

Research on the Temporal and Spatial Evolution of the Dynamic Coupling and Coordinated Development of Two-Way FDI in Jinan City

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Abstract

Under the background of "dual circulation", to implement the international investment concept of "bringing in" and "going global", it is urgent to realize the coupling and coordinated development of IFDI and OFDI. On the basis of trying to explore the coupling and coordination mechanism of two-way FDI in Jinan City, this paper uses the system coupling evaluation model to measure the coupling degree and coupling coordination degree. The results show that from 2003 to 2020, the coupling degree of two-way FDI in Jinan was at a high level of coupling, but the coupling coordination degree was low.

Keywords: two-way FDI, coupled and coordinated development, space-time evolution

1. Introduction

Since the 18th CPC National Congress, our country has roughly gone through the development stage of "borrowing foreign debts, absorbing foreign capital to two-way investment". The "Thirteenth Five-Year Plan" clearly points out that "going global" and "bringing in" complement each other, so as to make full use of the advantages of the two markets for common development. The report of the 19th National Congress of the Communist Party of China once again emphasized: focusing on the construction of the "Belt and Road", insisting on paying equal attention to "bringing in" and "going global". The coordinated development of Outward Foreign Direct Investment (OFDI) and Inward Foreign Direct Investment (IFDI) is the key to implementing the strategy of "bringing in" and "going global" in China's export-oriented economy, forming a new development pattern in which domestic and international dual circulation promote each other, and promoting high-quality economic growth. It is an important way for quality growth, and it is also an important experience for China to integrate into the international division of labor and participate in global cooperation.

Since the 18th National Congress of the Communist Party of China, combined with the new situation of our country's open economy development, Comrade Xi Jinping has published a series of important expositions on international investment, and put forward the concept of "two-way investment", emphasizing that while insisting on attracting foreign capital, we must vigorously develop foreign, so as to promote the national economy to realize the two-wheel drive of foreign investment and foreign investment. Taking Jinan City as an example, this paper draws a trend graph of IFDI flow and OFDI flow from 2003 to 2020 (in 10,000 US dollars), as shown in Figure 1.

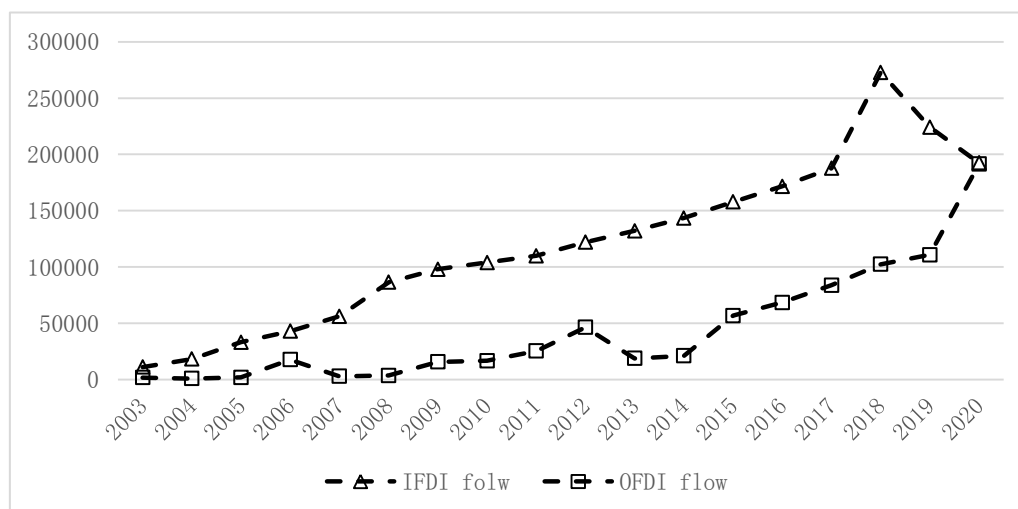


Figure 1. The flow trend of two-way FDI in Jinan

It can be seen that in the past 18 years, both IFDI flow and OFDI flow in Jinan have shown an overall upward trend, and by 2020, OFDI flow has caught up with IFDI flow, showing a strong growth momentum. In this context, what is the interaction between Jinan's Outward Foreign Direct Investment and Inward Foreign Direct Investment? Do they complement each other and develop harmoniously? These issues are worth thinking about and exploring in depth.

