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The Inequality of Regional Economic Development in China between 1991 and 2001

JR-TSUNG HUANG, CHUN-CHIEN KUO and AN-PANG KAO

ABSTRACT *This paper measures the unequal development of the regional economies in China and investigates the primary factors leading to the inequality. The official data on China's regional GDP and the regional GDP of three industrial sectors from 1991–2001, as reported in the* China Statistical Yearbook *and* A Statistical Survey of China, *are adopted to calculate and decompose the Gini coefficient for each year. The primary finding is that the levels of inequality in China's regional economies clearly showed a slight upward trend after 1991. The inequality of the overall GDP is primarily attributed to the between-group effect rather than to the within-group effect. It is also found that the regional inequality of the secondary industry sector's development accounted for half of the overall inequality. Thus, this study suggests that it is crucial for China to formulate and adhere to policies that will help it to develop the economy more equally among all areas and to develop the secondary industry sector among all regions/provinces in order to overcome the important issue of the inequality in regional economic development.*

Key words: China, Economic Development, Gini Coefficient Decomposition, Inequality.

JEL classifications: D39, O10, R12.

1. Introduction

For there to be an unevenness in regional development is far from unexpected in a developing nation, especially in one as large as China. In fact, from a historical point

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Jr-Tsung Huang, Sun Yat-Sen Graduate Institute of Social Sciences and Humanities, National Chengchi University, Taipei, 116 Taiwan; e-mail: jthuang@nccu.edu.tw. An-Pang Kao, Department of Economics, National Chengchi University, Taipei, 116 Taiwan. Chun-Chien Kuo, Department of Economics, Shih Hsin University, Taipei, 116 Taiwan.

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of view, even well before the Communist government took over mainland China in 1949, the coastal areas had already become more developed than the interior areas.[1] Although the Chinese Communist government proceeded to add substantial industrial support to the inland provinces in efforts to redress the unevenness in regional development, its achievements were limited at best. Moreover, the rigid central planning system implemented during the first three decades under the Communist regime distorted the allocation of resources, which lowered the efficiency of production and added to the unevenness in regional development.

This uneven pattern of development has been a troubling issue for China's regional economies ever since the country first embarked upon its bold program of reforms and opened itself up to the outside world in the late 1970s. This is largely because, in its adoption of new strategies, the Chinese Communist government put the emphases on the role of market mechanisms in resource allocation, on decentralization, and on efficiency in economic decision-making. This strategy, undoubtedly, broke the steel bowl that existed under egalitarianism and was designed to make only a small portion of the population rich first. At the expense of the inner areas, the economic reforms shifted the focus away from encouraging full regional development in China to developing only the coastal areas, which traditionally had a relatively well-developed infrastructure and a strong economic base. Since the readily accessible geographic location of the coastal areas promised a much higher rate of return on investments when compared with other parts of China, the central government further established special economic zones, and opened cities and regions along the coasts with the aim of attracting more investments from foreign countries and economies.

In terms of development, such rapid growth along the coasts has continued to widen the gap between the coastal and interior areas of China, and has thus brought about additional social, economic, and political repercussions. In light of this, ever since the late 1980s, the annual sessions of the National People's Congress have continually debated numerous issues pertaining to regional inequalities. However, as pointed out by Zhao and Gu (1995), the central government's promises of opening up in all directions and favoring the development of interior regions, by and large, fell on deaf ears throughout most of the 1990s. Another more recent plan named 'the Great Development of the Western Area,' which has been promoted by the Chinese government since 1999, may actually represent its first real determination to develop its vast interior, but then again, it might not. Nevertheless, this plan has at least temporarily subdued the considerable degree of discontent resulting from the disparities in the development of the interior regions of China.

Since the early 1980s, many studies have investigated the trend toward regional inequality, and although some have concluded that regional inequalities since the late 1970s have widened, others have reported just the opposite. The principal reason for this inconsistency, as pointed out by Fan (1997) and Hansen (1995), is that different geographic scales, time periods, indicators of well-being, and indices of inequality have been used in those empirical studies.

