IFEAMA SPSCP Vol.5 pp.99-107

A Statistical Analysis of the Determinants of FDI Locations in China

Yu Xiao Jun
Nagoya University of Foreign Studies
Japan

Abstract

Although China showed very good performance in attracting foreign direct investment (FDI) at the national level, FDI distribution was remarkably unbalanced at the regional level. It is critical to clarify the determinants of FDI locations in China for policy-making purposes. This study conducted multiple regression models using FDI during 2008－2012 in 30 regions in China as dependent variables and 17 independent variables in the same regions during 2007－2011, capturing seven factors that can affect FDI location.

1 Introduction

With the increase in the cost of Chinese labor in recent years, some foreign direct investment (FDI) has gradually been transferred to other countries in Southeast Asia because of the effects of operating costs. However, this does not mean China has lost its attraction as an FDI target. Based on research by the United Nations Conference on Trade and Development, from a medium-term perspective, China is still a preferred investment destination for multinational corporations (Zhou, 2013). Although the cost of Chinese labor has continued to increase, at the same time, labor quality has improved substantially, creating the capability for higher value-added work. The potential of the Chinese market has had a huge scale of economies effect on FDI, which is difficult to replace.

FDI has made great contributions to Chinese economic development, and most FDI has been highly concentrated in the eastern coastal areas, making FDI one of the major reasons for the expanding imbalance in regional economic development. The effects of FDI area selection have received attention from the Chinese government and from scholars for a long time. A thesis titled *Study on Gradient Transfer of Foreign Direct Investment in China* (United Study Group, 2004) was jointly published by China's economic authorities and academics. Thereafter, Japan published *Statistical Analysis on the Factors of the Effects of FDI Area Selection by Japan* (Yu，2005a) and *Statistical Analysis on Reasons for FDI "Moving North"* (Yu，2006) to conduct empirical studies on the effects of FDI area selection in China from Japan and from around the world. These studies have provided many beneficial insights that have helped us comprehend and judge factors that influence FDI area selection in China. However, it has been about 10 years since these papers were published, and many major changes have occurred both at home and abroad in that time. (1)In addition to the

continuous implementation of the “Western development” strategy, new regional development strategies termed the “Rejuvenation of Northeast China” and the “Rise of Central China” have been introduced by the Chinese government. (2)The ASEAN-China Free Trade Area (ACFTA) between China and the Association of Southeast Asian Nations and the Cross-Strait Economic Zone between mainland China and Taiwan have been established. (3)Major adjustments have been to the introduction of foreign investment policy. (4) Because of the unexpected shocks to many multinational corporations caused by the global financial crisis, corporations have been forced to adjust their global strategy. Although some related research results have been published during this time, to my knowledge, only a few comparatively detailed analyses have been conducted in some provinces (Cheng, 2007; Wang et al., 2008; Cao et al., 2009), and some regions (Yu, 2013), and none of these have taken the whole of China into consideration. As such, this paper focuses on the new environmental background following the international financial crisis and implement empirical analyses of the factors that impact the regional selection of FDI in the whole of China.

2. Empirical Analysis Method

2.1 Statistical Analysis Method

The author of *Study on Gradient Transfer of Foreign Direct Investment in China* (United Study Group, 2004) conducted unannounced investigations in various regions, proposing many good policy recommendations, many of the results of which can be used for reference. However, it is hard to determine what empirical research methods were used. Among the papers mentioned above, some have used discriminant analysis, while most have used the multiple regression method. In my opinion, multiple regression is one of the most mature and effective methods, and multiple regression will be used as the basic method for empirical study in this paper. The observation subjects, observation period, and observation variables are reset as necessary according to changing situations.

2.2 Observation period

Previous empirical studies (Dunning, 1993) have indicated that the locational factors that influence FDI distribution are not constant and shift with time. China has made some major adjustments to its regional development strategy and foreign investment policy during the Eleventh Five-Year Plan (2006－2010). This was especially the case after the issuing of regional economic planning and domestic demand stimulus policies following the global economic crisis in 2008, which has inevitably had new impacts on regional FDI selection. Therefore, I believe that the preferred observation period is the five -year period of following the global economic crisis. The observation period of the dependent variable *Y*, is 2008－2012; the observation period of the independent variable *X*, is 2007－2011.

