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The Investment Development Path Theory: Evidence from China

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***Abstract*:** During past the decades, the inward and outward FDI of China increased rapidly, and China became the net outward investor since 2015. Using the time series data of Chinese FDI stocks from 2003 to 2018 and the panel data of 281 cities, this paper studies the investment development path (IDP) model through a single variable polynomial function and a panel correction standard error model. The result shows that China had entered the early stage 4 of the investment development path in 2016 and has confirmed the U-shaped relationship between net outward investment position (NOIP) and GDP per capita. The subsample analysis shows that the IDP of Beijing-Tianjin-Hebei Urban agglomeration lags behind that of the Pearl River Delta and Yangtze River Delta. Besides, the IDP is also U-shaped and is ahead of economic development.

***Keywords*:** FDI, IDP, Net Outward Investment, Urban Agglomeration, U-shaped

INTRODUCTION

Since the early 1990s, China has been successful in attracting inward foreign direct investment (IFDI) from the outside world and became the second-largest recipient of FDI flows in 2016. In 2020, China surpassed the U.S. for the first time to become the largest foreign capital inflow country. At the same time, after the "Go Globally" strategy was put forward in 2000 by former Chinese President Jiang Zemin, it was first explicitly proposed as one of the four new national strategies (others are the Great Western Development Strategy, the

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Urbanisation Strategy, and the Talent Strategy). Then, China's outward foreign direct investment (OFDI) has rapidly developed rapidly. In 2015, China's OFDI reached 145.67 billion US dollars after the continuous rapid growth for 13 years, which was just less than the 299.96 billion US dollars by the United States. Since then, the flow of China's OFDI (145.67 billion) exceeded its IFDI (135.60 billion), which indicates that China had become a net outward investor.

As mentioned in the literature, the investment relationship between IFDI and OFDI is a somewhat complex, rather than a simple one-way relationship (Stoian, 2013; Yao, et al., 2016; Bord et al., 2019; Chen, et al., 2020). In fact, the OFDI of China has grown faster than its IFDI over the last two decades, owing to the rapid economic development. Using the IFDI and OFDI data from prefecture-level cities in China, this study examines the relationship between per capita net outward investment and the PGDP (per capita GDP). Besides, it also tests the applicability of IDP theory in China.

The remainder of this paper is organised as follows. Section 2 reviews the literature of the IDP theory. Section 3 presents the research model and methodology for empirical analysis implicated in this study. Section 4 shows the results of the basic empirical analysis. A further test of the IDP hypothesis based on city-level panel data is listed in section 5. Finally, conclusions and suggestions are listed in Section 6.

2. LITERATURE REVIEW

According to the IDP theory, there exists a close relationship between the net FDI of a country and its domestic economic development level. The investment development path is always U-shaped or J-shaped, and it can be described by a quadratic function (Dunning, 1981). In the common form of the IDP theory, countries always progress through five different stages. It progresses along the IDP curve according to the varying conditions of a country's location related advantages (such as quality and quantity of labour, the access to target markets, etc.), and the changes in domestic firms' ownership-related advantages (Dunning, 1986; Pan, et al., 2015; Chen & Chen, 2015; Nayyar & Mukherjee, 2020). Because of the specific economic structures, the position and shape of the investment development paths vary across individual countries (Durán & Úbeda, 2001; Bellak, 2001; Durán & Úbeda, 2005; Stoian, 2013; Djokoto and Pomeyie, 2021).

In the empirical studies, IDP theory has been tested by many scholars in various groups of countries. Buckley and Castro (1998) tested the IDP

paradigm for Portugal and found that IDP did not follow a quadratic function, but a polynomial function. Barry et al. (2003) found that the outflows of FDI from Ireland had increased more sharply than its inflows, which is consistent with the IDP concept. The IDP model has also been used as a common research framework for studies in various developing countries. Using annual FDI data between 1980 and 2006 from Brazil and China, Goldstein and Pusterla (2010) found a close relationship between the NOIP and per capita GDP. The results showed that both China and Brazil were moving towards the third stage of their investment development path. Using time-series data from 1991 to 2006, Verma and Brennan (2011) checked the applicability of IDP theory in India, but they found that the NOIP of India failed to fit the IDP model.