The objective of this study is to examine various issues relating to the trend toward regional inequality in the economic development of China in the 1990s. This study, however, differs from previous literature in three major aspects. First of all, the focus here is on provincial gross domestic product (GDP, hereafter) rather than on per capita income,[2] per capita consumption, and other indices, thereby making it easier to delve into the issue and to apply this research in such a way that it can equally serve as a supplement to existing studies on China's

inequality with respect to family income. The second unique feature of this paper is that, unlike numerous studies on the same issue, which have covered earlier periods, this study is limited to the 1991 to 2001 period. It is of particular interest to understand the scenario of inequality in regional economic development during the 1990s in that China's central government first began to show some concern for the issue of regional inequality in 1990.

The third feature is that, by design, this study adopts the methodology proposed by Bhattacharya and Mahalanobis (1967) according to which the Gini coefficient is decomposed into a between-group effect and a within-group effect. Finally, in order to consider the influence of the economic structure on the Gini measure of inequality in regional GDPs, this study follows the method initiated by Fei *et al.* (1978, 1979), which separates regional GDPs by source and calculates the contribution of the inequality of each regional GDP source to overall inequality.

The remainder of this paper is organized as follows. Section 2 reviews some of the literature; Section 3 presents an overview of China's regional economic development. Section 4 presents the methodology adopted in this study, while Section 5 analyzes the measured results of the regional inequality of economic development and discusses the contribution of the inequality of each regional GDP source to overall inequality. Finally, the last section outlines the concluding remarks and discusses policy implications.

2. Recent Literature on China's Regional Inequality

As referred to earlier, several studies have explored the regional inequalities in China, and indeed different approaches and time periods have been employed. Yao (1997a), for one, followed the procedures devised by Yao and Liu (1996) and Yao (1997b) and calculated and decomposed the inter-provincial per capita income Gini coefficient for just rural China during the 1986–92 period. The primary finding of Yao's paper was that income distribution in rural China had become more skewed as a result of economic reforms. Reportedly, more than one-half of the inequality in the national income, in fact, was a direct result of inter-provincial inequality, while three-quarters of the inter-provincial inequality was due to inter-zone inequality. The uneven development of enterprises in both townships and villages had seemingly been a major factor in the increased inequality in regional income.

Kanbur and Zhang (1999), meanwhile, used a decomposition analysis to determine the relative contributions of rural–urban and inland–coastal inequalities to ascertain regional inequalities in China during the 1980s and 1990s. Their primary finding was that, in terms of levels, the contribution of the former was much higher than that of the latter. Employing the decomposition method introduced by Tsui (1993), Lee (2000) later examined whether the major sources of China's regional inequality with regard to both per capita gross value of industrial and agricultural output and per capita consumption were different in 1982 and 1994. The major finding of this decomposition analysis was that the determinant source of the overall inequality in output had shifted from intra-provincial to inter-provincial inequality, from rural–urban to intra-rural inequality, and also from disparity within the coastal regions to the widening of the gap between the coastal and interior regions.[3]

To analyze the evolution of China's regional inequality during the 1978–98 reform period, Lu and Wang (2002) have used per capita GDP, per capita consumption, and per capita income to calculate three indices: the coefficient of

variance, the Gini coefficient, and the Theil entropy index. Their results indicated that inter-provincial and regional inequalities declined between 1978 and 1990, but steadily widened after 1990.[4]

On the question, 'Does the degree of inequality between provinces within a given region or between two regions decline or widen?' Zhang *et al.* (2001) have responded by calculating the Gini coefficient for China and its three regions, namely the Eastern,[5] Central, and the Western regions from 1952 to 1997.[6] They have found that, in general, income disparity in China clearly increased over the 1952–97 period, especially after the initiation of economic reforms. In addition, the Gini coefficient for the three regions displayed different patterns, with the Western region showing the lowest Gini coefficient in that period.

Other scholars have also tried to explore the determinants of China's regional income inequalities. Xu and Zou (2000) have presented a panel data set to compute the Gini coefficient of inequality in China's provincial–urban-level income and have found that the share of GDP by state-owned enterprises, inflation, economic growth, and the exposure to foreign trade have all had an important impact on income inequality in China.

