Comparison of International Competitiveness of Digital Services Trade between Korea and China*

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Abstract

Purpose – The purpose of this study is to analyze and compare the international competitiveness of digital service trade between Korea and China and to help enhance the competitive advantage of digital service trade between the two countries.

Design/methodology – This paper designs and establishes a comprehensive evaluation system for the international competitiveness of the Korea-China digital service trade. By using the analytical methods of combining theory and demonstration through qualitative and quantitative analysis, this paper makes a concrete and complete theoretical deconstruction and empirical measurement of its international competitiveness from the two levels of overall competitiveness and departmental competitiveness. At the same time, the study also analyzes the competitive advantages and comparative disadvantages of the two countries.

Findings – It is found that South Korea has a strong competitive advantage in the sector competitiveness of digital service trade, and the export structure is reasonable and balanced, but the deficit pattern affects the overall competitiveness. China has a strong competitive advantage in the overall competitiveness of the digital service trade. However, the structural imbalance in the export sector weakens the competitiveness of the sector. Both Korea and China have the space advantage and competitive potential to enhance international competitiveness in terms of development trends.

Originality/value – This paper takes the lead in solving the pain point of the relative lack of similar research topics. It demonstrates the evolution process, development trends, and structural characteristics of the digital service trade. A new combination of competitive power research methods is innovated, and a comprehensive evaluation system is established. The above innovation points show the academic theoretical value and practical application value of this study.

Keywords: Comparative Advantage, Competitive Disadvantage, Digital Services Trade, International Competitiveness
JEL Classifications: F14, O11

1. Introduction

Digital services trade originates from both services trade and digital trade and is an emerging form of trade where digital technology is deeply integrated with traditional trade. The concept of digital services trade sprang from the definition of digital trade in the report Digital Trade in the U.S. and Global Economies by the US International Trade Commission

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(USITC) in July 2013. Digital service is the domestic commerce and international trade conducted via the Internet. It took shape in the sectoral composition framework for digital services trade in ICT Services Trade and ICT-Enabled Services Trade made by the United Nations Conference on Trade and Development (UNCTAD) in 2015 and matured in the definition of digital services trade in the report Digital Services Trade Restrictiveness Index published by the Organization for Economic Co-operation and Development (OECD) in 2019 - trade of the services provided via electronic networks. However, there has been no unified consensus reached among the interpretations of the digital services trade made by the academic community over the years. It is only the primary stage, also the first stage, of the evolution of digital services trade connotation at present.

Digital services trade is an emerging services trade provided and delivered using digital technology and the Internet, it is also involved with all-digital services products and services departments that can be delivered digitally.

UNCTAD (2015) proposes a framework for the sectoral composition based on ICT services trade and on potential ICT delivery services trade, that is, based on the Extended Balance Payments Services Classification (EBOPS), it includes 6 sectors involving digitally deliverable insurance services (insurance and pension services), financial service, intellectual property service (royalties on intellectual property, royalties on R&D results, licensing fees for audiovisual and related products), ICT service (telecommunications, computer and information services), other business services (technical trade, professional and management consulting services, accounting, legal, advertising, and public relations services), personal recreation service (personal, cultural and entertainment services) in the classification of digital services trade. This EBOPS-based digitizable 6-sector classification framework serves as a relevant statistical accounting basis for digital services trade at the current stage. The Ministry of Commerce of China has defined the scope of digitizable classification in the China Digital Services Trade Development Report 2018, making statistical accounting for China's digital services trade in six sectors, that is, insurance, finance, intellectual property services, ICT services, other business services, and personal recreation services. In 2018, China's digitizable services exports amounted to $132.14 billion, registering a year-on-year increase of 28.8%, and digitizable services imports amounted to $124.04 billion, up 17.7% year-on-year. The total volume of digitizable services trade reached up to $256.18 billion. This paper conducts accounting measurement and comparative analysis based on the digitizable classification criteria of digital services trade by UNCTAD (2015), OECD (2019), and the Ministry of Commerce of China (2019). To ensure the completeness and accuracy of the data, the trade data were acquired from the databases of WTO, UNCTAD, OECD, the National Statistical Office of Korea, and the National Bureau of Public Statistics of China.

The international competitiveness of digital services trade refers to the ability of a country or region, digital service industry, or enterprise to participate in the international competition of digital services trade in the international market and the ability to continuously create added value and continuously increase wealth in the process of trade liberalization. The key to studying the international competitiveness of a country's digital services trade at the macro level lies in the development of its core competitiveness (i.e., industrial competitiveness). Despite the differences in economic scale and trade volume, Korea and China share a geographical advantage and a long-standing and close trade coopetition relationship, and they have a similar digital service industry development environment at a similar stage. Especially in the context that both Korea and China have crossed the factor-led and in-

vestment-led stage and entered the new innovation-led stage, an objective assessment of the international competitiveness of digital services trade between the two countries is of great practical significance for promoting the high-quality development of foreign trade and building China into a powerhouse in digital trade. What international competitiveness do Korea and China have in digital services trade? What are the comparative advantages and competitive advantages in the digital services industry sector? This paper conducts an in-depth study on this topic to help Korea and China jointly enhance their competitive advantages in the digital services trade. Based on the above purposes, this paper refers to the competitiveness index system of international trade in services and the national competitive advantage index system of IMD. Based on the existing competitiveness theoretical framework and empirical index and combined with the actual characteristics of the development of digital service trade in Korea and China, relevant competitiveness indicators are integrated according to the principle of comparability of indicators. By using the analytic methods of combining theory with empirical analysis and combining qualitative and quantitative analysis, a new combination of competitiveness research methods is innovatively proposed to construct a comprehensive evaluation system (see Table 1), and the international competitiveness of digital service trade between Korea and China is comprehensively investigated.

Table 1. Comprehensive evaluation system of international competitiveness of digital services trade between Korea and China

Analysis Layer	Factor Layer	Evaluation Connotation	Comparison Layer	Target Layer
Theoretical Analysis	Current situation of development	Competition situation	Realistic competitiveness	
	Aggregate indicator	Scale and growth		
	Income and expenditure indicators	Trade balance		
	Percentage indicator	Proportion of exports		International competitiveness
	Export structure	Degree of structural optimization		(Overall competitiveness) (Sectoral competitiveness)
Empirical Analysis	TC index	Competitive advantage in trade	Trade competitiveness	
	RCA index	Comparative advantage in exports	Export competitiveness	
	NRCA index	Comparative advantage in net exports	Competitiveness in net exports	
	IMS index	International market share	International market share	

The empirical analysis method used in the comprehensive evaluation system in Table 1 is different from previous studies in terms of index adoption. The main difference lies in the comprehensive adoption of relevant indexes in this analysis and research method, which can

completely reflect the true and complete picture of the research subject and then make objective evaluation results. Most of the previous studies use fewer or even a single index to carry out the empirical measurement, and the results are different. The competitiveness indexes have their respective applicable scope and have certain limitations, so this empirical analysis method comprehensively adopts the index measurement system composed of TC, RCA, NRCA, and IMS competitiveness indexes according to the goal orientation. The differences reflected by each index are analyzed, verified, and evaluated comprehensively to reflect the level of international competitiveness. This method overcomes the analysis defects caused by the internal differences in a few or a single index and avoids the analysis errors with inconsistent results. It can increase the comprehensive verification ability and realize the objectivity and scientificity of empirical analysis.

2. Analysis on the Current Situation of Digital Services Trade Between Korea and China

2.1. Current Situation of Development of International Digital Services Trade

The digital economy generated by Internet technology has been growing along with the global division of labor since the 1990s remove and has gradually become the core driver for global economic growth. As the new generation of information and communication technologies such as big data, cloud computing, industrial Internet, artificial intelligence, 5G, and blockchain continue to empower the digital economy and get rapidly penetrated and integrated with different fields of economy and society, industrial digitalization keeps reconstructing the pattern of the industrial division of labor, while changing the traditional model of international trade. The digital technology application of trade modes and trade objects has innovatively developed two modern trade patterns of digital trade and digital services trade, injecting powerful new kinetic energy into international trade, especially services trade, and driving more data flow-based trade in goods to transform into digital services trade, further promoting the rapid growth of global digital services trade. According to UNCTAD statistics, world digital services trade exports reached $3,226.911 billion in 2019, accounting for 12.8% of world trade exports and 52.5% of world services exports. Digital services trade has grown into a leading force in services trade, showing sustainable growth. Especially in the context of the shrinking global economy and trade caused by the COVID-19 pandemic and in urgent need of recovery, digital services trade is seen as an important step and focus area to lift the economy and it will bring a new way for countries to enhance their international competitiveness.

