

Are China's Service Exports Accurately Measured? Implications of an Alternative Measurement Approach

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Abstract

As economic development advances, a country's service sector grows. With globalization, this growth is often accompanied by the growth of trade in services. China is a good example. After three decades of spectacular economic advance, its service trade is now one of the world's largest, but so is its service trade deficit. How did this come about, given China's competitive strength in the export of goods? Second, is this deficit a statistical anomaly, i.e. with China participating in global supply chains, how well do gross exports reflect the true value of China's service exports? Third, what is the real competitiveness of China's service exports? This study examines these questions by first reviewing the structure and trends in China's service trade using official statistics. It then re-estimates these exports using the "forward linkage value-added method" to compare with gross exports. The third question is addressed by calculating revealed comparative advantage (RCA) indexes based on gross as well as value-added service exports. Using 2000-2014 data, the results show that no matter which method is applied, China's service exports have weak comparative advantage but rising RCAs show China's competitive situation improving. Also, gross export values overestimate the RCA compared to value-added values. A number of policy implications arise from these findings.

***Keywords:** service sector, globalization, service trade deficit, forward linkage revealed comparative advantage, value-added service exports*

1. Introduction

As a country develops, its service (tertiary) sector expands at the expense of the primary and secondary sectors. However, this expansion has not carried over to trade; while services account for 60 per cent of global production, it just creates 20 per cent of the value of world trade (WTO, 2012). Little

wonder then that trade analysis is heavily focused on the trade in goods. But this is changing, while the total global service exports was only US\$367.1 billion in the 1980s, this have increased to US\$4,861.5 billion by 2014, an increase of about 13.2 times and an average annual growth rate of around 8 per cent (WTO, 2015). Service trade is becoming the “new engine” leading global growth (WTO, 2013).

In addition, trade in services is also a source of trade diversification. With the costs of communications, travel and information flow continuously falling, it has become easier to create a service in one place and consume it in another place, thus increasing the tradability of services. Furthermore, service trade can generate high value added. According to data from OECD (2011), service sectors created 60 per cent of total value-added in developed countries. By 1999, over 60 per cent of the value of all cross-border mergers and acquisitions was generated by the service sector (UNCTAD, 2000).

At 6 per cent share of global service exports, China was the third largest exporter behind the US and UK. However, unlike its trade in goods, China’s service trade has been in deficit for 20 consecutive years from 1995 to 2015, and this deficit is growing. In 2014, China’s service trade deficit had increased to US\$159.9 billion, making it the biggest service trade deficit in the world (WTO, 2015). This together with the growing importance of this trade, provides strong grounds to examine China’s service export competitiveness.

This paper examines the issues surrounding China’s service trade. It is organized as follows. In the next section a brief review of relevant theories is followed by an account of empirical work on China. Section 3 deals with the methodology applied in this paper as well as the data used for estimation. In meeting one of the objectives of this paper, Section 4 reviews the development of China’s service exports using gross values as commonly measured. Using value added as well as gross service exports, Section 5 estimates revealed comparative advantage indices to assess the comparative advantage of each category of service exports. Section 6 concludes with implications of the findings for policies towards these export sectors.

2. Literature Review

Before the early 1990s, economists discussed the applicability of the comparative advantage principle to service trade through the factor-intensive approach (Hindley and Smith, 1984; Deardorff, 1984; Melvin, 1989; Jones and Ruane, 1990; Burgess, 1990). Deardorff (1984) confirmed the applicability of comparative advantage in service trade by using the Heckscher-Ohlin model. However, in the era of globalization, with the service trade structure shifting to capital and knowledge-intensive services, the

traditional trade theory has been found wanting in explaining trade in services and the issue of competitiveness in service trade.

Most early research on the competitiveness of service trade rely on indicators for making recommendations to enhance the competitiveness of service trade. For example, Sapir (1982, 1986) verified the applicability of comparative advantage in service trade and concluded that service sectors have different advantages among different countries. Since then, scholars have begun to use the revealed comparative advantage (RCA) index to analyze the competitiveness of a country's service trade (for example, Peterson and Barras, 1987; Zhao and Li, 2005).

In addition, services like trade logistics, trade insurance and finance depend heavily on the trade in goods. Thus, the relevant theory here is the theory of derived demand. As an economic term, derived demand describes the demand for a good or service resulting from the demand for an intermediate or related good or service.