2. Literature Review

2.1 Research on the Bidirectional Effect of IFDI and OFDI

In recent years, the two-way research of IFDI and OFDI has gradually increased, such as the construction of IFDI and OFDI interaction items to study the economic effects, environmental effects, and trade effects of two-way investment. There are also scholars who build an intermediate bridge to indirectly study the interaction between the two: in view of the fact that the increase in the investment income deficit will lead to the deterioration of the balance of payments, Hu Lifa and Tang Haiyan (2006) believe that it is necessary to balance the scale of two-way investment. Considering the substitution or complementarity between trade and investment and the dual economic structure of uneven development of urban and rural areas, the differences in the nature of IFDI and OFDI will be affected (Hu, L.-F., & Tang, H.-Y., 2006). Xu Qing and Xian Guoming (2013) sub-regional research considered that vertical OFDI and horizontal IFDI are coordinated in eastern China, and vertical IFDI and horizontal OFDI are coordinated in central China (Xu, Q., & Xun, G.-M., 2013). Based on the technological progress path of the manufacturing industry, Huang Lingyun (2018) and other studies found that there are obvious industry differences and path selection characteristics in the interactive effect of our country's two-way FDI (Huang, L.-Y., Liu, D.-D., & Xie, H.-Q., 2018). In addition, some scholars have directly studied the relationship between the two: Li Hongying (2015) used cointegration technology with structural break to empirically find that there is a cointegration relationship between IFDI and OFDI considering the sudden change of time series structure, and there is no long-term equilibrium relationship between the two (Li, H.-Y., 2015).

2.2 Research on the Coordinated Development of Two-Way FDI

In the research on the coordinated development of two-way investment, Dunning (1981) proposed the International Investment Development Path Theory (IDP theory) and divided it into four stages: when a country's economic level is low, Outward Foreign Direct Investment is almost zero, and Inward Foreign Direct Investment is also at a very low level; with the improvement of domestic economic level, Inward Foreign Direct Investment increases rapidly; after the comprehensive national strength is further enhanced, Outward Foreign Direct Investment continues to increase; becoming a net Outward Foreign Investment country, IFDI and OFDI have reached an advanced balance. Zhang Youwen (2017) believes that in the process of promoting two-way investment layout, attention should be paid to strategic coordination, including the coordinated promotion of investment and trade, the coordinated promotion of national strategies and local strategies, so that Outward Foreign Investment can effectively promote domestic technology and industrial upgrading (Zhang, Y.-W., 2017). Yang Xiaomei and Xiao Hongye (2020) believe that the coordinated development of two-way direct investment

will significantly reduce China's overall capital mismatch and labor mismatch by increasing the level of financial deepening and labor costs, but there are regional differences in the impact (Yang, X.-M., & Xiao, H.-Y., 2020). Song Xiaoling and Li Jinye (2021) found that the current two-way FDI has a significant promoting effect on green economic efficiency, but there is regional heterogeneity; technological innovation has a moderating effect on the green economic effect of two-way FDI (Song, X.-L., & Li, J.-Y., 2021). Xu Jing and Zhou Min (2021) explored the coordinated evolution mechanism of the two-way FDI composite system based on the dual action path of spillover effect and competitive effect, and used the coupling coordination degree evaluation model and the random effect panel Tobit model to respectively measure the space-time pattern and influencing factors of the coupling coordination level of two-way FDI (Xu, J., & Zhou, M., 2021).

To sum up, the current research on the coordinated development of two-way FDI is still in its infancy, and the mechanism of interaction between the two has not yet formed a theoretical system. Scholars at home and abroad generally agree that there is an interactive relationship of coordinated development between IFDI and OFDI, and this relationship can have a certain impact on the economy and society. However, the above studies focus on the macro level. Therefore, this paper attempts to study the dynamic and coordinated development relationship of two-way investment in Jinan City from the micro perspective of a city like Jinan, combined with the current "dual circulation" background, so as to provide policy reference for Jinan to actively participate in international bilateral or multilateral cooperation and continue to adhere to the supplement of "bringing in" and "going global".