The strong growth of the digital services trade is profoundly affecting the competition pattern of the global digital services trade market. Seen only from three key measures of digital services export volume, international market share, and average annual growth (as shown in Table 2), the global digital services trade presents unbalanced development.

According to the trade data released (by UNCTAD) in 2019 and the research of the China Academy of Information and Communications Technology, the United States and Europe, as the leaders of global services trade and the leaders of digital trade, are still at the forefront of the world in the development of digital services trade. In terms of digital service export

volume and international market share, the top 5 countries (U.S., U.K., Ireland, Germany, and the Netherlands) are in the leading position of the first tier, with the combined digital service exports of the above five countries accounting for 44.7% of global total and a combined digital service international market share of 45.2%, and they all have maintained a solid average annual growth, directly demonstrating their strong competitive advantages and market dominance. In 2019, the U.S. continued to top the list of digital services exports, reaching $534.18 billion ($845.03 billion in total exports and imports), and was far ahead of other countries with an international market share of 16.7%, reflecting the absolute advantage and strong international competitiveness of the U.S. digital services industry. However, the investigation of trade data of many developing countries shows that they are lagging in all three indicators and have a significant competitive disadvantage.

Table 2. Key Indicators of International Competitiveness of Digital Services Trade in 20 Representative Countries

(Unit: $100 million, %)

Country	Volume and Balance of Digital Services Trade in 2019				International Market Share in 2019	Growth in 2010-2019
	Export Volume	Import Volume	Total Amount	Income and Expenditure		
U.S.	5342	3109	8450	2234	16.7	5.2
U.K.	3073	1634	4707	1439	9.6	4.2
Ireland	2170	3022	5192	-852	6.8	11.5
Germany	2001	1775	3776	226	6.3	5.7
Netherlands	1844	1794	3638	50	5.8	-
India	1479	731	2210	748	4.6	-
France	1467	1372	2839	95	4.6	4.7
China	1436	1283	2718	153	4.5	10.7
Singapore	1161	1042	2203	119	3.6	12.7
Japan	1161	1283	2443	-122	3.6	-
Luxembourg	1011	765	1776	246	3.2	7.3
Canada	552	539	1092	13	1.7	-
Italy	489	604	1093	-115	1.5	-
Korea	419	526	945	-107	1.3	9.5
Philippines	237	101	337	136	0.7	-
Russia	212	377	589	-165	0.7	2.3
Brazil	208	373	581	-165	0.7	2.6
Australia	170	204	374	-34	0.5	-
Indonesia	87	154	241	-67	0.3	-
South Africa	38	56	94	-18	0.1	1.1

Source: UNCTAD and China Academy of Information and Communications Technology.

Since the beginning of the 21st century, Korea and China have taken great steps to develop their digital economies, driving the long-term rapid growth of the digital services trade. China ranked 6th with a growth rate of 8.6% and Korea ranked 7th with 6.3% in 2019, respectively, higher than most developed countries. However, there is still a small gap between these two

developed countries in Europe and the United States in terms of export volume and market share. Specifically, China exported $143.55 billion of digital services ($271.81 billion in total imports and exports) in 2019, accounting for 4.5% of the international market share, ranking 8th globally in both indicators and only slightly lower than India among developing countries. In 2019, Korea exported $41.9 billion of digital services ($94.5 billion in total imports and exports), with an international market share of 1.3%. It ranked 14th globally in both indicators, much higher than countries such as Russia, Brazil, and South Africa. The data above show that Korea and China are generally in the middle and upper reaches of the global digital services trade market, showing certain competitive advantages.

2.2. Current Situation of Development of Digital Services Trade in Korea

As a typical representative of the "East Asian Miracle", Korea entered the service-oriented development earlier. According to the National Statistical Office of Korea, the service industry in Korea accounted for 51.4% of GDP in 1990, rising to 60.1% in 2010 and reaching 62.5% in 2019. The service industry has long dominated Korea's economic growth. Korea's total services trade grew from $8.7 billion in 1980 to $179.8 billion in 2010 and reached $234.5 billion in 2019, moving it up to 11th place in the world services trade. Thanks to the long-term strategic layout, coupled with the superimposed effects of multiple factors such as economic structure reform and industrial transformation and upgrading, especially technological progress under independent innovation, Korea's technology and knowledge-intensive industries such as IT, culture, semiconductors, ICT enjoyed rapid growth in the 1990s, growing into a multinational value chain in the 21st century, and laying a solid industrial foundation for upgrading services trade to digital services trade.

Based on its comparative advantages in high-end service industries such as culture and ICT, Korea has made steady growth in the digital services trade (as shown in Table 3).

Table 3. Korea's Digital Services Trade Volume, Share and Balance from 2009 to 2019

(Unit: $100 million, %)

Year	Export Volume	Share in Service Exports	Import Volume	Share in Service Imports	Total Imports and Exports	Share in Services Trade	Income and Expenditure
2009	165.6	22.8	331.5	40.5	497.1	32.2	-165.9
2010	184.1	22.2	375.1	38.7	559.2	31.1	-191
2011	221.3	24.4	376.5	36.7	597.8	30.9	-155.2
2012	247.0	24.0	426.6	39.4	673.6	31.9	-179.6
2013	268.2	26.0	431.6	39.4	699.8	32.9	-163.4
2014	326.4	29.2	460.8	40.0	787.2	34.7	-134.4
2015	323.6	33.2	444.0	39.6	767.6	36.7	-120.4
2016	350.4	37.0	440.2	39.3	790.6	38.2	-89.8
2017	373.9	41.7	505.0	39.9	878.9	40.7	-131.1
2018	393.9	39.8	496.1	38.5	890.0	39.1	-102.2
2019	418.7	40.9	526.3	41.6	945.0	41.3	-107.6

Source: Calculated from WTO database.

In terms of absolute value, the overall volume of trade has been steadily growing, accounting for an increasing share of services trade. Korea's total digital services exports and imports expanded from $49.71 billion in 2009 to $94.5 billion in 2019, nearly doubling in 11 years, with imports reaching $33.15 billion in 2009 and $52.63 billion in 2019, also nearly doubling in 11 years; exports grew from $16.56 billion in 2009 to $41.87 billion in 2019, an increase of 2.5 times in 11 years. The continuous and steady expansion of digital services trade has brought it close to 50% of services trade in both the total volume and total value of imports and exports, as evidenced by the fact that the proportion of digital services trade in services trade rose to 41.3% in 2019, 41.6% in services imports and 40.9% in services exports, showing an obvious and relatively balanced simultaneous rise. The dominance of the digital services trade is gaining increasing prominence in the services trade.

The trade balance shows a trade deficit in general. The deficit in 2010 reached a maximum of $19.1 billion, shrinking to $10.76 billion in 2019 as exports grew faster than imports over the years. Despite the gradual narrowing of the deficit, there is no fundamental change in the long-term deficit pattern of trade in general. Among the sub-sectors, trade of financial, ICT, and personal recreation services has gained a sustained surplus in recent years, showing a strong competitive advantage.

Looking at the trade structure, the sectoral structure tends to be reasonable. The international experience of the evolution of digital services trade structure shows that the reasonable departmental structure at present is a basic structure supported by 4 leading forces and 2 basic forces and shows its advancement with the world-leading level of its internal superior departments. The proportion of technology-intensive sectors represented by ICT services is the first to show a rapid rise and tends to be stable followed by a slow as the technology industry reaches its peak in the current round; human resource-intensive sectors represented by other business services account for the largest proportion; knowledge-intensive sectors represented by financial and intellectual property services maintain a large proportion. The above 4 sectors together constitute the leading structure of digital services trade, driving insurance and personal recreation service sectors to play a fundamental supporting role. These structural characteristics of digital services trade at this stage are particularly evident in the export structure of developed countries (as shown in Fig. 1). Although the factors concerned in different countries may lead to some or even huge differences in the proportion at different development stages, they will not change the dominant force pattern of the sectoral structure or cause any change in the aggregate growth.

