

2014

# BioTechnology

*An Indian Journal*

FULL PAPER

BTAIJ, 10(9), 2014 [3642-3650]

## Relationship between service trade and economic growth empirical research in Shanghai

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### ABSTRACT

This article uses the quantitative analysis method, studying the relation between economic growth and trade in services in Shanghai. First calculate contribution and pull degree index of the Yangtze river delta economic zone three major provinces and cities to quantitative analysis of the role of service trade on economic growth, found that service trade plays an important role in promoting economic growth. Then using the econometric model empirical study on relationship between service trade and economic growth, found that Shanghai's trade in services have two-way granger causality between GDP growth, and long-term equilibrium and short-term deviation to long-term equilibrium regression trend, namely the virtuous circle between service trade and economic growth mutually promote mechanism.

### KEYWORDS

Trade in services and economic growth; Contribution; Pulling rate; Granger test; Error correction model.



## REVIEW THE SERVICE TRADE AND ECONOMIC GROWTH THEORY

### First, the concepts of service trade and economic growth

Service trade refers to a country's legal person or natural person provides services in domestic or overseas. According to the general agreement on trade in services which signed in 1994 in WTO, service trade supplied with four ways: cross-border delivery, consumption abroad, commercial presence and presence of natural person. Since the 1990s, the service trade is booming at an unprecedented speed. From the international point of view, according to the WTO global trade in services exports from the year of 1980 to 2012, has risen from 767.5 billion to expand to 8403.2 billion, 33 years growth of 11 times, average annual growth rate of 7.5%. Domestically, China's total trade in services becomes the third largest in the world in 2012, and still in the stage of strong growth.

Economic growth is depicted as on a longer time span, a country's GDP continue to increase. Foreign trade is the important factor that affects economic growth, especially export-oriented countries. So studying the relation between economic growth and China's trade is important. Cao liang, Sheng yue, Jianzhong-Huang (2012)<sup>[1]</sup> collected nearly 22 years authority literature, statistics show that international trade course studying the relation between economic growth and trade of literature is very rich. The vast majority of empirical research results show that the trade and economic growth was significantly positive correlation, a positive role in promoting trade on economic growth. The existing literature mainly concentrated in terms of trade in goods, ignored the world economy is booming the study of the relationship between service trade and economic growth.

Baojun-Tang, Jijun-Yang, Zhihe-Chen (2011)<sup>[2]</sup> think that global economic growth is closely related to the service trade, and the future further research object will be China. Given China's unbalanced economic development between regions, from the perspective of regional geographical relations become the key research services trade and economic growth.

### Second, the literature review

Domestic and foreign scholars' study of relationship between service trade and economic growth is mainly focused on the quantitative research. Most of the use of measurement methods to analyze early scholars, including contribution, pull degree, elasticity coefficient index describe relationship between trade and economic growth. In recent years, some researchers began using econometric model method to study relations between the two. Francois, etc. (1999)<sup>[3]</sup> empirical studies show that trade in services for the promotion of economic growth has a strong effect. Felix Eschenbach and Bernard Hoekman (2006)<sup>[4]</sup> empirical one of trade in services and economic growth, dynamic strength is closely related to the service policy. Domestic scholars mainly from the two kinds of empirical methods: one is to use the ordinary least squares regression analysis of the two related degree. Xu fang-Wei, zhi guo-zheng (2004)<sup>[5]</sup> from the national level of China's service trade and economic growth of the relationship between the quantitative research has shown that China's imports and exports is positively correlated with GDP, and the promoting effect on economic growth of service import is greater than service exports. The second is using cointegration analysis, error correction model and Granger causality test to analyze the causal relationship between them. Ridong-Hu and Zhifang-Su (2005)<sup>[6]</sup> believe that China's service trade import and export exist the cointegration relationship between GDP. In the long run, service export to promote GDP growth and the service import has inhibitory effect on GDP growth. Aimin pan (2006)<sup>[7]</sup> use national data to empirical study; show that service trade import, export and economic growth exist stable equilibrium relationship. Import and export service trade has positive effect on GDP, but the service trade import role than trade in services exports to GDP, service import and export is the Granger cause of China's GDP growth, GDP is not Granger causes of service import and export. Qi-quan xiong, Yan-guan zhang (2008)<sup>[8]</sup> empirical get Chinese service trade contribution to the economic growth share an average of 18.90% from 1983 to 2006, the service trade export's contribution to China's economic growth is greater than the contribution of imports.

