The Influence of Productive Service Trade Import Technology Level on the Productivity of Manufacturing Enterprises

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***Abstract* — Based on extended CD model, this paper adopts system GMM estimation to examine the effects of technological level of producer service import on firm productivity in China during 2002-2007.The results show that: (1) generally speaking, improvement of producer service import technological level can improve productivity of firms in China's manufacturing industry;(2) the higher technical content of producer service is, the stronger the promotion function of the measures on firm TFP is, and the largest are computer information services as well as patents and licensing , followed by the insurance, telecommunications and financial services, and then followed by transportation services and other commercial services;(3) producer service technological level has a significant positive effect on productivity of firms with capital and technology-intensive, but the effect to the labor-intensive firms is yet not clear. Therefore, this paper concludes by proposing service trade policies to help promote the technological level of producer service.**

Keywords - producer services; import technological level; firm productivity

I. INTRODUCTION

After the financial crisis, China's comparative advantage such as labor, land, policy gradually became weaken, and resource and environmental constraints gradually became increased, along with the international market demand continuing to shrink and the international competition pressure increasing gradually. So improving the level of manufacturing enterprise production efficiency becomes the key to the transformation of economic development mode from extensive to intensive. Productive service industry is the dominant force of industrialization development, which is in the form of the human capital and intellectual capital as the main intermediate inputs, embedded manufactured goods production process. Thus, the international competitiveness of Chinese manufacturing enterprises was constrained by the level of service economy, especially the producer services development. So, for Chinese manufacturing enterprises, can importing high-tech service goods significantly improve enterprise productivity levels? This article detailed discussions on the issue.

On the issue of the Chinese manufacturing enterprise productivity improvements, many domestic scholars have conducted empirical research. Yumiaojie (2010) investigated the influence of trade liberalization on China's manufacturing industry enterprise productivity, and pointed out that trade liberalization significantly improved enterprise productivity levels. Cheng Huifang (2014) tested the impact of trade policy changes on business productivity, and the results showed that trade policy which was favorable to economic development and actively respond to the changes in the international environment changes promoted our country enterprise productivity increase significantly. Xiao-hua sun and Wang Yun (2014) analyzed the influence of enterprise scale on the productivity, and results showed that the contribution of the difference of enterprise scale on productivity level of more than 90%, but the inverted u-shaped relation with the enterprise scale and the productivity : for labor-intensive textile industry and technology intensive medicine manufacturing, scale expansion depended on economies of scale and technological innovation effect led to productivity, and in capital-intensive transportation equipment manufacturing, mass production will weaken R&D activities for the promotion of productivity.

The above research on the factors affecting enterprise productivity mainly concentrated in the "quantity", national macro policy and trade enterprise own development Angle. A small amount of research on services "quality" , mainly focused on service trade import effect on economic growth, industrial economic growth mode transformation, and the efficiency of the industry analysis (2015, Yang ling, Xu shuting; 2013, Dai Xiang, Jin Bei; 2014, Dai Xiang), rarely on service trade import impact to the manufacturing enterprise productivity. Then, how did the technological level of producer service import affect the manufacturing enterprise productivity? On the one hand, the service was embedded as intermediate inputs into products production process, then the implied by the advanced information technology and knowledge absorbed by manufacturing enterprise directly, so as to promote enterprise productivity improvement. Obviously, if one country imported service goods implied by the more advanced technology, knowledge and information, and then the efficiency of the enterprise can produce a more significant positive impact. As the international division of labor, on the other hand, refinement, service industry, especially producer services from manufacturing segment becomes an independent in the industrial chain link or independent departments, and its implied innovation elements are bound to produce the forward or backward technology spillover effect. For this purpose, based on the industrial enterprises in China from

2002 to 2007 micro data as sample, the article empirically researched the impact of the technological level of producer service import on China's manufacturing industry enterprise productivity.

