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Research on Absorption Capacity, OFDI Reverse Technology Overflow and the Upgrading of China's Export Commodity Structure

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Abstract

Based on the data of 30 provinces and cities in China from 2009 to 2018, the empirical study uses threshold regression. The results show that the level of financial services, intellectual property protection and technological gap all have the threshold effect. The improvement of these absorption capacity representation variables will enhance the role of reverse technology spillover in promoting the upgrading of the export structure.

Keywords

Reverse Technology Spillover; Export Commodities Structure; Threshold Regression.

1. Introduction

According to data released by the General Administration of Customs, the total exports of China reached 17.93 trillion yuan in 2020, up 4 percent from 2019. However, due to the impact of COVID-19, the financial crisis and trade protectionism, the growth rate of China's export volume has decreased significantly since 2009. Simple scale growth is no longer used as the most important driving force for the high-quality development of China's trade in the long term. It is urgent to enhance China's position in the division of labor in the global value chain and promote the upgrading of its export structure.

Most studies at home and abroad show that outward foreign direct investment (OFDI) can promote the flow of technical resources to China, having an impact on the technological progress of the home country. With the implementation of the going out strategy, the potential of obtaining international technology spillover from OFDI is huge, and how to absorb and effectively exert the reverse technology spillover effect has also become an important research direction. The World Bank believes that technological progress in developing countries also depends on their ability to absorb technology. Therefore, it plays an important practical role to study the influence of reverse technology spillover and absorption capacity on export structure, help to optimize the absorption environment of the parent country, promote the play of reverse technology spillover and export structure effect, and enhance the competitive advantage of export.

2. Literature Review

Absorption ability refers to the process of knowledge utilization, including the steps of acquisition, absorption, and application (Todorova and Durisin, 2007[14]).The international technology spillover performance obtained from opening to the outside world is affected by the absorption capacity of the parent country, which has also been confirmed by some scholars, such as Yin Dongdong and Zhang Jianqing (2016)[15].The GMM estimation method is used to find that the factors such as scientific research expenditure, openness level, infrastructure, and financial services can positively affect the reverse technology spillover play. At regional level,

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Wang Xueli and An Tongxin (2021)[16], Feng Delen and Bai Yihong (2021)[17]use data from the Yangtze River Economic Belt for research, and the research results show that R & D strength and technical gap have a threshold effect. Some scholars also study the impact of reverse technology spillover and absorption capacity on China's high-quality development. Such as Li Hong and Wu Dongsong (2020)[18]use mediation model to study the influence of the absorption capacity on the product quality, and the results show that the R&D strength that characterizes the absorption capacity can strengthen the optimization effect of the reverse technology spillover on the product quality. Many scholars study the impact of absorption capacity on the upgrading of industrial structure. Such as Xiao Weiguo and Lin Qin (2019)[19].The results show that the technological gap and the economic level have a positive impact on the absorption capacity of the technology gap, affecting the process of industrial structure, and have no significant impact on the opening up and financial development. Liu Xiangru and Wu Liping (2020)[20]considered that the influence of reverse technology spillover on the industrial structure is nonlinear, and there are regional differences in the absorption capacity.

In the aespect of research on reverse technology spillover, export structure effect and absorption capacity, Ye Jinsong et al. (2015)[21] proves that R&D capital can significantly improve China's export structure. Liu Yingji (2016)[22] believed that knowledge accumulation can improve the level of technology and then optimize the export structure. Jiang Ying (2016)[23]revealed that human capital can directly or indirectly improve the complexity of export technology by affecting the absorption capacity, and the relationship is similar to the "J" type. Liu Haiyun and Wang Jing (2019)[24] neasure the export structure by the export commodity height index (EXPY), and it is concluded that the foreign direct investment can obviously optimize the export structure, and show obvious regional heterogeneity. FDI, financial services level and other factors can optimize the export structure. Ning Ye (2021)[25]establish a threshold regression model to investigate the relationship between reverse technology spillover and China's export competitiveness. The results show that the reverse technology spillover has a positive effect on the export competitiveness, and the technical gap affects the action relationship between the two sides, and there are significant regional differences.

