Advances in Social Science, Education and Humanities Research, volume 205
The 2nd International Conference on Culture, Education and Economic Development of Modern Society (ICCESE 2018)

Nonlinear Correlation Mechanism of Service Outsourcing Industry and Economic Growth

A Comparison between China and India

Dan Liu
School of Management
Jilin University
Changchun, China

Chun Wang
School of Management
Jilin University
Changchun, China

Xiaoyu Zhang
Business School
Jilin University
Changchun, China

Yongmin Wu
School of Management
Jilin University
Changchun, China

***Abstract*—The research on the function mechanism of service outsourcing industry to economic growth helps to locate the service outsourcing industry accurately during the economic transition from manufacturing to service. In order to obtain the experience path of advanced country's service outsourcing industry, this paper chooses India, which is the largest supplier of global service outsourcing, as the comparative analysis object. Based on the statistical data of service outsourcing in China and India from 2005 to 2016, a double logarithmic model is constructed to test the elastic effect of service outsourcing industry on economic growth. The results show that the growth elasticity of service outsourcing industry to GDP both in China and India is relatively large, and the two countries are very close, China is even slightly higher than that of India. While the ratio of service outsourcing value to GDP in China is considerably lower than that of India. But it also means that China's service outsourcing industry has a greater potential advantage and would have a good prospect for further development.**

Keywords—nonlinear correlation mechanism; service outsourcing industry; economic growth; double logarithmic model; cointegration test

I. INTRODUCTION

In today's world, a new round of science and technology revolution and industry revolution is just unfolding, the pattern of international division of labor is experiencing profound changes, and the global production factors flow more freely. With the rapid development of information technology revolution and Internet, the service outsourcing industry is facing new development opportunities, which has an unprecedented significance for the market to configure the global resources.

With the deepening of economic globalization, the opening and development of service industry has become the focus in the international economic cooperation and competition. Service trade and service outsourcing have been widely recognized. Especially, under the promotion of new round of science and technology revolution and industry revolution, service specialization and service outsourcing have risen rapidly, service innovation and value creation ability have strengthen unceasingly, service trade and service outsourcing have a vast potential and broad prospect.

Under this background, in order to save costs and improve industrial competitiveness, the developed countries would outsource their non-core businesses to the countries or companies with comparative advantages. Those companies that undertake service outsourcing usually have more efficient professional skills and lower labor costs than developed countries. The service outsourcing business will be further developed along with globalization, information and the change of trade structure.

China and India are both great powers to undertake service outsourcing. India has made great success in undertaking service outsourcing. In 2016, the IT-BPM industry in India had occupied 56% of market share, and the market scale was 143 billion US dollars, which accounted for over 9.3% of its GDP [1]. India is the largest country that offering service outsourcing in the world. Therefore, this paper selects India as the sample country for transnational comparative analysis. In this paper, we construct a double logarithmic model that contains service outsourcing production and GDP to investigate the nonlinear correlation mechanism of service outsourcing industry and economic growth, and further to examine the elastic effect of service outsourcing industry on economic growth, meanwhile to study the international impact differences based on the data from China and India.

II. PRESENT SITUATION OF SERVICE OUTSOURCING INDUSTRY IN CHINA

The service outsourcing industry has become a new engine for China's economic innovation and growth. From 2006 to

2016, the service outsourcing industry in China was formed rapidly and the scale of industry expanded rapidly.

A. Value of Service Outsourcing Contract

From 2006 to 2016, the value of service outsourcing contract execution has increased from 1.38 billion US dollars to 106.46 billion US dollars in "Fig. 1".

Fig. 1. Contract value and execution value of service outsourcing in China (Unit: A hundred million).

[a] Data source: Ministry of Commerce of China

In 2016, the contract value of offshore service outsourcing was 95.26 billion US dollars, the execution value was 70.41 billion US dollars, increased 9.14% and 8.94% respectively over last year; the contract value of onshore service outsourcing was 51.97 billion US dollars, the execution value was 36.05 billion US dollars, increased 19.07% and 12.46% respectively over last year in "Fig. 2". The growth rate of service outsourcing exceeded the growth rate of national foreign trade in the same period, and service outsourcing industry has become one of the highlights in foreign trade and service trade.

