

Research Article

Modelling the Coupled and Coordinated Development between China's Cross-border E-commerce Supply Chain and Economic System

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This study constructs a coupling model and establishes an index system for the coupled and coordinate development between cross-border e-commerce supply chain system and economic system. The index system adopts supply chain, foreign trade, e-commerce, e-commerce logistics, economic development, social consumption, talent environment, and technological innovation as sequential covariates. The calculation shows that the first three batches of 35 cross-border e-commerce comprehensive pilot areas (CBECCPA in brief) in China, in 2017, are classified into three degrees of the coupled and coordinated development: superior, good, and moderate. The study provides useful recommendations for promoting cross-border e-commerce supply chain, such as to pursue high-quality balanced development, to cultivate professional composite talents, to encourage innovation and entrepreneurship, and to create a favorable economic environment.

1. Introduction

In recent years, especially since 2020, with the rapid development of cross-border e-commerce and the escalation of competition, the supply chain has gradually become the focus of competition. The cross-border e-commerce supply chain (CBECSC in brief) is flatter than that of traditional international trade. It is with a shorter supply chain cycle and involves more links, longer processes, and more complex information flows. Unlike traditional foreign trade, cross-border e-commerce has not only a B2B model for small- and medium-sized oversea retailers but also a direct-to-consumer B2C model, by which consumers can talk directly with merchants through the platform, removing some of the intermediate links of traditional international trade and achieving de-intermediation effects. Meanwhile, new types of re-intermediation services and companies have emerged in the cross-border e-commerce ecosystem, involving more links and more complex information flows. The development of CBECSC greatly depends on the development of the economic system, and it

is also one of the driving forces and engines to promote the development of China's economy. It is very important to study the coupled and coordinated development between these two to promote the synergistic development of China's cross-border e-commerce industry and the whole economy.

At present, most research studies focus on the coupled and coordinated development between the supply chain and the industrial cluster, the coupled and coordinated development between the cross-border e-commerce and economic system, and the symbiotic coupling model of cross-border e-commerce logistics industry chain. Few research studies focus on the relationship between the CBECSC and the economics system. This paper empirically studies the coupling and coordination development between the CBECSC and local economic systems, building the sequential covariate index system of the CBECSC and local economic systems, and puts forward some suggestions on ecosystem of the cross-border e-commerce and economic environment to promote CBECSC's development.

2. Literature Review

Research on the relationship between CBECSC systems and economic systems: cross-border e-commerce can help cross-border e-commerce firms to ensure that cross-border e-commerce supply chains operate efficiently while at the same time meeting the dynamic needs of customers in all supply chain markets as fully as possible [1]. The growth of the e-tailing industry will have a huge impact on the spatial distribution of economic activity, requiring greater cross-regional and cross-border transport, and will also have a general impact on the global economy [2]. E-commerce could influence economy by providing the opportunities to improve customer's experience [3]. The co-development of two important economic subsystems, cross-border e-commerce, and industrial economic clusters has a significant positive correlation [4]. Important hard environmental conditions such as current geographical advantages, natural resources, transport and traffic routes, and infrastructural support facilities, and important soft environmental conditions such as current international market maturity, rapid industry development, institutional and institutional innovation advantages, and policy measure dividends are likely to determine the future growth rate of international trade [5].

Research on the factors influencing the cross-border e-commerce supply chain: with the rapid development of cross-border e-commerce, the elements that determine the competitiveness of the cross-border e-commerce industry gradually shift from commodities to supply chain levels and overall service levels. There are many factors that hinder the road to supply chain success in the retail industry [6]. Lu concluded through empirical analysis that resource integration, data analysis, information sharing, and logistics security factors are significantly associated with CBECSC efficiency [7]. Nazifa et al. emphasized the important role of information sharing in supply chain management [8]. Various factors such as international payment, economic development, trade base, logistics level, and Internet popularity will have a significant impact on the development of the cross-border e-commerce industry, and factors such as industrial investment, technological innovation, technological environment, development policies, support, and incubation will have a great impact on the development of cross-border e-commerce [9], which indirectly affects the cross-border e-commerce supply chain. Zhang et al., on the contrary, highlight three factors, namely, national policies, the penetration rate of the Internet, and the development level of logistics [10].

