TECHNOPOLIS AND REGIONAL DEVELOPMENT IN JAPAN: A STATISTICAL ANALYSIS

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Abstract This paper examines the impact of the Technopolis Plan in Japan through an analysis of inter-Technopolis area development. It is found that, although industrial indicators show that the Technopolis as a whole has a higher development rate than the rest of Japan, this is because some Technopolis areas have competitive advantages due to their low production costs. Their development pattern also reveals that this development is natural rather than due to the impact of the Technopolis Plan, since there is no definite assistance from the National Government. This paper examines the issue of economic development only from the short term point of view (*gaihatsu-gata*); the impact of longer term economic development (*naihatsu-gata*), based on technological innovations, is left for future discussion.

Key words: Technopolis, high-tech industries, regional development, discriminant analysis

1. Introduction

With the changing economic and industrial production environment, all industrialized regions and nations have developed their own industrial policy, one way or another, to sustain their competitiveness, and to adjust to changes in the balance of their internal economic development. Some of these policies have been successful, but others have not. The Japanese Technopolis Plan has aimed both to promote its competitive power in world markets through technological innovation and to adjust Japan's internal socio-economic balance by relocating innovative industries to the remoter areas of Japan. In this paper, we will discuss the impact of the Technopolis Plan, through a comparative analysis of the industrial development of Technopolis areas in Japan. The next section of the paper reviews the background of industrial regional policy in Japan, and the third section is concerned with a comparative analysis of the development of Technopolis areas. Based on the results of section three, the final section will emphasize the context of Technopolis and make clear the actual impact of Technopolis Plan.

2. Background and strategies of Technopolis

Since the mid-1970s, the emphasis of Japanese industrial policy has shifted towards technological innovation, because of the remarkable success of Japan's industrial sector. In 1971, the Ministry of International Trade and Industry (MITI) has proposed a knowledge intensive industrial structure which has less environmental impact (Abe 1998). After the oil shocks of the 1970s, the heavy chemical industry suffered a crisis and new plant formation in this sector dramatically decreased. On the other hand, new plant formation in high-tech industries, particularly IC and its related industries, increased in the northern Kyushu and Kanto regions, along with the technological and micro-electronic revolution (Takeuchi 1996; Yamazaki 1997). Japanese industrial policy changed in accordance with this situation, and became focused on high-tech industries (Yamazaki 1997). The high-tech industries related regional development policies have been realized by the Technopolis Plan in 1983. In accordance with the Technopolis Plan, 26 areas were designated between 1984 and 1989. From the late 1980s to early 1990s, regional policies related to the development of information technology, the promotion of location of management, and the promotion of R & D functions in the remoter areas like Techno-mart and Brain Location Plans, were implemented (Itoh 1998).

Technopolis is a new type of urban development in which industries, academia, and high-class residential area are to be harmonized. In addition, high-tech industries, expected to play a central role in the plan, and also new high-tech industrial complexes, were encouraged to locate in the Technopolis area through an attraction and incubation approach. As a consequence, not only hard-infrastructure, like industrial sites and industrial water supplies, but also soft-infrastructure like research and development functions, work-training facilities and information distribution functions were developed (Itoh 1998). In other words, Technopolis Plan aimed to provide, not only the production center of high-tech industries, but also an innovative center of self-motivation. Both functions were intended to develop in two ways: firstly through relocation of high-tech industries from congested metropolitan areas (*gaihatsu-gata*), and secondly through the promotion of self-motivation systems from local industries (*naihatsu-gata*) (Castells and Hall 1994).

To realize the Technopolis development plan, a "Technopolis Development Organization (TDO)" was formed in each Technopolis area as the principal organization for advancing the construction of the Technopolis. To attract the high-tech industries, construction of new industrial estates and research parks is carried out as hard-infrastructure by the local government. To incubate local industries, loan guarantees for research development, financial assistance to the industry-university research cooperation and assistance to develop new technology, are provided by each TDO. In addition, some Technopolis areas attract private research facilities into the "Research Park", and provide for the formation of "Prefectural Industrial Technology Centers" at the prefectural level. Also, "Research Cooperation Centers" are formed at the national university in some Technopolis areas in accordance with laws passed to enable further technological development (Itoh *et al.* 1995).

