

**Topic:** Socioeconomics Relations

**A Comparative Study of Economic Revitalization Policy in Coal  
Mining Areas Between China and Japan  
- From the Spatial Perspective**

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**Abstract**

The resource-based cities are the cities which are driven by the exploitation of mineral, forests and other natural resources, and the leading industry is based on the processing of those resources. The resource-based cities have been providing a lot of energy for the development of China, but around 2000, the economic depression of resource-based cities began to arouse people's attention. Regarding to restore resource-based cities to growth, after the implementation of a series of related stimulus plans in past decade, finally, Chinese government enacted the *Sustainable development plan of resource-based cities* in 2013.

According to my research, there is a similar experience in Japan. Given that the transformation of industrial structure and energy structure in 1960s, the coal mining areas in Japan entered the period of economic stagnation. And then, Japanese government passed *Act on Temporary Measures concerning the Vitalization of the coal mining areas* in 1961. Based on the policy, a series of economic revitalization policies was in force. Now, the transformation of economic structure in some coal mining areas has succeeded.

In this paper, the differences of economic revitalization policy between China and Japan will be compared from the spatial viewpoint. Based on comparative study, the importance of spatial viewpoint applied in regional economic policy making will be reconsidered, and the problems of policies in China will also be concluded. As a case study, the development of automobile industry in North Kyushu will be provided.

**Keywords**

Keywords: Resource-based cities; Coal mining areas; Spatial distribution; Economic transformation

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**1. Introduction**

First, the principle that economic revitalization through the advancement of the industrial structure in the previous researches will be discussed. To achieve the

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advancement and upgrading of industrial structure, those resource-based cities highly dependent on resource exploitation could, develop the downstream industries, and enhance Industrial competitiveness by increasing added value of the resource products. Thus, in the future, even if the resource was exhausted, the resource-based cities could also realize economic growth by resource imports.

In previous researches, the principle based on following three assumptions. First, the added value rate in each processing stage is constant. In this paper, it is set as  $\alpha$ . Second, the production in each processing stage will flow into next stage as raw material in a constant ratio. In this paper, it is set to be  $\beta$ . It means that the ratio of  $1 - \beta$  of total production is consumed. Third, other costs including transportation costs is set to be 0. It means that production value is the sum of the raw material value and added value (Hara, 2007, pp. 116-117). Through the three assumptions above, the production value of raw material and the added value in each processing stage are as shown in table below:

Table 1. The added value and production value of raw material in each processing stage

	Primary Processing	Secondary Processing	Tertiary Processing	...	N times processing
Raw Material	$Y_1$	$\beta Y_1(1 + a)$	$\beta Y_1(1 + a)^2$	...	$\beta^{n-2} Y_1(1 + a)^{n-1}$
Added Value	$\alpha Y_1$	$a\beta Y_1(1 + a)$	$a\beta Y_1(1 + a)^2$	...	$a\beta^{n-1} Y_1(1 + a)^{n-1}$
Production Value	$Y_1(1 + a)$	$\beta Y_1(1 + a)^2$	$\beta^2 Y_1(1 + a)^3$	...	$\beta^{n-1} Y_1(1 + a)^n$

According to the table, the added value that the enterprise could earn is determined by three variables. It means that the higher added value ratio, the higher ratio flow into next stage as raw material, the more processing stages there are, the more added value that the firms could earn. Therefore, regional economic revitalization is focus on following points: How to have improve the raw materials flow into next stage, how to improve the added value rate, and how to improve the processing stage (Hara, 2007, pp. 116-117).

As what other methods show us, the new industrial development way is pointed out. The new way of industrial development is that resource-based cities should establish the new industries that not rely on the existing resource through the accumulated capital, technology, and human resources by resource developing, and transform the labor from resource development to the new industries.

Talking about the transformation difficulties, the advancement of the industrial structure is considered as the easier one, but the new industrial development is the more radical one, because it gets rid of the dependence of resource. However, as the common points of the two methods, new firms or new investments are needed. In the previous researches, because the foreign investment could bring not only capitals but also advanced technologies, management, and concepts, so attracting foreign investment is considered the effective way to develop the new industrial. Obviously, it is also applicable to advancement of the industrial structure.

