



# Analysis on the Influencing Factors of OFDI by Jiangsu Province in China

Yu Xinyue <sup>a</sup>, Zhang Jifeng <sup>a\*</sup> and Wang Hongrui <sup>a</sup>

<sup>a</sup> Business School of Jiangsu Ocean University, Lianyungang, China.

## Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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## ABSTRACT

As a big economic province in China, Jiangsu takes the lead in opening to the global market. Both the stock and flow of OFDI in Jiangsu are among the best in China, but studies have shown that the imbalance of investment between inter cities has affected the further development of Jiangsu's OFDI. Using spatial econometric analysis method, this paper constructed a spatial lag and spatial error model to study the spatial distribution and influencing factors of OFDI in all cities of Jiangsu province from 2008 to 2018. The results show that: the overall OFDI of all cities in Jiangsu province maintained a rapid growth, showing an upward trend; There are significant differences and positive spatial correlation among different cities. There is a spatial crowding out effect of OFDI. The OFDI is positive with GDP, the number of industrial enterprises, the volume of export trade and IFDI.

Keywords: OFDI; space panel model; influencing factors; Jiangsu.

## 1. INTRODUCTION

Since the reform and opening up, Jiangsu province has grasped the opportunity of opening up to the outside world, vigorously developed the export-oriented economy, and made remarkable achievements. The open economy has played an

extremely crucial role in the economic and social development of Jiangsu Province, and has become an important support for economic growth. As a large open economy province in the east coast, Jiangsu should better and more deeply integrate into the world economy than other provinces in China, shoulder the great

\*Corresponding author: E-mail: zjfhhit@163.com;

responsibility of stabilizing the national open economy, and play a leading and exemplary role for the whole country. The integration into the global market requires not only the integration of the market, but also the integration of the industry and the integration of production factors, which requires Outward Foreign Direct Investment (OFDI). Since China put forward the "going global" strategy in 2000, Jiangsu's OFDI has entered a period of rapid growth. In 2003, Jiangsu's OFDI flow was only 0.025 billion dollars, which increased to 6.14 billion dollars in 2013, and reached the all-time high of 14.22 billion dollars in 2016. During 2017-2019, it declined to 8.95 billion dollars in 2019. From the above data, it can be clearly seen that Jiangsu province has developed from the initial focus on foreign capital inflow to a new period of strategic layout of two-way investment focusing on both capital inflow and capital outflow. It is of great significance to explore the spatial distribution of FOREIGN direct investment in Jiangsu province in the new period and analyze and study its influencing factors for improving the level of opening up to the outside world and promoting the high-quality development of economy in Jiangsu Province.

The remainder of the paper proceeds as follows. In the section 2, we provide a brief overview of research area. Section 3 introduces the methodological framework and data description. Section 4 presents the empirical analysis results. Section 5 is conclusion and policy recommendations.

## 2. LITERATURE REVIEW

### 2.1 Research on the Spatial Effect of OFDI

A multinational company may follow a strategy of complex integration which set up its vertical chain of production process across countries to exploit the comparative advantages of various locates. This suggest that OFDI decisions are multilateral in nature and may be affected by the third countries. Some studies have discussed about the influence of potential spatial effects on outward FDI decision. Blonigen et al. [1] used US outward FDI to a panel of OECD countries from 1980 through 2000, found evidence consistent with export platform FDI in Europe. Baltagi et al. [2] estimate a "complex FDI" version of the knowledge-capital model of U.S. outward FDI, and found spatial effects are significant [3]. Garretsen and Peeters [4] used a spatial lag

model to assess the importance of spatial linkages for Dutch FDI to 18 host countries, and found that complex investment had agglomeration in space. By utilizing a panel data set that consists of real FDI stocks for 476 country pairs for the years 1994-2004 and a distance weighted spatial matrix, Hall & Petroulas [5] found significant spatial effects.