Above all, the past study basic from national level, the relationship between service trade and economic growth has yet to dig deeper. Considering unbalanced regional economic development, the relationship has a huge difference in different regions. On the basis of predecessors' research results, this paper focused on the relationship between the local economic growth and service trade in Shanghai.

## QUANTITATIVE ANALYSIS OF THE RELATIONSHIP BETWEEN SHANGHAI'S SERVICE TRADE AND ITS ECONOMIC GROWTH

### First, contribution and pull

We commonly used contribution and pull indicators to measure relationship between trade and economic growth. Service trade to the economic contribution (remember GXD) refers to the ratio of service trade volume increment and economic increment. Service trade on the economy (LDD) refers to the service trade on economic growth and contribution to the GDP growth rate of the product, on behalf of the service trade's pulling strength of the economy.

The specific calculation formula is as follows:

$GXD = \text{service trade increment} / \text{GDP increment}$ ;

$LDD = (\text{service trade increment} / \text{GDP increment}) \times \text{GDP growth rate} = GXD \times \text{GDP growth rate}$

This excerpt Shanghai, Zhejiang, Jiangsu as comparative objects which belong to Yangtze river delta region. The following quantitative analysis data for year 2000-2012, including Shanghai, zhejiang, jiangsu. Indicators are GDP, GDP increment, GDP growth rate, service trade and service trade increment. The statistics datas respectively from statistical yearbook and service trade development report.

**TABLE 1 : The contribution and pull of service trade on economic growth**

indicators	GXD			LDD		
	year	Shanghai	Zhejiang	Jiangsu	Shanghai	Zhejiang
2000	0.2148	0.0142	0.0345	0.0392	0.0021	0.0038
2001	0.2995	0.0201	0.0299	0.0276	0.0025	0.0032
2002	0.3103	0.0379	0.0396	0.0316	0.0061	0.0048
2003	0.3959	0.0462	0.0104	0.0657	0.0098	0.0018
2004	0.5061	0.0846	0.0272	0.1042	0.0170	0.0056
2005	0.5051	0.0726	0.0317	0.0735	0.0110	0.0076
2006	0.4004	0.0381	0.0286	0.0573	0.0065	0.0048
2007	0.5100	0.0772	0.0221	0.0927	0.0149	0.0044
2008	0.6211	0.0830	0.0345	0.0783	0.0120	0.0066
2009	-0.004	0.0138	0.0703	-0.0003	0.0010	0.0079
2010	0.9628	0.0642	0.0721	0.1356	0.0132	0.0146
2011	0.5477	0.0338	-0.0153	0.0648	0.0056	-0.0029
2012	1.4013	0.0763	0.0105	0.0661	0.0054	0.0011
average	0.5132	0.0509	0.0305	0.0643	0.0082	0.0049

**Data sources: according to the calendar year in Shanghai, zhejiang, jiangsu statistical yearbook and service trade development reports.**

TABLE 1 is the calculated values of GXD and LDD in Shanghai, zhejiang, jiangsu from 2000 to 2012. Look from the population mean, the calculated values are positive, that trade in services has the contribution and pull effect on economic growth. From the time process, from 2000 to 2012, in addition to the influence of the financial crisis led to service trade drop too much and coefficient is negative in

2009, the rest of calculated values are positive. Shanghai service trade contribution to economic growth and stimulating degree is obviously higher than that of zhejiang and jiangsu. Shanghai's average of GXD is 0.5132, significantly higher than the 0.0509 and 0.0305 of jiangsu, zhejiang. Shanghai pull the degree of mean value is 0.0643, significantly higher than that of zhejiang and jiangsu.

In order to further analysis the relationship between shanghai's service trade and economic growth, the following use more sophisticated statistical caliber to empirical analysis the relationship between service trade and economic growth in Shanghai. Analysis objects including total trade in services, service trade exports, service trade imports and the GDP data in Shanghai.

## Second, measurement model empirical analysis

### The empirical data

We used the measurement software Stata12 to empirical analyze, due to data availability, we only collected Shanghai service trade figures from 2000 to 2012. Although we got only 13 years data, we also can reflect the important characteristics trends of the time series. In addition from the 21st century, especially after joining the WTO in 2001, foreign trade of Shanghai began to leapfrog development, service trade growth is obvious, therefore we do research on the data since 2000 has more realistic significance.