Based on the above viewpoints, around the problem about how local government to attract foreign investment, lots of studies had been done, and some local governments sacrifice their local interests to attract foreign investment. However, the relationship between firm locations and regional revitalization based on spatial viewpoint has not been paid enough attention. This paper will be divided into following parts. First, under the spatial viewpoint, the methods mentioned above may fail, we will discuss this possibility. Second, the spatial distribution of coal mining areas in Japan and resource-based cities in China will be plotted, then, the spatial distribution characteristics will be analyzed based on the plotted results. Third, the importance of spatial association will be

discussed. At last, as a case study, the development of automobile industry in North Kyushu will be provided.

## 2. Methodology

### 2.1. Theoretical model

According to the spatial economy (Fujita, Krugman, & Venables, 1999, pp. 120-126), in the spatial models of urban systems, because production costs are the same regardless of the location chosen, the problem reduces to one of minimizing transportation costs. The figure1 shows that how the total transportation costs of a producer located at  $s$  may be analyzed, given that all other producers are concentrated at  $\tau$ .

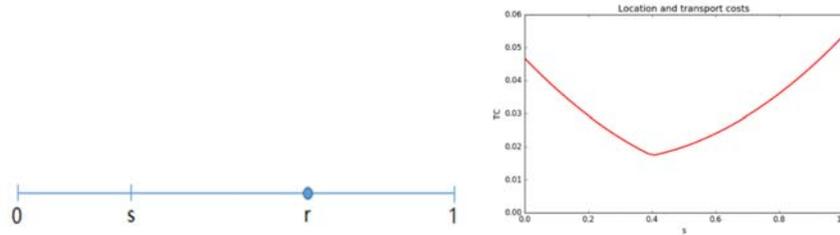


Figure1 Plant location; Figure2 Function of  $s$  (two accumulation points)

First of all, as shown in formula1 and figure1, the total transportation costs could be divided into three parts., the transportation costs of 0-  $s$ ,  $s$  -1, and  $r$ . Second, as shown in formula2, the transportation costs of each part are the product of transport volumes( $Q$ ), distance( $S$ ), and cost of per unit good transported one unit of distance( $V$ ). According to the above two formulas, the total transportation costs could be calculated as shown in formula3.

$$TC = TC_{0-s} + TC_{s-1} + TC_r \quad (1)$$

$$TC = Q * S * V \quad (2)$$

$$TC = \tau \left\{ \frac{1-\mu}{2} [s^2 + (1-s)^2] + \mu|r-s| \right\} \quad (3)$$

We could plot this total transport cost as a function of  $s$  for the parameters  $\tau=0.1$ ,  $\mu=1/3$ ,  $r=0.4$ . here, the parameters  $\mu$  is the share of the population that employed in manufacturing. Clearly, in this case the point of minimum transport cost - the optimal location of a firm choosing where to locate given the locations of other firms - is at  $s=0.4=r$ . This result continues to obtain in more satisfactory models. In the "market potential" function, an urban concentration normally both creates a cusp in the market potential function and is sustained by that cusp, which causes the existing urban location to be that function's maximum (Fujita, Krugman, & Venables, 1999, pp. 124-125).

In this model, we only consider the case of one accumulation point that each firm chooses to locate where all other firms are located. This model also could be extended to two accumulation points. As shown in figure4, other assumptions remain unchanged, all the firms are located in  $r_1$  and  $r_2$ .  $r_1$  employs industrial population of  $\mu_1$ ,  $r_2$  employs industrial population of  $\mu_2$ , and the condition of  $\mu=\mu_1+\mu_2$  is satisfied. Through the similar calculation method as shown in case1, we could the total transportation costs could be calculated as shown in formula4 and plot the total transport cost as a function of  $s$  for the

parameters  $r_1=0.4$ ,  $r_2=0.6$ ,  $\mu_1=2/9$ ,  $\mu_2=1/9$ ,  $\tau=0.1$ . As shown in figure3, we can still see that the point of minimum transportation costs - the optimal location of a firm choosing where to locate given the locations of more firms - is at  $s=0.4=r_1$ . That means, firms will prefer the larger cities which could bring lower transportation costs.