With the rapid increment in OFDI, the IDP of China has received more and more attention in the academic field (Song, et al., 2022; Rabe, 2022). However, only a relatively small number of studies have been conducted on China's IDP. Using annual data from 1979 to 2005, Marton and McCarthy (2007) used a fourth-order single variable polynomial function to demonstrate the form of IDP in China. And they concluded that China had already entered the 3rd stage of the IDP. Using FDI data for 17 developing countries and China respectively, Shen and Bao (2013) found that there is no empirical evidence supporting the IDP concept in developing countries. However, they found evidence that indicated China was already in stage 3 of the IDP and China's NOIP was still lagging its domestic economic development. Jiang (2014) found the relationship between NOIP and the GDP per capita of China was in accordance with a J curve from 1982 to 2009, and China began to enter the 3rd stage of IDP in 2007. Based on the time series data of Chinese FDI stock and the panel data of 31 provinces, Gao and Lu (2020) analysed the impact of digital connection on China's IDP and found that China had already entered the early stage 4 of the IDP, which was ahead of the economic development. This study proved that China had moved from stage 3 to stage 4 along the IDP after the rapid development of OFDI. However, the data they used were just at the provincial level and they did not conduct a subregional analysis.

Previous literature on IDP in China mostly tests the IDP stage by using a single variable polynomial function. In this study, we have attempted to conduct research from the following aspects. First, China's IDP at the national level was tested using time series data, as well as the regional IDP of the three main urban agglomerations (Beijing-Tianjin-Hebei region, the Pearl River Delta and the Yangtze River Delta) were examined. Second, based on the prefectural city level

data, the nonlinear relationship between China's NOIP and GDP per capita was tested using a panel correction standard error model, instead of the commonly used linear function or single variable polynomial function. Finally, the sub-regional IDP curves in the three main urban agglomerations were investigated respectively. Testing the investment development position of China's OFDI and IFDI can provide a theoretical basis for the Chinese government to improve the policy system for high-level opening-up and high-quality development.

Therefore, based on the common IDP hypothesis, this study established a dynamic relationship between a country's NOIP and per capita GDP (Dunning & Narula, 1996). This raises a key research question of whether China's NOIP can be predicted by its per capita GDP. If it can be predicted by the PGDP, and whether their relationship satisfies the quadratic specification and which stage of the path China's NOIP is currently located. Although the IDP somewhat reflects the macro performance of a country, this study also uses sub-country data to test the practice of IDP theory in China. By applying the IDP theory to China, we hope that it can contribute to improving the quality of international investment and stimulating domestic economic development in China.

3. MODEL AND METHODOLOGY

3.1. Model

Based on the time series data of China's FDI stock from year 2003 to 2018, this study tests the practice of IDP hypothesis in China, and as well as for the three major urban agglomerations. There are two commonly used IDP empirical research models: one is the quadratic function equation (Dunning, 1981; Dunning, 1986; Djokoto, 2021), and the other one is the polynomial function equation (Buckley & Castro, 1998; Djokoto & Pomeyie, 2021).

$$NOI_{pct} = \beta_1 GDP_{pct} + \beta_2 GDP_{pct}^2 + \mu + C \quad (1)$$

$$NOI_{pct} = \beta_3 GDP_{pct}^3 + \beta_4 GDP_{pct}^5 + \mu + C \quad (2)$$

where NOI_{pct} is the net outward investment per capita at time t, GDP_{pct} is the GDP per capita at time t, β_1,β_2, β_3,β_4 are the coefficients in the two models, respectively. In addition, μ is an error term, and C is a constant.

3.2. Variable and Data Source

Among the variables used in this study, net outward investment per capita (NOI per capita) was the explained variable and per capita GDP was the main explanatory variable. FDI data between year 2003 and 2018 were obtained

from the statistical database of the UNCTAD, with per capita GDP data were from the China Statistical Yearbook. City-level data were taken from the Statistical Yearbook of each province and the Statistical Bulletin of China's Outward Foreign Direct Investment (2004-2019).

3.3. IDP Hypothesis Test based on Major Urban Agglomerations

This study used Stata (version 15.0) to regress the quadratic and polynomial equations respectively. First, we used the BG tests and White tests to investigate the autocorrelation and heteroskedasticity in the regression models. The test results showed that there was autocorrelation between the two models, which was statistically significant at the 5% level. Model A had heteroskedasticity, while model B did not have heteroskedasticity. Here, model A refers to the quadratic equation in Equation (1), and model B is the polynomial equation in Equation (2). Accordingly, the heteroskedasticity and autocorrelation consistent (HAC) standard error were used to revise the two regression models, and the results are shown in Table 1. Compared with the polynomial function equation, the fitting effect of the quadratic function equation (Model A) is better. From a national perspective, the Chinese investment development path fits the IDP theory, and it follows a U-shaped curve. The inflection point of the curve is between 2009 and 2010. In 2016-2017, the curve crossed the zero axis, and the NOI per capita turned positive. Since then, China had begun to enter the fourth stage of the IDP.

