

Regional Income Inequality in China and Indonesia A Comparative Analysis

(Draft)

by

Takahiro Akita

International Development Program, International University of Japan

Yamato-machi, Minami Uonuma-gun, Niigata, Japan

E-Mail address: akita@iuj.ac.jp

Tel and fax: 81-257-79-1414

and

Kazumi Kawamura

Economic Research Institute for Northeast Asia

1. Introduction

As pointed out by Metwally and Jensen (1973), the measure of regional income inequality based on regional mean incomes relative to the national mean income fails to explain either the dispersion of individual incomes nationally or the dispersion of incomes within regions. It is quite possible for the measure to decrease over time (i.e., a convergence in regional mean incomes), while the dispersion of actual incomes may be experiencing the opposite trend. Despite this technical problem, however, there have been a number of studies that measure regional income inequality based on regional mean incomes, using such inequality indices as the weighted coefficient of variation (Williamson, 1965), Theil entropy indices (Theil, 1967) and the variance of log-income.¹ This is attributable mainly to the paucity of data on individual incomes within each region versus the availability of data on regional mean incomes.

The objective of this paper is to analyze regional income inequality in China and Indonesia by the two-stage nested Theil decomposition method, which was developed by Akita (2000) as an extension of the ordinary one-stage Theil decomposition method.² The method is analogous to a two-stage nested design in the analysis of variance (ANOVA).³ It considers the three-level hierarchical structure of a country: region-province-district as shown in Figure 1, and decomposes the overall regional inequality, as measured by a Theil index based on district-level mean incomes, into three components: the between-region, between-province, and within-province inequality components. It should be noted that the method relies on per capita GDP to measure regional income inequality; thus it does not solve the intrinsic problem mentioned above. However, it uses a district as the underlying regional unit to measure regional income inequality, rather than a province, the unit used by the majority of previous studies. By using the district as the underlying regional unit, this study can analyze the contribution of within-province inequalities as well as between-province and between-region inequalities to the overall regional income inequality in a coherent framework.

Figure 1

In this paper, we chose China and Indonesia as case studies, since in these two countries, district-level GDP and population data are available, and their within-province inequalities seem to have been more prominent than between-province inequalities.

The paper is organized as follows. The next section presents the two-stage nested Theil decomposition method, while section 3 discusses the data used in the inequality

decomposition analysis. Sections 4 and 5 then apply the two-stage nested Theil decomposition method to district-level GDP and population data in China and Indonesia, respectively, and explores factors determining regional income inequality. Finally, section 6 provides the summary of the findings and some policy implications.

2. Decomposition of Theil Inequality Indices: Two-Stage Nested Theil Decomposition Method

The Theil inequality decomposition method is based on two Theil inequality indices (T and L). Theil indices are additively decomposable and satisfy several desirable properties as a measure of regional income inequality, i.e., mean independence, population-size independence, and the Pigou-Dalton principle of transfers (Bourguignon, 1979; Shorrocks, 1980). An inequality index is said to be additively decomposable if total inequality can be written as the sum of between-group and within-group inequalities. Mean independence implies that the index remains unchanged if every region's income is changed by the same proportion, while population-size independence means that the index remains unchanged if the number of people in each region is changed by the same proportion, i.e., the index depends only on the relative population frequencies at each region, not the absolute population frequencies. Finally, the Pigou-Dalton principle of transfers implies that any income transfer from a richer to a poorer region that does not reverse their relative ranks in income reduces the value of the index.

We consider the following hierarchical structure of a country: region-province-district. By using a district as the underlying regional unit, overall regional income inequality can be measured by the following Theil index (Theil index T).

$$T_d = \sum_i \sum_j \sum_k \left(\frac{y_{ijk}}{Y} \right) \log \left(\frac{y_{ijk}/Y}{n_{ijk}/N} \right), \quad (1)$$

where y_{ijk} is the income of district k in province j in region i,

Y is the total income of all districts $\left(= \sum_i \sum_j \sum_k y_{ijk} \right)$,

n_{ijk} is the population of district k in province j in region i, and

N is the total population of all districts $\left(= \sum_i \sum_j \sum_k n_{ijk} \right)$.

If we define T_{di} as follows to measure between-district income inequality for region i ,

$$T_{di} = \sum_j \sum_k \left(\frac{y_{ijk}}{Y_i} \right) \log \left(\frac{y_{ijk}/Y_i}{n_{ijk}/N_i} \right), \quad (2)$$

then T_d in equation (1) will be decomposed into

$$\begin{aligned} T_d &= \sum_i \left(\frac{Y_i}{Y} \right) T_{di} + \sum_i \left(\frac{Y_i}{Y} \right) \log \left(\frac{Y_i/Y}{N_i/N} \right) \\ &= \sum_i \left(\frac{Y_i}{Y} \right) T_{di} + T_{BR} \end{aligned} \quad (3)$$

where Y_i is the total income of region i $\left(= \sum_j \sum_k y_{ijk} \right)$,

N_i is the total population of region i $\left(= \sum_j \sum_k n_{ijk} \right)$, and

$$T_{BR} = \sum_i \left(\frac{Y_i}{Y} \right) \log \left(\frac{Y_i/Y}{N_i/N} \right) \text{ measures income inequality between regions.}$$

Therefore, the overall regional income inequality T_d is the sum of the within-region component and the between-region component.

Next, if we define T_{ij} as follows to measure within-province income inequality for province j in region i ,

$$T_{ij} = \sum_k \left(\frac{y_{ijk}}{Y_{ij}} \right) \log \left(\frac{y_{ijk}/Y_{ij}}{n_{ijk}/N_{ij}} \right)$$

then T_{di} in equation (2) can be further decomposed into

$$\begin{aligned} T_{di} &= \sum_j \left(\frac{Y_{ij}}{Y_i} \right) T_{ij} + \sum_j \left(\frac{Y_{ij}}{Y_i} \right) \log \left(\frac{Y_{ij}/Y_i}{N_{ij}/N_i} \right) \\ &= \sum_j \left(\frac{Y_{ij}}{Y_i} \right) T_{ij} + T_{pi} \end{aligned} \quad (4)$$

where Y_{ij} is the total income of province j in region i $\left(= \sum_k y_{ijk} \right)$,

N_{ij} is the total population of province j in region i $\left(= \sum_k n_{ijk} \right)$, and

$$T_{pi} = \sum_j \left(\frac{Y_{ij}}{Y_i} \right) \log \left(\frac{Y_{ij}/Y_i}{N_{ij}/N_i} \right) \text{ measures income inequality between provinces in region } i.$$

By substituting T_{di} in equation (4) into equation (3), we obtain

$$\begin{aligned} T_d &= \sum_i \left(\frac{Y_i}{Y} \right) \left[\sum_j \left(\frac{Y_{ij}}{Y_i} \right) T_{ij} + T_{pi} \right] + T_{BR} \\ &= \sum_i \sum_j \left(\frac{Y_{ij}}{Y} \right) T_{ij} + \sum_i \left(\frac{Y_i}{Y} \right) T_{pi} + T_{BR} \\ &= T_{WP} + T_{BP} + T_{BR} \end{aligned} \quad (5)$$

Equation (5) is the two-stage Theil inequality decomposition equation, in which the overall regional income inequality is decomposed into the within-province component (T_{WP}), the between-province component (T_{BP}), and the between-region component (T_{BR}). The within-province component is a weighted average of within-province income inequalities (T_{ij}), while the between-province component is a weighted average of between-province income inequalities (T_{pi}).

In the region-province-district framework, Theil index L is defined as:

$$L_d = \sum_i \sum_j \sum_k \left(\frac{n_{ijk}}{N} \right) \log \left(\frac{n_{ijk}/N}{y_{ijk}/Y} \right) \quad (6)$$

Theil index L in equation (6) can also be decomposed into three components.

$$\begin{aligned} L_d &= \sum_i \sum_j \left(\frac{N_{ij}}{N} \right) L_{ij} + \sum_i \left(\frac{N_i}{N} \right) L_{di} + L_{BR} \\ &= L_{WP} + L_{BP} + L_{BR} \end{aligned}$$

It should be noted that inequality figures based on provincial income and population data are comparable to the sum of the between-province and between-region inequality components in the two-stage nested Theil decomposition analysis.

3. The Data

This section describes the data used in a two-stage nested decomposition analysis in China and Indonesia.

3.1. *China*

For China, we use district-level GDP and population data from the database compiled by a Japanese research institute (Soken) under the editorial supervision of the Chinese Statistical Bureau (Soken, 1999, 2000). This study uses nominal GDP figures, since district-level real GDP data are not available. It should be noted however that over the period of the study (1995-98), the inflation rate was less than 5% per annum. Therefore, the results would not be significantly different even if constant price data were used.

