development of the commercial and trade circulation industry [6]. Zheng Yang (2019) started from the current situation of the integration and development of "Internet + commerce and trade + finance" in China, and deeply studied the main problems that restrict its integration and development, and innovated the service model of Internet financial commerce and trade circulation[7]. Xiaoli Du (2020) proposed the innovative and integrated development path of China's commercial and trade circulation industry under the industrial Internet model[8]. Zhaohui Huang (2020) discussed the supporting role of Internet supply chain finance in the development of China's commercial and trade circulation industry [9]. Lianggang Ji (2020) pointed out that it is necessary to establish an integrated system of urban and rural commerce and trade, and use the new thinking and new technologies of "Internet +" to integrate and improve urban and rural business flow, logistics, information flow and capital flow, so as to promote the integrated and coordinated development of urban and rural commerce and trade [10].

2. METHODOLOGY

2.1. Entropy model

In order to effectively avoid the influence of subjective factors on the research when determining the weight, this paper adopts the entropy weight method to measure the index weight of my country's Internet and commercial circulation industries. The entropy weight method can judge the degree of dispersion between indicators, and it is a comprehensive evaluation method that can evaluate multiple objects and multiple indicators at the same time. The specific calculation steps are as follows:

We normalize the positive and negative indicators using Equations 1 and 2, respectively.

$$Y_{ij} = \frac{X_{ij} - \min(X_i)}{\max(X_i) - \min(X_i)} \tag{1}$$

$$Y_{ij} = \frac{\max(X_i) - X_{ij}}{\max(X_i) - \min(X_i)} \tag{2}$$

We measure the weight of each indicator:

We calculate the characteristic proportion of index j in year i as shown in Equation (3).

$$P_{ij} = \frac{Y_{ij}}{\sum_{i=1}^m Y_{ij}} \quad (0 \leq P_{ij} \leq 1) \tag{3}$$

We calculate the information entropy as shown in Equation (4).

$$e_j = - \frac{1}{\ln n} \sum_{i=1}^n P_{ij} \ln(P_{ij}) \tag{4}$$

$(0 \leq e_j \leq 1)$

We calculate the information entropy redundancy as shown in Equation (5).

$$D_j = 1 - e_j \tag{5}$$

Next we calculate the indicator weights as shown in Equation (6).

$$w_j = \frac{D_j}{\sum_{i=1}^n D_j} \tag{6}$$

Finally, we calculate the comprehensive evaluation score as shown in Equation (7).

$$U_j = \sum_{i=1}^n Y_{ij} w_j \tag{7}$$

Among them, U represents the comprehensive evaluation score, n represents the number of indicators, and w_j represents the weight of the j-th indicator. Therefore, the higher the comprehensive score of the index, the better, and finally the U value of each index can be compared.

2.2. Coupling Coordination Measure Model

The term coupling degree first originated from the field of physics. This study uses the coupling coordination model to measure the coupling and coordinated development of China's Internet and commerce and trade industries. The specific models are as follows:

$$C = \left[\frac{U_1 U_2}{\left(\frac{U_1 + U_2}{2} \right)^2} \right]^k \tag{8}$$

In the formula, C represents the coupling degree in physics, k is the adjustment coefficient, and k is set to be 2 in this paper. U₁, U₂, and U₃ represent the comprehensive development index of the Internet and the commercial and trade circulation industry, respectively. In order to more objectively evaluate the coupling and coordination status of China's Internet and commerce and trade circulation industry, this study further builds a coupling coordination degree model. The specific model is as follows:

$$D = \sqrt{C \times T} \tag{9}$$

$$T = \alpha U_1 + \beta U_2 \tag{10}$$

In the formula, D represents the degree of coupling coordination, C represents the degree of coupling in physics, T represents the comprehensive development index of the development level of the Internet and the commercial circulation industry, α and β represent the undetermined coefficient, and $\alpha + \beta = 1$. This paper believes that the development of the Internet and the commercial circulation industry is equally important, so this paper sets $\alpha = 0.5$ and $\beta = 0.5$.

3. DATA

3.1. Data Sources

Based on the relevant data of China's Internet and commercial circulation industry from 2016 to 2020, this paper conducts an empirical analysis on the level of coupling and coordinated development of the two. Among them, the data of the commercial and trade circulation industry comes from the 2017-2021 China Statistical Yearbook, and the Internet-related data comes from the 2017-2021 "Statistical Report on the Development of China's Internet Network".

3.2. Index System Construction and Weight

Referring to the accessibility indicators selected by existing research, this paper selects a total of 8 indicators from three levels to reflect the current situation of Internet development, and selects a total of 6 indicators from four levels to reflect the development of the commercial and trade circulation industry. The final measurement results of the coupling coordination degree between China's Internet and commercial circulation industry are shown in Table 1.

Table 1. Indicators of the coupling coordination degree of China's internet and commerce and trade circulation industry.

