

Development and Spatial Dynamism of the Automobile Component Industry in India

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Abstract This study focuses on the recent development of the automobile component industry and examines its spatial dynamism in India, where vehicle production has rapidly expanded over the past ten years. Based on the directory of the Automobile Components Manufacturers Association of India (ACMA), a database of 610 companies was created. Overall, the database exhibited a pyramid structure of many small- and medium-sized companies at the bottom and a few large companies at the top. The majority of the 610 companies were classified as OEM suppliers. There was a strong correlation between the number of plants and the number of automobile manufacturers that were customers.

Spatially, three industrial agglomerations, the National Capital Region of Delhi, Western Maharashtra, and Chennai-Bangalore, have formed in India. An analysis of the location patterns of corporate headquarters, major plants, and branch plants clarified that they had different location principles. Headquarters were mostly situated in a core city, while the main plants were located in the same city or its suburbs. The branch plants increased the trend of being distributed in the suburbs. This spatially resulted in the expansion of agglomerations. In addition, some branch plants were located inside other agglomerations or regions where automobile manufacturers have set up new assembly plants, which led to component companies being located in multiple locations.

Key words automobile component industry, industrial agglomeration, multiple locations, India

I. Introduction

The purpose of this paper is to discuss the overall characteristics of the automobile component industry in India, by analyzing the year when production commenced, number of employees, number of factories, and business trading of the main players. The spatial dynamism of the industry is also explored by examining the location of headquarters and factories in each districts. Furthermore, the formulation process of industrial agglomeration and spatial structure of the industry are also presented.

The production of a passenger car requires more than 20,000 components, and growth in automobile production necessitates a corresponding growth in the automobile component industry. There has been adequate research on the locational characteristics of the Indian automobile industry, including recent studies such as Tomozawa (2008, 2011, 2014a). On the contrary, research on the Indian automobile component industry is limited. Uchikawa (2011) elucidated the growth process of the industry in India. Tomozawa (1999, 2004, 2007, 2014b, 2015) examined component suppliers as the elements of production systems of certain automobile makers or the automobile industrial agglomeration.¹ However, there has not been sufficient research into the spatial structure of the industry as a whole. With the marked growth of this

industry in recent years, an understanding of the current spatial structure has become essential. Because statistics are aggregated by state, it is common to use the state as the fundamental unit for spatial analysis in research dealing not only with the automobile industry but also with India's economic and social phenomena. In this study, district (*zila* in Hindi) is used as the spatial unit of analysis, allowing for a more micro-level analysis of factory locations than what was permitted and investigated in previous research. Thus, this study attempts to obtain a more realistic picture of the spatial structure of the Indian automobile component industry.

The remainder of this paper is organized as follows. Chapter II discusses the databases used for collecting the data analyzed in this study. On the basis of these collected data, Chapter III clarifies the characteristics of the corporate groupings that comprise the automobile component industry through an analysis of 610 companies. Chapter IV discusses the spatial dynamism of the industry and examines location trends by district, while recognizing different location patterns for main and branch plants. On the basis of this information, Chapter V discusses the location process of the industry in three agglomeration regions. The purpose of this paper is accomplished by presenting a basic framework for the spatial structure of the automobile component industry in the newly industrial-

izing country of India through these five chapters. Finally, Chapter VI concludes the study.

Incidentally, the term “automobile components” in this study refers to components or parts used in two-, three-, and four-wheeled motorized vehicles, commercial vehicles, and tractors, as well as the engines for these vehicles.

II. Database and Associated Data

1. Statistical data for the automobile component industry in India

This section reviews the statistical data of the automobile component industry used in this paper. First, the *Annual Survey of Industries* (ASI²), one of government statistics sources, is referred. ASI covers all industrial units having 100 or more workers (mostly accord with the organized sector). The survey results are provided according to India’s industry classification NIC codes. Specific data are available in regional units by state and union territory based on two- and three-digit NIC codes, including the number of factories, output, number of employees, and others. In the 2008 ASI, the automobile component industry was included in the two-digit code “29” (motor vehicles, trailers, and semitrailers). The three-digit sub-classification code of “293” (manufacture of parts and accessories for motor vehicles and their engines) directly corresponds to automobile components. Therefore, it is possible to break down component manufacturing for the entire country by state and union territory using the NIC293 code data. However, NIC293 does not include components for two-wheeled motorized vehicles or tractors, and even though electronic components and forged products are also automotive components, these are classified under separate codes. Therefore, code 293 provides only a limited view of the automobile component industry.

The Automotive Component Manufacturers Association of India (ACMA) is a nationwide industry organization comprising automobile component manufacturers. This association provides extensive statistical data on the industry and its members. The ACMA was established to promote the automobile components industry and strives to improve quality and technology, promote trade, and collect information. As of January 2011, the ACMA comprises 619 member companies and organizations. According to the association, approximately 85% of automobile component production in the organized sector is conducted by association members. Therefore, the ACMA is an extremely important data source to consider when examining the automobile component industry in India.

The *Automotive Industry of India: Facts and Figures* was a well-known publication of the ACMA, which provided data on production and sales of the automobile component industry, including components for two-wheeled motorized vehicles and tractors. Hence, the automobile component industry according to this association’s publication encompassed a broader meaning than the aforementioned ASI NIC293 classification. However, the ACMA ceased publication of the *Facts and Figures* after the 2002–2003 edition and currently provides basic statistics for automotive components including total output, export turnover, and capital investment only on their website.³

While the aforementioned data are useful in understanding the automobile component industry in India, there are limitations when using them for economic and spatial analyses. First, the aggregate data do not reflect the conditions of the companies comprising the industry. Second, the level of the aggregate data is limited to the national or state level; therefore, it does not facilitate discussion on spatial units below the state level. In view of these limitations, a database of component companies was created in accordance with the methods discussed in the next section and used for the discussions from Chapter III onward.

2. Creation of a component company database

The ACMA publishes an annual directory of member companies called *Source India*. Information from the 2011 edition of this publication comprises the basic data used in the creation of the company database for this study. *Source India* includes extensive information for ACMA member companies, which follows a specific format. This information is distributed on a CD-ROM to members in February of each year. In this study, only the data related to 610 companies producing automobile components were used for the creation of the database.⁴

The following data were extracted from *Source India*: 1) name of the company; 2) year of commencing production; 3) headquarters address (state, district⁵); 4) main plant address (state, district); 5) other plant address (state, district); 6) products manufactured; 7) sales turnover (USD); 8) export turnover (USD); 9) number of employees; 10) OEM customers (domestic); 11) tier 1 customers (domestic); and 12) international trade. In addition, the hardcopy version of *Source India*, titled *Buyers’ Guide*, is published by the ACMA annually, in February. Although the ACMA’s description states that the contents of these two publications are the same, minor differences were discovered. Because of this, the data listed in items 1)–12) were

verified point-by-point with data from *Buyer's Guide* to determine if they matched. For items that did not match, the data from the company's website were used. If either the appropriate data were not listed or the company did not have a website, the data from *Source India* were given priority. Additional information and notes on the above data are listed below:

2) For the year of commencing production, the data from all 610 companies (100%) were input. Six companies were not listed in *Source India*. The data for each of these six companies were obtained from company websites.

3) For the headquarters address data, the information from 610 companies (100%) was input. There was one case in which the district was listed incorrectly,⁶ which was corrected. The same procedure was followed for items 4) and 6) below.

4) The data for the main plant address were input for 610 companies (100%). In every case, one address was used per company. The main plant location for 468 of these companies at the district level was the same as the headquarters address listed in item 3).

5) The other plant address data for 301 companies were input. The remainder of the companies were found to have only one main plant and no other plants. For the purposes of this study, branch plants are also considered as other plants.

6) Although the data for the products manufactured per company were entered, they were not used for the analysis.

7) Although the overall sales turnover for FY2009 was used, in some cases, this information was replaced with data from 2007 or 2008. Furthermore, data were unavailable for 39 companies; therefore, those for the remaining 571 companies (93.6%) were input.

8) The export turnover data were available and entered for 401 companies (65.7%). Similar to item 7), the data from different years were used in some cases.

9) The number of employees data were available and entered for 587 companies (96.2%).

10) For the OEM customers (domestic) data, the names of partner destinations for delivery of products based on OEM (original equipment manufactured output to branded partners) were used. While most OEM product destinations were automakers, there were also cases of delivery to companies in other industries.

11) For the tier 1 customers (domestic) data, the names of components suppliers with whom the company traded were input.

12) For the international trade data, the names of partner destinations receiving OEM products, partner com-

ponent suppliers, and countries (in case of after-market exports) were input.