2.3 Observation subjects

The observation subjects of this paper are 30 provinces, municipalities, and autonomous regions within China, excluding Tibet. Tibet is excluded because of incomplete

data.

1) Dependent variables: Y_{it}: FDI amount invested in region *i* in year *t*.

t = 2008, 2009,.....2012 (years); *i* = 1,2,.....30 (provinces, municipalities, and autonomous regions)

According to the *China Statistical Yearbook*, FDI includes investment from Hong Kong, Macao, and Taiwan.

2) Independent variables: X_{1it-1}, $X_{2\ it-1}$,……$X_{17\ it-1}$.

Factors influencing FDI region selection in this paper and its corresponding independent variables are shown in Table 1. To choose the influencing factors, I have referred to *On Competition*

Table 1 Influencing Factors and Independent Variables

Factor influencing FDI area selection	Independent variable
1. Science and technology capability	X_1: Number of patents/10,000 people
2. Levels of finance, services, logistics and other industries	X_2: Proportion of tertiary industries
3. Difficulty of acquiring well-educated talent	X_3: Number of students in colleges and universities/10,000 people
4. Large potential market	X_4: Per-capita GDP X_5: Economic growth
5. Economic correlation with other areas	X_6: Railway density (km/10,000 km^2) X_7: Road density (km/10,000 km^2)
6. Land, wages and other expenses	X_8: Rent index X_9: Disposable income of urban residents (yuan/year) X_{10}: Average net income of rural residents (yuan/year)
7. State of information infrastructure	X_{11}: Number of computers-/100 urban households
8. Existence of a customer base with high levels and strict requirements	X_{12} :Engel coefficient
9. Degree of aggregation of local and foreign businesses	X_{13}: Number of industrial enterprises above a designated size /10,000 km^2 X_{14}: Number of retail enterprises above a designated size/10,000 km^2 X_{15}: Number of foreign-funded enterprises/10,000km^2
10. Active investment in R&D and quality improvement	X_{16}: Volume of transactions in the technical market/GDP X_{17}: Rate of products with excellent quality

Notes: ① X_3 includes undergraduate and junior college students. ② For X_8, because the exact land cost data of cannot be obtained, the rent price index variable is used as a substitute variable because the two are often in direct correlation. ③Because of incomplete data in some areas, X_{17} uses an estimated value for 2007.

(Porter, 1998), *Knowledge Capitalism* (Burton-Jones, 1999), a study by the United Nations Conference on Trade and Development (UNCTAD, 2002), and other related research results (Yu, 2005a; Yu, 2006; Yu, 2012). For choosing the independent variables, considering the possibility of data acquisition.

2.4 Data sources

The empirical research data used in this paper are taken from relevant sections of the *China Statistical Yearbook* (National Bureau of Statistics of China, 2008－2013).

3. Multiple Regression Model Validity Tests

The multiple regression models built in this paper are

$$Y_{it} = \beta_0 + \beta_1 X_{1it-1} + \beta_2 X_{2it-1,} \ldots\ldots + \beta_{17} X_{17it-1} \quad \text{(Formula 1)}$$

The relevant data are placed in Formula 1, and Tables 2-5 are obtained from SPSS calculation.

3.1 Explanation degree test for the model

An explanation degree test was conducted for this paper as shown in Table 2. The correlation coefficient of the table is R = 0.867, the coefficient of determination is R^2 = 0.752, and the adjusted R^2 = 0.711. The difference between R^2 and the adjusted R^2 is very small; therefore, the degree to which X explains Y in the model is 71%. However, the standard error in the table is larger, 665.8, creating the need for further testing for this model.