In China, Chen and Li (2014) studied the competitiveness of the country's trade in services based on the different indicators of degree of openness (DO), market share (MS) index, revealed comparative advantage (RCA) index, and trade competitiveness (TC) index and found that China's service trade competitiveness in the world is very weak. Seyoum (2007) analyzed the international competitiveness of business, finance, transportation and tourism in the developing countries and proposed measures to enhance the competitiveness of the service industries. Zhao and Xu (2007) studied the international competitiveness of transportation services. A number of other service sectors have also been studied. Examples are Huang and Deng (2010) on financial services, Li and He (2012) on education services, and Yang (2009) on the transportation, tourism and architecture sectors.

Studies have also been undertaken using the value-added of goods exports instead of gross value of goods exports on the grounds that the value of imported intermediate goods should be excluded from the value of exports. Thus, Ma and Duan (2015) applied the world input-output table (WIOT) and TiVA database and found that China's domestic value-added is exhibiting a recovering trend in recent years. Li and Zhang (2015) applied the data from the OECD-WTO value-added trade database to analyze the revealed comparative advantage (RCA) of China's trade in services using value-added export data. Koopman, Wang and Wei (2012) also calculated sectoral RCAs from the perspective of value added.

Value added export data have been further refined but again applied only to the exports of goods. Using the Koopman, Powers, Wang and Wei (2010) approach¹, Brakman and Van Marrewijk (2017) determined the distributions of revealed comparative advantage (RCA) in terms of gross exports of goods and value added for 40 countries. They confirmed that the distributions of

RCA calculated with gross exports and the value added data they generated are indeed significantly different from each other.

In a significant departure from most studies focusing on goods trade, Wang, Wei and Zhu (2013) suggested further refinement of the value-added concept by distinguishing between indirect exports of a service sector's value added via aggregate exports from other service sectors of the same exporting country (forward linkage based value-added exports) and value added from all service sectors of a given exporting country embodied in a given service sector's gross exports (backward linkage based value-added exports). They used the forward linkage value added exports to calculate the RCA_F index for electrical and optical equipment in mainland China and the United States and compared them with the RCA index based on gross value exports.

3. Methodology and Data

Like a number of earlier studies on China, this paper uses the RCA index to measure the comparative advantage of a sector. This is an index used in international economics for calculating the relative advantage or disadvantage of a certain country in a certain class of goods or services as evidenced by trade flows. It is based on the Ricardian comparative advantage concept. It most commonly refers to an index, called the Balassa index, introduced by Balassa (1965). Balassa's (1965) RCA index is defined as the percentage share of a specific sector in national exports divided by the percentage share of that sector in world exports. The larger the RCA value, the stronger the international competitiveness of the service trade. This index is an important indicator to measure a country's comparative advantage in the world market. However, the traditional RCA index ignores both international and domestic production sharing. Thus, taking into account such production sharing, this study uses a new method – a forward-linkage based measure of value added service exports, which incorporates indirect exports of a service sector's value added embodied in other service sectors' exports. The reference standards

Table 1 The Criteria for Competitiveness of RCA Index

<i>Value of RCA</i>	<i>Competitive Judgement</i>
$RCA < 0.8$	Very Strong competitive disadvantage
$0.8 \leq RCA < 1$	Strong competitive disadvantage
$RCA \geq 1$	Has a revealed comparative advantage
$1.25 \leq RCA < 2.5$	Strong competitive advantage
$RCA \geq 2.5$	Very Strong competitive advantage

Source: Balassa (1977).

and meanings of the RCA index used in this paper refer to the standards established by the Japan External Trade Organization (JETRO).

3.1. Decomposition of Value Added Based on Forward Linkage

From the global value chain perspective, the traditional RCA index neglects the domestic and the international division of labour. Specifically, the traditional RCA index ignores the fact that a country-sector's value added may be exported indirectly through the country's export in other sectors. Furthermore, the traditional RCA index fail to deal with the fact that the gross export of a country's sector includes parts of foreign value (FVA and FDC). Therefore, this study will apply the correct measure of comparative advantage which includes indirect exports of a sector's value added via other sectors of the exporting country and exclude pure double counted terms in aggregate exports and foreign-originated value added.

