Regional Patterns of Manufacturing Industries: a Study of Manufacturing Industries in Java Region, Indonesia

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ABSTRACT

Previous studies on geographical distribution of economic activity in Indonesia demonstrate that firms are localized in major metropolitan areas as well as a set of emerging regions. The paper aims to complement the findings of the studies on regional and industrial concentration in Indonesia's manufacturing industry by exploring whether regional specialization and industrial concentration patterns changed during the 1998–2007 period. In particular, the focus is on the three biggest regions in Java using Indonesia's Standard Industrial Classification of Industries (SIC) at the three-digit level (SIC 151-293) on the basis of employment data by branch and by region. In order to analyze the regional patterns of manufacturing industries, two procedures were applied: first, identify the industrial area using contribution analysis and location quotient (LQ) index; and second, calculate regional specialization and industrial concentration using traditional statistical measures like the Herfindahl-Hirschman index. The major findings of the study show that during 1998–2007, Java's region became more specialized and industry became more concentrated.

INTRODUCTION

Developing countries give special emphasis on the development of the manufacturing sector because manufacturing is considered as a leading sector

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that could encourage the development of other sectors such as the services and agriculture sectors (Arsyad 1999). Thus, it is not surprising that the role of manufacturing has become more important in encouraging the development of a country's economy (Arifin 2003).

In order to accelerate the economic growth rate of a country, the process of transformation in economic activity from the primary sector, which is based on agriculture, into modern industrialization is believed to be one of the many strategies of developing countries including Indonesia. This is reinforced by the realization of long-term economic growth in developed countries because of a highly developed industrial sector compared to those that relied on the agricultural sector (Arsyad 1999).

Until now, the fields of regional and urban economics are still trying to explain why economic activity, particularly manufacturing, tend to be concentrated in some specific areas. For the Indonesian case, Kuncoro (2000) found that the concentration of central manufacturing industries is located in Java, with a two-pole pattern of concentration (bipolar pattern). Data on the development of manufacturing in Java and outside of Java is presented in Table 1, which shows that manufacturing in Java during 2001–2005 was dominant and accounted for more than 80 percent of total manufacturing in Indonesia.

Kuncoro (2002) found that the geographical concentration of manufacturing in Java was the result of dense population; i.e., urban areas of Java have an advantage in terms of localization and urbanization economies. This was the reason most manufacturing companies chose to locate in Java. In addition, the market structure in Java has led to a geographical concentration of the manufacturing industry. However, when viewed in more detail, it was found that economic activities were concentrated in certain areas only. This means that there were geographical gaps in smaller circles. For instance, observing one pole of the existing concentration, Kuncoro (2002) found several concentration of economic activities in Jakarta

Table 1. Location of Indonesian manufacturing industry (by number of establishments, in percent of total)

Location	2001	2001	2002	2003	2004	2005
Java	17,995	17,413	17,118	16,607	16,901	16,995
	(81.15%)	(81.38%)	(80.95%)	(81.71%)	(81.71%)	(81.99%)
Outside of Java	4,179	3,983	4,028	3,717	3,784	3,734
	(18.85%)	(18.62%)	(19.05%)	(18.29%)	(18.29%)	(18.01%)
Total	22,174	21,396	21,146	20,324	20,685	20,729
	(100%)	(100%)	(100%)	(100%)	(100%)	(100%)

Source: Indonesia's Central Statistical Office (2009).

and the surrounding areas such as Bogor, Tangerang, and Serang, Bekasi and Karawang which were also called Jabotabek Extended Industrial Area (EIA); Surabaya and the surrounding areas such as Sidoarjo, Gresik, Pasuruan, and Mojokerto (Surabaya EIA); city of Bandung and the surrounding areas (Bandung and Purwakarta); Semarang and the surrounding areas (Salatiga, Kudus, Kendal); and Surakarta and the surrounding areas (Klaten, Sukoharjo, Karanganyar).

The situation described above clearly showed that the spread of manufacturing industry in Indonesia was biased toward the Java region. The concentration in economic activity shows that industrialization is a selective process, and when viewed in terms of geography, the process only occurs in certain areas. For example, majority of the manufacturing industry in the United States has long been concentrated in a location called the "manufacturing belt" (Krugman 1991). Similarly, spatial concentration was also found in the United Kingdom in the Axial industrial belt (Kuncoro 2000).

The aim of this study is to investigate the pattern of manufacturing industry in the Java region from 1998 to 2007 by taking a sample of regency (*kabupaten*) levels in Java, particularly in the three biggest provinces; namely, west of Java, center of Java, and east of Java. This topic is becoming increasingly important with respect to economic policy and competitiveness; while the exploitation of scale economies and the specific endowments of the regions increase productivity, a highly specialized region is more vulnerable to economic shocks in its leading sector. Structural shifts in the economy, particularly in labor and endowment, should also be of high policy concern for Indonesia.

The paper is organized as follows. Section 2 gives an overview of the manufacturing industry in Java, while Section 3 briefly describes the relevant literature related to the topic. The measurement and methodology are explained in Section 4. Section 5 discusses the empirical results, which show the pattern of manufacturing industry in Java. The paper concludes with a summary of the main findings and directions for future research.

AN OVERVIEW OF MANUFACTURING INDUSTRY IN JAVA

Industrialization is seen as a main force to ensure high productivity and thus, economic growth. In the Indonesian context, the process of structural transformation from agriculture to manufacturing can be seen from the sectoral contributions to Indonesia's gross domestic product (GDP). As shown in Table 2, the manufacturing sector has been dominating the other sectors in terms of contribution to the Indonesian GDP. During 2003–2007, the manufacturing sector accounted for more than 27 percent of GDP. This was followed by the trade, hotel, and restaurant sector which contributed around 16–17 percent of GDP for the same period. The third major contributor to GDP was agriculture, although its share has slightly declined.

