AN EMPIRICAL STUDY OF CHINA’S INVESTMENT DEVELOPMENT PATH

UNE ÉTUDE EMPIRIQUE DU CHEMINEMENT DU DÉVELOPPEMENT DES INVESTISSEMENTS EN CHINE

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ABSTRACT
This article, which takes Dunning’s IDP theory as basis, does empirical analysis of international investment development stages in China. It constructs the time sequence model and the area cross section model of the relationship between per capita net foreign direct investment and per capita GDP in China, and does empirical analysis to examine whether China’s international FDI is in accord with Dunning’s IDP theory, and estimates China in which stage in Dunning’s IDP theory. It analyzes the current problems in international FDI in China and puts forward policy suggestions according to the research results.

KEY-WORDS: Investment development path, FDI, IDP

1. INTRODUCTION
Economic globalization has become the mainstream of world economic development. The development of international trade has become the important factors of a country's economic development, and international direct investment is an increasingly important factor.

Which stage is China's foreign direct investment in Dunning’s investment development path theory? What will the future trend be? It seems that China's foreign investment is in the second stage according to the results of domestic scholars’ researches. However, there are also many experts argue that the status quo of China's foreign investment simply does not meet the description of Dunning’s investment development path theory.

Nowadays, China’s foreign investment has been coming into rapid growth phase, so it is important to make sure of the stage of China's foreign investment in Dunning’s investment development path theory and to predict the trend of China's foreign direct investment. Simultaneously, this paper also gives the answer to the IDP theory whether to adapt in China.

2. IDP THEORIES
In the early 1980s, Dunning put forward investment development path theory. Dunning studied the relationship between direct investment and economic development of 67 countries from 1967 to 1978, who thought that a country’s direct investment is closely related to per capita GNP. Dunning believed that a country's net foreign direct investment, namely the difference between the foreign direct investment and the absorbing foreign direct investment, is a function of a country’s economic development stage. The targets reflecting a country stage of economic development includes: per capita GNP, educational level as well as the degree of opening to the outside world and so on. And, per capita GNP is the one of most important targets.

Dunning pointed out that there are five stages approximately in a country’s investment development path. Chart 1: the first stage, the absorbing foreign direct investment and the foreign direct investment are very few, and the economic development is slow; the second stage, the absorbing foreign direct investment becomes more, but the
foreign direct investment is still very few; The third stage, with domestic enterprises’ competitive power strengthening unceasingly, the absorbing foreign direct investment and the foreign direct investment both increase, but the foreign direct investment obviously increases faster than the absorbing foreign direct investment; The fourth stage, the foreign direct investment is more than the absorbing foreign direct investment; The fifth stage, the absorbing foreign direct investment and the foreign direct investment has taken shape and stays stably, and the net foreign direct investment fluctuates near to zero.

![Chart 1 - The five stages of investment development path theory](chart.png)

3. MODEL SELECTIONS

Dunning thinks that the absorbing foreign direct investment and the foreign direct investment of a country should increase along with the country's per capita GDP, but the net foreign direct investment (namely the difference between the foreign direct investment and the absorbing foreign direct investment) and per capita GDP of a country should be U curve relationship. And he used the quadratic model to do the empirical examination. There are three quantitative analysis models which Dunning used to do empirical studies as following:

\[
\text{LnpINFLOW} = \alpha + \beta \text{LnpGDP} + \mu_i
\]  
(1)

\[
\text{LnpOUTFLOW} = \alpha + \beta \text{LnpGDP} + \mu_i
\]  
(2)

\[
\text{perNFLOW} = c_1 + c_2 \text{perGDP} + c_3 \text{perGDP}^2 + \mu_i
\]  
(3)

In which, \(pINFLOW\): per capita absorbing foreign direct investment, \(pOUTFLOW\): per capita foreign direct investment, \(perNFLOW\): per capita net foreign direct investment, \(LnpINFLOW\): the logarithm of per capita absorbing foreign direct investment, \(LnpOUTFLOW\): the logarithm of per capita foreign direct investment.