Few studies have shed much light on issues concerning the regional inequalities in economic development as represented by regional GDP. Further, none of the previous studies discussed the contribution of between-group and within-group inequality and the inequality in individual sources of regional GDP to the overall inequalities at the same time. To get a firmer grasp on regional inequality in China, this study not only decomposes the inequality in regional economic development into a between-group effect and a within-group effect but also explores the contribution of the inequality of each regional GDP source to overall inequality.

3. Uneven Regional Development in China

Before the inequalities in regional economic development in China are investigated, this paper collects all available official data of the nominal GDP for each province during the 1991–2001 period from the *China Statistical Yearbook* (1992–95, 1997–2002) and *A Statistical Survey of China* (1997).[7] These regional panel data are listed in Table 1. This study also calculates the variance in regional GDPs for each specific year to illustrate roughly the disparities in regional economic development during the research period.

From Table 1, it is noted that China's regional development is characterized by four major features. First, the list of the five provinces with the highest GDP did not change significantly in the 1990s. The five provinces with the highest GDP before 1994 were Guangdong, Liaoning, Zhejiang, Sichuan, and Jilin, while in 1994 and 1996, Anhui replaced Jilin as the province with the fifth largest GDP in China. In 1997, Chongqing was separated from Sichuan, and at that time, Shandong took the place of Sichuan, becoming one of the five provinces with the highest GDP. Jiangsu and Henan replaced Liaoning and Anhui on the list of the five provinces with the highest GDP in 2001. The second feature in Table 1 is that the list of the five provinces ranked on the basis of having the lowest GDP during the same period was even more stable than that of provinces with the highest. The five lowest ranking provinces were Tibet, Gansu, Qinghai, Ningxia, and Hainan, except in 1998 and 1999 when Guizhou replaced Gansu in the lowest GDP ranking group.

Table 1. Regional GDPs in China from 1991 to 2000 (Unit: 100 million RMB)