The adjustments and changes in the sectoral structure of Korea's digital services trade tend to be increasingly rational and advanced, in line with the structural evolution pattern, which is a concentrated manifestation in the export structure (as shown in Table 4).

First, from the perspective of dominant forces, the 4 sectors that account for a larger share in Korea's digital services export structure are ICT, other business, intellectual property, and financial services in 2019, with their respective shares of 13.20%, 55.93%, 18.50% and 7.01%, which together account for 94.64% of total export earnings, in line with the pattern of dominant forces in the export structure of developed countries. As can be seen in Figure 1, the combined share of the above four in the export structure of developed countries is 93.3% of total export earnings, and that in the export structure of world trade is 93.2%. Second, from the perspective of sectoral growth, the growth of Korea's digital services exports by sector fluctuates in different years, but there was no effect on the high growth from 2007 to 2017, with the export growth of ICT and other business services peaking at 42.1% and 19.9% in

2013 and 2012, respectively, the export growth of intellectual property and personal recreation services reaching 38% and 31.6% in 2011, respectively, and the export growth of insurance and financial services reaching an all-time high of 63.3% and 25.3% in 2017. In 2019, the export growth of all sectors stabilized at a medium of 7.6% on average, but the export of personal recreation services still registered a higher growth of 19.1%. The long-term rapid growth of the sector's export trade has significantly contributed to the process of optimizing the sector's structural rationality. Third, from the perspective of sectoral strengths, the strengths of all sectors are relatively balanced. The sectors of ICT services, intellectual property services, and personal recreation services supported by the independent industrial chain have a prominent competitive edge in Korea, with the exports of intellectual property services increasing continuously from 9.9% in 2007 to 18.5% in 2019 and the exports of personal recreation services increasing continuously from 1.5% in 2007 to 3.2% in 2019. The two sectors rank high in the world in terms of share level, with significant international advancement and strong competitive advantages. It should also be noted that some sectors such as insurance services accounted for only 2.2% of exports in 2019, even lower than that of developing countries with an obvious competitive disadvantage.

**Fig. 1.** International comparison of the export structure of digital services trade in 2019
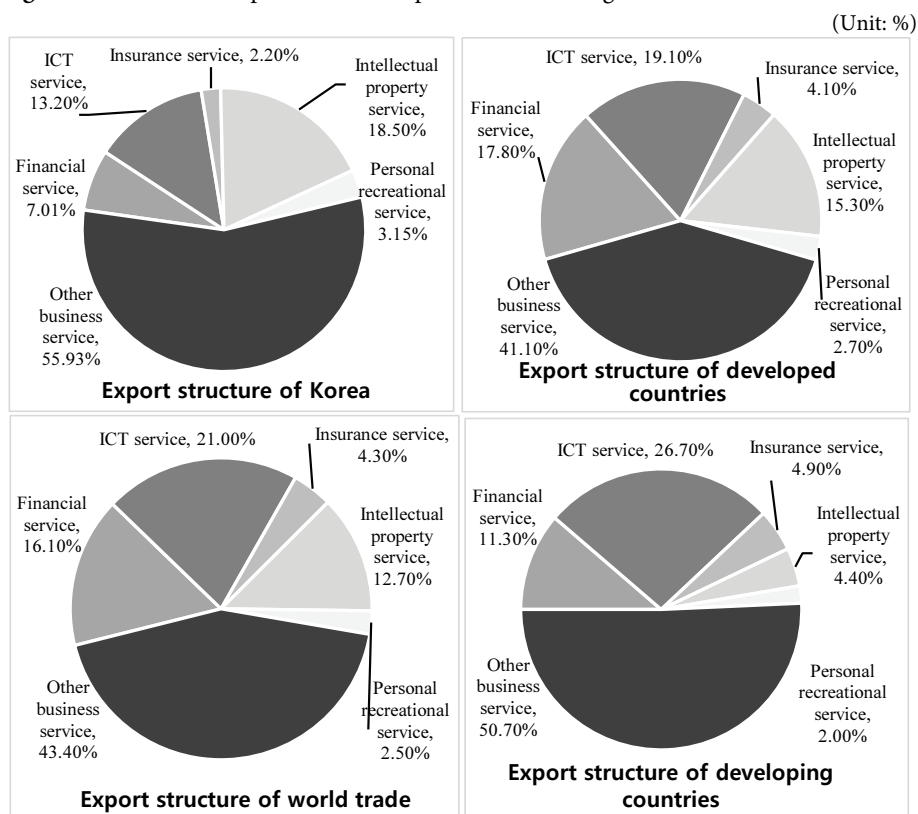
(Unit: %)

Table 4. Sectoral Structure of Korea's Digital Services Trade Exports from 2007 to 2019

(Unit: %)

Sector/Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Insurance services	2.27	2.40	2.05	2.79	2.34	1.98	2.39	2.46	2.28	1.95	2.98	2.17	2.20
Financial service	11.28	11.08	9.54	8.94	8.11	7.44	4.83	4.38	5.06	5.08	5.99	7.26	7.01
Intellectual property service	9.99	12.54	19.66	17.31	19.88	15.80	16.24	16.98	20.25	19.79	19.49	19.68	18.50
ICT service	4.92	4.87	5.33	5.59	5.96	6.15	8.04	9.17	10.82	10.61	12.25	13.02	13.20
Other business service	70.04	67.34	61.12	63.20	61.36	65.90	65.78	64.18	58.84	59.33	56.81	55.05	55.93
Personal recreation service	1.50	1.76	2.30	2.15	2.35	2.73	2.73	2.83	2.74	3.23	2.47	2.81	3.15

Source: Calculated from WTO database.

As seen from the long-term trend, the digital services trade in Korea will continue to grow steadily. Korea's exports grew at an average rate of 7.7% from 2009 to 2019. Compared with the world's growth of 5.2% for the same period (as shown in Figure 2), it was in the world's advanced ranks with strong growth potential.

Fig. 2. Comparison between Korea's Digital Service Export Growth and World Growth from 2009 to 2019

(Unit: %)
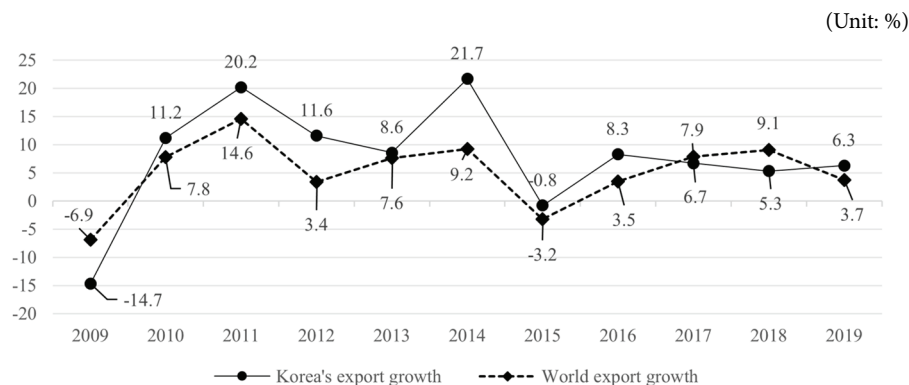
Source: UNCTAD database.

2.3. Current Situation of Development of Digital Services Trade in China

The continuous reform and opening have pushed China into a period of service-oriented development in the process of industrialization. According to the National Bureau of Statistics of China, the added value of China's service industry accounted for only 23.9% of GDP in 1978, rising to 43.4% in 2009 and reaching 53.9% in 2019, marking the shift of the service industry into the main driver of China's economic growth. The total services trade of

China grew from $5.2 billion in 1985 to $302.5 billion in 2009 and reached $785.0 billion in 2019, further solidifying its position as the world's second-largest country in services trade. The rapid rise of digital trade in the 21st century has greatly contributed to the transformation and upgrading of services trade, and the deep integration of digital technology and the service industry has further accelerated the growth of China's digital services trade.

China has experienced unprecedented rapid growth in ICT services-led digital services trade in the past decade (as shown in Table 5).