Later, Dunning also proposed the cubic model, and he discovered that the cubic model is often more suitable in certain countries. The cubic model is as following:

\[
\text{perNFLOW} = c_1 + c_2 \text{perGDP} + c_3 \text{perGDP}^2 + c_4 \text{perGDP}^3 + \mu_i
\]  
(4)

Afterward, Buckley used the quintic model to examine the IDP theory for the first time. He discovered that the quintic model is more suitable in Portugal's empirical analysis comparing to the quadratic model. The quintic model is as following:
perNFLOW = c_1 + c_2 perGDP + c_3 perGDP^2 + c_4 perGDP^3 + c_5 perGDP^4 + c_6 perGDP^5 + \mu_t \tag{5}

The time sequence analysis and the area cross section analysis will be used in the article when examining the relationship between per capita net foreign direct investment and per capita GDP of China. In the time sequence analysis, we will compare with the adaptability of the quadratic model, the cubic model and the quintic model, and then will select the most suitable model to analyze the relationship between the net foreign direct investment and per capita GDP. The model (3), model (4) and model (5) will be used in the time sequence analysis. The following models will be used in the area cross section analysis.

\begin{align*}
\text{perNFLOW} &= c_1 + c_2 \text{perGRP} + c_3 \text{perGRP}^2 + \mu_t \tag{6} \\
\text{perNFLOW} &= c_1 + c_2 \text{perGRP} + c_3 \text{perGRP}^2 + c_4 \text{perGRP}^3 + \mu_t \tag{7} \\
\text{perNFLOW} &= c_1 + c_2 \text{perGRP} + c_3 \text{perGRP}^2 + c_4 \text{perGRP}^3 + c_5 \text{perGRP}^4 + c_6 \text{perGRP}^5 + \mu_t \tag{8}
\end{align*}

In which, \text{perGRP}: per capita GDP of each area, \mu_t: error term.

4. EMPIRICAL STUDY OF IDP THEORY

4.1 The empirical analysis of relationship between the absorbing foreign direct investment and GDP in China

This article uses the model (1) to analyze the relationship between the absorbing foreign direct investment and per capita GDP. The regression result shows as following:

\begin{align*}
\ln(\text{INFLOW}) &= -9.589 + 1.912 \ln(\text{GDP}) \\
&= -9.589 + 1.912 \times \text{GDP} \tag{9} \\
P \text{ value} &\approx 0.000 \quad (0.000) \\
R^2 &= 0.773 \\
F &= 67.993 \\
Pr(\text{F}) &= 0.0000
\end{align*}

It can be seen from the regression result that the goodness-of-fit $R^2$ is more significant, and the overall test F is significant, and P values of the coefficients are also very significant. The value of $\beta$ is plus, which shows that the per capita absorbing foreign direct investment increases as the per capita GDP increases in China. Therefore, the relationship between per capita absorbing foreign direct investment and per capita GDP in China is in accordance with the description of Dunning’s IDP theory.

4.2 The empirical analysis of relationship between the foreign direct investment and GDP in China

This article uses the model (2) to analyze the relationship between the foreign direct investment and per capita GDP. The regression result shows as following:

\begin{align*}
\ln(\text{OUTFLOW}) &= -7.734 + 1.287 \ln(\text{GDP}) \\
&= -7.734 + 1.287 \times \text{GDP} \tag{10} \\
P \text{ value} &\approx 0.000 \quad (0.000) \\
R^2 &= 0.663 \\
F &= 39.319 \\
Pr(\text{F}) &= 0.000004
\end{align*}

It can be seen from the regression result that the goodness-of-fit $R^2$ is 66.3%, which is not very significant, and the overall test F is significant, and P values of the coefficients are significant. The value of $\beta$ is plus, which shows that the per capita foreign direct investment increases as the per capita GDP increases in China. The reason of low goodness-of-fit may be that the increase of foreign direct investment is not steady. But on the whole, the relationship
between per capita foreign direct investment and per capita GDP in China is in accordance with the description of Dunning's IDP theory.

4.3 The empirical analysis of relationship between the net foreign direct investment and GDP in China

4.3.1 The time sequence analysis of relationship between the net foreign direct investment and GDP in China

This article uses the quadratic model (3), the cubic model (4) and the quintic model (5) to analyze the relationship between the net foreign direct investment and per capita GDP.