Province/Region	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Beijing	598.9	709.1	863.54	1084.03	1394.89	1615.73	1810.09	2011.31	2174.46	2478.76	2845.65
Tianjin	342.75	411.24	536.1	725.14	920.11	1102.4	1240.4	1336.38	1450.06	1639.36	1840.10
Hebei	959.57	1155.05	1690.84	2187.49	2849.52	3452.97	3953.78	4256.01	4569.19	5088.96	5577.78
Shanxi	431.55	519.8	704.7	853.77	1092.48	1305.5	1480.13	1601.11	1506.78	1643.81	1779.97
Inner Mongolia	320.99	378.62	532.71	681.92	832.88	984.78	1094.52	1192.29	1268.2	1401.01	1545.79
Liaoning	1596.88 (2)	1982.02 (2)	2779.49 (3)	3872.18 (3)	2793.37	5960.42 (3)	6650.02 (3)	7162.2 (3)	7662.1 (3)	8542.44 (3)	5033.08
Jilin	1073.24 (5)	1297.65 (5)	2010.82 (5)	2461.78	1129.2	3157.69	3490.06	3881.73	4171.69	4669.06	2032.48
Heilongjiang	424	514.58	717.95	936.78	2014.53	1337.16	1446.91	1557.78	1669.56	1821.19	3561.00
Shanghai	734.69	855.93	1203.22	1618.63	2462.57	2402.58	2708.46	2832.84	2897.41	3253	4950.84
Jiangsu	857.71	1114.32	1511.61	1971.92	5155.25 (2)	2902.2	3360.21	3688.2	4034.96	4551.15	9511.91 (2)
Zhejiang	1471.05 (3)	1971.6 (3)	2998.16 (2)	4057.39 (2)	3524.79 (5)	6004.21 (2)	6680.34 (2)	7199.95 (2)	7697.82 (2)	8582.73 (2)	6748.15 (4)
Anhui	983.54	1220.69	1909.49	2666.86 (5)	2003.58	4146.06 (5)	4638.24 (4)	4987.5 (4)	5364.89 (4)	6036.34 (4)	3290.13
Fujian	600.13	730.19	1069.84	1488.47	2160.52	2339.25	2669.95	2805.45	2908.59	3038.24	4253.68
Jiangxi	465.1	559.52	723.06	948.16	1205.11	1517.26	1715.18	1851.98	1962.98	2003.07	2175.68
Shandong	993.08	1213.23	1662.76	2224.43	5002.34 (3)	3683.41	4079.26 (5)	4356.6 (5)	4576.1 (5)	5137.66 (5)	9438.31 (3)
Henan	856.85	1001.37	1424.38	1878.65	3002.74	2970.2	3450.24	3704.21	3857.99	4276.32	5640.11 (5)
Hubei	785.83	920.13	1278.28	1694.42	2391.42	2647.16	2993	3211.4	3326.75	3691.88	4662.28
Hunan	547.42	694.7	1133.49	1685.34	2195.7	2606.92	3000.36	3330.18	3550.24	3920.07	3983.00
Guangdong	1780.56 (1)	2293.54 (1)	3225.3 (1)	4240.56 (1)	5381.72 (1)	6519.14 (1)	7315.51 (1)	7919.12 (1)	8464.31 (1)	9662.23 (1)	10647.71 (1)
Guangxi	453.04	572.3	893.58	1241.83	1606.15	1869.62	2015.2	1903.04	1953.27	2050.14	2231.19
Hainan	107.93 (27)	141.68 (27)	258.08 (27)	330.95 (27)	364.17 (27)	389.53 (27)	409.86 (28)	438.92 (28)	471.23 (28)	518.48 (28)	545.96 (28)
Chongqing	NA	NA	NA	NA	NA	NA	1350.1	1429.26	1479.71	1589.34	1749.77
Sichuan	1281.1 (4)	1781.22 (4)	2096.48 (4)	2777.88 (4)	3534 (4)	4215 (4)	3320.11	3580.26	3711.61	4010.25	4421.76
Guizhou	289.76	331.67	416.07	521.17	630.07	719.83	792.98	841.88 (27)	911.86 (27)	993.53	1084.90
Yunnan	432.86	510.03	779.21	973.97	1206.68	1491.62	1644.23	1793.9	1855.74	1955.09	2074.71
Tibet	30.53 (30)	33.29 (30)	45.84 (30)	45.84 (30)	55.98 (30)	64.76 (30)	76.98 (31)	91.18 (31)	105.61 (31)	117.46 (31)	138.73 (31)
Shaanxi	427.9	492.64	671.37	816.58	1000.03	1175.38	1326.04	1381.53	1487.61	1660.92	1844.27
Gansu	255.45 (26)	301.64 (26)	371.24 (26)	451.66 (26)	553.35 (26)	714.18 (26)	781.34 (27)	869.75	931.98	983.36 (27)	1072.51 (27)
Qinghai	72.58 (28)	84.32 (28)	109.62 (28)	138.24 (28)	165.31 (29)	183.57 (29)	202.05 (30)	220.16 (30)	238.39 (30)	263.59 (29)	300.95 (29)
Ningxia	68.49 (29)	78.62 (39)	103.82 (29)	133.97 (29)	169.75 (28)	193.62 (28)	210.92 (29)	227.46 (29)	241.49 (29)	265.57 (30)	298.38 (30)
Xinjiang	311.72	382.26	505.63	673.68	825.11	912.15	1050.14	1116.67	1168.55	1364.36	1485.48
Standard Deviation1	458.56	597.02	850.31	1148.86	1475.05	1759.43	1971.89	2130.40	2276.43	2563.34	2762.60

Source: China Statistical Yearbook (State Statistical Bureau, 1992~1996 and 1997~2001).

Notes: 1. When computing the standard deviations, in order to compare the standard deviations across years, the GDP of Sichuan includes that of Chongqing after the year 1997.
2. The numbers in parentheses are the rankings.

The third highlight of China's regional economic development after 1991 is that, as a general rule, the GDP of provinces in the coastal areas were higher than those in the interior areas. With specific reference to the first two features, except for Anhui, the top ranking provinces with the highest GDP were all in coastal areas in 1997. However, from 1991 onwards, the five provinces with the lowest GDP were all interior provinces except for Hainan. The fourth feature of Table 1 is that the ratios of the highest to the lowest provincial GDP in each consecutive year formed a slightly lop-sided 'bell-shaped' curve during this period. The ratio was 58.32 in 1991, but increased sharply to 100.67 in 1996, and later declined considerably to 76.75 in 2001. Overall, this strongly implies that the difference between the highest and lowest GDP widened in the 1990s. Briefly stated, this finding can obviously be interpreted as meaning that the rich became richer, while the poor became poorer.