Studies on the coupling of cross-border e-commerce supply chains and economic systems: after Qian and He studied in-depth the influencing factors of the interaction between cross-border e-commerce and cross-border logistics, they gave the categories of synergy such as environment, mechanism, relationship, capability, willingness, and expectation [11]. Zhang constructed a model of industrial selection power, resource control power, technological innovation power, market development power, and cultural cohesion power from three parts: structure, capability, and

culture [12]. Liu and Chen constructed an analytical model of the synergy between e-commerce and cross-border logistics [13]. Cao and Wang stood in the industrial chain perspective and analyzed the main factors limiting the joint development of cross-border e-commerce and logistics [14]. It can be said that there are few quantitative studies that directly address the relationship between both the CBECSC system and the economic system.

3. Research Method

3.1. Modeling for the Coupling Development. The coupling method is used to quantitatively describe the degree of synergy of the elements of a system that interact with each other through the degree of coupling development, which can measure the degree of interdependence between two or more systems. A high degree of coupling allows the system to move from low-level, independent development to synergistic progressive development and from disorderly development to orderly development.

The economic system is the basis for the overall development of China's CBECSC and even cross-border e-commerce, while the development of the CBECSC will in turn further promote the development of the entire economic system. The two systems continuously interact and coordinate with each other, and various elements such as resources, information, and talents continuously interact, showing the characteristics and trends of synergistic development, forming a coupled system that mutually influences and promotes each other. Based on the relevant literature, this study constructs a coupling model between the CBECSC system and the economic system, as shown in Figure 1.

The CBECSC system consists of supply chain, foreign trade, e-commerce, and e-commerce logistics. Economic development, social consumption, talent environment, and technological innovation in the economic system are in turn closely linked to the cross-border e-commerce supply chain. In the CBECSC system, the supply chain industry is the core of the whole system operation; the level of foreign trade plays a decisive role in the development potential of the cross-border e-commerce supply chain; e-commerce is an important foundation and e-commerce logistics is the most critical support of the cross-border e-commerce supply chain. In the economic system, the level of economic development is the foundation, while social consumption capacity will directly affect the extent to which the CBECSC can play a role, and the talent environment and technological innovation are important factors that provide the core driving force for the sustainable development of the cross-border e-commerce supply chain.

3.1.1. Building the Sequential Covariate Index System of CBECSC. A perfect CBECSC is a strong guarantee for the development of the cross-border e-commerce industry. In addition to completing the duties of warehousing and logistics, express delivery, etc., it is also necessary to make rapid adjustments according to the market situation, which

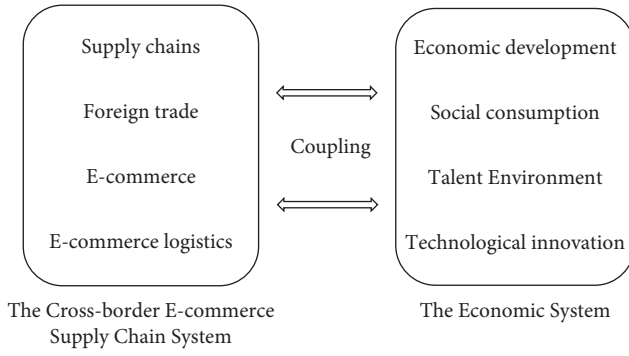


FIGURE 1: Coupling model between CBECSC system and economic system.

is conducive to coping with the uncertainty of the international economic environment, such as the ability to quickly resume work and production when encountering unexpected situations such as epidemics to ensure supply.

Combined with the available data, the following four indicators are selected to reflect the CBECSC system. (1) the supply chain scale of the city where a CBECCPA locates is expressed by the sequential covariate of supply chain, which is measured by the total express revenue of the city. (2) The foreign trade level of the city where a CBECCPA locates is expressed by the foreign trade sequential covariate, which is measured by two indicators: trade base is reflected by the import and export scale of the city, and trade radiation effect is reflected by the import and export scale of the province in which the CBECCPA locates. (3) The technical basis of cross-border e-commerce platform development is reflected by e-commerce sequential covariates, including three indicators of e-commerce development, e-commerce scale, and e-commerce penetration. (4) The distribution capacity of cross-border e-commerce logistics in a CBECCPA is expressed by e-commerce logistics sequential covariate. Cross-border e-commerce logistics undertakes the task of commodity delivery transfer, which is more complex compared with domestic logistics. The freight volume, express business volume, and logistics practitioners can reflect the logistics infrastructure and distribution capacity of a region. Considering the integrity of the data, this paper selects two measures of logistics employment and road freight volume, where the indicator of logistics employment connotes the number of employees in urban transportation, transportation, and storage and postal industries in the city where a CBECCPA locates, see Table 1.

