

LOCATIONAL DISTRIBUTION AND SPATIAL DIFFUSION OF FOREIGN DIRECT INVESTMENTS FROM HONGKONG AND MACAO IN MAINLAND OF CHINA

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ABSTRACT: Foreign direct investments (or FDIs) have been employed since the early 1980s and they have become more and more important in Chinese economic development. However, the roles of FDIs are very different between regions, partly due to the different locational preference of various source countries. Some facts show that FDIs from Hongkong – Macao indicate a strong locational preference. Therefore, this paper attempts to make an empirical research on the locational preference of Hongkong – Macao's FDIs and their spatial diffusion under the support of statistical data with regression analysis. In this paper, three statistical models, including the special location model, the general location model and the spatial diffusion model, are created. The results show that this kind of analysis is successful. The major conclusions are as follows. (1) The optimum location for FDIs from Hongkong – Macao lies in the coastal area, especially Guangdong, Hainan, Jiangsu, Shandong, Fujian provinces. Besides, Hubei Province is also an important region. (2) The FDIs from Hongkong – Macao in China have diffused gradually from the coastal provinces to the inland regions, the northern and the metropolis and from the locations that had attracted a large number of investments to their vicinities since the 1990s. (3) The special location factors, such as the border effect, the unique social and kinship ties are the key factors determining the special locational distribution. (4) The general location and spatial diffusion of Hongkong – Macao's FDIs are the results of interplay of several economic factors. They are the economic scale and advantage, the growth rate, the labor force and economic extrovert etc.

KEY WORDS: Hongkong – Macao, Foreign Direct Investments(or FDIs), location model

I. INTRODUCTION

Since the reform and opening-up, Foreign Direct Investments(FDIs) have been employed

in Chinese economic development. Some research results show that FDI in Chinese economic development have changed a series of economic structure, such as, investment structure, property structure, trade structure, technology structure etc. which suggests that roles of FDI in Chinese economic development should be seriously taken into consideration in studying the regional development issues. Evidently, the regional difference of roles of FDI is determined by the spatial pattern of FDI which varies with different source countries or regions of FDI. Consequently, in order to study the location distribution and spatial diffusion of FDI in a certain country, different source countries FDI's location preference should be firstly observed. As is known to all, Hongkong and Macao have been the main sources of FDI in mainland of China. However, the distribution of Hongkong and Macao's FDI shows greatly spatially unbalanced(Cai, 1994; Leung, 1990; Li, 1996). Therefore, it's believed that a study on the location distribution and spatial diffusion of Hongkong and Macao's FDI in mainland of China will impose highly scientific value on the analysis of the general distribution and diffusion law.

II. SPATIAL PATTERN AND DIFFUSION OF HONGKONG AND MACAO' FDI IN MAINLAND OF CHINA

1. Spatial Pattern

The spatial pattern of Hongkong and Macao's FDI in mainland of China is observed from investor and receiver and called Absolute Spatial Pattern and Relative Spatial Pattern respectively.

1.1 *Absolute Spatial Pattern*

The accumulative investment agreement number in each province during 1990 – 1993 is firstly calculated. Based on this result, the percentage of Hongkong and Macao's FDI that each province accounts for is produced and reflected in Fig. 1 Because it demonstrates the spatial pattern absolutely from Hongkong and Macao investors, it may be named Absolute Spatial Pattern. From this figure, The FDI's spatial characteristic and location preference are easily discerned. Evidently, the optimum investment locations for Hongkong and Macao investors are eleven provinces or metropolis in the coastal regions, accounting for 83.49%, especially Guangdong, Jiangsu, Shandong, Fujian, Hainan etc. attracting 60.95%. While the central and western regions are 9.65% and 3.84% respectively. In addition, Hubei province in the central regions is another important favorable investment location. Therefore, Spatial Pattern of Hongkong and Macao's FDI is almost consistent with Chinese regional economic pattern, decreasing by degrees from east to west.