Fig. 2. Value of offshore and onshore service outsourcing contract execution.

[b] (Unit: A hundred million).

[c] Data source: Ministry of Commerce of China

B. Service Outsourcing Enterprises

The service outsourcing industry in China has formed a nearly excellent industrial ecology. More than 130 cities in China have been committed to develop the service outsourcing industry. The total number of enterprises engaged in service outsourcing increased from about 500 in 2006 to 39,277 in 2016 in "Fig. 3". Only one year in 2016, 5,506 new service outsourcing enterprises were established.

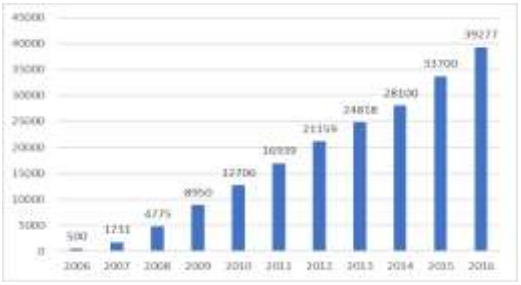

Fig. 3. The number of enterprises engaged in service outsourcing.

[d] Data source: Ministry of Commerce of China

C. Service Outsourcing Employees

In 2006, the number of employees engaged in service outsourcing was less than 60 thousand, while in 2016, the number surged to 8,560 thousand, the growth is nearly 150 times in "Fig. 4". Among them, the number of employees that have University degree (including college) or more is 5,510 thousand, accounting for 64.4% of the total number of employees [2].

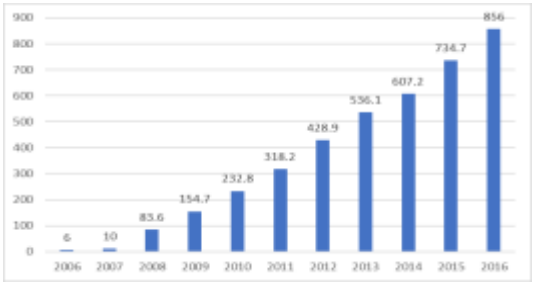

Fig. 4. The number of employees engaged in service outsourcing.

[e] (Unit: Ten thousand)

[f] Data source: Ministry of Commerce of China

D. International Competitiveness of Service Outsourcing Industry

The international competitiveness of service outsourcing industry in China is also improving, and the comprehensive strength has become the top of the world. In 2016, the contract execution value of offshore service outsourcing has reached 70.41 billion US dollars, and the share of offshore outsourcing market has risen to 33%, ranking the second in the world in "Fig. 5".

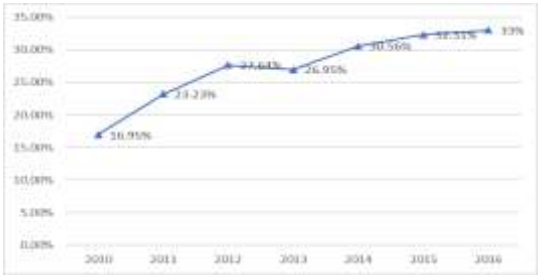

Fig. 5. Share of offshore outsourcing market.

[g] Data source: Ministry of Commerce of China

E. Business Structure of Service Outsourcing

The technological support of service outsourcing has shifted from traditional Internet and information technology to the new generation of information technology centered on "cloud computing, big data, mobile Internet and Internet of Things". The service patterns based on "cloud" are widely recognized, and cloud delivery is also widely used by traditional service outsourcing enterprises. SaaS (software as service) and On-demand Payment have become the mainstream delivery and pricing model. In 2016, the service outsourcing enterprises appeared to accelerate the development and application of artificial intelligence, block chain and other technologies.