Table 2. Sectoral contribution to Indonesia's gross domestic product (GDP), 2003–2007 (in percent)

Sectors	2003	2004	2005	2006	2007
Agriculture	15.24	14.92	14.50	14.20	13.83
Mining and quarrying	10.63	9.66	9.44	9.10	8.73
Manufacturing	28.01	28.37	28.08	27.83	27.40
Electricity, gas, and water supply	0.66	0.66	0.66	0.66	0.69
Construction	5.68	5.82	5.92	6.08	6.21
Trade, hotel, and restaurant	16.26	16.37	16.77	16.92	17.26
Transportation and communication	5.42	5.85	6.24	6.77	7.28
Banking and other financial intermediaries	8.90	9.12	9.21	9.21	9.35
Services	9.20	9.23	9.18	9.24	9.27
Total	100	100	100	100	100

Source: Indonesia's Central Statistical Office (2009)

Looking at the manufacturing sector in Java, the distribution at the three-digit level in the three provinces in Java based on the Standard Industrial Classification of Industries (*Kelompok Lapangan Usaha Industri*, or KLUI) issued by Indonesia's Central Statistical Office (BPS) is presented in Table 3. Overall, the number of manufacturing firms in the three provinces in Java showed a declining trend. In 1998, the total number of manufacturing firms was 12,542; in 2002, it slightly decreased to 11,162; and significantly decreased in 2007 to 6,745. Of the total number of manufacturing firms in 1998, around 41.5 percent (or 5,206 firms) were located in West Java, which accounted for the largest number of manufacturing firms. East Java followed with 4,335 firms (34.6%), and finally Central Java with 3,001 firms (23.9%).

The distribution of manufacturing firms in Java shifted significantly in 2002. The establishment of Banten as a new province, which separated from West Java in 2001, changed the structure of manufacturing particularly in West Java. Thus, the number of manufacturing firms in West Java fell quite sharply to 3,392 (or 30.4% of total firms in Java) in 2002. Meanwhile, the number of manufacturing firms in East Java decreased to 4,047 in 2002, although its share in total number of manufacturing firms increased to 36.3 percent. A sharp increase in the number of manufacturing firms was recorded in Central Java in 2002 to 3,727 (33.4%). In 2007, the number of manufacturing firms in Java Island showed a sharp decline in all provinces. There were 6,745 manufacturing firms in 2007 compared to 11,162

Table 3. Distribution of total number of manufacturing firms in Java by province, selected years

Provinces	1998		2002		2007	
	Total	%	Total	%	Total	%
West Java	5,206	41.51	3,392	30.39	2,501	37.08
Central Java	3,001	23.93	3,723	33.35	1,791	26.55
East Java	4,335	34.56	4,047	36.26	2,453	36.37
Total	**12,542**	100	**11,162**	100	**6,745**	100

Source: Survey on Manufacturing, Indonesia's Central Statistical Office (2010).

firms in 2002. West Java, East Java, and Central Java accounted for 2,501, 2,453, and 1,791 manufacturing firms, respectively. In particular, there was a decrease in the number of large and medium manufacturing firms. Thus, based on the distribution of manufacturing firms in each province from 1998 to 2007, it can be concluded that the concentration of manufacturing in three provinces in Java Island was unevenly distributed geographically.

PREVIOUS STUDIES IN INDONESIA

There are some studies related to concentration in manufacturing industries conducted in Indonesia. Examples of such studies were by Kuncoro (2002), Suharto (2002), Arifin (2003), Landiyanto (2003, 2005), and Hidayati and Kuncoro (2005). Kuncoro (2002) explored to what extent the unequal geographical distribution of manufacturing activities in Indonesia has persisted or changed over time. Using Theil's entropy index, his study proved useful in highlighting the uneven geographic distribution in Indonesia. First, he found that Indonesia constitutes an extreme case of geographical concentration. Second, the entropy between islands has played a prominent role in explaining the spatial inequality across provinces in Indonesia. Third, the pattern of spatial inequality formed a "U" curve, suggesting that a period of dispersing manufacturing activity has been replaced by a period of increasing geographic concentration. Fourth, the Chow tests confirmed that structural change has occurred from 1985 onwards. Thus, he concluded that his findings challenge the general consensus in the new economic geography that trade liberalization encourages dispersion of manufacturing activity.

Suharto (2002) explored the trend of regional disparity, specialization, and concentration of manufacturing industry employment in Indonesia by province and subsector, with focus on large and medium manufacturing firms. His study used industrial survey data from the BPS from 1993 to 1996. Using tools of analysis that consisted of the Theil entropy index, regional specialization index, regional Gini coefficient, and locational Gini coefficient, the results showed that

regional inequality in Indonesian manufacturing employment was relatively high compared to the international inequality standard. The other finding was that disparity by province and the main island tended to be stable. Generally, the distribution of regional manufacturing industry employment was not different (matches) from the overall distribution (national). With the exception of the wood (ISIC 33) and textile (ISIC 32) industries, manufacturing industry employment was relatively well distributed.

