Chapter 4

Result and Discussion

4.1 Regression Analysis

The regression results of multivariate models used cross section of 48 counties, which have 26 border counties sharing boundary line with 3 foreign country and 22 neighbour counties in inland of Yunnan province(shown in Appendix Table A.1), are showing in Table 4. 1. The R- square of this model is about 0.76 . The little low r - square show that some determination as a explanatory variable in this model may not completely explain the depend variable and / or some other independent variable are out of the model. In other words, the variable considered by this model only can explain 76 percent of independent variable (malaria incidence). The other 24 percent needed to be modified by error term.

4.1.1 Effects on Border Counties from Foreign Counties

The coefficient of incidence of foreign country is statistically different from zero at 5% level. That is, coefficient of incidence of foreign countries is not zero. There are some relationship between INCF and LogINC, and the sign is positive which is same as our estimate. That means, the malaria situation of 3 foreign counties does play a positive role in the malaria transmission in the border counties of Yunnan, China. If the coefficient of this variable was not statistically significant, the coefficient of INCF would be zero That is, there is no relationship between INCF and LogINC. The malaria situation in foreign countries does not

effect the malaria transmission in counties of Yunnan, China. Although the coefficient is a little smaller , we have to look at the incidence of 824 and 683 per 10,000 population of Lao PDR' s malaria incidence in 1997 and 1996. In short, mobile population crossing international boundary line is a very important factor for malaria transmission in this area .

Table 4.1 The Result of Regress Analysis

(Dependent Variable is LOGINC)

Variable	Coefficient	Std. Error	Prob.
C	-0.021527	0.053817	0.6898
INCF	8.08E-05	4.07E-05	0.0494
INCNEI	0.001645	0.000744	0.0286
VECT	0.014087	0.017445	0.4208
SUR	0.026660	4.958267	0.9957
Lagged-LOGINC	0.789719	0.052181	0.0000

R-squared	0.764205
F-statistic	89.45064
Prob(F-statistic)	0.000000

Included observations: 144

4.1.2 Effects on Border Counties from Neighbor Counties in Inland

The result showed to us was same as our estimate. That means, The malaria situation in inland of Yunnan play a role on the malaria transmission in the border counties by mobile population, too. The coefficient of INCNEI are statistically different from zero at 5% level. The relationship between INCNEI and

LogINC are existing, and a positive sign indicate that malaria situation in inland of Yunnan play a positive role on border malaria transmission. Malaria incidence rate will be effected in the border counties by mobile population when the situation of neighbor counties in inland is serious. This can explain some counties face risk from inland since the neighbor counties in inland is the hyperendemic area. It is similar to the variable of INCF discussed above. It would be no relationship between INCNEI and LogINC if the coefficient of INCNEI was zero in this model. Comparing the coefficient of INCF above, this one has a little bigger coefficient. On the one hand, we will find the average malaria incidence of less than 10 per 10,000 population when we look into the incidence of malaria in Yunnan (Appendix Table A.1). Therefore, it shouldn't be suppressed that it is a bigger coefficient as the malaria situation in neighbors of inland of Yunnan had a much lower incidence. On the other hand, maybe there are some inappropriate in the model. Because we even weighted the effect by the length of boundary line. Probably it is effected by the combination of the complicated geographic situation as well, such as mountain, convenience of transportation.

4.1.3 Vector Control

No statistics significant difference was displayed with a wrong sign. Usually, we believe that vector control can reduce the malaria transmission. A negative sign was estimate. It means that, vector control will lower the morbidity of malaria. The result of this study did not show the evidence of our believes because the coefficient of this variable is not significantly different from zero.

The argument may be:

One reason is in light of the present control policy in Yunnan, China. The authorities of malaria control carry out activities under the policy which control

priority will center on the riskier counties and population. That makes over activities in some counties so that the model can not reflect the relationship between malaria transmission and vector control as we estimate.

Another is that the small sample size cannot reflect the relationship of the variable with malaria incidence rate. As mentioned in introduction, border area is an endemic area of malaria disease. Most of counties in inland has much lower malaria incidence or no malaria case at all Unfortunately, most of inland counties cannot be included in this study due to the limitation of time. When we can consider all 127 counties, the result will more reliable. Or it may be inappropriate using DDT residual spraying only as proxy of vector control since some place employ less DDT residual spraying than other vector measures in Yunnan, China.