3. Analysis of impacts on regional development

Each Technopolis area has been set targets regarding four industrial indicators including manufacturing workers (MWR), manufacturing goods shipment (MGS), manufacturing value-added (MVA), and manufacturing productivity (MPY); and also population targets for each 5 — year planning period. Most of the previous studies related to the development of Technopolis areas used the achievement of their targets as the main comparative factors (see Japan Industrial Location Center 1997; Tanaka 1996; Yamazaki 1995). It is reasonable to use such data for analysis, since the targets were determined in accordance with the situation of each Technopolis area. All these studies, however, used 1980 as a start year for each Technopolis area, to evaluate the achievement of set goals. Actually, designation of Technopolis status began in 1984 and ended in 1989. Some prefectural governments had been making efforts to construct Technopolis-type industrial development areas before attaining official Technopolis status. However, development officers, and also institutions like TPO, came to realize this only after their official designation. It is difficult, therefore, to distinguish effects that occurred specifically because of Technopolis designation from those that stemmed from these pre-Technopolis actions by the prefectural governments for valid inter-Technopolis comparisons. In addition, as some studies have pointed out, the initial targets set for some of the Technopolis areas were unrealistically high; industries in these Technopolis areas were unlikely to achieve these figures (Tanaka 1996). The two points mentioned above create problems regarding the comparative analysis of actual inter-Technopolis development. This paper, therefore, will use the actual trends of the manufacturing indicators, rather than goal achievement, to examine the impact of the Technopolis Plan. The population indicator is, however, excluded from the analysis since population growth is related to many other factors besides manufacturing.

Figure 1 shows the trends of four manufacturing indicators of Technopolis, Technopolis' prefecture (the data of Technopolis' prefecture but excluding Technopolis itself), and Japan. Although the trend of each indicator is very similar, Technopolis areas themselves have generally higher trends than other two regions, from the beginning of 1984 — 1985. Since each Technopolis generally occupies the most industrialized areas of its prefecture, the indicators of each Technopolis seem to be higher than those of the prefecture generally. In addition, indicators of Japan as a whole include both its most industrialized areas (the three large metropolitan areas) and its least industrialized areas, the remote periphery. This results in an apparently lower development rate for Japan than for the Technopolis. The gaps among three regions, however, have increased since 1990 and Technopolis shows the highest level of industrial development. It can be concluded that Technopolis as a whole has showed a higher development rate in manufacturing indicators. However, the pattern of these indicators is probably different among various Technopolis areas; some Technopolis areas with favorable situations for high-tech development have advanced more than other Technopolis areas. Therefore, the next section will examine the trends of Technopolis areas, and the principal factors influencing these trends.

Manufacturing data used in this analysis were calculated from *Manufacturing Census of Japan (City, Town and Village)*. The sources of other social indicators are shown in

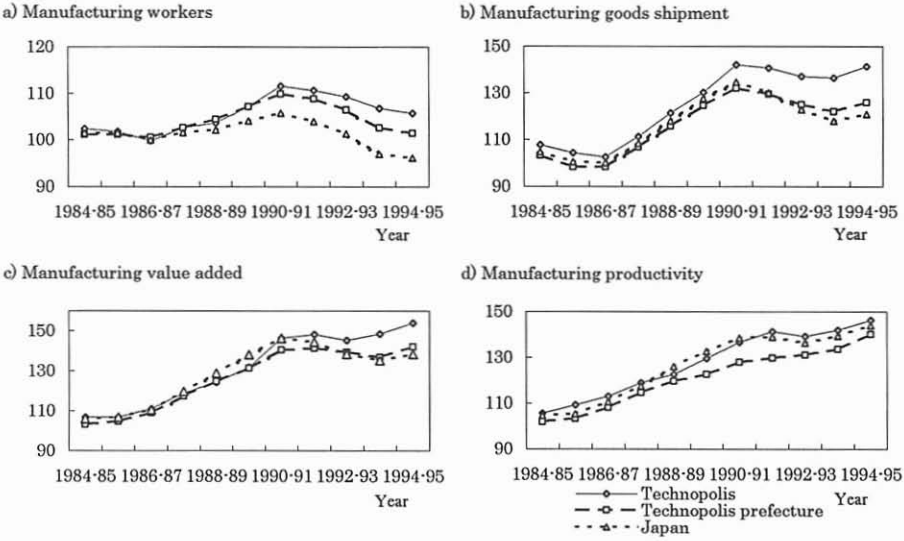

Fig. 1 Percentage change (in 1980=100) of manufacturing indicators of Japan, Technopolis prefecture (excluding Technopolis itself) and Technopolis. Source: Manufacturing Census of Japan.

Appendix I. Each Technopolis area has four indicators (MWR, MGS, MVA, and MPY) to evaluate its development. In addition, there is the length of time each Technopolis area has existed up till 1995 to be considered. The first step is to generalize this time span of Technopolis status up till 1995. In this step, the trend of manufacturing indicators for each Technopolis was represented by four indices. These indices are the average and standard deviation of annual development rate from starting year to 1995, the slope value of the regression line from start of Technopolis status up till 1995, and net growth from start till 1995 (1995 data/starting year data). Secondly, we can calculate 16 indices (4 indices for 4 indicators) to represent the development of each Technopolis area. Thirdly, cluster analysis was conducted in order to identify the development type of each Technopolis, and to group similar Technopolis areas based on the above mentioned 16 indices.

