**2E20**

# Location of sectors with dissimilar characteristics:

*Technological Distance of prefectures*

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**Abstract**

Location of sectors with dissimilar characteristics might play a different role affecting aggregate economic performance. In this paper we classify industries according to their technological content and factor intensity according to the OECD, 2001 [8]. Unexpectedly, there is some evidence that dispersion of sectors with high R&D intensity is positive for growth and regional agglomeration of production and R&D activities is linked to aggregate growth.

This agglomeration is growth enhancing, i.e. equal dispersion of economic activities across prefectures and dispersion of sectors with a high technological content can be observed within Japan.
Is the current pattern of regional industrial specialization going to change? To answer this question is necessary to construct the map of spatial distribution of innovative and productive activity, and asses the level of integration between prefectures.

## 1. Introduction

What is important for growth is innovation and not production and that high agglomeration in manufacturing does not necessarily mean high agglomeration of innovative activities (Audrestch, 1996 [1]). It is important to explain success at the prefectural level, it means competitiveness, and therefore, to apply the formula to the prefectures which fall behind the leaders.

The regional business climate can spur firms to be more innovative and then, Innovative clusters leverage the performance of the prefectures (Fig. 1). At the same time, it is observed that geographic disaggregation only highlights differences in development and sectoral concentration (employment concentration, high value-added activities), innovation (patents, R&D expenditure, research institutes and universities), and specialization are variables enhancing productive environment in regional competitiveness and can be indicators of the prefectures's capacity for creating new ideas, transforming them creating commercial value and obtain the results in the form of knowledge-based goods measured by patents and the growth created.

The attempt to find explanations for the tendency of economic activities to cluster in Japan and within clearly defined boundaries and to link this with the concept of regional competitiveness, this topic has stimulated a resurgence of interest for space-related issues in economic theory. Then is the opportunity to retake them in this paper.

Krugman, 1991 [7] sustains that geographical concentration is the equilibrium outcome of countervailing forces (centripetal and centrifugal) which on one hand attract consumers and firms to the same location and prevent that the production of one good be entirely located in a single massive centre.

## 2. Analytical Framework

According to the number of exposed the prefectures, after making a factor analysis with the number of employees, number of firms, value added of the manufacturing goods, and scattering the data with respect to this three variables, and it is easily identifiable the leading prefectures and the backwards or followers that happen to be their neighbors.

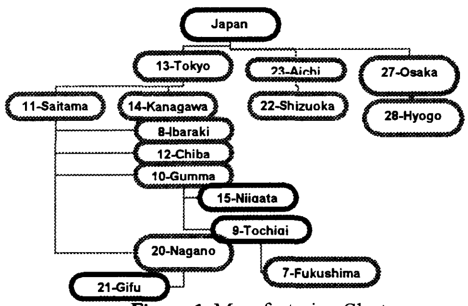


**Figure 1.** Manufacturing Clusters.

Patents' data offer tremendous potential for giving empirical content to the role of knowledge in the modern economy. As sustained by Jaffe, simple patent counts assign a value of one to all patents by construction, whereas their true values exhibit a very large variance.

According to Jaffe (1986)[4] and Jaffe and Trajtenberg (1999) [5], Hu and Jaffe (2003) [3] using a variable to measure Technological Proximity ( $Tprox_{i,j}$ ) between prefectures ***i*** and ***j***, according to patents, is defined as:

$$Tprox_{i,j} = \sum_{j=1}^{47} f_{n,i} f_{n,j} \quad (1)$$

for $\forall n$ and $\forall i$ ,

Where ***n*** is the patent class, in this case, according to the International Patent Classification (IPC) WIPO, ***i, j*** are the pair of regions that are being measured and $f_{n,i}$ and $f_{n,j}$ are the share of prefectures ***i***'s and ***j***'s patent class ***n***. This variable measures orthogonality between the patent's vectors of the different regions. The greater the variable the bigger the technological proximity between prefectures and will be zero when the vectors are orthogonal.