$$TC_r = \tau \left\{ \frac{1-\mu}{2} [s^2 + (1-s)^2] + \mu_1 |s - r_1| + \mu_2 |s - r_2| \right\} \quad (4)$$

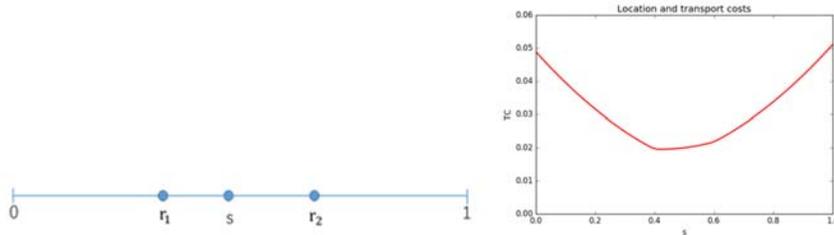


Figure3 Plant location (two accumulation point); Figure4 Function of s (two accumulation points)

In previous researches, Zhao (Zhao, 2007) pointed out that the city scale of resource-based city is smaller. And Liu (Liu, 2007) pointed out that the resource-based city located along the mines, with poor infrastructure, and away from the traffic trunks and developed areas. Therefore, according to the results in this section, we can infer that the resource-based cities will be of disadvantages when the firms consider investing and establishing plants. So, the policy effects may be less obvious if the policy only considers the resource-based cities.

## 2.2. The policy characteristics and spatial distribution of coal mining areas in Japan

Here are some concepts. First, the coal mining areas are the depressed coal production regions which caused by the depress of coal mining industry, and the regions connecting with it which has a close relationship with mining industry revitalizing. And then, in this paper, "article two region", "article six region", "article ten region" are the regions which are the object of article two, article six, article ten of *Act on Temporary Measures concerning the Vitalization of the coal mining areas*. According to *Act on Temporary Measures concerning the Vitalization of the coal mining areas*, "article two region" will be the aid object of the law. "Article six region" will be the object of loan for covering decrease in local tax revenues. "Article ten region" will be the object of interest subsidy for issuing municipal bond.

In this paper, the coal mining areas is chosen based on *Order for Act on Temporary Measures concerning the Vitalization of the coal mining areas* (2002.3.25). From the listed coal mining areas, the following characteristics will be found. First, "article six region" contained in "article ten regions", at the same time, "article ten region" contained in "article two region". Second, based on the characteristic one, it is clearly that the "article two region" has the largest number, the "article ten region" is the next, and the "article six region" has the least number. In reference of points based on "article six region", the number of more than "article six region" (added in article ten region), and also the number of more than "article ten region" (added in article two region) is decreasing. Third, based on the characteristic one and two, the "article six region" has the largest proportion, meanwhile, the "article six region" is aid object of article two, article six, article ten. So, it is obvious that article six is the main aid object of law, and the assistance intensity is decreasing from "article six region" to "article ten region".

Then, based on *Order for Act on Temporary Measures concerning the Vitalization of the coal mining areas*, the spatial distribution of coal mining areas in Hokkaido and Fukuoka-ken was plotted. According to the spatial figure, the spatial distribution characteristics are as followings. First, the “article six region” is located in the center area, the “article ten region” is distributed around the “added in article ten region”, and “the added in article ten region” is located at the extension of the “added in article two region”.

Overall, from the view of policy characteristics, there is an inclusion relation between each region, and from the view of spatial distribution characteristics, there is a connection relation between each region.

