Analysis of Trade Competition and Complementarity between China, Japan and The United States from the Perspective of Service Trade

Tonghui Zhang

East China University of Science and Technology, Shanghai, 201424, China

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Abstract: With the rapid development of the world economy and the continuous upgrading of the industrial structure, the importance of trade in services is becoming more obvious. Trade in services has become an important tenet of the current economic strength and international competitive advantage for various countries. The United States, as the world largest economy, has inherent competitive advantages. Japan, at the core of East Asian economic circle, is also becoming more competitive in the trade of services. China, the second largest economy in the world, has seen a sharp rise in the trade of services in recent years. The three countries are also important trading partners with each other. This particular setting raises questions about whether trade in services between these countries shows competitiveness and complementarities. This paper makes use of the service trade data from China, Japan and the United States from 2011 to 2018. Through forming RCA and CA indexes we look at the level of competition. We also analyze the complementarity in the bilateral trade through TCI and IIT indexes. The results lead to a few insights about China's development strategy for trade in services.

1. Introduction

With the rapid development of the world economy and the diversification of trade, trade in services is increasingly becoming a more important component of international trade. The focus in many countries is gradually shifting from trade in goods to trade in services. Claiming a more prominent role, trade in services is not only bringing a new impetus for development and growth, but also it is creating new opportunities and challenges along the way.

Since early 2000s, China has constantly opened up to international trade in services. In tandem, the competitiveness of trade in services has improved. Gross domestic product (GDP) of China has also been growing at breakneck speed. Fast-forward to recent years, and trade in services has become an important part of China's trade structure. It has become one driving force behind the economic growth and macroeconomic development of China [1]. As of 2017, China's total import and export trade reached 469.1 billion US dollars, compared with 2001, achieving an average annual growth rate of 20.55% [2]. In the same year, trade in services accounted for 51.6% of the GDP, surpassing the secondary industries and becoming the largest contributor to the Chinese economy for five consecutive years [3].

As one of the core countries in the East Asian economic circle, Japan has close trade ties with China and is an important trading partner. As developed country, Japan's total trade in services has been increasing, its competitiveness has been improving, and its trade structure has constantly become more efficient in recent years. However, compared with its developed manufacturing industry, the competitive advantage in the field of trade in services is still slightly inadequate [4].

The United States has dominated the world trade stage, especially in the area of services for many decades. The country benefits from a strong and progressive service industry on the one hand and its perfect management system of trade in services on the other [5]. In 2012, the US trade in services totaled $1.0695 trillion, accounting for about 12 percent of global trade. American services industry has had a rapid development since the 1970s. Service trade of the United States has made rapid development since the 1970s, and has formed a strong comparative advantage in the division

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of labor pattern of international service trade. Its technology and capital-intensive services occupy the mainstream position, and the new service trade has become the pillar system, thus setting the aspiring model for other countries to catch up with [6].

China is the fifth largest trading partner and sovereign country with the largest surplus of the United States. Japan is also a major trading partner of the United States and the scale of the United States and Japan is relatively large [7].

These three economies, being intertwined by trade and economic cooperation, are bound to display complementarities. Investigating these competitiveness and complementarities is the main topic of this paper.

2. Competitive analysis

2.1. Revealed Comparative Advantage (RCA)

2.1.1. Introduction of RCA Index

The RCA index is proposed by Balassa, a famous American economist. The index is an effective tool in measuring the apparent comparative advantage of a certain commodity or industry in a country compared to the world. The index is the ratio between the share of a country's exports of certain commodities in its total export value and the share of such goods in the total world exports. It measures the competitiveness of a country's industry in the international market. Formally put:

$$RCA_{ij} = \frac{X_{ij}}{X_{tj}} \div \frac{X_iW}{X_tW} \ .$$

In the above, X_{ij} represents the exports value of country j exporting commodity i, X_{tj} represents the total exports value of country j. X_iW represents the exports value of world for commodity i, and X_tW represents the total world exports.

