Analysis of The Industrial Combination Structure based on Doi’s Method: Case Study of Tamil Nadu Cauvery Basin (India)

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Abstract The Cauvery River is the biggest river in south India. The Cauvery river basin flows through districts such as Nilgiris, Coimbatore, Tirupur, Erode, Dharmapuri, Krishnagiri, Salem, Namakkal, Karur, Dindigul, Pudukottai, Trichirappalli, Perambalur, Ariyalur Thanjavur, Tiruvarur, Cuddalore and Nagapattinam in the state Tamil Nadu. The study area is between latitudes 76° 2’E, 79°8’ E and 12°7’ N, 10°14 N longitudes. The secondary data collected from the Ministry of Micro, Small and Medium enterprises (MSME) and statistical hand book of Cauvery basin districts. The data which collected are Food based, Textile based, Readymade garment and Embroidery, Forest based, Leather based, Chemical based, Plastic & Rubber based, Mineral based, Engineering based, Electrical & Electronics based and others industries. In this article, the industrial combination in the Tamil Nadu Cauvery Basin is outlined, followed by the discussion on the area using Doi’s method industrial combination analysis. The study of industrial combination is very significant for any particular region because it provides an idea about the relative position of industries which is necessary for future development of industries in Tamil Nadu Cauvery basin.

Keywords Cauvery River; Micro, Small and Medium enterprises; Tamil Nadu

1. Introduction

Manufacturing industry is the processing of primary products into more refined and usable products. Many of the natural resources cannot be utilized directly without processing. Because of this reason, we manufacture cloth from cotton, sugar from sugarcane, paper from wood pulp, and petro chemicals from mineral oil. By doing so, we make the primary products more valuable and usable. In other words, manufacturing industries mean transformation of natural material endowments into commodities of utility by processing, assembling and repairing. The industrial combination closely related to geo-climatic, socio-economic, historical and political factors. Manufacturing is vital for our very existence. It is an activity that works as an engine of economic growth, helps in removing poverty and employment and transform a traditional society into a modern society. The economic strength of a country is judged by the development of its industries. All the developed countries of the world are highly industrialized.

History of industry in India dates back to the history of mankind. Among all the industries of early times, the textiles, especially the cotton textiles industry, had the place of pride both in India and in the outside world. There is enough evidence to show that the Indians knew weaving some 1500
years before Christ, when the Europeans were still covering themselves with animal skins. Pyrard, the 17th century Portuguese writer has record that everyone from the Cape of Good Hope to China was clothed from head to foot in Indian made garments. Iron and steel industries was also advanced stage at that time. Industrial revolution in Europe resulted in modern factories. With this the scale of manufacturing goods increased tremendously leading to mechanization. As a result migration of workers occurred from village to cities. The better system of goods with goods came to an end, exchange of goods with money started. It is correct that a revolution occurred in the manufacturing sphere but the traditional village handicrafts and cottage industries witnessed their death toll (Khullar, 2012). Inter war period: Indian industries made rapid strides during the 1st world war (1914-18) due to rise in demand for industrial goods by the Armed Forces. However, the real spurt was provided by Indian Fiscal commission set up in 1921-22. This gave the much needed protection to industries like iron, steel, textile, cement, sugar, paper and metals.

World War II: while Indian industry proposed during World War I, the Second World War created problems for Indian industry. Indian became an active participant in war and the entry Japan in the hostilities brought war to India’s doorstep. However, the impact of war was short lived and the industry was quick to recover from the initial shock and exploited the opportunities offered by the war.

After independence, need to take solid steps for improving Industrial scene was badly felt. It was realized that industrialization was the only vehicle which could lead the shattered economy of the country on the path of process and prosperity. Consequently, industry attached special attention of plans and planners.

Now Indian government follows the 12th five year plan. For sustaining pace of growth and investment, several initiatives have been launched for modernizing, technology, upgradation, reducing transaction costs, increasing export thrust, so as to enhance its global competitiveness and achieve balanced regional development. Further, in order to give export thrust, department of commerce launched major initiatives such as assistances to State Infrastructure Development for Exports

1.1. Significant Factors

The major geographical factor is raw materials, power, labour, transport, market, site and climate. The non-geographical factor is capital, government policies, industrial inertia, efficient organization, banking facilities and insurance.