Table 5. China's digital services trade volume, share and balance from 2009 to 2019

(Unit: $100 million, %)

Year	Export Volume	Share in Service Exports	Import Volume	Share in Service Imports	Total Imports and Exports	Share in Services Trade	Income and Expenditure
2009	273.4	22.3	489.3	33.5	762.7	28.4	-215.9
2010	576.5	32.3	689.7	35.7	1266.2	34.1	-113.2
2011	750.1	37.3	898.3	36.2	1648.4	36.7	-148.2
2012	736.1	36.6	886.8	31.5	1623.4	33.6	-150.2
2013	825.5	39.9	1025.5	31.0	1851	34.4	-200
2014	990.2	45.2	1023.7	23.6	2013.9	30.9	-33.5
2015	933.1	42.7	861.3	19.8	1794.4	27.4	71.8
2016	937.0	44.7	970.7	21.5	1907.7	28.8	-33.7
2017	1025.7	44.9	1053.8	22.5	2079.5	29.9	-28.1
2018	1321.7	48.7	1240.7	23.6	2562.4	32.2	81
2019	1435.6	50.7	1282.6	25.6	2718.2	34.7	153

Source: WTO database.

In terms of absolute value, the overall volume of trade continues to grow, with its share in services trade rising rapidly. The total imports and exports of digital services in China grew from $76.27 billion in 2009 to $271.82 billion in 2019, an increase of 3.6 times in 11 years, accounting for an increasing share of services trade from 28.4% to 34.7%; specifically, the imports grew from $48.93 billion in 2009 to $128.26 billion in 2019; the exports grew from $27.34 billion in 2009 to $143.56 billion in 2019, accounting for an increasing share from only 22.3% to 50.7% in service exports. The change has established the dominant position of digital services trade in services trade.

From the perspective of trade balance, the deficit pattern has been reversed in general. The general deficit reached $21.59 billion in 2009, followed by a stepwise reduction with the gradual expansion of exports, especially a series of reform measures, including the structural adjustment and innovation strategy implemented in 2015, which have yielded remarkable results, and applies a strong boost to the export growth of digital services. In 2015, the trade surplus reached $7.2 billion, which played an important role in balancing international payments. China has realized consecutive trade surpluses in general since 2018, with an increase in its whole competitiveness. However, among the sub-sectors, there is still a large deficit in the trade of all insurance, intellectual property, and personal recreation services.

From the perspective of trade structure, the sectoral structure remains continuously optimized. With the rapid development of digital industrialization and industrial digitali-

zation, the huge demand for the digital service market, and the continuous adjustment of economic and trade structure, the internal structure of China's digital services trade has undergone great changes with the sectoral structure continuously optimized. These changes are particularly prominent in the export structure (as shown in Table 6).

**Table 6.** Sectoral structure of China's digital services trade exports from 2009 to 2019

(Unit: %)

Sector/Year	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Insurance Services	5.86	3.00	4.02	4.52	4.84	4.62	5.33	4.40	3.94	3.73	3.32
Financial Service	1.30	2.31	1.13	2.56	3.86	4.58	2.50	3.43	3.60	2.63	2.72
Intellectual Property Service	1.57	1.44	0.99	1.42	1.07	0.68	1.17	1.25	4.64	4.21	4.63
ICT Service	28.19	18.17	18.54	22.06	20.71	20.37	27.63	28.31	27.07	35.61	37.47
Other Business Service	62.71	83.57	75.15	69.27	69.34	69.57	62.59	61.79	59.99	52.89	51.03
Personal Recreation Service	0.35	0.21	0.16	0.17	0.18	0.18	0.78	0.79	0.74	0.92	0.83

Source: Calculated from WTO database.

According to the analysis of Table 6, first, ICT and other business services playing a leading role continue to hold the largest share of trade in digital services. Exports from the two sectors together accounted for 90.9% of the total in 2009 and still accounted for a large share of 88.5% in 2019, with ICT services exports rising rapidly from 28.19% in 2009 to 37.47% in 2019, indicating a further increase in the dominant role of the technology-intensive services sector. Second, most high value-added service sectors have an increasing share of exports. Exports of intellectual property services rose from 1.57% in 2009 to 4.63% in 2019, an increase of nearly three times; exports of financial and personal recreation services rose from 1.30% and 0.35% in 2009 to 2.72% and 0.83% in 2019, both increasing by more than two times, indicating that the fundamental role of the knowledge-intensive service sector has been consolidated and enhanced. Third, as a major driver of structural optimization, sectoral exports grow at an ever-accelerating rate. All sectors maintained a high double-digit annual growth of exports from 2009 to 2019. The fastest-growing sectors are financial, intellectual property, ICT, and personal recreation services, with annual growth of 27.1%, 31.5%, 21.4%, and 28.6%, respectively, followed by fast-growing sectors engaged in insurance and other business services, with annual growth of 11.5% and 15.6% respectively over the same period. Fourthly, the exports of some sectors, such as insurance services, showed a continuous decline, falling from 5.86% in 2009 to 4.62% in 2014 and then to 3.32% in 2019, with its low share level directly affecting the optimization of the overall structure.

As seen from the long-term trend, the digital services trade in China will continue to grow rapidly. China's exports grew at an average rate of 18.1% from 2009 to 2019 (as shown in Figure 3), 13% higher than the global average of 5.2% in the same period, ranking among the highest in the world, with huge growth potential and vast space for development.

Fig. 3. Comparison between China's Digital Service Export Growth and World Growth from 2009 to 2019

(Unit: %)
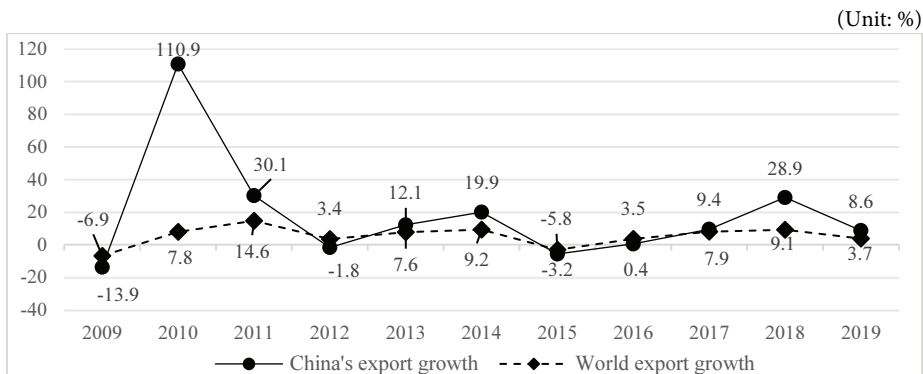
3. Analysis of International Competitiveness of Korea-China Digital Services Trade

For scientific evaluation and objective comparison of the international competitiveness of digital services trade between Korea and China, this paper conducts empirical analysis based on 4 metrics including TC, RCA, NRCA, and IMS at the levels of overall competitiveness and sectoral competitiveness, respectively.

3.1. International Competitiveness Analysis Based on TC Index

TC index, namely Trade Competitiveness Index, is one of the important indicators to measure the international competitiveness of a country's foreign trade in an industry (or a sector, a service, a product). TC index refers to the proportion of the balance of imports and exports of an industry in the total import and export volume of a country, mainly reflecting the country's competitive advantage in foreign trade of that industry. Its calculation equation is as follows:

$$TC_{ij} = \frac{X_{ij-M_{ij}}}{X_{ij+M_{ij}}}$$

Where TC_{ij} represents the trade competitiveness index of industry j in country i, X_{ij} represents the export value of industry j in country i, and M_{ij} represents the import value of industry j in country i. The value of the TC index is in the range of [-1-1]. The TC index equal to 0 indicates that the trade competitiveness is at the international average level, the TC index closer to -1 indicates that the trade competitiveness is weaker, TC index equal to -1 indicates that the industry has only import but no export, showing that the competitiveness is extremely weak; TC index closer to 1 indicates that the trade competitiveness is stronger, TC index equal to 1 indicates that the industry has only export but no imports, showing that the competitiveness is extremely strong.

As the TC index is a relative value to the absolute value of trade, it is always between ±1 regardless of the absolute volume of imports and exports. Therefore, it excludes the fluctuations of macro factors such as inflation and excludes the incomparable factors of trade scale arising from the different sizes of countries. Given this, the use of the TC index to measure the trade competitiveness of different countries provides high comparability and objectivity.

According to the digital services trade data of Korea and China from 2009 to 2019, the trade competitiveness index, namely the TC index, of the two countries is calculated (as shown in Table 7).