2.1.2. Analysis

We compute the RCA value for a range of industries and for the three aforementioned countries and report them in Table 1. As the indexes show, the most competitive industries in China is Construction Services. In Japan, the most competitive industries are Royalties and License Fees, and Construction Services. In the United States, the most competitive industries are Other Business Services.

Although Construction Service is the most competitive industry in China, its RCA index has been falling over the years. At the same time, Computer and Information Services and Other Business Services have become more competitive in China. Specifically, the RCA index for Computer and Information Services has had an upward trend, while the RCA index of Other Business Services does not fluctuate much. Royalties and License Fees, Personal, Cultural, and Recreational Services, and Government Services all lag the other two countries in competitiveness. Travel industry and Transportation have moderate competitiveness. In 2018, the two least competitive industries in China were Financial Services, and Communications Services. Their RCA indexes were 0.18 and 0.06 in 2018, respectively, falling short of the other two countries.

Construction Services in Japan has almost the same RCA index as that in China. Moreover, it shows the same downward trend. Government Services is one industry that has maintained strong competitiveness in Japan and its RCA index even shows an upward trend. Travel Services originally has a low RCA index in Japan, but its index has increased every year. In the last years of the data, it has become moderately competitive. Financial Services, Computer and Information Services, Personal, Cultural, and Recreational Services are less competitive in Japan. The least competitive industry in Japan is Communications Services. Like in China, it has an RCA index of

less than 0.10 for all years.

As for the United States, Travel industry, and Personal, Cultural, and Recreational services are the most competitive industries in all years. At the same time, Construction services, Insurance Services, and Government Services are the three least competitive industries in the United States.

Compared to the United States and its status as a dominant power, China and Japan are far less competitive in Personal, Cultural, and Recreational Services. However, as Table 1 indicates, the international competitiveness of the Chinese industry is catching up with the US.

Table 1 RCA Indexes for China, Japan and the United States

Country	Year	Transportation	Travel	Construction services	Insurance services	Financial services	Computer and information services	Royalties and license fees	Other business services	Personal, cultural, and recreational services	Government services	Communications services
China	2011	1.01	1.16	4.05	0.71	0.05	0.95	0.07	1.54	0.05	0.25	0.02
	2012	1.11	1.18	3.37	0.75	0.12	1.09	0.10	1.36	0.05	0.34	0.03
	2013	1.05	1.15	2.97	0.84	0.19	1.07	0.08	1.45	0.06	0.44	0.04
	2014	1.01	0.93	3.77	0.89	0.25	1.13	0.05	1.58	0.07	0.37	0.04
	2015	1.10	0.99	4.61	1.11	0.14	1.39	0.09	1.43	0.28	0.40	0.04
	2016	1.07	0.99	3.91	0.86	0.19	1.41	0.09	1.38	0.29	0.47	0.05
	2017	1.14	0.85	3.37	0.88	0.21	1.45	0.37	1.39	0.29	0.68	0.06
	2018	1.17	0.81	3.35	0.99	0.18	1.38	0.39	1.42	0.34	0.65	0.06
Japan	2011	1.47	0.33	3.76	0.48	0.31	0.17	3.29	1.25	0.09	1.24	0.02
	2012	1.56	0.44	4.08	0.12	0.37	0.20	3.77	0.87	0.10	1.35	0.04
	2013	1.51	0.46	3.67	0.04	0.37	0.23	3.75	0.98	0.09	1.25	0.06
	2014	1.28	0.49	3.37	0.37	0.50	0.22	3.65	1.05	0.22	1.93	0.05
	2015	1.21	0.64	3.45	0.40	0.69	0.21	3.43	0.96	0.29	1.84	0.05
	2016	1.06	0.73	3.06	0.47	0.76	0.23	3.34	0.99	0.33	2.13	0.05
	2017	1.05	0.81	2.88	0.49	0.63	0.28	3.27	0.97	0.40	1.97	0.05
	2018	0.87	0.92	2.49	0.54	0.69	0.23	3.51	0.98	0.25	1.90	0.06
America	2011	0.61	0.98	0.20	0.25	1.44	0.41	0.91	12.88	1.78	0.43	2.17
	2012	0.72	1.15	0.22	0.31	0.04	0.52	1.00	14.89	2.16	0.47	1.14
	2013	0.73	1.19	0.13	0.30	0.04	0.52	0.98	15.14	2.24	0.44	1.22
	2014	0.74	1.26	0.11	0.30	0.05	0.52	0.92	15.03	2.47	0.36	1.03
	2015	0.74	1.31	0.16	0.27	0.03	0.56	0.86	14.91	2.54	0.34	1.00
	2016	0.75	1.29	0.08	0.29	0.03	0.60	0.83	15.64	2.59	0.31	1.01
	2017	0.74	1.27	0.11	0.30	0.04	0.67	0.82	16.00	2.83	0.31	0.82
	2018	0.64	0.98	0.15	0.25	1.31	0.72	0.77	15.77	2.19	0.27	0.62