The other may be due to some error from data. It is not difficult to find some figure of 12.05, 12.69, 8.59, 5.7, and 4.7 (Appendix Table 1). That is, some place can spray DDT 12 times, 8 times, 5 times, and 4 times In one year according to my definition of variable given in before, It looks like to be unbelievable. Since there are a guide line how many times should spraying practically. Three times of DDT residual spraying is the most possible spraying number in those place which have a more serious malaria situation. Moreover, under the limitation of insecticide supply in most counties, even once complete spraying is not possible as their planning coverage according to the stratification of malaria in Yunnan.

4.1.4 Surveillance

We are estimate a negative sign in this variable. Generally, We thought that there are a lagged effect on malaria control activities. That is, the more activities of ACD completed in this year, the lower malaria incidence will be in

the next year. The t-value of this study show that it is not different between the estimated coefficient and zero. And it show us a wrong sign. It did not show the evidence as we thought.

The reason may be that It cannot reflect the situation of malaria transmission exactly due to the over activities. Because ACD is a routine work for each anti-epidemic and preventive station. Usually, each anti-epidemic and preventive station completes the number of ACD as planing according to malaria situation in the previous year. Looking at the SUR of 0.0027, 0.0024, and 0.0021 in Tengchong (No. 23), Jingu (No.37), Yongde (No.41), respectively (Appendix Table A.1). By contrast, the malaria incidence in the three counties is 14.78, 3.27, 0.61 per 10,000 population , respectively (Appendix Table A.1). Although the morbidity of malaria in the three counties are quite different each other. Activities of surveillance in the three counties are very close.

Same reason with vector control may be the case again. This study only involved 48 counties out of 127 counties since most of counties excluded by this study has a lower malaria incidence rate generally. After involving the inland counties, the result will be more reliable.

The reason maybe is that ACD only as proxy of surveillance may be not a good indicator as we hope.

No lagged effect of surveillance on morbidity suggest that the ability of quick response in Yunnan is good since report monthly is necessary for each anti-epidemic and preventive station. Meanwhile, Anti- epidemic and preventive station often conduct the survey of ACD in the possible problematic area. This can discover the problem as soon and early as possible.

4.1.5 Lagged Malaria Incidence

We estimated that a positive relationship between the incidence in the year t and the incidence in one year before the year t. According to Pongsa Pornchaiwiseskul' s study, malaria severity of prevalence depend on the transmission rate and patient's recovery rate (equation 2.1). The coefficient of lagged incidence is statistically significant different from zero. The lagged malaria incidence effects the malaria transmission in the next year. This study coincides with the findings by Pornchaiwiseskul. This imply that, referring the previous incidence can be an appropriate factor taken into consideration when policy of control or resource allocation was done. Because the change of working or living condition is always at a very slow speed and human behavior always changes a little by a little.

4.1. 6 Conclusion of Regress Analysis

The regression analysis showed that the model can be accepted. It imply that there are positive relationship between foreign nations and the malaria incidence in the border counties of Yunnan, China. Lagged incidence has also positive effect on malaria incidence in the border counties of Yunnan, China. Surveillance, vector control haven't show the evidence of relationship with independent variable of malaria morbidity. It seems that mobile population is an important fact effected malaria transmission in this area.

4.2 Analysis of Other Factors

As shown in regress analysis, INCF play a role on malaria transmission in Yunnan, but there are three countries with different situation along the international boundary line. If the mobile population based on county was

available, the conclusion would had been easy to drawn. Moreover, as discussing in the methodology, the factor affected malaria transmission not only result from mobile population, but social economic factors, as well. Therefore, it is necessary and helpful to have a close look at these factors before our drawing conclusion.

Generally, Lao PDR has the highest incidence of malaria as shown in Table 4.2 , The second one is Myanmar. The lowest incidence rate is Vietnam. Looking at the incidence rate in border counties of Yunnan, the group bordered on Lao has highest incidence rate. The group linked with Myanmar ranks the second place. The lowest one is those connect with Vietnam. This consequence is exactly consistent with the incidence of the three foreign nations. Looking into the detail of Table 4.2, can found that the severity of malaria transmission in border counties of Yunnan exactly coincide to the severity of malaria transmission in Lao, and Vietnam during 1995 to 1997. The malaria situation of border areas along with Lao during 1995- 1997 is worsen year by year while the same situation was happening In Lao. On the opposite, The malaria situation In both side of China-Vietnam boundary line is getting better during the three years. Although the counties along with Myanmar is not match the situation in Myanmar during the period. The malaria incidence rate in 1996 is lowest in the border areas of Yunnan while the malaria incidence rate in 1997 is lowest in Myanmar. This may be due to the figure of malaria morbidity in the study used the national incidence rate. It is may not representative the situation in the border area of Myanmar along with Yunnan. This can tell us that there are relationship between foreign nation and the border counties in Yunnan in spite of the difference Myanmar.