After considering the domestic and international division of labour in production, the context defines a new indicator to measure the revealed comparative advantage of a country (short for "New RCA index" or RCA_value added). That is defined as the share of a country-sector's forward linkage based measure of domestic value added in exports in the country's total domestic value added in exports relative to that sector's total forward linkage based domestic value added in exports from all countries as a share of global value added in exports as proposed by Wang, Wei and Zhu (2013).²

3.2. Sample and Data

The updated (World Input-Output Database) WIOD provides the World Input-Output Table (WIOT) for the time series from 2000-2014, which covers 43 countries and 56 industry sectors.

The classification of trade in services in this paper is in accordance with the International Standard Industrial Classification (ISIC), Rev.4 categories. It separates the service industries into 12 sectors. The twelve sectors are construction, wholesale and retail trade, transportation and storage, accommodation and food service, information and communication, financial and insurance activities, real estate activities, professional, scientific and technical activities, administrative and support service activities, education, human health and social work, arts, entertainment and recreation.

3.3. China's Service Exports

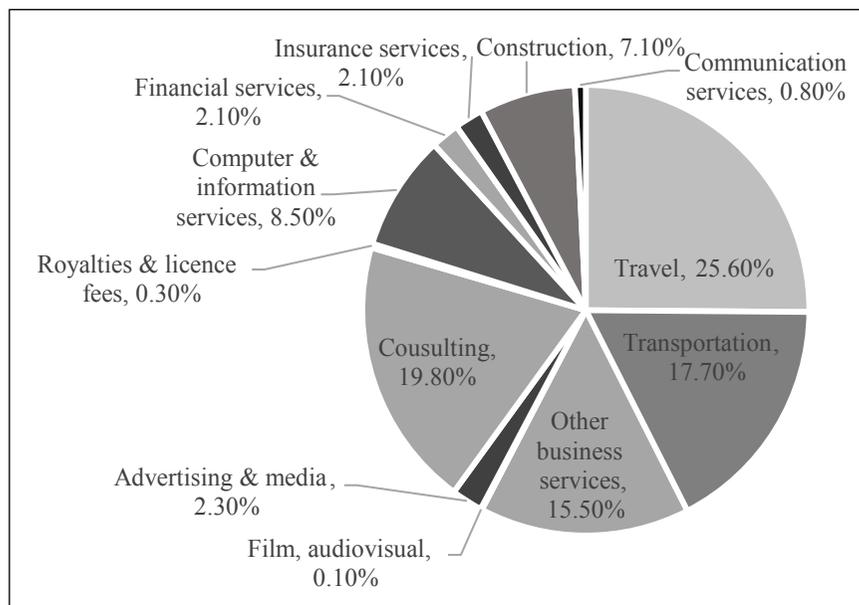
China's service trade has increased rapidly since its opening-up in 1978. Its service imports increased from US\$1.9 billion in 1982 to US\$382.1 billion

in 2014, with an average annual growth rate of 18 per cent, making China the second largest service importer next to the United States in 2014. Service exports also increase from US\$2.5 billion to US\$222.2 billion, an annual growth rate of 15.1 per cent. However, with the more rapid increase of service imports, the service trade deficit has increased. In 2014, the service trade deficit reached US\$159.9 billion, the largest in the world.

Currently, the main service export sectors are China's traditional service sectors like travel, transportation, construction and other business services. In 2014, the export share of these four sectors was 65.9 per cent of China's total service exports. The modern service industries such as consulting, financial services and computer and information technology also account for an important share of total service exports (34.1 per cent) as shown in Figure 1. Some modern service industries such as communication, insurance, film, audio visual, advertising and media, royalties and licence fees account for a small share of service exports, implying that these modern service industries lack competitiveness since the level of competitiveness of a country's services trade is related to the composition of the country's service trade sectors, that is the export and import of services (Yao and Fang, 2013).

Calculating China's service trade between 2000 and 2014 using gross value and value added methods shows that China's service exports calculated

Figure 1 Export Structure of China's Service Sectors



Source: China Statistics of Trade in Services 2014.