Combing related research found that the study of OFDI influence on export structure literature are more, time is relatively early, then related papers of OFDI reverse technology overflow and its absorption capacity on export structure gradually increased, but the research object is mainly different countries, industries or products, technical complexity is mostly used as the measurement index of export structure. Some scholars also study the differences in the impact of OFDI reverse technology spillover on the export structure for different purposes. The basic conclusion is that the reverse technology spillover can significantly promote the technical complexity and the upgrading of the export structure. In terms of the absorption capacity of reverse technology spillover in the process of export structure, most scholars have used threshold regression, PSTR and other methods, and the human capital and technology gap are the more studied absorption capacity characterization variables.

To sum up, the influence of reverse technology spillover on export structure is mostly studied by countries, industries (services, manufacturing, technology-intensive industries, etc.) and products, while there are few studies on the comparison of different international technology spillover channels by using panel data of each region of a country. Studies on absorptive capacity mainly focus on the impact of reverse technology spillovers on the upgrading of technological progress and industrial structure. There are few literatures that link the reverse technology spillovers of absorptive capacity with export structure.

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3. Evaluation Index and Model Construction

3.1. Model Construction

In the following equation (1),

$$EXPY_{it} = \alpha_0 + \alpha_1 lnS_{it}^{d} + \beta_1 lnS_{it}^{ofdi} I(q_{it} \leq \gamma) + \beta_2 lnS_{it}^{ofdi} I(q_{it} > \gamma) + \mu_i + \varepsilon_{it} \quad (1)$$

Where, EXPY said the export structure upgrading index, S_{it}^{d} said the domestic independent research and S_{it}^{ofdi}, S_{it}^{fdi} and S_{it}^{im} respectively said the international technology spillover obtained through foreign direct investment, foreign direct investment and import, μ_i is the individual effect of the province and ε_{it} is a random interference item. q_{it} represents the threshold variable,γ represents the threshold value, β_1, β_2 represents the threshold variable in different intervals when the reverse technology spillover effect acts on the estimated parameters of the exit structure optimization. If a double threshold exists, the model can be represented as:

$$lnEXPY_{it} = \alpha_0 + \alpha_1 lnS_{it}^{d} + \beta_1 lnS_{it}^{ofdi} I(q_{it} \leq \gamma_1) + \beta_2 lnS_{it}^{ofdi} I(\gamma_1 \leq q_{it} < \gamma_2) + \beta_3 lnS_{it}^{ofdi} I(q_{it} > \gamma_2) + \mu_i + \varepsilon_{it} \quad (2)$$

3.2. Variable Selection and Processing

3.2.1. Interpreted Variable

$$PRODY_i = \sum_{c \in C} \left\{ \frac{X_{ic} / X_c}{\sum_{j \in C} X_{ij} / X_j} \times Y_c \right\} \quad (3)$$

$$EXPY_c = \sum_{i \in M} \frac{X_{ic}}{X_c} \times PRODY_i \quad (4)$$

$PRODY_i$ and $EXPY_c$ indicates the technical complexity of exports in categories i and region c respectively, Y_c as the per capita GDP in c, and X represents the export volume, thus $\frac{X_{ic}}{X_c}$ indicating the proportion of exports of i products in c, and the $\sum_{j \in C} \frac{X_{ij}}{X_j}$ indicating sum of i products in all regions exporting i products.

3.2.2. Core Explanatory Variable

$$S_{it}^{ofdi} = \frac{OFDI_{it}}{\sum_{i=1}^{n} OFDI_{it}} \times S_{t}^{ofdi} \quad (5)$$

$OFDI_{it}$ is the total foreign direct investment of each province.

3.2.3. Controlled Variable

①Technology spillover from FDI channel and import channel were expressed by FDI and the international R&D capital stock obtained from imports, respectively. ②The research and development capital stock is used to express the level of independent research and development.③Human capital is measured by the average length of education, equal to (number of primary education×6 + middle school education×9 + number of high school education×12 + college education or above×16) / number of 6 years and above.