The regression result of the quadratic model shows as following:

\[
perNFLOW = 22.8163191 - 0.0939254 \times perGDP + 0.0000313 \times perGDP^2
\]

\[ (5.6856) \quad (-9.9394) \quad (7.1416) \]

\[ P \text{ value} \quad (0.0000) \quad (0.0000) \quad (0.0000) \]

\[ R^2 = 0.9090 \quad F = 94.9148 \quad Pr (ob F) = 0.000000 \]

The regression result of the cubic model shows as following:

\[
perNFLOW = 36.04 - 0.15 perGDP + 9.37 \times 10^{-5} perGDP^2 - 1.92 \times 10^{-8} perGDP^3
\]

\[ (4.4332) \quad (-4.7259) \quad (2.7391) \quad (-1.838) \]

\[ P \text{ value} \quad (0.0003) \quad (0.0002) \quad (0.0135) \quad (0.0826) \]

\[ R^2 = 0.9234 \quad F = 72.3228 \quad Pr (ob F) = 0.000000 \]

The regression result of the quintic model shows as following:

\[
perNFLOW = 31.41 - 0.09 perGDP + 1.3 \times 10^{-4} perGDP^2 + 3.01 \times 10^{-7} perGDP^3 - 1.9 \times 10^{-10} perGDP^4 + 3.91 \times 10^{-14} perGDP^5
\]

\[ (0.7977) \quad (-0.3442) \quad (-0.2144) \quad (0.4678) \quad (-0.6092) \quad (0.7014) \]

\[ P \text{ value} \quad (0.4367) \quad (0.7351) \quad (0.8329) \quad (0.6462) \quad (0.5509) \quad (0.4931) \]

\[ R^2 = 0.9324 \quad F = 44.1003 \quad Pr (ob F) = 0.000000 \]

It can be seen from the three models’ regression results that the goodness-of-fit of the cubic model is 92.34% and the goodness-of-fit of the quintic model is 93.24%, and the overall test F is very significant. However, neither of t values of the cubic model’s quadratic coefficient and cubic coefficient is significant, and none of t values of the quintic model’s coefficients is significant. The quadratic model’s goodness-of-fit has achieved 90.9% and each coefficient’s t value is significant, and F value is also very significant. Therefore, we believe that the quadratic model is more suitable in China, and we will do forecasting and analysis in accordance to the quadratic model in the later study such as the chart 2, chart 3 and chart 4.
Comparing chart 1 and chart 2, we can see that the quadratic model’s fitting chart is very satisfactory, which confirms that the Dunning’s investment development cycle theory should be applied in China. From chart 2, we can see that per capita net foreign direct investment reaches minimum value when per capita GDP increases to 1500 dollars, and then it begins to rise when per capita GDP increases to more than 1500 dollars. This shows that China has entered the third phase of the IDP theory, and China’s per capita net foreign direct investment will increase with the gradual growth of the per capita GDP in the future. Then the growth rate of foreign direct investment will be larger than the one of foreign direct investment.
From chart 3, we can see that the quadratic mode of relationship between per capita net foreign direct investment and per capita GDP has fully verified the U curve relationship in Dunning’s IDP theory, and we can come to a conclusion that China has come to the third phase from the second phase in IDP theory. The per capita GDP is about 1500 dollars in turning point from the second phase to the third phase, and then per capita net foreign direct investment in China reaches minimum value. After then, per capita net foreign direct investment will increase when per capita GDP in China continues to increase. Per capita net foreign direct investment will become to 0 dollars when per capita GDP gets to about 2800 dollars, namely the foreign direct investment will become more than the absorbing foreign direct investment, and the differential value will increase unceasingly. After then, the per capita net foreign direct investment will become to an increasing plus value, which shows that China will come to the fourth phase in IDP theory. After this, the foreign direct investment will increase till the per capita net foreign direct investment reaches maximum value, when China will come to the fifth phase.

4.3.2 The area cross section analysis of relationship between the net foreign direct investment and GDP in China

This article respectively constructs the quadratic model (6), the cubic model (7) and the quintic model (8), in which the variable is per capita GRP and the dependent variable is each area’s net foreign direct investment. The regression result of the quadratic model shows as following:

\[ \text{perNFlow} = 147.63 - 0.155 \times \text{perGRP} + 1.84 \times 10^{-5} \times \text{perGRP}^2 \]