On the basis of the above analysis, it is evident that regional economic development in China was more uneven and that the levels of inequality in regional economic development increased after 1991. The standard deviations of the provincial GDP, which in some aspects can sufficiently represent the disparities in regional GDP, are calculated and listed in the bottom row of Table 1. The standard deviations of in the regional GDP increased after 1991. To be precise, from 458.56 in 1991, it rose substantially to 1475.05 in 1995, and then further soared to 2762.60 in 2001. Based upon the values of the standard deviations, it is also reasonable to conclude that the inequalities of regional economic development worsened after 1991. Given the purposes of this study to investigate the inequality in regional economic development and to compare the contributions of different components to overall regional inequality, the Gini coefficient methodology is adopted and is discussed in the following section.

4. Methodology

In Section 3, no matter which measures are adopted, the same conclusions concerning the unevenness in the regional economic development of China are drawn. However, to investigate this issue of inequality more accurately than through the approaches taken in the previous section, this study adopts the most popular method, the Gini coefficient technique.

Most earlier studies have examined inequality by calculating the *L*-Gini coefficient. This study decomposes the aggregate value of the Gini coefficient, *G*, based upon Yang (1999). Thus:

$$G = \frac{(1/2n^2)\sum_i \sum_{j \neq i} |y_i - y_j|}{\mu} \tag{1}$$

where y_i denotes the nominal GDP of the i^{th} region;[8] n is the number of regions; μ is the average GDP of all regions; and $\mu = (1/n)\sum_{i=1}^{n} y_i$. In their discussion of the regional inequality of consumption in India, Bhattacharya and Mahalanobis (1967) calculated statistical measures by decomposing the Gini coefficient into between-group effect and within-group effect. Paglin (1975) further identified the between-group effect by *P*-Gini and asserted that *P*-Gini, in fact, represented the inequality in family income. Comments with respect to *P*-Gini and the *P*-Curve have been numerous, and some have even recently supported the argument that

P-Gini is so affected by the arbitrary choice of the age grouping that it makes us question the validity of the age-related measure (Formby *et al.* 1989). However, 'most pointedly', Paglin (1989) said, 'with a sufficiently narrow age partition, the *P*-curve can always be driven to the *L*-curve'.

Bearing in mind that the main purpose of this study is to examine the inequality of regional economic development, it is necessary to understand clearly the regional inequalities in China and to identify their main source. To do so, separating the Gini coefficient on the basis of between-region and within-region effects to extract information pertaining to disparities is not just necessary but also meaningful. Following the method introduced by Bhattacharya and Mahalanobis (1967), the between-group effect G_B is defined as:

$$G_B = \frac{(1/2)\sum_{i \neq j} p_i p_j (\mu_i - \mu_j)}{\mu} \tag{2}$$

where μ_i is the average GDP of group i, and p_i is the proportion of regions belonging to group i. The within-group effect G_W in Bhattacharya and Mahalanobis (1967) is defined as the difference between the Gini coefficient and the between-group effect, i.e. $G_W = G - G_B$.

In addition to decomposing the Gini coefficient into between-group and within-group effects, the importance that the Gini measure of inequality of total income is affected by income structure was highlighted by Fei *et al.* (1978). Accordingly, they separated the total income by source and calculated the distribution of the share of each income source as the contribution ratio of inequality of the total income. Pyatt *et al.* (1980) showed that it might be misleading to interpret only the share distribution of the factor components of income as if they were Gini coefficients since those components also depend on the correlation effects. Tsaur (1996), therefore, used the share distribution and correlation coefficient to shed light on the inequalities in Taiwan's total family income.