Table 7. Korea-China TC index of digital services trade from 2009 to 2019

Item	Country	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total Digital Services	Korea	-0.334	-0.342	-0.260	-0.267	-0.234	-0.171	-0.157	-0.114	-0.149	-0.115	-0.114
	China	-0.283	-0.089	-0.090	-0.093	-0.108	-0.017	0.040	-0.018	-0.014	0.032	0.056
Insurance Services	Korea	-0.367	-0.250	-0.139	-0.237	-0.177	0.039	-0.062	-0.172	-0.045	-0.054	-0.189
	China	-0.752	-0.802	-0.735	-0.722	-0.694	-0.662	-0.277	-0.513	-0.440	-0.414	-0.386
Financial Service	Korea	-0.215	-0.075	-0.060	-0.106	-0.226	-0.105	-0.023	0.018	0.071	0.174	0.148
	China	-0.287	-0.021	0.064	-0.011	-0.074	-0.043	-0.062	0.225	0.391	0.243	0.226
Intellectual Property Service	Korea	-0.386	-0.485	-0.255	-0.376	-0.386	-0.311	-0.211	-0.152	-0.142	-0.121	-0.128
	China	-0.925	-0.880	-0.904	-0.889	-0.919	-0.942	-0.906	-0.907	-0.714	-0.729	-0.676
ICT Service	Korea	-0.201	-0.166	-0.076	0.001	0.081	0.193	0.112	0.154	0.140	0.258	0.243
	China	0.269	0.437	0.468	0.495	0.383	0.305	0.393	0.357	0.183	0.329	0.334
Other Business Service	Korea	-0.346	-0.337	-0.303	-0.276	-0.222	-0.179	-0.196	-0.157	-0.223	-0.205	-0.195
	China	-0.106	0.114	0.068	0.093	0.095	0.257	0.193	0.143	0.179	0.193	0.191
Personal Recreation Service	Korea	-0.107	-0.236	-0.077	-0.066	-0.054	0.009	0.144	0.261	0.119	0.133	0.155
	China	-0.483	-0.502	-0.529	-0.635	-0.684	-0.666	-0.443	-0.485	-0.568	-0.473	-0.546

Source: Calculated from WTO database.

From the perspective of overall competitiveness, the overall TC index of Korea remained negative from 2009 to 2019, which agrees with the deficit of trade balance in the same period, indicating that its overall competitiveness is still relatively weak. However, the trend of the overall trade competitiveness indicator shows that the TC index rose from -0.334 in 2009 to -0.171 in 2014 and continued to rise to -0.114 in 2019, indicating the overall competitiveness of Korea's digital services trade is steadily getting out of its weakness. China's overall TC index also remained negative from 2009 to 2014, indicating the overall competitiveness was weak during this period. With the first surplus in the trade balance in 2015, the TC index also turned positive from negative to 0.04 for the first time in that year, and then rose to 0.056 in 2019, indicating the overall competitiveness of China's digital services trade was further consolidated and enhanced.

From the perspective of sectoral competitiveness, the sectors with high TC indexes of digital services trade in Korea are finance, ICT, and personal recreation services. The TC index of financial services increased from 0.018 in 2016 to 0.148 in 2019; the TC index of ICT services turned positive to be 0.001 in 2012 and reached 0.243 in 2019, making the sector the most competitive; the TC index of personal recreation services increased from 0.009 in 2014 to 0.155 in 2019. The sectors with low TC indexes are insurance, intellectual property, and other business services, all having negative TC values. The long-term excess of imports over

exports is one of the major reasons for the weak competitiveness. According to the changes in the TC indicator of Korea from 2009 to 2019, the sectors with a significant increase in international competitiveness are finance, intellectual property, ICT, and personal recreation services, while insurance and other business services also maintain a steady increase. In China, the sectors with high TC indexes of digital services trade are finance, ICT, and other business services. The TC value of financial services increased from -0.287 in 2009 to 0.226 in 2019; the sector of ICT services has been showing a strong competitive advantage, with the TC index reaching 0.269 in 2009, followed by continued expansion ever since, and peaking at 0.495 in 2012, and it still showed strong competitiveness with a value of 0.334 in 2019; the TC value of other business services grew from 0.114 in 2010 to 0.191 in 2019. The sectors with low TC indexes are insurance, intellectual property, and personal recreation services, all having negative values, and showing weak competitiveness. According to the changes in the TC indicator of China from 2009 to 2019, the sectors with a significant increase in international competitiveness are insurance, finance, ICT, and other business services, followed by the sector of intellectual property services, while the TC value of personal recreation services hovers between 0.4 and 0.6 for a long time with a slow decline.

3.2. International Competitiveness Analysis Based on the RCA Index

The RCA index, namely the Revealed Comparative Advantage Index, is the ratio of the share of a country's industry in its total exports to the share of the world's industry in the total world exports, mainly reflecting the relative advantage of the country's exports in the industry compared to the world's average. The RCA index, created by American economist Balassa Bela in 1965, is one of the most common measures used by the economic circle to analyze the export competitiveness of a country's industry, aiming to determine more accurately the revealed comparative advantage of a country's industry in export trade. Its calculation equation is as follows:

$$RCA_{ij} = \frac{X_{ij}/X_i}{X_{wj}/X_w}$$

Where, RCA_{ij} represents the index of revealed comparative advantage of industry j in country i, X_{ij} represents the export value of industry j in country i, X_i represents the total value of export trade in country i, X_{wj} represents the export value of industry j in the world and X_w represents the total value of world export trade. It is generally believed that if the RCA index of an industry in a country is greater than 1, it indicates there is a revealed comparative advantage in the industry; if in a range of 1.25-2.5, it indicates a strong comparative advantage; if greater than or equal to 2.5, it indicates a very strong comparative advantage; if in a range of 0.8-1.25, it indicates a moderate comparative advantage; if in a range of 0.4-0.8, it indicates a weak comparative advantage with average international competitiveness; if less than 0.4 or even less than 0, it indicates that the industry has a strong comparative disadvantage and lacks international competitiveness.

The RCA index is used to indirectly measure comparative advantage by closely connecting the actual results of a country's export trade to the industry's share of world exports, with its index size indicating the international competitive position of a country's industry. Thus, it excludes the dual influence of fluctuations in national and world aggregates to facilitate the freedom from harsh theoretical assumptions in empirical analysis, and therefore it can be

used extensively: the RCA index can be used to determine the revealed comparative advantage of an industry, a sector, a service or a product of a country, also can be used to measure the international competitiveness of a country's export trade in general or in its sub-sectors, and can be used to analyze trade structure and trade dependence, and can be compared among countries of different economic size. The limitations of the RCA index lie in the fact that it does not consider import factors, as well as the effects of intra-industry trade and policy interventions.

The following are the calculation results of the revealed comparative advantage index in Korea-China digital services trade from 2009 to 2019 (as shown in Table 8).

Table 8. Korea-China RCA Index of Digital Services Trade from 2009 to 2019

Item	Country	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	The mean
Total Digital Services	Korea	0.35	0.35	0.36	0.39	0.40	0.44	0.44	0.47	0.46	0.46	0.51	0.42
	China	0.19	0.34	0.38	0.34	0.34	0.36	0.32	0.32	0.34	0.39	0.40	0.34
Insurance Services	Korea	0.12	0.19	0.17	0.15	0.18	0.21	0.21	0.19	0.29	0.22	0.26	0.20
	China	0.19	0.20	0.30	0.30	0.31	0.32	0.35	0.30	0.28	0.32	0.32	0.29
Financial Service	Korea	0.18	0.16	0.15	0.16	0.10	0.11	0.12	0.14	0.16	0.20	0.22	0.15
	China	0.01	0.04	0.02	0.05	0.07	0.09	0.04	0.06	0.07	0.06	0.07	0.05
Intellectual Property Service	Korea	0.53	0.45	0.55	0.49	0.51	0.59	0.69	0.73	0.68	0.70	0.74	0.61
	China	0.02	0.04	0.03	0.04	0.03	0.02	0.03	0.03	0.12	0.13	0.15	0.06
ICT Service	Korea	0.11	0.11	0.12	0.14	0.18	0.22	0.25	0.27	0.30	0.30	0.32	0.21
	China	0.31	0.36	0.40	0.43	0.40	0.40	0.47	0.49	0.48	0.70	0.72	0.47
Other Business Service	Korea	0.50	0.50	0.51	0.59	0.61	0.64	0.60	0.65	0.60	0.59	0.66	0.59
	China	0.28	0.58	0.66	0.54	0.54	0.57	0.46	0.46	0.46	0.48	0.47	0.50
Personal Recreation Service	Korea	0.30	0.26	0.31	0.38	0.41	0.46	0.44	0.57	0.42	0.50	0.63	0.43
	China	0.02	0.03	0.02	0.02	0.02	0.02	0.09	0.10	0.09	0.14	0.13	0.06

Source: Calculated from WTO database.

