The Improvement and Application of Econometric Model for Reverse Spillover Effect of Technology Sourcing FDI

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Abstract—**In order to study the relation between service trade development and FDI, in this paper we study the generating ways for them, then point out that service industry mainly through the form of commercial presence and cross border supply promote the development of service trade directly, besides, the technical effect , employment effect and the capital benefits promote it indirectly. At the same time service industry makes use of FDI play an alternative role in service trade, and service trade would play a positive role in promoting the service industry use FDI. For further proving the mutual relationship between them, we use some index for the vector auto-regressive (Var) analysis. These index include foreign direct investment (FDI), service trade (TES), employee in service industry (SPE), the social fixed assets investment in service industry (SINV), the added value in service industry (SAVL).**

Keywords- interaction; service trade; FDI; service industry

I. INTRODUCTION

Since the reform and opening, Chinese economy developing fast, and its infrastructure become consummate, all of these create a favorable environment for the access of foreign capital. Also governments everywhere carried out preferential policies to attract foreign capital. And China has a population of one billion three hundred million, the broad market prospects attract many foreign tradesmen invest in our country directly, so China has become the biggest FDI receiving country in the world for several years. As FDI used by Chinese service industry increasing, the service trade in our country also get the corresponding development. Although the growing rate of the service trade in our country is high, comparing with the total level in the world, the service trade account for its proportion of total trade in our country is still low. For example, in 2012 the total import and export volume in our country is about $3641.86 billion, but the service trade only account for 12.2%. According to the statistics of WTO, global service trade is almost 20% in international trade. The service trade and Chinese service industry use FDI have the same growth trend, whether these two have any relationship, and what relationship between them, what

are the generating ways for them, it is worth enough for us to make research.

II. LITERITURE REVIEW

Scholars everywhere studied the relationship between FDI and service trade, they discussed the serviced FDI mainly start from external relations of the multinational corporation in service trade. Lucas(1993) studied in some southeast Asian countries, the research results show that export expansion attracted FDI flow in. However, the results which Bayonmi & Lipworth (1997), Muchielli & Chedor (1999) got are opposite. They believe the growth of FDI would led to the export expansion. He Wei(2005) made a regression analysis on the service trade data and the FDI, he found that FDI and service trade are positively related. Burns and Pan Li(2006) choose the relevant data in year 1970-2003 of America, then he established regression model, and had conclusions that the homonymous correlation between FID and international trade was not significant. Zhou Hairong(2008) thought that service trade is highly dependent on FDI used by service industry, she used the economic data in the year 1983~2005, made a co-integration test and granger inspection for the relationship between them, it comes out that they have stable relationship. Although there has been some literature studied the relationship between FDI and service trade development, they are just simple empirical analysis, and no further discussed for the interaction ways and the mechanism of the relationship between them.

III. THE INTERACTION WAYS FOR THE DEVELOPMENT OF SERVICE TRADE AND THE SERVICE INDUSTRY USE FDI

Because service products have following features: simultaneity in production and consumption, intangibility, can't store, can't trade, heterogeneity and so on, those features make mechanism of FDI used in service trade is different from that in manufacturing business, also we can't simply and directly conclude that the relationship between service industry use FDI

and the service trade is the trade complementary, import substitution or mutual promotion and so on. There are several interaction ways for the development of service trade and the service industry use FDI, mainly interaction ways are the service industry use FDI play direct positive role, indirect positive role or alternative role in promoting the service trade and service trade play positive role in improving FDI used by service industry, also FDI used by service industry have counteractive effect to the service trade.

A. Direct positive Role

1) The form of commercial presence help the service trade development

As mentioned above, service products have those features: simultaneity in production and consumption, intangibility, can't store, can't trade, heterogeneity and so on, those characteristics block the service trade, and it makes service trade can not like the goods trade have the cross-border transactions. However, the form of commercial presence overcomes these traditional barriers in service trade, it also changes non-tradable service into tradable service. Through the form of commercial presence, we realize the international service trade, at the same time, it creates conditions for batch production, scale effect, and it reduced the cost and price.