From the aspect of specific business structure, in 2006, the service provided by China's service outsourcing enterprises was mainly focused on IT outsourcing (ITO), which occupied up to 68%, the ratio of business process outsourcing (BPO) was 32%, and knowledge process outsourcing (KPO) was almost zero. By 2016, the contract execution value of ITO, BPO and KPO in China was 56.35, 17.30 and 33.56 billion US dollars respectively. The proportion of contract execution value was adjusted from 49:14.2:36.8 in 2015 to 53:16:31 in 2016 [3] in "Fig. 1". It shows the trend that the service outsourcing industry is marching up the value chain is obvious.

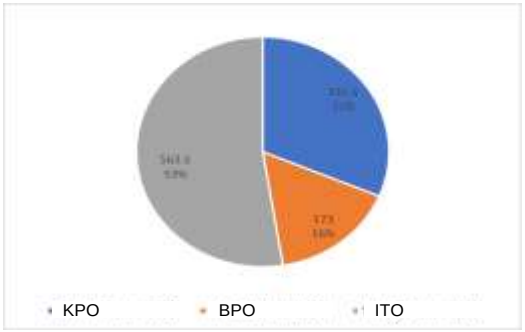

Fig. 6. The value and proportion of contract execution value in 2016.

[h] (Unit: A hundred million).

[i] Data source: Ministry of Commerce of China

III. VARIABLES SELECTION AND DATA PROCESSING

In this paper, we use the index of GDP to measure the economic growth, and use the index of service outsourcing output value to measure the development of service outsourcing industry. The basic data from 2005 to 2016 are from the World Bank website. In order to investigate the elastic effect of service outsourcing industry on economic growth, a double logarithmic model is built, so the data we used are logarithmically processed. The logarithmic series of GDP and logarithmic series of service outsourcing output value in China and India are showed in in "Fig. 7", "Fig. 8", "Fig. 9", and "Fig. 10". Because the data available are only from 2005 to 2016, in order to ensure that the model contains enough samples, the logarithmic difference is performed on the series of service outsourcing output value.

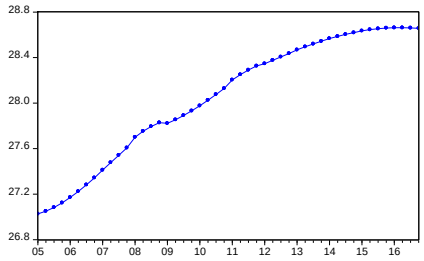

Fig. 7. Logarithmic series of GDP in China.

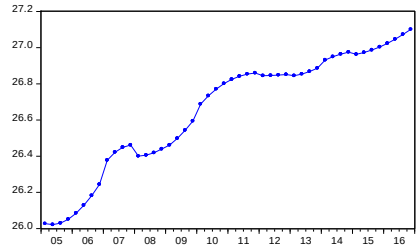

Fig. 8. Logarithmic series of GDP in India

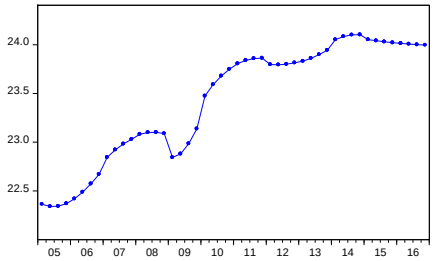

Fig. 9. Logarithmic series of servicing outsourcing industry in China.

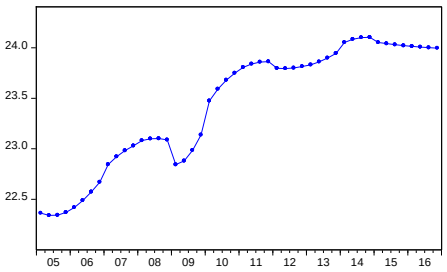

Fig. 10. Logarithmic series of servicing outsourcing industry in India.