1.2 *Relative Spatial Pattern*

The location quotient is employed to study the regional difference of Hongkong and Macao's FDI in China from the receiver of international capital. The location quotient is expressed as follows;

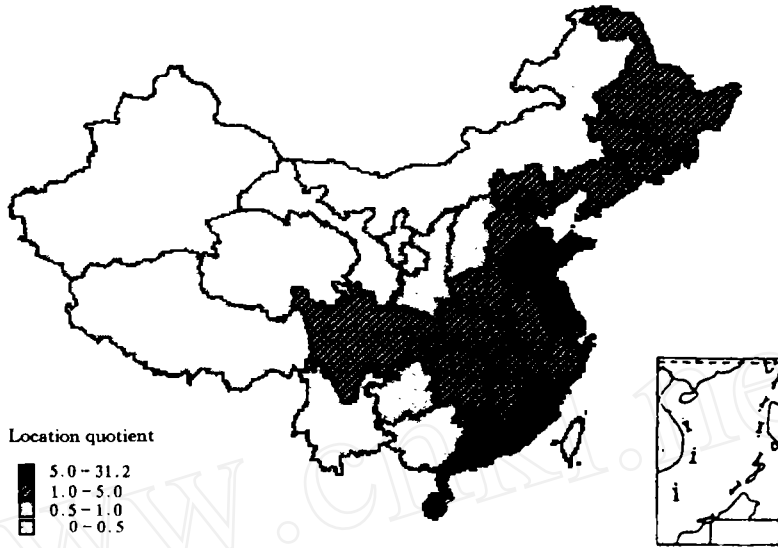


Fig. 1 Absolute Spatial Pattern of Hongkong and Macao's FDI in mainland of China

$$LQ = \left[\frac{FDI_i}{FDI} \right] / \left[\frac{\sum FDI_i}{\sum FDI} \right]$$

where LQ is the location quotient of Hongkong and Macao's FDI in i province, FDI_i is the total agreement investment numbers of Hongkong and Macao's FDI in i province, FDI is the total agreement investment number of FDI in the same province, $\sum FDI_i$ and $\sum FDI$ are the sums of $\sum FDI_i$ and $\sum FDI$ respectively, namely, the total agreement investment numbers of Hongkong and Macao's FDI in mainland of China and the total agreement investment numbers of FDI in mainland of China.

LQ reflects the relative importance of Hongkong and Macao's FDI in a certain province, $LQ < 1$ means that Hongkong and Macao are important FDI sources, while $LQ > 1$ suggests less importance. Similarly, LQ is demonstrated in Fig. 2.

The figure judges the location distribution relatively and is named Relative Spatial Pattern. It clearly displays that Hongkong and Macao are the main FDI source regions in the following provinces: Guangdong (1.3723), Hainan (1.3394), Guangxi (1.2284), Guizhou (1.1846), Hubei (1.0998), Jiangxi (1.0938) and Hunan (1.0607) etc. which are located in the south-middle China, geographically close to Hongkong and Macao regions. At the same time, there exist the unique social and kinship network between Hongkong - Macao and the southern China. While, to the north east areas and west areas, Hongkong and Macao's FDI have less importance. This strongly suggests the roles of border effect and geography distance.

2. The Spatial Diffusion of Hongkong and Macao's FDI in Mainland of China

The difference between the percentage in 1993 and in 1990 is used to measure the spatial