Table 1: Revised results with HAC standard error

Variable	*Total*		*Beijing-Tianjin-Hebei*		*Yangtze River Delta*		*Pearl River Delta*	
	Model A	*Model B*	*Model A*	*Model B*	*Model A*	*Model B*	*Model A*	*Model B*
GDP_{pc}	-0.135*** (0.033)		-0.051*** (0.014)		-0.055*** (0.016)		-0.026* (0.014)	
GDP_{pc}^{2}	$1.58e^{-05}$*** ($3.09e^{-06}$)		$2.75e^{-06}$** ($1.66e^{-07}$)		$3.27e^{-06}$*** ($9.93e^{-07}$)		$2.46e^{-06}$** ($9.21e^{-07}$)	
GDP_{pc}^{3}		$-5.10e^{-10}$** ($2.31e^{-10}$)		$-3.02e^{-10}$*** ($9.33e^{-11}$)		$-1.36e^{-10}$* ($7.16e^{-11}$)		$2.81e^{-11}$ ($6.16e^{-11}$)
GDP_{pc}^{5}		$1.08e^{-17}$*** ($2.65e^{-18}$)		$1.78e^{-18}$** ($6.97e^{-19}$)		$7.51e^{-19}$* ($3.88e^{-19}$)		$2.28e^{-19}$ ($3.88e^{-19}$)
R^2	0.789	0.784	0.743	0.596	0.487	0.224	0.648	0.618
N	16	16	16	16	16	16	16	16

Note: Analysis in Model A and Model B were separately conducted for the total and three subregions.

The following Figure 1 shows the IDP curves of the entire country and the three major urban agglomerations, respectively. It can be clearly seen that the IDP curves of the three urban agglomerations are also U shaped, but the curves have not yet crossed the 0 axes. That is, all these three regions have not yet entered stage 4 of the IDP. This is probably due to the strong ability of the three regions in attracting FDI, which results in a still negative net outward investment. Among the three urban agglomerations in China, the Pearl River Delta has the highest IDP stage, which is quite close to the stage 4 of the IDP. As a gateway to Hong Kong and Macau, the Pearl River Delta is the earliest area that opened to the outside world and its IFDI & OFDI developed in a coordinated manner. In addition, the IDP stage of Beijing-Tianjin-Hebei was significantly behind that of the other two urban agglomerations, indicating that Beijing-Tianjin-Hebei's OFDI needed to be strengthened and well-planned in the future. Compared with the Pearl River Delta and the Yangtze River Delta, the Beijing-Tianjin-Hebei region behaved more like a political center and cultural center, instead of acting as a financial and economic center. Besides,

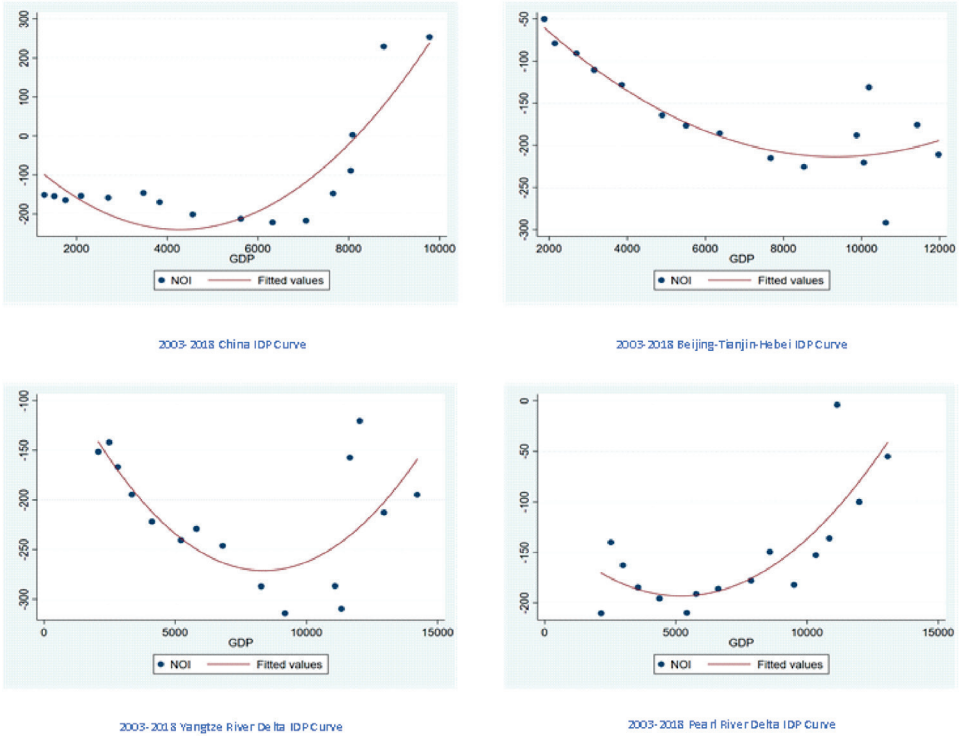

Figure 1: National and three major urban agglomeration IDP curves from 2003 to 2018

there was still a huge gap between these three urban agglomerations in terms of regional economic development, industrial development level, transportation infrastructure, and technological innovation ability, which led to a lag in OFDI development in the Beijing-Tianjin-Hebei region.