1.2. Classification of Industrial (Micro, Small and Medium Class)

Food based: Rice, Floor Milling, Mango pulp Oil, Seeds, Tea, and plantation crops etc. Chemical based: Safety matches, Polystyrene bags, chalk crayon, chemical dye, Fertilizer, petroleum filtering etc. Plastic & Rubber based: P.V.C. pipes, Rubber, etc. Electrical & Electronics based: Battery charging Lamps Starters, T.V. Antenna, computer parts, etc. Forest based: Wood, Furniture, Timber, Paper, etc. Engineering based: Machining, Metals, Iron and Steel manufactory, Motor Vehicles spare parts etc. Textile based: Cotton, Power loom, Silk reeling, etc., Others (Specify): Beauty parlor, Paper, printing, gas stove, water filtering, watches, optical, clocks etc., Leather based: Leather bags, belt, shoes and winter dress etc. and Mineral based: mineral, sand, coal, granite, marble, basalt industries etc.
2. Database and Methodology

Industrial combination is made with help of secondary data obtained from the Ministry of Micro, Small and Medium enterprises (MSME) and Statistical hand book of Nilgiris, Coimbatore, Salem, Namakkal, Erode, Dharmapuri, Karur, Trichirappalli, Thanjavur, Tiruvarur and Nagapattinam districts. In order determine Cauvery basin districts wise combination of Doi’s Method is used for the calculation of the location quotient. The following formula used to work out the concentration of industrial combination in Cauvery basin. The Doi’s method 1st (1957) used in industrial combination in Tokyo, Japan. After 1959 modified used in crop combination. The present study adopted in Doi’s industrial combination in Tamil Nadu Cauvery basin. The aim is present studies have been adapted to show the regional industrial combination in the basin.

2.1. Geographical Back Round of the Study

Figure 1: Study area

The Cauvery river basin lies between districts is Nilgiris, Coimbatore, Tirupur, Erode, Dharmapuri, Krishnagiri, Salem, Namakkal, Karur, Dindigul, Pudukottai, Trichirappalli, Perambalur, Ariyalur Thanjavur, Tiruvarur, Cuddalore and Nagapattinam of Tamil Nadu state (Figure 1). It is located between latitudes 76° 2'E, 79°8' E and 12°7' N, 10°14' N longitudes. The Cauvery River is biggest river in south India. It originated in the Tala-Cauvery on the Brahmagiri range in the Western Ghats in Karnataka at an elevation of about 1341 m above mean sea level and flows for about 800 km, before it reaches into the Bay of Bengal. The basin drains a total area of 81,155 Sq.Kms (Tamil Nadu, Kerala and Karanataka). It enters Tamil Nadu in the region of Mannar and moves from West to East for 234 kms and joins the Cauvery near Bhavani Town. Due to this, Cauvery basin has tropical climate and our study area has monsoon rain. Here, the recorded maximum and minimum temperatures are 44°C and 18°C respectively. The Physiographic divisions has controlled by Structural hills, Denudational and Pediplain and Fluvial process. The major tributaries are Amravati, Hemavathi, Kabini, Noyil and Bhavani. All the distributaries in this region are non-perennial and river
flow is mainly due to Cauvery water release during June to January. The length of the river Cauvery from the head to its outfall into the sea comprises a length of 43,867 km² in Tamil Nadu. The principal soil types found in the basin are Black soils, Red soils, Laterites, Alluvial soils, Forest soils, and mixed soils. Red soils and Back soil occupy large areas in the basin (Coimbatore, Erode, Salem, Tirupur and Karur). Alluvial soils are found in the delta areas (Trichirappalli, Thanjavur, Tiruvarur, Cuddalore, Perambalur, Ariyalur and Nagapattinam). This region is major manufacture Industrial economic zone in Tamil Nadu. The Nilgiris district covered the mountains region, developed the forest and food based industries (Vegetables, Fruits and Tea). The Coimbatore, Tirupur and Erode regions found the black and red soil, this soil suitable for cotton production. So, this region located the Textiles based industries. The Cauvery end part of the delta regions such as Trichirappalli, Thanjavur, Cuddalore, Perambalur, Ariyalur, Tiruvarur and Nagapattinam regions where food based industries are located.