With the development of China's OFDI, studies on the spatial effect of China's OFDI are gradually increasing. Cheng Huiyang, Yu Xiang [6] proved by constructing a gravity model that the sum of economic scale, per capita national income level and bilateral trade volume of the investor country and the host country are positively correlated with the international direct investment flow between the two countries. Zheng Lei and Liu Zhigao [3] analyzed China's spatial pattern of OFDI in countries along the "Belt and Road" and pointed out that differentiated spatial investment strategies should be implemented according to the economic development realities of China and countries along the "Belt and Road". Ma Shuzhong and Liu Mengheng [7] empirically tested the spatial effect of OFDI in third countries by using panel data of China and 42 countries along the Belt and Road from 2003 to 2014, and the research results showed that China's OFDI in countries along the Belt and Road had a significant third-country crowding out effect. Xiong Bin and Wang Mengjiao [8] analyzed the influencing factors of China's OFDI on countries along the "Belt and Road" from 2005 to 2015, and pointed out that China's OFDI was significantly affected by the third-country effect, which was manifested as spatial agglomeration. Bian Jing, Zhang Wei proved through empirical analysis that the import effect and export effect of China's direct investment in countries along the "Belt and Road Initiative" are significantly positive. Yang Lizhuo and Liu Xuejiao [9] analyzed the influencing factors of China's OFDI location choice based on the OFDI data of 111 countries or regions in China from 2004 to 2013 based on institutional endowment and factor environment.

### 2.2 Research on FDI in Jiangsu Province

There are few studies on the spatial effect of Jiangsu OFDI by domestic scholars, which mainly focus on the impact of OFDI on industrial upgrading and economic development. Using geographical information system (GIS) spatial analysis and SPSS correlation analysis methods, Shi et al.[10] analyzes the change in the spatial

distribution of OFDI enterprises in the Yangtze River Economic Belt and found OFDI has been gradually changing with technological innovation capability, urbanization level, economic development level, technological innovation capability, and degree of economic openness. By establishing VAR model, Zhao Ming and Zhang Rong found that there was a long-term equilibrium relationship between Jiangsu OFDI and industrial structure. And OFDI was negatively correlated with the development of the secondary industry and positively correlated with the development of the tertiary industry. CAI Hongzhi studied the relationship between OFDI and industrial structure upgrading in the context of supply-side reform, and proposed several countermeasures and suggestions for promoting industrial optimization and upgrading in Jiangsu Province by USING OFDI. Sun Yajun took Jiangsu province as an example to study OFDI of countries along the belt and Road, combined OFDI with GVC embedment, and deeply discussed the influence between Jiangsu's OFDI and GVC embedment. Zhang Jifeng et al. [11] point out that the scale of OFDI in Jiangsu is relatively small, and the performance of OFDI still needs to be improved.

To sum up, current studies on the spatial effect of OFDI are mainly focused on the national level. As for Jiangsu Province, the research focuses on the relationship between OFDI, industrial structure and economic growth, and there are few specific studies on the spatial layout and influencing factors of OFDI in Jiangsu Province. Therefore, this paper makes the following assumptions: first, cities in Jiangsu province had a positive spatial correlation. Second, there is crowding out effect of OFDI between cities in Jiangsu Province. Last but not least, the OFDI is positive with GDP, the number of industrial enterprises, the volume of export trade and IFDI. To test the above hypothesis, this paper used spatial econometric analysis method to analyze the OFDI data of cities in Jiangsu Province from 2008 to 2018, calculated the global Moran's I statistics, described the Moran's I scatter diagram, studied the influencing factors of OFDI, and put forward relevant policy suggestions based on the empirical results.

### 3. METHODOLOGICAL FRAMEWORK AND DATA DESCRIPTION

#### 3.1 Spatial Autocorrelation Analysis

First perform unit root test on OFDI data before testing spatial correlation. And the test results are as follows. The results show that OFDI is a stationary series.