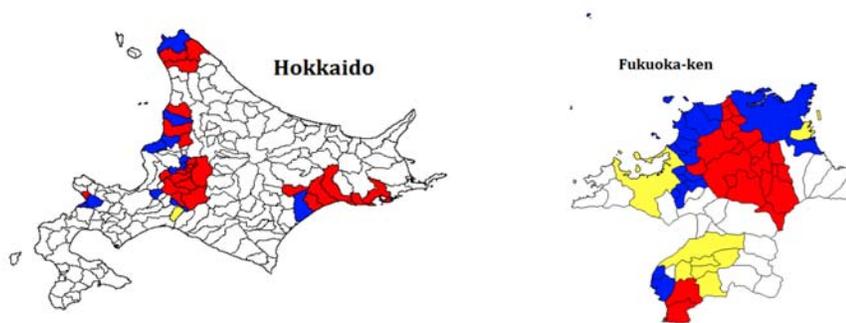


Figure5 the spatial distribution of coalfields in Hokkaido and Fukuoka-ken (yellow is the added in article 2 regions, red is the article 6 regions, blue is the added in article 10 regions.)

### 2.3. *The policy characteristics and spatial distribution of resource-based cities in China*

According to the policy, resource-based cities in China had been classified by 4 types. They are developing resource-based cities, mining resource-based cities, decline resource-based cities, and regenerate resources-based cities.

The developing resource-based cities are the cities which resource development in a rising stage. These cities have great development potential of resource, economic, social, and regarded as supply and reserve base of resource. The mining resource-based cities are the cities which resource development in a stable stage. These cities have a strong resource security capability, a higher development level of economic and social, and regarded as the core area of energy security at the present stage. The decline resource-based cities are the cities which resource reserves tend to dry up. In these cities and economically underdeveloped areas, livelihood and environment issues are serious. So, these cities are defined as the key and difficult areas in great need of being accelerated the transformation of economic development mode. The regenerate resources-based cities are the cities which get rid of resource dependence. These cities began to enter the track of Sustainable and healthy development, and become the leading regions of economic transformation of resource-based cities.

Refer to the characteristics of each type of resource-based cities, the policy has given a different guidance. For the developing resource-based cities, resource and city development based on a long-term perspective is of importance. For the mining resource-based cities, the upgrading of the industrial structure based on the high-level resource development is focused. For declining resource-based cities, how to promote economic transformation, and enhance sustainable development ability is a hot topic. For regenerate

resource-based cities, how to improve the efficiency of economic growth after the resource dependence reduced, and open wider to the outside world is focused.

Form the policy characteristics mentioned above, the relationship between each type of resource-based cities is hard to find. so, we selected Inner Mongolia as the developing resource-based region, Shanxi province as the mining resource-based region, Jilin province as the declining resource-based region, and Henan provinces as the common example to analysis the spatial distribution characteristics of resource-based cities in China, and determine if there is a relationship among each type of resource based cities.