This approach of Technological distance by patents, between prefectures, regions or countries, since all patents are weighted in the same way, will measure specialization, it means regions with the same quantity of patents but in the other hand, industries which have different technological content and factor intensities which proximate R&D intensity ( ***RDINT*** :OECD, 2001) will have the same technological distance what is not accurate for our purposes. It is important to notice that this is not just a scalar factor but to set the real difference between prefectures, and using this technology proximity matrix as a carrying array of technological content embodied in the patents, it s possible to modify the equation as follows:

$$Tprox_{i,j} = \sum_{j=1}^{47} f_{n,i} f_{n,j} RDINT_n \quad (2)$$

for $\forall n$ and $\forall i$ ,

**3. Results**

The information at prefectural level and sectoral classification at the same time is difficult to gather since seems not helpful but results shown that this is an important source to find out more detailed differences between growth of regions. Then, using the information of patents by prefectures according to the International Patent Classification (IPC), they were reclassified according to the International Standard Industrial Classification (ISIC) by industry, the data was able to be analyzed, consequently with the information.

The OECD classification has shown a slightly difference in the classification of High, Medium, Low -medium and Low technology intensity industries in the case of Japan (See Fig. 2 and Fig. 3), therefore in this paper is utilized the Classification according to the Japanese Industries' performance but with the same principles of the OECD STI Scoreboard.

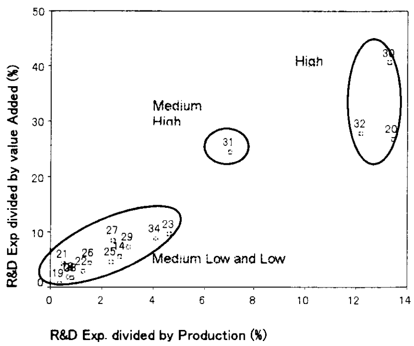


**Figure 2.** Aggregate R&D Intensity of Japan (Low to High)[a].

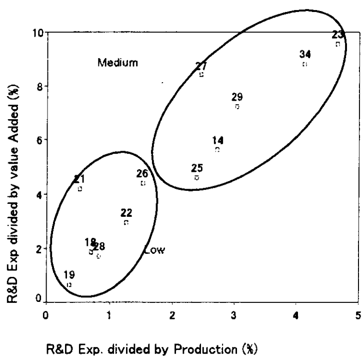


**Figure 3.** Aggregate R&D Intensity of Japan. (Low and Medium)

[a] Figure 2 indicates sectors classified by ISIC

In the past decade there has been a significant change in the composition of international trade in manufactured goods and the growth rate of trade in high-technology industries has accelerated, and their share in total OECD trade has increased. Analyzing the different explanatory variables and their role in the performance of the prefectures two cases have arisen:

(i) Spatial autocorrelation using Geographical Proximity as explanatory variable

$$\frac{\boldsymbol{GNP}}{\boldsymbol{cap}} = 0.37[\boldsymbol{Gprox}]\frac{\boldsymbol{GNP}}{\boldsymbol{cap}} + 0.1 + 0.24\boldsymbol{UNIV} + 0.57\boldsymbol{PAT}$$

(2.30) (2.63)(1.14) (3.14)

$$-0.02\boldsymbol{R\,\&\,D} - 0.07\boldsymbol{RESE} - 0.07\boldsymbol{RESIN} + 0.07\boldsymbol{FIRMS}$$

(0.15) (-0.9) (-0.5) (0.74)

**$R^2$=0.74**

(ii) Spatial Autocorrelation using Technological proximity as an explanatory variable of economic growth.

$$\frac{\boldsymbol{GNP}}{\boldsymbol{cap}} = 0.02[\boldsymbol{Tprox}]\frac{\boldsymbol{GNP}}{\boldsymbol{cap}} + 0.10 + 0.23\boldsymbol{UNIV} + 0.28\boldsymbol{PAT}$$

(1.33) (3.15) (0.85) (1.23)

$$-0.03\boldsymbol{R\,\&\,D} - 0.01\boldsymbol{RESE} - 0.04\boldsymbol{RESIN} + 0.39\boldsymbol{FIRMS}$$

(-0.2) (-0.05) (-0.54) (2.76)

**$R^2$=0.73**

Previous analysis made to the Japanese performance, Carvajal 2002 [[2]], shown by mapping tools the presence of spillovers between leading and backwards prefectures and the variables affecting the economic performance simulated how prefectures can catch–up with the leaders and their assimilation capacity, but technology proximity was not taken into account.