After unit root test, this paper tests the existence of OFDI spatial correlation. Two statistics are often used in spatial statistics: Moran's I proposed by Moran and Geary's C proposed by Geary. Compared to Geary's C, Moran's I is less susceptible to deviations from the normal distribution, so Moran's I is mostly used in related research. Therefore in this paper, Moran's I statistic is selected to test whether the spatial correlation of OFDI exists in Jiangsu province. Moran's I is defined as[12]:

$$I = \frac{n \sum_{i=1}^n \sum_{j=1}^n W_{ij} (y_i - \bar{y})(y_j - \bar{y})}{S^2 \sum_{i=1}^n \sum_{j=1}^n W_{ij}}$$

In the above formula,  $y_i$  represents the observed value of OFDI in region  $i$ ,  $n$  is the total number of regions, and  $W_{ij}$  is the binary weight matrix of adjacent space. The general adjacency weight matrix is adopted in this paper.  $W_{ij}$  is defined as 1 when any city  $i$  and another city  $j$  in Jiangsu province are adjacent, and 0 when they are not adjacent. A city is not adjacent to itself, so a symmetric matrix of  $13 \times 13$  whose main diagonal elements are all 0 is formed [13]. Moran's I varies in the range  $(-1, 1)$ , and if there is no spatial autocorrelation, the expected value of  $I$  is close to 0. When  $I$  is positive, positive autocorrelation exists. When  $I$  is negative, negative autocorrelation exists. Meanwhile, the significance of autocorrelation is tested by constructing statistic  $Z$ . In this paper, OFDI data of cities in Jiangsu province from 2008 to 2018 were selected for spatial analysis, and Moran's I statistics and corresponding P values were calculated. The spatial weight matrix  $W$  was the spatial adjacency matrix mentioned above. The calculation results are in Table 1.

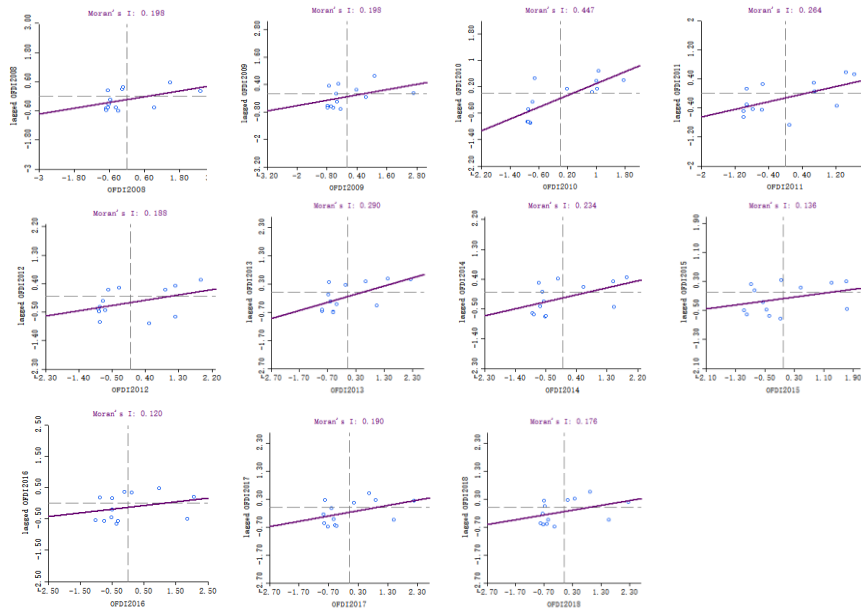
**Table 1. The Unit Root Test Results**

Testing method	LLC	IPS	Fisher
$\Delta \ln OFDI_{it}$	-4.5727*** (0.000)	-3.9331*** (0.000)	-3.7572*** (0.000)

**Table 2. Moran's I index of OFDI in all cities in Jiangsu Province**

year	2008	2009	2010	2011	2012	2013
Moran's I (OFDI)	0.198**	0.198**	0.447***	0.264**	0.018**	0.289**
year	2014	2015	2016	2017	2018	
Moran's I (OFDI)	0.234**	0.136	0.120	0.190*	0.173*	

\*Note: Robust standard errors are in parentheses, \*\*\*, \*\* and \*, respectively, are significant at 1%, 5% and 10%



**Fig. 1. Scatter Plot and LISA Analysis**

\*Note: Scatter plot calculated by Genda

### 3.2 Moran's I Scatter Plot and LISA Analysis

As can be seen from Table 2, during 2008-2018, the corresponding statistic P value of OFDI of cities in Jiangsu Province was very small. Except 2015 and 2016, the Moran's I are significant in all other years, and Moran's I statistic was significantly positive, indicating that OFDI of cities in Jiangsu province had a positive spatial correlation, that is, spatial aggregation.