5. FURTHER TESTS OF IDP HYPOTHESIS BASED ON CITY PANEL DATA

5.1. Full Sample Analysis

Considering the differences in IDP at the prefectural city level, this study used a panel data from 281 cities in China to empirically test the above two regression models. Firstly, using the Hausman test, it was confirmed that both models were applicable to the two-way fixed effects analysis. Secondly, the tests of inter-group heteroskedasticity and the inter-group correlation test were performed. The test results showed that at the 1% significance level, there was inter-group heteroskedasticity and the inter-group correlation in both models. Therefore, we decided to take a panel-corrected standard error model (PCSE) correction. Since this study used short panel data, the nonparametric covariance matrix estimation method proposed by Driscoll and Kraay (1998) was applied for the correction. The details of the regression results are shown in following Table 2. Since the value of R^2 was low, it could be concluded that the goodness-of-fit of the two models in the full-sample is poor. This analysis result also indicates that

Table 2: Results before and after correction with PCSE

Variable	*Before correction*		*After correction*	
	Model A	*Model B*	*Model A*	*Model B*
GDP_{pc}	-0.015*** (0.001)		-0.015*** (0.001)	
GDP_{pc}^2	$3.10e^{-07}$*** ($6.61e^{-08}$)		$3.10e^{-07}$*** ($4.53e^{-08}$)	
GDP_{pc}^3		$-1.78e^{-11}$*** ($3.12e^{-12}$)		$-1.78e^{-11}$*** ($2.48e^{-12}$)
GDP_{pc}^5		$1.02e^{-20}$** ($4.07e^{-21}$)		$1.02e^{-20}$** ($3.25e^{-21}$)
Constant	-35.08*** (3.979)	-77.61*** (2.166)	-35.08*** (2.732)	-77.61*** (1.985)
R^2	0.057	0.017	0.060	0.022
N	4496	4496	4496	4496

Note: the analysis was conducted for 281 cities over 16 years.

there is no U-shaped curve for the IDP at the prefectural city level in China. The reason may be that there exists a large gap in the economic development level among the 281 cities, and it is quite difficult to obtain relatively robust results through the analysis.

5.2. Subsample Analysis by Regions

To conduct a sub-regional analysis, the full sample with the 281 cities was divided into four subsamples: the Beijing-Tianjin-Hebei region, the Yangtze River Delta, the Pearl River Delta, and other regions group. The cities not located in the first three major urban agglomerations are all counted in the other regions group, with 218 prefectural level cities in total. Regression results are presented in the following Table 3. The results show that the IDP curves of the three urban agglomerations and other regions are all under U shaped, which is consistent with the previous analysis result using time series data. However, its GDP per capita had not yet reached the threshold for the fourth stage, indicating that China's IDP was ahead of its regional economic development. In other words, the economic promotion and stimulation effects of investment needed to be further improved and deepened in the future.

In addition, according to the analysis results in the following Table 3, it showed that the research models applicable to the four regions were different. The three major urban agglomerations were suitable for the quadratic function equation, and the other regions were suitable for the polynomial function equation. This is consistent with the study of Buckley and Castro (1998), which confirmed that the quadratic functions are more suitable for economically developed regions and the polynomial functions are more suitable for developing regions. In our research case, the lowest per capita GDP of the three main urban agglomerations in year 2018 was the Beijing-Tianjin-Hebei region. It had a value at 11,500 US dollars, which was much higher than the average PGDP in China. Therefore, the three major urban agglomerations were in the economically developed region group and were more suitable using quadratic functions. But the remaining cities were in the developing region group according to their level in per capita GDP and were more suitable using the quintic polynomial functions.