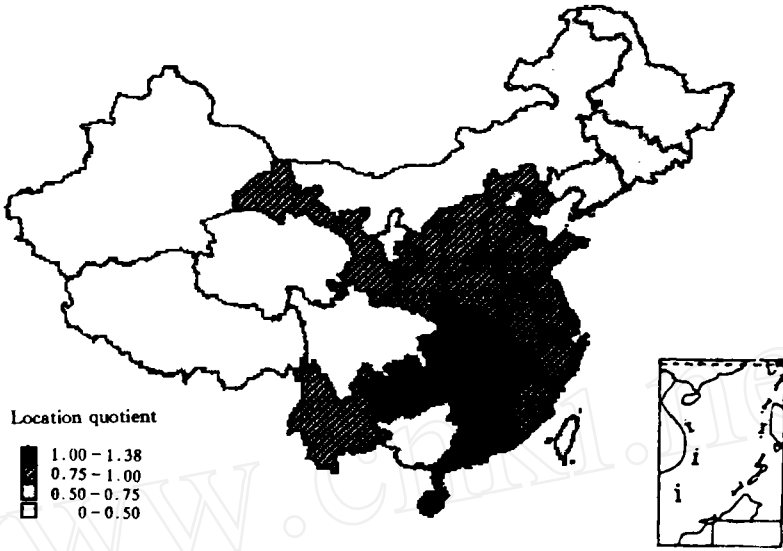


Fig. 2 Relative Spatial Pattern of Hongkong Macau's FDIs in mainland of China

diffusion (Fig. 3). From the figure, the relative outflow provinces include Guangdong, Fujian, Liaoning, Sichuan etc. (without FDIs in Xizang and Qinghai), among them Guangdong decreased by 23.33%. While Jiangsu, Shangdong and Hainan relatively increased greatly, which means that key locations of investment have moved to those provinces. In addition, other provinces, such as, Guangxi, Tianjin, Shanghai, Hubei, Henan, Hunan, Zhejiang, Jiangxi, Beijing etc. show a certain increase. As a conclusion, the spatial diffusion of Hongkong and Macao's FDIs in mainland of China can be generalized as follows: (1) gradually to the

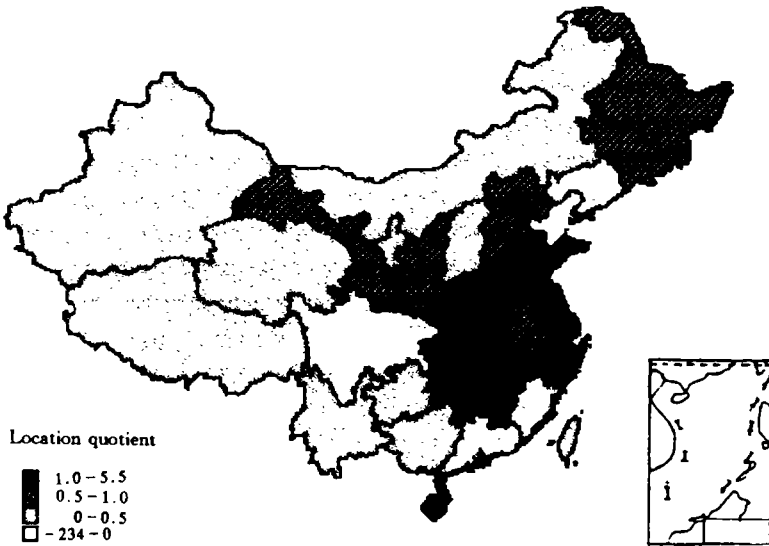


Fig. 3 Spatial diffusion of Hongkong and Macao's FDIs in mainland of China

provinces in the north of China from the south, (2) to the metropolitan areas like Beijing, Shanghai, (3) from the coastal regions to the inland, especially concentrating on south-middle China.

III. SPATIAL AND TEMPORAL MODEL OF HONGKONG – MACAO’S FDIs IN MAINLAND OF CHINA

With respect to special and general location factors, the special location model and the general location model are produced, then considering the time factor, the general spatial and temporal model is obtained.