Through the regression line, it can be seen that the scattered points in the figure are positively correlated, which is consistent with the calculation result of Moran's I statistic, indicating that OFDI of all cities in Jiangsu province has spatial aggregation.

Based on the above research, it is possible to further study the factors affecting OFDI in various cities in Jiangsu by constructing a spatial model.

### 3.3 Spatial Lag Model (SLM) and Spatial error Model (SEM)

The explained variable studied in this paper is the direct investment of cities in Jiangsu province, which is expressed by flow. Considering the spatial autocorrelation of the explained variables, the interaction term of third-party OFDI and geographical weight  $W$  was added to the explanatory variables. And the spatial lag model (SAR) was constructed as follows:

$$OFDI_{it} = \alpha_0 + \alpha_1 POP_{it} + \alpha_2 GDP_{it} + \alpha_3 CUS_{it} + \alpha_4 IND_{it} + \alpha_5 EXP_{it} + \alpha_6 IFDI_{it} + \rho \cdot W \cdot OFDI_{it} + \varepsilon$$

$\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6$  respectively represent the influence coefficient of each explanatory variable on the explained variable.  $\rho$  is the spatial lag coefficient, and it measures the degree and direction of the influence of a cities'

neighboring cities' OFDI on the explained variables.

If the spatial dependence exists in the perturbation term, that is, the missing variables that are not included in the explanatory variable and have an impact on the dependent variable have spatial correlation, it can be tested by constructing a spatial error model (SEM):

$$OFDI_{it} = \alpha_0 + \alpha_1 POP_{it} + \alpha_2 GDP_{it} + \alpha_3 CUS_{it} + \alpha_4 IND_{it} + \alpha_5 EXP_{it} + \alpha_6 IFDI_{it} + \varepsilon$$

$$\varepsilon = \lambda W \varepsilon + \mu$$

$\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6$  respectively represent the influence coefficient of each explanatory variable on the explained variable.  $\lambda$  is the spatial error coefficient to be estimated, which reflects the influence degree and direction

of other unmeasured factors of OFDI in Jiangsu cities on the explained variable.

The meanings and data sources of variables in the model.

### 3.4 Regression Analysis

In this paper, spatial lag model (SAR) and spatial error model (SEM) are used to test the influencing factors of OFDI of cities in Jiangsu Province, and the fixed effect model is selected. The regression results of the full-sample spatial panel fixed effect model are shown in the Table.

The spatial coefficient ( $\rho$ ) in the SAR model is negative at the level of 10%, indicating that OFDI of other cities is competitive with OFDI of current cities, resulting in crowding out effect. The spatial error term ( $\lambda$ ) of the SEM model is also significantly negative at the level of 10%, which indicates that the third unpredictable factor not included in the explanatory variable also has a crowding effect on the OFDI of cities in Jiangsu Province.

**Table 3. Meanings and Data Sources**

Variables	Meanings	Data Sources
LnOFDI	Outward FDI (flow)	Jiangsu Statistical Yearbook
LnPOP	population	Jiangsu Statistical Yearbook
LnGDP	GDP	Jiangsu Statistical Yearbook
LnCUS	Retail sales of social consumer goods	China City Statistical Yearbook
LnIND	Number of industrial enterprises	China City Statistical Yearbook
LnEXP	Export trade volume	Jiangsu Statistical Yearbook
LnIFDI	Inward FDI (flow)	Jiangsu Statistical Yearbook

**Table 4. Regression Results of Spatial Panel Models**

Variables	OLS	SAR	SEM
$\rho$	-	-0.0594* (0.0260)	-
$\lambda$	-	-	-0.0705* (0.0357)
LnPOP	-10.94** (4.594)	0.545 (0.359)	0.603 (0.410)
LnGDP	0.356*** (0.108)	0.431*** (0.174)	0.467*** (0.172)
LnCUS	3.110*** (0.413)	0.162 (0.494)	0.131 (0.492)
LnIND	-0.863 (0.529)	1.330*** (0.482)	1.352*** (0.494)
LnEXP	-0.359 (0.336)	0.538* (0.314)	0.558* (0.325)
LnIFDI	2.004*** (0.617)	0.759** (0.353)	0.715* (0.372)
_cons	17.57 (25.39)	-	-
sigma2_e	-	0.617*** (0.119)	0.615*** (0.115)
Log-Likelihood	-	-168.2444	-168.2176
N	143	143	143
R2	0.631	0.651	0.660