Considering about the mobile population crossing, the figure of mobile population show that the number crossing the boundary of Myanmar and China. is far more than any other one. Suppose that Mobile population cross border evenly, the number of population crossing border line per Kilometer regard as the

Table 4. 2 Comparison of Malaria Situation in the Border County of Yunnan, China.

Variables	Laos-China			Myanmar-China			Vietnam-China		
	1995	1996	1997	1995	1996	1997	1995	1996	1997
Foreign countries Incidence [1] (1 / 1,000)	63.2	68.2	82.5	22.8	25.6	20.7	9.01	7.07	5.8
Incidence rate in border counties of Yunnan [2](1/1,000)	2.0	2.61	3.77	1.64	1.42	1.82	1.1	0.72	0.55
No. Of border crossing [3] (person times)	230,827	203,235	242,905	5,714,340	8,830,580	11,801,616	1,594,466	1,285,664	1,582,239
Length of border line [4](Km)	423			2,185			1,281		
GCP per capita [5] (RMB)	2974	3,318	Na	2311	2,576	Na	1344	1527	Na

Note: 1: Data source compile from statistics yearbooks for Vietnam, thesis for Laos, unpublished data for Myanmar.

2: The data extract from annual report of YIMC in 1995, 1996, 1997.

3: The data resource is statistics records of border port office.

4: Central intelligent agency

5: The data resource is from statistics yearbook of Yunnan.

indicator. The group of Myanmar and China, is still the highest. The group of Vietnam and China is following, then it is the group of Lao- China. As the coefficient of INCF show, when every unit change of foreign nation's malaria incidence, as a result, the malaria incidence in border county of Yunnan will change the percentage much of coefficient (the real percentage need transform by anti-logarithm). That is, the number of mobile population is a matter of malaria transmission in Yunnan. The more border crossing there are in one county, the higher risk the county is facing.

As mentioned in previous, we can look at the change of independent variable to compare the effect from each side of boundary line by coefficient of INCF or INCNEI multiplying the unit weighted malaria incidence. Actually, the figure only show us the evidence of effect by the number of mobile population. Further, we can measure the effect of length of boundary line by comparing the intensity effect of each counties, which show us the per unit length of change of independent variable result from the change of explain variable(as shown in Equation 4.1).

$$\text{Intensity effect from foreign country} = \frac{\alpha_1 * Incf}{L_X} \qquad (4.1)$$

For example, considering the effect from foreign country in 1997, Meng la (No. 8) which have longest boundary line in all ranked the second highest risk according intensity effect (as shown in Table 4.3). Its malaria incidence rate in 1997 is the highest county in Yunnan province. Thus, It seems that the length of boundary line suggest the risk from foreign. Jian chen (No.7) face a quite higher risk at malaria from foreign country comparing to the other counties (as shown in Table 4.3). Actually, the length of border line with foreign country is medium

Table 4.3 Comparison of intensity effect from foreign country and inland county

No.	County	Intensity effect from foreign country			Intensity effect from inland county		
1	Fu nin	0.007277	0.005713	0.004686	0.000885	0.001049	0.000963
2	Ma li po	0.007278	0.005713	0.004687	0.003915	0.002003	0.002111
3	Ma guan	0.007277	0.005714	0.004686	0.020217	0.017816	0.011678
4	He kou	0.007278	0.005713	0.004686	0.021220	0.012169	0.009454
5	Jin ping	0.007278	0.005713	0.004687	0.038746	0.030444	0.024046
6	Lu chun	0.007278	0.005713	0.004686	0.029701	0.019926	0.018232
7	Jian cheng	0.035143	0.037175	0.044104	0.012098	0.012535	0.019542
8	Meng la	0.048015	0.051893	0.061970	0.045884	0.042364	0.075358
9	Jing hong	0.018382	0.020685	0.016725	0.019531	0.023711	0.034389
10	Meng hai	0.018382	0.020685	0.016726	0.030579	0.027417	0.049811
11	Lan can	0.018382	0.020685	0.016726	0.023421	0.016646	0.015965
12	Meng lian	0.018382	0.020685	0.016725	0.017253	0.011624	0.012659
13	Xi meng	0.018382	0.020685	0.016726	0.007305	0.005048	0.008639
14	Can yuan	0.018382	0.020685	0.016726	0.011322	0.015800	0.017842
15	Geng ma	0.018382	0.020684	0.016726	0.004742	0.008306	0.010266
16	Zhen kang	0.018382	0.020685	0.016726	0.006996	0.010720	0.012666
17	Long ling	0.018382	0.020684	0.016726	0.017611	0.014627	0.013838
18	Lu xi	0.018382	0.020685	0.016726	0.029204	0.012934	0.019593
19	Wan ding	0.069852	0.078602	0.063558	0.032719	0.025728	0.034339
20	Rui li	0.004837	0.005443	0.004402	0.052693	0.019939	0.025869
21	Long chuan	0.018382	0.020684	0.016726	0.039902	0.031014	0.032416
22	Ying jiang	0.018382	0.020685	0.016726	0.035071	0.017246	0.026142
23	Teng chong	0.018995	0.021374	0.017283	0.020265	0.015935	0.014973
24	Lu shui	0.018382	0.020685	0.016726	0.018914	0.017445	0.011794
25	Fu gong	0.018382	0.020685	0.016726	0.006033	0.008029	0.008005
26	Gong shan	0.018382	0.020685	0.016726	0.007027	0.010416	0.009955