Table 2 Model Aggregation

R	R^2	Adjusted R^2	Standard error
.867	.752	.711	665.8

3.2 Model predictive test

Tests were conducted as shown in Table 3 for H_o: “This model cannot be used for prediction.” The significance level in the table is 0.000<5%. Thus, the assumption is abandoned. The result indicates that this model reaches a predictable level.

Table 3 Analysis of Variance

	Sum of squares	Degree of freedom	Mean square	F-value	Significance level
Regression	137025607.000	17	8060329.824	18.182	.000
Residual	45218112.867	102	443314.832		
Total	182243719.867	119			

3.3 Match degree test for measured and predicted values

Match degree test for measured and predicted values is conducted as shown in Figure 1. All measured values (the dots) in the figure are gathered around the predicted values (the straight line), indicating a high degree of approximation.

3.4.Multicollinearity test

The multicollinearity of the model was tested as shown in Table 4. The maximum value for the conditions index was 339.83 for dimension 18.The largest numbers of 0.87 and 0.10 correspond to X_5 and X_8 respectively, illustrating that the two variables have suspicion of collinearity. The author tested the correlation coefficient (Pearson) and found that R = -0.049. Suspicion of collinearity was then excluded.

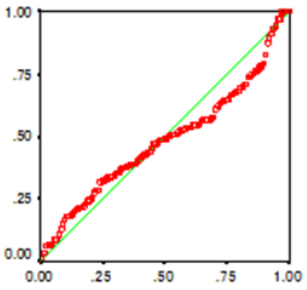

Figure1 P-P Figure Test

Table 4 Collinearity Test

Dimen-sion	Charac-teristic Value	Condi-tions Index	Variance Ratio																	
			Cons-tant	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	X_{10}	X_{11}	X_{12}	X_{13}	X_{14}	X_{15}	X_{16}	X_{17}
1	13.46	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	2.33	2.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.01	0.01	0.00
3	0.90	3.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.72	0.00
4	0.41	5.72	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.01	0.05	0.00
5	0.37	6.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.30	0.06	0.03	0.00
6	0.20	8.27	0.00	0.06	0.00	0.01	0.00	0.00	0.12	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.02	0.02	0.00
7	0.13	10.15	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.06	0.04	0.00
8	0.07	13.55	0.00	0.04	0.01	0.03	0.02	0.00	0.02	0.04	0.00	0.00	0.00	0.00	0.00	0.33	0.02	0.31	0.01	0.00
9	0.05	16.62	0.00	0.35	0.02	0.03	0.02	0.00	0.05	0.04	0.00	0.00	0.01	0.03	0.01	0.07	0.07	0.03	0.00	0.00
10	0.02	23.75	0.00	0.02	0.02	0.61	0.01	0.00	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.02	0.27	0.00	0.00
11	0.02	28.99	0.00	0.01	0.10	0.00	0.07	0.00	0.04	0.12	0.00	0.00	0.01	0.19	0.02	0.13	0.06	0.14	0.06	0.03
12	0.01	31.89	0.00	0.14	0.56	0.02	0.10	0.00	0.34	0.28	0.00	0.00	0.00	0.04	0.02	0.01	0.01	0.01	0.00	0.01
13	0.01	41.30	0.00	0.02	0.07	0.01	0.39	0.00	0.02	0.01	0.00	0.00	0.07	0.00	0.39	0.10	0.04	0.02	0.02	0.10
14	0.01	44.09	0.00	0.19	0.00	0.00	0.12	0.00	0.02	0.01	0.00	0.00	0.56	0.08	0.10	0.04	0.01	0.04	0.01	0.10
15	0.00	64.26	0.01	0.03	0.01	0.06	0.01	0.01	0.02	0.04	0.04	0.04	0.05	0.00	0.30	0.00	0.00	0.01	0.00	0.70
16	0.00	94.99	0.00	0.00	0.11	0.10	0.17	0.00	0.07	0.02	0.01	0.95	0.26	0.64	0.08	0.07	0.02	0.01	0.00	0.05
17	0.00	149.57	0.04	0.00	0.01	0.12	0.02	0.12	0.02	0.04	0.84	0.00	0.03	0.00	0.05	0.00	0.01	0.00	0.00	0.00
18	0.00	339.83	0.95	0.01	0.09	0.00	0.07	0.87	0.00	0.00	0.10	0.00	0.02	0.01	0.04	0.01	0.06	0.00	0.02	0.00

Multiple regression model validity tests were conducted from four aspects. When the larger standard errors are excluded, the remaining indexes are normal, which indicates that the tests were passed. The model below is used to conduct an empirical analysis of factors that influence FDI locations in China.