1. Special Location Model

From above analysis, the special location characteristic of Hongkong – Macao’s FDI in mainland of China is that the investments are focused in the coastal regions and those adjoining them (or existing special social economic link with Hongkong and Macao). The special location model is used to test the special location characteristics. After careful consideration, the following regression model is adapted.

$$FDI = GNP^\alpha \times EXP(\beta \times B + \delta \times R + \mu)$$

where *FDI* represents Hongkong – Macao’s investment agreement numbers in each province; *GNP* is gross national product which reflects economic scale and investment opportunity; *B* and *R* are two special variables, *B* is used to test the border effect, which is 1 if the province is near to Hongkong – Macao or has some special social link with them, otherwise, 0; *R* is employed to test spatial gradient distribution, equal to 1 in the east provinces, 2 in the centre and 3 in west; α, β and δ are undecided coefficients, μ is the error.

This model is used to explain the distribution of FDIs from Hongkong – Macao in mainland of China from macroscopic and special location factors. It is assumed that the location selection of Hongkong – Macao’s FDIs in mainland of China depends on the economic scale, border effect and economic distance from coastal regions. If the regression coefficient α is more than 0 and the testing effect is significant, the lure to attract Hongkong – Macao’s investment varied with different economic scale, the greater the economic scale and the investment opportunity, the more their investments. If the regression coefficient β is more than 0 and the testing effect is obvious, the border effect and special social link have a strong effect on FDI’s location selection and spatial diffusion. If δ is less than 0 and the effect is obvious, it proves that the east is the best locations for Hongkong – Macao’s FDIs mainland of China and the west is worse.

To simplify the calculation, this formula can be obtained as follows

$$\ln FDI = \alpha \times \ln GNP + \beta \times B + \delta \times R + \mu$$

By regression method in SAS system, the parameter estimate is obtained:

$$FDI = GNP^{0.6630} \times EXP(0.9626 \times B - 0.7973 \times R + 4.2939)$$

α, β and δ are 0.6630, 0.9626 and -0.7973 respectively. F -test is 0.05 and R^2 is equal to 0.84. We can say the regression results are satisfying and the above-mentioned hypotheses are tested. As conclusions, the characteristics of the location selection of Hongkong – Macao's FDI in mainland of China are:

(1) The spatial pattern of investments is determined by province distribution in mainland of China. To Hongkong – Macao's investments, the east is prior to other regions, and the distribution appears to be gradient from the east to the west.

(2) The difference of the economic scale and investment opportunity are of first importance among investment environment factors when Hongkong – Macao's investors plan to invest in mainland of China.

(3) The social link and kinship are special factors which have an important effect on spatial distribution of investment and are more significant than province distribution. Therefore it is reasonable that many scholars explain Hongkong – Macao's FDI in China from this perspective.

2. General Location Model

2.1 Location factor selection and model creation

The above-mentioned model is only concerned with some special factors which influence the distribution of FDI from Hongkong and Macao' in mainland of China, but they can't explain all of the investment location selection. The general location model is developed to try to find some general location factors.

The factors which influence the foreign investment policies of multinational enterprises generally may be classified as enterprise special factors, location factors and policy factors. In these three factors, enterprise special factors are of first importance. Location factors determine the location selection of FDI and the policies in the host country are the prerequisite conditions, but no matter how flexible and favorable the policies are, it's not the policies themselves attract more foreign investments, but the significant means to improve location advantages. Many substantial studies indicate that the special advantage of enterprises is the most important, such as the density of research and exploitation and management techniques. However the location factors and policy factors are important factors if it's concerned with location decision of investments. Obviously the location factors should be paid more attention to when general location characteristic of Hongkong – Macao's FDI in China are analyzed.

Some studies indicate that Hongkong – Macao's investors show four kinds of motives when they invest in mainland of China.

(1) Taking advantage of their labor-intensive products by employing cheap labor force and resource in mainland of China.

(2) Taking advantage of favorable policies on foreign investments in China.

(3) Based on social link and kinship.

(4) Expanding consumer market space in mainland of China.

In accordance with theoretical analysis and previous studies and considering location factors of both sides of investment, we can select the location factors which influence Hongkong – Macao’s investment in China as follows:

(1) Investment opportunity, the location factors include gross national product (GNP), per capita gross national product, GNP growth rate.