Arifin (2003) identified the spatial concentration of large and medium manufacturing industry firms throughout 25 districts in West Java. Using secondary and establishment data from BPS for the period 1990–1999, the results using Geographic Information System (GIS), logistic regression, panel data regression, and convergence analysis showed that industry growth in West Java was not distributed equally among districts. Several districts have a high industry concentration while some have a low industry concentration. The manufacturing industry was concentrated in the Botabek (Bogor, Tangerang, and Bekasi) and Bandung areas. The factors that have affected the growth of manufacturing were labor cost (salary), output, foreign direct investment (FDI), economies of scale, and dummy variables for crisis periods and industry. Meanwhile, logistic regression analysis showed that several variables significantly explained why the manufacturing industry was more concentrated in industrial regions. This result was consistent with the regression analysis using panel data, which showed that the manufacturing industrial growth was influenced by the variables cited above. Convergence analysis indicated that West Java Province should grow by at least 6.30 percent per year for its convergence growth.

Using employment and value-added data for manufacturing industries in Surabaya City for 1994 and 2002, and based on the location quotient (LQ) and Ellison-Glaeser geographic concentration index similar to Maurel and Sedillot (1999), it was found that the manufacturing industry was concentrated in the subdistricts (*kecamatan*) of Rungkut, Tandes, and Sawahan while the food, beverage, and tobacco; and metal, machinery, and equipment industries were the leading industries (Landiyanto 2003). Meanwhile, Landiyanto (2005) investigated the concentration of East Java manufacturing industry, the locational distribution, and the relation between spatial concentration and specialization of industries in East Java. He used LQ, Herfindahl index, Ellison-Glaeser index, Krugman regional specialization index, and Krugman bilateral index to analyze the data. He found that in the manufacturing industry, spatial concentration was determined by wages, transportation cost, market access, and externalities that related to localization economies and urbanization economies. The existence of spatial concentration is related to industrial specialization, which is based on the industrial structure in that region.

Hidayati and Kuncoro (2005) examined the existence of industrial concentration in Java, and they found that industry concentration followed a bipolar pattern: western (Jakarta and Bandung Greater) and eastern (Surabaya Greater). Using the GIS, the study attempted to identify where the agglomeration of large and medium establishments (LMEs) tended to locate within the DKI Jakarta and West Java regions as one of the industrial concentration polars in Java; to observe its pattern and dynamics in the 1980–2000 period; and to prove whether industrial concentrations in those regions developed into one big agglomeration or separated. The results of the study showed that in the initial year of observation (1980), there were only two industrial agglomeration districts particularly marked "high" in both employment and value-added criteria, but a few new industrial agglomeration districts emerged in the next decade. Moreover in 2000, 13 districts were observed. For some years of observation, the pattern and dynamics of industrial agglomeration were extending. The extension of the agglomeration was only taking place in the main metropolitan region, Jakarta and Bandung, and its surrounding regions known as Extended Metropolitan Region (EMR). The study also found empirical evidence that by 2000, industrial agglomeration in the western pole has been developing into a network city joining Jakarta and Bandung Metropolitan Region as one big agglomeration.

METHODOLOGY

Unit analysis and data

The objective of the study is to analyze the pattern of geographical concentration of manufacturing industry in the Java region. The unit of analysis is the regency (*kabupaten*) in three provinces in the Java region, namely west of Java, center of Java, and east of Java. The West Java Province consists of 19 regencies, while Central Java and East Java each consist of 31 regencies. The data of the study is retrieved from the Annual Survey on Large and Medium (L&M) Size Manufacturing Industry conducted by the *Badan Pusat Statistik* (BPS, Indonesia's Central Statistical Office) for the period 1998–2007. The dataset based on the annual survey on manufacturing industry is the only source of data which recorded the number of medium- and large-sized manufacturing firms at the regency and province levels in Indonesia. Medium- and large-sized firms in the manufacturing industry are defined as those establishments with 20 or more workers. The 3-digit industry is selected because it is the highest level of disaggregated manufacturing industry available at the regency level.

The method of analysis

The objective of identifying the patterns of manufacturing industry is to show where manufacturing in the Java region is mainly located. Furthermore, it will help

to identify which of the leading industries of Java's manufacturing are dispersed. To identify the patterns, there are three procedures to be applied: (1) calculate the contribution of manufacturing in each regency based on the distribution of employment and value-added data; (2) identify the leading industries using LQ method; and (3) finally, compute the Herfindahl-Hirschman index to determine the specialization and concentration of manufacturing.

Contribution analysis

Contribution analysis is applied based on value-added and employment data in the manufacturing sector. The objective is to describe the distribution of employment and value added in the manufacturing sector in the regency of each province. Hidayati and Kuncoro (2005) used employment and value-added measurements in order to determine the agglomeration and nonagglomeration areas. This study will also use these criteria as guidelines for the determination of an industrial area. Based on Hidayati and Kuncoro, there are two steps: (1) give the ratings for all regencies in terms of employment and value added; based on this ranking, we will get the distribution patterns of manufacturing industry in each province during the study; and (2) set a specific criterion on employment and value added in order to distinguish whether an area is included under agglomeration or nonagglomeration.

The main characteristic of industrial agglomeration is the areas which have high density levels both of employment and value added. The growth of employment and value added (output) have been generally used as a measure to assess the occurrence of agglomeration, especially in urban areas (Glaeser et al. 1995; Bradley and Gans 1998). Urban areas generally offer many advantages in the form of productivity and higher revenue, and attract new investment, new technology, educated and skilled workers more than rural areas (Malecki 1991). Therefore, it is understandable if agglomeration is a central issue in the literature on economic geography and regional studies (Krugman 1998).

Like the criterion that was applied by Hidayati and Kuncoro (2005), this study used three criteria, namely, high, medium, and low criteria of agglomeration. In the study, in order to determine whether a regency is included in one of those criteria, a cut-off point method was used. The cut-off point applied in this study is based on the data on employment and value added in the manufacturing sector and not in other sectors. This means that if the results categorized a regency as an industrial area, it is because that regency scored high in both employment and value added; otherwise, if the level of employment and value added are in the low or medium categories, then it will be categorized as a nonindustrial area.