3. Analysis on the Interaction Mechanism of Two-way FDI in Jinan

The concept of "Equal emphasis on two-way investment" not only emphasizes the equal emphasis on quantity and quality of IFDI and OFDI, but also pays more attention to the development relationship of coupling and coordination between the two. However, the interaction mechanism between two-way FDI has not formed a mature theoretical system. Based on the relevant research, this paper proposes that the interaction of two-way FDI in Jinan is mainly explained by the spillover effect theory and investment development path theory. Form a coupling and coordination relationship. The spillover effect theory can be explained by direct effects from an industry perspective, while the investment development path theory can be analyzed from a macro perspective by indirect effects. The specific mechanism analysis is shown in Figure 2.

The spillover effect theory holds that both IFDI and OFDI can directly promote each other through intra-industry and inter-industry spillover effects. (1) In the industry, the spillover effect of IFDI mainly promotes the foreign investment of host country enterprises through the "demonstration effect and the "competitive effect". The combined effect of the "demonstration effect and the "competitive effect" brought by IFDI enables domestic enterprises to actively or passively participate in transnational operations. IFDI spillover effects may also occur between industries, that is, between vertical supplier firms. On the one hand, local enterprises enter the global production chain of multinational corporations as demanders or suppliers, learn and improve their own production technology and management methods, and then acquire the ability of foreign direct investment. On the other hand, as part of the global production chain of multinational corporations, host country enterprises will also support multinational corporations abroad through foreign direct investment, and further integrate into the global value chain of multinational corporations. As the later participants of the global production network, the host country enterprises have acquired relevant knowledge and improved their ability to participate in international production by becoming the suppliers of mature multinational companies in the host country market. (2) Outward Foreign Direct Investment can increase the profitability of multinational enterprises. On the one hand, it intensifies internal competition in the domestic industry, enables enterprises in the industry to carry out innovation activities, improves total factor productivity, and attracts more foreign investment; On the other hand, among industries,, multinational enterprises participating in the global production chain need vertical suppliers that can participate in global production, forcing domestic upstream and downstream enterprises to strive to improve their own strength, so as to attract foreign investment.

In the research on the coordinated development of two-way investment, Dunning (1981) proposed the International Investment Development Path Theory (IDP Theory), which holds that developing countries can improve their ability to invest abroad by attracting foreign capital, and on the other hand, they can improve their ability to attract foreign investment by foreign investment.