2.2. Comparative Advantage (CA)

2.2.1. Introduction of CA

CA index, was introduced by Vollratlh in 1988. He additionally took into account the level of imports, subtracting the comparative advantage of imports from the comparative advantage of

exports. The residual is better aligned with the real competitive advantage of a country's industries.

In reality most industries are engaged in both importing and exporting. The RCA index, relying on exports only, does not take into account the impact of imports to that industry. To include the importing impact, the RCA formula is revised as follows:

$$CA_{ij} = RCA_{ij} - \frac{M_{ij}}{M_j} \div \frac{W_i}{W}.$$

In the above, M_{ij} indicates the amount of imports of product i by country j. M_j represents the total imports of all products into country, W_i represents the total imports of product i by the world, and W represents the total imports of all products by the world.

If a country's CA index is greater than 0, it means that its services industry has a comparative trade advantage. If the CA index is less than 0, the services industry does not have a comparative trade advantage. The higher the index, the more competitive the country's services are on the world stage. The lower the index, the less competitive the country's services on the world stage.

2.2.2. Analysis

We report the CA indexes by country and year in Table 2. The results are roughly the same as those observed in Table 1, using the RCA index. However, there are a few differences. China still maintains a strong competitive advantage in Construction Services, but Japan's competitiveness in this industry has declined significantly.

According to the RCA index, China's travel industry is moderately competitive, yet its CA index is negative. After deducting the contribution of imports, the competitiveness of China's Travel is weak. In fact, according to the CA index, the two least competitive industries in China in 2018 are Travel, and, then, Personal, Cultural, and Recreational Services, with CA values of -1.35 and -0.47, respectively.

With the CA index, Personal, Cultural, and Recreational Services remains the most competitive industry in Japan. However, the CA index suggests that the competitiveness of Construction Services in Japan is lower than previously indicated. Its CA index falls over the years and eventually becomes negative in 2018. Government Services in Japan still maintains strong competitiveness. But, for Other Business Services the results are different from those reflected by the RCA index. According to the RCA index, Other Business Services in Japan are moderately competitive, but its CA value is consistently negative, indicating that the industry does not have a competitive advantage after accounting for imports.

The industry with the most comparative advantage in the United States in 2018 is still Other Business Services. Interestingly, the CA index for Other Business Services in the United States has shifted from negative to positive. Its CA value is -2.01 in 2011 going up to 1.91 in 2018. The industry with the least comparative advantage in the United States used to be Construction Services when using the RCA index. It is now Government Services using the CA index. The CA index for this industry hits a low of -7.15 in 2018. In 2011, the United States has the most comparative advantage in Personal, Cultural, and Recreational Services, though it's comparative advantage has declined over the years, going from 1.19 in 2011 to 0.26 in 2018.

Generally speaking, the industry with the most comparative advantage in China is Construction Services. In addition, Other Business Services, Computer and Information services maintain reasonable comparative advantage. Comparative advantage for Transportation, Insurance Services, Financial Services, and Government Services is lagging. Travel is the industry with the lowest degree of comparative advantage.