2) The form of undertake service outsourcing in cross-border supply promote further development of the service trade

The developed countries in order to get cheap labor, reduce cost, also they covet the broad market space in our country, they built some controllable offshore centers and overseas subsidiaries, and give these places some non-core auxiliary business to complete, then resell to the un-host investors, meanwhile provide service to the third country. According to the statistics, through this form our country has been bought nearly $10billion service trade income in 2012. It contributes to the development of Chinese service trade directly, also it is the specific performance for that our Chinese service industry use FDI have positive impact on service trade.

B. Indirect Positive Role

1) The path of technology spillover effects

Through the following ways, technology spillover effects appear: the first one is demonstration effect, that is, after long-term contact with transnational investment enterprises, enterprises in the host country can learn, imitate the modern service technology, means and management methods to improve the level of technology. The second one is competition effect, when overseas-funded enterprise entered in, they have broke the monopoly situation in Chinese service industry. Now service industry in China meet with more and more fierce competition, in order to survive, the host country enterprise have to make innovations in technology, also they should improve their service quality, service efficiency and the management level. The third one is correlation effect, the service enterprise who use FDI through always provide technical advice and training for the

related industry in host country to produce technology effect. The forth one is diffusion effect, that is, the staff who had been cultivated by overseas-funded enterprise move between the domestic enterprise, in this way, it helps service technology and management method spread and consummate.

2) The path of capital effects

At present the economy of our country is in the stage of rapid development, and the service industry need a lot of capital flow into infrastructure. But service industries in our country are faced with the capital shortage dilemma. At this time, FDI inflows can just make up for the funding gap, especially conductive to the development of capital intensive service industry. It is not only goods for the development of service industry in our country, but also boosts the capital intensive products export.

3) The path of employment effects

Green field Investment is the mainly used way for foreign capital entering Chinese service industry. Green field investment is mainly fulfilled by setting up branches or subsidiaries, then a large number of people most of whom come from local place are needed to hire, that is the direct creation of employment opportunities. Especially the employment effect is reflected in the labor-intensive multinational service enterprise, such as retail trade, information services, transportation industry. The typical example is KFC who has established more than 1,400 restaurants in over 200 cities in China mainland and directly improves the employment opportunities for more than 60,000. Not only can the large number of idle labor be absorbed and employment be achieved by the employment effects of the service sector foreign direct investment, but more important is able to form Chinese human capital, the upgrading of human capital, improving the quality of human capital. Multinational service industry, especially technology-intensive and capital-intensive service industries, their competitive advantage is that they built on the basis of quality human resources. And multinational corporations train the talents who will grasp the concept of advanced experience, management knowledge and technical ability in the host country. Through training such talent person, it helps our country get more human capital with high-level. It's helpful for changing the original service industry ratio of capital and labor, increasing the wage levels of workers in the short term, changing services internal structure in the long term, achieving the dynamic upgrade of the service sector competitiveness. With the upgrading of human capital, high-quality service personnel can promote Chinese service industry to shift from labor, capital-intensive to capital, knowledge, and technology-intensive, and achieve the purpose of changing the export structure of Chinese service trade.

C. The Alternative Role of FDI Used by Service Industry on the Development of Trade in Services

The main generated ways are in the following:

- If the quality of the FDI flow into the host country service sector is lower than the host country itself, it indicates that foreign direct investment of multinational

enterprises is to learn the advanced technology, management experience and organizational system of the host service industry. This foreign direct investment will reverse to improve the service level of the investors, thus improving the export competitiveness of the investors, gradually reducing the import of the host service. From this perspective, FDI produce export substitution effect on certain original service product s of the host.

- If the host has certain comparative advantages in certain service sectors, and if foreign enterprises import the service will have high market transaction costs and bear a larger trade costs, the foreign enterprises may select acquisitions or greenfield investments to build factories in the host country, which can save the production cost. At this point, the investment countries will reduce imports of services of the original cross-border payment models, then form the same impact as former path.