The specific variables are as follows: gross domestic product (GDP) in 2000-2012, imports trade in services (IM), exports trade in services (EX) and the total amount of trade in services (EI) of Shanghai, with one hundred million yuan as the unit. What's more, in order to eliminate the heteroscedasticity of the time series variables, we took the natural logarithm of each variable as follows: LGDP, LIM, LEX and LEI.

**TABLE 2 : Trade in services and original data of GDP of Shanghai**

Year	GDP	IM	EX	EI	LGDP	LIM	LEX	LEI
2000	4771.2	356.0	298.9	654.8	8.4703	5.8750	5.7001	6.4844
2001	5210.1	404.8	381.6	786.3	8.5584	6.0034	5.9445	6.6673
2002	5741.0	486.7	464.3	951.1	8.6554	6.1876	6.1406	6.8576
2003	6694.2	687.8	640.7	1328.4	8.8090	6.5335	6.4625	7.1918
2004	8072.8	1022.2	1004.0	2026.2	8.9962	6.9297	6.9117	7.6139
2005	9247.7	1353.3	1333.4	2619.6	9.1321	7.2103	7.1955	7.8708
2006	10572.2	1700.4	1555.1	3150.0	9.2660	7.4386	7.3493	8.0552
2007	12494.0	2406.6	1959.2	4130.2	9.4330	7.7860	7.5803	8.3261
2008	14069.9	3041.3	2393.5	5109.0	9.5518	8.0200	7.7805	8.5388
2009	15046.5	3113.2	2076.4	5104.8	9.6189	8.0434	7.6384	8.5379
2010	17166.0	4373.9	2776.1	7145.5	9.7507	8.3834	7.9288	8.8742
2011	19195.7	5592.4	3235.9	8257.2	9.8624	8.6292	8.0820	9.0188
2012	20101.3	6387.0	3290.2	9526.3	9.9085	8.7620	8.0987	9.1618

**Data sources: According to the calendar year of Shanghai statistical yearbook and service trade development reports of Shanghai.**

### ADF integration test

We used cointegration regression analysis method when analyze the time series. Therefore unit root test must first undertake to determine integration order of the economic variables. All variables with the same integration order is necessary conditions to the test of causality between variables. We adopted

ADF (Augmented Dickey-Fuller) test method. When the ADF is less than the critical value, it shows the time variable is stationary series, otherwise is non-stationary series, then we need differential treatment. When the variable is non-stationary but after n-th difference it become stationary, we call the time variable is n order integration. Through ADF test on logarithm variable, LGDP, LIM, LEX and LEI of Shanghai are all second order integration variables.

### Granger causality test

We can get the conclusion from the test result of the TABLE 3:

**TABLE 3 : The results of granger causality test**

Null hypothesis	Lags	Chi-square statistics	Concomitant probability value	Conclusion
LEX isn't the granger reason of LGDP	1	2.36	0.1248	Accept null hypothesis
LGDP isn't the granger reason of LEX	2	18.47	0.0001	Reject null hypothesis
LEI isn't the granger reason of LGDP	3	17.38	0.0006	Reject null hypothesis
LGDP isn't the granger reason of LEI	3	12.98	0.0047	Reject null hypothesis
LIM isn't the granger reason of LGDP	1	0.42	0.5147	Accept null hypothesis
LGDP isn't the granger reason of LIM	2	12.01	0.0025	Reject null hypothesis
LIM isn't the granger reason of LEX	2	16.49	0.0003	Reject null hypothesis
LEX isn't the granger reason of LIM	1	0.42	0.5147	Accept null hypothesis

Changes of Shanghai's exports trade in services aren't the reason of changes of its GDP, in reverse the latter is the reason of the former. That's to say, GDP changes will affect exports trade in services, and is a one-way causal relationship;

Changes of Shanghai's imports trade in services aren't the reason of changes of its GDP, in reverse the latter is the reason of the former. That's to say, GDP changes will affect imports trade in services, and is a one-way causal relationship;

The relationship between changes of Shanghai's GDP and the total amount of trade in services is a two-way causality, that's to say they promote each other;

Changes of Shanghai's imports trade in services are the reason of changes of exports trade in services, not vice versa, that's to say the relationship between imports trade in services and exports trade in services is a one-way causality.

In conclusion, the relationship among imports trade in services, exports trade in services and GDP is only a one-way causality, the relationship between the total amount of trade in services and GDP is a two-way causality, the relationship between imports trade in services and exports trade in services is only a one-way causality.