6. CONCLUSIONS AND SUGGESTIONS

According to the IDP hypothesis, a country's NOIP depends on its level of regional economic development. Based on the data of China's NOIP and per

Table 3: Regression results of subsample panel data

Variable	*Beijing-Tianjin-Hebei*		*Yangtze River Delta*		*Pearl River Delta*		*Other Regions*	
	Model A	*Model B*	*Model A*	*Model B*	*Model A*	*Model B*	*Model A*	*Model B*
GDP_{pc}	-0.070** (0.004)		-0.040*** (0.004)		-0.037* (0.018)		-0.060*** (0.010)	
GDP_{pc}^{2}	$1.13e^{-06}$** ($5.51e^{-07}$)		$1.65e^{-06}$*** ($3.79e^{-09}$)		$1.58e^{-06}$** ($5.54e^{-07}$)		$3.14e^{-06}$*** ($5.70e^{-07}$)	
GDP_{pc}^{3}		$-1.39e^{-10}$*** ($3.88e^{-11}$)		$-5.80e^{-10}$*** ($8.92e^{-11}$)		$-5.04e^{-12}$ ($3.84e^{-11}$)		$-3.22e^{-10}$*** ($2.95e^{-11}$)
GDP_{pc}^{5}		$1.79e^{-20}$* ($9.07e^{-21}$)		$1.21e^{-20}$*** ($1.71e^{-21}$)		$4.56e^{-20}$ ($5.79e^{-20}$)		$1.27e^{-18}$*** ($3.36e^{-19}$)
Constant	-27.91 (28.35)	-58.61*** (13.22)	-31.68*** (12.01)	-143.6*** (6.418)	-98.8** (43.78)	-509.6*** (47.04)	-23.00*** (2.957)	-43.63*** (1.674)
R^2	0.556	0.241	0.596	0.275	0.548	0.242	0.627	0.669
N	208	208	656	656	144	144	3488	3488

Note: There were 13 cities in Beijing-Tianjin-Hebei Urban Agglomeration, 41 cities in Yangtze River Delta, 9 cities in Pearl River Delta, and 218 cities located in the other regions in our research case. Therefore, our research sample consisted of 281 cities in total.

capita GDP from 2003 to 2018, this study constructed the quadratic and the quintile equations of China's NOI and GDP per capita to test the practice and application of the IDP theory in China. The results show that: Firstly, the analysis result in China was consistent with common IDP theory and showed a U-shaped curve relationship between NOIP and GDP per capita in China. The curve crossed the zero axis in 2016 and turned from negative to positive, indicating that China entered the fourth stage of the IDP. Secondly, in the sub-regional sample, the IDP stage of Beijing-Tianjin-Hebei lagged behind that of the Pearl River Delta and Yangtze River Delta. However, it was reasonable according to the regional planning and industrial structure in China. Third, the IDP paths of the three major regions and other regions were also U-shaped, but their GDP per capita had not reached the threshold of the fourth stage, indicating that China's IDP was ahead of its regional economic development.

With their development of economy, developing countries should actively change their position from net receiving countries of FDI to net exporting countries of FDI. During the development of China's opening up to the world, it was necessary to abandon the previous aggregate model and shift to focus on the high-quality and coordinated development of OFDI and IFDI. Aiming at industrial upgrading and technological progress, China should attract more global high-quality multinational corporations (MNCs) to complement and strengthen its domestic supply chain and innovation ability. These MNCs can become an important force in China's domestic circulation and international circulation. Based on the B&R Initiative and RCEP Agreement, China will deepen international cooperation on the global value chain through OFDI and ensure the supply of oil, minerals, and other important energy resources. In the next stage, the coordination between increasing high-quality inward FDI and the outflow of more technological OFDI will work together to stimulate the development of Chinese international trade and bring regional economic development back.

For the countries in the fourth stage of the IDP, the growth rate of OFDI is always faster than that of IFDI. In fact, the outward investment industry is relatively more concentrated in middle and high-technology products and services. Inward FDI focuses on technology-intensive manufacturing and information-intensive services. Consequently, intra-industry FDI has become an important part of mutual investment in the last decade. As in Duran and Ubeda (2005), they highlighted the importance of institutional and technological factors in developing countries, as they preferred to move

forward along the IDP curve. According to the main characteristics of the IDP and the conditions in the fourth stage, the government should improve policies to facilitate direct investment to reduce the transaction costs and boost the efficiency of international trade. It is also important to support the research, development, and innovation system, and increase investment in education and digital information infrastructure. All these inputs and policy implementations will create a great environment for inward and outward investments, to promote regional economic development. Additionally, the domestic companies should further develop their ownership advantages, and enhance their ability of cross-border allocation of the value chain and learning ability of knowledge-intensive assets. In other words, the current investment development ahead of regional economic development is reasonable, but the government should take actions to stimulate regional economic development, in order to move forward to the fifth stage of the IDP.

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No potential conflicts of interests were reported by the authors.

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