4. Empirical Analysis of Factors Influencing FDI Area Selection

Factors that influence FDI area selection will be analyzed in the order shown in Table 1. The results are shown in Table 5.

Table 5 Coefficient

	Non-standardized coefficients		Standardized coefficients	*t*	Significance level	Correlation coefficient			Collinearity statistics	
	B	Standard error	*B*			Zero order	Partial	Part	Tolerance	VIF
(Constant)	5205.464	4374.151		1.190	.237					
X_1	153.216	31.704	.624	4.833	.000	.743	.432	.238	.146	6.864
X_2	-174.102	1284.156	-.012	-.136	.892	.315	-.013	-.007	.332	3.008
X_3	-3.916	2.263	-.197	-1.731	.087	.310	-.169	-.085	.188	5.323
X_4	.090	.016	1.297	5.730	.000	.615	.493	.283	.048	21.050
X_5	-38.218	34.232	-.069	-1.116	.267	-.227	-.110	-.055	.628	1.592
X_6	-4.223	1.026	-.577	-4.116	.000	.307	-.377	-.203	.124	8.081
X_7	.110	.025	.404	4.415	.000	.563	.401	.218	.291	3.442
X_8	-6.148	19.563	-.018	-.314	.754	-.119	-.031	-.016	.763	1.311
X_9	-.296	.078	-1.237	-3.782	.000	.641	-.351	-.187	.023	43.993
X_{10}	.012	.119	.025	.099	.922	.635	.010	.005	.037	27.288
X_{11}	31.758	10.878	.544	2.920	.004	.656	.278	.144	.070	14.266
X_{12}	4526.536	1857.682	.161	2.437	.017	-.046	.235	.120	.557	1.795
X_{13}	-.036	.046	-.137	-.776	.440	.552	-.077	-.038	.078	12.864
X_{14}	-.006	.117	-.005	-.053	.958	.365	-.005	-.003	.299	3.349
X_{15}	-.001	.013	-.012	-.080	.937	.465	-.008	-.004	.106	9.404
X_{16}	-3.541	3.239	-.060	-1.093	.277	-.129	-.108	-.054	.811	1.234
X_{17}	-951.514	995.539	-.059	-.956	.341	.168	-.094	-.047	.640	1.564

(1)Science and technology capability. The significance level of X_1 (Number of patents/10,000people) is 0.000<5%; the standardized coefficient is 0.624, which can be considered a moderate positive impact. This result reflects the emphasis of FDI on the importance of science and technology.

(2)Levels of finance, services, logistics, and other industries. The significance level of X_2 (proportion of tertiary industries) is 0.892>5%. Surprisingly, its influence cannot be confirmed, which leads to the need for further investigation.

(3) Difficulty level of acquiring well-educated talent. The significance level of X_3 (Number of students in colleges and universities/10,000people) is 0.087>5%. Its influence cannot be confirmed, which may be the result of major mobility among current Chinese talent, indicating that many students may not be employed locally after graduation.

(4) Large potential market. The significance level of X_4 (Per-capita GDP) is 0.000<5%; the standardized coefficient is 1.297, which can be considered a strong positive impact. This

indicates the emphasis of FDI on Chinese domestic markets. The significance level of X_5 (Economic growth) is 0.892>5%, and its influence cannot be confirmed. This result is related to the major changes in the economic growth of each region during the observation period. Since the start of the international economic crisis, there has been a decline in economic growth in eastern coastal areas, while there has been a gradually increasing trend of economic growth in the central and western regions.