### Long-run equilibrium relationship between Shanghai trade in services and economic growth demonstration: co-integration analysis

#### Exports trade in services and economic growth

According to the foregoing ADF and granger causality test results, LGDP and LEX are second order integration time series, what's more, LGDP is the granger reason of LEX. So LEX should be explained variable, LGDP be explanatory variable. OLS regression results as shown in formula (1):

$$LEX_t = -0.0041year + 1.6695LGDP_t + u_t \quad (1)$$

(-10.61) (19.79)

$$R^2=0.9997 \text{ MSE}=0.1416 \text{ T}=13$$

Use the residual sequence  $u_t$  from formula (1) to ADF unit root test in order to determine the residual stability. The ADF result is -1.612, which is smaller than 10% of significant critical value 1.600, that's to say the residual sequence  $u_t$  is steady, the relationship between LEX and LGDP is long-run equilibrium. Shanghai exports trade in services has a promoting effect to the local GDP growth, and they have long-term stable equilibrium relationship.

#### **Imports trade in services and economic growth**

In a similar way, LIM should be explained variable, LGDP be explanatory variable. OLS regression results as shown in formula (2):

$$LIM_t = -0.0057 \text{year} + 2.0350 LGDP_t + u_t \quad (2)$$

(-53.06) (87.42)

$$R^2=1 \text{ MSE}=0.0390 \text{ T}=13$$

Use the residual sequence  $u_t$  from formula (2) to ADF unit root test in order to determine the residual stability. The ADF result is -2.622, which is smaller than 1% of significant critical value -2.600 that's to say the residual sequence  $u_t$  is steady, the relationship between LIM and LGDP is long-run equilibrium. Shanghai imports trade in services has a promoting effect to the local GDP growth, and they have long-term stable equilibrium relationship.

#### **The total amount of trade in services and economic growth**

In a similar way, LEI should be explained variable, LGDP be explanatory variable, and LGDP should be explained variable, LEI be explanatory variable. OLS regression results as shown in formula (3) and (4):

$$LEI_t = -0.0045 \text{year} + 1.8466 LGDP_t + u_t \quad (3)$$

(-24.44) (45.81)

$$R^2=0.9999 \text{ MSE}=0.0676 \text{ T}=13$$

Use the residual sequence  $u_t$  from formula (3) to ADF unit root test in order to determine the residual stability. The ADF result is -2.113, which is smaller than 5% of significant critical value -1.950 that's to say the residual sequence  $u_t$  is steady, the relationship between LEI and LGDP is long-run equilibrium.

$$LGDP_t = 0.0025 \text{year} + 0.5387 LEI_t + u_t \quad (4)$$

(52.76) (45.81)

$$R^2=1 \text{ MSE}=0.0365 \text{ T}=13$$

Use the residual sequence  $u_t$  from formula (4) to ADF unit root test in order to determine the residual stability. The ADF result is -2.040, which is smaller than 5% of significant critical value -1.950 that's to say the residual sequence  $u_t$  is steady, the relationship between LGDP and LEI is long-run equilibrium.

That's to say, the total amount of trade in services of Shanghai and the local GDP growth have two-way long-term stable equilibrium relationship, and they have the mutual promotion effect.

### **Imports trade in services and exports trade in services**

In a similar way, LEX should be explained variable, LIM be explanatory variable. OLS regression results as shown in formula (5):

$$\text{LEX}_t = 0.0005 \text{year} + 0.8210 \text{LIM}_t + u_t \quad (5)$$

(3.75) (21.02)

$$R^2 = 0.9997 \text{ MSE} = 0.1335 \text{ T} = 13$$

Use the residual sequence  $u_t$  from formula (5) to ADF unit root test in order to determine the residual stability. The ADF result is -1.423, which is bigger than 10% of significant critical value -1.600, that's to say the residual sequence  $u_t$  isn't steady, There is no long-term equilibrium relationship between LEX and LIM. There is no long-term equilibrium relationship between Shanghai exports trade in services and imports trade in services.

### **Shanghai's short-term changes relationship between service trade and economic growth empirical: error correction model analysis**

The cointegration analysis results show that LGDP and LEX, LGDP and LIM have the long-term equilibrium relationship of unidirectional; the relationship between LGDP and LEI is two-way long-term equilibrium. The following use error correction model to investigate how the relationship change in the short-term, namely whether the relationship between economic variables will return to the long-term equilibrium when they deviating the long-term equilibrium.