II. MEASUREMENT MODEL AND DATA PROCESSING

(I) Main variables and the measurement methods

1.Import technological level of productive service trade. Based on the research of Michaely (1984), Haussmann et al. (2005) put forward the measurement methods of the technical complexity of commodity trade export after readjusting the weight. Based on the research of Haussmann et al Dai Xiang (2013) put forwards measurement method of making indirect measurement for the complexity of its import according to the complexity of service trade export. This paper will measure the import technological level (referred to as ITL) of a country by using the methods, the specific calculation steps are as follows:

Firstly, calculate ITLk of a certain kind of commodity in classification of service trade.

$$ITL_k = \sum_n \frac{e_{nk}/E_k}{\sum_n (e_{nk}/E_k)} Y_n \quad (1)$$

Where, enk stands for export value of type-k service commodity in country n; Ek is the total exports of service trade in country n; Yn is per capita GDP in country n. Based on formula (1), the overall ITL of service trade in a country can be further measured.

$$ITL = \sum_k \frac{x_k}{X} ITL_k \quad (2)$$

In formula (2), xk stands for export value of type-k service commodity in China; X is the total exports of service trade in China.

2.Manufacturing enterprises productivity. This paper uses Solow residual method namely based on Douglas production function:

$$Y_{it} = \varphi_{it} K_{it}^{\alpha} L_{it}^{\beta} \quad (3)$$

Where, Yit, Kit and Lit respectively stand for the total industrial output, capital input and labor input of enterprise i at the time of t. In order to calculate the total factor productivity φ it of enterprise i, take the logarithm of both sides of formula (3):

$$LnY_{it} = \beta_0 + \alpha LnK_{it} + \beta LnL_{it} + \varepsilon_{it} \quad (4)$$

In this way, through OLS method and calculating through formula (4), the residual term ε_{it} obtained is the total factor productivity φ it. However, in the actual production process, the change in current part of total factor productivity for enterprise can be observed. Accordingly adjust the next phase of the input ratio of different factors so as to maximize profits. Therefore, there is certain endophytism between the factor input and the enterprise productivity. Then there will be a deviation for the estimated result through OLS method namely simultaneity bias. During the observation period, as there are exit and exiting and entering behaviors for enterprise, it will lead to selective bias. In order to overcome the above two biases. In the paper, OP method of semi-parameter method is adopted (Olley-Pakes, 1996) for amendment.

(II) Measurement model

The measurement model set in this paper is as follows:

$$LnTFP_{it} = \alpha_0 + \alpha_1 LnITL_t + \alpha_2 LnTFP_{it-1} + \alpha_3 LnSize_{it} + \alpha_4 RE_{it} + \alpha_5 DR_{it} + \alpha_6 EX_{it} + \varepsilon_{it} \quad (5)$$

LnTFPit stands for napierian logarithm of total factor productivity for enterprise i at the time of t; LnITL stands for napierian logarithm of ILT for service trade. In addition, in this paper, the enterprise's total assets, profit ratio, asset liability ratio, the export conditions of enterprises (export enterprise virtual variables, among which export enterprises are 1 and non export enterprises are 0) are also selected as control variables, which are respectively represented by Size, RE, DR and EX. Among them, for the enterprise's total assets index, carry out deflation with 2001 as the base period and price index of investment in fixed assets of every province. Total assets reflect the enterprise scale; generally speaking, the larger the enterprise scale is, the more research and development capabilities or the ability to purchase advanced equipment it has so as to contribute to the improvement of enterprise efficiency level; profit ratio represents the profitability of an enterprise. The higher profit ratio stands for enterprises having more funds for the expansion of the scale, developing new products and producing positive effects on productivity; asset liability ratio represents an enterprise's liabilities level. Generally speaking, the excessive asset liability ratio means greater capital risk not conducive to the production and operation and long-term development of enterprises. So there is a negative effect on productivity.