(5) Economic correlation with other areas. The significance level of X_6 (Railway density) is 0.000<5%; the standardized coefficient is -0.577, which can be considered a moderate negative impact. Although a previous study (Yu, 2005a) has shown that FDI from Japan only focuses on roads and not railways, the "-" symbol is also unexpected, and the results need further investigation. The significance level of X_7 (Road density) is 0.000<5%; the standardized coefficient is 0.404, which can be considered a moderate positive impact. This result reflects the emphasis of FDI on road transportation, which may be relevant to the increasing localization of parts supplies and the exploration of the Chinese market through FDI.

(6) Land, wages, and other expenses. The significance level of X_8 (Rent index) is 0.754>5%, which cannot be confirmed and may be the result of an inappropriate choice of independent variables. Because the data regarding land, housing and rent prices in each region are difficult to obtain, the rent index has to be used as an alternative variable. However, the rent index may not reflect land prices correctly. The significance level of X_9(Disposable income of urban residents) is 0.000<5%; the standardized coefficient is -1.237, which can be considered a strong negative impact. This reflects the fact that FDI has not changed the pursuit of cheap labor. The significance level of X_{10} (Average net income of rural residents) is 0.754>5%, and its impact cannot be determined. This reflects the focus of FDI on labor quality.

(7) State of information infrastructure. The significance level of X_{11} (Number of computers/100 urban households) is 0.004<5%; the standardized coefficient is 0.544, which can be considered a moderate positive impact.

(8) Existence of a customer base with high levels and strict requirements. The significance level of X_{12} (Engel coefficient) is 0.017<5%; the standardized coefficient is 0.161, which can be considered a weaker positive impact.

(9) Degree of aggregation of local and foreign businesses. The significance levels of X_{13} (Number of industrial enterprises above a designated size /10,000 km^2), X_{14} (Number of retail enterprises above a designated size/10,000 km^2), and X_{15}(Number of foreign funded enterprises/ 10,000 km^2) are 0.440, 0.958, and 0.937 respectively, which are all more than 5%; their impacts cannot be confirmed. These results in addition to a high degree of aggregation of the region causing rising land, housing, wages, and other costs may relate to the barriers raised by the government. Therefore, in regard to FDI, areas with a high degree of aggregation are attractive, but may also be places they want to reject.

(10) Active investment in R&D and quality improvement. The significance levels of X_{16}(Volume of transactions in the technical market/GDP) and X_{17} (Rate of products with excellent quality) are 0.277 and 0.341, respectively, which are each more than 5%; their impacts cannot be confirmed. These results can be explained in the same manner as those of (9). Generally speaking, areas with higher "Volume of transactions in the technical

market/GDP" often have higher degrees of aggregation of industrial and commercial enterprises, and therefore, in regard to FDI, but may also be places they want to reject.

5. Conclusion and Policy Implications

According to each analysis in 4. (1)－(10) above, a conclusive summary of the results of this empirical study is described below.

First, the results that show that X_4 and X_9 have an extremely strong positive and an extremely negative influence, respectively, indicate that the continuously expanding Chinese market and labor force (which has good performance considering its lower wages) are still the two most important factors for determining FDI locations.

Second, closely following these two factors are science and technology capability and the state of information infrastructure. The results show that X_1 and X_{11} have medium-level positive influences, indicating that these two factors have become very important in terms of choosing FDI locations in China. Sufficient attention should be paid to these two factors.

Third, the results show that the significance levels of X_{13}, $X_{14,}$ and X_{15} are more than 5%, indicating that the degree of aggregation of businesses and enterprises with foreign investments in each location does not seem to be as important as indicated in the results of previous studies (Yu, 2005a; Yu, 2006). This kind of change, in addition to the reasons for the aggregation itself, which include rising relevant costs such as land, housing, and wages in locations with relatively high aggregation, an increase in the standard of access by the local government, and other factors indicate that the regional development strategy of the Chinese government, which favors the central and western regions, is starting to have an effect.