In this study, China is divided into the following three regions, as adopted by the Seventh Five Year Plan (1986-90) for the purpose of regional development planning: the Western, Central, and Eastern (or Coastal) Regions. The Western Region includes the provinces of Sichuan, Chongqing, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, and Xinjiang. The Central Region includes the provinces of Jiangxi, Shanxi, Anhui, Henan, Hunan, Hubei, Inner Mongolia, Jilin, and Heilongjiang. Finally, the Eastern (or Coastal) Region includes the provinces of Liaoning, Fujian, Guangdong, Hainan, Guangxi, Zhejiang, Jiangsu, Shanghai, Shandong, Beijing, Tianjin, and Hebei. For the purpose of geographical convenience in this two-stage nested inequality decomposition analysis, the following separate administrative units have been subsumed into its contiguous province: Shanghai into Jiangsu province; Beijing and Tianjin into Hebei province; Hainan into Guangdong province; and Chongqing into Sichuan province. With these reclassifications, the Western, Central, and Eastern Regions consist of 9, 9, and 8 provinces, respectively, and 105, 115, and 115 districts, respectively.

During the Seventh Five Year Plan and throughout the 1990s, the Eastern Region was targeted for technological advancement, foreign investment, and export-oriented industries.

In contrast, the Central Region was targeted for key energy projects and the production of raw materials, partly processed materials, and foodstuff. The Western Region was targeted for mineral and animal resource processing (Wang, Li, and Linge, 1997). In this tripartite regional classification, the Eastern Region was expected to serve as a growth center, which, through interregional multiplier effects, would generate development linkages to inland provinces. These conditions would, in turn, produce a gradual growth momentum that is appropriate for each province's productivity level and comparative advantages (Wang, Li, and Linge, 1997).

3.2. Indonesia

For Indonesia, we use district-level GDP data from *Gross Regional Domestic Product of Regencies/Municipalities in Indonesia* (BPS, 1997b, 1998a, 2000a), where GDP figures are reported in constant 1993 prices. The district-level GDP statistics provides total GDP figures and GDP figures after excluding the oil and gas sectors, where the oil and gas sectors include oil and gas mining, oil refining, and LNG. However, for Irian Jaya's Fak-Fak, GDP figure after excluding non-oil and gas mining is also reported due perhaps to the sector's dominance in the economy.⁴

It should be noted that regional GDP shows the amount of income generated within a region, rather than the income received by the region's inhabitants. Often, much of the value added generated by a resource-rich region through extracting activities does not trickle-down to the people living there, but goes instead to other regions or abroad. For example, the bulk of income derived from oil and gas in Indonesia accrues to the central government, with only a small portion going to the governments and people of the producing regions. For this reason, like previous studies on regional income disparities in Indonesia, we exclude the oil and gas sectors in the estimation of regional income inequality.⁵

In this study, Indonesia is divided into five regions: Sumatra, Java-Bali, Kalimantan, Sulawesi, and Others. Sumatra includes DI Aceh, North Sumatra, West Sumatra, Riau, Jambi, South Sumatra, Bengkulu, and Lampung. Java-Bali includes DKI Jakarta, West Java, Central Java, DI Yogyakarta, East Java, and Bali. Kalimantan includes West Kalimantan, Central Kalimantan, South Kalimantan, and East Kalimantan. Sulawesi includes North Sulawesi, Central Sulawesi, South Sulawesi, and Southeast Sulawesi. Finally, Others are West Nusatenggara, East Nusatenggara, East Timor, Maluku, and Irian Jaya.

4. Results: China

This section applies the two-stage nested Theil decomposition method to district-level GDP and population data in China.

Table 1 presents the results of the two-stage nested inequality decomposition analysis (see also Figure 2). The overall regional income inequality increased slightly from 0.230 in 1995 to 0.235 in 1997, and then to 0.249 in 1998. The decomposition of the overall inequality into the within-province, between-province, and between-region components reveals that while the within-province inequality component accounted for most of the increase in the overall inequality between 1995 and 1997, the three inequality components contributed equally to the increase from 1997 to 1998.

Table 1

Figure 2

Within-province inequality accounted for the largest component of overall regional income inequality at 62 percent. This was followed by the between-region component at 27 percent and the between-province component at 11 percent. This contrasts sharply with Indonesia, which had almost the same level of per capita GDP as China in 1997 (in terms of purchasing power parity) and is composed of 27 provinces and 303 districts.

(a) Between-Region Inequality

Over the 1995-98 period, the Eastern Region had the largest per capita GDP, followed by the Central Region and the Western Region (Table 2). In 1998, the Central Region's per capita GDP was 54 percent of the Eastern Region's, while the Western Region's per capita GDP was an even smaller 42 percent. This is in sharp contrast to the situation in 1990 when the Central Region and the Western Region's per capita GDP were 61 and 56 percent, respectively, of the Eastern Region's per capita GDP (Akita, Yue, and Kawamura, 1999). Thus, there was a substantial increase in income disparity between the Eastern Region and the

Central and Western Regions over the 1990-95 period. According to Akita, Yue, and Kawamura, regional income inequality between provinces, as measured by a Theil index, increased significantly between 1990 and 1995 (from 0.057 to 0.086), but this increase was mostly attributable to a rise in income disparity between the Eastern Region and the Western and Central Regions.⁶

Table 2

A relatively large between-region inequality in China seems to have been brought about by export-oriented regional development policies based on comparative advantages, all of which were introduced during the open-door policy initiated by Deng Xiaoping in 1978. In the 1980s, the central government designated several special economic zones (SEZs) and economic and technological development zones (ETDZs) in coastal provinces, particularly in the southeast coastal provinces of Guangdong and Fujian. The SEZs and ETDZs were meant to promote economic development through international trade and FDI.⁷ Preferential treatment given to these selected areas and the geographical proximity of many of these areas to Hong Kong and Taiwan have led to massive inflows of export-oriented and highly productive FDI into these areas in the 1980s and the 1990s, thus widening regional income disparities between inland and coastal provinces.

(b) Between-Province Inequalities

Overall between-province inequality has been stable between 1995 and 1997 at approximately 0.024, but there was an increase in 1998 to 0.028 (see Table 1). Each region's between-province inequality exhibited distinct trends from 1995-1998 as seen in Figure 3. The Eastern Region had the highest levels of between-province inequality in every year except 1995 when the Western Region had a slightly higher level of between-province inequality. While the Eastern Region's between-province inequality remained constant from 1995-97 at 0.026, it jumped to 0.033 in 1998. The main factor seems to have been much

faster growth in per capita GDP in the Eastern provinces of Zhejiang and Fujian viz. other provinces in the Eastern Region. In 1998, Zhejiang became the province with the largest per capita GDP in China at 12,584 yuan. Other provinces with high per capita GDP, in descending order, were Jiangsu, Guangdong, and Fujian (see Table 2). Further compounding the high level of between-province inequality in the Eastern Region in 1998 is the large negative growth in per capita GDP in Guangxi, the poorest province of the Eastern Region.

Figure 3

The Central Region recorded increasing levels of between-province inequality during the 1995-98 period; in contrast, the Western Region experienced decreasing levels of between-province inequality. Thus, by 1998, the Central Region had approximately the same level of between-province inequality as the Western Region. In the Central Region, Heilongjiang had the largest per capita GDP, followed by Hubei and Jilin; this order remained the same over the 1995-98 period. These three richer provinces' per capita GDP grew faster than the three poorest provinces (i.e., Jiangxi, Anhui, and Henan) over this period; thus, the Central Region's level of between-province inequality rose from 0.017 to 0.021.

The Western Region had the highest levels of between-province inequality in 1995 at 0.027, but this decreased dramatically to 0.020 in 1998. The main reason seems to have been due to much slower growth in per capita GDP in Xinjiang, the richest province of the Western Region, when compared to the per capita GDP growth rates of other Western provinces. Xinjiang, in fact, recorded negative growth in per capita GDP in 1998.⁸ Despite this, Xinjiang still had the highest per capita GDP in 1998 at 5,894 yuan, followed by Sichuan and Yunnan.

(c) Within-Province Inequalities

Overall within-province inequality increased from 0.144 to 0.156 during the 1995-98 period (see Table 1 and Figure 2). But, the increase was due mostly to the rising levels of within-province inequality in the Eastern Region's provinces of Guangdong, Jiangsu,

Liaoning, Zhejiang, and Fujian. These provinces' combined contribution to overall regional inequality rose from 32 percent in 1995 to 34 percent in 1998. Of the remaining twenty-one provinces, eleven experienced an increase in within-province inequality. However, their contribution to the increase in overall within-province inequality was negligible.