Three clusters can be identified from the analysis: the first cluster includes six Technopolis areas; the second and third clusters include seven and thirteen Technopolis areas, respectively. The characteristics of each cluster are shown in Fig. 2. It is clear that the first cluster has the highest development trend in four indicators. Although both the second and third clusters show stagnant development trends, the former has higher indicators regarding manufacturing productivity than the latter. The second cluster also indicates a decrease in manufacturing workers and manufacturing good shipment.

The spatial distribution of the clusters is shown in Fig. 3. Cluster 1 is generally distributed in the Kyushu and Tohoku areas. Cluster 2 is generally distributed around Tokyo and Osaka; it seems that the manufacturing activities with high productivity rate can only survive in the production environment of relatively high land prices and other living costs. Cluster 3 is generally located in the distant periphery from the large metropolitan areas.

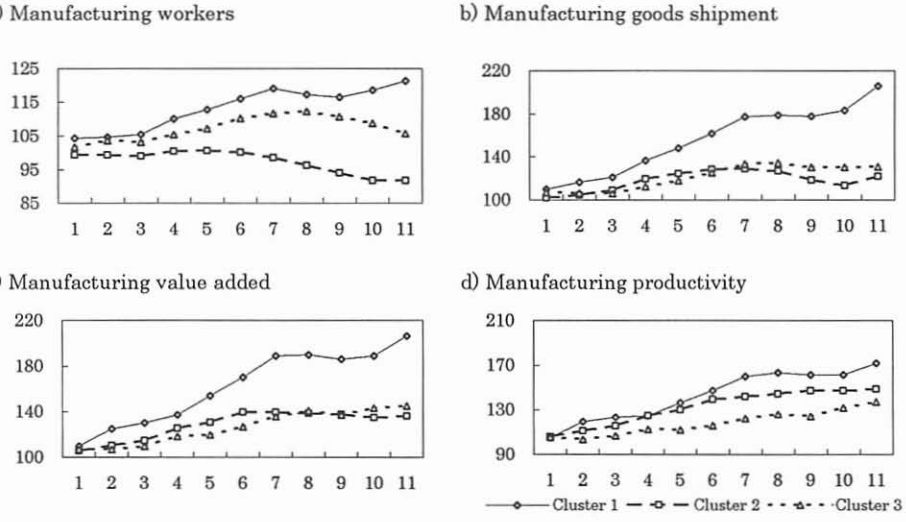

Fig. 2 Average values of manufacturing indicators of each cluster. Source: Manufacturing Census of Japan. Note: Horizontal axis indicates time span from the year of achieving technopolis status to 1995 and Vertical axis the percentage change.

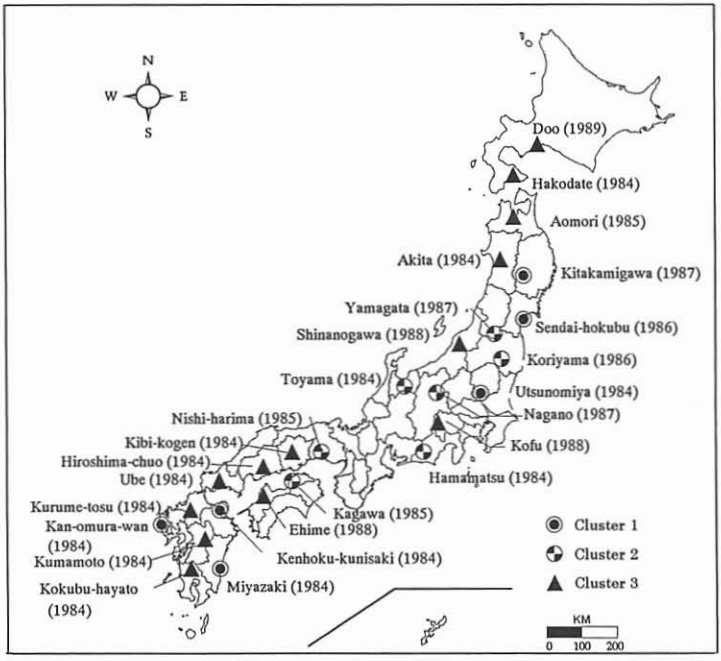

Fig. 3 Distribution of Technopolis Clusters. Number in the parenthesis is year of Technopolis establishment.