Since 2013, China's Cross-border e-commerce industry has developed rapidly, but it greatly relies on the support of the economic system. At the same time, the cross-border e-commerce talent gap is expanding. At present, the construction of cross-border e-commerce majors in colleges and universities are just getting started, most of them still only use cross-border e-commerce as a small part of the curriculum of trade and other majors. To maintain the sustainable development of the cross-border e-commerce supply chain, the problem of insufficient supply of compound-type high-quality talents needs to be solved urgently. In addition, in the era of digital economy, technological

innovation is the core of all development. Only by continuously and deeply developing the innovation system can we enhance the sustainability of CBECSC development in the cities where CBECCPAs locate.

3.1.2. Building the Sequential Covariate Index System of Economic System. In this study, the following four indicators are selected to reflect the economic system. (1) The economic development sequential covariate reflects the economic basis of cross-border e-commerce development in the cities where CBECCPAs locate by two secondary indicators of economic scale and economic structure. (2) The consumption capacity of the city where a CBECCPA is reflected by the secondary indicators of disposable income and consumption expenditure of the social consumption sequential covariate. (3) The talent environment reflects the driving force for the optimal development of cross-border e-commerce supply chain, including the talent cultivation ability and talent attraction ability of the cities where CBECCPAs locate, among which the talent cultivation ability is measured by the education expenditure of the city where CBECCPA locates. (4) Technological innovation sequential covariates mainly include three indicators: R&D investment, R&D intensity, and science and technology expenditure, where R&D investment and R&D intensity are those of the province where a CBECCPA locates, and science and technology expenditure is that of the city where CBECCPA locates, see Table 2.

3.2. Measuring the Coupling Coordination. At present, there are 105 CBECCPAs in China, covering 30 provinces and cities. In this study, we select relevant data in 2017 from the 35 cities where the first three batches of CBECCPAs locate in China. After standardization, we measure the orderliness of 17 secondary indicators of CBECSC system and economic system and measure the degree of coupled development between CBECSC and economic system.

3.2.1. Data Standardization. Since the units and quantitative levels of the selected indicators are different, the data were first processed using the z-score data normalization method in order to conduct a valid study.

The original data sequence x_1, x_2, \dots, x_n is transformed with the formula:

$$y_i = \frac{x_i - \bar{x}}{s}, \quad (1)$$

where $\bar{x} = (1/n) \sum_{i=1}^n x_i$ and $s = \sqrt{1/(n-1) \sum_{i=1}^n (x_i - \bar{x})^2}$, and the transformed new sequence y_1, y_2, \dots, y_n has mean 0 and variance 1 and is dimensionless.

Using the same method to standardize $x_{11}, x_{12}, \dots, x_{ij}$, we obtain $y_{11}, y_{12}, \dots, y_{ij}$, where i is a secondary indicator and j is the city, where the CBECCPA locates.

3.2.2. Orderliness of Sequential Covariates. The following efficacy functions are established to measure the orderliness

TABLE 1: Sequential covariate index system of the CBECSC system.

Sequence covariates	Secondary indicators	Content of the indicator	Unit of measure
Supply chains	Logistics revenue	Total express revenue in the city ¹	100 million yuan
Foreign trade	Trade base	Total city imports and exports in the city ¹	US\$100 million
	Trade radiation effect	Total exports and imports in the provinces driven ²	US\$100 million
E-commerce	E-commerce development	E-commerce development index of the city ³	—
	E-commerce scale	E-commerce scale index of the city ³	—
	E-commerce penetration	E-commerce penetration index of the city ³	—
E-commerce logistics	Logistics employment	Number of people employed in urban transport, storage and postal services in the city ¹	Person
	Road freight volume	Urban road freight volume in the city ¹	Ten thousand tons

Data sources:¹, 2018 statistical yearbook by cities; ², 2018 statistical yearbook by provinces; ³, China e-commerce development index report (2017); ⁴, 2017 most attractive cities for talents and related data compilation; ⁵, 2017 national statistical bulletin on science and technology funding inputs.

TABLE 2: Sequential covariate index system of the economic system.