3. Discussion

The present study has mainly examined the industrial combination using the Doi’s Method on Tamil Nadu Cauvery basin, would be the tools for future planning in case of industrial development in the region. The study of industrial combinational regions constitutes an important aspect of industrial geography or regional geography. The industries are generally in combination and rarely that particular Industry occupies a position of total isolation other industries in a given area, at the point and time.

The Doi’s represents critical value for various elements at different ranks against cumulative percentage of elements at higher ranks and industrial element are food based, textile based, chemical based, forest based, plastic and Rubber based enterprises. The critical value table (Annexure-I) requires only the summing up of actual percentages under different industries instead of finding the differences between actual percentages and theoretical distributions. Annexure-I is an abridged format of critical value table prepared by Doi’s in 1957 (Husain, 2007).

Table 1: The percentage of micro, small and medium class’s industries in Tamil Nadu Cauvery basin regions

| District     | Food based | Textile based | Ready Made Garment and Embroidery | Forest based | Leather based | Chemical based | Plastic & Rubber based | Mineral based | Engineering based | Electrical & Electronics based | Others (Specify) |
|--------------|------------|---------------|----------------------------------|--------------|---------------|----------------|------------------------|--------------|-------------------|-----------------------------|-----------------|
| Nilgiris     | 10         | 26            | 0                                | 29           | 10            | 0              | 0                      | 0            | 14                | 0                          | 11              |
| Coimbatore   | 10         | 32            | 0                                | 5            | 0              | 2              | 3                      | 3            | 32                | 8                          | 5               |
| Erode        | 23         | 52            | 6                                | 1            | 6              | 0              | 1                      | 0            | 3                 | 1                          | 6               |
| Dharmapuri   | 28         | 43            | 3                                | 0            | 0              | 3              | 10                     | 5            | 0                 | 7                          |                 |
| Salem        | 14         | 21            | 1                                | 4            | 0              | 0              | 6                      | 9            | 16                | 2                          | 26              |
| Namakkal     | 23         | 63            | 6                                | 1            | 0              | 0              | 0                      | 2            | 3                 | 3                          | 2               |
| Karur        | 7          | 40            | 7                                | 4            | 1              | 4              | 5                      | 6            | 8                 | 2                          | 17              |
| Trichy       | 12         | 2             | 44                               | 7            | 1              | 2              | 3                      | 24           | 1                 | 3                          |                 |

Source: Ministry of Micro, Small and Medium Enterprises, Chennai.
The Doi’s an Abridged of Deviation Analysis Table can be seen by making use of actual percentages under different industries in the Tamil Nadu Cauvery basin for 2015-16. The ranking industrial per cent and cumulative percentage are as shown the Table 2.

The Doi’s techniques have three combinational elements. This technique shows that higher ranking industries have high percentage (above 10 per cent), the lower ranking element with less than 5 per cent which are usually excluded from the combination. This technique is most profitably applied to such a situation as is found in the industrial combination in which interrelationship exists between the component combinations. Using this technique, industries which has cumulative percentage is less than 50 are included in combination; or the critical value for all the industries at different ranks against 50 in Zero. Therefore, the scale of cumulative percentage starts from above 50 percentages which contributed as higher rank may be 1st three industries (Husain, 2007). In the present study Nilgiris District first food based industry occupies 29 per cent, the next automatically included so as to make cumulative percentage above the 50 per cent. The next industry per cent Forest Based, Textile based industry included in the combination which makes the sum of the first two industry 56 per cent (Table 2) from the critical value table (Annex - I). The Cumulative Percentage of 56 (Forest and Textile based) lies between 55 and 60, which is closer to 55 as the sum of percentage of the higher ranking elements is called Mono combination industry and Double combination industry region. The industry contributing is to over 50 per cent of total number of industries. Actual percentage of third industry in larger than critical value, it is to be included in the combination. Same thing fourth and fifth industry cumulative per cent higher than critical value fourth and fifth rank of element, the region developed combination fourth and fifth industrial included combination (Table 3).