(2) Repayment rate of investment, this factor can be reflected by capital product rate and labor product rate.

(3) Lure to investment, which contains labor cost, favorable policies and economic opening level.

(4) Support for investment, this factor refers to infrastructure, cooperative investment and industry structure level.

Where the capital product rate is the ratio of GNP and gross labor force; labor cost is the proportion of the payment of labor in GNP; the economic opening level is the ratio of the sum of import-export and GNP; the infrastructure is expressed by gross transportation, post and communication product; the industry structure level is the sum of the proportion of the second industry and that of the third industry. Because of the speciality of the policy factors, it is not considered. In addition, the factor, which is concerned to proportion, is expressed by decimal. After comparative study, the regression model can be developed as:

$$FDI = X_1^{a_1} \cdot X_2^{a_2} \cdot X_3^{a_3} \cdot X_4^{a_4} \cdot X_5^{a_5} \cdot EXP (a_6 \cdot X_6 + a_7 \cdot X_7 + a_8 \cdot X_8 + a_9 \cdot X_9 + a_0)$$

It can be changed into linear model by logarithm:

$$\ln FDI = a_1 \ln X_1 + a_2 \ln X_2 + a_3 \ln X_3 + a_4 \ln X_4 + a_5 \ln X_5 + a_6 \ln X_6 + a_7 X_7 + a_8 X_8 + a_9 X_9 + a_0$$

where $X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9$ are respectively referred to GNP, gross value of transportation, post and communication, per capita GNP, capital product rate, labor product rate, GNP growth rate, labor cost, economic opening level, industry structure level.

The regression results are produced with forward regression and stepwise regression analysis respectively. The results are shown in Table 1 and Table 2.

Table 1 Results of the Forward Regression Analysis about the General Location Model

Parameter variable	Parameter estimate	Second error	Sum of square	Value of F-test	Probability >F
intercept	-6.0504	4.0303	0.5135	2.25	0.1482
$\ln X_1$	0.9906	0.4268	1.2271	5.39	0.0304
X_6	9.0324	2.4212	3.1790	13.92	0.0012
X_7	2.3917	2.0617	0.3066	1.35	0.2591
$\ln X_2$	-0.3760	0.4394	0.1669	0.73	0.4017
X_8	1.7478	1.4330	3.7119	16.29	0.0006
$\ln X_5$	0.6086	0.3118	0.8687	3.81	0.0643

Table 2 Results of the Stepwise Regression Analysis about the General Location Model

Parameter variable	Parameter estimate	Second error	Sum of square	Value of F-test	Probability > F
intercept	1.3665	0.8388	0.6300	2.65	0.1163
$\ln X_1$	0.6199	0.1318	5.2589	22.15	0.0001
X_6	9.2414	2.2528	3.9949	16.83	0.0004
X_8	2.1846	0.3482	9.3429	39.26	0.0001

2.2 Result analysis

(1) The regression coefficients of X_1 and X_2 , which reflect investment opportunity or investment capacity, are a_1 and a_2 , their F -tests are obvious. It suggests that the first economy location factor to influence the distribution of Hongkong - Macao's FDIs in mainland of China, is the investment opportunity. On one hand, the more the investment opportunity, the less the investment risk, the less the investment transaction cost and easier to get investment items which have high profit rate. On the other hand, to the sides which accept the capital, the greater the economic scale, the faster the rate of economic growth, the greater the effective demand for capital, the greater the foreign investment lure. At the same time, they can provide better company investments and investment environments than other regions, so that these regions are definitely the best investment location for Hongkong - Macao's FDIs in mainland of China, such as Guangdong, Fujian, Jiangsu and Liaoning provinces.