As the most populous developing countries, GDP either in China or India has been showing an exponential growth in recent years, and the growth rates of GDP also have been maintained at medium and high speed growth. See form "Fig. 9" and "Fig. 10", the logarithmic series of valued-added of service outsourcing in China and India have a very similar wave pattern, which can also be seen clearly from the level series of value-added of service outsourcing both in China and India as showed in "Fig. 11".

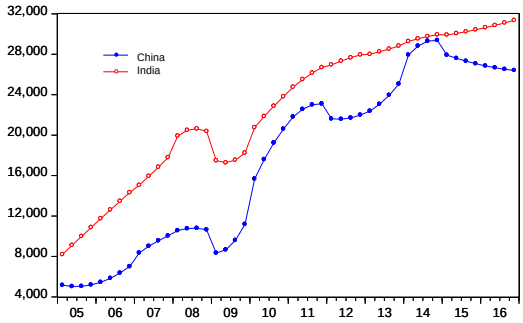

Fig. 11. Value-added of service outsourcing (Unit: million US dollar).

IV. CONSTRUCTION OF DOUBLE LOGARITHMIC MODEL AND COINTEGRATION TEST

In this part, a double logarithmic model that contains service outsourcing production and GDP is constructed to investigate the nonlinear correlation mechanism of service outsourcing industry and economic growth, and further to examine the elastic effect of service outsourcing industry on economic growth.

A. Construction of the Double Logarithmic Model

In order to investigate the elastic effect of service outsourcing industry on economic growth, a double logarithmic model [4] is constructed as follows:

$$\ln Y_{jt} = \alpha_j + \beta_j \ln X_{jt} + \varepsilon_{jt} \quad (1)$$

Among them, $\ln Y_{jt}$ represents the logarithm of GDP of country j ($j = c$ represents China, $j = i$ represents India) in the period of t; $\ln X_{jt}$ represents the logarithm of value-added of service outsourcing industry of country j ($j = c$ represents China, $j = i$ represents India) in the period of t; regression coefficient β_j represents the elastic coefficient of value-added of service outsourcing industry of country j ($j = c$ represents China, $j = i$ represents India) to GDP of country j ($j = c$ represents China, $j = i$ represents India); ε_{jt} is an independent and identically distributed random error.

B. Stability Test of Data

To avoid the pseudo regression problem that may be caused by modeling using the non-stationary time series, before estimating the above double logarithm model, an unit root test is held separately to the logarithmic series of GDP and the logarithmic series of valued-added of service outsourcing industry both in China and India. The test results are showed in "Table I".

TABLE I. UNIT ROOT TEST RESULTS

ADF test				
Variable	***Test Statistic***	***1% Critical Value***	***5% Critical Value***	***10% Critical Value***
lnYc	2.5573	-4.2119	-3.5298	-3.1964
lnYi	-1.4875	-4.2191	-3.5331	-3.1983
lnXC	-1.9913	-4.1706	-3.5107	-3.1855
lnXi	-2.1529	-4.1923	-3.5208	-3.1913
PP test				
Variable	***Test Statistic***	***1% Critical Value***	***5% Critical Value***	***10% Critical Value***
$\ln Y_c$	1.1429	-4.1658	-3.5085	-3.1842
$\ln Y_i$	-1.6047	-4.1658	-3.5085	-3.1842
$\ln X_C$	-1.3253	-4.1658	-3.5085	-3.1842
$\ln X_i$	-2.7120	-4.1658	-3.5085	-3.1842
KPSS test				
Variable	***Test Statistic***	***1% Critical Value***	***5% Critical Value***	***10% Critical Value***
$\ln Y_c$	0.2245***	0.2160	0.1460	0.1190
$\ln Y_i$	0.1929**	0.2160	0.1460	0.1190
$\ln X_C$	0.1738**	0.2160	0.1460	0.1190
$\ln X_i$	0.1931**	0.2160	0.1460	0.1190

[j.] Note : $\ln Y_c$、$\ln Y_i$、$\ln X_C$ and $\ln X_i$ represents respectively the logarithm of GDP in China and India, the logarithm of valued-added of service outsourcing industry in China and India. *, **, ***denotes rejection of the hypothesis at the 1%, 5% and 10% significant level respectively

From the unit root test results, we can find out whether it is ADF test or PP test, the corresponding test statistic of the logarithm of GDP and the logarithm of valued-added of service outsourcing industry in China and India couldn't reject the hypothesis at the 10% significant level, which shows that the test series all contain unit roots and are nonstationary time series.

