Impact of Two-Way FDI on the Industrial Structure in Shandong Province Under the Background of "New and Old Kinetic Energy Conversion"

Zhiqing Xia*, Ge Song, Zahid Hussain

School of Finance, Qilu University of Technology, Jinan 250353, Shandong Province, China

*Corresponding author: Zhiqing Xia, xiazhiqing@hotmail.com

Abstract: This paper uses the panel data of 17 cities in Shandong Province from 2003 to 2018 to construct a panel model to empirically study the impact of foreign direct investment (FDI) on the industrial structure. The results show that two-way investment, financial industry development, and policy variables have significant roles in promoting the advancement of the industrial structure in the province. In the future implementation of the "Going Global" strategy in Shandong Province, the cooperation between two-way investment and the financial industry should be strengthened, the level of regional financial development should be improved, and the impact of two-way investment on the optimization and upgrading of the industrial structure should be reinforced.

Keywords: New and old kinetic energy conversion; Foreign direct investment; Industrial structure transformation

1. Introduction

In recent years, the economy of Shandong Province in China has encountered many problems, such as overcapacity and irrational industrial distribution. Therefore, realizing the resurgence of Shandong's economy through enterprises "going global" is the focus of research. This paper believes that the development of enterprises in the province by "going global" stimulates the macroeconomic variables in the province [1]. Optimizing cross-border investment is one of the keys to new and old kinetic energy conversion, which can promote the transformation and upgrading of industries in the province, improve technological development capabilities, and identify new economic growth points [2].

2. Literature review

In recent years, the effect foreign direct investment (FDI) on the economy of our home country has become a trending topic among local economists. By learning from well-known foreign companies and imitating them, Chinese companies will be able to form good demonstration and competitive effects on other domestic companies; at the same time, there will be a strong upstream and downstream industry linkage effect. The transmission of supply and demand chains will create momentum for upstream and downstream industries as well as promote the development of upstream and downstream enterprises and industries [3]. Jianqing Yang and Zhilin Zhou analyzed the impact of outward (O)FDI in eastern, central, and western

China on the upgrading of local industries; the analysis showed that the OFDI in China has a significant positive impact on the upgrading of local industries [4]. According to the results of the regional analysis, the promotion effect in eastern China is the most significant, while the effect in both central and western regions is not significant. Dongkun Li and Min Deng analyzed the relationship between China's provincial OFDI, spatial spillover, and industrial structure upgrading. In their research, the spatial panel Dubin model was used to carry out empirical analysis. The results showed that local OFDI not only improves the level of local industrial structure rationalization, but also significantly promotes the improvement of the level of industrial structure rationalization in neighboring areas, especially critical provinces through spatial spillover effects [5].

3. Model setting

3.1. Selection of theoretical model

According to the international research and development (R&D) spillover model, proposed by Coe and Helpman, imports and OFDI can absorb advanced technologies and R&D elements, and they are important carriers for the international transfer of technological resources, thereby promoting the technological progress of the home country and the transformation and upgrading of the home country's industries. The formula is as follows [6]:

$$IS = \alpha + \beta_1 S_t^d + \beta_2 S_t^{im} + \beta_3 S_t^{ofdi} + \varepsilon_t \tag{1}$$

where IS represents the level of the industrial structure development of the home country, S^d represents the technology spillover benefit brought about by the capital of the home country, S^{im} represents the reverse technology spillover brought about by imports, and S^{ofdi} represents the reverse technology spillover brought about by OFDI [7].

Model (1) is integrated and modified as follows: (1) in order to determine the spillover benefit of domestic capital to the industrial structure, domestic capital is divided into FDI and domestic fixed asset investment for consideration; (2) in order to prevent the omission of important variables, which would lead to deviations in the regression results, this paper adds the financial industry development level (FD) and the R&D level (RD) of enterprises above designated size as the control variables [8]; (3) in consideration of the impact of the "new and old kinetic energy conversion" macro policy on the industrial structure of Shandong Province, this paper uses "new and old kinetic energy conversion" as a dummy variable to explain the policy's intervention in the industrial structure. The model is as follows:

$$HIS_{i,t} = \alpha + \beta_1 LnGDP_{i,t} + \beta_2 LnFAI_{i,t} + \beta_3 LnIFDI_{i,t} + \beta_4 LnOFDI_{i,t}$$
$$+ \beta_5 LnIM_{i,t} + \beta_6 FD_{i,t} + \beta_7 LnRD_{i,t} + \beta_8 Dum + \varepsilon_{i,t} \tag{2}$$

where HIS refers to high-level industrial structure, GDP refers to gross domestic product (GDP) per capita, FAI refers to fixed asset investment, IFDI refers to foreign direct investment, OFDI refers to outward foreign direct investment, IM is the amount of imports [9], FD represents the level of financial industry development, and RD represents the enterprise's technology R&D level.