For Japan, industries with the highest levels of comparative advantage are Personal, Cultural,

and Recreational Services. Travel, Government Services still has certain advantages. All other industries in Japan do not show much comparative advantage.

For the United States, the industry with the highest comparative advantage is Other Business Services. The two industries with the lowest comparative advantage are Government Services and Insurance Services.

Table 2 CA Indexes for China, Japan and the United States

Country	Year	Transportation	Travel	Construction services	Insurance services	Financial services	Computer and information services	Royalties and license fees	Other business services	Personal, cultural, and recreational services	Government services	Communications services
China	2011	-0.24	-0.15	3.24	-1.15	-0.02	0.46	-0.75	0.66	-0.08	0.08	-0.04
	2012	-0.07	-0.42	2.71	-1.02	-0.07	0.63	-0.79	0.69	-0.11	0.17	-0.10
	2013	-0.09	-0.54	2.40	-0.71	-0.10	0.56	-0.80	0.81	-0.13	0.27	-0.11
	2014	0.05	-1.23	3.21	-0.49	-0.05	0.64	-0.65	1.16	-0.10	0.16	-0.09
	2015	0.20	-1.38	3.35	0.51	-0.01	0.87	-0.57	1.03	-0.05	0.11	-0.10
	2016	0.19	-1.31	2.77	0.03	0.08	0.81	-0.60	0.97	-0.07	0.07	-0.11
	2017	0.20	-1.40	2.23	0.14	0.09	0.35	-0.41	1.01	-0.13	0.27	-0.43
	2018	0.20	-1.35	2.34	0.20	0.08	0.43	-0.47	1.03	-0.12	0.17	-0.35
Japan	2011	0.33	-0.41	1.27	-0.47	-0.17	-0.58	1.70	0.07	-0.42	0.79	-0.04
	2012	0.35	-0.26	1.84	-0.90	-0.14	-0.56	2.18	-0.27	-0.47	0.88	-0.16
	2013	0.35	-0.12	1.41	-0.91	-0.21	-0.63	2.24	-0.35	-0.47	0.74	-0.26
	2014	0.18	0.05	0.50	-0.38	-0.27	-1.04	2.09	-0.42	-0.16	1.44	-0.26
	2015	0.11	0.26	0.88	-0.43	-0.18	-1.33	2.13	-0.61	-0.28	1.29	-0.29
	2016	0.03	0.19	0.33	-0.47	-0.12	-1.46	1.82	-0.61	-0.50	1.51	-0.33
	2017	0.02	0.38	0.12	-0.56	-0.82	-1.80	1.78	-0.46	-0.07	1.36	-1.15
	2018	-0.06	0.49	-0.13	-0.80	-0.39	-1.52	2.07	-0.54	0.00	1.31	-1.04
America	2011	-0.07	0.10	0.05	-2.65	0.53	-0.36	0.56	-2.01	1.19	-2.95	-1.66
	2012	-0.03	0.14	0.04	-3.24	0.01	-0.30	0.61	-1.65	1.44	-4.27	0.31
	2013	-0.09	0.23	0.00	-2.84	0.00	-0.34	0.58	-1.42	1.40	-4.05	0.40
	2014	-0.15	0.31	-0.02	-2.65	0.02	-0.35	0.51	-1.55	1.56	-3.97	0.30
	2015	-0.20	0.31	-0.02	-2.23	0.01	-0.28	0.49	-1.05	1.37	-3.37	0.28
	2016	-0.20	0.27	-0.01	-2.25	0.01	-0.22	0.44	0.76	1.16	-3.41	0.36
	2017	-0.18	0.22	0.01	-3.06	0.00	-0.17	0.42	1.81	0.98	-9.74	0.18
	2018	-0.25	0.05	-0.06	-1.75	0.08	-0.12	0.39	1.91	0.26	-7.15	-0.07

3. Complementary analysis

3.1. Trade Complementarity Index (TCI)

3.1.1. Introduction of TCI

The TCI is often used to calculate the degree of trade complementarity between one country's exports and another country's imports. The formula for this index is:

$$TCI_{ij}^{k} = RCA_{xi}^{k} * RCA_{mj}^{k}.$$

3.1.2. Analysis

The TCI by country and year is reported in Table 3. In this table, Other Business Services exported by China and Japan to the United States has the highest degree of complementarity. However, the complementarity index for Other Business Services exported by Japan to the United States shows a steep downward trend. By 2018, the index for Japan's exports of Other Business Services to the United States is substantially lower than that of China.