(4.106) (4.2870) 

\[ P \text{ value} = (0.0004) \quad (0.0000) \quad (0.0002) \]

\[ R^2 = 0.6406 \quad F = 23.1727 \quad \text{Prob}(F) = 0.000002 \]
The regression result of the cubic model shows as following:

\[ \text{perNFLOW} = -180.87 + 0.27\, \text{perGRP} - 1.33 \times 10^{-4}\, \text{perGRP}^2 - 1.5 \times 10^{-8}\, \text{perGRP}^3 \]  
(15)

\[ (-4.2269) \quad (5.1958) \quad (-7.6243) \quad (8.5201) \]

\[ P \text{ value} \quad (0.0003) \quad (0.0000) \quad (0.0000) \quad (0.0000) \]

\[ R^2 = 0.9079 \quad F = 82.31836 \quad Pr(\text{F}) = 0.000000 \]

The regression result of the quintic model shows as following:

\[ \text{perNFLOW} = 183.14 - 0.43\, \text{perGRP} + 3.44 \times 10^{-3}\, \text{perGRP}^2 - 1.29 \times 10^{-7}\, \text{perGRP}^3 + 1.95 \times 10^{-11}\, \text{perGRP}^4 \]
\[ -9.81 \times 10^{-16}\, \text{perGRP}^5 \]

(1.0142) \quad (-1.1711) \quad (1.2596) \quad (-1.395) \quad (1.3682) \quad (-1.1936)

\[ P \text{ value} \quad (0.3211) \quad (0.2535) \quad (0.2205) \quad (0.1764) \quad (0.1845) \quad (0.2448) \]

\[ R^2 = 0.9292 \quad F = 60.3263 \quad Pr(\text{F}) = 0.000000 \]

It can be seen from the three models’ regression results that the goodness-of-fit of the quadratic model is 64.06%, which is not satisfactory. The goodness-of-fit of the quintic model is 92.92% and the overall test F is also very significant, but none of t values of the quintic model’s coefficients is significant. The quadratic model’s goodness-of-fit has achieved 90.79% and each coefficient’s t value is significant, and the F value is also very significant. Therefore, we believe that the cubic model is more suitable in China, and we will do forecasting and analysis in according to the cubic model in the later study such as the chart 5 and chart 6.

Chart 5 - Actual depiction points chart of each area’s per capita net FDI and per capita GRP in China in 2005
From chart 4 and chart 5, we can see that the cubic mode of relationship between each area's per capita net foreign 
direct investment and per capita GRP has fully verified the U curve relationship in Dunning’s IDP theory. In 
addition, we can clearly see that the economic development speed in different regions in China is different, and the 
development of FDI is also very different. Shanghai’s per capita GRP has reached 6283.68 dollars, and its per capita 
net foreign direct investment is also close to 0 dollars, whose foreign direct investment is more than its absorbing 
foreign direct investment. So Shanghai is entering the fourth phase from the third phase in Dunning’s IDP theory. 
After entering the fourth stage, Shanghai's per capita GRP continues to rise, simultaneously the scale of the net 
foreign direct investment also will grow to more than 0 dollars and go on to grow. The absorbing foreign direct 
investment will decelerate gradually, but the foreign direct investment will continue to rise fast. However, in some 
quite backward area such as Yunnan Province, per capita GRP is only 956.46 dollars, its per capita net foreign direct 
investment is negative value close to zero, which shows that its foreign direct investment and absorbing foreign 
direct investment both just start to increase, and its scale has been small. So Yunnan Province is being in the second 
stage initial period of Dunning’s IDP theory, which will need to experience absorbing foreign direct investment 
gradually from small to large. And its net foreign direct investment also will be the negative number, whose absolute 
value increases unceasingly till goes out the second stage.

5. CONCLUSIONS

In this article, the main conclusions are the following three points:
(1) The relationship between the absorbing foreign direct investment and GDP, and the relationship between the 
foreign direct investment and GDP are both in accordance with Dunning’s IDP theory. Namely China’s absorbing 
foreign direct investment and foreign direct investment increase as GDP increases.
(2) The quadratic model of relationship between the net foreign direct investment and GDP suits China's actual 
situation. China has already entered the third stage in IDP theory. The absorbing foreign direct investment and the 
foreign direct investment both increase in China, and the increasing rate of the foreign direct investment is higher 
than the one of the absorbing foreign direct investment.
(3) The fitting of the cubic model of the relationship between each area per capita net foreign direct investment and 
the per capita GRP in China in 2005 is good, which conforms to the IDP theory. The economic development speed 
in different regions in China is different, and the development of FDI is also very different. A few developed areas 
in China have entered the fourth stage, but some backward areas are still in the second stage.
REFERENCES


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