As this paper also considers the contribution of the three sources of GDP, i.e. the primary, secondary, and tertiary industries, to the GDP Gini coefficient in China, it also combines the method of decomposition and of the contribution of each source of the GDP. First, based upon the approach of Fei *et al.* (1978, 1979) and Pyatt *et al.* (1980), the regional GDP Gini coefficient is defined as the sum of the weighted Gini coefficient of the three GDP sources which are shown in equation (3). That is:

$$G = \phi_1 g_1 G_1 + \phi_2 g_2 G_2 + \phi_3 g_3 G_3 \tag{3}$$

where G, G_1, G_2, and G_3 represent the Gini coefficient of GDP for the whole nation, as well as for the primary, secondary, and the tertiary industries, respectively.[9] The term Ψi is the distributive share of the i^{th} GDP source; $i = 1, 2, 3$; and g_i is the rank correlation coefficient between GDP and the i^{th} GDP source.[10] The Gini coefficient of the ith GDP source G_i is then decomposed into the between-group effect G_{iB} and the within-group effect G_{iW}, and equation (3) can be rewritten as:

$$G = (\phi_1 g_1 G_{1B} + \phi_2 g_2 G_{2B} + \phi_3 g_3 G_{3B}) + (\phi_1 g_1 G_{1W} + \phi_2 g_2 G_{2W} + \phi_3 g_3 G_{3W}) \tag{4}$$

where the terms B and W denote the between-group and within-group effects, respectively.

The first part of the right-hand side of equation (4) is the sum of the weighted between-group effects across the three industries, which in this study is defined as the between-group effects of the total Gini coefficients. That is to say, $G_B = \varphi_1 g_1 G_{1B} + \varphi_2 g_2 G_{2B} + \varphi_3 g_3 G_{3B}$. Similarly, the second part of the right-hand side of equation (4) is defined as the sum of the weighted within-group effect across the three industries, i.e. the within-group effect of the total Gini coefficient, or $G_W = \varphi_1 g_1 G_{1W} + \varphi_2 g_2 G_{2W} + \varphi_3 g_3 G_{3W}$.[11]

Since the secondary industry group consists of the industry and construction sectors, then, following the same method, the regional Gini coefficient of China's secondary industry can be further decomposed as:

$$G_2 = (\phi_{2I} g_{2I} G_{IB} + \phi_{2C} g_{2C} G_{CB}) + (\phi_{2I} g_{2I} G_{IW} + \phi_{2C} g_{2C} G_{CW}) = G_{2B} + G_{2W} \tag{5}$$

where I and C denote the industry sector and construction sector, respectively.

5. Inequality of China's Regional Economies

This study adopts the panel data of regional aggregate GDP and regional GDP of the primary, secondary, and tertiary industries across 30 provinces during 1991–96 and across 31 provinces during 1997–2002. The data are taken from various volumes of the *China Statistical Yearbook* and *A Statistical Survey of China* (1997). As pointed out by Cannon (1990), the three conventional economic belts or zones, i.e. the Eastern, Central and Western zones, are ill-defined because some economically very diverse provinces have been placed into the same zone. To categorize provinces with a high degree of similarity in terms of their level of economic development, this study categorizes all China's provinces and regions into seven areas: the Northeast Area, the Northwest Area, the Greater Bohai Sea Area, the Midland Five Provinces Area, the Southwest and Southern Area, the Southeast Related Coastal Area, and the Changjiang River Delta Area.[12]

Using equation (1), the Gini coefficient for each regional GDP source in a specific year is calculated.[13] Equation (2) is then used to decompose the Gini coefficient for each regional GDP source into the between- and within-group effects. After the share distribution Ψi and the correlation coefficient g_i are measured, the between- and within-group effects of the total Gini coefficient and total Gini coefficient per se are obtained using equation (4). The Gini coefficient and its components are shown in Table 2.

From Table 2, it is seen that the pattern of inequality with respect to regional economic development is best viewed when it is divided into two periods – from 1991 to 1996 and from 1997 to 2001, since Chongqing was designated a special municipality (like Beijing, Tianjin and Shanghai) in 1997.[14] During both periods, the inequality of regional GDP in China experienced a slightly upward trend. In the first period, the Gini coefficient of the regional GDP was below 0.40 in 1991, then increased marginally to 0.41 in 1994, and remained stable for the next two years. In the second period, the Gini coefficient of the regional GDP increased sharply from 0.41 in 1997 to 0.45 in 2001.