Table 2: Ranking and cumulative percentage (Doi’s Method) in industries 2015-16

| Rank/ Districts | R1  | R2  | R3  | R4  | R5  | R6  | R7  | R8  | R9  | R10 | R11 |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Nilgiris        | FB  | TB  | Engg.| Others | LB | Food |
| PNI             | 29  | 26  | 14  | 11  | 10  | 10  |
| CF              | 55  | 69  | 80  | 90  | 100 |
| Coimbatore      | TB  | Engg.| Food | EE | Others | FB | PR | MB | CB |
| PNI             | 32  | 32  | 10  | 8   | 5   | 5   | 3   | 3   | 2   |
| CF              | 64  | 74  | 82  | 87  | 91  | 94  | 98  | 100 |
| Erode           | TB  | Food | RGE | LB | Others | Engg.| EE | FB | PR | MB |
| PNI             | 52  | 52  | 52  | 52  | 52  | 52  | 52  | 52  | 52  |
| CF              | 75  | 81  | 87  | 93  | 95  | 97  | 98  | 99  | 100 |
| Dharmapuri      | TB  | Food | MB | Others | Engg.| RGE | PR | CB | FB |
| PNI             | 43  | 28  | 10  | 7   | 5   | 3   | 3   | 0   | 0   |
| CF              | 71  | 81  | 88  | 93  | 96  | 99  | 99  | 100 |
| Salem           | Others | TB | Food | Engg.| MB | PR | FB | EE | RGE |
| PNI             | 26  | 21  | 14  | 16  | 9   | 6   | 4   | 2   | 1   |
| CF              | 48  | 61  | 78  | 87  | 92  | 96  | 98  | 100 |
| Namakkal        | TB  | Food | EE | RGE | Engg.| Others | FB | MB | PR |
| PNI             | 63  | 23  | 3   | 6   | 2   | 2   | 1   | 0   | 0   |
| CF              | 86  | 89  | 95  | 97  | 98  | 99  | 99  | 100 |
| Karur           | TB  | Others | RGE | Engg.| Food | MB | PR | FB | CB | EE | LB |
| PNI             | 40  | 17  | 7   | 8   | 7   | 6   | 5   | 4   | 4   | 2   | 1   |
| CF              | 56  | 64  | 72  | 79  | 85  | 89  | 94  | 97  | 99  | 100 |
| Tiruchirappalli | RGE | Engg.| FB | Food | Others | MB | CB | PR | TB | EE | LB |
| PNI             | 44  | 24  | 7   | 12  | 3   | 3   | 2   | 2   | 1   | 1   |
| CF              | 68  | 75  | 87  | 90  | 92  | 94  | 96  | 98  | 99  | 100 |
| Region       | Others | RGE | Food | Engg. | FB | LB | PR | TB | CB | MB |
|--------------|--------|-----|------|-------|----|----|----|----|----|----|
| Thanjavur    | 25     | 20  | 14   | 13    | 9  | 5  | 5  | 3  | 3  | 3  |
| CF           | 45     | 59  | 72   | 81    | 86 | 91 | 94 | 97 | 100|
| Tiruvarur    | 45     | 29  | 8    | 9     | 4  | 2  | 1  | 1  | 1  |    |
| CF           | 74     | 82  | 91   | 95    | 96 | 98 | 99 | 100|
| Nagapattinam | 28     | 18  | 17   | 12    | 10 | 4  | 3  | 3  | 2  |    |
| CF           | 45     | 62  | 74   | 84    | 88 | 91 | 94 | 97 | 99 | 100|
| Krishnagiri | 31     | 24  | 15   | 11    | 5  | 3  | 3  | 2  | 2  | 1  |
| CF           | 55     | 70  | 81   | 86    | 91 | 94 | 96 | 99 | 100|
| Dindigul     | 57     | 57  | 57   | 57    | 57 | 57 | 57 | 57 | 57 | 57 |
| CF           | 72     | 79  | 84   | 89    | 93 | 96 | 97 | 98 | 99 | 100|
| Perambalur   | 42     | 18  | 13   | 8     | 7  | 5  | 2  | 2  | 2  |    |
| CF           | 61     | 74  | 82   | 89    | 94 | 97 | 98 | 100|
| Ariyalur     | 50     | 28  | 17   | 6     |    |    |    |    |    |    |
| CF           | 77     | 94  | 100  |       |    |    |    |    |    |    |
| Cuddalore    | 29     | 29  | 29   | 29    | 29 | 29 | 29 | 29 | 29 | 29 |
| CF           | 54     | 74  | 87   | 92    | 95 | 97 | 98 | 99 | 100|
| Pudukottai   | 30     | 21  | 13   | 8     | 7  | 5  | 5  | 4  | 2  |    |
| CF           | 51     | 64  | 71   | 78    | 84 | 89 | 93 | 98 | 100|

Source: Author. Doi’s Method.