According to Table 8, at the level of overall competitiveness, the RCA index reflects the generally average export competitiveness of the digital service industries in Korea and China, neither of which has an overall RCA index of more than 0.8. The mean values of the overall RCA index of Korea and China from 2009 to 2019 were 0.42 and 0.34, respectively, indicating that the export competitiveness of the two countries has a weak comparative advantage. However, according to the changes in the overall index of revealed comparative advantage over the years, the overall RCA index of Korea steadily increased from 0.35 in 2009 to 0.51 in 2019, while the rapid growth of China's digital service industry has led to a rapid increase in its overall RCA index from 0.19 in 2009 to 0.40 in 2019, thus it shows that the comparative advantages of both Korea and China in export competitiveness in digital service industries are continuing to expand in the long run.

At the sectoral competitiveness level, the sectors in Korea's digital service industry with comparative advantages in export competitiveness are intellectual property, other business,

and personal recreation services, with RCA averages of 0.61, 0.59, and 0.43 from 2009 to 2019, respectively. Their RCA indexes in 2019 reached 0.74, 0.66, and 0.63, respectively, reflecting these three sectors have a strong advantage in export competitiveness. The sectors with low RCA indexes are insurance and financial services, with RCA averages of 0.20 and 0.15 from 2009 to 2019, respectively, indicating that they have a significant comparative disadvantage in export competitiveness. However, according to the changes in revealed comparative advantage indicators over the years, the sectors with the fastest increase in export competitiveness are insurance, ICT, and personal recreation services. Their RCA indexes have increased 2-3 times respectively in the past 11 years, while other sectors are raising their export competitiveness steadily. The sectors with a comparative advantage in export competitiveness in China's digital service industry are ICT and other business services, with RCA averages of 0.47 and 0.50 from 2009 to 2019, respectively. The sector of ICT services saw a high RCA index of 0.72 in 2019, reflecting a strong competitive advantage. However, financial, intellectual property, and personal recreation services show strong comparative disadvantages, and the RCA averages from 2009 to 2019 were at a low level of only 0.05, 0.06, and 0.06, respectively. According to the changes in the revealed comparative advantage indicator over the years, the sectors with a significant increase in export competitiveness are insurance, ICT, and other business services. RCA indexes for finance, intellectual property, and personal recreation services have also been slowly increasing in recent years after a long time of hovering at low levels, with their values rising to 0.07, 0.15, and 0.13 in 2019, respectively.

3.3. International Competitiveness Analysis Based on the NRCA Index

The NRCA index, namely Net-Export Revealed Comparative Advantage Index, is the difference between the ratio of a country's industry in total exports and the ratio of that country's industry in total imports, mainly reflecting the comparative advantage of the country's international competitiveness in exports and imports of that industry. Its calculation equation is as follows:

$$NRCA_{ij} = \frac{X_{ij}}{X_i} - \frac{M_{ij}}{M_i}$$

Where, $NRCA_{ij}$ represents the net-export revealed comparative advantage index of industry j in country i, X_{ij} represents the export value of industry j in country i, X_i represents the total value of trade exports in country i, M_{ij} represents the import value of industry j in country i, and M_i represents the total value of trade imports in country i. For the NRCA index, the central axis is 0. NRCA =0 indicates self-balance in the trade, NRCA >0 indicates a competitive advantage, and a higher value indicates stronger international competitiveness, NRCA <0 indicates a competitive disadvantage, and a lower value indicates weaker international competitiveness.

The NRCA index, also created by Balassa Bela in 1989, further combines import and export factors based on the RCA index to measure the comparative advantage based on the absolute value of import and export trade. It is not affected by intra-industry trade or international division of labor, so the use of this index can better ensure a true and comprehensive reflection of the industry's international competitiveness. Table 9 shows the NRCA index of Korea-China digital services trade from 2009 to 2019.

Table 9. Korea-China NRCA Index of Digital Services Trade from 2009 to 2019

Item	Country	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total Digital Services	Korea	-0.0439	-0.0383	-0.0258	-0.0300	-0.0286	-0.0243	-0.0291	-0.0256	-0.0271	-0.0188	-0.0182
	China	-0.0217	-0.0106	-0.0094	-0.0095	-0.0108	-0.0041	-0.0033	-0.0070	-0.0044	0.0013	0.0019
Insurance Services	Korea	-0.0010	-0.0008	-0.0003	-0.0005	-0.0005	0.0000	-0.0003	-0.0007	-0.0003	-0.0002	-0.0007
	China	-0.0085	-0.0089	-0.0085	-0.0083	-0.0080	-0.0076	-0.0022	-0.0045	-0.0029	-0.0027	-0.0025
Financial Service	Korea	-0.0024	-0.0007	-0.0004	-0.0008	-0.0013	-0.0007	-0.0005	-0.0003	0.0002	0.0010	0.0011
	China	-0.0003	-0.0001	0.0000	-0.0001	-0.0003	-0.0003	-0.0003	0.0004	0.0008	0.0005	0.0005
Intellectual Property Service	Korea	-0.0107	-0.0118	-0.0050	-0.0077	-0.0092	-0.0084	-0.0078	-0.0064	-0.0051	-0.0039	-0.0038
	China	-0.0092	-0.0077	-0.0070	-0.0080	-0.0089	-0.0092	-0.0100	-0.0112	-0.0105	-0.0114	-0.0109
ICT Service	Korea	-0.0013	-0.0009	-0.0004	-0.0001	0.0003	0.0012	0.0005	0.0010	0.0012	0.0027	0.0033
	China	0.0019	0.0034	0.0041	0.0046	0.0037	0.0034	0.0050	0.0053	0.0028	0.0081	0.0089
Other Business Service	Korea	-0.0282	-0.0237	-0.0195	-0.0207	-0.0177	-0.0164	-0.0211	-0.0198	-0.0233	-0.0187	-0.0186
	China	-0.0054	0.0030	0.0021	0.0025	0.0029	0.0099	0.0047	0.0038	0.0062	0.0076	0.0070
Personal Recreation Service	Korea	-0.0003	-0.0005	-0.0002	-0.0002	-0.0002	-0.0001	0.0002	0.0006	0.0002	0.0003	0.0005
	China	-0.0002	-0.0002	-0.0001	-0.0002	-0.0003	-0.0003	-0.0006	-0.0007	-0.0009	-0.0008	-0.0011

Source: Calculated from WTO database.

According to Table 9, with the impact of imports on export competitiveness taken into full account, the measurement results of the overall NRCA index show that the overall competitiveness of the Korean digital service industry is still at a relatively weak level, and all its overall NRCA indexes from 2009 to 2019 remained negative, indicating that trade still had a deficit during the same period, and in terms of net exports, it has not yet shown a strong comparative advantage in general. However, by examining the changes in Korea's overall NRCA index over the years, we can find that its overall NRCA index grew from -0.0439 in 2009 to -0.0182 in 2019, indicating that its overall competitiveness is steadily and consistently increasing though it has not yet reached trade balance. Measurement of the comparative advantage of the overall competitiveness of China's digital service industry, also from the perspective of net exports, shows that its overall NRCA indicator from 2009 to 2017 was higher, especially in 2018 and 2019 when it went beyond the central axis value in two consecutive years, rising to 0.0013 and 0.0019, respectively, showing that China's digital service industry has a strong advantage in overall competitiveness.

As for the sector competitiveness, the NRCA index shows that the sectors with net-export comparative advantages in Korea's digital service industry include financial, ICT, and personal recreation services, with NRCA indexes turning positive from negative in 2017, 2013, and 2015, respectively, reaching 0.0011, 0.0033 and 0.0005 respectively in 2019, showing a strong competitive advantage. The sectors with low NRCA indexes are insurance, intellectual property, and other business services, and their negative figures over the years show that they still have a weak competitive disadvantage in net exports. The sectors with net-export comparative advantages in China's digital service industry include finance, ICT, and other business services, and their NRCA indexes increased from 0.0004, 0.0019, and 0.0030 in 2016, 2009, and 2010 to 0.0005, 0.0089, and 0.0070 in 2019, respectively. ICT services have been positive for 11 consecutive years with an increase of 4.7 times, showing strong competitiveness in net exports. The sector of insurance services has a low NRCA index. The sectors with declining NRCA indexes are intellectual property and personal recreation

services, and their NRCA values have continuously decreased from -0.0092 and -0.0002 in 2009 to -0.0109 and -0.0011 in 2019, respectively, clearly showing the serious disadvantages of these two sectors in net-export competitiveness.