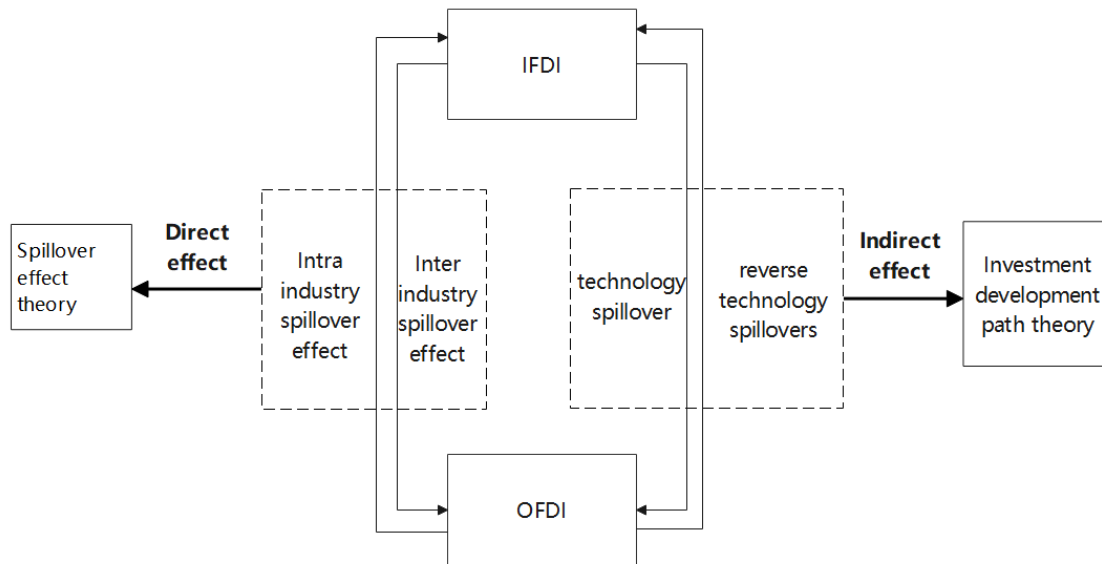


Figure 2. The interaction mechanism of two-way FDI in Jinan

4. Empirical Analysis

4.1 Data Sources

The research interval of this paper is from 2003 to 2020. The reason why it started in 2003 is that the Ministry of Commerce of Shandong Province only began to publish data related to foreign direct investment in 2003. Both IFDI data and OFDI data are from Shandong Statistical Yearbook. Among them, IFDI adopts the data of actual investment amount, OFDI data adopts the annual agreement investment amount from 2003 to 2011, and adopts the foreign actual investment amount from 2012 to 2020.

4.2 Variable Selection

Based on the standard theoretical system of the system coupling evaluation model, combined with the connotation of the coordinated development of the two-way FDI coupling in Jinan, and drawing on the research of Xu Jing and Zhou Min, this paper constructs a comprehensive evaluation index system for the two-way FDI coupling coordination degree from the two dimensions of scale and benefit (see Table 1).

Table 1. Evaluation system of two-way FDI coupling coordination degree

Subsystem	First -level indicator	Secondary indicator	Unit
IFDI system	Scale indicator	IFDI flow amount	Ten thousand yuan
		Per capita IFDI flow amount	yuan
	Benefit indicator	Proportion of IFDI flow to GDP	%
OFDI system	Scale indicator	OFDI flow amount	Ten thousand yuan
		Per capita OFDI flow amount	yuan
	Benefit indicator	Proportion of OFDI flow to GDP	%

Both IFDI and OFDI choose actual flow as a variable to objectively reflect the reality of capital input and capital output in Jinan. Since the units of OFDI and IFDI are both 10,000 US dollars, this paper uses the annual average price of the RMB exchange rate to convert the US dollar data into RMB for accounting, and the exchange rate comes from the People's Bank of China.

4.3 Model Settings

Coupling theory is derived from physics, and usually refers to the dynamic interaction between two or more

systems through interaction and influence to produce coordination effect. Although the theory comes from natural disciplines, more and more scholars have used it in the study of economics and management in recent years. According to the above interaction between IFDI and OFDI, referring to the practice of (Huang Lingyun et al., 2018), the coupling coordination model can be used to calculate and analyze the coupling degree and synergy degree of the two.

According to the concept and model of Capacitive Coupling in physics, the value of system coupling is denoted as C . In view of the concept of "bringing in" and "going global", IFDI and OFDI should be equally important. Therefore, this paper constructs the following functional expression of the system coupling degree C as:

$$C = 2 * \frac{\sqrt{IFDI * OFDI}}{IFDI + OFDI} \quad (1)$$

The coupling degree $C \in [0,1]$, and the larger the value of C , the greater the degree of mutual influence of the system, and the stronger the coupling effect. Referring to relevant research, the coupling degree stages are divided as shown in Table 2.

Table 2. System coupling degree stage division

Stage	status description
$C=0$	The coupling degree is very small, there is no connection between the subsystem and the disorderly development
$0 < C \leq 0.3$	Low-level coupling
$0.3 < C < 0.5$	The system is in the rivaling stage
$0.5 \leq C < 0.8$	The system enters the running-in stage
$0.8 \leq C < 1$	The system is in a high-level coupling stage
$C=1$	Benign coupling resonance and tending to new ordered structure