3.2.4. Absorptive Capacity

The following three absorption capacity characterization variables are selected as shown in Table 1.

Table 1. Absorption Capacity variables

Variable name	Variable definition	unit
Financial services	Loan balance to GDP ratio	%
IPR	Number of IP infringement cases / total number of infringement cases as of 2018	%
Technological gap	Labor productivity ratio, labor productivity = GDP / number of labor force	%

3.3. Data Source

GDP data was derived from the World Bank database. Provincial R&D expenditure was obtained from China Science and Technology Statistics Yearbook. The human capital data comes from the China Education Statistical Yearbook and the China Statistical Yearbook, the loan balance data comes from the Financial Statistical Yearbook, and the amount of patent infringement disputes is collected from the State Intellectual Property Office. The rest of the data are obtained from the National Bureau of Statistics.

4. Empirical Test

The Bootstrap method was used to estimate the number of thresholds, and observing the F values in Table 2 and their probability selected the appropriate threshold regression model. The test results found that the level of financial services and intellectual property protection is a significant single threshold, the level of economic development, nationalization and technological gap are a significant double threshold, and the industrial structure is a significant triple threshold.

Table 2. The threshold regression test

Gate limit variable	Door limit type	F price	P price
Financial services	Single	39.66**	0.0367
	Double	6.83	0.82
	Three	5.67	0.7833
technological gap	Single	11.72	0.4167
	Double	37.66**	0.0167
	Three	10.66	0.28
Intellectual Property protection	Single	22.52**	0.0333
	Double	4.12	0.82
	Three	39	0.9

Note: *, * * and * * * are significant at 10%, 5% and 1%, respectively.

The sum of minimum residual squares was further used to calculate the threshold estimates of each absorptive capacity representation variable and test them, with the threshold regression results obtained.

Table 3. Threshold valuation results

Limit variable, (γ)	estimated value	The 95% confidence interval was used
Financial services	1.05	[1.0373, 1.0569]
IPR	0.0382	[0.0287, 0.0392]
Technical Gap (1)	0.79	[0.7616, 0.7929]
Technical Gap (2)	0.3569	[0.3548, 0.3578]

Table 4. Results of the threshold model regression results

ln export structure	financial service	intellectual property right	technological gap
The ln R&D capital stock	0.0967*** (6.33)	0.1071*** (6.91)	0.1142*** (5.39)
The ln reverse technology overflow			
0	0.1882*** (16.12)	0.1827*** (14.17)	0.1495*** (11.37)
1	0.2022*** (17.96)	0.1901*** (15.53)	0.1533*** (12.21)
2			0.1587*** (12.77)
3			
C	7.7725*** (69.85)	7.8383*** (60.52)	8.2383*** (52.89)
R^2	0.7953	0.7829	0.7510

Note: *, * * and * * * are significant at 10%, 5% and 1%, respectively.

Table 3 shows that the threshold values exist for all the characteristic variables of each absorptive capacity, and all have passed the significance level test, indicating the agreement with the true value. The threshold regression results in Table 4 are analyzed as follows:

Financial services level: the threshold value of 1.05, the sample is divided into two intervals, under the weak financial services level (ln financial services level <1.05), the influence coefficient of reverse technology overflow is 0.1882, when the financial services level across the threshold value, the influence coefficient increased to 0.2022, are positive and reverse technology overflow influence coefficient with the improvement of financial services level, indicating that the financial services level can promote the effect of reverse technology spillover effect on the optimization of export commodity structure growth.

Intellectual property protection: Under the strength of weak intellectual property protection, The influence coefficient of reverse technology spillover effect on the height change index of export structure is 0.1827. The influence coefficient of reverse technology spillover effect on the height index of export structure was increased to 0.1901.

Technology gap: The technology gap is the ratio of the labor productivity of all provinces and cities in China to the labor productivity of the 16 investment regions, and the ratio is less than 1. Therefore, the larger the ratio, the smaller the technical gap. With two threshold values, the technology gap can be divided into three intervals: the high technology gap (<0.3569), the medium technology gap (0.3569 <<0.79), and the low technology gap (> 0.79). The influence coefficients were 0.1459,0.1533, and 0.1587, respectively.