Provinces in the Western Region had relatively high levels of within-province inequality as their Theil T indices were all greater than 0.1 in 1998. In 1998, Yunnan had the largest within-province inequality in the Western Region at 0.329, followed by Xinjiang, and Gansu. In these provinces, there were a small number of key districts that had per capita GDP levels that were approximately 10 times larger than the per capita GDP levels of the poorest district in each province. These key districts include Yuxi and Kunming in Yunnan, Urumqi and Karamay in Xinjiang, and Lanzhou and Jiayuguan in Gansu. It should be noted that Tibet experienced a significant decrease in within-province inequality – this was due to narrowing disparities between Lhasa and the other districts.

In contrast to the Western Region, provinces in the Central Region had relatively low levels of within-province inequality. With the sole exception of Heilongjiang, the levels of within-province inequality were all less than 0.1, and the per capita GDP levels of the richest districts in each province were only four times larger than the poorest districts in 1998. Overall, Heilongjiang had the largest within-province inequality in the Central Region at 0.142 in 1998, followed by Hubei, Jiangxi, and Shanxi. The Central Region has thus far been the most successful in maintaining balanced regional development, not only across provinces but also within provinces.

In the Eastern Region, all but Hebei experienced an increase in within-province inequality over the 1995-98 period. There is much variation in within-province inequality in the Eastern Region. Guangdong registered the largest within-province inequality at 0.416 in 1998, accounting for 18 percent of overall regional inequality. At less than half the level of Guangdong's inequality, Jiangsu had the second highest level of within-province inequality at

0.202, which accounted for 10 percent of overall regional inequality. The next highest provinces were Liaoning, Shandong, and Fujian. Guangdong, in fact, had the highest level of within-province inequality in China.⁹ In contrast, Zhejiang registered 0.059 in 1998, which was one of the lowest levels of inequality in China. At the district level in Guangdong, Shenzhen had the largest per capita GDP at 112,500 yuan in 1998, which was more than 40 times as high as Heyuan, the district with the smallest per capita GDP at 2,500 yuan. In Jiangsu, a similar comparison yielded a much less extreme divergence between the district with the largest per capita GDP and the district with the smallest: Shanghai's per capita GDP at 25,200 was 7.7 times greater than Suqian's per capita GDP at 3,200 yuan. This is roughly comparable to conditions in the provinces of Liaoning and Shandong, which generated ratios of 7.0 and 8.7, respectively, when comparing the district with the highest per capita GDP with the lowest. In Liaoning, Panjin district recorded a per capita GDP of 19,400 yuan versus Chaoyang district's 2,700 yuan. In Shandong, the district of Weihai had a per capita GDP of 21,600 yuan in comparisons to Heze district's 2,500 yuan. Finally, in the province of Zhejiang, the ratio of the district with the highest per capita GDP to the district with the lowest was only 3.9: the district of Hangzhou recorded a per capita GDP of 18,600 yuan versus Lishui's 4,700 yuan. These observations suggest that each province in the Eastern Region had its own distinct pattern of economic development as engendered by the economic reforms in the past two decades.

5. Results: Indonesia

This section applies the two-stage nested Theil decomposition method to district-level GDP and population data in Indonesia. Since Indonesia is one of the hardest hit countries by the Asian economic crisis, the study period (1993-98) is divided into two sub-periods: before the economic crisis (1993-97) and during the economic crisis (1997-98).

5.1. Before the Economic Crisis

Table 3 presents the result of the two-stage nested inequality decomposition analysis (see also Figure 4). Before the economic crisis, the overall regional income inequality increased significantly from 0.262 in 1993 to 0.287 in 1997. Decomposition of overall inequality into the within-province, between-province, and between-region components reveals that the increase was due mostly to the rise in the within-province inequality component; its contribution to the overall inequality thus rose from 45.5% to 49.7%. The between-region component also contributed to the increase but only slightly. On the other hand, the between-province component was very stable; thus, its contribution fell from 47.7% to 43.1%.

Table 3

Figure 4

(a) Between-Region Inequality

Among the 5 regions (i.e., Sumatra, Java-Bali, Kalimantan, Sulawesi, and Others) Kalimantan had the highest per capita GDP over the 1993-97 period; this was followed by Java-Bali, Sumatra, Sulawesi, and Others (Table 4). The modest increase in the between-region inequality component in the pre-crisis period seems to have been due to an increasing disparity between Sumatra/Java-Bali/Kalimantan and Sulawesi/Others.

Table 4

(b) Between-Province Inequalities

Though the between-province inequality component remained relatively constant over the 1993-97 period, each region recorded a distinct movement in between-province inequality (Figure 5).¹⁰ Due largely to the existence of Jakarta, Java-Bali's between-province inequality was the highest. However, it exhibited a slight decreasing trend. The main factor behind the

slight decrease seems to have been West Java's much faster per capita GDP growth rate compared to the other Java-Bali provinces. Accordingly, whereas West Java's per capita GDP was the second lowest among Java-Bali provinces in 1993, by 1997 it had become the third largest after Jakarta and Bali.¹¹

Figure 5

According to the data on provincial GDP from *Gross Regional Domestic Product of Provinces in Indonesia by Industrial Origin* (BPS, 1996, 1998b, 2000b), West Java's non-oil and gas manufacturing grew very rapidly over the period; its annual average real GDP growth rate in non-oil and gas manufacturing was 12.5%, which is much larger than the country's growth rate of 10.4% in non-oil and gas manufacturing. In West Java, non-oil and gas manufacturing accounted for 37.5% of total GDP after excluding the oil and gas sectors in 1997; the comparable figure in Indonesia as a whole is 24.5%.

East Java had a similar growth pattern to West Java. Again, the non-oil and gas manufacturing sector was the engine of growth for the provincial economy as it recorded an annual average growth rate of 12% during 1993-97 and accounted for 30.2% of total GDP in 1997. Unlike West and East Java, Jakarta's GDP growth during 1993-97 was led by the construction sector, which experienced an annual average growth rate of 12.6% and accounted for 15.4% of the province's GDP in 1997. According to the data on provincial GDP from *Gross Regional Domestic Product of Provinces in Indonesia by Expenditure* (BPS, 1997a, 1999), Jakarta's gross fixed capital formation grew rapidly at an average annual rate of 9.1% during 1993-97, contributing to the construction sector's high growth rate.

Contrary to the Java-Bali region, the regions of Sumatra, Kalimantan, and Sulawesi recorded rising levels of between-province inequality over the 1993-97 period (Table 3 and Figure 5). Kalimantan had the second highest between-province inequality next to Java-Bali and experienced a very slight increase. In Kalimantan, there are very large differences in per capita GDP between the richest province (East Kalimantan) and the other three provinces, and

these differences seem to have increased in relative terms. In 1997, the ratio of the per capita GDP of the richest province to the poorest province was 2.4 in Kalimantan. In contrast, Sumatra's GDP is more evenly distributed among its provinces and population than in Kalimantan, but Sumatra's between-province inequality increased over the 1993-97 period. In Sumatra, the disparities between the richest province (North Sumatra) and the other seven provinces seem to have been increasing. While Sulawesi's GDP is more evenly distributed among its provinces and population than in Sumatra, it experienced a similar growth pattern to Sumatra and Kalimantan, in which the per capita GDP of the richest province (i.e., North Sulawesi) grew faster than in the other provinces. Thus, its between-province inequality rose over the 1993-97 period.

(c) Within-Province Inequalities

The within-province inequality component increased significantly from 0.119 to 0.143 over the 1993-97 period (Table 3 and Figure 4).¹² As a result, its contribution to overall regional inequality increased from 45.5% to 49.7%. However, the increase was due mostly to the increases in the within-province inequalities of 4 provinces in particular: Riau, Jakarta, West Java, and East Java. Whereas their combined contribution to overall regional inequality was 31.8% in 1993, it had risen to 36.5% by 1997. Of the twenty-three other provinces, fifteen provinces experienced an increase in within-province inequality. However, their contributions to the increase in the within-province inequality component were all negligible.

Of the eight provinces in Sumatra, six provinces recorded an increase in within-province inequality over the 1993-97 period. However, only Riau experienced a significant increase, as its contribution to the overall regional inequality rose from 1.8% to 2.3%. In 1997, Riau had the highest level of within-province inequality in Sumatra, which was followed by West Sumatra and Lampung. The main reason why Riau had a very high level of inequality is due to Batam Island, which is located just 20km southeast of Singapore and has received

preferential treatment from the central government as an export-oriented industrial zone. Batam Island's per capita GDP of Rp12.8 million was much larger than other districts' per capita GDP after excluding the oil and gas sectors. Riau's increasing within-province inequality is attributable mainly to the rising disparity between Batam Island and other districts.