Sequence covariates	Secondary indicators	Content of the indicator	Unit of measure
Economic development	Size of the economy	GDP of the city ¹	100 million yuan
	Economic structure	Share of the tertiary sector in the city's GDP ¹	%
Social consumption	Disposable income	Per capital disposable income of urban residents in the corresponding province ²	Yuan
	Consumer spending	Per capital consumption expenditure of urban residents in the corresponding province ²	Yuan
Talent environment	Talent development	Education expenditure in the city ¹	Ten thousand yuan
	Talent attraction	Talent attraction index of the city ⁴	—
Technological innovation	R&D input	Total R&D investment in the corresponding province ⁵	100 million yuan
	R&D intensity	R&D investment intensity of the corresponding province ⁵	%
	Science and technology expenditure	Science and technology expenditures in the city ¹	Ten thousand yuan

Data sources: ¹, 2018 statistical yearbook by cities; ², 2018 statistical yearbook by provinces; ³, China e-commerce development index report (2017); ⁴, 2017 most attractive cities for talents and related data compilation; ⁵, 2017 national statistical bulletin on science and technology funding inputs.

of each sequential covariate so that the orderliness of the whole system can be further calculated and analyzed:

$$f_s = \frac{1}{k} \left[\sum_{i=1}^k \left(\frac{1}{35} \sum_{j=1}^{35} y_{ij} \right) \right], \quad (2)$$

where k is the number of secondary indicators for a given sequential covariate and s is the sequential covariate number.

When f_s is a positive indicator, a higher value indicates a higher degree of order. When f_s is a negative indicator, a larger value indicates a lower degree of order.

3.2.3. System Orderliness. The average of the orderliness of its own sequential covariates is taken as the orderliness of the cross-border e-commerce system:

$$F_1 = \sum_{s=1}^4 f_s. \quad (3)$$

The average of the orderliness of its own sequential covariates is taken as the orderliness of the economic system:

$$F_2 = \sum_{s=5}^8 f_s. \quad (4)$$

3.2.4. Degree of System Coupling Development. The degree of coupling development can reflect the degree of coordinated development of CBECSC and economic system at a point in time. The degree of coupling development between the CBECSC system and the economic system is derived according to the following formula:

$$F = \left[\frac{2F_1 F_2}{(F_1 + F_2)^2} \right]^{(1/2)}, \quad (5)$$

where $F \in [0, 1]$. The larger the value of F is, the higher the degree of coupled and coordinated development of the two

TABLE 3: Evaluation criteria for the degree of the coupled and coordinated development.

Level	Coupling coordination type	Coupling coordination value	Level	Coupling coordination type	Coupling coordination value
1	State of extreme dysfunction	0.00–0.10	6	Barely coordinated coupling	0.50–0.55
2	State of severe dysfunction	0.10–0.20	7	Primary coordination coupling	0.55–0.60
3	Moderate disorder	0.20–0.30	8	Intermediate coordination coupling	0.60–0.65
4	Mildly disorder	0.30–0.40	9	Well-coordinated coupling	0.65–0.70
5	On the verge of dysfunctional	0.40–0.50	10	Quality coordination coupling	0.70–1.00

TABLE 4: Supply chain orderliness in the cities where the CBECCPAs locate.