5. Conclusion and Recommendations

The threshold regression results show that there is only one threshold for financial service level and intellectual property protection, and with the improvement of financial service level and the increase of intellectual property protection, the spillover effect of reverse technology in promoting the optimization of export structure is enhanced. There are two threshold limits for the technical gap. The narrowing of the technical gap can enhance the absorption capacity of the reverse technology spillover effect of OFDI, and then promote the optimization of the export commodity structure.

For the research conclusion, the following suggestions are put forward:

1)Enhance the economic strength and government management capacity, improve the laws, strengthen the protection of intellectual property rights, increase the conversion rate of scientific and technological achievements, and provide economic support and legal guarantee for the spillover effect of reverse technology.

2)Continue to adhere to the purpose of "technology-seeking" foreign investment, to invest more in areas with high technical level, but also to improve their own technical level, always adhere to the country through science and education, strengthen education and scientific research expenditure. On the other hand, we should encourage independent innovation, establish a scientific and democratic atmosphere in the academic circle, strengthen the integration of industry, university and research, and strive to cultivate scientific research talents.

3) We should improve the financial and service level, and provide sufficient financial support for scientific and technological innovation through innovative financing. We will continue to deepen financial reform, such as expanding the credit scale and expanding financing channels. We need to allocate good financial resources and adjust the direction of financial services.

References

[1] Todorova,G., Durisin, B. Absorptive capacity: valuing a reconceptualization[J]. Academy of Management Review,2007,32(3):774-786.

[2] Yin Dongdong, Zhang Jianqing. Research on the Reverse Technology Overflow Effect of OFDI in China by--Empirical Analysis Based on the Absorption Ability View [J]. International Trade Issues, 2016 (01): 109-120.

[3] Wang Xueli, Ann Tongxin. Research on the impact of OFDI reverse technology spillover on China's Technological Innovation--threshold panel model analysis based on the Yangtze River Economic Belt [J]. Financial Development Research, 2021 (03): 30-36.

[4] Feng Delen, Bai Yihong. Reverse technology spillover effect and regional innovation capability of OFDI in the Yangtze River Economic Belt [J]. Journal of Anhui University (Philosophy and Social Sciences edition), 2021,45 (01): 115-123.

[5] Li Hong, Wu Dongsong. Influence of OFDI reverse technology overflow on domestic product quality in China [J]. Modern Finance and Economics (Journal of Tianjin University of Finance and Economics), 2020,40 (11): 68-78.

[6] Xiao Weiguo, Lin Qin. Absorption capacity, Chinese reverse technology spillover and industrial upgrading of the US OFDI [J]. Sankei Review, 2019,10 (04): 58-67.

[7] Liu Xiangru, Wu Liping. Industrial upgrading effect of reverse technology spillover of OFDI: PSTR model analysis based on absorption capacity threshold effect [J]. Wuhan Finance, 2020 (08): 56-63.

[8] Ye Jinsong, Fei Wan kiss. An Empirical Study on the Impact of Human Capital on Export Trade [J]. Journal of Fujian University of Administration, 2015 (5): 101-112.

[9] Liu Yingji. An Empirical Analysis of the Impact of Knowledge Capital on the Technology Complex of Manufacturing Export [J]. World Economic Research, 2016 (03): 97-107 + 136.

[10] Jiang Ying, He Caiyin. An Empirical Research on reverse Technology Overflow, Export Technology Complex and Human Capital--Based on Panel threshold Model [J]. Asia-Pacific economy, 2016 (06): 110-117.

[11] Liu Haiyun, Wang Jing. Study on the Impact of OFDI on Export Commodity Structure--An empirical analysis based on provincial panel data from 2007 to 2016 [J]. Price Monthly, 2019 (03): 54-62.

[12] Ning Ye, Cui Xinxin, Wang Jinting. The influence of OFDI reverse technology Overflow on China's export competitiveness by--Empirical Analysis based on the perspective of technology gap [J]. Journal of Northeastern University (Natural Science Edition), 2021,42 (04): 589-597.