III. Composition of India's Automobile Component Industry

1. Growth of India's automobile component industry

Figure 1 shows the trends in total output of automobile components in India. Although source data from both the ASI and ACMA were used, the trends of both sets are essentially the same. The automobile component production has expanded more than ten times in the last 12 years. The ACMA lists the 2013 production at Rs. 2,117 billion, whereas the ASI lists production at Rs. 1,678 billion. Both sets of data show that the year 2000 began with a period of unprecedented growth in India's automobile component industry.

The important factors are responsible for such rapid growth in India's automobile component industry: The first factor is the increase in demand for automobile components to satisfy the increase in vehicle production in India. Tomozawa (2011) and others examined this increase in vehicle production. While their research is not reexamined in this study, to summarize, the expansion of foreign automobile companies into India played a major role in this increase. The second factor is the expansion of foreign automobile component companies into India. The automobile companies that had expanded into India cultivated local companies as their component suppliers, while encouraging their existing, preferred suppliers of key components to also expand locally. Consequently, the number of local subsidiaries and joint ventures with local companies increased. The third factor is the nurturing influence of India's government policies toward this industry. Foreign automobile companies made some local inroads owing to the economic liberalization policies implemented during the 1990s; however, the utilization of a certain level of local supply was mandated. Although this system was abolished in 2001, custom duties at around 34% are imposed on the imported components, which is substantial compared with other countries. Even with the free trade agreements that India has signed in recent years, the government's intention to protect and nurture this industry is evident, as some automobile components are excluded or treated as special items.⁷

In addition, special mention must be made regarding the accumulation of technology by local component manufacturers that accompanied this expansion of production. Both direct and indirect technical guidance and

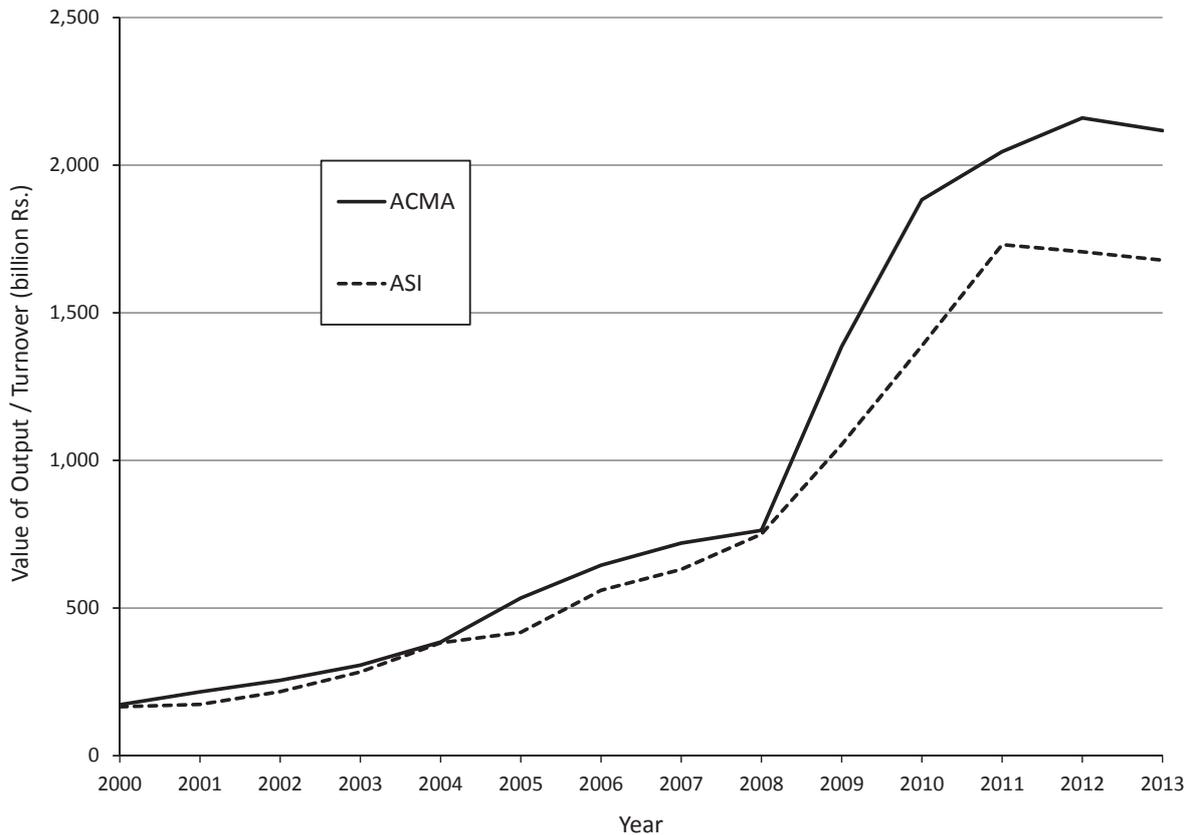


Figure 1. Annual production of automobile component industry in India

Note: Data for value of output are obtained from ASI and those for turnover are extracted from ACMA

Source: Data from ASI and ACMA

technology transfers occur through business with foreign automobile companies. The contribution of these to quality and productivity are described by Uchikawa (2011). Furthermore, engineers and managers change jobs frequently in India; this fluidity of talent is seen as a contributing factor in the dissemination of production technology, which results in the accumulation and improvement of technology in local companies.

2. Composition by company size

As mentioned previously, 610 component companies are members of the ACMA. The year of commencing production for these member companies is shown in Figure 2. Over half of the companies commenced production in either the 1980s or 1990s, with 1984 being the average and 1986 the median year. A characteristic of India's automobile industry in the 1980s was the establishment of Japanese-Indian joint ventures created against the backdrop of partial liberalization. This business opportunity led to the establishment of many component companies. Moreover, liberalization was promoted in earnest in the 1990s, and the world's major automakers established local subsidiaries for the commencement of production in India, which in turn also stimulated the establishment of component

companies. On the other hand, only 10.8% of the companies commenced production in the 21st century. One reason for this seemingly low percentage is the fact that many companies established during this period had not reached a level of growth commensurate for inclusion in industry organizations such as the ACMA. In addition, rather than the establishment of new companies, this was a period of expansion by existing companies that increased production through the formation of branch plants and creation of additional production lines.

Note that there were already a number of component companies that had commenced operations in India prior to the 1970s. Many types of industrial products were promoted under the socially planned economic system of post-independence India, including cars, two-wheeled motorized vehicles, and their related components. Although the components industry was still nascent in this period, over 195 component companies commenced production by the 1970s. The large number can be attributed to the status of automobile parts as an item reserved exclusively for production by small- and medium-sized companies. These companies currently play an important role as standard bearers for the components industry. The period breakdown utilized in this study is based on the

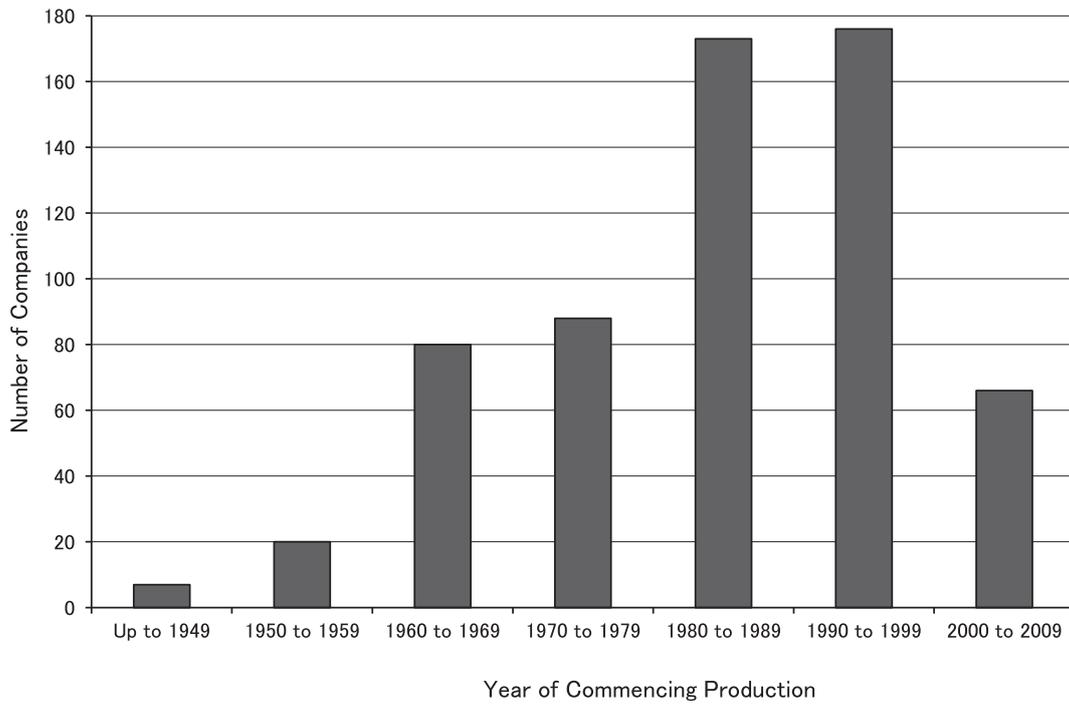


Figure 2. Year of commencing production
Source: ACMA 2011

Table 1. Number of factories per company

Year of establishment	Number of factories							Average
	1	2	3	4	5	6 and over	Total	
Pre-1980	87	45	26	12	10	15	195	2.41
1980s	68	44	30	13	5	13	173	2.45
1990s	100	37	23	7	3	6	176	1.91
2000s	54	6	4	2			66	1.30
Total	309	132	83	34	18	34	610	2.15

Source: See Fig. 2

years companies commenced production and a general historic background: Pre-1980 (Initial Period), the 1980s (Partial Liberalization), the 1990s (Liberalization), and the 2000s (Expansion).