#### (1) Service trade export and economic growth

$EEX_t$  represents the regression residuals in regression equation (1), eliminate the variable that was not statistically significant, then error correction model is set up as shown in (6)

$$\Delta \text{LEX}_t = 6.8870 \Delta \text{LGDP}_{t-1} - 0.2757 EEX_{t-2} \quad (6)$$

$$R^2 = 0.8617 \text{ MSE} = 0.1321 \text{ T} = 10$$

The error correction coefficient is negative in model (6), show that short-term departure would eventually converge to a long-term equilibrium relationship. That is short-term GDP will deviate from the long-term relationship between it and service trade exports, and error correction coefficient is negative show that short-term deviation will eventually to convergence in a long-time. In accordance with reverse correction mechanism. Survived variables in model (6) are passed the P value of 5% inspection, is significant. Model (6) shows that the change of GDP has influence to the service trade export, and lag.

#### (2) Service trade import and economic growth

$EIM_t$  represents the regression residuals in regression equation (2), eliminate the variable that was not statistically significant, then error correction model is set up as shown in (7).

$$\Delta \text{LIM}_t = -2.8992 \Delta \text{LIM}_{t-1} + 9.2204 \Delta \text{LGDP}_{t-1} - 0.3991 EIM_{t-2} \quad (7)$$

$$R^2 = 0.9278 \text{ MSE} = 0.1059 \text{ T} = 10$$

The error correction coefficient is negative in model (7), show that short-term departure would eventually converge to a long-term equilibrium relationship. In accordance with reverse correction

mechanism. Survived variables in model (7) are passed the P value of 5% inspection, is significant. Model (7) shows that the change of GDP has influence to the service trade import, and lag.

(3) The total trade in services and economic growth

$EEI_t$  represents the regression residuals in regression equation (3), eliminate the variable that was not statistically significant, then error correction model is set up as shown in (8).

$$\Delta LEI_t = 6.1517 \Delta LGDP_{t-1} - 0.8210 EEI_{t-2} \quad (8)$$

$$R^2 = 0.8478 \quad MSE = 0.1420 \quad T = 10$$

The error correction coefficient is negative in model (8), show that short-term departure would eventually converge to a long-term equilibrium relationship. In accordance with reverse correction mechanism. Survived variables in model (8) are passed the P value of 5% inspection, is significant. Model (8) shows that the change of GDP has influence to the total trade in services, and lag.

$EGP_t$  represents the regression residuals in regression equation (4), eliminate the variable that was not statistically significant, then error correction model is set up as shown in (9).

$$\Delta LGDP_t = 1.649 \Delta LGDP_{t-1} - 0.2798 \Delta LEI_{t-1} - 0.1076 EGP_{t-2} \quad (9)$$

$$R^2 = 0.8902 \quad MSE = 0.0617 \quad T = 10$$

The error correction coefficient is negative in model (9), show that short-term departure would eventually converge to a long-term equilibrium relationship. In accordance with reverse correction mechanism. Survived variables in model (9) are passed the P value of 5% inspection, is significant. Model (9) shows that the change of total trade in services has influence to GDP, and lag.

## CONCLUSIONS

1. The service trade has a promoting effect on economic growth. From the index of contribution and pull, we know that service trade has promoting effect to the economy in the Yangtze river delta economic zone of Shanghai, Zhejiang, Jiangsu. The high index of Shanghai's contribution and pull in three regions show that service trade plays more important role in economic growth.
2. The relationship between the total amount of trade in services and GDP is a two-way causality, there exists a long-term equilibrium relationship between each other, and short-term deviation to long-term equilibrium regression trend. Namely Shanghai virtuous circle between service trade and economic growth mutually promote mechanism. Thus Promote the development of service trade is significant to the sustained and rapid economic development.
3. Shanghai's economic growth and service trade exports has a one-way granger causality, economic growth and service trade import also has a one-way granger causality. There exists a long-term equilibrium relationship between each other, and short-term deviation to long-term equilibrium regression trend. Therefore also prove economic growth promoting service trade import and export. So the relationship between trade in services and economic growth is two-way role.
4. The relationship between Shanghai's service trade import and service trade export is one-way granger causality. The service trade import can promote the growth of exports, but there is no long-term equilibrium relationship.

## ACKNOWLEDGEMENT

Thanks to the ministry of education philosophy and social sciences research for important project fund.

Fund grant no.13JZD010

Under the background of the rising elements cost of medium and long term development trend research about China's foreign trade



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