Location quotient index

The location quotient (LQ) is used to identify areas of industrial specialization for industries, states, and regions. LQ compares the proportion of employment in

a particular industry within the local economy to the proportion of employment in that same industry within a larger reference economy (Miller 1998; McCann 2001). Formally, LQ is the numerical equivalent of a fraction whose numerator is the share of employment of manufacturing industry relative to total population in a region, and whose denominator is the share of manufacturing employment relative to total population in the nation. For computation of the industrial location, the following formula is used:

$$LQ_i = (e_i/e) / (E_i/E), \tag{1}$$

where LQ_i is the location quotient of industry i in the local region; e_i is the employment of industry i in the local region; e is total manufacturing employment in the local region; E_i is the reference area employment in industry i; and E is total manufacturing employment in all categories. If the LQ for an industry in a particular regency is greater than one, this suggests that the regency exports the output of that particular industry. Those industries with LQs less than one imply that the regency imports the outputs from outside. As such, all industries with LQs greater than one are defined as specialized industries.

The Herfindahl-Hirschman index

The Herfindahl index, also known as Herfindahl-Hirschman index (HHI), is a measure of the size of firms relative to the industry and an indicator of the amount of competition among the firms in the industry. In other words, HHI is normally used as an indicator of competition among firms in an industry. HHI is the most commonly used indicator to measure concentration/specialization (Goschin et al. 2009):

$$\textbf{Specialization:} \quad H_i^s = \sum_{j=1}^{m}\left(g_{ij}^s\right)^2 \text{ where: } g_{ij}^s = \frac{x_{ij}}{\sum_{j=}^{m} x_{ij}} = \frac{x_{ij}}{x_i} \tag{2}$$

$$\textbf{Concentration:} \quad H_j^c = \sum_{i=1}^{n}\left(g_{ij}^c\right)^2 \text{ where: } g_{ij}^c = \frac{x_{ij}}{\sum_{i=}^{n} x_{ij}} = \frac{x_{ij}}{x_j} \tag{3}$$

where
i refers to region, and j to industry;
x : gross value added or employment;
x_{ij} : gross value added or employment in industry j in region i;
x_i : total gross value added or employment in region i;
x_j : total gross value added or employment in industry j;
g_{ij}^s : the share of sector j in total value of region i; and
g_{ij}^c : the share of region i in total national value of industry j.

The index can take on several values. A regency is called totally concentrated if HHI is equal to one, which is the maximum value. The value of HHI equals one only if manufacturing in the regency is concentrated in only one industry. Meanwhile, if the value of HHI approaches zero, it indicates that the regency is totally dispersed. That is, if concentration of industries decreases (or diversification increases), HHI will decline.

EMPIRICAL FINDINGS

Distribution of manufacturing in the Java region

The survey on large and medium manufacturing firms by Indonesia's Central Statistical Office uses the number of labor as a factor to measure and categorize the industry. Based on this measurement, if a manufacturing firm's total number of labor is between 20 and 99, it is classified as medium scale. If a manufacturing firm's total number of labor is more than 100 people, then it is classified as large scale. The distribution of manufacturing industry by region clearly showed that there was a significant decrease in the number of firms (Table 3). The distribution of manufacturing based on size is presented in Table 4. It can be seen in Table 4 that the number of medium- and large-scale industries significantly declined from 1998 to 2007.

Table 4. Number of manufacturing firms under medium and large categories in Java, selected years

Medium Scale	1998	%	2001	%	2004	%	2007	%
West of Java	3,190	36.01	2,707	33.74	2,575	32.90	1,716	34.55
Central of Java	2,387	26.95	2,264	28.22	2,216	28.31	1,338	26.94
East of Java	3,281	37.04	3,051	38.03	3,035	38.78	1,912	38.50
Total	**8,858**	100.00	**8,022**	100.00	**7,826**	100.00	**4,966**	100.00

Large Scale	1998	%	2001	%	2004	%	2007	%
West of Java	2,016	54.72	1,561	47.68	1,501	47.26	785	44.13
Central of Java	614	16.67	653	19.95	653	20.56	453	25.46
East of Java	1,054	28.61	1,060	32.38	1,022	32.18	541	30.41
Total	**3,684**	100.00	**3,274**	100.00	**3,176**	100.00	**1,779**	100.00

Source: Survey on Manufacturing, Indonesia's Central Statistical Office (2010).

Distribution of manufacturing based on employment using graphical analysis for regencies in Java in the selected years (1998 and 2007) shows that manufacturing in Java is spread unevenly across regencies (Figure 1). In the selected observation, regencies such as Bandung, Bekasi, Bogor, and Karawang still occupy the main industrial area in West Java. Meanwhile, regencies in East Java show the highest number of regencies with highest employment compared with other regencies.

Figure 2 shows that distribution of manufacturing for regencies in Java based on the value added using graphical analysis for the years 1998 and 2007 indicates that manufacturing in Java is spread unevenly across regencies.