Table 2 Total Export Value of China's Service Trade Based on Different Calculation Methods, 2000-2014 (Unit: US\$ billion)

<i>Year</i>	<i>Conventional Value Method (SGX)</i>	<i>Value Added Method SDVA</i>	<i>Overestimated Rate (%)</i>
2000	518,86.82	458,03.38	13.28
2001	582,30.82	516,85.48	12.66
2002	719,13.37	632,83.70	13.64
2003	792,49.05	686,34.29	15.47
2004	976,43.07	831,26.23	17.46
2005	114,549.34	976,80.32	17.27
2006	144,732.14	122,741.45	17.92
2007	195,471.90	165,270.74	18.27
2008	255,588.64	219,028.95	16.69
2009	237,475.92	209,556.51	13.32
2010	296,103.20	257,097.85	15.17
2011	368,016.79	318,104.92	15.69
2012	398,304.97	347,987.89	14.46
2013	385,163.32	337,366.43	14.17
2014	398,128.29	353,227.44	12.71

Note: Overestimate Rate = (Service Gross Export Value (SGX) – Service Domestic Value Added Export Value (SDVA))/Service Domestic Value Added Export Value (SDVA) × 100 per cent.

Source: Author's calculation based on WIOTs.

in gross terms are higher than in value-added terms, the average overestimate being around 15.21 per cent, as shown in Table 2. This means a large number of intermediate goods have been double-counted in the calculation of gross exports. The value added statistical method removes this double-counting and is a better measure of the actual value of exports originating from China.

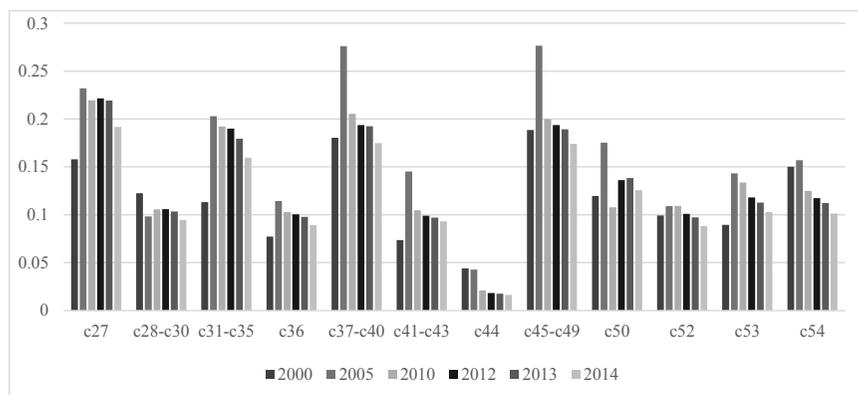
The overestimate rose from just under 13 per cent to over 18 per cent in 2007, declining thereafter back to what it was in 2000. The reason for this was changes in the sectoral composition of service exports. The overestimate rate displays an increasing trend from 2000 to 2007, after which the overestimate rate gradually decreases from the peak to the bottom point, that is 12.71 per cent in 2014. Despite the fact that the overestimate rate continuously declines after 2007, Liu and Wang (2017) also reported that the overestimate rate shows a downward trend from 2000 to 2014, which indicates that even though most of the incremental value is created by other countries, the domestic value added belonging to the home country is increasing. It shows that Chinese service industry is continuously moving upstream Liu and Wang (2017). However,

the proportion of overestimation is still greater than 10 per cent, which demonstrates that the gross value method contains a large number of repeated trade statistics, that is, a large number of intermediate goods are involved in the calculations. Therefore, it exaggerates the total export of China's service and thus is unable to present the real situation of China's service export.

As Table 2 shows, the total export value of China's service trade based on two different methods shows an increasing trend. Wang, Wei and Zhu (2013) decomposed bilateral exports into 16 value added parts and the double counting items. Since domestic value added (DVA) is a part of gross exports, the value of DVA is less than that of gross exports. When the export value calculated by the conventional value method is greater than the value added method, it will show an overestimate. The greater this difference, the larger is the overestimate rate.

For the twelve service sub-sectors, the overestimate using gross value ranges between 1.62 per cent and 27.7 per cent, as shown in Figure 2. The highest average overestimate rate appears in the construction sector, which confirms the findings of Liu and Wang (2017). However, this overestimate is gradually decreasing between 2000 and 2014, indicating that China's service

Figure 2 Overestimate Rate of China's Main Service Sectors Based on Two Different Calculation Methods from 2000-2014



Note: c27 is construction, c28-c30 is wholesale and retail trade, c31-c35 is transportation and storage, c36 is accommodation and food service activities, c37-c40 is information and communication, c41-c43 is financial and insurance activities, c44 is real estate activities, professional, c45-c49 is scientific and technical activities, c50 is administrative and support service activities, c52 is education, c53 is human health and social work activities, arts, c54 is entertainment and recreation.