Cities	Supply chain orderliness	Orderliness of foreign trade	Orderliness of electronic commerce	Orderliness of e-commerce logistics	CBECCSC orderliness
Guangzhou	0.0472	0.038	0.1523	0.0577	0.2953
Shanghai	0.1319	0.0505	0.0178	0.0507	0.2508
Shenzhen	0.0473	0.0671	0.0508	0.016	0.1813
Beijing	0.0351	0.0274	0.0323	0.0526	0.1474
Zhuhai	0.0151	0.0377	0.0508	0.0237	0.1272
Dongguan	0.0083	0.0421	0.0508	0.0226	0.1238
Chongqing	0.0093	0.0116	0.0157	0.0683	0.1049
Suzhou	0.0057	0.0584	0.0099	0.0156	0.0897
Lanzhou	0.0157	0.0213	0.0263	0.0218	0.085
Changchun	0.0142	0.0194	0.0307	0.0193	0.0836
Harbin	0.0129	0.0205	0.0321	0.0172	0.0827
Haikou	0.0156	0.0209	0.0172	0.026	0.0797
Hangzhou	0.026	0.0067	0.042	0.0038	0.0785
Hohhot	0.0151	0.0209	0.0241	0.016	0.0761
Tangshan	0.0156	0.0184	0.0183	0.0207	0.073
Nanchang	0.0132	0.0187	0.0205	0.0199	0.0723
Guiyang	0.0145	0.021	0.017	0.0193	0.0718
Nanning	0.0131	0.0182	0.0254	0.0119	0.0686
Yiwu	0.0017	0.0111	0.0419	0.0109	0.0656
Ningbo	0.005	0.007	0.042	0.009	0.063
Shenyang	0.0122	0.0159	0.0283	0.0048	0.0612
Dalian	0.0134	0.0107	0.0283	0.0082	0.0605
Changsha	0.0108	0.0186	0.0127	0.0181	0.0602
Weihai	0.0158	0.0078	0.0093	0.0261	0.059
Wuxi	0.0075	0.0184	0.0099	0.0195	0.0553
Kunming	0.0133	0.0198	0.0196	0.0012	0.054
Zhengzhou	0.0161	0.0119	0.0172	0.0084	0.0536
Chengdu	0.0023	0.0124	0.0035	0.0299	0.0482
Xian	0.0099	0.0159	0.014	0.0054	0.0452
Hefei	0.0102	0.0166	0.0076	0.0093	0.0436
Tianjin	0.0039	0.0091	0.0222	0.0083	0.0436
Nanjing	0.0043	0.0175	0.0099	0.0113	0.0431
Wuhan	0.0031	0.0166	0.0115	0.0076	0.0389
Xiamen	0.011	0.0049	0.0071	0.0109	0.0339
Qingdao	0.0099	0.0021	0.0093	0.0071	0.0284

systems is. In this study, the coupled and coordinated development degree is divided into 10 levels, see Table 3.

4. Results and Analysis

4.1. *Results and Analysis of the Orderliness of CBECCSC.* In general, the orderliness of supply chain systems in the 35 cities where the CBECCPAs locate in 2017 (see column 6 of Table 4) was uneven. Guangzhou City has the highest

orderliness, Shenzhen has the highest orderliness of supply chain and foreign trade, Guangzhou has the highest orderliness of e-commerce, and Chongqing has the highest orderliness of e-commerce logistics sequential covariate. Chongqing, Guangzhou, and Shenzhen all belong to the second batch of CBECCPAs in China, which were built earlier and have made certain achievements in cross-border e-commerce development. In addition, together with the prominence of their location advantages,

TABLE 5: Orderliness of the economic system of the cities where the CBECCPAs locate.

Cities	Orderliness of economic development	Orderliness of social consumption	Orderliness of the talent environment	Orderliness of technological innovation	Orderliness of the economic system
Beijing	0.069	0.0761	0.1104	0.083	0.3385
Shanghai	0.0568	0.0837	0.0763	0.0561	0.2730
Shenzhen	0.0259	0.0152	0.0384	0.0385	0.1179
Haikou	0.0416	0.0198	0.0216	0.0283	0.1112
Guangzhou	0.0425	0.0152	0.0243	0.0213	0.1033
Tangshan	0.0474	0.0212	0.0149	0.0163	0.0997
Lanzhou	0.0245	0.0338	0.018	0.0192	0.0955
Guiyang	0.0176	0.0332	0.0161	0.0242	0.0911
Yiwu	0.0249	0.0326	0.0189	0.0128	0.0892
Hohhot	0.0353	0.007	0.02	0.024	0.0862
Nanning	0.017	0.0277	0.015	0.0243	0.084
Changchun	0.0263	0.0209	0.014	0.0225	0.0837
Chongqing	0.0345	0.0121	0.0288	0.0048	0.0802
Nanchang	0.0247	0.0225	0.0155	0.0161	0.0788
Kunming	0.0108	0.0316	0.0143	0.0209	0.0776
Tianjin	0.0191	0.0273	0.0153	0.0145	0.0761
Hangzhou	0.0146	0.0326	0.0179	0.0094	0.0744
Harbin	0.0157	0.0213	0.0132	0.0222	0.0724
Zhuhai	0.0237	0.0152	0.0184	0.0142	0.0715
Weihai	0.0303	0.0096	0.0187	0.0127	0.0713
Ningbo	0.0187	0.0326	0.0079	0.0085	0.0677
Dongguan	0.0113	0.0152	0.0127	0.0153	0.0544
Zhengzhou	0.0084	0.0267	0.0054	0.0135	0.0541
Hefei	0.0163	0.02	0.0099	0.0052	0.0514
Suzhou	0.011	0.015	0.007	0.0168	0.0499
Wuxi	0.0069	0.015	0.0119	0.0145	0.0484
Xian	0.0075	0.0235	0.0079	0.008	0.047
Chengdu	0.0105	0.0208	0.0085	0.0064	0.0462
Wuhan	0.0169	0.0148	0.0045	0.0072	0.0434
Changsha	0.0118	0.0152	0.0063	0.0094	0.0427
Nanjing	0.0075	0.015	0.0016	0.0121	0.0364
Xiamen	0.009	0.0033	0.0129	0.0099	0.0351
Dalian	0.0061	0.0019	0.0137	0.0095	0.0312
Shenyang	0.0065	0.0019	0.0119	0.0091	0.0295
Qingdao	0.0008	0.0096	0.0063	0.0105	0.0272