Among Java-Bali provinces, all but Bali experienced an increase in within-province inequality; in particular, Jakarta, West Java, and East Java recorded significant increases. In 1997, East Java had the highest level of within-province inequality, accounting for 20.9 percent of overall regional inequality. East Java's very high level of inequality is due to the existence of a few very rich districts: urban Kediri, urban Surabaya, and Gresik. With its limited population, urban Kediri's per capita GDP was the highest in the entire country at Rp22.3 million, which was significantly larger than Central Jakarta's per capita GDP at Rp16.8 million. While much lower than Kediri's, Surabaya and Gresik had per capita GDP of Rp5.7 and 3.8 million, respectively, both of which are significantly higher than most other districts in East Java.

Within Java-Bali, Central Java had the second highest level of within-province inequality in 1997. This is driven mainly by the districts of Kudus and urban Semarang, both of which had relatively high levels of per capita GDP (Rp5.0 and 4.2 million, respectively). West Java had the third highest level of inequality in 1997, which is much smaller than the levels recorded by Central Java and East Java. This is due to the fact that, unlike Central Java and East Java, which include the primary cities of Semarang and Surabaya, respectively, West Java does not include any dominant city and is relatively uniformly developed. In West Java, urban Tangerang had the highest level of per capita GDP (Rp5.3 million), which was followed by Bekasi (Rp3.4 million), Serang (Rp3.4 million), urban Cirebon (Rp3.3 million), and urban Bandung (Rp2.7 million). In other districts, per capita GDP ranged from Rp1.0 to 2.5 million.

Among Kalimantan provinces, West Kalimantan registered the highest level of within-

province inequality in 1997. This is driven in part by urban Pontianak, which had the highest level of per capita GDP (Rp4.2 million). In other districts, per capita GDP ranged from Rp1.0 to 2.4 million. It is interesting to observe that while East Kalimantan had a very large per capita GDP (Rp4.6 million after excluding the oil and gas sectors), its level of within-province inequality is one of the lowest in Indonesia (after excluding the oil and gas sectors).

Among Sulawesi provinces, three provinces experienced a slight increase in within-province inequality. The province of South Sulawesi had the highest level of within-province inequality in 1997 due in large part to Ujung Pandang's per capita GDP of Rp2.5 million. Sulawesi, however, had a very even distribution of income not only across provinces but also within provinces. Finally, within Others, Irian Jaya had the highest level of within-province inequality in 1997.

5.2. During the Economic Crisis

In this section, we analyze the initial impact of the economic crisis on regional income inequality based on 1998 district-level and provincial GDP data, by assuming that most of the change we observed in 1998 reflects the initial impact of the economic crisis.

The Indonesian economy contracted by a substantial amount in 1998 due to the economic crisis. According to the district-level GDP data at 1993 constant prices, the national average per capita GDP after excluding the oil and gas sectors fell by 11.9% in 1998 (Table 4); thus, per capita GDP in 1998 had retreated to the 1995 level.¹³ However, the impact was very uneven across regions and provinces: while most provinces in Java recorded a reduction in per capita GDP of more than 10%, the effects were much less severe in the Outer Islands.

Overall regional income inequality, as measured by the Theil index T based upon district-level GDP and population data, declined from 0.287 in 1997 to 0.266 in 1998, which is essentially the same level as in 1993-94 (Table 3 and Figure 4). The two-stage inequality decomposition analysis reveals that about three quarters of the decline was due to the decrease

in the between-province inequality component; its contribution to the overall regional inequality decreased to 40.6% (from 43.1% in 1997).¹⁴ Consequently, the contribution of the within-province inequality component to overall regional inequality rose sharply to 52.8% in 1998 (from 49.7%), although the inequality component itself recorded a slight decrease. Finally, the between-region inequality component decreased also, but only slightly.

(a) Between-Region Inequality

The economic crisis reduced Java-Bali's per capita GDP by 14.8% in 1998, bringing it to the same level as in 1994-95 (Table 4). Sumatra also experienced a large decrease in per capita GDP, but the decrease was not as significant as it was in Java-Bali; Sumatra's per capita GDP in 1998 had fallen to the same level as in 1995-96. On the other hand, the economic crisis does not seem to have affected Kalimantan and Sulawesi very much. As a result, the between-region inequality fell to 0.018 in 1998.

(b) Between-Province Inequalities

Java-Bali's between-province inequality played a major role in the reduction of the between-province inequality component. This is translated into a fall in its contribution to the overall regional inequality from 38.6% to 35.1% (Table 3 and Figure 5). Upon examining the trend in Java-Bali's between-province inequality since 1993, the decrease in 1998 is a continuation of the declining trend that existed before 1997, though the decrease between 1997 and 1998 is much larger than before and is due to different factors than those of the pre-crisis period, as explained below.

The economic crisis affected Jakarta in a significant way. In terms of GDP, Jakarta's economy contracted by 19% in 1998, or a reduction of almost 20% in per capita GDP. The resulting level is equivalent to the level that was recorded in 1993 (Table 4). The economies of West Java and East Java also contracted substantially, though the rates of decrease were not as large as in Jakarta.¹⁵ The primary reason why Java-Bali recorded a significant decrease in

between-province inequality between 1997 and 1998 appears to have been Jakarta's large decrease in per capita GDP relative to other Java-Bali provinces. This contrasts with the 1993-97 period, which experienced a slight decreasing trend in Java-Bali's between province inequality due to West Java's much faster per capita GDP growth rate compared to the other Java-Bali provinces.

To analyze regional differences in the growth rate of GDP between 1997 and 1998, a shift and share analysis was performed by using provincial GDP data.¹⁶ The sector classification used in this analysis is: agriculture, non-oil and gas mining, non-oil and gas manufacturing, gas and water, construction, trade, transportation/communication, finance, and services. The results are presented in Table 5. The provinces of Jakarta, West Java, and East Java contracted at much faster rates than the nation as a whole; thus their GDP decrease exceeded the calculated decrease if these provinces had contracted at the same rate as the national rate (i.e., total growth minus regional share was negative for these provinces in Table 5). However, there are differences in the pattern of contraction between Jakarta and the provinces of West Java and East Java: while the industry-mix shift component played an important role in the contraction of Jakarta, the competitive-shift component played a dominant role in the contraction of West Java and East Java.

Table 5

In Jakarta, the non-oil and gas manufacturing, finance, and construction sectors contributed significantly to a large negative industry-mix shift, signifying its unfavorable industrial structure, as the combined share of these three worst crisis-hit industries was about 60% in Jakarta. The declines in these 3 sectors in the country as a whole were 18.2%, 17.3%, and 33.3%, respectively, which were much larger than the negative growth rate of the total national economy. It should be noted that in Jakarta these three sectors contracted by 18.0%, 9.6%, and 38.3% respectively.

In West Java, the non-oil and gas manufacturing, finance, and construction sectors

contributed to a large negative competitive shift, as their growth rates were -21.4%, -40.3%, and -46.2%, respectively. On the other hand, in East Java, the non-oil and gas manufacturing and trade sectors contributed significantly to its large negative competitive shift, as their growth rates were -24.3% and -17.8%, respectively. It should be noted that in West Java and East Java, the industry-mix shift component was also negative due to a very large negative growth in the non-oil and gas manufacturing and construction sectors whose combined GDP shares in West Java and East Java were 44% and 36%, respectively. Nonetheless, the industry-mix shift component was much less significant than the competitive shift component because of the prominence of the agricultural sector in these provinces.¹⁷

In contrast to Java-Bali, Kalimantan and Sulawesi both recorded an increase in between-province inequality in 1998 (Table 3 and Figure 5). The reason seems to have been that the richest province in each region – East Kalimantan for Kalimantan and North Sulawesi for Sulawesi – performed better than the other provinces in each region, though all the provinces experienced negative growth in per capita GDP (Table 4). According to the shift and share analysis, East Kalimantan and North Sulawesi had a positive total shift (= total regional growth - regional share of the national growth), and more than three-quarters of the total shift was accounted for by the competitive shift component (Table 5). East Kalimantan and North Sulawesi seem to have had a competitive advantage in non-oil and gas manufacturing and trade. In North Sulawesi, these two sectors achieved large positive growth, whereas in East Kalimantan, they neither grew nor contracted.

Sumatra's between-province inequality was stable during 1997-98. Among Sumatra's provinces, Riau performed relatively well. In 1998, Riau became the richest province in Sumatra in terms of per capita GDP (Table 4). Like East Kalimantan and North Sulawesi, Riau appears to have had a strong competitive advantage in non-oil and gas manufacturing and trade; its competitive shift component explained most of its total shift (Table 5).

