Development of Trade in Services and Its Impact on Economic Growth: Empirical Evidence from China

Han Liangqiu

Beijing Language and Culture University, Beijing, China

Abstract

The service sector has made significant contributions to the global economy and is the most dynamic component of international trade. Trade in services is becoming more significant in economic growth in an age dominated by the service sector. An assessment system is being built to analyse the development of China's trade in services based on sixteen trade in services indicators. The Gray Relation Analysis (GRA) is used to assess the relationship between the development of China's trade in services and economic growth. According to this analysis, China's trade in services has been growing steadily between 2003 and 2018. Furthermore, there is a strong correlation between the development of services trade and various indicators of economic growth. Among these, trade in services has the strongest connection with total investment in fixed assets, showing that the contribution to economic development is primarily realised through drawing investment from the whole society. Policymakers and governments are urged to foster the growth of services trade and realise its economic potential.

Keywords: trade in services, economic growth, entropy method, Gray Relation Analysis

1. Introduction

The World Trade Report (2019) released by the World Trade Organization (WTO) pointed out that the service industry has become the essential component of the global economy and the most dynamic component of international trade. In 2019, the total imports and exports of China's trade in services was 5,415.29 billion yuan, a year-on-year increase of 2.8%. Prioritizing the development of trade in services has become an important part of promoting the development of China's service industry and creating a new engine for economic growth.

Multiple perspectives on trade in services have been studied. As far as evaluation methods are concerned, the current research focuses primarily on a single dimension, such as

international competitiveness or sustainable development of trade in services. Using the DEA model, Chen (2016) evaluated the effectiveness of China's sustainable development of its trade in services. By calculating the trade competitiveness index and the revealed comparative advantage index, Fei (2018) found that China's trade in services has increased significantly; Bei (2019) analysed the international competitiveness of China's producer trade in services using the trade competitiveness index. He (2011) constructed a foreign trade quality evaluation index system and conducted a comprehensive analysis of the quality of China's foreign trade from 1990 to 2009; Zhu and Yan (2012) analysed the quality of China's foreign trade growth and its influencing factors by constructing foreign trade evaluation indicators and using empirical evidence.

Concerning the correlation analysis of trade in services and economic growth, Xing (2015) empirically analysed the relationship between China's trade in services export and economic growth based on China's trade in services export data from 1982 to 2012, using cointegration and error correction models, which found that short-term changes in trade in services exports have a positive impact on GDP; Cai and Li (2016) empirically analysed the impact of the technical complexity upgrade of trade in services exports on a country's economic growth through cross-country panel data, and found that the improvement of the technical complexity of trade in services exports has a significant role in promoting the economic growth of various countries; Wang and Zhao (2017) studied the structure of trade in services and its impact on economic growth using the cointegration and impulse response function analysis based on VAR model and found that the increase of the proportion of traditional trade in services export and the modern trade in services import can promote economic growth and has a long-term accumulation effect. The current research is mainly focused on the volume or the structure of trade in services, and there is little analysis of the correlation between the overall level of development of trade in services and economic growth. This article seeks to provide some insights into evaluating the development of China's trade in services and analyse the nexus that exists between trade in services and economic growth using Gray Relation Analysis. It is expected that the findings of this article will benefit policymakers when they are making a trade in services strategy.

2. Construction of a comprehensive evaluation system
2.1 Construction of the evaluation system

The comprehensive evaluation system of trade in services constructed in this paper is based on two dimensions: internal performance and external performance. Therefore, four core indicators are analysed: (1) internal growth of trade in services; (2) internal benefit of trade in services; (3) external competitiveness of trade in services; (4) external participation of trade in services.

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2.2 Selection of specific indicators

2.2.1. Internal growth

The evaluation of the internal growth of trade in services includes the volume, speed, and structure of the trade in services. China's total trade in services import (C_1), total trade in services export (C_2), trade in services import growth rate (C_3), and trade in services export growth rate (C_4) are selected to measure the internal growth.