D. The Promoting Function of the Development of Service Trade on FDI in Service Industry

The relationship between FDI used by service industry and trade in services development is mutual, FDI of service industry has promoting and substitution effect on the development of trade in services, but in turn, the development of trade in services also has counterproductive on FDI of service industry, mainly in the following areas:

- First, terms of service imports, the increasing of the service imports, not only explains the increasing in consumption and demanding of the service, also shows that the service of the country at a comparative disadvantage in international competition market.. Owe to fancy of the market opportunities and prospects, multinationals bound to increase theirs' foreign investment, resulting in FDI inflows increase.

- Second, Exports of services also can promote the growth of FDI used by service industry. According to H-O factor endowment theory, the products with relative abundance factors have comparative advantage, and countries tend to export these products in international trade. With the increase in trade in services exports, the original abundance of production factors will be reduced, and the originally scarce factor (capital) will be more scarce, leading to the rise of capital in the country's domestic marginal return then attract more international capital flows.

- Third, the development of trade in services is to help accelerate the improvement of regional infrastructure, and to form industrial agglomeration effect easily. For our country's growth in demand for services, in imports of finance, insurance, consulting, IT and other high value-added service products, the restrictions of these service industries or sectors is bound to relax and the extent of opening up of service-related industry will be expanded.

While favorable investment environment and broad market demand are bound to attract foreign capital to enter.

IV. VAR ANALYSIS OF THE RELATIONSHIP OF FDI USED BY SERVICE INDUSTRY AND TRADE IN SERVICES

Based on the above analysis of the interaction path between FDI used by service industry and the development of trade in services, we can get that FDI in service industry will form directly promoting effect to he development of trade in services through commercial presence, service outsourcing or other forms, and indirectly promoting effect through capital effect, the technology spillover benefits, employment effects or other path. While anti-effect will be formed between the two objects. To verify the above view, I propose to use vector auto-regressive model (VAR) to analyse. In order to fully reflect the indirect effects between FDI in service industry(FDIS) and trade in services (TES), I will use employment personnel in service industry(SPE) to measure the employment effects, total social fixed assets investment in service industry(SINV) to measure the effect of technology, added value in service industry((SAVL) to measure capital benefits (Data are shown in Table 4.1). Vector auto-regression model as follows:

$$y_t = A_1 \, y_{t-1} + ... + A_P \, y_{t-p} + B_1 x_t + ... + B_r x_{t-r} + \varepsilon_t$$

Where y_t is a m-dimensional endogenous variable; x_t is a d-dimensional exogenous variables, $A_1, \cdots, A_p$ and $B_1, \cdots, B_r$ is matrix with estimated parameters, endogenous variables and exogenous variables respectively have p and r-order lag, ε_t is disturbance. Use the collected data, the results are as follows:

$$
\begin{bmatrix} TES_t \\ FDIS_t \\ SPE_t \\ SVAL_t \\ SINV_t \end{bmatrix} = \begin{bmatrix} 487.13 \\ 43.65 \\ 14200 \\ -2817.5 \\ 27091.33 \end{bmatrix} +
$$

$$
\begin{bmatrix} 0.25 & 0.11 & 0.30 & 1.97 & 22.97 \\ 1.85 & 0.84 & -10.94 & 30.30 & 8.91 \\ -0.13 & -0.07 & 0.30 & 1.87 & -2.84 \\ -0.09 & -0.01 & 0.07 & -0.79 & -1.08 \\ -0.02 & -0.001 & -0.08 & 1.01 & 0.62 \end{bmatrix} * \begin{bmatrix} TES_{t-1} \\ FDIS_{t-1} \\ SPE_{t-1} \\ SVAL_{t-1} \\ SINV_{t-1} \end{bmatrix} +
$$

$$
\begin{bmatrix} 0.52 & 0.18 & 0.59 & 1.09 & 5.01 \\ 0.79 & -0.52 & 7.72 & -4.96 & 16.81 \\ -0.09 & -0.011 & -0.20 & -2.29 & 0.79 \\ 0.04 & -0.003 & 0.21 & 0.80 & 1.42 \\ -0.003 & 0.03 & -0.14 & 0.78 & -0.007 \end{bmatrix} * \begin{bmatrix} TES_{t-2} \\ FDIS_{t-2} \\ SPE_{t-2} \\ SVAL_{t-2} \\ SINV_{t-2} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \\ \varepsilon_5 \end{bmatrix}
$$