(c) Within-Province Inequalities

In Java-Bali, all but Jakarta experienced a fall in within-province inequality (Table 3). Jakarta's within-province inequality rose in 1998, but this is a continuation of the trend that existed in the pre-crisis period. The reason why Jakarta experienced increasing within-province inequality over the 1993-98 period seems to have been a rising disparity between Central Jakarta, the second richest district in Indonesia next to urban Kediri, and the other Jakarta districts. In 1998, Central Jakarta experienced an 8% decrease in per capita GDP, while the other Jakarta districts recorded a 20%+ decrease. This implies, together with the fact that the districts in West Java adjacent to Jakarta (i.e., Tangerang, Bekasi and Bogor) recorded a 20%+ decrease in per capita GDP, that the economic crisis had unprecedented adverse effects on the greater Jakarta metropolitan region (Jabotabek). The severe economic downturn in Jabotabek would have had enormous direct and indirect effects not only on the other districts of Java-Bali but also on the Outer Islands, for Jabotabek generated about a quarter of total Indonesian GDP, after excluding the oil and gas sectors and there exist numerous inter-industry linkages between Jabotabek and other regions, especially provinces in Java.

East Java had a slight decrease in within-province inequality, but it still had the highest level of inequality in all the provinces of Indonesia. Like Jabotabek, the crisis seems to have affected East Java's major urban area very adversely; the relatively rich districts of Surabaya, Sidoarjo, and Gresik experienced significant negative per capita GDP growth rates of -17%, -18%, and -13%, respectively. On the other hand, the richest district in Indonesia, Kediri, recorded only a minor reduction in its per capita GDP (-3%). Central Java's level of within-province inequality decreased significantly; the 1998 level of inequality had almost retreated to the 1993 level. Again, the crisis hit Central Java's major urban areas the most: Semarang, Kendal, Demak, and Kudus recorded significant decreases in per capita GDP (-19%, -13%, -12%, and -13%, respectively). These observations, together with Jabotabek's very severe economic conditions in 1998, confirm that Indonesia's economic crisis was a crisis afflicting

urban Java (Booth, 2000). However, the crisis also hit most of the other parts of the Java-Bali region, though to a lesser extent.

In Sumatra, all except West Sumatra and Riau experienced a fall in within-province inequality in 1998. In particular, Lampung recorded a significant decrease in its within-province inequality; this is due mainly to a substantial reduction in the per capita GDP of Bandar Lampung, the richest district in the province. Among Sumatra districts, Banda Aceh, Tebin Tinggi, Medan, Binjai, Sawah Lunto, Palembang, and Bandar Lampung registered relatively large decreases in per capita GDP (around -15%). But, Batam, the richest district in Sumatra, was not significantly affected by the crisis (4% decrease in per capita GDP). Like Java-Bali, the economic crisis seems to have hit major urban areas in Sumatra.

In Kalimantan, South Kalimantan recorded a significant increase in its level of within-province inequality. This is due to the fact that Kota Baru, the richest district in South Kalimantan, experienced positive growth in its per capita GDP (3%), while the second and third richest districts (Barito Kuala and Banjarmasin) recorded substantial decreases in their per capita GDP (-9% and -14%, respectively). It should be noted that among Kotamadyas in Kalimantan (i.e., Pontianak, Palangka Raya, Banjarmasin, Balikpapan, and Samarinda), only Banjarmasin had a large decrease in per capita GDP, signifying that the crisis did not have much adverse effects on urban Kalimantan.

In Sulawesi, all except South Sulawesi experienced a slight increase in within-province inequality in 1998. The main reason why South Sulawesi experienced a fall in within-province inequality is that Ujung Pandang, the richest district in South Sulawesi, experienced a significant decrease in its per capita GDP (-9%). In North Sulawesi, four out of seven districts (i.e., Minahasa, Sangile Talaud, Gorontalo, and Bitung) recorded increases in their per capita GDP, though the growth rates were much lower than the pre-crisis period (1% to 3% vs. 6% to 12%). The crisis affected other Sulawesi districts adversely, but the effects seem to have been uniform across districts.

6. Concluding Remarks

The paper presented an inequality decomposition method, the two-stage nested Theil inequality decomposition method, as an extension of the ordinary one-stage Theil inequality decomposition method. The method uses a district as the underlying regional unit, rather than a province, to measure regional inequality in per capita GDP; thus, it can analyze within-province inequalities as well as between-region and between-province inequalities in a coherent framework. Though the method cannot solve the intrinsic problem that the measure of regional inequality based on per capita GDP fails to explain the dispersion of incomes within the underlying regional unit, it provides a much clearer picture of regional inequalities at a more granular level within a country, especially in such large, developing countries as China and Indonesia.

Given unequal distribution of natural resources and transportation facilities, some regional income disparities are inevitable from the perspective of efficiency. China and Indonesia are still at a relatively early stage of economic development, and thus income-enhancing economic activities tend to have concentrated in a few districts in each province in order to take advantage of agglomeration economies. In fact, the results of this study show that very high levels of regional income inequality still exist among the districts of China and Indonesia.

Applying the two-stage nested decomposition method to district-level GDP and population data reveals that in China, the within-province component accounted for 64 percent of the overall regional inequality, while in Indonesia, it accounted for about a half of the overall regional inequality. Thus, within-province inequalities are much more prominent than between-region and between-province inequalities, at least in these two countries. These observations suggest that policy makers should look not only at between-region or between-province inequalities but also within-province inequalities to formulate better regional policies.

References

- Akita, T. (2000), 'Decomposing Regional Income Inequality using a Two-Stage Nested Theil Decomposition Method,' International Development Working Paper Series 2, IUJ Research Institute, International University of Japan.
- Akita, T., and R.A. Lukman (1995), 'Interregional Inequalities in Indonesia: A Sectoral

- Decomposition Analysis for 1975-92', *Bulletin of Indonesian Economic Studies* 31(2): 61-81.
- Akita, T., N. Yue, and K. Kawamura (1999) 'Inter-provincial income inequality in China, 1985-1997: an inequality decomposition analysis', *Journal of Econometric Studies of Northeast Asia* 1(2): 55-71.
- Anand, S. (1983), *Inequality and Poverty in Malaysia: Measurement and Decomposition*, A World Bank Research Publication, Oxford University Press, New York.
- Armstrong, H.W., and J. Taylor (1985), *Regional Economics and Policy*, Blackwell Publishers.
- Booth, A. (2000), 'The Impact of the Indonesian Crisis on Welfare: What Do We Know Two Years On', in C. Manning and P. van Diermen (eds), *Indonesia in Transition: Social Aspects of Reformasi and Crisis*, Institute of Southeast Asian Studies, Singapore, pp.145-162.
- Bourguignon, F. (1979), 'Decomposable Income Inequality Measures', *Econometrica* 47(4): 901-920.
- BPS (1996), *Gross Regional Domestic Product of Provinces in Indonesia by Industrial Origin, 1993-1995*, Jakarta.
- BPS (1997a), *Gross Regional Domestic Product of Provinces in Indonesia by Expenditure, 1993-1996*, Jakarta.
- BPS (1997b), *Gross Regional Domestic Product of Regencies/Municipalities in Indonesia, 1993-1995*, Jakarta.
- BPS (1998a), *Gross Regional Domestic Product of Regencies/Municipalities in Indonesia, 1994-1997*, Jakarta.
- BPS (1998b), *Gross Regional Domestic Product of Provinces in Indonesia by Industrial Origin, 1994-1997*, Jakarta.
- BPS (1999), *Gross Regional Domestic Product of Provinces in Indonesia by Expenditure, 1995-1998*, Jakarta.
- BPS (2000a), *Gross Regional Domestic Product of Regencies/Municipalities in Indonesia, 1995-1998*, Jakarta.
- BPS (2000b), *Gross Regional Domestic Product of Provinces in Indonesia by Industrial Origin, 1996-1999*, Jakarta.
- Chen, Jian, B.M. Fleisher (1996), 'Regional income inequality and economic growth in China', *Journal of Comparative Economics* 22:141-164
- Daniere, A. (1996), 'Growth, inequality and poverty in south-east Asia: the case of Thailand', *Third World Planning Review* 18(4):373-395