(III) Data source and description

Manufacturing enterprise data comes from database of Chinese industrial enterprises (from in 2001to in 2007). Firstly, carry out discussion based on a sample of only 29 manufacturing industry enterprises. In this paper, the research method of Yang Rudai (2015) will be used for reference for corresponding four digit industry classification of 1994 national standard (GB/T4754—1994) to three digit industry classification of 2002 national standard (GB/T4754—2002) namely industry classification for all years is unified in the level of 2002 three digit industry classification, then removing mineral production and selection, petroleum and other resource industries and the production and supply of water and electricity and other industries finally so as to get the basic samples. Secondly, according to the accounting standards and synthesizing the data processing methods of Yu Miaojie (2010), Nie Huihua (2012), Yang Rudai (2015) etc. In this paper, carry out removal based on the following principles: (1) the number of

employees in enterprises is less than 10; (2) the main financial indicators (total output, industrial added value, total value of fixed assets) are negative value or in default; (3) current assets are greater than the total assets; (4) fixed assets are greater than the total assets. After screening according to the above methods, a balanced panel data including 197658 enterprises is obtained as the sample data for the follow-up study in this paper.

III. EMPIRICAL RESULTS

In the paper, system GMM parameter estimation method is adopted to carry out regression for measurement equation (5); results obtained are shown in Table 1 and Table 2.

TABLE 1. SYSTEM GMM REGRESSION RESULT FOR SERVICE TRADE SUBSECTOR

Explanatory variable	Model 1	Mode2	Mode3	Mode4	Mode5	Mode6	Mode7	Mode8
LnITL	4.47***							
	(0.1543)							
LnITL1		2.56**						
		(0.0258)						
LnITL2			4.46***					
			(0.1776)					
LnITL3				4.34***				
				(0.1409)				
LnITL4					5.16***			
					(0.0906)			
LnITL5						5.03***		
						(0.1176)		
LnITL6							4.50***	
							(0.1649)	
LnITL7								3.33**
								(0.1834)
LnTFPt-1	12.39***	12.54***	12.52***	12.46***	12.98***	12.53***	12.30***	12.58***
	(0.4563)	(0.4585)	(0.4564)	(0.4877)	(0.4639)	(0.4577)	(0.4558)	(0.4590)
LnSize	-1.81**	-1.71**	-1.74*	-1.75*	-1.71*	-1.87*	-1.84*	-1.75*
	(-0.0508)	(-0.0449)	(-0.0407)	(-0.0279)	(-0.0491)	(-0.0483)	(-0.0517)	(-0.0501)
RE	0.69	0.54	0.43	0.16	0.64	0.67	0.72	0.66
	(0.9759)	(0.6957)	(0.4794)	(0.1748)	(0.9151)	(0.8585)	(1.023)	(0.9529)
DR	2.04**	2.00**	1.98**	1.22	1.86*	1.98*	2.05*	1.99*
	(0.7663)	(0.7375)	(0.7511)	(0.863)	(0.6539)	(0.7477)	(0.7816)	(0.7274)
EX	-1.88**	-2.07**	-2.26**	-2.14***	-1.87*	-2.00*	-1.86*	-1.87*
	(-0.0374)	(-0.0400)	(-0.0420)	(-0.0854)	(-0.0373)	(-0.0385)	(-0.0371)	(-0.0374)
Constant term	2.99	4.01	7.82	0.73	4.84	5.70	3.97	2.85
AR(1)	0.031	0.015	0.013	0.027	0.022	0.019	0.041	0.037
AR(2)	0.461	0.369	0.299	0.259	0.445	0.409	0.476	0.460
Sargan test	0.283	0.149	0.539	0.063	0.090	0.523	0.345	0.150

Notes: (1) values in brackets are T statistics; ***, **, and * respectively stand for parameter estimation being significant at the level of 1%, 5% and 10%; (2) AR (1) and AR (2) are the related test for disturbance term difference divided into first order autocorrelation and second order autocorrelation; GMM consistency estimation require s disturbance term without autocorrelation but with first-order difference correlation and without correlation for above the second order difference. The original hypothesis is "autocorrelation not existing for disturbance term difference"; (3) effectiveness of dynamic panel parameter estimation depends on whether the tool variable is effective. Therefore, Sargan test is used to identify its effectiveness.