For China, the industries with the highest degree of complementary with Japan are Transportation industry, Travel industry, and Construction Services, as well as Personal, Cultural, and Recreational Services. Among them, the TCI for Transportation shows an overall downward trend, but the TCI for Travel services is increasing over the years.

Among the industries exported from the United States to China, the two industries with the highest TCI are Travel industry, and Other Business Services. The TCI for Travel rises for a while then falls. The TCI for Other Business Services, on the other hand, consistently falls.

Construction Services is the industry with the highest degree of complementarity when it comes to China's exports to Japan. The TCI index in this case stays consistently high for all years.

In Table 3, the TCI for the US exports of Computers and Information Services to Japan is rising steadily over the years and goes from 0.31 in 2011 to 1.26 in 2018. For the United States, in addition to Other Business Services, China's exports of Insurance Services, and Government Services to the United States have a high degree of complementarity.

The degree of complementarity for other industries stays around the average. That is especially true for Government Services. The TCI for Japanese exports to the United States in 2011 is 4.20, but rises to 14.07 in 2018, making it the industry with the highest degree of complementarity among the Japanese industries when it comes to exporting to the United States.

Table 3 TCI Indexes for China, Japan and the United States

Country	Year	Transportation	Travel	Construction services	Insurance services	Financial services	Computer and information services	Royalties and license fees	Other business services	Personal, cultural, and recreational services	Government services	Communications services
China exports to the United States	2011	0.68	1.02	0.60	2.05	0.05	0.74	0.02	22.96	0.03	0.86	0.09
	2012	0.83	1.19	0.61	2.67	0.00	0.89	0.04	22.50	0.04	1.59	0.03
	2013	0.87	1.10	0.39	2.64	0.01	0.92	0.03	23.99	0.05	1.95	0.04
	2014	0.90	0.88	0.48	2.62	0.01	0.98	0.02	26.19	0.06	1.61	0.03
	2015	1.04	0.99	0.83	2.76	0.00	1.17	0.03	22.85	0.33	1.47	0.03
	2016	1.02	1.01	0.37	2.19	0.00	1.16	0.04	20.55	0.41	1.77	0.03
	2017	1.05	0.89	0.33	2.97	0.01	1.22	0.15	19.69	0.53	6.86	0.04
	2018	1.04	0.76	0.68	1.98	0.23	1.16	0.15	19.63	0.66	4.80	0.04
China exports to Japan	2011	1.15	0.86	10.08	0.67	0.03	0.71	0.11	1.82	0.03	0.11	0.00
	2012	1.34	0.83	7.54	0.77	0.06	0.83	0.15	1.55	0.03	0.16	0.01
	2013	1.22	0.67	6.75	0.80	0.11	0.92	0.12	1.93	0.03	0.22	0.01
	2014	1.12	0.41	10.81	0.67	0.20	1.42	0.08	2.32	0.02	0.18	0.01

