

Empirical Analysis of FDI and Jiangsu's Economic Development

Jian Yin ^{1,2} *, Junrong Xiao ²

¹ Faculty of Science, Jiangsu University, Zhenjiang, Jiangsu, 212013, P.R. China

² Zhenjiang New Area Investment Promotion Bureau

(Received 15 October 2007, accepted 17 December 2007)

Abstract: This article evaluates FDI's influence on Jiangsu's economic development by quantitative method, and analyzes effects of capital investment on Jiangsu's economic growth. To understand relationships of FDI and Jiangsu's Economic development, will help Jiangsu Province utilizing FDI better and more effective.

Key words: FDI; economic development; relationship; analyze

1 Introduction

Capital shortage is the common problem faced by the developing countries and it's also the to-be-solved problem for China's economic development. The development of economic globalization strengthens the capability of capital cross-border flow and makes the capital globalization a trend. The characteristic of the globalization is the competition on FDI attraction in the whole world. Most countries adopt the liberalization to the investment field and their economic departments are open to foreign investors[1]. Foreign capital can be supplement for capital deficiency, support the construction of infrastructures and other weak fields of economic development. But the most important thing is that foreign capital creates a short cut for Chinese enterprises to participate international economic cooperation and competition. Since China's opening to the outside world at the end of 1970s and its entry into the WTO, Chinese globalization has been facilitated[2]. China has absorbed a large amount of foreign capital. By the end of 2006, the accumulated FDI reached about 704 billion USD in China from about 200 countries and regions all over the world. And about 480 companies listed in World Top 500 have invested in China. Jiangsu Province is located in Yangtze Delta, which is the most economic developed area in China. And it is one of the provinces with most foreign investment. From year 2002, the actual utilized foreign capital in Jiangsu Province increases over 10 billion USD every year to reach 17.4 billion USD in year 2006. Among the World Top 500 companies, 385 companies have invested in Jiangsu. As we known, most economic growth theories regard economic growth as the function of capital, technology, employment and so on[3]. Thus, large amount of FDI accelerates economic development and promotes foreign trade in Jiangsu. This article focuses on studying the association between FDI and Jiangsu's economic development.

2 The association between foreign investment and Jiangsu's economic development

From the empirical analysis of Jiangsu Province, the attraction of foreign investment stimulates the economic development in Jiangsu Province[4]. To study the association between foreign investment and Jiangsu's economic development, we use coefficient of correlation among variables of mathematical statistics. In Eq.

* Corresponding author. E-mail address: suo_feiya@hotmail.com

(1), γ is the coefficient of correlation between variable X and Y , X is the investment index, Y is other relative economic index, such as GDP, etc., L_{xy} is the covariance between X and Y , L_{xx} and L_{yy} are the variance of X and Y respectively. The coefficient of correlation[5] is:

$$\gamma = \frac{L_{xy}}{\sqrt{L_{xx} L_{yy}}} \tag{1}$$

Normally, when $\gamma \leq 1$ and γ is closer to 1, the association between X and Y is closer. Contrarily, the association is looser.

According to the data listed in Table 1, the coefficient of correlation between Jiangsu's foreign investment and relative economic index can be calculated by Eq. (1).

Table 1: Utilized foreign investment and relative economic variable in Jiangsu Province

Year Variable	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
GDP (Y)	6680.34	7200.8	7700.56	8584.7	9514.6	10636.3	12451.8	15512.4	18272.12	21548.36
Actual Foreign Investment (X)	60.63	69.60	66.40	66.00	73.50	108.3	158.0	121.0	131.80	174.3

Y :RMB 10000.00 yuan. X :USD 10000.00

Source: Provincial economy and social development statistical report of Jiangsu

The coefficient of correlation between the actual foreign investment in Jiangsu (X) and GDP (Y) $\gamma_{xy} = 0.878511303$. Now test the association. Let $\partial=0.01$, then $\gamma_{\partial}(n - 2) = \gamma_{0.01}(8)=0.7646$, $\gamma_{xy} > \gamma_{0.01}$ (8)

The result shows obviously positive correlation between the foreign investment and GDP, which shows that the foreign investment promote the increase of GDP in Jiangsu.