Figure 1. Distribution of manufacturing in Java based on employment, 1998 and 2007
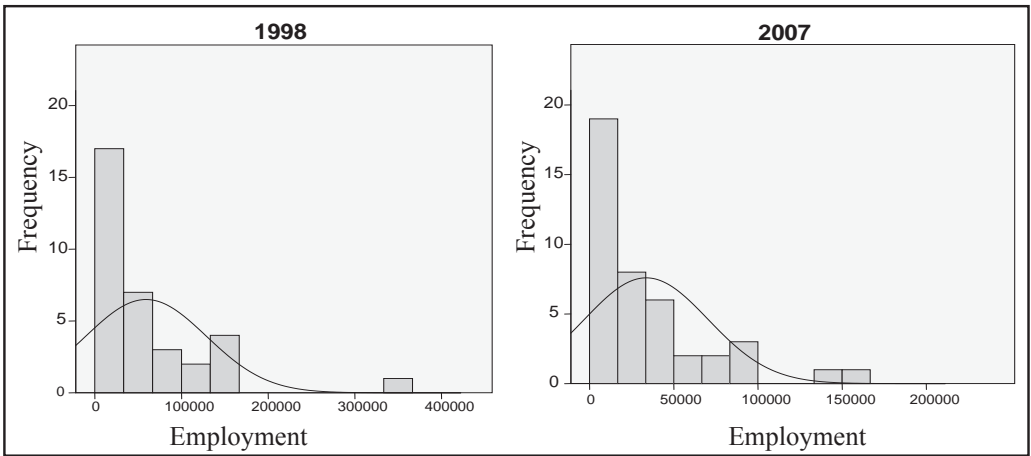
Figure 2. Distribution of manufacturing in Java based on value added, 1998 and 2007
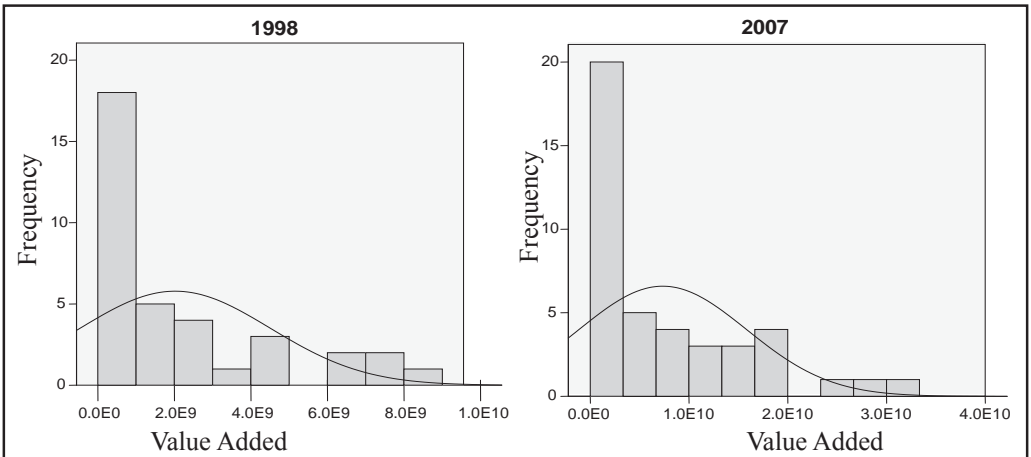
West of Java

In 1998, the highest employment in West of Java was subsequently distributed in Bandung, Tangerang, Bogor, Bekasi, Serang, and Karawang regencies. In 2001, positions of highest employment were still occupied by Bandung followed by Bekasi, Bogor, and Karawang. Meanwhile, regencies such as Tangerang and Serang that were previously entered in the main industrial area with highest employment, were replaced by Depok and Purwakarta in 2001. It was because these two areas in 2000 were formed into a new separate province, Banten. Not much different from previous years, regencies such as Bandung, Bekasi, Bogor, Karawang, and Depok were still considered as the main industrial area in West of Java in 2004, while Purwakarta was replaced by Cimahi. While in 2007, Depok was the only city that was removed from the main industrial area category and was replaced by Sukabumi (Table 5).

Center of Java

Concentration of manufacturing industries based on the highest number of labor absorption during the period 1998–2007 is indicated in regencies like Semarang, Kudus, Sukoharjo, Karanganyar, and Pekalongan. Highest labor absorption in these areas indicated that many labor-intensive manufacturing industries are located there. For example, as a regional capital of Central Java Province, Semarang has long been known as a major driver of regional economic growth industry of Central Java.

East of Java

Similar to the distribution of manufacturing industry in West Java and Central Java, manufacturing industry in East Java also showed an uneven distribution. Analysis using the histogram shows a positive skewness trend. This indicates that there are regions with high industrial density while other regions do not.

Table 5. Regencies with high employment in West of Java

1998		2003		2007	
Regency	**Number of Employment**	**Regency**	**Number of Employment**	**Regency**	**Number of Employment**
Bandung	345,917	Bandung	274,562	Bandung	143,319
Tangerang	184,566	Bekasi	172,531	Bogor	86,996
Bogor	163,420	Bogor	150,862	Bekasi	61,518
Bekasi	149,632	Cimahi	80,509	Cimahi	48,922
Serang	69,114	Karawang	75,686	Sukabumi	36,299
Karawang	58,898	Depok	36,360	Karawang	24,182

Source: Survey on Manufacturing, Indonesia's Central Statistical Office (2010).

Table 6. Regencies with high employment in Central Java

Regency	1998 Number of Employment	Regency	2003 Number of Employment	Regency	2007 Number of Employment
Semarang	107,302	Semarang	118,709	Semarang	94,430
Kudus	69,191	Kudus	68,091	Kudus	72,575
Sukoharjo	45,207	Sukoharjo	41,880	Sukoharjo	29,700
Karanganyar	35,716	Karanganyar	39,815	Karanganyar	26,005
Pekalongan	31,627	Pekalongan	33,173	Pekalongan	19,907
Kendal	21,500	Kendal	17,443	Pati	11,620
Boyolali	16,889	Cilacap	16,591	Tegal	10,644
Surakarta	15,308	Boyolali	16,194	Klaten	9,126
Pati	13,274	Pati	15,779	Sragen	8,984
Kebumen	11,229	Surakarta	13,691	Boyolali	8,149

Source: Survey on Manufacturing, Indonesia's Central Statistical Office (2010).