\*Note: Robust standard errors are in parentheses, \*\*\*, \*\* and \*, respectively, are significant at 1%, 5% and 10%. There are 13 cities in Jiangsu Province. And the time span is 2008-2018, so N=143

Secondly, GDP of cities in Jiangsu province is significantly positive at the level of 1%, indicating that cities with higher GDP have more OFDI. To a certain extent, GDP represents the economic strength of the city and its high economic level, thus it has a high ability of foreign direct investment. The number of industrial enterprises is significantly positive at the level of 1%, which indicates that the more the number of local industrial enterprises, the more their outbound investment [14-17]. The more industrial enterprises the city has, the higher the industrial level, the stronger the economic strength and the better foreign investment capacity. Export volume is significantly positive at the level of 10%, foreign investment attraction is significantly positive at the level of 5% in SAR model and 10% in SEM model, respectively, indicating that export trade, foreign investment attraction and OFDI are positively correlated, that is, the stronger the export capacity is, the more foreign investors are attracted, the more OFDI is.

#### **4. CONCLUSION AND POLICY RECOMMENDATIONS**

##### **4.1 Conclusion**

In this paper, the spatial econometric analysis method was used to study the OFDI level of cities in Jiangsu Province, and the conclusion was drawn that there was spatial aggregation of OFDI in cities in Jiangsu Province, and the aggregation space was classified and summarized. Through the establishment of SAR and SEM spatial econometric models, the factors affecting the LEVEL of OFDI are studied. The results show that: first, there is a positive spatial correlation between the OFDI of each city in Jiangsu Province, and the OFDI of this city is competitive with the surrounding cities, resulting in crowding out effect. Second, the coefficients of GDP, number of industrial enterprises, export volume, foreign investment attraction and other variables of each city are significantly positive, which indicates that the higher the GDP level is, the stronger THE IFDI capacity is, and the cities with stronger export capacity have more OFDI. Thirdly, the OFDI level of different cities in Jiangsu varies greatly. The OFDI capacity of southern Jiangsu is stronger than that of northern Jiangsu, and there are many factors affecting the OFDI level, such as GDP, foreign trade volume, and foreign direct investment flow.

##### **4.2 Policy Suggestions**

Based on the above theoretical analysis and empirical test, this paper puts forward the following suggestions on effectively promoting the OFDI level of cities in Jiangsu Province.

First, Jiangsu province should pay attention to the regional balanced development of OFDI. The government should strengthen legislative work and provide policy support and a good legal environment for enterprises to "go global"; relevant support policies should be tilted towards high-tech industries such as machinery manufacturing and new energy. In the selection of investment destination countries, enterprises are encouraged to invest and cooperate with countries with advanced technology level to realize the technology feedback effect of OFDI. Northern Jiangsu should give full play to the advantages of Xuzhou as a transportation hub and Lianyungang as a city supported by the "Belt and Road" strategy to improve THE OFDI level. Nanjing gives full play to its role as the provincial capital city and takes advantage of its rich university resources and enterprise advantages to drive the development of surrounding cities so as to promote the overall balanced development of OFDI level in all cities in Jiangsu Province.

Second, develop clustered OFDI. Industrial optimization can accelerate the development of a single enterprise to achieve a combined overall industry. In order to enhance the industrial advantage, the optimized enterprise should be technologically transferred, which can improve the OFDI income and project success rate, expand the scale of the enterprise, and enhance the ability of the enterprise to resist risks.

Third, Jiangsu province should "go out" with a high level to promote high-quality "bring in". As two directions of internationalization. OFDI and IFDI show significant positive interaction in economic development. Municipal enterprises in Jiangsu province are highly complementary and have great potential for cooperation. Through foreign investment, cities in Jiangsu province have increased industrial docking, and also promoted IFDI from other countries to Jiangsu Province, forming a circular interaction of two-way direct investment, deepening industrial and supply chain cooperation, and realizing high-quality development.

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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