We analyzed other indicators that serve to bridge these periods. Table 1 shows the number of factories per company. The average number of factories per company is 2.15, whereas the median is merely one. Hence, the composition of companies is a pyramid-shaped formation with very few companies having many factories and many companies with only one factory. While approximately half of all companies have only one factory, less than 10% have more than five. A similar trend is observed across all periods; however, there is a clear difference in the average numbers of factories for companies that commenced production in the 1980s or earlier compared with those that commenced production in the 1990s or later. There is a larger than 0.5 point difference between these groups of

companies, indicating a certain relationship between the size of the company and years of operation.

The same trend is observed in the number of employees (Table 2). The average number of employees per company is 701, with a median of 323. Hence, there are few companies with many employees and many companies with few employees. There is also a clear trend toward a company having a larger number of employees the longer it has been in business. It is apparent from the numbers above that there is a moderate correlation between the number of factories and number of employees (correlation coefficient=0.59), as companies with more factories tend to have more employees. A cross tabulation of the number of employees with the number of factories (Table omitted) shows that of companies with less than 500 employees, many have only one factory. Of companies with 500 or more employees, many have two or more factories. In essence, large-scale companies with 500 or more

Table 2. Companies by years of establishment and number of employees

Year of Establishment	Number of employees									Average
	Below 100	100–199	200–499	500–999	1,000–1,999	2,000–4,999	5,000 and over	Unkown	Total	
Pre-1980	26	32	50	36	27	16	4	4	195	830.8
1980s	34	25	36	30	25	13	1	9	173	793.8
1990s	38	36	43	32	11	8	3	5	176	577.0
2000s	14	14	18	8	6	1	0	5	66	392.9
Total	112	107	147	106	69	38	8	23	610	701.0

Source: See Fig. 2

Table 3. Average characteristics for the three company types

	OEM suppliers	Secondary suppliers	Exporters
Companies	510	51	44
Average year of commencing production	1983	1990	1988
Average number of factories	2.28	1.55	1.45
Average turnover (million USD)	38.37	16.87	14.94
Average number of employees	777.2	287.3	366.7

Note: Five companies were not classified owing to lack of information

Source: See Fig. 2

employees tend to have a production system with multiple factories. Similarly, there exists a relatively strong correlation (correlation coefficient=0.74) between the number of employees and sales turnover.

3. Composition by business dealings

The names of automakers and primary suppliers for which a partnership exists and the names of countries and total export value for after-market products were input into the database using the *Source India* data. This information permits categorization of companies into three types: 1) OEM suppliers, 2) secondary suppliers, and 3) exporters. There are 510 companies (OEM Suppliers) that deliver OEM products to automakers domestically. An OEM supplier is defined as a company that supplies components on an OEM basis to at least one automaker. Secondary suppliers are those companies that only deliver components to domestic component companies and do not have exports or direct transactions with automakers. There are 51 companies in this category. There are 44 companies in the category of exporters, which is defined as companies with over half of sales derived from exports.⁸ While companies in this category may have dealings with domestic companies, domestic transactions occupy a subordinate position in their business.

Table 3 shows the average characteristics for these three types. The first point to note is that in comparison to the actual state of India's automobile components industry, the groups of companies considered in this study are clearly biased in favor of OEM suppliers with secondary

suppliers and exporters comprising only a small number of the companies. Moreover, the piecemeal type "job work"⁹ that constitutes a large part of the unorganized sector is not represented at all. Hence, the results of this study can be considered to fundamentally represent the characteristics of OEM suppliers. Furthermore, there are clear differences among the three groups of OEM suppliers, secondary suppliers, and exporters in terms of the indicators of company scale such as the number of factories, sales turnover, and employee headcount. In terms of the year production commenced, OEM suppliers commenced production earlier, with secondary suppliers and exporters having shorter histories. Furthermore, the scale of secondary suppliers and exporters tends to be relatively smaller.

A characteristic of OEM suppliers is the wide range of transactions with a predominance of deliveries to automakers within India. Of these 510 OEM suppliers, 348 deliver components to at least one other OEM supplier, which shows active transactions among companies within the same hierarchy. In addition, 109 OEM suppliers deliver products to companies outside the automobile industry. In total, 327 OEM suppliers are involved in exporting products. Further breakdown shows that 207 OEM suppliers export to overseas automobile makers, with 170 delivering to component suppliers and 150 supplying components to the aftermarket. Tomozawa (2004) referred to this type of varied transaction environment as the component supplier's pursuit of "economies of scope."

IV. Spatial Characteristics of the Automobile Component Industry

1. Geographic overview of the automobile component industry

First, the distribution of the automobile component industry by state was verified using ASI NIC293 codes. Figure 3 shows the percentages by state for number of factories, number of persons engaged, total output, and net value added.

The three states of Haryana, Maharashtra, and Tamil Nadu clearly stand out in each of these categories. These states account for the following percentages in each of the categories: number of factories: 60.8%; persons engaged: 69.4%; total output: 75.0%; and net value added: 70.9%. Among these four indicators, the number of factories shows a slight dispersion tendency. Despite this, the prevalence of India's automobile component industry in these three states is evident. In addition, the distribution