Modern trade in services has the characteristics of high added value. The proportion of a country's modern trade in services in the overall trade in services can directly reflect the structure of trade in services. Therefore, the proportion of modern trade in services (C_4) is also involved. Referring to the classification of modern trade in services by Song and Wang (2014), combined with the trade in services statistical caliber of the BPM6, communication services, insurance services, financial services, computer and information services, patent royalties, and license fees are selected as the modern trade in services.

2.2.2. Internal benefits

Indicators which can indicate the internal benefits of trade in services are mainly selected from three aspects: internal economic contribution, industrial development, and employment creation. When considering the internal economic contribution of trade in services, the ratio of trade in services growth to GDP growth (C_6) is used to measure the contribution of trade in services to domestic economic growth.

Li and Cai (2016) believed that the import of producer services can promote the efficiency of independent innovation in the manufacturing industry. Zhao and Yang (2019) believed that trade in producer services can have an impact on manufacturing upgrades through technology spillovers and competition effects. Therefore, industrial development is measured by the share of producer service imports (C_7). Based on the Statistical Classification of Producer Services (2019) published by the National Bureau of Statistics and the statistical caliber on trade in services in the balance of payments BPM6, the construction industry, transportation industry, financial insurance industry, and business service industry are regarded as productive services sector.

There is a lack of clear classification standards and statistical data for the employment in the trade in services industry. Referring to the method of Zhu and Yan (2012), the trade in services industry is approximated by multiplying the total annual employment in China by the proportion of the total import and export of trade in services in GDP (C_8).

2.3.3. External competitiveness

Select the international share of service exports (C_9) and the trade in services competition index (C_{10}) as sub-indicators under the dimension of external competitiveness. The international share of service exports is calculated by the proportion of a country's trade in services exports to the world's trade in services exports. The calculation method of the trade in services competition index (TC index) is shown in Eq. 1, where X represents the

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export value of trade in services of a country, M represents the trade in services import value of a country. The value range of the TC index is [-1, 1]. When the value is close to 0, the competitive advantage is close to the average level; when the value is greater than 0, it means that the production efficiency of the industry is higher than the international level, and the closer it is to 1, the stronger the competitive advantage; on the contrary, if TC<0, it means that the country is a net importer, its production efficiency is lower than the international level, and it is at a competitive disadvantage. The TC index considers a country's own import and export trade status, and can reflect whether the country's industry has a competitive advantage over other countries in the world.

$$TC = \frac{X-M}{X+M} \tag{1}$$

2.2.4. External participation

External participation is analysed from two aspects: external economic contribution and trade in services openness. The contribution of trade in services to global economic growth (C_{11}) can be calculated from the ratio of China's trade in services growth to world GDP growth. The openness of trade in services (C_{12}) is based on the World Bank's definition of trade openness, with reference to Chen et al. (2017) calculated by the ratio of a country's trade in services exports and imports to its GDP, trade openness The degree can be expressed as Eq. 2:

$$openess = \frac{EX+IM}{Y} \tag{2}$$

2.3 Data sources

China's trade in services import value, trade in services export value, China 's GDP, and world trade in services export value are all from the World Bank's statistics. Transportation services, construction services, insurance and pension services, financial services, intellectual property rights in China's trade in services and other related data are all from China's balance of payments (BPM6) published by the State Administration of Foreign Exchange. The trade in services evaluation system is shown in Table 1.