(2) X_8 reflects economic opening level and the result of regression is good, F -test is less than 5%. It's said that economic opening level decides the location selection of Hongkong - Macao's FDIs in mainland of China to some degree. In fact, the connection with the overseas market is the precision of attracting foreign investments and the necessary condition for Hongkong - Macao investment in these regions. Because, in mainland of China, the higher the economic opening level, the more flexible and favorable the policy, the higher the industry structure level, the greater the demand for foreign investment and the greater the lure to FDIs.

(3) The results of X_5 and X_7 are very good. The believable degree of X_5 is less than 10%. Both of them are the indexes concerned with labor factor, which indicates that the labor factor is taken into more consideration when Hongkong - Macao's investors plan to invest in mainland of China. And it's consistent with their motives of investment and their transformation state of industry structure. From the industry structure level, Hongkong and Macao belong to the second level, their labor intensive products have developed completely and they are transferring to capital intensive industry. Because of the rise of wages and land price, many labor-intensive industries became "sun-down" industries and have lost competitive advantage in international markets. In order to make full use of cheap labor and resource in mainland of China and take advantage of this kind of corporation, Hongkong and Macao locate labor intensive industries in mainland of China. Therefore, it becomes necessary to take labor factors into consideration seriously.

(4) X_2 represents gross transport - post - communication product which reflect infrastruc-

ture level. It's useful only when the believable degree is less than 0.5. But during the course of regression, this factor is the first factor to be introduced into the model and its regression coefficient is positive and the result of F-test is also obvious. However, when X_1 (GNP) is introduced, X_2 becomes unobvious and negative, which indicates that X_1 has a negative effect on X_2 . In those regions where foreign investments have been attracted and it is the bottleneck to attract more foreign investments in some degree. As a result, the results of regression show that the key measure of improving investment environment is to improve the hard investment environment, especially the transport and post and communication department. In a word, the location factors influencing the distribution of Hongkong Macao's FDI in mainland of China are economic scale, economic growth rate, labor cost and labor product rate, economic opening level and infrastructure.

3. Spatial Diffusion Model

According to the above-mentioned special location and general location analysis, the spatial pattern of investment is determined by the special social link, economic distance from coastal regions, investment opportunity, the economic opening level and labor etc. In fact, it's just the different roles of these factors in different stage that determine the spatial diffusion of Hongkong - Macao FDI in mainland of China. From these location factors, the laws of spatial diffusion of Hongkong - Macao's FDI in mainland of China will be explored.

The general spatial and temporal model is developed by analyzing the statistics data in 1990 and 1993. X_1 , X_2 , X_3 and X_4 are respectively referred to GNP, labor products rate, GNP growth rate, economic opening level. B is the same as above and R is equal to 1 or 0 according to the east or the midwest.

The model is developed as follows:

$$FDI = X_1^{a_1} X_2^{a_2} EXP(a_3 \cdot X_3 + a_4 \cdot X_4 + a_5 \cdot R + a_6 \cdot B + a_0)$$

It can be changed into linear model by logarithm:

$$\ln FDI = a_1 \ln X_1 + a_2 \ln X_2 + a_3 X_3 + a_4 X_4 + a_5 \cdot R + a_6 \cdot B + a_0$$

In order to analyze the spatial diffusion, the time factor is introduced into the origin model using the expansion method (Stuart, 1991). The time factor is supposed as linear function of each regression coefficient.

$$a_1 = a_{11} + a_{12} \cdot t$$

$$a_2 = a_{21} + a_{22} \cdot t$$

$$a_3 = a_{31} + a_{32} \cdot t$$

$$a_4 = a_{41} + a_{42} \cdot t$$

$$a_5 = a_{51} + a_{52} \cdot t$$

$$a_6 = a_{61} + a_{62} \cdot t$$

where t is time variable and equals 0 in 1990 and 1 in 1993.