	2015	1.21	0.38	11.85	0.92	0.12	2.14	0.12	2.24	0.16	0.22	0.02
	2016	1.11	0.54	10.65	0.82	0.17	2.37	0.14	2.22	0.24	0.29	0.02
	2017	1.18	0.36	9.30	0.92	0.30	3.01	0.55	1.99	0.13	0.41	0.07
	2018	1.09	0.35	8.76	1.32	0.20	2.42	0.56	2.16	0.08	0.38	0.07
Japan exports to China	2011	1.83	0.43	3.04	0.89	0.02	0.08	2.70	1.09	0.01	0.22	0.00
	2012	1.84	0.70	2.66	0.21	0.07	0.09	3.33	0.58	0.02	0.22	0.01
	2013	1.73	0.77	2.13	0.07	0.11	0.12	3.29	0.63	0.02	0.20	0.01
	2014	1.24	1.06	1.89	0.51	0.15	0.11	2.56	0.45	0.04	0.40	0.01
	2015	1.09	1.52	4.34	0.24	0.10	0.11	2.26	0.38	0.09	0.52	0.01
	2016	0.94	1.68	3.48	0.40	0.09	0.13	2.31	0.41	0.12	0.86	0.01
	2017	0.99	1.81	3.27	0.36	0.08	0.30	2.56	0.37	0.17	0.80	0.03
	2018	0.84	1.99	2.51	0.42	0.07	0.22	3.03	0.38	0.11	0.90	0.03
Japan exports to the United States	2011	1.00	0.29	0.56	1.39	0.29	0.13	1.14	18.59	0.05	4.20	0.09
	2012	1.17	0.44	0.74	0.41	0.01	0.16	1.48	14.39	0.07	6.40	0.04
	2013	1.24	0.44	0.49	0.14	0.01	0.20	1.47	16.29	0.08	5.60	0.05
	2014	1.14	0.46	0.43	1.09	0.02	0.19	1.50	17.45	0.20	8.34	0.04
	2015	1.14	0.64	0.62	1.00	0.02	0.18	1.29	15.24	0.33	6.82	0.04
	2016	1.02	0.74	0.29	1.20	0.02	0.19	1.33	14.78	0.48	7.93	0.03
	2017	0.97	0.85	0.29	1.63	0.02	0.23	1.34	13.79	0.74	19.74	0.04
	2018	0.77	0.86	0.51	1.07	0.86	0.19	1.32	13.62	0.48	14.07	0.04
Us exports to China	2011	0.76	1.29	0.16	0.47	0.10	0.20	0.75	11.30	0.25	0.08	0.14
	2012	0.84	1.83	0.14	0.56	0.01	0.24	0.88	9.96	0.36	0.08	0.15
	2013	0.84	2.00	0.08	0.46	0.01	0.27	0.86	9.70	0.43	0.07	0.19
	2014	0.72	2.73	0.06	0.41	0.01	0.26	0.65	6.36	0.40	0.08	0.14
	2015	0.67	3.10	0.20	0.16	0.01	0.29	0.57	5.94	0.84	0.10	0.14
	2016	0.66	2.98	0.10	0.24	0.00	0.36	0.58	6.41	0.92	0.13	0.16
	2017	0.70	2.86	0.12	0.22	0.00	0.74	0.65	6.04	1.18	0.12	0.40
	2018	0.62	2.13	0.15	0.20	0.13	0.69	0.67	6.07	1.00	0.13	0.25
Us exports to Japan	2011	0.70	0.72	0.49	0.24	0.70	0.31	1.45	15.23	0.90	0.19	0.14
	2012	0.87	0.80	0.48	0.32	0.02	0.40	1.58	16.97	1.22	0.22	0.23
	2013	0.85	0.69	0.30	0.28	0.02	0.45	1.47	20.19	1.26	0.22	0.40
	2014	0.82	0.55	0.33	0.23	0.04	0.66	1.43	22.07	0.93	0.18	0.32
	2015	0.81	0.50	0.41	0.22	0.03	0.86	1.12	23.27	1.44	0.19	0.34
	2016	0.78	0.70	0.23	0.27	0.03	1.02	1.27	25.10	2.17	0.19	0.39
	2017	0.77	0.55	0.29	0.31	0.05	1.39	1.22	22.92	1.33	0.19	0.99
	2018	0.59	0.42	0.39	0.33	1.42	1.26	1.11	24.03	0.54	0.16	0.68

3.2. Index of Intra-Industry Trade (IIT)

3.2.1. Introduction of IIT

This index is used to measure the degree of intra-industry trade for an industry. By measuring the intra-industry trade of an industry, we can analyze the complementary between trade and demand in the industry. The formula for this index is:

$$IIT = 1 - \frac{|X-M|}{(X+M)}.$$

X and M represent exports and imports of a particular industry or class of goods, respectively. By construction, $0 \leq IIT \leq 1$. When IIT=0, there is no intra-industry trade. When IIT=1, the intra-industry imports are equal to exports. The higher the IIT value, the higher the degree of intra-industry trade.