Table 1: Trade in Services Evaluation System

	Core indicators	Indicators
Overall	Internal Growth (B_1)	Total imports of trade in services (C_1)

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Index (A_1)		Total exports of trade in services (C_2)
		Trade in services imports growth rate (C_3)
		Trade in services exports growth rate (C_4)
		Percentage share of modern trade in services (C_5)
	Internal Benefits (B_2)	Contribution of trade in services to domestic economic growth (C_6)
		Percentage share of producer services imports (C_7)
		Employment in trade in services (C_8)
	External Competitiveness (B_3)	International share of service exports (C_9)
		Trade in Services Competitiveness Index (C_{10})
	External Engagement (B_4)	Contribution of trade in services to global economic growth (C_{11})
		Trade in services openness(C_{12})

3. Comprehensive evaluation based on entropy method
3.1 Standardization of evaluation indicators
In order to transform the data to comparable scales, the range normalization method is used to perform dimensionless processing on the original data x_i, and the normalized evaluation value is obtained by Eq. 3

$$x_i' = \frac{x_i - minx_i}{maxx_i - minx_i} \tag{3}$$

3.2 Entropy method to determine weight
After the standardization of all the evaluation indicators, it is necessary to weight the 12 specific indexes. The weight processing usually includes subjective weighting method and objective weighting method. To avoid the limitation of the evaluator's experience and knowledge in the subjective weighting method, the entropy value method in the objective weighting method is used to determine the weight of each index. The entropy value method mainly determines the weight by the difference degree of the evaluation index. If the entropy value is small, it indicates that the amount of information contained in the index is larger, which can provide more effective information, and play a more important role in the comprehensive evaluation. The greater the effect, the greater the weight, and vice versa.

Assuming that there are *n* indicators, and each indicator has *m* values to be evaluated. Calculate the proportion of each indicator value p_i by using Eq. 4 and then the entropy value

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e_j is calculated by Eq. 5, and then calculate the difference coefficient of the index g_j through Eq. 6, and finally calculate its weight through Eq. 7 w_j. Based on the normalized evaluation values of the 12 indicators selected in this paper, the weights of each indicator calculated by the entropy method are shown in Table 2.

$$p_i = \frac{x_i'}{\sum_{i=1}^{m} x_i'}$$ (4)

$$e_j = -\frac{1}{\ln_m}\sum_{i=1}^{m} p_i * \ln p_i$$ (5)

$$g_j = 1 - e_j$$ (6)

$$w_j = \frac{g_j}{\sum_{j=1}^{n} g_j}$$ (7)

Table 2: Summary of the calculation results of the entropy method

index	Information entropy value e	Information utility value d	Weight coefficient w	ranking
C_1	0.8706	0.1294	12.96%	1
C_2	0.9215	0.0785	7.86%	8
C_3	0.8979	0.1021	10.23%	5
C_4	0.9533	0.0467	4.68%	9
C_5	0.9079	0.0921	9.23%	7
C_6	0.9662	0.0338	3.38%	12
C_7	0.8706	0.1294	12.96%	1
C_8	0.9589	0.0411	4.12%	11
C_9	0.8965	0.1035	10.37%	4
C_{10}	0.8963	0.1037	10.39%	3
C_{11}	0.9077	0.0923	9.25%	6
C_{12}	0.9543	0.0457	4.58%	10

Through the ranking of the weight coefficients in Table 2, we can see the contribution of each index to the comprehensive development of trade in services. It can be seen from Table 2 that the total import of trade in services (C_1), which indicates the internal growth capability of trade in services, and the share of producer service import (C_7), which represents the domestic benefit of trade in services, have the largest weight, which is 12.96%. The international share of service exports (C_9) and the trade in services competitiveness index (C_{10}), two indicators representing the international competitiveness of trade in services have a weight of 10.37% and 10.39% respectively. At the same time, the contribution of trade in services to global economic growth (C_{11}) and the trade proportion of modern trade in services (C_5) also play an important role in the comprehensive evaluation, with the weight of 9.25% and 9.23% respectively.