Source: Author's calculation based on WIOTs.

industry is moving towards greater participation in segments of global value chains that capture a higher value (Liu and Wang, 2017).

According to Figure 2, some sectors such as construction, transportation and storage, accommodation and food service, human health and social work have overestimates that were rising. The rest of the service sectors such as information and communication, real estate activities, professional, scientific and technical, arts, entertainment and recreation show a decreasing overestimate trend. The overestimate rate of another two sectors, administrative and support services, remains unchanged around 10 per cent, while the education sector remains stable at 1 per cent.

These findings reveal both good and bad news for China's service exports. The good news is that with China's strengthening technological capability, technologically related services deficits are shrinking. The bad news is that other service deficits are either stagnant or rising. These findings need to be qualified in that estimated RCAs may well produce different results. It is to these RCAs that we next turn.

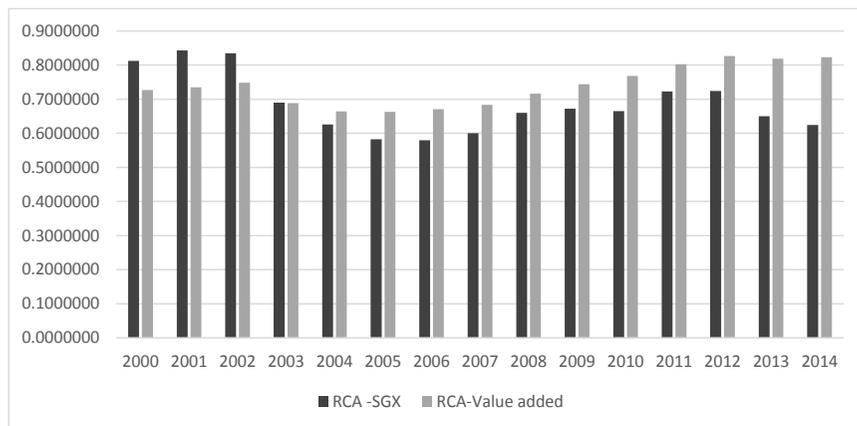
3.4. Measuring Export Competitiveness Using the RCA Index

The above deficits are at best indirect indicators of competitiveness. To directly measure export competitiveness of services, RCAs need to be calculated. Figure 3 shows the aggregate services exports RCA value based on conventional statistical method and value added (forward linkage) method. According to Figure 3, the RCA indices based on value added method in the last four years have been constant at around 0.8, which means that China's service trade still has a slight competitiveness disadvantage. As the figure shows, from 2000 to 2003 the estimated result based on gross value method overestimates the international competitiveness of China's service industry, hereafter the calculation result based on gross value method underestimates the international competitiveness level of China's service industry (Cao, 2016; Zheng and Yang, 2015).

Trade statistics of value-added focus on the production process and production line and it is more reasonable than the traditional gross trade statistics in measuring the scale of industrial trade. Therefore, it is acceptable to apply the RCA indices to reflect the competitiveness level of China's service industry based on the trade statistics of value-added.

RCA values of gross export and export value added (forward linkage) for China's service subsectors export have been calculated in Tables 3 and 4 respectively. It can be seen that no matter which method is applied, the RCA indices are less than 1, which means that the competitiveness of China's service trade is relatively weak. However, the RCA indices based on value added is continuously increasing over time and the gap between

Figure 3 RCA Indices of China’s Aggregate Services Based on Two Different Trade Statistics



Source: Author’s calculation based on WIOTs.