Putting above-mentioned linear equations into the spatial and temporal model, we get

$$\begin{aligned} \ln FDI = & a_{11} \cdot \ln X_1 + a_{21} \cdot \ln X_2 + a_{31} \cdot X_3 + a_{41} \cdot X_4 \\ & + a_{51} \cdot R + a_{61} \cdot B + a_{12} \cdot t \ln X_1 + a_{22} \cdot t \ln X_2 \\ & + a_{32} \cdot t X_3 + a_{42} \cdot t X_4 + a_{52} \cdot t R + a_{62} \cdot t B + a_0 \end{aligned}$$

The regression result is produced by forward regression method in SAS system. When the believable degree is equal to 0.25, the regression results are put into the spatial and temporal model and we get:

$$\begin{aligned} \ln FDI = & 0.9395 \cdot \ln X_1 + 1.5033 \cdot X_4 - 0.8361 \cdot R + 2.2698 \cdot B - 0.8555 \cdot t \ln X_1 \\ & + 0.7579 \cdot t \ln X_2 + 19.2869 \cdot t X_3 - 2.2422 \cdot t B - 0.5736 \end{aligned}$$

The regression results indicate that the spatial diffusion of Hongkong - Macao's FDIs in mainland China is determined to great degree by GNP, the economic opening level and the changed roles of GNP, labor product rate, the economic growth rate, special social link.

(1) The regression coefficient a_{12} of $t \cdot \ln X_1$ is negative, which indicates that the effect of the economic scale in the location selection of Hongkong - Macao's FDIs descends and the investments are diffused to the regions where the economic scales are relatively small. This can explain why the investments diffuse to the midwestern China to some degree.

(2) a_{62} is the regression coefficient of $t B$ and the value is negative, but a_{61} (the regression coefficient of B) is positive, which indicates that the effect of special social link is weakened, but the factor is still an unignored location factor. Owing to the weakening of this link, the investments in southern China are decreased.

(3) It can be obtained from the regression result of a_{32} that the change of the economic growth rate is an important location factor which leads to spatial diffusion of Hongkong - Macao's FDIs in China. It's well-known that since 1992, the omnidirection opening strategy has been implemented along the coast and the border and the Changjiang River, the core of economic development has been transferred to the north and the economic growth rate has been accelerated in some north provinces. At the same time, the development opportunity is quite well in some interior provinces, the border trade development, change of economic development mechanism in interior provinces and participation of national significant investment items accelerate the economic growth rate, and the demand for effective capital is expanded and the investment opportunity is increased. Hongkong - Macao's investors catch this opportunity and locate their investments in inland and north step by step.

(4) Of course, because the investments from Hongkong and Macao are mainly labor-intensive industry, they have to pay more attention to the labor factor. So that the spatial and temporal change of the labor product rate is also the key factors which have an effect on the investment spacial diffusion. The trend is that the investments are gradually diffusing to such locations where the labor product rate is greater.

IV. CONCLUSIONS

This paper makes a tentative location analysis for Hongkong – Macao's FDI in mainland of China with reference to statistical data and draws several conclusions as follows:

(1) The optimum location for FDI from Hongkong – Macao lies in the coastal area, especially Guangdong, Hainan, Jiangsu, Shandong, Fujian provinces. Besides, Hubei Province in the middle area is also an important region.

(2) The FDI from Hongkong – Macao in China have diffused gradually from the coastal provinces to the inland regions, the northern and the metropolis and from the locations that had attracted investment to their vicinities since the 1990s.

(3) The special locational factors, such as the border effect, the unique social and kinship ties are the key factors determining the special location distribution.

(4) The general location and spatial diffusion of Hongkong – Macao's FDI are the results of interplay of several economic factors. They are the economic scale and advantage, the growth rate, the labor force and economic openness etc.

Of course, the policy factor is also a considerably important factor which has an undeniable effect on attracting foreign investments in mainland China especially in the initial stage of reform. However since the 1990's, the omnidirectional opening strategy has been carried out, the policy factor is no longer the decisive factor and because there are some difficulties in considering the policy factor, this paper does not consider the policy factor as a location factor.

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