**Legend:** Food - Food Based, TB - Textile Based, RGE - Readymade Garment and Embroidery, FB - Forest Based, LB - Leather Based, CB - Chemical Based, PR - Plastic & Rubber Based, MB - Mineral Based, Engg.-Engineering Based, EE - Electrical & Electronics Based, Others - Others (Specify), CF - Cumulative Percentage, PNI - percentage of Number of Industry, R - Rank.

**Table 3:** Doi’s method industrial combination in Tamil Nadu Cauvery River Basin 2015 – 16

| Type of combination | Number of regions |
|---------------------|-------------------|
| Mono combination    | 17                |
| Food based (1)      |                   |
| Textile based (5)   |                   |
| Forest based (1)    |                   |
| Readymade Garment and Embroidery (4) |       |
| Others (5)          |                   |
| First two          | 17                |
| combination         |                   |
| Industrial region   |                   |
| Forest based + Textile based (1) | Nilgiris |
| Textile based + Engineering based (1) | Coimbatore |
| Textile based + Food based (4)     | Erode, Dharmapuri, Namakkal |
| First three combination industrial region | 12 |
|------------------------------------------|----|
| Others (Specify) + Textile based (1)      | Salem |
| Readymade Garment and embroidery + Engineering based (2) | Trichirappalli and Kirshnagiri |
| Mineral + Engineering Based (1)           | Ariyalur |
| Others (Specify) + Mineral (1)            | Cuddalore |
| Readymade Garment and Embroidery + Food based (2) | Tiruvarur and Perambalur |
| Others (Specify) + Engineering Based (1)  | Pudukottai |
| Food based + Textile based (1)            | Nagapattinam |
| Others (Specify) + Readymade Garment and Embroidery and | Thanjavur and Dindugul |
| Textile based + Engineering based (1)     | Nilgiris |
| Textile based + Engineering based + Food based (1) | Coimbatore |
| Others (Specify) + Textile based + Food based (1) | Salem |
| Textile based + Others (Specify) + Readymade Garment and Embroidery (1) | Karur |
| Readymade garment and Embroidery + Engineering based + Food based (2) | Trichirappalli and Kirshnagiri |
| Others (Specify) + Readymade Garment and Embroidery + Food based (1) | Thanjavur |
| Others (Specify) + Engineering based + Food based (1) | Pudukottai |
| Readymade garment and embroidery + Food based + Engineering based (1) | Tiruvarur |
| Food based + Textile based + Readymade Garment and Embroidery (1) | Nagapattinam |
| Readymade Garment and Embroidery + Food Based + others (specify) (1) | Perambalur |
| Others (Specify) + Mineral Based + Forest Based (1) | Cuddalore |

| First four combination industrial region | 4 |
|------------------------------------------|----|
| Others (Specify) + Textile based + Food based + Engineering based (1) | Salem |
| Others (Specify) + Readymade Garment and Embroidery + Food based + Engineering based (1) | Thanjavur |
| Food based + Textile based + Readymade Garment and Embroidery + Forest based (1) | Nagapattinam |
| Others (Specify) + Engineering based + Food based + Textile based | Pudukottai |

| First five combination industrial region | 1 |
|------------------------------------------|----|
| Others (Specify) + Textile based + Food based + Engineering based + Mineral based (1) | Salem |

In this method, the first ranking industry occupied the highest percentage of the total industrial in district wise. It may be noticed from Table 3 that Textile based, Readymade Garment and Embroidery, food and forest based industries ranking first in 17 districts respectively, are the leading
industry in Tamil Nadu Cauvery river basin. The monoculture is not prevalent. So, this method helps in ascertaining the areas of dominance of the first rank industrial region in the study area (Figure 2).

The Tamil Nadu Cauvery basin region has mono industrial combination where Food Based industries are mostly present in lower part of Cauvery basin districts due to favorable physical factors (Climate, Alluvial soil, Delta, Irrigation). The upper part of Cauvery Basin Coimbatore, Erode, Dharmapuri, Nammakal and Karur district has high percentage of textile industries because of the presence of Red Soil and other physical factors. Nilgiris district are surrounded by mountain region due to which presence of forest based industries are more in that region. The Readymade Garment and Embroidery Industries are developed in the centre and lower part of Cauvery River basin (delta region).