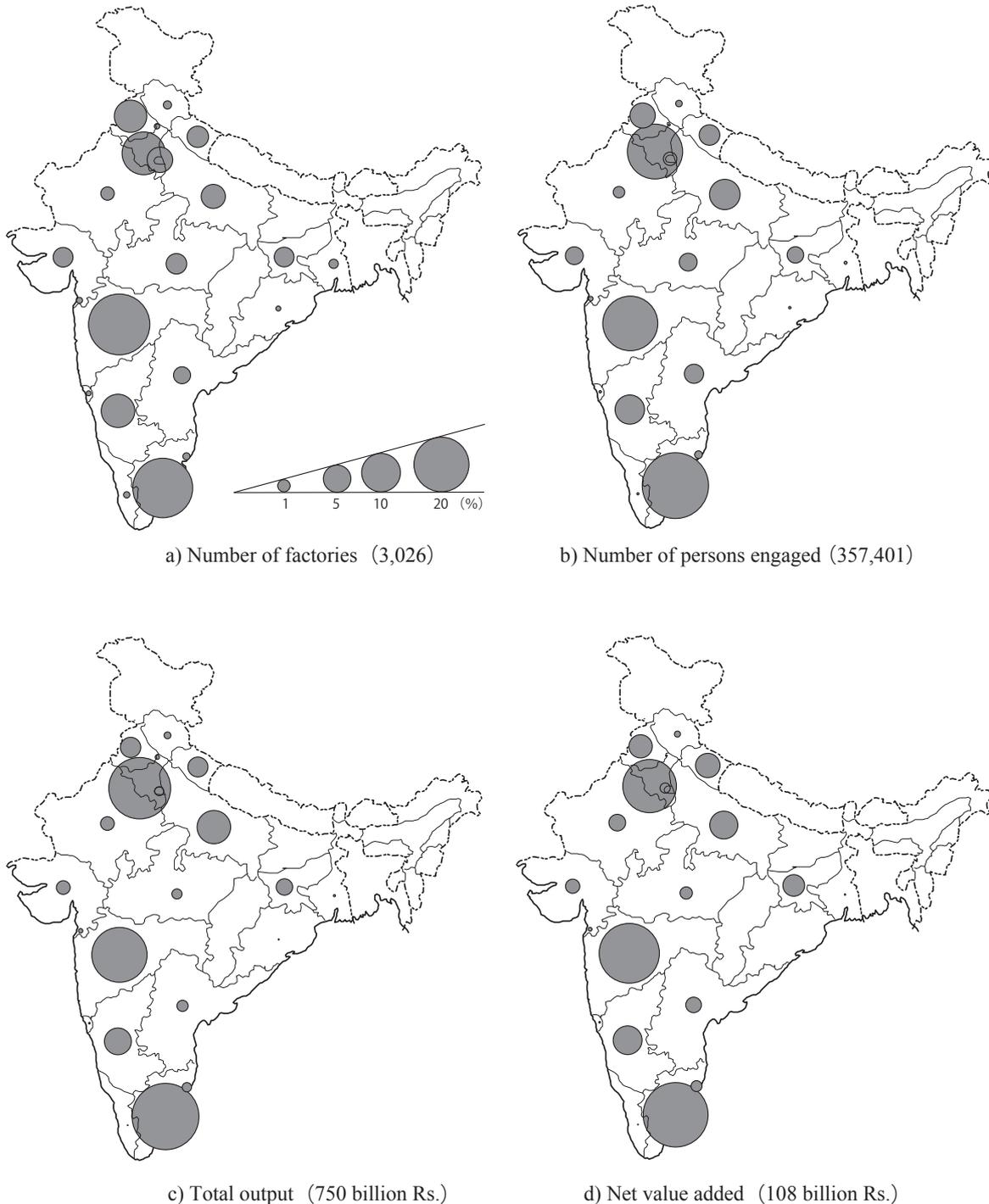


Figure 3. Distribution of the automobile components industry (NIC293, 2008)

Source: Annual Survey of Industries

of NIC293 is proportional to the manufacture of motor vehicles (NIC291) with a very high correlation coefficient of total output at 0.97. The automobile component industry locations in India are closely related to the locations of the automobile industry.

2. Location of headquarters

The above analysis was performed by state. This section considers the analysis by district. Figure 4 displays the

addresses of the headquarters for component companies for each year of commencing production. According to this figure, the three regions¹⁰ of the National Capital Region (NCR) of Delhi, Western Maharashtra, and Chennai-Bangalore exhibit an obvious pattern as the prime locations for components industry headquarters in and before the 1970s—a pattern that has continued in subsequent years. The overall percentages of component company headquarters located in these three regions

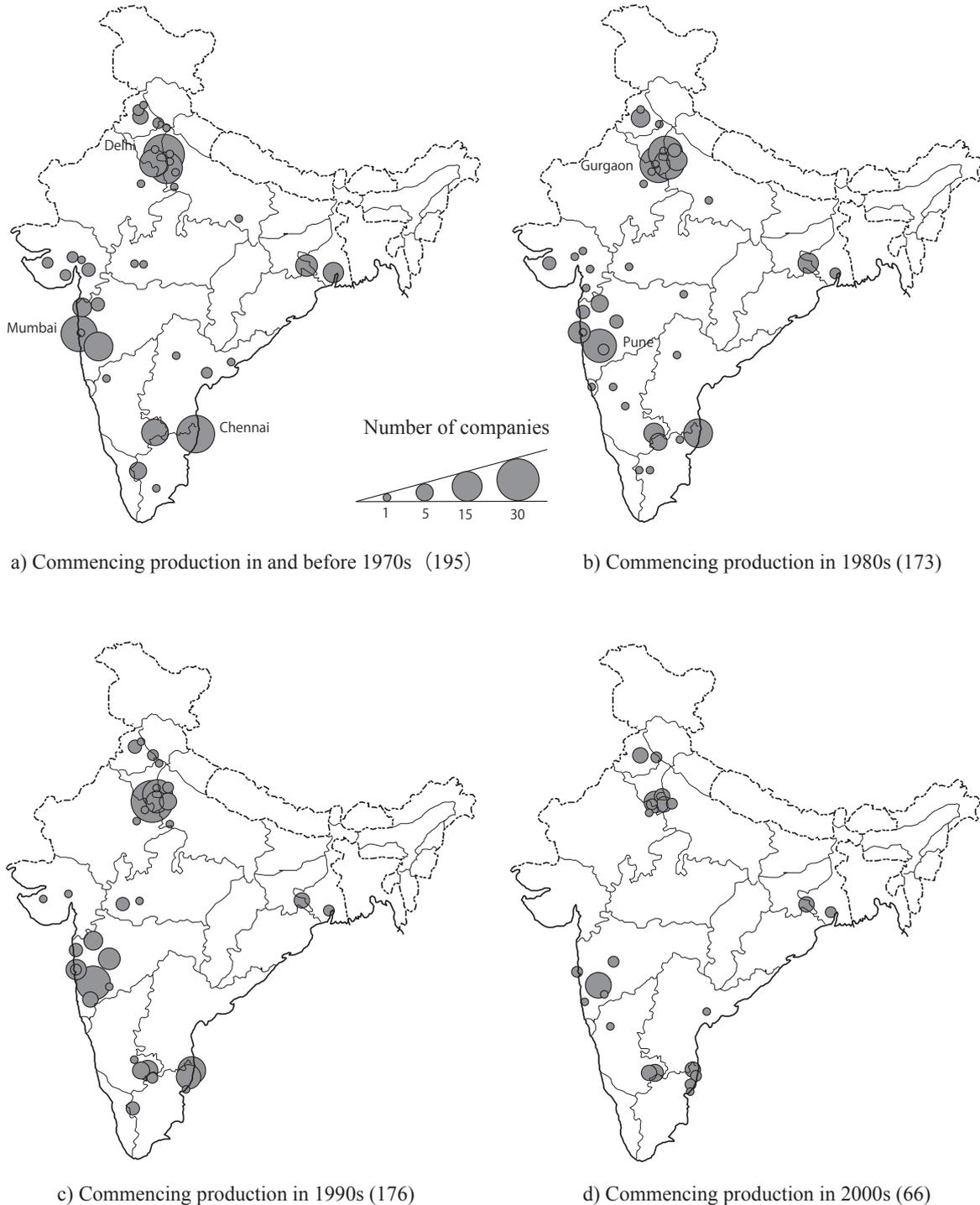


Figure 4. Distribution of the headquarters for component companies

Source: See Fig. 2

were at their lowest in and before the 1970s, at 73.3%, and reached their peak during the 1990s, at 85.2%. In every period, these three regions were the primary locations for establishing component companies. The prevalence of automobile component companies in these three regions was well established prior to 1980, with the origination of multiple automobile-related companies such as motor vehicle, two-wheeled motorized vehicle, and tractor companies. Therefore, these regions became natural receptacles for new, automobile-related investments.

One can observe the movement of corporate headquarters within these three regions among these overall trends. At the beginning of the 1970s, the largest cities for each of these regions were the most prevalent places of incorporation in a specific order: Delhi, Mumbai, and Chennai. In the 1980s, Delhi accorded the leading position to suburban Gurgaon, and this pattern continued with the establishment of new companies concentrated in Gurgaon. In addition, the establishment and subsequent growth of companies such as Maruti Udyog (currently “Maruti Suzuki”) and Hero Honda (currently “Hero Motocorp”) contributed to Gurgaon’s prominence. The promotion of office space in Gurgaon must also be mentioned as an inducement to the establishment of new company headquarters. Likewise, Mumbai relinquished the leading

position to the inland city of Pune. The cities of Pune and Mumbai are approximately 170 kms apart, and this distance makes it less reasonable to consider them as city and suburb along the lines of the relationship between Delhi and Gurgaon. The difference here is that of the business conditions between the slumping Premier Automobile, which maintains headquarters in Mumbai, and the rising Tata Motors, which maintains a production base in Pune. Furthermore, land is scarce in Mumbai, making the city uncondusive to the establishment of new companies. On the other hand, industrial parks are consecutively being developed in Pune, resulting in this city becoming a prime location for companies commencing operations. In South India, the location of headquarters was originally confined to the cities of Chennai and Bangalore; however, a dispersion trend subsequently began. Specifically, Krishnagiri—located to the south of Bangalore—in the 1980s and Kanchipuram—located to the south of Chennai—in the 1990s began to gain visibility as new locations for company headquarters. However, until the 1990s, the primate city of Chennai differentiated itself from the other two industrial agglomerations as consistently being the most prominent location for the establishment of new companies.