Table 3 RCA Indices of China’s Major Sectors Based on Gross Value Method

	2000	2002	2005	2007	2008	2009	2010	2011	2012	2013	2014
c27	0.91	0.89	0.93	1.23	1.29	1.20	1.29	1.52	1.46	1.31	1.16
c28-c30	1.20	1.29	0.81	0.79	0.93	1.06	1.01	1.15	1.23	1.10	1.11
c31-c35	0.79	0.79	0.67	0.73	0.76	0.76	0.77	0.80	0.76	0.72	0.66
c36	0.95	0.96	0.83	0.82	0.77	0.67	0.55	0.47	0.40	0.38	0.35
c37-c40	0.20	0.17	0.15	0.19	0.21	0.20	0.22	0.25	0.26	0.26	0.21
c41-c43	0.01	0.02	0.02	0.03	0.04	0.05	0.07	0.09	0.11	0.09	0.10
c44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
c45-c49	1.24	1.22	1.05	1.18	1.26	1.23	1.17	1.17	1.06	0.86	0.84
c50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.05	0.05
c52	0.17	0.20	0.15	0.16	0.16	0.14	0.14	0.15	0.14	0.15	0.14
c53	0.00	0.00	0.00	0.36	0.35	0.26	0.23	0.22	0.19	0.22	0.18
c54	5.57	5.74	2.18	1.57	1.55	1.33	1.28	1.24	1.16	1.05	0.86

Note: c27 is construction, c28-c30 is wholesale and retail trade, c31-c35 is transportation and storage, c36 is accommodation and food service activities, c37-c40 is information and communication, c41-c43 is financial and insurance activities, c44 is real estate activities, professional, c45-c49 is scientific and technical activities, c50 is administrative and support service activities, c52 is education, c53 is human health and social work activities, arts, c54 is entertainment and recreation.

Source: Author’s calculation based on WIOTs.

Table 4 RCA Indices of China's Major Sectors Based on Value Added Method

	2000	2002	2005	2007	2008	2009	2010	2011	2012	2013	2014
c27	0.38	0.32	0.22	0.25	0.30	0.31	0.37	0.43	0.45	0.48	0.44
c28-c30	0.90	0.98	0.82	0.78	0.88	0.99	1.05	1.13	1.18	1.16	1.18
c31-c35	1.07	1.04	0.89	0.88	0.87	0.85	0.84	0.88	0.88	0.86	0.85
c36	1.16	1.22	1.27	1.25	1.25	1.16	1.05	0.98	0.97	0.94	0.93
c37-c40	0.42	0.42	0.43	0.43	0.38	0.32	0.30	0.31	0.31	0.31	0.30
c41-c43	0.74	0.67	0.58	0.77	0.85	0.85	0.89	0.94	0.97	1.01	1.04
c44	0.54	0.53	0.55	0.75	0.69	0.84	0.93	0.96	1.00	0.99	0.98
c45-c49	0.48	0.51	0.60	0.65	0.67	0.72	0.74	0.74	0.75	0.72	0.74
c50	0.01	0.01	0.02	0.02	0.02	0.03	0.03	0.03	0.05	0.04	0.04
c52	0.46	0.50	0.51	0.48	0.47	0.48	0.39	0.34	0.34	0.35	0.40
c53	0.56	0.61	0.91	1.00	0.84	0.64	0.44	0.35	0.29	0.30	0.32
c54	2.22	2.71	1.66	1.40	1.39	1.38	1.32	1.33	1.34	1.30	1.29

Note: c27 is construction, c28-c30 is wholesale and retail trade, c31-c35 is transportation and storage, c36 is accommodation and food service activities, c37-c40 is information and communication, c41-c43 is financial and insurance activities, c44 is real estate activities c45-c49 is professional, scientific and technical activities, c50 is administrative and support service activities, c52 is education, c53 is human health and social work activities, c54 is arts, entertainment and recreation.

Source: Author's calculation based on WIOTs.

the two statistical methods is gradually narrowing. This means that the competitiveness of China's service industry has progressively improved. The RCA indices based on the gross value is greater than those based on the value-added method in 2000, but this situation was reversed after 2003. Since the value-added method eliminates the double counting items of intermediate products, it reflects the real competitiveness situation of China's service industry (Koopman *et al.*, 2010).

Comparing the two different statistical methods, the RCA indices of some sectors calculated by gross value such as construction, wholesale and retail trade overestimate the real competitiveness of Chinese service industry. However, the international competitiveness of most of the sub-sectors of the Chinese service industry namely transportation and storage, accommodation and food service, information and communication activities, financial and insurance activities, real estate activities, professional, scientific and technical activities, administrative and support service activities, education, human health and social work activities, arts, entertainment and recreation appear to be underestimated.

After analysing, it is realized that the gross value method fails to reflect the real competitiveness level of Chinese service industry (Li and Zhang, 2015). The competitiveness of most sub-sectors of Chinese service industry is underestimated based on the gross value method. It indicates that the export competitiveness of Chinese service industry calculated by value added method is relatively stronger than calculated by gross value method (Cao, 2016). From the perspective of the whole service industry, the international competitiveness of Chinese service trade export is gradually increasing if estimated based on trade in value added.