3.4. International Competitiveness Analysis Based on the IMS Index

Followed by the empirical analysis of trade competitiveness, export competitiveness, and net export competitiveness of digital service industries in Korea and China, measurement and comparison of their international market shares based on the IMS index are required.

The IMS index, namely International Market Share Index, is the proportion of a country's export value in the world's total, mainly reflecting the competitive position and competitiveness of the country's industry in the international market. Its calculation equation is as follows:

$$IMS_{ij} = \frac{X_{ij}}{X_{wj}}$$

Where, IMS_{ij} represents the index of international market share of industry j in country i, X_{ij} represents the value of exports of industry j in country i, and X_{wj} represents the total value of exports of industry j in the world. A lower IMS index indicates a lower share of an industry's exports in the world market and weaker international competitiveness; a higher IMS index indicates a higher share in the world market and stronger international competitiveness. Table 10 shows the IMS index of Korea-China digital services trade from 2009 to 2019.

Table 10. Korea-China IMS Index of Digital Services Trade from 2009 to 2019

Item	Country	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	The mean
Total Digital Services	Korea	0.94	0.97	1.02	1.10	1.11	1.24	1.27	1.33	1.31	1.27	1.30	1.169
	China	1.56	3.04	3.45	3.28	6.42	3.75	3.65	3.55	3.59	4.24	4.44	3.725
Insurance Services	Korea	0.34	0.54	0.48	0.42	0.51	0.59	0.62	0.53	0.83	0.60	0.67	0.557
	China	1.58	1.80	2.77	2.89	3.17	3.36	4.08	3.22	3.02	3.45	3.48	2.984
Financial Service	Korea	0.48	0.46	0.43	0.44	0.29	0.30	0.36	0.39	0.46	0.55	0.56	0.429
	China	0.11	0.37	0.20	0.45	0.71	0.96	0.51	0.70	0.76	0.67	0.75	0.563
Intellectual Property Service	Korea	1.44	1.29	1.57	1.38	1.43	1.67	2.00	2.03	1.95	1.91	1.89	1.687
	China	0.19	0.34	0.27	0.37	0.29	0.20	0.33	0.34	1.27	1.37	1.62	0.599
ICT Service	Korea	0.29	0.32	0.35	0.39	0.51	0.63	0.73	0.79	0.85	0.82	0.82	0.591
	China	2.55	3.26	3.72	4.19	4.03	4.27	5.39	5.35	5.16	7.54	7.93	4.854
Other Business Service	Korea	1.35	1.42	1.45	1.66	1.68	1.82	1.17	1.81	1.71	1.62	1.67	1.572
	China	2.29	5.26	6.04	5.22	5.46	5.98	5.32	5.03	4.95	5.22	5.23	5.091
Personal Recreation Service	Korea	0.81	0.75	0.89	1.08	1.14	1.31	1.27	1.60	1.20	1.38	1.60	1.185
	China	0.20	0.23	0.21	0.20	0.23	0.25	1.05	1.05	0.99	1.51	1.46	0.671

Source: Calculated from WTO database.

According to Table 10, an examination of the overall competitiveness of digital services trade between Korea and China based on the international market share indicator shows that China has a relatively obvious advantage. The overall IMS index of Korea from 2009 to 2019

averaged 1.17% and reached 1.3% in 2019, largely in line with the export position represented by its total exports. The overall IMS indexes of China from 2009 to 2019 averaged 3.73%. On the one hand, it is in connection with the huge export volume of China. On the other hand, it shows that China's IMS index is out of keeping with its status as the second-largest country in foreign trade. The IMS index of 2019 was only 4.44, indicating that there was great room for improvement.

In terms of the sectoral IMS index, Korea's intellectual property and personal recreation services show strong competitiveness and a high international market position, with their IMS indexes from 2009 to 2019 averaging 1.69 and 1.19, and their IMS values in 2019 reaching 1.89 and 1.60, respectively, both ranking 10th in the world; the sectors with low IMS indexes are insurance and financial services, with their IMS indexes from 2009 to 2019 averaging only 0.56 and 0.43, respectively, reflecting weaker international competitiveness; the sectors with IMS indexes remaining at an average level are ICT and other business services. According to the changes in the international market share indicator over the past years, its sectoral trends and overall trends also remain steady with an expansion. The sectors with high IMS indexes in China are insurance, ICT, and other commercial services, with their IMS indexes from 2009 to 2019 averaging 2.98, 4.85, and 5.09, and the IMS value in 2019 reached 3.48, 7.93, and 5.23, ranking 8th, 4th, and 7th in the world, respectively, reflecting a high international competitive position and great competitive strength. However, financial, intellectual property, and personal recreation services further reflect a serious shortage of international competitiveness in these three sectors with low IMS indexes. Their IMS indexes from 2009 to 2019 averaged only 0.56%, 0.59%, and 0.67% of those of the international market, respectively. The changes in international market share indicators over the years show that most of the sectoral trends are in line with the overall trend, with their IMS values rising in a fluctuating manner; the IMS value of ICT services keeps expanding while remaining relatively stable, showing that there is a growth potential of international competitiveness.

4. Conclusions and Prospect

Based on the statistical data on digital service trade, this paper constructs a comprehensive evaluation system of international competitiveness and comprehensively investigates the international competitiveness of digital service trade in Korea and China by combining theory with demonstration, qualitative and quantitative. On the one hand, it elaborates the current situation of the development of digital services trade between the two countries as well as the international competitive position and real competitiveness directly reflected by their aggregate indicators through theoretical analysis, identifies the future competitive potential implied by the growth trend, and abstracts the corresponding structural characteristics from the structural analysis. On the other hand, it empirically analyzes the overall and sectoral competitiveness of the digital services trade between the two countries. The study provides a complete and specific measurement and analysis of their international competitiveness at these two levels. It also conducts a comparative study of the trade competitiveness, export competitiveness, net export competitiveness, and international market share of the digital services industry of the two countries by measuring TC, RCA, NRCA, and IMS indexes, respectively. In addition, it also makes a comparative analysis of the competitive advantages and comparative disadvantages of the two countries. The comprehensive analysis results lead to the following conclusions:

First, in terms of the overall competitiveness of the digital service trade, China has a strong competitive advantage. It not only shows a high level in terms of total volume (us $271.8 billion in 2019) and international market share (4.5%), but also shows obvious advantages in terms of trade competitiveness and net export competitiveness, which reached 0.056 and 0.0019 respectively in 2019. The main reason lies in the leading role of the ICT service trade. China's technologically advanced and powerful ICT industrial cluster strongly supports the continuous growth of ICT services trade and promotes the continuous improvement of overall competitiveness in the long term. The overall competitiveness of Korea, on the other hand, is weaker, especially the same results of negative values for the balance of payments, TC and NRCA greatly weaken the competitiveness, reflecting that the overall competitiveness is still at a deficient stage, primarily due to the overall trade deficit in the same period. However, Korea's long-term solid growth and reasonable sectoral structure will continue to help enhance its overall competitiveness.

Second, in terms of sector competitiveness, many sectors in South Korea have strong competitive advantages. Financial services, ICT services, and personal entertainment services all showed high levels in aggregate and various indexes (RCA and NRCA for financial services reached 0.15 and 0.11; ICT service TC and RCA index reached 0.243 and 0.21. TC, RCA, and IMS of personal entertainment service are 0.151, 0.43, and 1.185 respectively). The RCA and IMS values of intellectual property service and other business services are relatively high, and the RCA and IMS index of intellectual property service are 0.61 and 1.687 respectively. This evenly distributed pattern of competitive advantage reflects South Korea's overall competitive strength in technology, knowledge, and human resource-intensive service sectors. Only insurance services showed a comparative disadvantage in indicators (e.g., TC of -0.189 and NRCA of -0.007). China's sector competitiveness is weak. Supported by strong competitive advantages in ICT services and other commercial services; However, the other four knowledge-intensive service sectors lack competitive advantages. Among them, the indicators of financial services differ greatly and do not match each other. In comprehensive consideration, they are generally competitive sectors affected by policies. The insurance service sector has obvious comparative disadvantages in other indicators except for IMS (such as TC value -0.386 and NRCA value -0.0025), which makes it a relatively weak competitive sector. Intellectual property service and personal entertainment service showed a relatively large comparative disadvantage in terms of their total volume, IMS, RCA index, and negative results of TC (-0.676 and -0.546), NRCA (-0.109 and -0.0011) index, which showed that their competitiveness was seriously inadequate and aggravated the weakness of the competitiveness of the department.