among the border counties of Yunnan. It seems that the combination effect of length of boundary line and malaria situation in the three foreign countries have the influence on malaria transmission in border area of Yunnan.

We can notice that the counties bordering with Laos has highest GCP per capita. The second is the group along with Myanmar. The last one is Vietnam. It seems to us that mobile population crossing international boundary line attribute to the development of local economy while it suffer the malaria disease. This show us the malaria go along with economic activities in Yunnan.

4.3 Analysis of Resource Allocation

As mentioned in previous chapter, the spillover effect indicate the effect of this factor on output by one more unit input employed. The higher spillover effect means the border counties is at higher risk from foreign nation by mobile population. Measures of control focusing on mobile population in those area will get higher return than the control in the counties with lower spillover effect. Generally speaking , with the increase of mobile population cross the international border, Luchun (No.6) Jinghong (No. 9), Longling (No. 17), Longchuan (No. 21) in 1997 have a higher spillover effect (shown in Table 4.4) according to Equation (3.8.1). Theoretically , overall allocation efficiency can be reached under the limitation of health resource if more resource were allocated in those counties. That is, same amount of resource in control malaria in the four highest spillover effect can get higher return or comparatively lower cost per prevented case or death compare to that in the counties with lower spillover effect. On the opposite side , Funin (No1), Menglian(No 12), Ximeng (No. 13), and Gongshan (No. 26) have lowest spillover effect. It can less input on malaria control in the later five counties in 1997 if a more appropriate efficiency of resource allocation is the requirement. Inefficient allocation will be the case if input in the in the five

Table 4.4 The spillover effect of Mobile Population in Each County of Yunnan .

	County	SP95	SP96	SP97
1	Fu nin	0.000116	0.000133	0.000139
2	Ma li po	0.000155	0.000130	0.000144
3	Ma guan	0.000729	0.000773	0.000688
4	He kou	0.000406	0.000333	0.000321
5	Jin ping	0.000451	0.000451	0.000441
6	Lu chun	0.000915	0.000854	0.000896
7	Jian cheng	0.000149	0.000147	0.000167
8	Meng la	0.000115	0.000110	0.000124
9	Jing hong	0.000348	0.000366	0.000527
10	Meng hai	0.000297	0.000258	0.000430
11	Lan can	0.000580	0.000438	0.000488
12	Meng lian	0.000147	0.000121	0.000135
13	Xi meng	0.000109	0.000098	0.000118
14	Can yuan	0.000122	0.000132	0.000151
15	Geng ma	0.000227	0.000297	0.000388
16	Zhen kang	0.000154	0.000179	0.000220
17	Long ling	0.000680	0.000573	0.000627
18	Lu xi	0.000400	0.000224	0.000330
19	Wan ding	0.000150	0.000130	0.000160
20	Rui li	0.000476	0.000240	0.000322
21	Long chuan	0.000575	0.000459	0.000538
22	Ying jiang	0.000194	0.000132	0.000174
23	Teng chong	0.000256	0.000207	0.000226
24	Lu shui	0.000301	0.000266	0.000239
25	Fu gong	0.000128	0.000137	0.000149
26	Gong shan	0.000104	0.000112	0.000117

Table 4.4 The spillover effect of Mobile Population in Each County of Yunnan .