Table 4. Number of component factories by district (top 20)

Rank	District	State	Factory			Headquarters
			Main	Branch	Total (%)	
1	Gurgaon	Haryana	73	85	158 (12.0)	74
2	Pune	Maharashtra	59	96	155 (11.8)	62
3	Chennai	Tamil Nadu	37	34	71 (5.4)	53
4	Faridabad	Haryana	42	21	63 (4.8)	44
5	Bangalore	Karnataka[30	31	61 (4.6)	31
5	Udham Singh Nagar	Uttarakhand	1	60	61 (4.6)	0
7	Kanchipuram	Tamil Nadu	20	31	51 (3.9)	11
8	Aurangabad	Maharashtra	18	26	44 (3.4)	13
9	Gautam Buddha Nagar	UP	21	22	43 (3.3)	15
10	Delhi	Delhi	32	6	38 (2.9)	67
10	Nashik	Maharashtra	19	19	38 (2.9)	14
12	Jamshedpur	Jharkhand	24	12	36 (2.7)	21
13	Rewari	Haryana	9	20	29 (2.2)	3
14	Coimbatore	Tamil Nadu	8	17	25 (1.9)	9
15	Ludhiana	Punjab	13	11	24 (1.8)	13
16	Thane	Maharashtra	17	6	23 (1.8)	12
17	Krishnagiri	Tamil Nadu	8	12	20 (1.5)	7
18	Haridwar	Uttarakhand	0	19	19 (1.4)	0
19	Mumbai	Maharashtra	16	2	18 (1.4)	39
20	Alwar	Rajasthan	7	9	16 (1.2)	3
20	Tiruvallur	Tamil Nadu	8	8	16 (1.2)	3
	Others		148	156	304 (23.2)	116
Total			610	703	1,313 (100)	610

Source: See Fig. 2

3. Component factory locations

As mentioned in Chapter II, the main plant and branch plant are separate entries. The corresponding districts for each were input into the database. First, the top 20 locations (21 districts) by total factories (Table 4) were examined. Of these 21 districts, 15 are located in the three regions of high concentration of component companies, namely, the NCR of Delhi, Western Maharashtra, and Chennai-Bangalore. Overall, 844 factories are located in these three districts, constituting 64.3% of the total. These three regions stand out not only as locations of company headquarters but also as locations for factories, and are viewed as regions of automobile component industrial agglomeration in this study. Hence, the pattern of component industry prominence in the three states of Haryana, Maharashtra, and Tamil Nadu, as discussed in Session 1, is substituted by the regional agglomeration in three regions. Incidentally, in examining the number of main plants and branch plants by district, a point to be noted is that there are districts with roughly the equivalent number of each, such as Gurgaon, as well as districts with many more branch plants than main plants, such as Udham Singh Nagar in Uttarakhand. There are also districts with fewer branch plants than main plants, such as Delhi. Because of this, a chi-square test was performed to better understand the relationship between locations of main plants and those of branch plants. The null hypothesis that “there is no difference between the top 20 districts with regard to location ratios of main plants and branch plants” was proposed and rejected at the 0.01 level. This suggests that the difference between location of main plants and branch plants is statistically significant and that there are principles for their respective locations.

Next, a null hypothesis that “there is no difference in location ratios of headquarters and main plants as well as headquarters and branch plants” was proposed. A chi-square test was performed and this hypothesis was similarly rejected.¹¹ This shows that the difference of these locations is considered statistically significant. Therefore, it can be surmised that while the automobile component industry in India forms regional agglomerations, the fundamental elements of these agglomerations, namely the locations of headquarters, main plants, and branch plants, have different reasons for their respective locations. This spatial dynamism within each regional agglomeration is further explored in the next chapter.

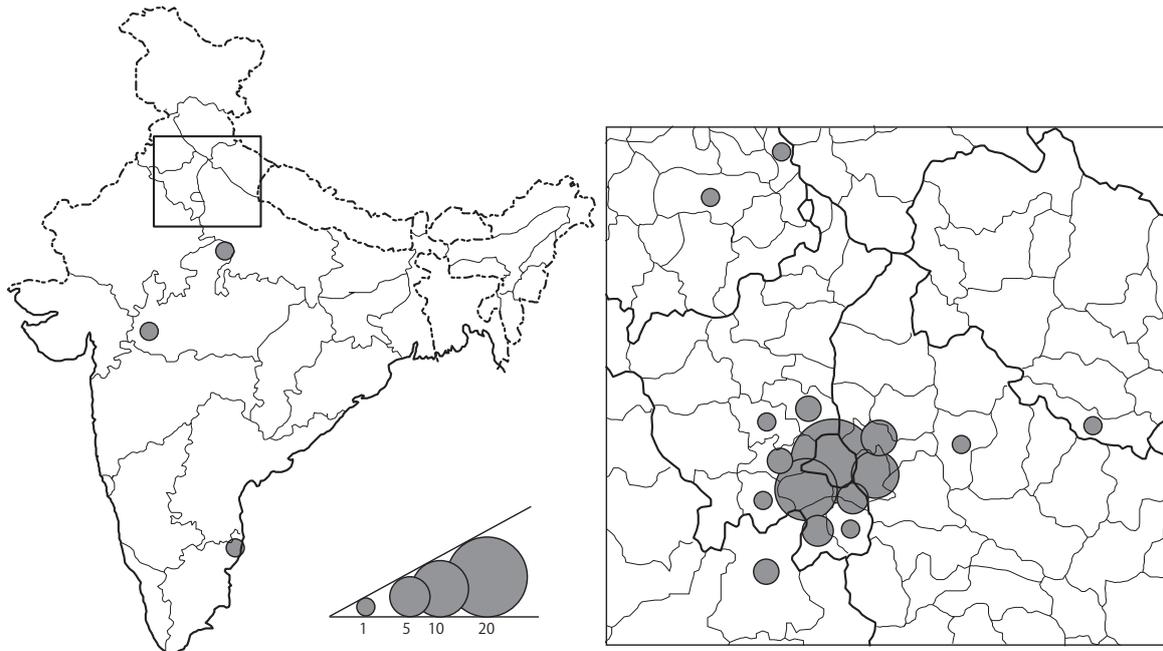
V. Spatial Dynamism of Component Factories in Major Regions of Agglomeration

1. National Capital Region of Delhi

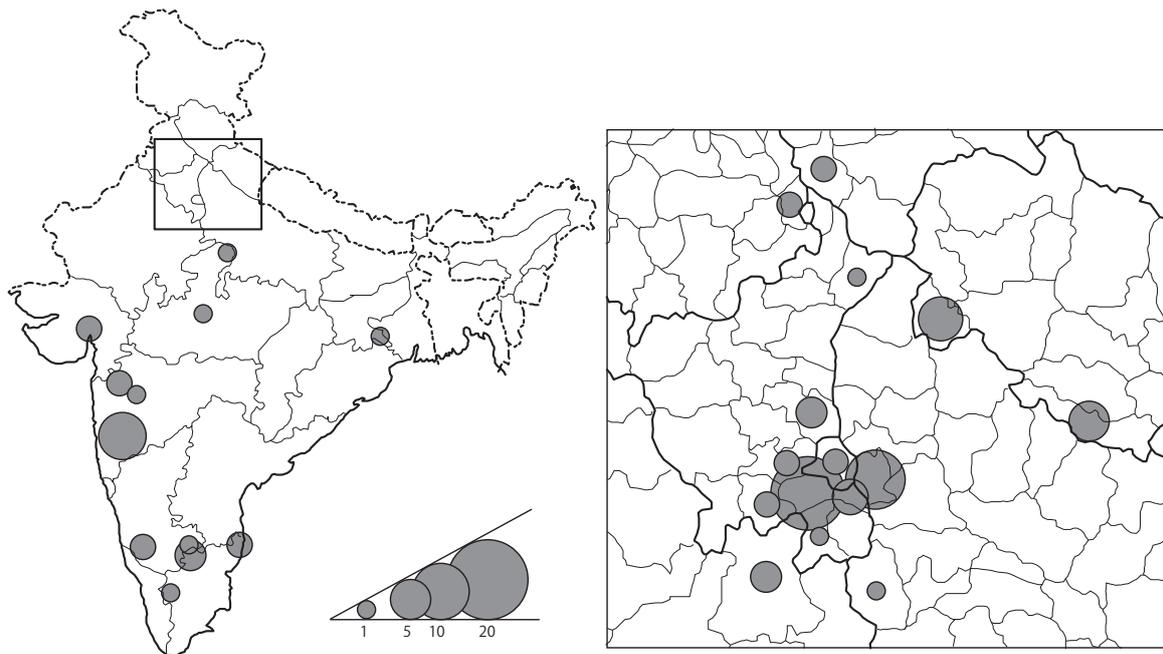
There are four districts within the NCR of Delhi, which host headquarters for more than 10 component companies: Gurgaon (74 company headquarters), Delhi (67), Faridabad (44), and Gautam Buddha Nagar (15). This section explores the factory locations for companies with headquarters in Delhi and Gurgaon.