In this analysis, Geographical proximity plays a more significant role in economic growth than Technology proximity , its variable is more significant explains 3% of the model but Tprox just 1%.

One important point is the increasing significance of the firms when technology proximity is an explanatory variable for growth, it means regions present clustering of firms according to their technology intensity so it can be said there are more specialized and technological advanced prefectures.

The following noteworthy hypothetical findings are obtained some hypothesis can be inferred:

(i) **H1**: Technological content and factor intensity: Location of sectors with dissimilar characteristics might play a different role in affecting aggregated growth.

(ii) **H2:** Regional dispersion of sectors with a high technological content is good for aggregated growth and agglomeration of production, and may be a good proxy of R&D activities and technological spillovers. (See Fig. 4)

(iii) **H3:** Industries grow slower in cities where they are more concentrated and less specialized prefectures know higher growth than more specialized ones.

(iv) **H4:** Growth is an increasing function of agglomeration.

(v) **H5**: Growth will also encourage agglomeration and lead to higher growth where they are more concentrated (leading prefectures) and less specialized prefectures will know higher growth than more specialized ones (backward prefectures).

These hypothetical findings are supported by the location of patents registrations by sector as shown in Fig. 4:

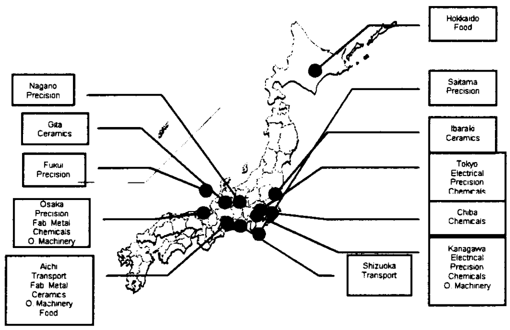


**Figure 4.** Mapping Clusters in Japan.

It is important then to measure until what extent is the technological specialization of Japanese prefectures associated with their productive specialization pattern and analyze possible technological advantages.

There are factors suggested by theory as having an effect on competitiveness for which there is no quantifiable approximation. Much of government policy falls into this category, as do indicators measuring the extent of venture capital activity, business registration rates, and the presence of high-tech clusters. Such features can be examined to see whether they are present in the characteristics of those regions which produce productivity growth in excess of what would be expected when taking account of the more measurable influences.

## 4. Conclusions

### 4.1. New Findings

Sectors with high Technological intensity seem to be more dispersed than sectors with low technology intensity. It means innovative activity is observed to not to be spatially clustered within specific industries then in Japan there is not tendency towards formation of specialized technological enclaves.

High Technology and medium high intensive industries follow a more dispersed pattern than medium low and low technology counterparts.

Dispersion is explaining uniform distribution of productivity, but clustering or agglomeration seems to be an explanatory variable of economic growth within and between prefectures.

The existence of differences between prefectures related to technology intensity and heterogeneity in industry concentration can give the tools for promoting policies of industry formation and industrial organization.

Homogeneous industrial organization (i.e. firms classified in the same sector and concentrated in proximal areas) will promote higher growth because of competitiveness, and innovation rate.

### 4.2. Implications in Cluster and Technology Policy

Concentration of manufacturing in Tokyo and Osaka is due less to inadequacies in infrastructure than a powerful and intrusive central government, with its centralizing errors in policies and institutions.

This is coherent with the prime minister's policy speech in the Diet in February 2003 that an Industrial Revitalization Corporation will be established to make fundamental revision for special measures toward industrial reorganization.

Then, This research will lead industrial policy to distort competition in favor of a particular location, to remove obstacles, relax constraints, and eliminate inefficiencies in order to leverage productivity growth relaying on dynamic improvement.

### 4.3. Future Work

Measure until what extent is the technological specialization of Japanese prefectures associated with their productive specialization pattern is advantageous for economic growth.

Analyze the significance of registered patents as innovative variables in networking and indicators to identify if prefectural clustering strategy exists and the propensity of innovative activity to cluster and the importance for start-up companies to locate in specialized prefectures.

## 5. References


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