	County	SP95	SP96	SP97
27	Xi chou	0.001645	0.001645	0.001645
28	Guang nan	0.001645	0.001645	0.001645
29	Wen shan	0.001645	0.001645	0.001645
30	Ping bian	0.001645	0.001645	0.001645
31	Ge jiu	0.001645	0.001645	0.001645
32	Yuan yang	0.001645	0.001645	0.001645
33	Hong he	0.001645	0.001645	0.001645
34	Mo jiang	0.001645	0.001645	0.001645
35	Pu er	0.001645	0.001645	0.001645
36	Si mao	0.001645	0.001645	0.001645
37	Jing gu	0.001645	0.001645	0.001645
38	Shuang jiang	0.001645	0.001645	0.001645
39	Lin can	0.001645	0.001645	0.001645
40	Yun xian	0.001645	0.001645	0.001645
41	Yong de	0.001645	0.001645	0.001645
42	Shi dian	0.001645	0.001645	0.001645
43	Bao shan	0.001645	0.001645	0.001645
44	Liang he	0.001645	0.001645	0.001645
45	Yun long	0.001645	0.001645	0.001645
46	Lan ping	0.001645	0.001645	0.001645
47	Wei xi	0.001645	0.001645	0.001645
48	De qin	0.001645	0.001645	0.001645

Note: No.1-26 are border counties

No. 27-48 are non border counties

counties with lower spillover effect is same as the counties with higher spillover effect. For the non-border counties, it will be another story. As we hypothesis the non-border counties which is not connect foreign country haven't effect at all, so that the part of 2*INCF and INCF in Equation (3.8.1) are zero. As a result, the spillover effect is the coefficient of the variable of INCNEI. Obviously, It is not the truth due to the assumption.

Referring to the control activities of malaria control activities in 1997 (Shown in Appendix Table A.1), the vector control in counties with highest spillover effect are 0, 0.9993, 0, 0.0112, 0, respectively. The vector control in counties with highest spillover effect are 0, 0.6677, 0.8326, 0.3433, and 0. The population covered by DDT residual spraying is higher than the counties with lower spillover effect than in those counties with higher spillover effect.

Next, let' s look at surveillance . The surveillance in counties with higher spillover effect was 0.0085, 0.0102, 0.00206, and 0.0044, respectively. The higher effect group were 0.00319, 0.00985, and 0.00243. It seems quite similar amount of surveillance activities conducted in the two group.

For effect on the non-border counties, the spillover effect of population mobility from inland counties is considered (showing in Table 4.5). Since we assume that there is no effect from foreign country so that the spillover effect from foreign country are zero for the non-border county. Suffering higher risk will be the case when there are higher spillover effect. For example, Honghe (No. 33), Mojian (No. 34), Puer (No. 35) have a higher priority in 1995 since it is within a riskier situation. By contrast, Yunxian (No. 40), Shidian (No. 42), Yunlong (No. 45), needs less resource in this year. Comparing Input on mosquito control, the population covered by DDT residual spraying was 0.345, 0.233, 0.333, 0, 0.00027, and 0, respectively. (showing in Appendix Table A.1).

Table 4.5 Composition of spillover effect from different mobile populationon on malaria transmission in Yunnan

	County	α1* Incf (Foreign)			α2*Incnei (Domestic)		
		1995	1996	1997	1995	1996	1997
1	Fu nin	0.005094	0.003999	0.00328	0.002389	0.002833	0.002601
2	Ma li po	0.021107	0.016569	0.013591	0.021533	0.011017	0.01161
3	Ma guan	0.008005	0.006285	0.005155	0.115236	0.101551	0.066565
4	He kou	0.017466	0.013712	0.011247	0.093367	0.053545	0.041599
5	Jin ping	0.031294	0.024567	0.020152	0.197606	0.155263	0.122635
6	Lu chun	0.007278	0.005713	0.004686	0.169297	0.113576	0.103925
7	Jian cheng	0.077314	0.081786	0.097028	0.071381	0.073956	0.115295
8	Meng la	0.360113	0.389197	0.464776	0.165184	0.152511	0.271287
9	Jing hong	0.040440	0.045507	0.036796	0.169920	0.20629	0.299186
10	Meng hai	0.051470	0.057917	0.046832	0.168183	0.150791	0.273962
11	Lan can	0.025735	0.028959	0.023416	0.245921	0.17478	0.167632
12	Meng lian	0.044117	0.049644	0.040141	0.039681	0.026735	0.029115
13	Xi meng	0.036764	0.04137	0.033451	0.013879	0.009592	0.016415
14	Can yuan	0.05147	0.057917	0.046832	0.028306	0.039501	0.044604
15	Geng ma	0.016544	0.018616	0.015053	0.034619	0.060633	0.074941
16	Zhen kang	0.029411	0.033096	0.026761	0.029383	0.045024	0.053196
17	Long ling	0.009191	0.010342	0.008363	0.116234	0.096538	0.091334
18	Lu xi	0.025735	0.028959	0.023416	0.134339	0.059496	0.090126
19	Wan ding	0.034926	0.039301	0.031779	0.032719	0.025728	0.034339
20	Rui li	0.009191	0.010342	0.008363	0.063232	0.023927	0.031043
21	Long chuan	0.016544	0.018616	0.015053	0.155619	0.120955	0.126423
22	Ying jiang	0.075366	0.084808	0.068575	0.119241	0.058638	0.088884
23	Teng chong	0.056984	0.064123	0.051849	0.145910	0.114729	0.107808
24	Lu shui	0.036764	0.04137	0.033451	0.122942	0.113391	0.076658
25	Fu gong	0.064337	0.072397	0.05854	0.041026	0.054599	0.054435
26	Gong shan	0.069852	0.078602	0.063557	0.021783	0.03229	0.030862