- Das, S.K., A. Barua (1996), 'Regional inequalities, economic growth and liberalisation: a study of the Indian economy', *Journal of Development Studies* 32(3):364-390
- Esmara, H. (1975), 'Regional Income Disparities', *Bulletin of Indonesian Economic Studies* 11(1): 41-57.
- Garcia, J.G., and L. Soelistianingsih (1998), 'Why Do Differences in Provincial Income Persist in Indonesia?', *Bulletin of Indonesian Economic Studies* 34(1): 95-120.
- Gilbert, A.G., Goodman DE (1976), 'Regional income disparities and economic development: a critique', In Gilbert AG (ed) *Development planning and spatial structure*, John Wiley & Sons, New York
- Green, A.G. (1969), 'Regional inequality, structural change, and economic growth in Canada: 1890-1957', *Economic Development and Cultural Change* 17(4):567-583
- Jensen, R.C. (1969), 'Regional income inequalities and employment shifts in New Zealand', *New Zealand Economic Papers* 3(2):27-50
- Mathur, A. (1983), 'Regional development and income disparities in India: a sectoral analysis', *Economic Development and Cultural Change* 31(3):475-505
- Metwally, M.M., and R.C. Jensen (1973), 'A note on the measurement of regional income dispersion', *Economic Development and Cultural Change* 22(1):135-136
- Montgomery, D.C. (1984), *Design and analysis of experiments*, John Wiley & Sons, New York
- Mutlu, S. (1991), 'Regional disparities, industry and government policy in Japan', *Development and Change* 22(3): 547-586
- Shorrocks, A.F. (1980), 'The Class of Additively Decomposable Inequality Measures', *Econometrica* 48(3): 613-625.
- Soken (1999, 2000), *Chinese province and district-level database*, Kanki Publisher, Tokyo
- State Statistical Bureau (1999), *China statistical yearbook*, China Statistical Publishing House, Beijing
- Tabuchi, T. (1988), 'Interregional income differentials and migration: their interrelationships', *Regional Studies* 22(1): 1-10
- Theil, H. (1967), *Economics and information theory*, North-Holland, Amsterdam
- Tsui, K.Y. (1991), 'China's regional inequality, 1952-1985', *Journal of Comparative Economics* 15: 1-21
- Tsui, K.Y. (1993), 'Decomposition of China's Regional Inequalities', *Journal of Comparative Economics* 17(3): 600-627.
- Tsui, K.Y. (1996), 'Economic reform and interprovincial inequalities in China', *Journal of Development Economics* 50:353-368
- Uppal, J.S., and Budiono Sri Handoko (1986), 'Regional Income Disparities in Indonesia', *Ekonomi dan Keuangan Indonesia* 34(3): 286-304.
- Wang, Huijiong, Shantong Li, and Godfrey Linge (1997), 'Regional Planning: Developing an Indigenous Framework', In Godfrey Linge, Ed., *China's New Spatial Economy: Heading Toward 2020*, pp.22-45. New York: Oxford University Press.

- Wei, Y, L.J.C. Ma (1996), 'Changing patterns of spatial inequality in China, 1952-1990', *Third World Planning Review* 18(2): 177-191
- Williamson, J.G. (1965), 'Regional Inequality and the Process of National Development: A Description of the Patterns', *Economic Development and Cultural Change* 13(4): 3-45.
- Zheng, X.P. (1997), 'China's regional inequality and related long-term policies', *Review of Urban and Regional Development Studies* 9:114-128

Table 1. Two-Stage Nested Inequality Decomposition Analysis for China, 1995-1998

Region	Province	1995		1996		1997		1998	
		Theil T	Contrib	Theil T	Contrib	Theil T	Contrib	Theil T	Contrib
Western Region (105)		0.027	1.6	0.023	1.4	0.025	1.5	0.020	1.1
	1 Sichuan (20)	0.110	2.9	0.111	3.0	0.110	2.8	0.117	2.8
	2 Guizhou (9)	0.143	0.7	0.124	0.6	0.133	0.6	0.136	0.6
	3 Yunnan (17)	0.312	2.8	0.347	3.3	0.326	3.0	0.329	2.8
	4 Tibet (7)	0.246	0.1	0.153	0.1	0.173	0.1	0.130	0.1
	5 Shaanxi (10)	0.090	0.7	0.089	0.7	0.113	0.8	0.117	0.8
	6 Gansu (14)	0.265	1.1	0.268	1.2	0.273	1.2	0.255	1.0
	7 Qinghai (8)	0.185	0.2	0.152	0.2	0.139	0.1	0.145	0.1
	8 Ningxia (4)	0.240	0.3	0.227	0.3	0.253	0.3	0.246	0.3
	9 Xinjiang (16)	0.301	1.9	0.299	1.7	0.308	1.8	0.304	1.5
Central Region (115)		0.017	2.0	0.017	2.1	0.019	2.2	0.021	2.3
	1 Jianxi (11)	0.072	0.6	0.080	0.7	0.087	0.8	0.092	0.7
	2 Shanxi (11)	0.104	0.9	0.106	0.9	0.100	0.8	0.091	0.7
	3 Anhui (16)	0.052	0.8	0.047	0.7	0.048	0.7	0.067	0.9
	4 Henan (17)	0.074	1.7	0.076	1.8	0.073	1.6	0.073	1.5
	5 Hunan (14)	0.044	0.7	0.051	0.9	0.056	0.9	0.058	0.9
	6 Hubei (12)	0.098	1.8	0.090	1.8	0.093	1.8	0.095	1.7
	7 Inner Mongolia (12)	0.104	0.6	0.100	0.6	0.100	0.6	0.089	0.5
	8 Jilin (9)	0.028	0.2	0.034	0.3	0.039	0.3	0.046	0.4
	9 Heilongjiang (13)	0.159	2.3	0.135	1.9	0.144	2.1	0.142	1.9
Eastern Region (115)		0.026	6.7	0.026	6.6	0.026	6.4	0.033	7.8
	1 Liaoning (14)	0.114	2.6	0.122	2.6	0.136	2.7	0.144	2.7
	2 Fujian (9)	0.090	1.5	0.090	1.5	0.105	1.7	0.109	1.8
	3 Guangdong (22)	0.370	16.0	0.371	17.2	0.398	18.0	0.416	17.9
	4 Guangxi (15)	0.084	1.0	0.073	0.9	0.077	0.9	0.094	0.9
	5 Zhejiang (11)	0.047	1.2	0.053	1.4	0.057	1.5	0.059	1.6
	6 Jiangsu (14)	0.186	10.6	0.187	10.4	0.195	10.5	0.202	10.2
	7 Shandong (17)	0.133	5.0	0.126	4.8	0.131	4.7	0.136	4.7
	8 Hebei (13)	0.109	4.3	0.095	3.8	0.092	3.7	0.094	3.5
Within Province		0.144	62.5	0.144	63.0	0.150	63.8	0.156	62.3
Between Province		0.024	10.3	0.023	10.1	0.024	10.1	0.028	11.2
Between Region		0.063	27.2	0.061	26.8	0.061	26.1	0.066	26.5
Total		0.230	100.0	0.228	100.0	0.235	100.0	0.249	100.0

(Notes) (a) 'Contrib' is the % contribution to total regional inequality (T_d in equation (5)). Contribution figure for a region is the % contribution of the region's between-province inequality ($(Y_i/Y)T_{pi}$ in equation (5)), while contribution figure for a province is the % contribution of the province's within-province inequality ($(Y_{ij}/Y)T_{ij}$ in equation (5)).

(b) Numbers in parentheses indicate the number of districts

(Source) Soken with Chinese Statistical Bureau (1999, 2000)

**Table 2. Per Capita GDP, China
1995-1998**

in yuan

Region	Province	1995	1996	1997	1998
Western Region		2,936.9	3,497.6	3,891.2	4,132.6
	1 Sichuan	3,118.8	3,687.7	4,119.2	4,480.9
	2 Guizhou	1,797.1	2,100.0	2,324.7	2,533.5
	3 Yunnan	3,026.4	3,814.6	4,222.3	4,406.4
	4 Tibet	2,333.9	2,695.0	3,158.3	3,322.8
	5 Shaanxi	2,887.8	3,499.5	3,916.3	4,171.3
	6 Gansu	2,270.3	2,894.9	3,132.9	3,276.0
	7 Qinghai	2,839.5	3,128.1	3,394.8	3,757.5
	8 Ningxia	3,320.6	3,716.3	3,979.6	4,287.0
	9 Xinjiang	4,966.4	5,472.0	6,193.5	5,894.9
Central Region		3,700.8	4,498.6	5,031.8	5,360.9
	1 Jiangxi	2,847.3	3,448.5	3,900.3	3,910.3
	2 Shanxi	3,649.2	4,388.1	4,731.0	5,057.7
	3 Anhui	3,328.7	3,864.0	4,370.3	4,609.1
	4 Henan	3,297.6	4,103.9	4,479.3	4,734.5
	5 Hunan	3,390.3	4,110.3	4,626.5	5,000.1
	6 Hubei	4,728.3	5,907.5	6,762.8	7,266.9
	7 Inner Mongolia	3,399.0	4,136.0	4,622.2	5,063.7
	8 Jilin	4,310.8	5,304.3	5,693.9	6,376.3
	9 Heilongjiang	5,147.6	6,077.6	6,991.5	7,420.2
Eastern Region		6,817.5	8,135.1	9,092.1	9,943.5
	1 Liaoning	7,259.5	8,082.6	8,827.7	9,659.2
	2 Fujian	6,664.8	8,119.7	9,268.5	10,895.1
	3 Guangdong	7,566.7	9,516.1	10,674.0	11,610.1
	4 Guangxi	3,533.7	4,242.5	4,667.9	4,204.6
	5 Zhejiang	8,139.2	9,422.6	10,488.3	12,583.8
	6 Jiangsu	8,933.2	10,544.3	11,691.0	12,431.0
	7 Shandong	5,731.2	6,821.2	7,569.8	8,353.7
	8 Hebei	6,087.2	7,343.3	8,393.9	9,103.2
Total		4,817.5	5,772.4	6,448.3	6,974.3