3 The Influence by Foreign Investment to Jiangsu's Economic Development

Considering capital, labor and technology improvement, gross production function can be described by the following equation[6] as:

$$Y_t = F(k, l, t) = A_0 e^{mt} l^{\alpha} k^{\beta} \tag{2}$$

In which, Y, k, l are the GDP and capital and labor respectively. α, β are the output flexibility coefficient of labor and capital respectively. m is the coefficient of technology improvement. Eq. (2) is the basic model of analyzing modern economic development. From Eq. (2) we can get:

$$\ln y = \alpha \ln l + \beta \ln k + mt + \ln A_0 \tag{3}$$

in which $\alpha + \beta = 1$. Rewrite Eq.(3) to

$$\ln \frac{y}{l} = \beta \ln \frac{k}{l} + mt + \ln A_0 \tag{4}$$

Let $\ln \frac{y}{l} = \theta, \ln \frac{k}{l} = p, \ln A_0 = \alpha_0$. Then

$$\theta = \beta p + mt + \alpha_0 \tag{5}$$

Eq. (5) is a linear regression equation. According to the least-square method to solve for parameter $\alpha_0, \alpha, \beta, m$, the standard equation is:

$$\begin{aligned} \sum \theta &= n\alpha_0 + \beta \sum p + m \sum t \\ \sum t\theta &= \alpha_0 \sum t + \beta \sum pt + m \sum t^2 \\ \sum p\theta &= \alpha_0 \sum p + \beta \sum p^2 + m \sum pt \end{aligned}$$

In the time series design, $\sum t = 0$ so the Eq.(6) can be simplified as:

$$\begin{aligned}\sum \theta &= n\alpha_0 + \beta \sum p \\ \sum t\theta &= \beta \sum pt + m \sum t^2 \\ \sum p\theta &= \alpha_0 \sum p + \beta \sum p^2 + m \sum pt\end{aligned}\quad (6)$$

To quantitatively analyzing the influence by foreign investment to Jiangsu's economic development according to Eq. (7).

Table 2: GDP, labor number and investment amount in Jiangsu

Parameter Year	GDP (RMB 10000.00 yuan) Y	Labor Number (10000 people) L	Social Fixed Asset Investment (RMB 10000.00 yuan) K	Domestic Investment (RMB 10000.00 yuan) K_1	Foreign Investment (USD 10000.00) K_2
1997	6680.34	4388.79	2203.09	1699.86	60.63
1998	7200.80	4389.92	2535.30	1957.62	69.60
1999	7700.56	4390.71	2742.17	2191.05	66.40
2000	8584.70	4418.14	2995.40	2447.60	66.00
2001	9514.60	4434.28	3303.00	2715.00	73.50
2002	10636.3	4458.00	3849.20	2982.80	108.3
2003	12451.8	4468.70	5335.80	4071.80	158.0
2004	15512.4	4482.50	6827.60	5859.60	121.0
2005	18272.12	4510.12	8739.70	7685.30	131.8
2006	21548.36	4564.76	10063.65	8669.25	174.3

Source: Provincial economy and social development statistical report of Jiangsu

Table 3: Quantitative analysis (1)

Year	Time Series (t)	GDP (RMB 10000.00 yuan) Y	Labor Number (10000 people) L	Social Fixed Asset Investment (RMB 10000.00 yuan) K	$p = \ln(K/L)$	$\theta = \ln(Y/L)$
1997	-9	6680.34	4388.79	2203.09	-0.689192642	0.420115322
1998	-7	7200.80	4389.92	2535.30	-0.54899903	0.494881127
1999	-5	7700.56	4390.71	2742.17	-0.470741367	0.561802108
2000	-3	8584.70	4418.14	2995.40	-0.388641014	0.664262756
2001	-1	9514.60	4434.28	3303.00	-0.294534111	0.763462203
2002	1	10636.3	4458.00	3849.20	-0.1468349	0.869572444
2003	3	12451.8	4468.70	5335.80	0.177341288	1.024767652
2004	5	15512.4	4482.50	6827.60	0.420792294	1.241458778
2005	7	18272.12	4510.12	8739.70	0.661552103	1.39905264
2006	9	21548.36	4564.76	10063.65	0.790563983	1.551933773
					$\sum p = -0.488693397$	$\sum \theta = 8.991308804$

Table 4: Quantitative analysis (2)