There are 67 companies with headquarters located in Delhi with an average year of commencing production of 1981 (median 1986). The factory locations are shown in Figure 5. Examining the location of main plants, it is clear that Delhi has the most at 22. These plants are patterned concentrically around the heart of the city, and the distribution of most is within the NCR. Only seven factories are located outside the NCR. Thus, while most companies with headquarters in Delhi also have main plants located within Delhi, there are many that have a main plant located away in locations such as Gurgaon (12 plants) and Gautam Buddha Nagar (7 plants). Delhi is often an inconvenient location for larger factories because space is not always readily available. In addition, government policies exist that promote the transfer of factories from Delhi to the suburbs and surrounding districts. Two districts are known for the creation of industrial areas, namely Gurgaon, which boasts the Udyog Vihar and IMT Manesar industrial areas, and Gautam Buddha Nagar, which hosts the Noida and Greater Noida industrial areas. These industrial areas have become the receptacles for industries oriented toward the NCR.

On the other hand, the locations of branch plants are characteristically more dispersed. Out of a total of 86 branch plants, only two are located in Delhi. A company's first factory is its main plant and second factory is a branch plant. Hence, Delhi is rarely chosen as a location for new factories. Gurgaon, with 17 factories, and Gautam Buddha Nagar, with 11 factories, are the main locations for branch plants. When comparing the overall NCR and other locations, the number of branch plants is approximately equal with the NCR hosting 46 branch plants and other locations hosting 41. In comparison to the relative concentration of main plant locations, the level of dispersion for branch plants is quite high. The major locations for branch plants outside the NCR are Pune with seven branch plants and Haridwar, in the state of Uttarakhand, with five branch plants. Pune represents Western Maharashtra as the district with an abundance of automotive companies, whereas the state of Uttarakhand enjoys



a) Main plants (67 plants)



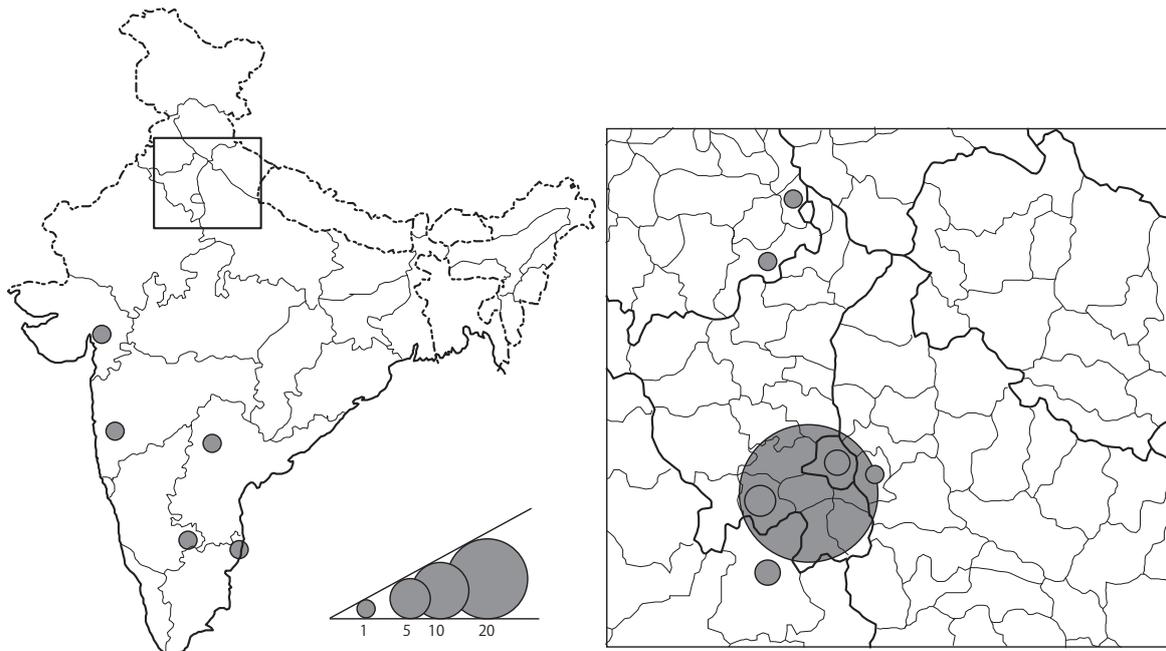
b) Branch plants (86 plants)

Figure 5. Plants locations for companies having headquarters in Delhi
Source: See Fig. 2

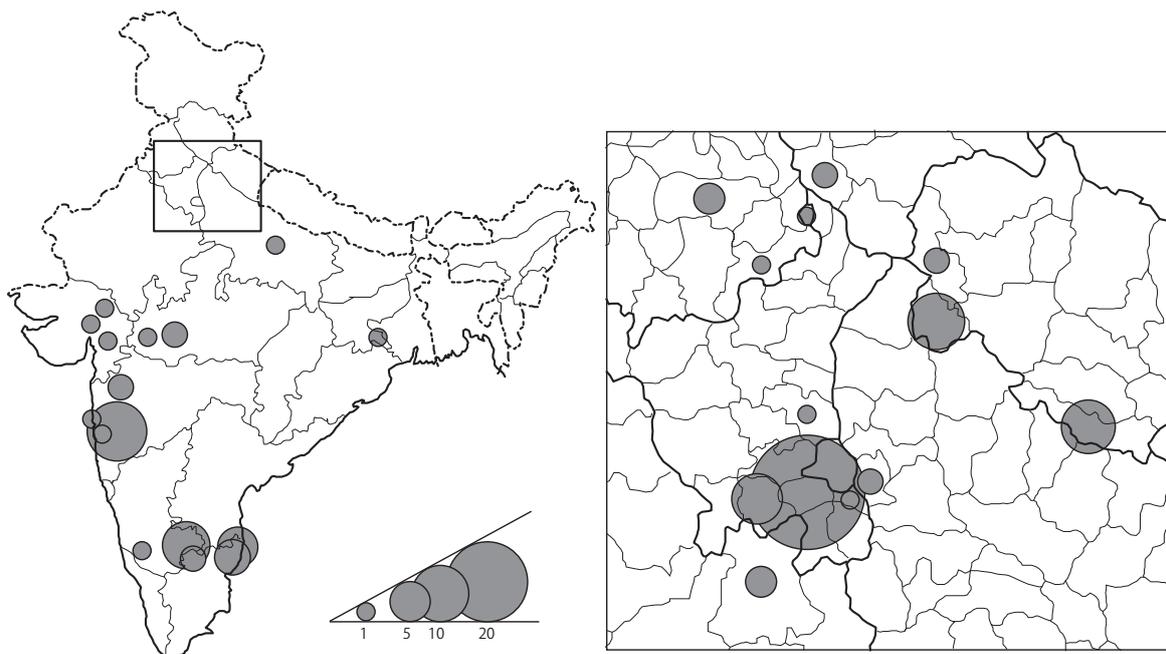
status as a special category state, which has been a factor conducive to the rapid increase in the growth of large-scale automotive factories in recent years (Tomozawa, 2014a, 2014b). As suppliers of components to automobile factories, it is logical that these branch plants are concentrated in the districts where their product destinations are also located. Hence, two patterns emerge for the location

of branch plants: dispersion within the NCR and dispersion outside the NCR oriented around automobile factories.

Within the NCR, there are over 74 headquarters based in Gurgaon, which surpasses even Delhi, and is the highest in India. The average year of commencing production is 1988 (with a median of 1990), which implies that these



a) Main plants (74 plants)



b) Branch plants (126 plants)

Figure 6. Plants locations for companies having headquarters in Gurgaon

Source: See Fig. 2

plants are newer on average than the companies with headquarters in Delhi. The examination of main plants (Figure 6) shows immense concentration in Gurgaon with 59 main plants or over 80% being located there. In comparison to Delhi, many companies have their headquarters and main plant characteristically located in the same area. When examining the 126 branch plants, 41 are located in Gurgaon, which has the largest number, even

though the level of concentration is much lower at 32.5%. This suggests that when expanding factories, Gurgaon, the location of the main factory, is a popular choice. A total of 56 branch plants are located with the NCR, including those located in Gurgaon. The eastern side of the NCR hosts few branch plants, whereas a number of plants have been built along National Highway 8 in the western side, with eight factories in Rewari and three in Alwar. The

NCR suburbs are home to 70 branch plants (55.6%) with an overall distribution trend similar to the case of Delhi. Excluding the NCR, the largest concentrations of branch plants is found in Pune (11), followed by Haridwar (10) and Udham Singh Nagar (9). These areas exhibit many similar distribution characteristics to Delhi.