From the discussion above, it can be seen that no matter which method is used, the RCA indices of sub-sectors are less than 1 except for the RCA indices of the arts, entertainment and recreation sector. It means that the international competitiveness of most sub-sectors is still at the level of competitive disadvantage. However, the comparative disadvantage of the sub-sectors has gradually reduced over time (Cao, 2016). The RCA indices of wholesale and retail trade, transportation and storage, accommodation and food services, financial and insurance activities, real estate activities remained at around 1, which means the comparative advantage of these sectors are at

Table 5 Variance between Two Different Statistical Methods from 2000-2014

	<i>Variance – Gross Value Method</i>	<i>Variance – Value Added Method</i>
c27	0.038	0.007
c28-c30	0.027	0.020
c31-c35	0.002	0.006
c36	0.044	0.015
c37-c40	0.001	0.003
c41-c43	0.001	0.023
c44	0.000	0.036
c45-c49	0.000	0.009
c50	0.016	0.000
c52	0.001	0.003
c53	0.000	0.055
c54	3.321	0.240

Note: c27 is construction, c28-c30 is wholesale and retail trade, c31-c35 is transportation and storage, c36 is accommodation and food service activities, c37-c40 is information and communication, c41-c43 is financial and insurance activities, c44 is real estate activities, professional, c45-c49 is scientific and technical activities, c50 is administrative and support service activities, c52 is education, c53 is human health and social work activities, arts, c54 is entertainment and recreation.

Source: Author's calculation based on WIOTs.

par with the international standard. However, the RCA indices of information and communication, education, human health and social work activities vary from around 0.2 to 0.5, which shows a weak comparative advantage. This is especially the case for the administrative and support service activities sector which appears to have the weakest comparative advantage. Hence one can see that the comparative advantage of Chinese service industry is still concentrated on the labour-intensive services, while the comparative disadvantage lies in capital and technology-intensive services.

Table 5 describes the different variances between gross value method and value added method. Since the gross value method is not the net value, the variance of most service sectors is larger than the variance calculated by value added method, such as construction, wholesale and retail trade, accommodation and food service activities, administrative and support service activities and entertainment and recreation.

As shown in Table 6, it can be seen that most of China's service sectors fall in the range of $RCA < 0.8$ except some sectors which have revealed comparative advantage, such as arts, entertainment and recreation, wholesale and retail trade, financial and insurance activities, which means that China's trade in service has a significant disadvantage globally; China still has a long journey to go to gain competitive advantage in the export of services (Dai, 2015).

Table 6 RCA Indices of China's Service Sectors Based on Value Added Method in 2014

Very strong competitive advantage ($RCA \geq 2.5$)	Strong competitive advantage ($1.25 \leq RCA < 2.5$)	Has a revealed competitive advantage ($1 \leq RCA < 1.25$)	Strong competitive advantage ($0.8 \leq RCA < 1$)	Very strong competitive disadvantage ($RCA < 0.8$)
None	c54	c28-c30, c41-c43	c31-c35, c36, c44	c27, c37-c40, c45-c49, c50, c52, c53

Note: c27 is construction, c28-c30 is wholesale and retail trade, c31-c35 is transportation and storage, c36 is accommodation and food service activities, c37-c40 is information and communication, c41-c43 is financial and insurance activities, c44 is real estate activities, professional, c45-c49 is scientific and technical activities, c50 is administrative and support service activities, c52 is education, c53 is human health and social work activities, arts, c54 is entertainment and recreation.

Source: Author's calculation based on WIOTs.

4. Comparing Data Estimates

Comparing RCA estimates based on the two data sets, the competitiveness of some sectors calculated by gross value overestimate the real competitiveness of some Chinese service sectors, such as construction, wholesale and retail trade. For most other sectors RCAs estimated using gross values underestimate their competitiveness. These sectors are transportation and storage, accommodation and food service, information and communication activities, financial and insurance activities, real estate activities, professional, scientific and technical activities, administrative and support service activities, education, human health and social work activities, arts, entertainment and recreation.