The goodness of fit of the above five equations are:

$$R^2_{TES} = 0.998995 \quad R^2_{FDIS} = 0.978018 \quad R^2_{SPE} = 0.998856$$
$$R^2_{SVAL} = 0.999488 \quad R^2_{SLNV} = 0.999719$$

We can get: (1) The current trade in services is impacted by the former first phase and second phase of the total FDIS. The impact coefficient respectively are 0.1 and -0.52, indicating that FDI used by service industry has promoting effect on current trade in services at former first phase but substitution effect at former second phase. Both promoting and substitution effect exits from the use of FDI in service industry to trade in services; (2) Current service use of FDI is also impacted by the former first phase of trade in services. Impact coefficient is 1.89, which is positive, indicating that trade in services can promote the services sector of FDI growth; (3) It's complex about the impact of service use of FDI on SPE, SNAL and SINV, because impact coefficient is neither positive or negative in short term. But with the impact coefficient that reflects the impact of those three indicators on the former first phase trade in services as 0.26, 1.92, 22.95, and as 0.72, 1.14, 4.92 at former second phase, the promoting effect is more obvious in general. It's to say FDI used by service industry can promote the development of trade in services, through the path of technical effect, the path of capital efficiency and the path of employment, which is a large indirect role on trade in services.

TABLE 1 THE DISTRIBUTION OF TES, FDIS, SPE, SVAL, SINV BETWEEN 1992-2012

Years	TES(One hundred million dollars)	FDIS（One hundred million dollars）	SPE（Million）	SVAL（One hundred million yuan）	SINV（One hundred million yuan）
1992	183	43.45	13098	9357.4	5498.7
1993	226	136.28	14163	11915.7	7925.9
1994	322	144.64	15515	16179.8	9615
1995	430	106.79	16880	19978.5	10898.24
1996	430	111.9	17927	23326.2	13091.94
1997	522	120.6	18432	26988.1	14597.87
1998	504	135.12	18860	30580.5	17943.34
1999	572	118.29	19205	33873.4	19382.06
2000	660	104.64	19823	38714	23110
2001	719	111.81	20228	44361.6	25718.05
2002	855	122.5	21090	49898.9	27320.72
2003	1013	133.25	21809	56004.7	32562.8
2004	1337	140.53	23011	64561.3	39846.3
2005	1571	149.14	23771	74919.3	47613.2
2006	1917	199.15	24614	88554.9	58769.2
2007	2509	309.83	24917	111351.9	72766.7
2008	3045	379.48	25717	131340	90802.7
2009	2867.0715	385.28	26603	147642.1	121453.1
2010	3579.7	482.52	27429	174198.4	151557.5
2011	4661.4	591.59	28309	189823.7	188122.6
2012	6152.3	623.92	29869	218825.6	230201.1

Data Source: Table data were collated from the State Statistical Yearbook from 1993 to 2012 and Statistical Yearbook of the tertiary industry.

V. CONCLUSION

From the above analysis, the use of FDI in service industry can not only directly promote the development of Chinese trade in services through commercial presence and cross-border trade, but also indirectly contribute to the development of Chinese trade in services through technological spillover benefits, capital efficiency, and the employment effects, meanwhile trade in services also promotes the use of FDI in service industry. But the use of FDI in service industry can inevitably form counteractive on Chinese service trade and development of service industry. Mainly displays in the following aspects: First, the development of service industry in China is relatively late, and lower than the level of related industries. Therefore, large inflows of foreign capital will bring Chinese disadvantage service industries a huge impact, even monopolize the whole service market. Second, a huge gap is being between the development level of service industry in China compared with that in developed countries. If the foreign direct investment enter Chinese financial, communications, aviation or other state monopolized industries too early too fast, the financial stability and the entire economic security of our country will inevitably be effected, even jeopardized.

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