Table 7. Regencies with high employment in East of Java

Regency	1998 Number of Employment	Regency	2003 Number of Employment	Regency	2007 Number of Employment
Surabaya	143,822	Sidoarjo	134,613	Surabaya	70,024
Sidoarjo	122,810	Surabaya	119,089	Sidoarjo	58,779
Pasuruan	71,438	Malang	74,644	Malang	48,311
Malang	66,318	Pasuruan	70,363	Pasuruan	42,512
Gresik	63,412	Gresik	68,547	Kediri	34,892
Kediri	50,687	Kediri	51,837	Gresik	32,344
Jember	37,126	Jember	29,462	Jember	18,461
Banyuwangi	27,886	Mojokerto	28,727	Mojokerto	14,830
Mojokerto	27,546	Banyuwangi	26,219	Banyuwangi	11,685
Probolinggo	18,571	Probolinggo	17,473	Jombang	10,585

Source: Survey on Manufacturing, Indonesia's Central Statistical Office (2010).

Based on employment data, highest employment absorption in East Java is shown in Surabaya, Sidoarjo, Pasuruan, Malang, Gresik, and Kediri, while others had lower employment. Generally, industrial areas in East Java are concentrated in the north-south corridor, stretching from Gresik to Kediri.

Location quotient index

The analysis of location quotient index (LQ) is used to investigate the level of relative advantage of a sector in one region compared with other regions. In this study, data on employment are used to calculate the LQ of manufacturing industry in 42 regencies in Java. The results of LQ are shown in Table 8.

One important point to keep in mind about the result of LQ is that the change in the value of LQ is affected by regional population shifts. In most cases, an increase in the index is accompanied by an increase in manufacturing employment since our study uses this manufacturing data. In the same manner, a decrease in the index does not always mean the loss of employment.

Based on the number of labor, LQ analysis for manufacturing in West Java showed a tendency to decrease during the observation period. In 1998, most of the regencies in West Java had a value of LQ > 1. This meant that most areas in West Java had an industry sector that is the mainstay, and had potential for

Table 8. Location quotient index for regencies in West of Java

1998		2002		2003		2007	
Regency	LQ	Regency	LQ	Regency	LQ	Regency	LQ
Pandeglang	3.83	Depok	1.18	Cimahi	1.41	Cimahi	1.67
Serang	3.32	Banjar	1.07	Depok	1.06	Sukabumi	1.61
Tangerang	2.92	Karawang	0.85	Banjar	0.99	Kuningan	1.16
Lebak	2.66	Subang	0.82	Karawang	0.77	Subang	1.08
Cianjur	2.42	Bekasi	0.79	Bekasi	0.73	Sumedang	0.97
Bandung	2.36	Purwakarta	0.78	Cirebon	0.69	Depok	0.88
Majalengka	2.18	Majalengka	0.76	Majalengka	0.68	Banjar	0.81
Bogor	2.18	Bogor	0.72	Purwakarta	0.67	Purwakarta	0.77
Sumedang	2.06	Cirebon	0.72	Indramayu	0.66	Cirebon	0.77
Purwakarta	2.00	Sumedang	0.71	Garut	0.66	Bogor	0.72
Tasikmalaya	1.96	Indramayu	0.68	Bogor	0.65	Tasikmalaya	0.70
Bekasi	1.95	Garut	0.67	Sumedang	0.64	Ciamis	0.69
Indramayu	1.93	Bandung	0.65	Kuningan	0.64	Cianjur	0.65
Subang	1.87	Cianjur	0.64	Tasikmalaya	0.61	Bandung	0.59
Karawang	1.86	Kuningan	0.63	Bandung	0.60	Garut	0.52
Cirebon	1.83	Sukabumi	0.60	Cianjur	0.54	Majalengka	0.51
Garut	1.70	Ciamis	0.59	Sukabumi	0.53	Bekasi	0.49
Ciamis	1.61	Tasikmalaya	0.34	Ciamis	0.50	Karawang	0.47
Sukabumi	1.52	Cimahi	0.00	Subang	0.48	Indramayu	0.32

Source: Authors' calculations.

Table 9. Location quotient index for regencies in Central Java

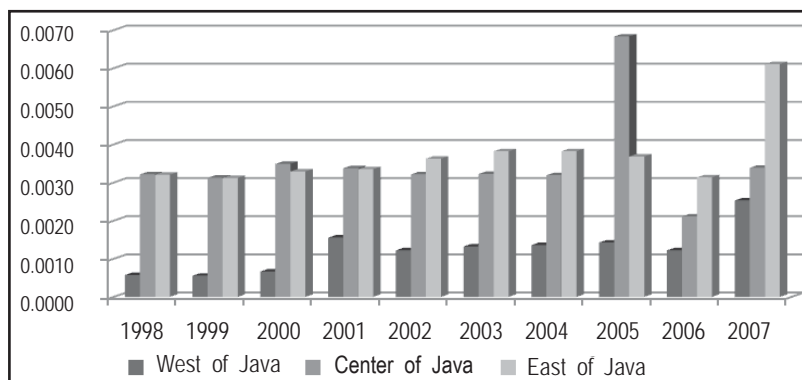| 1998		2002		2003		2007	
Regency	**LQ**	**Regency**	**LQ**	**Regency**	**LQ**	**Regency**	**LQ**
Wonogiri	2.24	Cilacap	1.26	Cilacap	1.78	Jepara	1.64
Kebumen	1.73	Wonsobo	1.20	Wonosobo	1.24	Sragen	1.62
Banyumas	1.42	Pemalang	1.15	Batang	1.19	Kudus	1.51
Kendal	1.35	Demak	1.13	Demak	1.16	Purbalingga	1.44
Pemalang	1.23	Blora	1.12	Klaten	1.12	Blora	1.43
Purworejo	1.18	Boyolali	1.12	Temanggung	1.10	Rembang	1.18
Wonosobo	1.18	Salatiga	1.11	Salatiga	1.07	Semarang	1.13
Surakarta	1.14	Karanganyar	1.11	Magelang	1.07	Tegal	1.12
Boyolali	1.11	Magelang	1.07	Purworejo	1.06	Pati	1.03
Sukoharjo	1.10	Pati	1.06	Kendal	1.03		
Jepara	1.07	Surakarta	1.04	Karanganyar	1.03		
Kudus	1.04	Sukoharjo	1.03	Pati	1.02		
		Batang	1.02	Tegal	1.01		
		Klaten	1.00	Boyolali	1.01		
		Wonogiri	1.00				
		Temanggung	1.00				