3.2. Variable selection and description

The basic data in this paper are derived from the 2003–2018 "Shandong Province Statistical Yearbook," "Shandong Province National Economic and Social Development Statistical Bulletin," and the municipal statistical yearbooks of 17 cities in Shandong Province [10].

The dependent variable is high-level industrial structure (HIS). In the process of upgrading the industrial structure, the added value of the service industry is significantly higher than that of the agriculture industry [11]. Therefore, the degree of advanced industrialization in a region is indicated by the proportion of the total social production of the service industry in that region. The details are shown in formula (3).

$$HIS = Y_3 / Y_2 \tag{3}$$

The independent variables include foreign direct investment (IFDI), social fixed asset investment (FAI), amount of imports (IM), and per capita GDP (GDP), which are all calculated using U.S. dollar as the currency unit of each city's historical flow. For outward foreign direct investment (OFDI), the stock of each city that has been calculated in U.S. dollars since 2003 is used.

With regard to financial industry development level (FD), this study uses "the proportion of non-state-owned sector loan balance to GDP" to indicate the improvement in the efficiency of financial development. With regard to enterprise technology R&D level (RD), the R&D investment per capita of each city is used to express the technology R&D level [12]. This study uses the "new and old kinetic energy conversion" policy as a dummy variable (Dum). Before the policy is implemented (2003–2015), the value is set to "0," but after the policy is implemented (2016–2018), the value is set to "1."

4. Empirical analysis

In order to test the stability of the data, this paper uses LLC in the same root case and ADF-Fisher, PP-Fisher, and IPS in different root cases to perform unit root tests at the same time. The results show that some variables passed the significance test, but some failed. After the first-order difference, all variables passed the significance test. In order to determine whether there is a long-term stable relationship between the original variables [13], this paper uses the Kao test, proving that there is a long-term stable cointegration relationship between the variables. Due to the limitation of the layout, the test results will not be shown here.

Table 1. Regression results

Variable	Model 1	Model 2
	Fixed effect	Fixed effect
LnGDP	0.039 (1.388)	
LnIFDI	0.039*** (3.160)	0.043*** (3.595)
LnOFDI	0.012*** (3.160)	0.008*** (3.216)
LnFAI	0.111** (2.478)	0.058** (2.478)
LnIM	-0.021** (-2.096)	-0.025** (-2.597)
FD	0.189*** (4.259)	0.207*** (4.882)
LnRD	6.5E-07*** (5.064)	6.28E-07*** (4.899)
Dum	0.139*** (9.497)	0.139*** (9.474)
Fixed effect	Cross-section	Cross-section
Adjusted R^2 value	0.937	0.930
Hausman test value	22.555** (0.004)	25.042*** (0.000)
F-value	153.112*** (0.000)	159.091*** (0.000)
n	272	272

Note: (…) refers to the t value, but in Hausman test and F-test, (…) refers to the P-value; *, **, and *** indicate significant at the level of 10%, 5%, and 1%

According to the regression results (**Table 1**), the explanatory variables IFDI, OFDI, FAI, FD, and RD in the model have a significant positive impact on the advancement of the industrial structure, implying that increasing foreign direct investment, outward foreign direct investment, fixed asset investment, financial loan ratio, and scientific research investment can promote the industrialization of Shandong Province. Since 1990, attracting investment has been an effective driving force that boosted the economy of Shandong Province and improved the distribution of Shandong's industries. Since 2001, the Chinese government has implemented the "Going Global" policy [14]. Shandong Province responded to the call, and batches of powerful emerging companies have stepped out of the country and are on the international stage. It is precisely because these companies have absorbed the advanced technology and learned advanced management models abroad, a reverse technology spillover effect has taken place, outdated domestic sunset industries have been eliminated, the transformation of new and old kinetic energy has been realized, and the development of advanced industries in Shandong Province has been promoted. It is worth noting that the rise of the financial industry has accelerated the pace of industrial upgrading in Shandong Province, indicating that in the upgrading process, it is not only necessary to encourage physical enterprises to "bring in" and "go global," but also to optimize the allocation of capital in the financial industry [15].

5. Policy recommendations

(1) We should attach great importance to the impact of foreign investment and the use of foreign capital on industrial structure, continue to encourage and guide companies with international competitiveness to "go global," and cultivate enterprises with certain competitiveness and brand value on the international stage. While focusing on quantity, we should also focus on quality and enhance the independent innovation capabilities of enterprises. At the same time, various preferential policies should be introduced to attract powerful foreign companies to invest and compete with domestic companies; however, their focus must be transformed from the original "quantity-centered" to "quality-centered."

(2) Not only should we expand the scale of domestic and foreign financial markets, but the efficiency of financial markets should also be improved, and better financial services should be provided for overseas investment by enterprises. The financial industry should not only be a catalyst for the optimization and upgrading of the industrial structure of overseas investment, but also further reform the differentiated regional financial development strategy and focus on supporting independent innovative enterprises to "go global," so as to promote domestic industrial upgrading and technological progress.

Disclosure statement

The authors declare no conflict of interest.

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