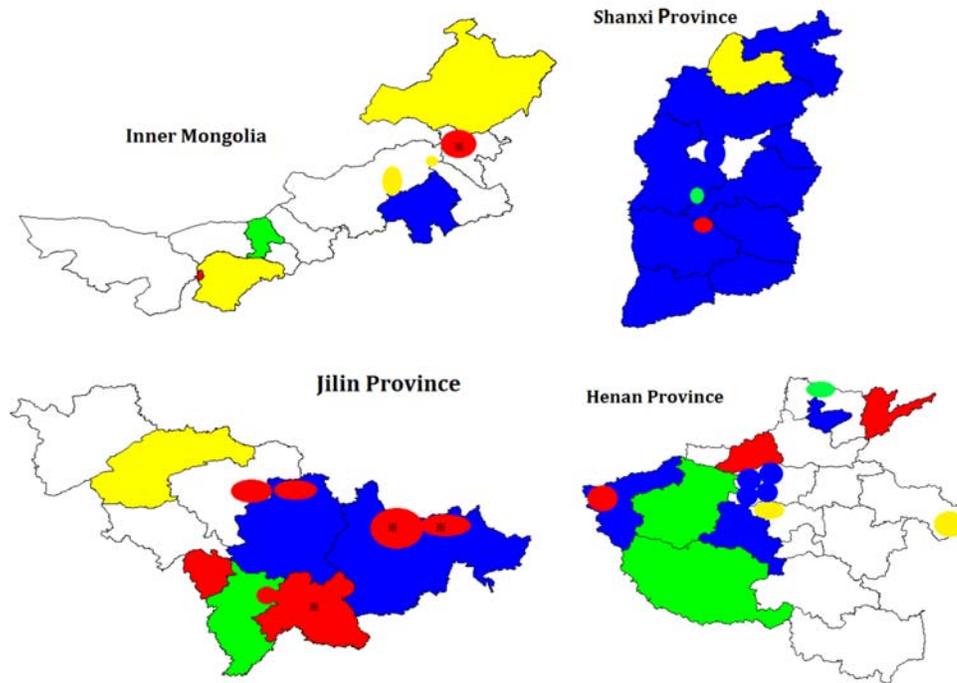


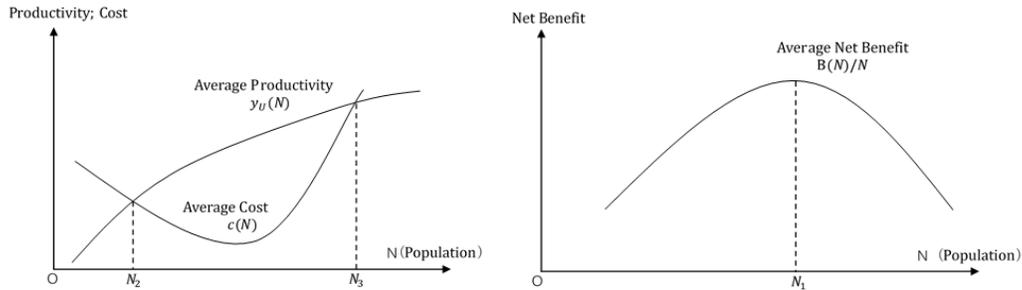
Figure 6 the spatial distribution of resource-based cities in China (yellow is the developing resource-based cities, blue is the mining resource-based cities, red is the declining resource-based cities, green is the regenerate resources-based cities)

From the results(figure6), in Inner Mongolia, almost all types of resource-based cities are related to the developing resource-based cities. In Shanxi province, almost all regions are mining resource based cities. In Jilin province, mining resource based cities, declining resource based cities, regenerate resource based cities are interconnected, while the developing resource based city are isolated. In Henan province, isolated developing resource based city, decline-resource based city existed, and interconnected regions also are exiting. Therefore, it is difficult to sum up the common disciplines from the results. At the same time, various resource-based cities have involved in policies, such as coal-based cities, forest industry based cities, so, there are examples which relate with each other, but the resource types of cities are different. Clearly, the concept like 'the regions connecting with it which has a close relationship with mining industry revitalizing' in Japan is not reflected in China's policy.

### 3. The importance of spatial association

About the benefit of firm cluster, input sharing, labor pooling, skill matching, and knowledge spillovers, all of which could generate higher productivity and lower

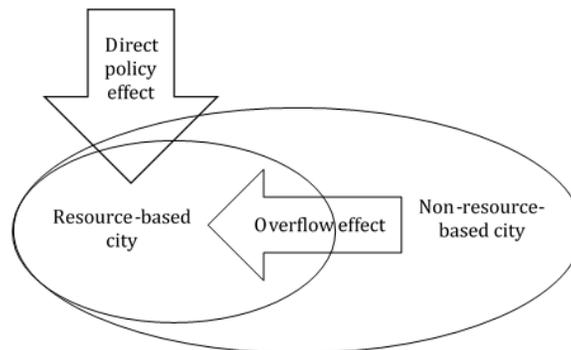
production costs indicated by O'Sullivan's work (O'Sullivan, 2012, pp. 45-64). However, due to the constraints of region space, with the increasing of agglomeration scale, higher commuting time, higher building density, and environmental issues will bring a negative impact on the firms which located in the agglomeration region. Therefore, the agglomeration scale is not the bigger the better, and it is considered that if the agglomeration scale exceeds the limitation, the agglomeration economics will be reduced.