2. Western Maharashtra

The following five districts in Western Maharashtra

have over ten companies with headquarters located within their borders: Pune (62), Mumbai (39), Nashik (14), Aurangabad (13), and Thane (12). This section explores this industrial agglomeration, paying special attention to Mumbai and Pune, which demonstrate similar characteristics to Delhi and Gurgaon.

The average year of commencing production for companies with headquarters in Mumbai is 1976, and the median is 1978. Although many companies have estab-

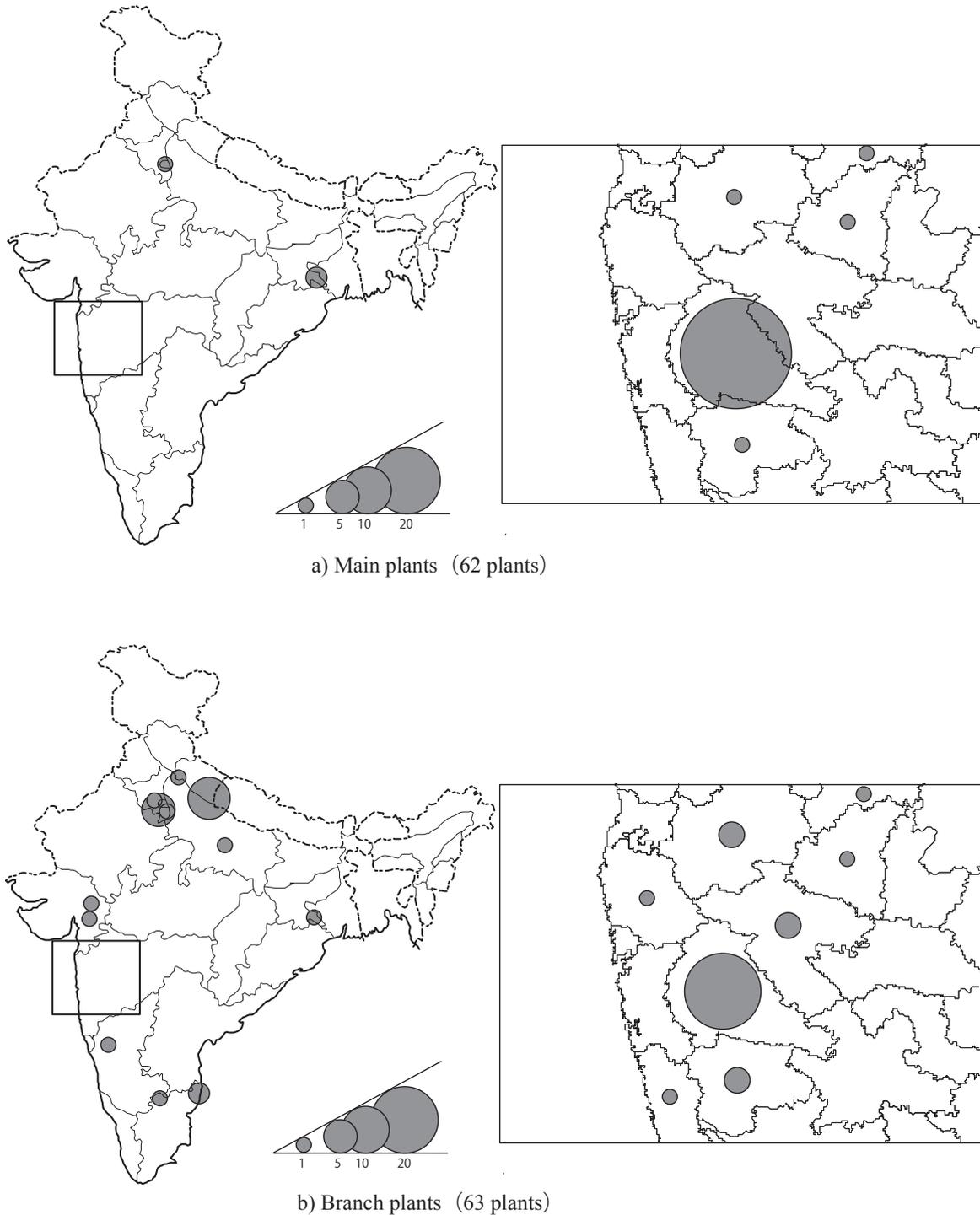


Figure 7. Plants locations for companies having headquarters in Pune
Source: See Fig. 2

lished histories in Mumbai, it is not a place that tends to attract new companies. When examining the location of these companies' factories (Figure Omitted), 14 of 39 have their main plants located in Mumbai (35.9% degree of concentration in Mumbai), and this figure increases to 29 when including those within the region of agglomeration. Although these companies have 36 branch plants, none of them are located in Mumbai. There is a high degree of similarity to the location pattern of factories of companies with headquarters in Mumbai and those of companies with headquarters located in Delhi. However, one distinct feature is the higher tendency toward the dispersion of branch plants compared with companies with headquarters located in Delhi, with 14 branch plants located within and 22 outside of the region.

Sixty-two companies have headquarters located in Pune with both the average and median year of commencing production of 1988. Pune is the most preferred location for the main plants of these companies with 55 (88.7%) (Figure 7) being located in this area. An analysis of the locations of the 63 branch plants of these companies shows that the concentration of the 26 branch plants in Pune is higher (41.3%) than in Gurgaon. Another important point to consider is the disparity in land available for industrial use because the area of Pune (15,642 km²) is close to half that of the NCR (33,578 km²). The region of agglomeration that includes Pune is home to 39 branch plants (61.9%) and has a lower percentage of branch plants outside the region than Gurgaon. An analysis of districts outside the region shows that Udham Singh Nagar has the most branch plants (8), which surpasses Gurgaon (5). One specific contributing factor to this parallels the situation in Delhi; Tata Motors and Bajaj Auto both have headquarters in Pune, and local component companies have established nearby branch plants in response to the successive startup of assembly plants for these two companies in recent years.

3. Chennai-Bangalore

The following three districts within Chennai-Bangalore are home to over 10 company headquarters: Chennai (53), Bangalore (31), and Kanchipuram (11). This section explores the unique characteristics of Chennai.

The headquarters of 53 companies are located in Chennai with an average year of commencing production of 1979 (with a median of 1981). Chennai is the most preferred location for the main plants of these companies, hosting 36 (Figure 8). The degree of concentration of main plants is higher than both Delhi and Mumbai, at 67.9%. Within this region of agglomeration, Kanchipuram (8

main plants) and Tiruvallur (5 main plants) both experienced expansion by foreign automakers during and after the 1990s. There are 90 branch plants in this region, with 19 located in Chennai. The degree of concentration is 21.1%, which is high compared with those of Delhi and Mumbai. While the difference in the degree of concentration may be attributed to the smaller population and industrial agglomeration of Chennai and less to a tendency to pump out factories in comparison with Delhi and Mumbai, more concrete factors have yet to be determined. Kanchipuram (17) and Tiruvallur (6) are home to most branch plants within this agglomeration, with Kanchipuram undergoing extensive expansion.

4. Summation

This chapter explored the three regions of agglomeration, namely the NCR of Delhi, Western Maharashtra, and Chennai-Bangalore, in regard to the geographic location of headquarters and factories. The differences in geographical patterns for headquarters, main plants, and branch plants noted in previous sections are summarized in this paragraph. For any given region of agglomeration, assuming the headquarters of a company is located in the central city, there is a strong tendency to disperse the main plant and branch plant to the suburbs. There are cases where the location of the main plant is the same as the headquarters, as well as those where the headquarters and main plant are located separately. Both situations lead to different geographical patterns. A high percentage of branch plants are located in other regions of agglomeration and new automobile industrial regions, whereas the geographical locations of headquarters and main plants follow an entirely different pattern. While it appears a forgone conclusion, these trends indicate that agglomeration takes place in response to the placement of assembly plants of automakers with which companies have supply relationships. Recent years have also witnessed movement toward suburbs where large-scale land acquisitions are more readily available, as well as a shift toward special category states to take advantage of available benefits. These are the major factors engendering an abundance of location options for India's automobile component companies.