TABLE 2. SYSTEM GMM REGRESSION RESULT FOR INDUSTRY GROUPING OF MANUFACTURING ENTERPRISES

Explanatory variable	Labor-intensive enterprise	Capital-intensive enterprise	Technology-intensive enterprise
LnITL	1.09	3.91***	4.76***
	(0.0493)	(0.1667)	(0.1471)
LnTFPt-1	5.43***	8.94***	9.67***
	(0.3872)	(0.5337)	(0.5128)
LnSize	-1.52	-2.23**	-3.29***
	(-0.0231)	(-0.0494)	(-0.0334)
RE	0.83	0.93	1.61
	(0.1765)	(0.9092)	(0.9078)
DR	0.95	1.73*	0.80
	(0.3661)	(0.6330)	(0.2511)
EX	-2.59*	-0.30	-1.27
Constant term	(-0.0789)	(-0.0085)	(-0.0252)
AR(1)	4.42	1.31	2.63
AR(2)	0.045	0.023	0.013
Sargan test	0.768	0.689	0.579
	0.878	0.747	0.185

Notes: same as Table 1

As shown in column (1) of the Table 1, in the paper, firstly from the overall level, the influence of China's productive service trade import technology level (LnITL) on the productivity of manufacturing enterprises is investigated. From the point of view of quantitative regression results, there is a positive correlation between ITL of productive service trade and the productivity of manufacturing enterprises in China. Specifically, parameter estimation of ITL of productive service is 4.47 with being significant at 1% level, which means that the improvement of ITL of service trade is conducive to the improvement of manufacturing enterprise productivity. In terms of other control variables, seeing from the regression results of line (9) to line (13), productivity of one-period lag has great influence on enterprise productivity. Because the producers will adjust the current factor input based on the previous phase of the productivity level so as to achieve the purpose of improving efficiency. Coefficient estimation of enterprise scale is negative with significant influence at 5% level, which may be owing to that too large enterprise scale may not be conducive to corporate research and development activities with weakening the positive effect on the productivity of enterprises; coefficient estimation of profit ratio variable is negative but without significant influence, which means that enterprise profitability has a certain role in promoting productivity but with not obvious effect. Coefficient estimation of asset liability ratio is positive with significant influence at 5% level; this may be owing to the increase in productivity requiring enterprises to invest more funds to carry out technical research and development activities. This will inevitably lead to an increase in the asset liability ratio; coefficient estimation of virtual variables in export enterprises is negative with being significant at the level of 5%, which means that the productivity of export oriented enterprises is lower than that of non export oriented enterprises. This may be owing to export enterprises in China more involved in processing trade with showing extensive growth pattern. So the promotion effect of the enterprise productivity on the industrial production will be weakened.

(2)When productive service trade import is regarded as intermediate input products, the role of promoting the productivity of enterprises for different "link" of different service trade department even the same service trade department is not necessarily the same. Therefore, in the paper, ITL of 7 types of productive service trade subitems are calculated separately as an explanatory variable for regression so as to make analysis of its impact on the productivity of manufacturing enterprises. model 1 to model 8 in Table 2 respectively stand for transportation services (referred to as ITL1), communication service (referred to as ITL2), financial services (referred to as ITL3), computer and information services (referred to as ITL4), patents and concession (referred to as ITL5), insurance services (referred to as ITL6) and other business services (referred to as ITL7). It can be found from the regression results that firstly, in 7 types of productive service trade subitems, coefficient estimation value of ITL of are all positive with at least passing 5% of the significant test, which shows that it has a positive effect on the productivity of manufacturing enterprises. Secondly, the influence of ITL of different productive service trade subitems on enterprise productivity is different. By comparing coefficient estimation value, the biggest of them is computer, information services, patents and concession; in the next place, insurance, communications and financial services; finally, transport services and other business services. It can be found that service trade import with different characteristics. Because of the difference in technical content concluded, there is a great difference for the influence on the way of the development of industrial economy. This further validates the theoretical mechanism of the hypothesis, namely service trade imports with higher technical content, as an intermediate input, because of its more direct effects, more essential factor recombination effect, more technology spillover effect etc, which will have bigger and more significant influence on transformation of industrial economic development mode.