In order to investigate the robustness of the above test results, we also use the KPSS test method to test the stability of the four series. Unlike ADF test and PP test, the null hypothesis of KPSS test is that the test series does not contain unit root, that is, the test series is stationary time series. From the KPSS test results, the KPSS test statistics of four series reject the hypothesis of stationary series at the 10% significant level. Among them, the logarithm of GDP in India, the logarithm of valued-added of service outsourcing industry in China and India reject the hypothesis at the 5% significant level. The results show that the KPSS test is in agreement with ADF test and PP test. The above four series all contain unit roots and are nonstationary time series.

C. Cointegration Test

Cointegration test mainly includes two kinds of methods: Engle-Granger two-step method (E-G two-step method) and Johansen cointegration test, which is a unit root test based on vector autoregressive (VAR) model.

1) E-G Two-step method

- The first step: estimate the regression equation that includes the logarithm of GDP and the logarithm of valued-added of service outsourcing industry using ordinary least square (OLS).

Considering the elastic effect of service outsourcing industry on economic growth, we use OLS to estimate the equation (1), the results are as follows:

$$\ln \hat{Y}_c = 7.4975 + 0.8772 \ln X_c \quad (2)$$
$$(0.6505)\ (0.0278)$$

$$\ln \hat{Y}_i = 6.1244 + 0.8632 \ln X_i \quad (3)$$
$$(0.7627)\ (0.0321)$$

The number in the parentheses is the standard deviation of corresponding parameter estimator. From the above estimation results, we can see that the regression coefficients of equation (2) and (3) are both highly significant, and the corresponding significant probability, that is, the P value is less than 0.01.

- The second step: Calculate the residual column vectors using the estimated results of equation (2) and (3).

If the residual column vectors are stationary time series, which means there is a cointegration relationship between logarithmic series of GDP and the logarithmic series of value-added of service outsourcing industry, that is, there is a stable long-term equilibrium relationship between them.

We calculate two columns of residual series based on equation (2) and equation (3), after ADF test, the test results show that the ADF test statistics for residual series of two equations are -3.2694 and -2.5621 respectively, the corresponding significant probabilities are 0.0016 and 0.0118, the null hypothesis that contains the unit root can be rejected at the 5% significant level. The results show that the residual series of two equations are stationary, so the logarithmic series of GDP and the logarithmic series of service outsourcing output value both in China and India does exist a long-term equilibrium relationship.

2) Johansen cointegration test: Johansen cointegration test is a system cointegration test based on vector autoregressive (VAR) model, the maximum eigenvalue test and trace test can be constructed respectively [5]. Based on the logarithm of GDP and the logarithm of value-added of service outsourcing in China and India, the results of Johansen cointegration test are shown in "Table II".

TABLE II. JOHANSEN COINTEGRATION TEST RESULTS

China	**Trace Test**			**Maximum Eigenvalue Test**		
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Prob.	Eigenvalue	Trace Statistic	Prob.
None	0.3649	29.8717	0.0017	0.3649	20.8844	0.0075
At most 1	0.1775	8.9873	0.0540	0.1775	8.9873	0.0540
India	**Trace Test**			**Maximum Eigenvalue Test**		
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Prob.	Eigenvalue	Trace Statistic	Prob.
None	0.3670	28.1082	0.0034	0.3670	21.0339	0.0071
At most 1	0.1425	7.0743	0.1225	0.1425	7.0743	0.1225

From the results of Johansen cointegration test, it can be seen whether the trace test or the maximum Eigenvalue test, the results all reject the hypothesis of none at the 1% significant level. While at the 5% significant level, the results can reject the hypothesis of at most 1, the system that constructed by the logarithm of GDP and the logarithm of value-added of service outsourcing in China (India) just contains one cointegration equation, which means that there is a long-term equilibrium relationship between them, the results are the same as that obtained by the E-G two-step method.