**Figure 7 the change of average productivity and average cost; figure 8 the change of average net benefit** (Nakamura & Tabuchi, 1996, pp. 34-35)

As shown in figure 7, the average productivity will increase with the expansion of agglomeration scale, however, the growth rate is decreasing. The average cost will decrease with the expansion of agglomeration scale, but after a certain scale, the average cost will increase at an increasing growth rate. Average net benefit is the value that the average productivity minus the average cost. From the figure 8, it is clearly that average net benefit is increased first, and reached the maximum at  $N_1$ , then decreased. In this paper, we called  $N_1$  the optimal scale of region.

In terms of the above theory, return to figure, minimum transportation costs will be achieved if a firm choosing where to locate given the locations of other firms, and when location point moves to both sides, the transportation costs is increased. Therefore, firms will give priority to the agglomeration region, when the optimal scale of region exceeded, part of the firms will locate on both sides of agglomeration region. Similar result is also showed in the two agglomeration regions model, but from the figure, we can see that the growth rate of transportation cost is slowly when location point move from larger agglomeration region to smaller one.



**Figure 9 the effect of regional revitalization policy in Japan**

So, as shown in figure 9, the effect of regional revitalization policy in Japan could be divided into two parts, one is the direct policy effect which brought from policy directly, and the other one is overflow effect which brought from the diffusion of agglomeration economics. the direct policy effect will be effective only when the benefit brought from

policy to firms can offset the disadvantages of transportation cost brought from the location select, and the direct policy effect need a sustainable policy helps the agglomeration economics reach a certain scale. Therefore, the direct policy effect needs huge input. However, the overflow effect is based on the regional development where the agglomeration economies have a comparative advantage. So, from the point of firm location, the input of the overflow effect is smaller, and more efficient.

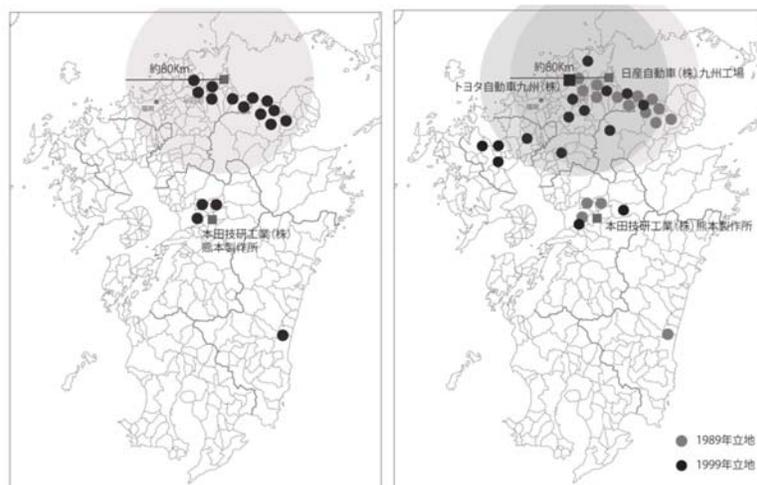
#### 4. A case study of Japan

Next, we will explain the overflow effect through the relationship between automobile industry development and regional economic revitalization. Due to transformation of industrial upgrading and energy structure, the coal industry of Kyusyu began to decline in 1960. And Kyusyu began to economic transformation from coal industry to processing industry.

The development of the automobile industry in Kyusyu can be divided into three stages (Forum Fukuoka, 2007). The first stage is in 1970s. In 1973, through the industry location policy of Kitakyusyu, Kyusyu factory of Nissan automobile was established in Kanda-machi. Then, Engine factory started production from 1975, and vehicles factory started production from 1976. After the location of Nissan automobile in the first stage, the primary products manufacturers of automobile started active in Kyusyu.

The second stage is in 1990s. In 1991, Toyota Kyusyu factory was located in Miyaata-machi, and started production from 1992. And in 1992 the second factory in Kyusyu factory of Nissan automobile was completed. Through the second stage, the number of production in northern Kyushu automobile reached a peak of 613 thousand, accounted for 7.6% of the total in Japan. However, affected by Asian financial crisis, the number of production decreased after 1996.