System	Dimension	Index	Weights
Internet development level	Internet infrastructure	Number of Internet Broadband Access Ports	0.10992
		Number of domain names	0.20244
		Number of CN domain names	0.0939
		Number of IPV4 addresses	0.13883
	Internet popularity ability	Internet penetration	0.14231
		Internet broadband access users	0.11018
	Internet application ability	number of sites	0.09602
		number of pages	0.10642
Development level of commercial and trade circulation industry	Scale of commercial circulation	Retail sales of social consumer goods	0.11969
	Business circulation structure	Ratio of wholesale and retail sales above designated size	0.13737
		Commercial circulation facilities	Wholesale and retail enterprises above designated size
	The total number of retail chain stores		0.19475
	The number of commodity trading markets over 100 million yuan		0.1798
	Efficiency of commerce and trade	Efficiency of commodity trading market over 100 million yuan	0.13007

4. RESULTS

4.1. Analysis on the Coupling and Coordination Degree of China's Internet and Commercial Circulation Industry

From the comprehensive evaluation values U₁ and U₂ of the Internet and the commercial circulation industry, it can be seen that during 2016-2020, the development level of China's Internet industry first rose and then decreased, while the commercial and trade circulation

industry continued to improve. At the same time, the development speed of the two was different. As can be seen from Table 2, with China's vigorous development of the big data industry since 2016, its comprehensive development index U₁ has increased significantly, with a year-on-year increase of 96.81% in 2017. In addition, due to the promoting effect of the booming Internet development on the real economy, the commercial and trade circulation industry continued to increase, but the degree of increase gradually declined.

As shown in Table 2, between 2016 and 2020, the type of coupled development of the Internet and the commerce and trade circulation industry in China is the phenomenon of the lag of Internet development and the lag of the commerce and trade circulation industry. This shows that the development speed of the two has not reached a coordinated state. In 2018, $U_1 < U_2$, that is, the Internet development is lagging, which means that the development of the Internet has not driven the development of the commerce and trade circulation industry well, and the needs of the two are not equal, thus restricting each other and affecting the development level of each other. However, in 2019, the commercial and trade circulation industry is lagging behind, that is, the development of the commercial and trade circulation industry is slow compared to the development of the Internet industry. This is closely related to China's 5G construction in 2019 and attracting Internet talents.

It can be seen from the coupling degree C that from 2016 to 2020, the coupling degree of China's Internet and commercial circulation industry has always been at a high level, playing a strong role in promoting. From the

degree of coupling coordination D, it can be seen that the degree of coupling and coordination between China's Internet and commerce and trade circulation industry has been continuously improved from 2016 to 2020, and the mutual promotion has become more and more strengthened. The development trend of coupling and coordination is gradually strengthened. In 2016, the degree of coupling and coordination between China's Internet and commerce and trade circulation industry was only 0.4059, and it was in the stage of imbalance and recession, which indicated that its development was relatively backward and its development was imbalanced; In 2017, it was in the stage of excessive imbalanced development, and the development of both was in a transition period; From 2018 to 2020, it is in the stage of coordinated development. This stage is reflected in the overall development of the Internet and the commercial circulation industry in a good direction, and the role of coordinated development continues to increase. It can be seen that the development of China's Internet and commercial circulation industry has been in a well-coordinated state.

Table 2. Coupling Development of China's Internet and Commerce and Trade Circulation Industry.

Year	Internet Composite Index U_1	Commercial Circulation Industry Composite Index U_2	Coupling C	Coupling coordination D	Type of development	Coupling coordination level	Coupling coordination interval
2016	0.1537	0.1798	0.9878	0.4059	Internet development lags	Mild disorder	Dissonance Decline
2017	0.3025	0.3184	0.9987	0.5568	Commercial and trade circulation industry development lags	Barely coordinated	Over-coordinated development
2018	0.4436	0.4512	0.9999	0.6689	Internet development lags	Primary coordination	Coordinated development
2019	0.7694	0.6244	0.9785	0.8258	Commercial and trade circulation industry development lags	Well coordinated	
2020	0.6707	0.7838	0.9879	0.8476	Internet development lags	Well coordinated	

5. CONCLUSION

In general, China's Internet industry and the commerce and trade circulation industry are developing in a continuous and coordinated manner, but by the end of 2020, there is a phenomenon that the Internet industry lags behind the commerce and trade circulation industry.

Therefore, China should continue to promote the development of the Internet industry, continuously promote the structural reform of China's supply side, and update the "Internet + commerce and circulation industry" model. At the same time, resources from all walks of life should be used to make up for the "shortcomings" of the commercial and trade circulation

industry. For this purpose, the following references are proposed:

The first is to speed up investment in the construction of Internet and business infrastructure to provide a basic platform for promoting coordinated development. On the one hand, the infrastructure construction of China's core Internet industries should be accelerated, and the efficiency of information transmission should be continuously improved. We will build a 5G network covering urban and rural areas, and further promote the integration of the Internet, artificial intelligence, big data, and commerce and trade. On the other hand, it is crucial to enhance the specialization level of the wholesale market, improve the rationality of warehousing and logistics, and continuously increase the infrastructure construction of the commercial and trade circulation industry.

Secondly, it is necessary to broaden the way of online and offline integration. Through big data technology, we can analyze consumer behavior and provide personalized products and services. At the same time, we should also pay attention to the construction of China's trade and logistics platform, and strengthen the integration and utilization of resources between local trade cities and Alibaba.

Thirdly, we can promote cross-border collaboration to promote the integration and innovation of China's business travel, agriculture, rural areas and farmers. China has abundant tourism resources, and driven by the digital economy, industrial synergies are exerted to promote resource utilization.

Fourth, the government should play a leading role. Under the guidance of the government, efforts will be made to establish an innovative brand of "Internet + business circulation". At the same time, it responds to the national rural revitalization strategy, promotes agricultural-business cooperation, and creates local "star" agricultural and sideline products.

This paper studies the coupling and coordinated development of China's Internet and commercial circulation industry. In the future, we can explore the integration and development of the Internet and other traditional industries, such as industry, agriculture, and finance, in order to promote China's industrial transformation and upgrading.

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