Based on the results of Johansen cointegration test, we calculate the corresponding cointegration equations, shown as follows:

$$\ln \hat{Y}_c = 10.7443 + 0.7471 \ln X_c \quad (4)$$
$$(0.8144)\ (0.0340)$$
$$\ln \hat{Y}_i = 0.2100 + 1.1251 \ln X_i \quad (5)$$
$$(1.5660)\ (0.0654)$$

From equation (4) and equation (5), we can see that there is no significant difference between these two cointegration equations that obtained by Johansen cointegration test and E-G two-step method. It shows that the economic growth of China and India and the development of service outsourcing industry have a long-term and stable equilibrium relationship.

At the same time, from equation (2) and equation (3), we can find out that the growth elasticity of service outsourcing industry to GDP in China and India are both relatively large and the two countries are very close, China is even slightly higher than India. The growth elasticity of service outsourcing industry to GDP in China is 0.8772, that is, the service outsourcing industry in China increases by 1%, the GDP will increase by 0.8872%. The growth elasticity of service outsourcing industry to GDP in India is 0.8632, that is, the service outsourcing industry in India increases by 1%, the GDP will increase by 0.8632%.

V. CONCLUSION

From the present situation of China's service outsourcing industry, although the service outsourcing industry in China has developed rapidly in recent years, its output value, scale and market share are all lower than those of India. Therefore, the service outsourcing industry in China has great potential and space for further development. As we all know, the economic development of India has also entered the fast lane in recent years, and the growth rate of GDP has exceeded China. The rapid growth of economy is inextricably linked to the rapid growth of India's service industry. Taking 2016 as an example, the export of service outsourcing industry (IT-BMP) in India accounted for up to 45% of the export of service industry, and its output value accounted for 5.48% of the whole GDP [6]. It can be seen that the service industry, which takes the service outsourcing industry as the leading development, plays an important role in India's economy.

In comparison, although the service outsourcing industry in China has developed rapidly in recent years, the proportion of its output value to GDP is still low. In 2016, the proportion of output value of service outsourcing industry in China accounted for only 0.95% of GDP, which was considerably lower than that in India of 5.48%. From the conclusion of empirical analysis, the growth elasticity of service outsourcing industry to GDP in China is up to 0.8772. This means that if the service outsourcing output value in China increased by 12.40 billion US dollars in 2017 (Suppose the annual growth rate is 10%), it would drive the growth rate of GDP to increase by 89.50 billion US dollars. It is obvious that the development of service outsourcing industry has great significance to promote economic growth and cultivate economic growth point in China.

REFERENCES

[1] Savita Kumari Sheoran, "Make in India campaign and India's IT-BPM sector," International Journal of Applied Research, vol. 3(1), pp. 471-475, 2017.

[2] Development of service outsourcing industry in China, Ministry of Commerce of China, 2016.

[3] Review of China's service outsourcing development in 2016 and seventh development trend in 2017, Service outsourcing research center, Ministry of Commerce of China, 2016.

[4] A Harmina, K Dumičić, B ŽmukI.S, "Linear versus double logarithmic cross-country regression: The influence of entrepreneurial activity and competitiveness on real gross domestic product per capita," Isccro-international Statistical Conference in Croatia, 2016.

[5] AR Chowdhury, "Futures market efficiency: Evidence from cointegration tests," Journal of Futures Markets, vol. 11 (5), pp. 577-589, 2010.

[6] Dileep Baragade, "A perspective study of Make in India in IT and BPM Sector," Working paper, 2016.