the development of supply chains in the cities are more complete.

4.2. Results and Analysis of Economic System Orderliness.

In terms of the overall orderliness of the economic system, Beijing has the highest orderliness, see Table 5. Beijing also has the highest orderliness in economic development, talent environment, and technological innovation. Shanghai has the highest orderliness of social consumption. Beijing and Shanghai are China's first-tier big cities, enjoying richer resources and more favorable policies. Their economic development levels far exceed most of other cities, which can provide strong support for the development of cross-border e-commerce supply chains.

4.3. Results and Analysis of Coupled and Coordinated Development Degrees.

In 2017, among the 35 cities where CBECCPAs locate in China, the CBECCSC system and the economic system are in superior coordinated coupling in 21

cities, good coordinated coupling in 13 cities, and moderate coordinated coupling in one city, as shown in Table 6.

The 21 cities where CBECCPAs locate in Table 6 are in a state of superior coordinated coupling, but they are all just reaching the standard of superior coupling and coordination. Although the CBECCSC system and the economic system in these cities can achieve benign resonance, it is not yet known whether the momentum of coordinated development can be maintained in the future. To maintain sustainable development, the elements of the two systems need to work more closely together and improve the efficiency of resource utilization.

Among the 13 cities in good coordinated coupling state in Table 6, 6 cities' CBECCSC systems and economic systems are close to a superior coordinated coupling state, including Yiwu, Tangshan, Haikou, Changsha, Kunming, and Shenzhen, while Dongguan and Beijing have a relatively low coordinated coupling degree. The main reason for Dongguan comes from the fact that its economic system lags behind the development of the CBECCSC system, while Beijing stems from the fact that the CBECCSC system lags behind the development of the economic system.

TABLE 6: Degree of coupled development of supply chain system and economic system in 35 cities where CBECCPAs locate in China in 2017.

Coupling type	Cities	Degree of coupling development	Cities	Degree of coupling development	Cities	Degree of coupling development	Cities	Degree of coupling development
Superior coordination coupling	Zhengzhou	0.7071	Qingdao	0.7069	Hohhot	0.7057	Nanning	0.7035
	Changchun	0.7071	Ningbo	0.7067	Wuxi	0.7055	Guiyang	0.7021
	Chengdu	0.707	Shanghai	0.7065	Harbin	0.7055	Chongqing	0.7008
	Xiamen	0.707	Nanchang	0.7064	Hefei	0.7047		
	Xian	0.707	Wuhan	0.7061	Nanjing	0.7046		
	Hangzhou	0.7069	Lanzhou	0.7059	Weihai	0.7039		
Good coordination coupling	Yiwu	0.6989	Kunming	0.6956	Suzhou	0.6778	Beijing	0.6501
	Tangshan	0.6986	Shenzhen	0.6911	Dalian	0.6699		
	Haikou	0.6974	Tianjin	0.6805	Shenyang	0.6624		
	Changsha	0.6968	Zhuhai	0.6788	Dongguan	0.6514		
Moderate coordination coupling	Guangzhou	0.6197						

Guangzhou is the only city in the moderate coordinated coupling state in Table 6. As one of the second batch of CBECCPAs, Guangzhou city has obvious geographical advantages, industrial advantages, higher economic development level, and good development of the CBECS, but is still in the run-in period of the coupled and coordinated development between the CBECS and the economic system.