Table 2. The Gini coefficient of China's regional GDP and the decomposition

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Gini coefficient	0.38	0.40	0.40	0.41	0.41	0.41	0.41	0.41	0.42	0.42	0.45
1. By within-/between-effects (%)											
Within-effect	36.84	37.5	32.5	34.1	34.1	31.7	26.83	24.39	26.19	26.19	26.82
Between-effect	63.16	62.5	67.5	65.9	65.9	68.3	73.17	75.61	73.81	73.81	73.18
2. By type of industry (%)											
Primary industries	25.93	22.49	18.02	17.92	18.26	17.56	15.76	14.46	13.86	11.70	11.62
Secondary industries	48.20	51.06	50.78	50.96	50.26	49.81	51.00	50.72	50.22	51.33	50.57
Tertiary industries	25.86	26.45	31.20	31.12	31.48	32.63	33.23	34.83	35.91	36.97	37.81

Source: Same as in Table 1.

The between- and within-group effects of the regional GDP Gini coefficients are also shown in Table 2. The measured figures in Table 2 illustrate that the between-group effect accounted for more than half of the total regional inequality throughout the 1990s. The share of the between-group effects to the total Gini coefficient, on the other hand, increased over time. In 1991, inter-provincial inequality accounted for 63.16% of the total regional inequality, but this increased to over 68.3% in 1996, and then peaked at 75.61% in 1998 before slipping to 73.18% in 2001.

These findings are quite consistent with previous observations reported by Jian *et al.* (1996) and Lee (2000) even though those researchers used different data or methods. Jian *et al.* (1996) argued that the widening gap between incomes in the coastal and interior areas after 1990 more than offset any continued convergence in income within the coastal areas, hence leading to an increase in the variance in overall regional income. Lee (2000) claimed that the disproportionate output among the three regions, i.e. the coastal, central and western areas, was a significant source of the regional inequality at that time. This is very much in line with the findings in the present study, which indicate that the inter-area inequality of economic development among the seven areas, as opposed to Lee's three regions, is the primary contributor to the overall inequality in regional economic development.

As for the issue of the contribution of regional GDP sources to overall Gini coefficient, from Table 2 it is quite clear that the inequality of regional GDP in secondary industries is the primary contributor to the inequality in total regional economic development. The inequality in regional secondary industries accounted for 48% of the inequality in total regional economic development in 1991 and, except for a slight slump in 1996, it more or less gradually increased to more than 50% for the remainder of the decade. In the year 2001, 50.57% of the inequality in total regional GDP came from the uneven regional distribution of secondary industries. It is also worth noting the importance of the uneven regional distribution of tertiary industries. Their contribution increased steadily after 1991 and made up 37.81% of the inequality in total regional GDP in 2001.

The Gini coefficient and their between- and within-group effects of the primary, secondary, and tertiary industries are also calculated and are shown in Table 3. Three features are well worth noting. First, it is found that the inequality in regional GDP distribution of all industries remained quite stable during the 1990s and that a similar level was found across industries. Secondly, the regional inequalities in industries were mainly products of the between-group effects. As for the regional unevenness of the primary industries, the between-group effect accounted for

Table 3. The Gini coefficient of China's regional GDP for three industries

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
1. Primary industries	0.42	0.41	0.41	0.41	0.42	0.42	0.40	0.40	0.41	0.41	0.44
Within-effect (%)	52.38	46.34	43.9	44.96	44.02	45.21	41.83	42.14	42.20	41.81	30.40
Between-effect (%)	47.62	53.66	56.1	55.04	55.98	54.79	58.17	58.10	57.80	58.19	69.60
2. Secondary industries	0.41	0.43	0.43	0.44	0.45	0.45	0.45	0.45	0.45	0.46	0.48
Within-effect (%)	26.83	27.91	27.91	28.90	29.61	30.24	25.39	25.17	25.66	25.98	27.86
Between-effect (%)	73.17	72.09	72.09	71.10	70.39	69.76	74.38	74.61	74.34	74.02	72.14
Industry sector (%)	90.05	89.67	89.17	89.48	89.06	88.85	89.32	88.00	89.11	89.54	89.37
Construction sector (%)	9.95	10.33	10.83	10.52	10.94	11.15	10.68	12.00	10.89	10.46	10.63
3. Tertiary industries	0.37	0.39	0.39	0.40	0.40	0.41	0.41	0.41	0.41	0.42	0.44
Within-effect (%)	32.43	30.77	31.15	30.29	29.87	28.34	22.28	22.22	22.03	21.24	28.19
Between-effect (%)	67.57	69.23	68.85	69.71	70.13	71.66	77.72	77.78	77.97	78.76	71.81