3.2.2. Analysis

We compute and report the IIT for countries and years in Table 4. The highest intra-industry trade in China happens in Communication Services. Its IIT hardly changes in recent years.

The IIT for Transportation, industry Other Business Services, and Personal, Cultural, and Recreational Services in China has been steady and relatively high throughout the years. The IIT index for Travel Services has changed the most, falling from 0.8 in 2011 to 0.25 in 2018. The industry is already the one with the least demand for trade in China by 2018. In China, the degree of intra-industry trade in Financial Services, and Government Services has, to some extent, experienced a decline in 2018 compared with 2011. China's IIT has increased significantly in Construction Services, and Insurance Services in the recent years. The index value has almost doubled. In China, the industries with the lowest level of intra-industry trade is Personal, Cultural, and Recreational Services.

The IIT of Japan's services are very high, indicating that Japan has had a strong demand for service trade in recent years. The biggest change happens in Japan's Personal, Cultural, and Recreational Services, where its IIT increases 2.5 times from 0.28 in 2011 to 0.98 in 2018 The index varies only a little within other industries, but the degree of intra-industry trade remains high. In Japan, the industry with the lowest level of intra-industry trade is Computer and Information Services.

The situation in the United States is similar to that in Japan. The changes in the IIT of most industries are small and the index is relatively stable. The largest change in the IIT in the US happens in Personal, Cultural, and Recreational Services, where the IIT rises from 0.51 to 0.89. The IIT index for Transportation industry, Construction Services, Computer and Information Services, and Government Services has been around 1.0 in the recent years, and demand has been relatively large. In the United States, the industry with the lowest degree of intra-industry trade is Financial Services.

Table 4 IIT Indexes for China, Japan and the United States

Country	Year	Transportation	Travel	Construction services	Insurance services	Financial services	Computer and information services	Royalties and license fees	Other business services	Personal, cultural, and recreational services	Government services	Communications services
China	2011	0.61	0.80	0.40	0.27	0.94	0.53	0.10	0.93	0.47	0.83	1.00
	2012	0.62	0.66	0.46	0.28	0.99	0.51	0.11	0.91	0.36	0.98	0.95
	2013	0.57	0.57	0.53	0.31	0.93	0.62	0.08	0.91	0.32	0.98	1.00
	2014	0.57	0.32	0.48	0.34	0.96	0.70	0.06	0.74	0.33	0.68	0.99
	2015	0.62	0.31	0.76	0.72	0.94	0.63	0.09	0.81	0.56	0.59	1.00
	2016	0.59	0.30	0.80	0.48	0.78	0.67	0.09	0.85	0.51	0.55	0.99
	2017	0.57	0.26	0.83	0.52	0.64	0.84	0.29	0.83	0.43	0.66	1.00
	2018	0.56	0.25	0.78	0.60	0.77	0.88	0.27	0.83	0.44	0.56	1.00