5. Conclusions and Suggestions

5.1. Main Conclusions and Discussion

5.1.1. *Main Conclusions.* The calculation of the orderliness and coupling coordination degree of the CBECS system and the economic system of the 35 cities where CBECCPAs locate in China in 2017 shows that 21, 13, and 1 cities where the CBECCPAs locate are classified as being in the state of superior, good and moderate coupling, and coordination, respectively. The CBECS development in the cities where the CBECCPAs set earlier is superior such as Zhengzhou and Hangzhou, and the two systems have a superior degree of coordinated coupling. However, the two systems in Shenzhen and Guangzhou have a mismatch of coordinated coupling with the former batch of CBECCPAs approved. Beijing has a strong economy, but the development of the CBECS system lags behind the economic development, and there is still space to improve the degree of coupling development. The development of Dongguan’s economic system lags behind the development of the CBECS system.

5.1.2. *Discussion.* At present, most relative research studies focus on the factors influencing the development of CBECS and economic systems. On the basis, this paper studies the coupled and coordinated relationship between the two systems, which is a new aspect. And this study selects 35 CBECCPAs in China as research objects, which is more realistic and effective.

5.1.3. *The Limitation and Further Research.* This paper analyzes the coupled and coordinated development between

China’s CBECS and economic system only for 35 CBECCPAs and only in 2017 because of data availability. It will be more meaningful to find out the general rule of the change or evolution of the coupled and coordinated development between years. And the research will be more convincing if it covers more CBECCPAs. Further research will cover more CBECCPAs and development between many years.

5.2. *Suggestions.* To promote the coordinated development of the CBECS and the economic system, it is necessary not only to improve the orderliness of the supply chain and of the economic system in the city where the CBECCPAs locate but also to improve the close integration and good cooperation between the CBECS and the economic system and to continuously improve the coupling and coordination between them. Specific countermeasures are proposed as follows.

5.2.1. *To Improve the Ecosystem of the CBECS.* According to the orderliness of supply chains in cities where CBECCPAs locate, the orderliness of cross-border e-commerce supply chains in Chengdu, Xi’an, Hefei, Tianjin, Nanjing, Wuhan, Xiamen, and Qingdao is low. The CBECS is a key link and logistics gateway for the development of cross-border e-commerce. For cities with low orderly cross-border e-commerce supply chains, much efforts should be made to the cohesive role of CBECCPAs, to improving the CBECS ecosystem, to strengthening the construction of cross-border e-commerce platforms, to developing supporting industries including warehousing and logistics, information services, and financial services, and to improving resource integration capacity and operational efficiency.

5.2.2. *To Pursue High-Quality Development of the Urban Economy.* There are large differences in the economic development among the 35 cities where CBECCPAs locate. Beijing and Shanghai have a much more orderly economic system than the other 33 cities, while Nanjing, Xiamen,

Dalian, Shenyang, and Qingdao have a less orderly economic system, and the industrial base of the third- and fourth-tier cities is relatively weak. Therefore, in order to improve the orderliness of the economic system, it is more necessary to innovate the concept of urban economic development, promote the optimization of industrial structure, pursue high-quality development, stimulate greater economic vitality, and establish a mechanism of synergistic innovation, complementary advantages, and linkage development on the basis of the city's development positioning, which is of great significance to take full advantage of each place and achieve balanced regional development as well.

5.2.3. To Create a Favorable Environment for the Coordinated Development. City development should aggregate and coordinate government and market forces, promote the in-depth and synergistic development of CBECSC and economic system, deepen cooperation between industries and enterprises, break the boundaries between regions, enhance regional ties, accelerate the flow and reorganization of resources, and construct a good development environment. And cities such as Beijing and Shanghai, whose economic development has far outpaced the development of cross-border e-commerce supply chains, should make up for their shortcomings, provide a suitable business environment for cross-border e-commerce development, accelerate customs clearance facilitation, and vigorously promote the development of cross-border e-commerce supply chain and its coordinated development with the economic system.

5.2.4. To Cultivate Professional Composite Talents and to Encourage Innovation and Entrepreneurship. The cross-border e-commerce industry involves a multidisciplinary and cross-fertilization knowledge and requires practitioners with a higher standard. The development of cross-border e-commerce requires international and composite talents who understand business, have sensitivity to the market, understand customers' needs, and are good at data-based operation and promotion. To build and improve the training system for professional and technical talents in cross-border e-commerce, we should encourage the combination of industry, academia, and research to build and optimize the relevant courses in cross-border e-commerce; encourage cross-border e-commerce enterprises to carry out relative training and establish an incubation mechanism to encourage cross-border e-commerce innovation and entrepreneurship, etc.

Data Availability

The data used to support the findings of this study are included within the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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