(3)Because different enterprises will have different characteristics of factor intensity, they have different production techniques. In order to investigate the disparate impact between different enterprises, in this paper, grouping method of Dai Xiang (2013) will be referred. The manufacturing enterprises are divided into three categories including labor-intensive, capital-intensive and technology-intensive enterprises. Among them, the labor intensive enterprises include: enterprises belonging to 14 industries including rubber products industry, plastic products industry, agricultural and sideline products processing industry, food manufacturing industry, beverage manufacturing industry, tobacco industry, textile industry, textile and garment, shoes, hats manufacturing industry, leather, fur, feathers (cashmere) and the products industry, wood processing and wood, bamboo, rattan, palm, straw products industry, furniture manufacturing industry, paper and paper products industry, printing and record medium replication and stationery and sporting goods manufacturing industry. Capital-intensive enterprises include: enterprises belonging to 8 industries including petroleum processing, coking and nuclear fuel processing industry, non-metallic mineral products industry, ferrous metal smelting and rolling processing industry, non-ferrous metal smelting and rolling processing industry, metal products industry, general equipment manufacturing industry, special equipment manufacturing industry, instrumentation and culture, office machinery manufacturing; technology-intensive enterprises include: enterprises belonging to 7 industries including chemical raw materials and chemical products manufacturing, pharmaceutical manufacturing, chemical fiber manufacturing, transportation equipment manufacturing, electrical machinery and apparatus manufacturing industry, communications equipment, computers and other electronic equipment manufacturing and arts and crafts and other manufacturing industries. Then, the overall ITL of productive service trade is regarded as the main explanatory variable; carry out group-level regression analysis. Results obtained are shown in Table 2:

It can be found from regression results of Table 2 that: for the three major groups, coefficient estimation value of ITL variable of service trade from big to small are respectively technology-intensive enterprise, capital-intensive enterprise

and labor-intensive enterprise. Among them, technology-intensive and capital-intensive enterprises all pass 1% of the significant test; however, labor-intensive enterprise has no significant effect, which might be attributable to that the demand for producer services trade of enterprise with different factor intensity characteristics is different.; however, technology-intensive and the Service input demand intensity of capital-intensive enterprises may be greater thus manifesting that the higher of ITL of productive service trade is, the greater of promoting effect for improvement of capital and technology intensive enterprise productivity is.

IV. CONCLUSION AND SUGGESTION

According to the above conclusions, the following policy recommendations are made in the paper: firstly, further promote the opening of service industry sector; by effective combination of "introduction" and "going out" strategy, optimize the industrial structure of China's service industry, especially for productive service industry so as to improve the overall level and quality. Open up gradually and in order foreign capital access conditions of service industry; quicken the steps of utilizing the foreign capitals; selectively introduce transnational corporation of large scale service industry, especially for the top 500 enterprises in the world. Simultaneously, seize the opportunity of "One Belt and One Road", form a series of personnel training program of high-end service industry with powerful Europe and the United States and countries along "One Belt and One Road"; encourage the talented persons of domestic service industry to go abroad for further study for learning international advanced service industry technology and knowledge; train a number of outstanding domestic service enterprises; encourage and guide them for international investment and participate in international competition in service trade so as to further promote the development of enterprise itself. Secondly, further improve the level of service industry, especially for productive services. After a period of development, at present, service industry in our country has initially formed scale, therefore, development priority shall be transferred from the increase in the number of service industries to the improvement of international competitiveness namely quality of service products. In order to apply the advanced science and technology, professional knowledge and information to service industry, increase special funds investment, strengthening the cultivation of professional talents and accelerating the development and upgrading of service software.

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