VI. Conclusion

This study attempted to clarify the trends and spacial dynamism of the rapidly growing automobile component industry in India. The findings are as follows:

1. The subject of our research, a group of automobile component companies, was subdivided into subgroups of

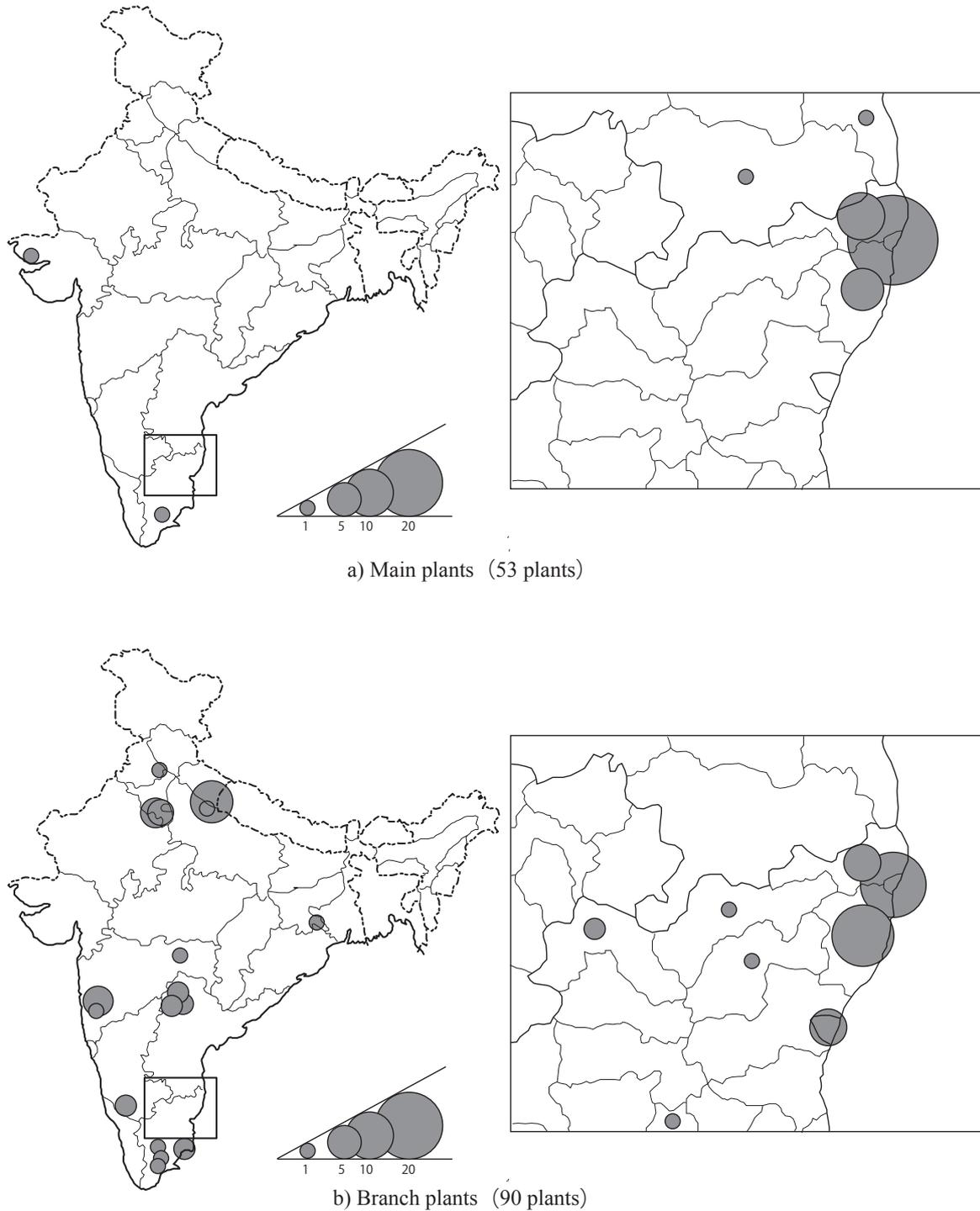


Figure 8. Plants locations for companies having headquarters in Chennai
Source: See Fig. 2

OEM suppliers, secondary suppliers, and exporters. There was a clear difference in the size of OEM suppliers compared with companies in the other two categories. There was also a difference in the size of the OEM suppliers evidenced by the number of factories, which was clearly dependent upon the size of their partners. Moreover, component companies tend to usually execute business dealings that seek economies of scope with a variety of delivery destinations.

2. There are three regions of agglomeration of the automobile component industry in response to factory locations of major automakers in India: namely the NCR of Delhi, Western Maharashtra, and Chennai-Bangalore. These regions of agglomeration were formed by the 1970s, and Delhi, Mumbai, and Chennai were the nuclei for companies established in that period. During and after the 1980s, the establishment of companies and factories in Delhi and Mumbai transitioned to Gurgaon and Pune

respectively, and these two districts have now become the nuclei for their respective regions of agglomeration. Chennai has long occupied a position as the nucleus for the region of Chennai-Bangalore; however, in recent years, there has been significant growth in suburbs such as Kanchipuram.

3. There are also significant differences in the elements that comprise regions of agglomeration, namely the locations of headquarters, main plants, and branch plants. For any given region of agglomeration, assuming the headquarters is located in the central city, there is a strong tendency to disperse the main plant and branch plant to the suburbs. This has led to a further expansion of the industrial agglomeration. In addition, there is a high percentage of branch plants that, while separated from a given region of agglomeration, are established in other regions of agglomeration or locations where automobile plants have been newly located. The establishment of branch plants results not only in multiple factories for component companies, but also in the development of multiple locations.

4. A special mention is made of the trend toward new nuclei formed in the 21st century in Udham Singh Nagar and Haridwar in the special category state of Uttarakhand. The establishment of companies in both these districts was enhanced by the establishment of automobile factories that took advantage of the benefit system provided by the special state status. Within a short period of time, this led to the establishment of component company branch plants concomitant with these automobile factories. These regions are thus composed of automobile company branch plants and component company branch plants, thereby formulating the regional economic characteristic of a “branch plant economy.”

Notes

1. In addition, Kumar (2010) explores the specific automobile component industry region of agglomeration of Chennai and its characteristics.
2. ASI data may be downloaded from the following website: http://mospi.nic.in/Mospi_New/upload/asi/ASI_main.htm?status=1&menu_id=88 (accessed April 29, 2016)
3. The ACMA website is as follows: <http://www.acmainfo.com/> (accessed April 29, 2016)
4. Of the 619 companies and organizations, three industry organizations and six companies classified as design and engineering or consulting companies were omitted. In addition, the definition of automobile component companies used herein includes companies that produce components for two- and three-wheeled motorized vehicles as well as tractors.
5. There are actually nine districts within Delhi. However, for

the purpose of this study, Delhi was considered to be a single regional unit.

6. One specific example is Hosur city, which is located in the Krishnagiri district of the Tamil Nadu state and borders the Bangalore district, but it was listed as being located in the state of Karnataka.
7. In the ASEAN free trade agreement signed in 2009, tariffs for 80% of the products were eliminated and about 50 types of automobile components were granted exemptions. Moreover, in the Japan-India Comprehensive Economic Partnership Agreement, there were some items such as mufflers (currently under a 10% tariff rate) for which tariffs were to be eliminated over a ten-year span; others that did not result in the complete elimination of tariffs, such as tariffs on gearboxes (currently at 12.5%), are to be reduced to 6.25% over eight years; and tariffs on diesel engines (currently at 12.5%) are to be reduced to 5% in six years.
8. Among companies for which revenues and export turnover data were unavailable, those that had delivery destinations only to foreign countries also received this classification.
9. Tomozawa (1999) surveyed 24 component companies in the industrial area of Noida near Delhi and classified them into five categories: OEM suppliers, secondary suppliers, exporters, piecemeal job workers, and repair parts.
10. In this study, the Delhi National Capital Region is defined as the Delhi Union Territory, nine districts of Haryana state (Gurgaon, Mewat, Palwal, Rewari, Jhajjar, Sonapat, Panipat, Faridabad, and Rohtak), five districts of Uttar Pradesh state (Meerut, Baghpat, Bulandshahar, Ghaziabad, and Gautam Buddha Nagar), and Alwar district of Rajasthan. Western Maharashtra refers to seven districts in the Konkan Division within Maharashtra (Mumbai, Mumbai Suburban, Raigad, Ratnagiri, Sindhudurg, and Thane), five districts in the Pune Division (Kolhapur, Pune, Sangli, Satara, and Solapur), five districts in the Nashik Division (Nashik, Dhule, Jalgaon, Nandurbar, and Ahmednagar), and Aurangabad district in the Aurangabad Division. Chennai-Bangalore refers to six districts in the state of Tamil Nadu (Chennai, Kanchipuram, Tiruvallur, Vellore, Tiruvannamalai, and Krishnagiri) and three districts in Karnataka state (Bangalore Urban, Bangalore Rural, and Ramanagara).
11. In general, chi-square testing must be performed with five or more theoretical values (predicted values). Therefore, the test was performed for the headquarters and main plants both for all 21 districts and 18 districts, having less than five main plants (Udham Singh Nagar, Haridwar, and Alwar). In each case, the null hypothesis was rejected at the 0.01 level. This was not an issue when testing headquarters and branch plants.

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