Year	t^2	$p\theta$	p^2	pt	θt
1997	81	-0.289540389	0.474986498	6.202733781	-3.781037896
1998	49	-0.271689259	0.301399935	3.842993213	-3.464167891
1999	25	-0.264463493	0.221597435	2.353706837	-2.809010541
2000	9	-0.258159751	0.151041838	1.165923043	-1.992788268
2001	1	-0.224865661	0.086750343	0.294534111	-0.763462203
2002	1	-0.127683583	0.021560488	-0.1468349	0.869572444
2003	9	0.181733615	0.031449932	0.532023864	3.074302957
2004	25	0.522396287	0.177066155	2.103961472	6.207293888
2005	49	0.925546217	0.437651186	4.630864724	9.793368481
2006	81	1.226902945	0.624991412	7.115075849	13.96740396
Total	330	1.420176928	2.528495222	28.09498199	21.10147493

Solving for $\alpha, \beta, \alpha_0, m$, we find that:

$$\alpha = 0.441 \quad \beta = 0.559 \quad \alpha_0 = 0.9263 \quad m = 0.01635$$

It shows that capital output flexibility coefficient is 0.559.

The average development rate by capital injection is:

$$\frac{\Delta K}{K} = \sqrt[9]{\frac{10063.65}{2203.09}} - 1 = 0.1838661068$$

Then the contribution by the capital to economic development is:

$$\beta \frac{\Delta K}{K} = 0.10278115$$

Let R be the proportion of actual FDI in Jiangsu to social fixed asset investment between year 1997 to 2006:

$$R = 0.171109052$$

Then the average contribution of FDI to Jiangsu's economic development within 10 years:

$$\beta \frac{\Delta K}{K} \times R = 0.01758679$$

The average Jiangsu's economic development rate between year 1997 to 2005 is:

$$\frac{\Delta Y}{Y} = \sqrt[9]{\frac{21548.36}{6680.34}} - 1 = 0.1389714832$$

Then the proportion of actual FDI in Jiangsu to its economic development is:

$$\beta \frac{\Delta K}{K} \times R / \frac{\Delta Y}{Y} = 12.65496\%$$

The result shows that Jiangsu's economy increased 1.758679% in average during 1997 to 2006 based on the effect of FDI. And the contribution of FDI to Jiangsu's economic development is 12.65496%.

Now, we consider to the contribution by the technology improvement to economic development[7] is:

$$M = \frac{\Delta Y}{Y} - \left(\alpha \frac{\Delta L}{L} - \beta \frac{\Delta K}{K} \right) = 3.425948\%$$

The result shows that Jiangsu's economy increased 3.425948% in average during 1997 to 2006 based on technology improvement.

Thus it can be seen that technology improvement is the main impetus for Jiangsu's economic growth. From the fact in Jiangsu, the capital & technology density of foreign invested enterprises is much higher than that of domestic enterprises. Then we can think that foreign invested enterprises are the main contributors to Jiangsu's economic development. Foreign invested enterprises play important roles in Jiangsu's economic development.

4 Conclusion

Jiangsu's economic development is obviously positive correlation with FDI, which means FDI promotes the increase of Jiangsu's GDP and Gross Industry Output. Based on capital and technology improvement, Jiangsu's economy increased 1.758679% and 3.425948% in average during 1997 to 2006 respectively. Foreign invested enterprise play important roles in Jiangsu's economic development, and become main contributors to Jiangsu's economic growth.

References

- [1] UNCTAD (2003): World Investment Report, FDI policies for development. *New York: United Nations*(2003)
- [2] Hongxing Yao, Chengyao Wu, Juan Ding: The stability analysis of Duopoly investment model with bounded rationality based on China's entry into the WTO. *International Journal of Nonlinear Science*. 3(1):44-51(2007)
- [3] Honglin Yang, Lixin Tian, Zhanwen Ding: Renewable resources, technological progress and economic growth. *International Journal of Nonlinear Science*. 1(3):149-154(2006)
- [4] Liya Wu, Kang Cao, Peng Chen, Weizhong Su :The influence of foreign investment to Jiangsu economic development since year 1990. *Economic geography*. 25(4) :479-482(2005)
- [5] Li Guangjiu, et al: Statistics of application mathematics. *Southeast University Publishing Company*. 12(1993)
- [6] Li Zhiyuan : Western economics. *Higher Education Publishing Company* (1999)
- [7] Chen Lizhen, et al: Study on the lag influence and countermeasure of Asia financial crisis to Zhenjiang economic development. *Jiangsu Science and Technology University*. 12(1998)