Table 4.5 Composition of spillover effect from different mobile population on malaria situation in Yunnan

	County	α1*Incf (Foreign)			α2*Incnei (Domestic)		
		1995	1996	1997	1995	1996	1997
27	Xi chou	0	0	0	0.020946	0.018391	0.014976
28	Guang nan	0	0	0	0.013522	0.010332	0.006276
29	Wen shan	0	0	0	0.028106	0.013588	0.0028106
30	Ping bian	0	0	0	0.100208	0.08071	0.055035
31	Ge jiu	0	0	0	0.095701	0.073461	0.05846
32	Yuan yang	0	0	0	0.200167	0.110965	0.080633
33	Hong he	0	0	0	0.246813	0.1741	0.156676
34	Mo jiang	0	0	0	0.349493	0.219765	0.173381
35	Pu er	0	0	0	0.077575	0.077593	0.095693
36	Si mao	0	0	0	0.152396	0.142705	0.237742
37	Jing gu	0	0	0	0.060839	0.03748	0.042451
38	Shuang jiang	0	0	0	0.036157	0.05921	0.066557
39	Lin can	0	0	0	0.036869	0.028041	0.024101
40	Yun xian	0	0	0	0.021874	0.024071	0.026236
41	Yong de	0	0	0	0.054377	0.068771	0.0687633
42	Shi dian	0	0	0	0.024757	0.022082	0.023178
43	Bao shan	0	0	0	0.060592	0.045351	0.049745
44	Liang he	0	0	0	0.145357	0.096573	0.106135
45	Yun long	0	0	0	0.032104	0.037207	0.022714
46	Lan ping	0	0	0	0.106175	0.109768	0.065441
47	Wei xi	0	0	0	0.15008	0.135352	0.097379
48	De qin	0	0	0	0.040049	0.52824	0.06374

Generally, distribution in this six counties coincident with the economic theory. Let us look into detail, the consequence of resources needed in Honghe, Mojian, and Puer should be ranked by the order of Puer, Mojian, then, Honghe according to economic theory. Practically, the consequence of resource rank by the order of Honghe Puer, then Mojian. That is, the authority can do some adjustment in the amount of input in different counties, a better efficiency can be reached.

Similarly, we believed that the higher priority should be given when there are higher spillover effect of malaria morbidity among different counties . Economically , more efficiency will be touched by allocating more resource of mosquito control in Hekou Menglian, and less control activities in Longling Tengchong , Shidian in 1995 . We found the percentage of population covered by DDT-spray in 1995 was 1.1533, 1.6393 , 0.0069 0.0005 and zero in those counties respectively .They are consistent exactly .

Looking at the effect from surveillance, What is the situation? In 1996, allocating more surveillance in Hekou (No. 4), Jinghong (No.9) and Gongshan (No. 26) will improve overall efficiency (Shown in Table 4.5), On the other hand, reducing input in Lushui (No. 24), Guangnan (No. 28), Gejiu (No. 31) which with the contribution is 0.446, 0.291, and 0.30, respectively, will came to more efficiency in resource allocation according to the economics. The percentage of surveillance in total population is 0.0176, 0.0115, and 0.012 in higher three, and 0.0009, 0.00078, 0.00072 in the lower three , respectively (shown in Appendix Table1).