3.3 Calculation of Comprehensive Score

The weighted sum evaluation model is used to calculate the comprehensive score of China's trade in services from 2003 to 2018. The weighted sum scoring model is a common comprehensive evaluation method. The calculation of the weighted sum scoring model in this paper is Eq. 8. The scoring results are shown in Table 3. The comprehensive score range is [0, 1].

$$C = \sum_{i=1}^{12} x_i' w_i \quad \text{i} = 1,2,3 \ldots \ldots .12 \tag{8}$$

Table 3: Comprehensive Scores Results

years	score	years	score
2003	0.23	2010	0.40
2004	0.41	2011	0.66
2005	0.33	2012	0.49
2006	0.40	2013	0.49
2007	0.48	2014	0.55
2008	0.48	2015	0.39
2009	0.36	2016	0.36
2010	0.40	2017	0.39
2011	0.66	2018	0.44

3.4 Comprehensive evaluation

The development of China's trade in services is shown in Figure 2, showing a certain volatility, but the overall trend is rising, and in 2011 it reached the maximum value of 0.66. The comprehensive score of the development of trade in services in 2018 increased by about 90% compared with 2003. Although the development of trade in services in China has fluctuated, it is generally being optimized and improved.

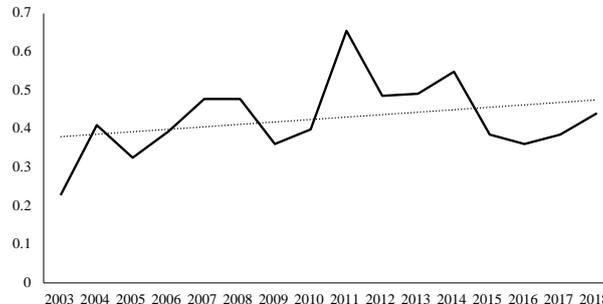*Figure 1: Comprehensive scores of trade in services from 2003 to 2018*

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4. The correlation between trade in services and economic growth

4.1 Research methods

Grey relational theory was proposed by Deng (1982) and is widely used in the practice of social sciences. Compared with analysis methods such as multiple regression, grey relational analysis avoids the difference in dimension and order of magnitude and has better model ductility. At the same time, grey relational analysis is suitable for dynamic analysis among various factors in complex environment and comparison of time series. When studying the relationship between the development of trade in services and economic growth, many influencing factors are not necessarily linear, and each factor affects each other, showing the characteristics of a "gray" relationship. Therefore, the gray correlation analysis method can be used to explore the relationship between the development of trade in services and economic growth.

4.2 Selection of indicators and data sources

Referring to Tian and Zhou (2019) and Feng (2015), this study selected GDP (y_1), added value of primary production (y_2), added value of secondary production (y_3), added value of tertiary production (y_4), fiscal revenue (y_5), retail sales of consumer goods (y_6), and fixed asset investment (y_7) as indicators to measure economic growth, theses data are all from China Statistical Yearbook. Use the comprehensive score (C) and the 12 specific indicators ($C_1 \sim C_{12}$) in the trade in services evaluation system as the indicators to measure the development of China's trade in services calculated in previous section.

4.3 Grey correlation analysis

Define the relevant indicators of economic growth as the reference series $y_j = (y_j(1), y_j(2),…, y_j(n))$, and define the relevant indicators of the development of trade in services as the comparison series $x_i = (x_i(1), x_i(2),…, x_i(n))$. Standardize the data according to Eq. (3). and the standardized sequence can be expressed as x_i' and y_j', the correlation coefficient

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can be calculated by Eq. 9, and the grey relational degree $r(y_j, x_i)$ can be calculated from Eq. 10. In Eq. 9 and 10 i=1, 2.3...12, j=1,2,3...7, k=1,2, 3... 19, n=19, ρ is the identification coefficient, generally assume $\rho = 0.5$.

$$r(y_j'(k), x_i'(k)) =$$
$$[\min_j \min_i |y_j'(k) - x_i'(k)| + \max_j \max_i |y_j'(k) - x_i'(k)|]/|y_j'(k) - x_i'(k)| + \rho \max_j \max_i |y_j'(k) - x_i'(k)| \quad (9)$$
$$r(y_j, x_i) = \frac{1}{n}\sum_{k=1}^{n} r(y_j'(k), x_i'(k)) \quad (10)$$

4.4 Analysis of the results

Table 4 shows the results of the grey correlation degree between different indicators of trade in services and economic growth. If $0 < r \leq 0.35$, the correlation strength is weak correlation. If $0.35 < r \leq 0.65$, the correlation strength is moderate correlation; If $0.65 < r \leq 1$, the correlation strength is strong correlation. From the grey correlation data in Table 4, there is a good correlation between trade in services and economic growth-related indicators.