Third, in terms of development trends, both Korea and China have the spatial advantage and competitive strength to improve their international competitiveness. From the analysis of the growth and the changes of each indicator in the past years, we can learn that in the long term, along with the expansion of the export volume, Korea will continue to increase its competitiveness with "steady growth" while China will do so with "fast growth".

Fourthly, the innovative contribution and application of this research in theoretical practice and analytic methods.

First, the relevant theoretical viewpoints discussed in this paper enrich the theoretical system of digital service trade. Based on theoretical analysis and qualitative research of empirical data, this paper summarizes and analyzes the competitive advantages and competitive patterns of Korea and China from the aspects of digital service trade scale, proportion, income and expenditure, structure, and so on. This paper summarizes the evolution process and reveals the development trend, especially the corresponding structural characteristics

preliminarily extracted from the structural analysis, which embodies certain theoretical value and contributes to academic innovation. In this paper, these innovative theoretical viewpoints provide a reference for the application and development of digital service trade theory.

Additionally, this study provides the empirical basis and optimization direction for the practice of enhancing the international competitiveness of the digital service trade. Based on the empirical analysis and quantitative research of TC, RCA, NRCA, and IMS, this paper shows that South Korea and China have comparative disadvantages in the field of digital service trade, and South Korea's department competitiveness is weak due to its overall balance of payments deficit; the structural imbalance of China's export sector leads to the lack of sector competitiveness, which is the main optimization content and direction to enhance international competitiveness. It has important reference value and practical significance for the further development of the digital service trade between the two countries.

Finally, this paper proposes a new combination of competitiveness research methods and constructs a comprehensive evaluation system based on it, which has the value of method innovation. Its innovative contribution lies in that this new combination method is more scientific and advanced. This study uses theoretical analysis to decompose the analytic indicators of digital service trade and uses empirical analysis to deconstruct and quantitatively compare the indicators of trade and industrial competitiveness. In the process of interactive verification, the organic combination of theoretical analysis and empirical analysis, qualitative analysis, and quantitative analysis is realized, which reflects the innovative connotation of scientifically advanced research methods. Compared with previous studies, the innovation of this research method is the new combination of the comprehensive evaluation system of the international competitiveness of digital service trade. It has practical application significance for the follow-up research and related research.

Fifthly, the limitations of this study and the future research direction.

This study analyzes the international competitiveness of digital service trade between Korea and China from the perspective of import and export, so there are certain limitations in the analysis. On the one hand, there is a lack of micro-level analysis. This study mainly analyzes international competitiveness from the national macro level and industrial competitiveness medium level. The micro level (enterprise and product competitiveness) is not discussed. The multilevel analysis will further expand the scope of this study. On the other hand, the analysis of influencing factors is lacking. A series of influencing factors, such as technological level, industrial openness, resource factors, demand factors, research, and development intensity, and FDI, have an important impact on international competitiveness. Applying the diamond model of competitive advantage theory to measure the influencing factors will further increase the depth of this study. The above research limitations provide useful enlightenment for further research.

Further research will focus on the international competitiveness of digital services trade in the post-pandemic era. The global outbreak of COVID-19 has severely impacted the economic development of all countries and international trade. What are the development practices of digital services trade during and after COVID-19? How will it affect and change the international competitiveness of all countries, especially Korea and China? In-depth research on these new topics will further help Korea and China jointly enhance the international competitiveness of digital service trade. This will be the focus of this study in the future, but also the fundamental purpose of follow-up research.

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References

China Academy of Information and Communications Technology(2020), *White paper on Digital Trade Development (2020), BeiJing.*

Cui, Ming-Xu (2021), "A study on the competitive cooperation of China:Japan:ROK trade in services", *Korean Chinese Relations Institute*, 7(1), 25-54.

Dong, Whan-Ko (2021), "China Shocks to Korea's ICT Exports", *Journal of Korea Trade*, 25(4), 146-163.

Eichengreen, B., Perkins, D. H. and Shin, K. H. (2012), *From Miracle to Maturity: The Growth of the Korean Economy*, Cambridge, MA: Harvard University Asia Center.

Feng, Xiao-Ling (2019), *Research on international Competitiveness of American Service Trade*, BeiJing, China: Economy & Management Publishing House.

Ferencz, J. (2019), The OECD Digital Services Trade Restrictiveness Index, Organization for Economic Co-Operation and Development. Available from https://www.oecd-ilibrary.org/trade/the-oecd-digital-services-trade-restrictiveness-index_16ed2d78-en

Jin, Bei (2003), *Economics of Competitiveness*, Guang Dong, China: Guangdong Economic Publishing House.

Lan, Qing-Xin and Dou Kai (2019), "Concerning the Connotation Evolution, Development Trend and China's Strategy of Digital Trade in the United States, the European Union and Japan", *Intertrade,* 06, 48-54.

Li, Bo-Ying (2019), "Research on the Development of Sino-South Korea Trade in Service from the Perspective of High quality Development", *Intertrade*, 08, 12-20.

Li, Jin-Mei (2021), "Research on international Competitiveness of China's service trade under digital Economy", *Business & Economy,* 07, 94-97+186.

Li, Tian-Guo (2017), *The Logic of Economic Transition in South Korea: Reform and Breeakthrough in an Emerging Economy*, BeiJing, China: Economy & Management Publishing House.

Ministry of Commerce of the People's Republic of China (2019), *Report on development of China's Digital Services Trade(2018), BeiJing.*

Organization for Economic Co-operation and Development(OECD) (2017), *Measuring Digital Trade: Towards a Conceptual Framework.*

Porter, M. E. (2002), *The Competitive Advantage of Nations*, New York, NY: Free Press.

Tan, Xiao-Fen (2003), "International Comparison of China's competitiveness in service trade", *Economic Review,* 02, 52-55.

United Nations Conference on Trade and Development (2015), *Proposed Indicators from the Partnership on Measuring ICT for Development.*

United States International Trade Commission (2013), *Digital trade in the U.S. and global economies*.

Wan, Hong-Xian (2008), *Research on international Competitiveness of China's service trade,* He Fei, China: Press of University of Science and Technology of China.

Wang, Tuo (2019), "A Comparative Study of Digital Service Trade and Related Policies", *Intertrade,* 09, 80-89.

Wang, Yue (2002), *Trade in services：Liberalization and Competitiveness*, BeiJing, China: China Renmin University Press.

Wu, Hua-Jia (2009), *Research on industrial division and cooperation among China, Japan and South Korea*, Shang Hai, China: Shanghai People's Publishing House.

Yan, Yun-Feng (2018), "The Competitiveness of China, Japan and South Korea's Service Industry in

Global Value Chain", *Contemporary Economy of Japan*, 01, 48-59.

Yong, min-Kim and Bo-young Choi(2021),"Financial Services Trade Determinants Analysis and Implications: Focusing on the China's Financial Opening", *Research on market economy*, 50(2), 69-94.

Zhang, Yun-Ru (2002), "Analysis on the openness and competitiveness of China's service industry", *Journal of International Economic Cooperation*, 04, 34-37.

Zheng, Ji-Chang and Lei Zhou (2005), "Index evaluation of International competitiveness of Chinese service industry", *On Economic Problems,* 11, 18-20.

Zhou, qi-Liang and Bo-Ming Zhan (2013), "A Comparative Study of the International Competitiveness in Services Trade between China and South Korea", *Asia-pacific Economic Review,* 03, 50-54+70.

Zhou, Rui (2020), "Analysis of trade competition and complem entarity between China, Japan and South Korea from the perspective of service trade", *Prices Monthly,* 02, 38-44.