On the basis of first and second ranking industry, 11 industrial combinations may be recognized in the Tamil Nadu Cauvery river basin. The resulting industrial combinations present have been shown in the Table 3. It reveals that 17 out of the 11 industrial units reporting districts of Tamil Nadu Cauvery river basin. The relative strength of the first two industries is textile and food based one in 4 districts.

When the first three industries were taken in consideration, the number of industrial combinational region becomes as large as eleven. The districts occupied these type of industries are given in Table 3 which shows that Readymade Garment and Embroidery, Engineering based and Food based industries are dominated constituents in the first three rank combinations, which cover 17 out of 12 reporting districts.

The first four industrial combinations are seen in our study area (4 out of 17 districts) which has been mentioned in the Table 3 and Figure 2.

From the Table 3, we observe that 1 out of 17 districts have five industrial combinational regions on Tamil Nadu Cauvery basin.
4. Conclusion

In recent years, the concept of industrial combination has engaged the attention of Geographers and Regional Planners. The study of industrial combination is very significant for any particular region because it provides an idea about the relative position of industries on a region-wise basis. Thus, information on industrial combination is the basic requirement for planning the future orientation of the industrial zone in Tamil Nadu Cauvery Basin. To analyze the industrial combination of Tamil Nadu Cauvery Basin, Doi's method was applied. For simplification and generalization of industries, regions showing less than 5% were omitted from the calculation. Then, cumulative percentage was determined and compared with the critical value which gives the district which are included or excluded in the industrial combination. Using Doi's method, we conclude that our study area Tamil Nadu Cauvery basin region has micro, small, and medium class industrial combinations. They are mono industries (17 districts), First Two industrial combination 17 industries, First Three Industrial combination 12 districts, First Four industrial combination 4 districts, First Five industrial combination 1 districts.

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**Annexe- I: Doi’s Deviation Analysis**

An Abridged Part of Deviation Analysis Table (One-Sheet Table)

| Rank of Element | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|----------------|---|---|---|---|---|---|---|---|---|----|----|----|----|
| Critical Value |   |   |   |   | 6.98 | 6.27 | 5.68 |   |   |   |   |   |   |
| 95            |   |   |   |   | 8.84 | 7.60 | 6.67 | 5.94 | 5.35 | 4.49 |   |   |   |
| 90            |   |   |   |   | 12.93 | 10.00 | 8.17 | 6.91 | 5.99 | 5.29 | 4.73 | 4.29 | 3.91 |
| 85            |   |   |   |   | 13.83 | 10.00 | 7.85 | 6.46 | 5.49 | 4.78 | 4.23 | 3.79 | 3.33 | 3.14 |
| 80            |   |   |   |   | 16.67 | 10.57 | 7.75 | 6.13 | 5.06 | 4.32 | 3.76 | 3.33 | 2.99 | 2.71 | 2.49 |
| 75            |   |   |   |   | 27.64 | 12.25 | 7.93 | 5.96 | 4.65 | 3.85 | 3.29 | 2.87 | 2.55 | 2.29 | 2.08 | 1.90 |
| 70            |   |   |   |   | 27.64 | 12.25 | 7.93 | 5.96 | 4.65 | 3.85 | 3.29 | 2.87 | 2.55 | 2.29 | 2.08 | 1.90 |
| 65            |   |   |   |   | 18.38 | 8.66 | 5.63 | 4.19 | 3.14 | 2.77 | 2.37 | 2.07 | 1.84 | 1.65 | 1.50 | 1.37 |
| 60            |   |   |   |   | 11.27 | 5.46 | 3.59 | 2.68 | 2.14 | 1.78 | 1.52 | 1.33 | 1.18 | 1.06 | 0.97 | 0.88 |
| 55            |   |   |   |   | 5.38 | 2.68 | 1.73 | 1.29 | 1.04 | 0.86 | 0.74 | 0.64 | 0.57 | 0.52 | 0.47 | 0.43 |
| 50            |   |   |   |   | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Source: Doi, Kikukazu, “The Industrial Structure of Japan Prefectures”, Tokyo, Proceedings of the International Geographical Union, Regional Conference in Japan, 1957, pp. 310-316.