With RCA indices of sub-sectors less than 1 – construction, information and communication, scientific and technical activities, administrative and support service activities, education and human health and social work activities – regardless of the data used, the international competitiveness of these sub-sectors is still at a competitive disadvantage. However, this disadvantage has gradually reduced over time. The RCA indices of wholesale and retail trade, transportation and storage, accommodation and food services, financial and insurance activities, real estate activities remain at around 1, which means the comparative advantage of these sectors are on par with the international standard.

However, the RCA indices of information and communication technology, education, human health and social work activities vary from around 0.2 to 0.5, which show substantial comparative disadvantage. The administrative and support service activities sector appears to be the weakest. Hence, one can conclude that the comparative advantage of the Chinese service industry is still concentrated in labour-intensive activities, while its comparative disadvantage lies in capital and technology-intensive services, as also found by Cao (2016) and Chen and Zhang (2010). This paper draws on Zheng and Yang's (2015) method of dividing service industries mainly into labour-intensive, capital intensive, knowledge intensive and social. Labour-intensive includes construction, wholesale and retail trade, accommodation and food service activities. Capital intensive sectors are transportation and storage, information and communication technology, and real estate activities. Financial and insurance activities are knowledge intensive. Health, education and public services are social services.

From the above analysis, it can be seen that the sectors with low value added – information and communication technology, education, administrative and support service activities, human health and social work activities also have low RCAs, a double disadvantage.

5. Conclusion

RCA indices of Chinese service exports calculated using different definitions of exports (gross values and forward-linkage value-added) turn out to be less than 1 no matter which definition is used, suggesting that these exports suffer comparative disadvantage. However, estimates based on gross values of exports undervalue China's service exports' competitiveness. Further, these RCA indices have been increasing in recent years, suggesting that this comparative disadvantage is gradually diminishing, and should reach parity in the not too distant future.

Additionally, RCA indices based on forward-linkage value added for major service export sectors show that only the sectors wholesale and retail trade, financial and insurance activities, arts, entertainment, and recreation are less disadvantaged, but as indicated earlier their competitiveness is improving over time. The sectors that do relatively well belong to the more traditional service sectors, while others that require human capital depth, technology and capital suffer greater comparative disadvantage. Since ICT and other "knowledge-based" sectors not only have low RCAs but also low value added, this means China, in addition to efforts to strengthen RCA, also needs to move up the value chain in its production of these goods and services.

From a policy perspective, it could be argued that as China moves from labour intensive to higher value-added goods production and as its human capital base deepens, the comparative advantage of its service exports will likewise strengthen. However, rather than wait for this to materialize, policy measures to promote greater competitiveness for the wholesale and retail trade, transforming and upgrading the industry based on the new normal consumer demand and speeding up inter-industry integration can be attempted. For example, it could combine the wholesale and retail with high-tech industry, especially with the integration of the Internet industry. Integrative development can be achieved by gathering tourism industry with wholesale and retail, accommodation, entertainment and other services. However, specific policy prescriptions lie outside the scope of this paper.

Finally, future research should focus on the determinants of sectoral competitiveness so that the main drivers for China's services trade and the strengths and weaknesses of these drivers can be identified and policies developed to strengthen them.

Notes

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1. Koopman *et al.* (2010) took into account the international division of labour in their estimation of value added. They proposed a method to decompose a country's exports into domestic and foreign value added share based on a country's input-output (I/O) table.
2. The mathematics used in this method is not reported in this paper. Details are available in Wang, Wei and Zhu (2013) and Koopman, Wang and Wei (2014), and can be supplied on request.

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Appendix

Definitions for Variables

<i>Variable</i>	<i>Definition</i>
FVA	Foreign value-added
FDC	Foreign value-added pure double counting
VAX	Value-added export
RDV	Domestic value-added returns home
$vax_f_i^r$	Value-added exports of sector i from country r based on forward-linkage
$rdv_f_i^r$	Domestic value added of i sector of country r which is first exported but finally returned and absorbed at home based on forward-linkages
$\sum_i^n (vax_f_i^r + rdv_f_i^r)$	Sum of VAX and RDV for country i 's service industries export
$\sum_r^G (vax_f_i^r + rdv_f_i^r)$	Sum of VAX and RDV for service industry i 's export of the whole country
$\sum_r^G \sum_i^n (vax_f_i^r + rdv_f_i^r)$	Sum of VAX and RDV for whole service industries export for all countries in the world