The third stage is after 2003. In 2003, the promotion conference of million production base in northern Kyushu was established, then, Nissan and Toyota automobile began to strengthen the existing factory, and build new factories. At the same time, Daihatsu car body (Daihatsu Kyusyu) moved from Gunma-ken to Kyusyu in 2004. Through the development of the third stage, the number of production in northern Kyushu automobile reached 1million and 10 thousand, accounted for 10.1% of the total in Japan.



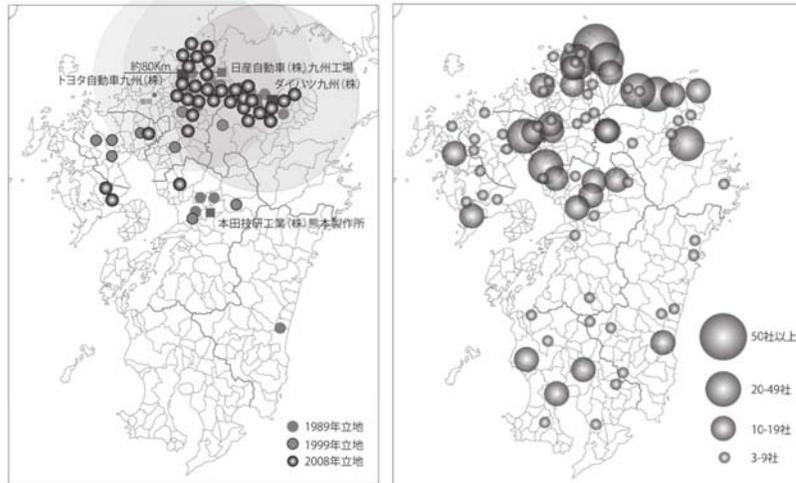


Figure 9 The change about location distribution of the first supplier of automobile industry (Kyushu Bureau of Economy, Trade and Industry, 2009)

After above three stages mentioned above, the development of automobile industry in Kyusyu is regarded as a successful model, and Kyusyu is known for a car island. The change about location distributions of the first supplier of automobile industry is shown in figure. In 1973, Kyusyu factory of Nissan automobile was located in article two region, and in 1989, the first supplier of automobile industry was mainly located in article two region and article ten region, in 1999, with the agglomeration scale in article two region and article ten region were strengthened, the agglomeration scale in article six region began to increase. In 2008, the agglomeration scale in all of article two region, article ten region and article six region was be strengthened. In general, the overflow effect is very obvious.

About the impact of overflow effect on the coal mining areas, the Miyaata-machi which located in Chikuhou, had begun the coal mining since the middle of Meiji period, and achieved long-term prosperity as a coalfield. After the mine closed, Miyaata-machi began to establish industrial park near the Wakamiya interchange of Kyushu expressway. With the convenience of transportation, abundant labor sources, and various funds established for regional revitalization, Miyaata-machi achieved success of industrial location through reducing the location cost of firms, and being referred to as excellent student of coalfields.

## 5. Conclusions

Firs, from a theoretical point of view, it is possible to help cities achieve region economic revitalization through the advancement of industrial structures and new industrial development. However, from the spatial perspective, the policy will face great difficulties in the implementation process if the policy object only affects the regions which most in need of assistances, and it may also lead to less policy effect. In the author's another research, effect of economic transformation policies in Henan province was be evaluated by compared with the indicators between resource-based cities and the non-resource-based cities which connecting with resource-based cities. The results have shown that in all the 61 indicators, only 15% account for a strong policy effect, and 5% of which have a weaker policy effect, in other words, the indicators which could be judged to be effective were only 20% in total (Zhu, 2016). This is a very disappointing result, and it also shows the influence that led by a lack of spatial viewpoint.

Second, through the analysis above, in the industry location policy, it is efficient that assistance to the developed regions which connecting with underdeveloped regions. Therefore, the revitalization policy should pay more attentions to those regions. And for the underdeveloped regions, such as infrastructure constructions, quality of labors should be paid more attentions, because they could reduce the location cost of firms effectively, and accelerate the agglomeration economics to underdeveloped regions from developed regions.

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