(Source) Soken with Chinese Statistical Bureau (1999, 2000)

Table 3. Two-Stage Nested Inequality Decomposition Analysis for Indonesia, 1993-1998 (excluding the Oil and Gas Sector)

Region	Province	1993		1994		1995		1996		1997		1998	
		Theil T	Contrib	Theil T	Contrib	Theil T	Contrib	Theil T	Contrib	Theil T	Contrib	Theil T	Contrib
Sumatra (73)		0.024	1.7%	0.025	1.7%	0.028	1.9%	0.028	1.8%	0.031	2.0%	0.032	2.3%
	1 DI Aceh (10)	0.019	0.1%	0.019	0.1%	0.019	0.1%	0.019	0.1%	0.020	0.1%	0.018	0.1%
	2 North Sumatra (17)	0.043	1.0%	0.042	1.0%	0.038	0.9%	0.037	0.8%	0.038	0.8%	0.034	0.8%
	3 West Sumatra (14)	0.082	0.7%	0.084	0.7%	0.090	0.7%	0.087	0.6%	0.088	0.6%	0.111	0.9%
	4 Riau (7)	0.225	1.8%	0.240	1.9%	0.257	2.0%	0.274	2.1%	0.299	2.3%	0.303	2.8%
	5 Jambi (6)	0.033	0.1%	0.033	0.1%	0.036	0.1%	0.037	0.1%	0.037	0.1%	0.036	0.1%
	6 South Sumatra (10)	0.032	0.4%	0.033	0.4%	0.034	0.4%	0.034	0.4%	0.036	0.4%	0.031	0.4%
	7 Bengkulu (4)	0.016	0.0%	0.016	0.0%	0.015	0.0%	0.014	0.0%	0.019	0.0%	0.016	0.0%
	8 Lampung (5)	0.066	0.5%	0.065	0.5%	0.074	0.5%	0.060	0.4%	0.065	0.4%	0.048	0.3%
Java-Bali (116)		0.172	43.4%	0.171	42.4%	0.170	41.0%	0.169	39.9%	0.167	38.6%	0.146	35.1%
	1 DKI Jakarta (5)	0.074	5.0%	0.079	5.2%	0.084	5.4%	0.089	5.6%	0.090	5.5%	0.118	7.1%
	2 West Java (25)	0.083	5.7%	0.088	6.0%	0.098	6.5%	0.101	6.7%	0.115	7.7%	0.101	6.8%
	3 Central Java (35)	0.161	6.7%	0.172	6.9%	0.178	6.8%	0.186	7.0%	0.187	6.7%	0.166	6.6%
	4 D I Yogyakarta (5)	0.059	0.3%	0.059	0.3%	0.062	0.3%	0.064	0.3%	0.069	0.3%	0.068	0.3%
	5 East Java (37)	0.311	19.3%	0.326	19.7%	0.343	20.0%	0.358	20.6%	0.377	20.9%	0.365	22.0%
	6 Bali (9)	0.097	0.7%	0.097	0.7%	0.097	0.7%	0.097	0.7%	0.097	0.7%	0.090	0.7%
Kalimantan (29)		0.066	1.8%	0.065	1.7%	0.069	1.8%	0.070	1.9%	0.069	1.8%	0.076	2.3%
	1 West Kalimantan (7)	0.110	0.8%	0.109	0.7%	0.107	0.7%	0.105	0.7%	0.105	0.7%	0.103	0.8%
	2 Central Kalimantan (6)	0.033	0.1%	0.033	0.1%	0.036	0.1%	0.038	0.2%	0.039	0.2%	0.039	0.2%
	3 South Kalimantan (10)	0.066	0.4%	0.064	0.4%	0.060	0.4%	0.054	0.3%	0.058	0.3%	0.069	0.4%
	4 East Kalimantan (6)	0.025	0.3%	0.022	0.2%	0.021	0.2%	0.026	0.3%	0.024	0.2%	0.027	0.3%
Sulawesi (38)		0.002	0.0%	0.003	0.1%	0.004	0.1%	0.006	0.1%	0.006	0.1%	0.008	0.2%
	1 North Sulawesi (7)	0.038	0.1%	0.038	0.1%	0.037	0.1%	0.038	0.1%	0.041	0.1%	0.046	0.2%
	2 Central Sulawesi (4)	0.002	0.0%	0.001	0.0%	0.001	0.0%	0.001	0.0%	0.001	0.0%	0.002	0.0%
	3 South Sulawesi (23)	0.068	0.7%	0.071	0.7%	0.071	0.7%	0.072	0.7%	0.077	0.7%	0.070	0.7%
	4 Southeast Sulawesi (4)	0.011	0.0%	0.010	0.0%	0.015	0.0%	0.011	0.0%	0.013	0.0%	0.017	0.0%
Others (47)		0.059	0.8%	0.055	0.7%	0.052	0.7%	0.049	0.6%	0.059	0.7%	0.056	0.8%
	1 West Nusa Tenggara (7)	0.022	0.1%	0.023	0.1%	0.023	0.1%	0.023	0.1%	0.024	0.1%	0.025	0.1%
	2 East Nusa Tenggara (12)	0.047	0.1%	0.050	0.1%	0.058	0.2%	0.063	0.2%	0.060	0.2%	0.056	0.2%
	3 East Timor (13)	0.079	0.1%	0.081	0.1%	0.081	0.1%	0.077	0.1%	0.083	0.1%	0.073	0.1%
	4 Maluku (5)	0.041	0.1%	0.046	0.1%	0.051	0.2%	0.055	0.2%	0.063	0.2%	0.062	0.2%
	5 Irian Jaya (10)	0.112	0.4%	0.111	0.4%	0.109	0.3%	0.106	0.3%	0.141	0.5%	0.136	0.5%
Within Province		0.119	45.5%	0.125	46.5%	0.131	47.4%	0.136	48.4%	0.143	49.7%	0.141	52.8%
Between Province		0.125	47.7%	0.125	46.6%	0.125	45.4%	0.124	44.2%	0.124	43.1%	0.108	40.6%
Between Region		0.018	6.9%	0.019	7.0%	0.020	7.2%	0.021	7.4%	0.021	7.2%	0.018	6.6%
Total		0.262	100.0%	0.269	100.0%	0.276	100.0%	0.281	100.0%	0.287	100.0%	0.266	100.0%

(Notes) (a) Same as Note (a) in Table 1.

(b) Numbers in the parentheses are the number of Kabupatens and Kotamadyas.

(Source) BPS (various issues), *Gross Regional Domestic Product of Regencies/Municipalities in Indonesia*.