The coupling model reflects the strength of the interaction between the systems. The coupling between the systems is high but the coordination is not necessarily within the system. It is difficult to reflect the overall efficacy and coordination effect of the interaction between the two only by the coupled model. In order to judge the coordination degree of the two interlaced coupling, the coordination degree model of the system is constructed:

$$D = \sqrt{C * T} \quad (2)$$

$$T = a * IFDI + b * OFDI \quad (3)$$

In formula (2), C is the coupling degree, and T is the comprehensive coordination index of "two-way FDI", which reflects the overall synergistic effect of IFDI and OFDI. In formula (3), D is the coordination degree. where, $T \in (0,1)$ to ensure $D \in (0,1)$. a and b are the contribution coefficients of IFDI and OFDI. Since two-way FDI is very important in this paper, and $a+b=1$, it is assumed here that $a=b=0.5$. The coordination degree is divided into four stages, as shown in Table 3.

Table 3. Division of System Coordination Degree Stages

Stage	status description
$0 < D \leq 0.3$	Low-degree coordination
$0.3 < D \leq 0.5$	Moderate coordination
$0.5 < D \leq 0.8$	High coordination
$0.8 < D < 1$	Extreme coordination

4.4 Coupling and Coordination Analysis

In this paper, the coupling degree C of two-way FDI in Jinan is calculated by formula (1), and the coupling relationship between the two systems is further examined. The results are shown in Figure 3.

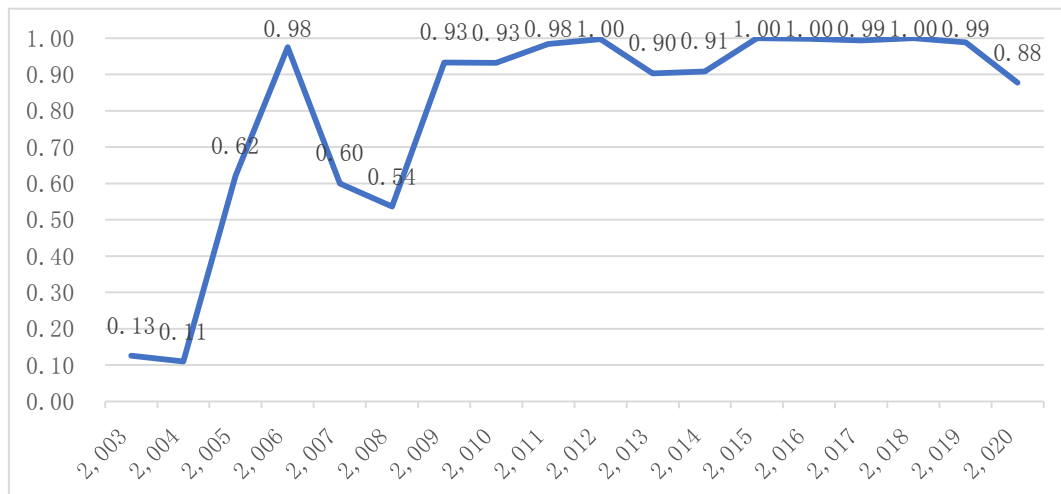


Figure 3. Variation trend of two-way FDI coupling in Jinan from 2003 to 2020

As can be seen from Figure 3, from the overall situation of Jinan City, the coupling degree of two-way FDI is in the range of 0.1-1, indicating that the two systems of IFDI and OFDI have been in the running-in stage; and the coupling degree shows an upward trend. It has increased from 0.11 in 2003 to 1 in 2020, and since 2009, the coupling degree is greater than 0.8, indicating that the interaction between two-way FDI in Jinan is strong and a high level of coupling has been achieved.

In this paper, the coordination degree D of two-way FDI in Jinan City is calculated by formula (2) and formula (3), and the coordination and interaction relationship between the two systems is further examined. The results are shown in Figure 4.