Table 4: Grey correlation between trade in services and economic growth

	C	C_1	C_2	C_3	C_4	C_5	C_6	C_7	C_8	C_9	C_{10}	C_{11}	C_{12}
y_1	0.70	0.96	0.74	0.63	0.59	0.65	0.54	0.64	0.61	0.71	0.52	0.77	0.59
y_2	0.66	0.85	0.82	0.62	0.55	0.61	0.60	0.60	0.55	0.78	0.49	0.75	0.53
y_3	0.69	0.89	0.79	0.63	0.58	0.63	0.57	0.62	0.59	0.74	0.51	0.78	0.57
y_4	0.70	0.92	0.71	0.64	0.61	0.65	0.51	0.66	0.61	0.68	0.51	0.75	0.61
y_5	0.67	0.92	0.76	0.61	0.56	0.62	0.56	0.61	0.58	0.73	0.51	0.76	0.56
y_6	0.68	0.95	0.71	0.61	0.58	0.64	0.52	0.63	0.59	0.69	0.51	0.75	0.58
y_7	0.75	0.82	0.73	0.66	0.64	0.67	0.55	0.65	0.66	0.70	0.52	0.82	0.63

According to the correlation data, the correlation strength between the comprehensive evaluation index of trade in services and the seven economic growth indicators is strongly correlated (r> 0.65). (y_7) has the highest correlation with the comprehensive development level of trade in services at 0.75. It can be seen that the high-level development of China's trade in services has a good role in promoting investment in fixed assets (such as investment in infrastructure construction related to trade in services, tourism facilities and transportation roads). It can attract the whole society to invest in fixed assets. The correlation results of trade in services and the different sector show that the added value of the tertiary industry (y_4) > the added value of the secondary industry (y_3) > the added value of the primary industry (y_2). The improvement and development of trade in services level has the most obvious effect on the growth of the tertiary industry. At the same time, the development of trade in services has a good correlation with GDP (y_1), fiscal revenue (y_5) and retail sales of consumer goods (y_6).

To make it a step further, the total import of trade in services (C_1), the total export of trade in services (C_2), the percentage share of modern trade in services (C5), the international share of service export (C_9) and the trade in service contribution to global economic growth (C_{11}) has a good correlation with each indicator of economic growth, the correlation is basically greater than 0.65, and the correlation strength is strong.

5. Conclusions and recommendations

From 2003 to 2018, China's trade in services had an overall increasing development trend, indicating that China's trade in services has been continuously improving. However, it should be noted that while China's trade in services had its highest comprehensive score of 0.66 in 2011, the average trade in services score over the previous 16 years was only 0.44. The overall level of development remains quite low. Policymakers and governments should focus on promoting the growth and structure of services trade, as well as maximising its domestic economic benefits. Furthermore, it is critical to improve the competitiveness of service trade and to seek a more active role in global trade.

According to the correlation analysis results, there is a good correlation between the level of development of trade in services and economic growth, and the two are strongly correlated. The growth of services trade has a positive impact on GDP, industrial added value, fiscal revenue, retail sales of consumer goods, and fixed asset investment. Total investment in fixed assets has the strongest correlation with the development of services trade. The economic impact is realised by attracting more investment in fixed assets, such as tourism facilities and transportation roads, in order to realise the economic potential of trade in services. The government should create a welcoming environment for the development of service trade, define their trade strategy, remove trade barriers, and provide more support for investment in fixed assets related to the service industry.

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