Table 4. Per Capita GDP after excluding Oil and Gas Sectors, Indonesia 1993-1998

in thousand rupiah

Region	Province	Per Capita GDP			Growth Rate	
		1993	1997	1998	93-97	97-98
Sumatra		1,342.1	1,717.5	1,583.8	6.4%	-7.8%
	1 DI Aceh	1,308.3	1,644.3	1,521.6	5.9%	-7.5%
	2 North Sumatra	1,648.5	2,186.6	1,981.1	7.3%	-9.4%
	3 West Sumatra	1,448.7	1,815.5	1,678.7	5.8%	-7.5%
	4 Riau	1,635.1	2,162.9	2,119.1	7.2%	-2.0%
	5 Jambi	1,077.9	1,296.7	1,180.1	4.7%	-9.0%
	6 South Sumatra	1,245.9	1,573.3	1,442.4	6.0%	-8.3%
	7 Bengkulu	1,100.1	1,225.7	1,171.2	2.7%	-4.4%
	8 Lampung	853.4	1,059.8	959.1	5.6%	-9.5%
Java-Bali		1,661.6	2,173.8	1,852.5	6.9%	-14.8%
	1 DKI Jakarta	5,801.7	7,424.2	5,979.2	6.4%	-19.5%
	2 West Java	1,377.3	1,882.3	1,546.5	8.1%	-17.8%
	3 Central Java	1,069.8	1,338.9	1,211.1	5.8%	-9.5%
	4 D I Yogyakarta	1,390.5	1,760.1	1,562.5	6.1%	-11.2%
	5 East Java	1,405.4	1,827.8	1,632.1	6.8%	-10.7%
	6 Bali	2,009.6	2,579.3	2,447.2	6.4%	-5.1%
Kalimantan		2,043.5	2,681.6	2,585.0	7.0%	-3.6%
	1 West Kalimantan	1,506.3	1,963.1	1,888.8	6.8%	-3.8%
	2 Central Kalimantan	1,968.4	2,538.5	2,372.9	6.6%	-6.5%
	3 South Kalimantan	1,624.0	2,092.3	1,965.0	6.5%	-6.1%
	4 East Kalimantan	3,516.0	4,619.3	4,558.8	7.1%	-1.3%
Sulawesi		1,007.5	1,264.1	1,200.8	5.8%	-5.0%
	1 North Sulawesi	1,091.3	1,465.4	1,443.4	7.6%	-1.5%
	2 Central Sulawesi	948.5	1,138.3	1,070.4	4.7%	-6.0%
	3 South Sulawesi	1,022.9	1,283.7	1,211.1	5.8%	-5.7%
	4 Southeast Sulawesi	860.8	995.1	917.1	3.7%	-7.8%
Others		872.6	1,096.2	1,030.1	5.9%	-6.0%
	1 West Nusa Tenggara	719.0	897.3	859.1	5.7%	-4.3%
	2 East Nusa Tenggara	610.1	771.4	718.3	6.0%	-6.9%
	3 East Timor	623.6	825.6	813.4	7.3%	-1.5%
	4 Maluku	1,219.8	1,441.5	1,342.6	4.3%	-6.9%
	5 Irian Jaya	1,398.2	1,828.8	1,694.3	6.9%	-7.4%
Total		1,520.9	1,973.8	1,738.1	6.7%	-11.9%

(Source) BPS (various issues), *Gross Regional Domestic Product of Regencies/Municipalities in Indonesia*.

Table 5. Shift and Share Analysis for Provinces in Indonesia, 1997-98
Based on GDP Excluding Oil and Gas Sectors

in billion rupiah

Province	Total Growth (A)	Regional Share (B)	Total Shift (C) = (A) - (B) = (D) + (E)	Industry Mix Shift (D)	Competitive Shift (E)
1 Aceh	-380	-824	444	169	275
2 North Sumatra	-2,733	-3,139	406	368	38
3 West Sumatra	-520	-1,010	490	203	287
4 Riau	-155	-1,080	925	-57	982
5 Jambi	-282	-398	116	56	60
6 South Sumatra	-1,082	-1,551	470	127	342
7 Bengkulu	-109	-220	110	64	46
8 Lampung	-500	-909	409	91	317
9 DKI Jakarta	-12,163	-8,776	-3,387	-2,742	-645
10 West Java	-12,744	-8,583	-4,161	-567	-3,595
11 Central Java	-5,750	-5,201	-549	170	-719
12 Yogyakarta	-596	-667	71	31	40
13 East Java	-10,424	-8,108	-2,316	-49	-2,267
14 Bali	-306	-954	648	173	475
15 West Kalimantan	-340	-911	571	94	476
16 Central Kalimantan	-297	-541	244	161	83
17 South Kalimantan	-404	-781	377	135	242
18 East Kalimantan	-317	-1,440	1,122	256	866
19 North Sulawesi	-89	-475	386	88	299
20 Central Sulawesi	-92	-292	201	83	118
21 South Sulawesi	-570	-1,248	678	302	377
22 Southeast Sulawesi	-95	-207	112	36	77
23 West Nusa Tenggara	-125	-424	300	122	178
24 East Nusa Tenggara	-77	-358	281	119	162
26 Maluku	-183	-388	205	49	156
27 Irian Jaya	931	-916	1,847	518	1,329
Total	-49,402	-49,402	0	0	0

(Source) BPS (2000b), *Gross Regional Domestic Product of Provinces by Industrial Origin in Indonesia*.

**Figure 1. Three-Level Hierarchical Structure
Region-Province-District**

**Figure 2. Two-Stage Nested Inequality Decomposition Analysis for China
1995-1998**

**Figure 3. Between-Province Inequality by Region, China
1995-1998**

**Figure 4. Two-Stage Nested Inequality Decomposition Analysis for
Indonesia, 1993-1998
Excluding the Oil and Gas Sector**

**Figure 5. Between Province Inequality by Region, Indonesia
1993-1998
Excluding the Oil and Gas Sector**

(Note) The between-province inequality component is an average of between-province inequalities weighted by GDP shares.

¹ For example, Akita and Lukman (1995), Akita, Yue, and Kawamura (1999), Chen and Fleisher (1996), Danieri (1996), Das and Barua (1996), Esmara (1975), Gilbert and Goodman (1976), Green (1969), Jensen (1969), Mathur (1983), Mutlu (1991), Tabuchi (1988), Tsui (1991, 1993, 1996), Uppal and Budiono (1986), Wei and Ma (1996), Zheng (1997).

² For the one-stage decomposition of Theil indices, see, for example, Anand (1983).

³ For a two-stage nested design in ANOVA, see, for example, Montgomery (1984).

⁴ In Fak-Fak, non-oil and gas mining accounts for more than 90% of total GDP.

⁵ For Irian Jaya's Fak-Fak, non-oil and gas mining is also excluded due to the same reason as the oil and gas sectors.

⁶ Akita, Yue, and Kawamura (1999) used provincial GDP, rather than district-level GDP, to estimate regional income inequality over the 1985-97 period.

⁷ The central government has so far established 5 SEZs and 39 ETDZs mainly during the economic reforms in the 1980s.

⁸ According to provincial GDP data from the China Statistical Yearbook (1999), Xinjiang had a per capita GDP of 6,229 yuan in 1998, while Qinghai, the second richest province in the Western Region, had a per capita GDP of 4,367 yuan. There seems to be data inconsistency between provincial data and district-level data in the Western Region. If we use 6,229 yuan for Xinjiang and 4,367 yuan for Qinghai, then the Western Region's resulting level of between-province inequality would have been much higher than 0.02.

⁹ Government-compiled population statistics based on the family register system do not reflect actual population since they exclude those who do not have family registers in the district; however, the output of the excluded groups are included in the production statistics of the district. It is often assumed that such rapidly growing districts near Hong Kong as Shenzhen, Zhuhai, Guangzhou, Foshan, Dongguan, and Zhongshan in Guangdong province have, in fact, 50-100 percent greater population than indicated in official population statistics. If, in fact, Shenzhen had 100 percent greater population than its official population statistic, while Zhuhai, Guangzhou, Foshan, Dongguan, and Zhongshan had 50 percent greater population than their respective official population statistics, Guangdong's within-province inequality would have been 0.258 in 1998. Though it is significantly lower than 0.416, this is still the highest level of inequality in the Eastern Region.

¹⁰ The between-province inequality component is an average of between-province inequalities weighted by GDP shares.

¹¹ It should be noted that, for an unknown reason, West Java's GDP in *Gross Regional Domestic Product of Regencies/Municipalities in Indonesia* is much larger than its GDP in *Gross Regional Domestic Product of Provinces in Indonesia*. For example, West Java's GDP minus the oil and gas sectors in 1997 was Rp76,150 billion in the regencies/municipalities' statistics (BPS, 2000a); in contrast, it was Rp68,010 billion in the provincial statistics (BPS, 2000b). In other provinces, the discrepancy is significantly smaller over the 1993-97 period (all are within 3% of each other).

¹² The within-province inequality component is an average of within-province inequalities weighted by GDP shares.

¹³ According to the provincial GDP data, per capita GDP declined by 13.9% in 1998 (BPS, 2000b).

¹⁴ It should be noted that we use only 1998 data, and thus care should be taken to interpret the results. Since 1999 district-level GDP data is not yet available, we do not know whether the within-province inequality component decreased or increased in 1999; but, according to *Gross Regional Domestic Product of Provinces in Indonesia by Industrial Origin, 1996-1999* (BPS, 2000b), regional income inequality, as measured based on provincial GDP data, reduced further in 1999 due mainly to the fall in the between-province inequality component.

¹⁵ The following should be noted: in 1997 East Java's GDP in *Gross Regional Domestic Product of Regencies/Municipalities in Indonesia* was smaller than its GDP in *Gross Regional Domestic Product of Provinces in Indonesia* (Rp62,815 vs. 64,259 billion), in 1998 the former became larger than the latter (Rp56,606 vs. 53,825 billion) (BPS, 2000a, 2000b). Therefore, the rate of decrease in GDP was much smaller when the statistics of regencies/municipalities are used rather than provincial statistics (-10% vs. -16%).

¹⁶ For the shift and share analysis, see, for example, Armstrong and Taylor (1985).

¹⁷ This is true even though the agricultural sectors in West Java and East Java contracted by 7.6% and 5.0%, respectively, both of which were higher than the 2.6% negative growth rate in the agricultural sector of the whole country.