Source: Authors' calculations.

development. Different conditions were indicated by LQ in 2002 and 2003. In 2002, only Depok and Banjar had LQ > 1, while Cimahi and Depok were areas that had LQ > 1 for 2003. This meant that the manufacturing industry in that period was no longer a leading industry. Similar condition was indicated by LQ in 2007. In 2007, there were four regencies with LQ > 1, which indicated that manufacturing industry was a base sector only in a few regions in certain periods.

Different conditions are shown by the results of LQ calculations for each area in Central Java. During the period 1998–2007, most of the LQ values for manufacturing in Central Java gave a number more than one. This meant that most areas in Central Java had an industrial base that had the potential to be developed. Those industrial base areas spread over several areas in Central Java.

In East Java, LQ analysis for each region during the observation period showed a tendency to LQ > 1. This meant that most areas in East Java had an industry base or superior area to be developed.

Figure 3. The Herfindahl-Hirschman index of specialization based on employment in Java, 1998–2007

Source: Authors' calculations.

Table 10. Location quotient index for regencies in East of Java

1998		2002		2003		2007	
Regency	LQ	Regency	LQ	Regency	LQ	Regency	LQ
Madiun	1.53	Batu	5.04	Malang	1.16	Pacitan	5.44
Sampang	1.51	Jombang	1.68	Mojokerto	1.13	Nganjuk	1.91
Bangkalan	1.19	Sidoarjo	1.60	Kediri	1.10	Bojonegoro	1.77
Sumenep	1.17	Lumajang	1.56	Pasuruan	1.07	Lamongan	1.56
Situbondo	1.16	Banyuwangi	1.55	Jombang	1.05	Ngawi	1.50
Ponorogo	1.14	Gresik	1.50	Probolinggo	1.05	Bondowoso	1.40
Jember	1.13	Surabaya	1.40	Bangkalan	1.04	Sampang	1.34
Probolinggo	1.10	Jember	1.37	Blitar	1.03	Malang	1.33
Surabaya	1.10	Bojonegoro	1.37	Bondowoso	1.02	Kediri	1.33
Mojokerto	1.08	Tulungagung	1.34	Sumenep	1.02	Blitar	1.31
Pasuruan	1.08	Tuban	1.32	Sidoarjo	1.00	Sumenep	1.18
Kediri	1.06	Ngawi	1.32	Lumajang	1.00	Tuban	1.16
Bondowoso	1.06	Situbondo	1.31			Probolinggo	1.13
Tulungagung	1.04	Magetan	1.26			Pasuruan	1.12
Banyuwangi	1.02	Bangkalan	1.25			Jombang	1.08
Malang	1.02	Ponorogo	1.24			Jember	1.01
		Sampang	1.17				
		Sumenep	1.17				
		Lamongan	1.03				

Source: Authors' calculations.

Herfindahl-Hirschman index

The Herfindahl index, also known as Herfindahl-Hirschman index (HHI), is a measure of the size of a firm relative to an industry, and is an indicator of the amount of competition among the firms in the industry. A regency is considered as totally concentrated or the region is specialized in only one industry if the value of HHI is one, which is the maximum. Meanwhile, if the value of HHI approaches zero, it indicates that regency is totally dispersed (Goschin et al. 2009).

Sectoral specialization

HHI analysis for each region in Java using employment data showed a tendency to increase during the period 1998–2007. This meant that the manufacturing industry in Java tended toward sectoral specialization. West Java's sectoral specialization index showed the lowest value compared to the two other provinces. A significant change in specialization index was demonstrated by East Java. Meanwhile, Central Java's sectoral specialization index in 2005 increased sharply compared to previous years, although it fell sharply in 2006.

Regional concentration

The concentration of HHI based on employment data for each industry in the three provinces are shown in Tables 11, 12, and 13. In general, they show that the value of the concentration index is higher than the value of the specialization index. In West Java, the highest index of concentration of ten sectors from 43 sectors is shown in Table 11. In particular, there was a shift in industry concentration index for the period 1998–2007. Sequentially, the three industries with the highest index in 1998 were 231 (from coal industrial goods), 160 (tobacco processing industry), and 266 (industrial goods from asbestos). Meanwhile, the sequence in 2007 was 266 (from asbestos industrial goods), 222 (printing industry and activities related to printing including photocopy), and 182 (manufacture of wearing apparel/leather goods hairy and dyeing feathers).

In Central Java, most industries had a high concentration index during the observation period. Some industries also had the same concentration index. For example, in 1998, four industries in Central Java had the highest concentration index value: 232 (industrial oil refinery, gas processing, and industrial goods from petroleum refinery products), 223 (reproduction of recorded media, film, and video), 152 (industrial milk and dairy foods), and 266 (industrial goods from asbestos). On the other hand, the industries with the highest concentration index in 2007 were: 281 (metal goods industry ready to put the building, construction tanks, and steam generators), 266 (industrial goods from asbestos), 231 (industrial goods from coal), and 265 (goods industry from stone).