Japan	2011	0.91	0.57	0.83	0.39	0.90	0.55	0.80	0.90	0.28	0.77	0.93
	2012	0.87	0.69	0.80	0.10	0.82	0.58	0.77	0.72	0.26	0.75	0.99
	2013	0.82	0.87	0.04	0.88	0.60	0.72	0.74	0.25	0.83	1.00	1.00
	2014	0.93	0.99	0.96	0.47	0.84	0.43	0.72	0.78	0.72	0.61	0.99
	2015	0.93	0.78	0.87	0.50	0.74	0.39	0.64	0.72	0.67	0.62	0.99
	2016	0.91	0.75	0.89	0.54	0.69	0.42	0.68	0.77	0.74	0.57	1.00
	2017	0.92	0.69	0.88	0.52	0.85	0.52	0.68	0.79	0.92	0.59	1.00
	2018	0.86	0.65	0.94	0.51	0.83	0.45	0.65	0.76	0.98	0.60	0.99
America	2011	0.99	0.75	0.97	0.43	0.36	0.79	0.45	0.84	0.51	0.83	0.94
	2012	0.99	0.77	0.99	0.46	0.41	0.85	0.47	0.85	0.51	0.89	0.69
	2013	0.98	0.71	0.91	0.48	0.50	0.84	0.47	0.85	0.56	0.93	0.67
	2014	0.98	0.71	0.92	0.51	0.43	0.83	0.49	0.85	0.58	0.90	0.67
	2015	0.95	0.71	0.93	0.51	0.44	0.88	0.49	0.84	0.64	0.97	0.67
	2016	0.93	0.75	0.93	0.51	0.37	0.91	0.54	0.82	0.69	0.93	0.64
	2017	0.93	0.78	0.98	0.53	0.40	0.95	0.57	0.81	0.81	0.93	0.67
	2018	0.93	0.78	0.97	0.58	0.44	0.95	0.50	0.76	0.89	0.98	0.77

4. Conclusions and suggestions

4.1. Conclusions

Overall, among Japan, China and the US, the US is the most competitive country in services trade. It is followed by Japan, and then by China. The most competitive industries in China turn out to be Construction Services, Computer and Information Services, and Other Business Services. In Japan, the most competitive industries are Construction Services, Personal, Cultural, and Recreational Services, as well as Government Services. The most competitive industries in the United States are Other Business Services, Personal, Cultural, and Recreational Services, Royalties and License Fees. When it comes to complementarity, there is a high degree of complementarity in Construction Services, Computer and Information Services, Other Business Services, Royalties and License Fees between China and Japan. There is also a high degree of complementarity in Insurance Services, Other Business Services, Government Services, and Travel industry between China and the United States. Other Business Services, and Government Services between Japan and the United States have the highest degree of complementarity among all.

4.2. Suggestions

4.2.1. Suggestion 1

Our findings support the continued efforts to improve the competitiveness of industries with a trade advantage by further opening the service market. Among the three industries with strong competitiveness in China, the international competitiveness of Construction Services is on the decline. Therefore, there is a need to rely on the competitive advantage of the other highly competitive industries to compensate for that decline. To accomplish this goal, China needs to further open up the market, continue to liberalize trade in services, and consolidate China's position in the industrial chain of international trade in services. China also needs to attract Japan, the United States and other countries to seek our cooperation.

4.2.2 Suggestion 2

China should focus on supporting industries that are not very competitive. A policy to stimulate

the market for these industries could revitalize them. Communication Services, Royalties and License Fees, Personal, Cultural, and Recreational Services, and Financial Services are all currently uncompetitive industries in China. That is despite the fact that these industries are part of the modern service trade and are knowledge, technology, and capital-intensive industries. The government should carry out macro-control, strengthen industry assistance policies and increase capital investment in those areas in order to rapidly enhance the international competitiveness of vulnerable industries and constantly improve China's position in the industrial chain of international trade in services.

4.2.3. Suggestion 3

China should increase international cooperation in complementary industries while preventing over-dependence. Construction Services, Computer and Information Services, and Other Business Services are highly complementary in China, Japan and the United States. But, China also has strong international competitiveness in these industries. China should encourage industries to engage in more international cooperation. However, in order to prevent industrial dependence and over-reliance on other countries, China is also bound to accept some reduction in its international competitiveness of service industry as a trade off.

4.2.4. Suggestion 4

China should pay attention to the industrial balance and deficit, and strengthen the sustainability of the development of its service trade. After eliminating the influence factors caused by industrial imports, the CA index shows that there is a slight deviation from the RCA value. China should pay attention to the import and export volumes of trade and their balance. Blindly exporting will bring vicious competition. Blindly importing reduces the core competitiveness of Chinese industry. So either extreme is undesirable. China must make a good choice trade off between short-term interests and long-term interests, and strategically make a long-term layout to promote the sustainable development of China's service trade.

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