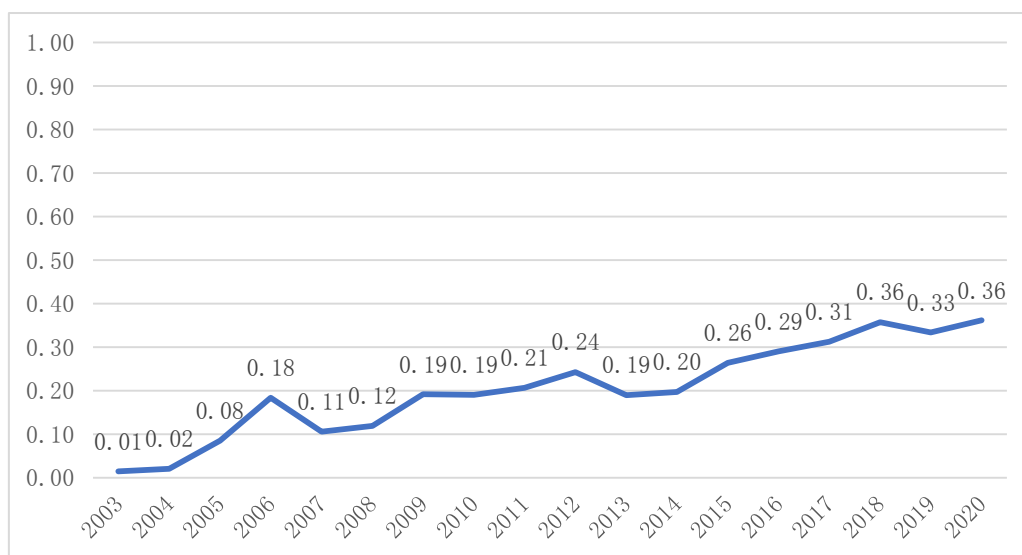


Figure 4. Variation trend of two-way FDI coupling and coordination degree in Jinan from 2003 to 2020

It can be seen from Figure 4 that on the whole, the coordination degree of two-way FDI coupling in Jinan is low, with a maximum value of 0.36 and a minimum level of only 0.01; and from 2003 to 2016, it was in a low degree of coordination; from 2017 to 2020, It is in a state of moderate coordination, showing an overall upward trend, indicating that although the coupling degree of interaction between the two-way FDI systems in Jinan is high, the coordination effect of the system is poor. The IFDI system and the OFDI system failed to form a positive interactive impact. All parties need to consider comprehensively, take multiple measures, take precise measures, and continuously promote the implementation of the strategy of "bringing in" and "going global".

5. Conclusions and Policy Recommendations

Using the data of Bilateral international direct investment from 2003 to 2020, this paper uses a systematic coupling evaluation model to measure the coupling degree and coupling coordination degree of two-way FDI, trying to describe the interaction between IFDI and OFDI. The results show that: From 2003 to 2020, the coupling degree of two-way FDI in Jinan was in a high coupling stage; the coupling coordination degree was low, and only entered a moderate coordination state in 2017, indicating that the development of IFDI and OFDI in Jinan was not synchronized, and the two systems did not form a positive interaction effect.

Based on the above conclusions, this paper puts forward the following policy suggestions: (1) Improve the "direct effect" and "indirect effect" of the coordinated development of two-way FDI, and promote the coupled and coordinated development of the two. Fully exploit the cooperation opportunities in bilateral and multilateral economic and trade relations, promote the continuous increase of two-way FDI, pay attention to the smooth channels of "direct effect" and "indirect effect", enhance the overall spillover effect of coordinated development between IFDI and OFDI, promote the combination of the international capital input and output, better implementation of the "introduction to" and "going global" strategy, We will boost high-quality economic development. (2) Continue to promote the high-quality development of OFDI and IFDI. On the one hand, taking the "Belt and Road" construction as an important opportunity, actively use platforms such as free trade agreements and overseas economic and trade cooperation zones to carry out cross-border cooperation, fully release the policy dividends of trade and investment liberalization and facilitation, and improve the international operation capabilities of enterprises; on the other hand, pay attention to the level and quality of foreign investment, actively encourage foreign investment to participate in high-quality development industries and industries, and realize the scientific distribution and optimal allocation of IFDI and OFDI in different industries and regions.

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2021 Jinan philosophy and social science topics: Jinan two-way FDI coupling coordinated development and economic growth: one-way driver or two-way driver? - Research based on the perspective of "dual circulation" perspective, topic number: JNSK21C50.

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