Table 11. Statistical measure of concentration based on employment for West of Java

1998		2002		2003		2007	
Sectors	HHI	Sectors	HHI	Sectors	HHI	Sectors	HHI
231	0.9999	266	0.7099	174	0.9999	266	0.9999
160	0.6801	160	0.6171	266	0.7223	222	0.9999
266	0.6037	243	0.4696	160	0.5451	182	0.9898
182	0.3363	261	0.4476	243	0.4683	232	0.6093
271	0.2503	174	0.4247	261	0.4550	243	0.3218
152	0.1961	273	0.2370	173	0.2344	271	0.3016
273	0.1725	173	0.2338	152	0.2315	262	0.2836
232	0.1471	292	0.2310	292	0.1804	264	0.2662
293	0.1405	271	0.1860	273	0.1753	201	0.2356
291	0.1277	272	0.1592	201	0.1551	261	0.2238

Source: Authors' calculations.

Table 12. Statistical measure of concentration based on employment for Central Java

1998		2002		2003		2007	
Sectors	HHI	Sectors	HHI	Sectors	HHI	Sectors	HHI
232	0.9999	152	0.9999	152	0.9999	281	0.9999
223	0.9999	182	0.9984	273	0.9993	266	0.9999
152	0.9999	293	0.8827	293	0.9143	231	0.9999
266	0.9997	272	0.5660	269	0.8757	265	0.9997
182	0.5885	266	0.5009	272	0.7432	272	0.9995
272	0.5739	269	0.3749	232	0.5402	293	0.9994
222	0.4506	292	0.3510	173	0.4863	291	0.9954
273	0.4210	262	0.3257	261	0.4635	243	0.9887
269	0.3760	261	0.3130	292	0.3296	261	0.8467
262	0.3529	173	0.3023	262	0.3274	271	0.8407

Source: Authors' calculations.

Table 13. Statistical measure of concentration based on employment for East of Java

1998		2002		2003		2007	
Sectors	HHI	Sectors	HHI	Sectors	HHI	Sectors	HHI
223	0.9999	182	0.9999	223	0.9999	231	0.9999
221	0.5055	223	0.9999	243	0.9999	266	0.9999
293	0.4782	243	0.7830	231	0.7082	293	0.9000
266	0.3994	231	0.4490	269	0.3400	243	0.7183
243	0.3567	266	0.3823	292	0.2909	232	0.6093
231	0.2925	222	0.3063	293	0.2716	182	0.5299
273	0.2859	292	0.2878	152	0.2716	269	0.5082
152	0.2301	173	0.2612	266	0.2221	222	0.4957
292	0.2123	272	0.2506	262	0.2186	289	0.4052
232	0.1601	293	0.2291	272	0.1773	262	0.3760

Source: Authors' calculations.

Concentration index in East Java also showed a tendency toward high values during the observation period. Those values were also higher than the index of specialization. Industrial sectors in East Java which had a high concentration index value in 1998 were: 223 (reproduction of recorded media, film, and video), and 221 (publishing industry). In 2007, the index value showed the highest concentration in: 231 (industrial goods from coal), 266 (industrial goods from asbestos), and 293 (the household industry not elsewhere classified).

CONCLUDING REMARKS

This paper investigated the patterns of manufacturing industry in Java especially in three provinces, namely West Java, Central Java, and East Java. Based on the data on employment of manufacturing industries during 1997–2007, the study found that the density of employment with respect to provinces was indicated in Bandung (West Java), Semarang (Central Java), and Surabaya (East Java).

Scattered resources led to disparities in economic growth between regions. Inequality of resources is reflected in the concentration of economic activity, particularly manufacturing industry, which occurred in certain areas (i.e., Bandung, Semarang, and Surabaya). Those three areas showed concentration of economic activity, i.e., the existence of agglomeration economics with benefits resulting from geographical proximity (Bradley and Gans 1998).

Agglomeration produced spatial differences in income levels. The areas which showed many manufacturing industries will be growing faster than other areas that have little manufacturing industry. The reason is that areas where more manufacturing industries are located will have accumulated capital. In other words, the regions with concentration of manufacturing industry are growing faster than areas that do not. In our study, the LQ calculation results show that there are only a few areas that have the industrial base and potential for development. In West Java, areas such as Bogor, Bandung, Depok, Cimahi, Sukabumi are a regional base of manufacturing industry and have the potential to grow. Meanwhile, Cilacap, Wonosobo, Sragen, Jepara, Kudus have the largest LQ in Central Java. For East Java, the highest LQ can be found in Malang, Mojokerto, Kediri, and Pasuruan.

Another major finding of this study is that the values of the concentration and specialization measures are very sensitive to the level of disaggregation of the data. For instance, concentration increases with the number of sectors that are envisaged. We found a low and decreasing degree of economic specialization for all the regions, while the concentration level is slightly increasing for most of the economic sectors, in contradiction with the "traditional" theories which predict similar, if not identical, evolutions of concentration and specialization. Even if concentration and specialization are two different ways to look at the same data, given the unequal size of the regions/sectors, and the fact that the synthetic indicators computed reflect the entire distribution of shares, concentration and specialization may go in opposite directions. The outcomes of the research are in line with the new theories stating that divergent evolutions of specialization and concentration are possible (e.g., the Rossi-Hansberg model), although the robustness of these results still has to be checked on a longer time period and a finer disaggregation of data.

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