The three conclusions above, lead us to the following insights: ①China has now become the "world market," but its position as the "world's factory" has not changed. The labor force, which has good performance considering its lower wages, is still the most important factor in selecting locations for FDI. ②The world is heading toward a knowledge economy, and although factors related to the traditional industrial economy are still important in determining FDI locations, the factors that are relevant to the knowledge economy, such as science and technology capability and the state of information infrastructure, have become factors with mid-level importance. Therefore, in order to attract FDI, it is not sufficient to only improve infrastructure for the industrial economy (such as power and water supplies, airports, ports, railways, highways); it is also necessary to build new information infrastructures that meet the requirements of the knowledge economy. This is also consistent with the requirements for the transformation of China's economic development model. ③It is a welcome change that the locations chosen for FDI are no longer clumped together. The Chinese government should put more effort into encouraging an FDI shift into central and western regions with certain conditions, gradually changing the substantial regional differences in China on the basis of mutual benefit of FDI and the host country, and achieving a coordinated development of the Chinese regional economy.

References

1. Burton-Jones Alan (1999), *Knowledge Capitalism*, Oxford University Press.

2. Cao Hui Ping and Qin Chao (2009), Empirical Analysis of FDI Area Selection Factors in Anhui Province, China. *Economic Research Guide* No.10, pp.148-149.

3. Chen Qian (2007), The Key Factor Affecting FDI Location Selection－Based on Empirical Analysis of Jiangsu Province, China, *Economic Research Guide* No.4, pp.131-132, p.192.

4. Dunning, John Harry (1993), *Multinational Enterprises and Global Economy*, Addison Wesley Publishing Company.

5. Lan Yi Sheng (2005), *China's Opening Up and Economic Development in The Region*, Shanghai Academy of Social Sciences Press.

6. National Bureau of Statistics of China (2008－2013), *China Statistical Yearbook*, China Statistics Press.

7. Porter, Michael Eugene (1998), *On Competition*, Harvard Business School Publishing.

8. UNCTAD (2002), *World Investment Report.* United Nations New York and Geneva.

9. United Study Group of Ministry of Commerce and Chinese Academy of Social Sciences (2004), Study on Gradient Transfer of Foreign Direct Investment in China, *China Industrial Economy*, 193(4), pp.5-12.

10. Sun Cheng Ping, Li Lu Jing and Wang Dong Sheng (2010), Regional Planning, Industrial Transformation and Regional Development, *China Industrial Economy*, 268 (7), pp. 146-15.

11. Wang Ru Yuan, Li Cui Hua, Zhang Xue Hui and Yan Ting Zhen (2008), Characteristics and Mechanism of FDI Area Selection in Sichuan Province, China, *Geographical Research*, Vol.27, No.2, pp. 385-396.

12. Yu Xiao Jun (2005a), A Statistical Analysis of the Determinants of the Location of Japanese FDI in China, *JOURNAL OF BUSINESS MANAGEMENT*(13), pp.46-59.

13. Yu Xiao Jun (2005b), Benchmarking China’s Regional FDI Performance, *Journal of Asian Management Studies* (11), pp.209-217.

14. Yu Xiao Jun (2006), A Statistical Analysis of the Determinants of the Location of Japanese FDI in China, *JOURNAL OF BUSINESS MANAGEMENT* (18), pp.83-96.

15. Yu Xiao Jun (2012), The Second Benchmarking of China’s Regional FDI Performance, *Journal of Japan Regional Policy* (10), pp.9-18.

16.Yu Xiao Jun (2013), A Statistical Analysis of the Ecological Determinants of Attracting FDI into Middle Coastal Regions in China, *The 11th Conference of International Federation of East Asian Management Associations(session C,D,E)*, pp.149-155.

17. Zhou Xiao Yuan (2013), Stable Rising of Foreign Investment in Recent Years, *People's Daily Overseas Edition,* 8/14/2013.