Source: Same as in Table 1.

over 50% after 1992. This inter-area unevenness was even more pronounced in the regional inequality of tertiary industries than in that of the other two types of industries in the period following 1996. Finally, as concerns the inequality of the major contributor of the total Gini coefficient in the secondary industries, the industry sector, not the construction sector, accounted for almost 90% of regional inequality.

6. Concluding Remarks

The objective of this research was to measure the unequal development of China's regional economies and to investigate the primary factors causing the inequalities. The official data of China's regional GDP and the regional GDP of three industrial sectors during the 1990s provided by the *China Statistical Yearbook* and *A Statistical Survey of China* are adopted to calculate the Gini coefficient for each year. In addition, the Gini coefficient is decomposed into between-group effect and within-group effect, as proposed by Bhattacharya and Mahalanobis (1967). The Gini coefficients are also decomposed into the first, second, and third sectors following the method proposed by Fei *et al.* (1978, 1979), Pyatt *et al.* (1980), and Tsaur (1996).

The most enlightening finding of this paper is that the level of inequality in China's regional economies clearly increased from 1991 to 2001 and the inequality in development of the regional secondary industry accounted for half of overall inequality. In categorizing all regions into seven areas in the present study, it is also found that inequality in the overall regional GDP chiefly came from the between-group effect rather than from the within-group effect. This finding is quite consistent with conclusions from previous studies. Finally, the inequality in the regional distribution of all industries remained quite stable across industries, and was mainly contributed to by the between-group effect during the study period.

Although the issue of regional inequality in China has attracted the government's concern, the issue was still unresolved as of 2001 and has likely even been gradually aggravated at the time of publication. The conclusions drawn in this paper closely echo those of other studies, with inter-area inequality being the primary factor causing China's regional inequality in regional GDP. Thus, it is suggested that the government of China intensify its efforts to develop its large

economy evenly across all areas and not simply across provinces in respective areas. This study distinguishes itself from earlier studies by pointing out that the uneven development of secondary industries across provinces played an important role in the regional inequality in China in the 1990s. This study additionally indicates that developing the secondary industrial sector among areas is also very important for China to overcome the important issue of inequality in its regional economic development.

Notes

1. Lu and Wang (2002) recently indicated that the uneven development between the coastal and inner areas is due both to differences in regional characteristics, such as production factors, and to over 100 years of foreign colonial influence before 1949.
2. This paper concentrates only on the measurement and analysis of the inequality of regional economic development, not the inequality of family income. The measured regional inequality based upon the aggregate GDP instead of per capita GDP might be more suitable and reasonable.
3. However, intra-provincial inequality, rural–urban inequality, and disparity within the coastal areas are still important factors in overall regional inequality in terms of per capita consumption.
4. Lu and Wang's paper has also indicated that the levels of regional inequalities in China appear to be sensitive to changes in government development strategies and regional policies.
5. In this classification, the East (coastal area) includes Beijing, Tianjin, Hebei, Liaoning, Shanghai, Jiangsu, Zhejiang, Shandong, Fujian, Guangdong, Guangxi, and Hainan. The Central area consists of Shanxi, Inner Mongolia, Jilin, Heilongjiang, Anhui, Jiangxi, Henan, Hubei, and Hunan. The West includes Sichuan, Guizhou, Yunnan, Tibet, Shaanxi, Gansu, Qinghai, Ningxia, and Xinjiang.
6. The Gini coefficient for China is derived from the per capita mean income at the provincial level. The Gini coefficients for the three regions are also derived from the provincial level per capita income within each of the three regions.
7. The nominal GDP is used instead of a real term here for the purposes of comparison of nominal GDP levels across regions in a specific year, but not across years.
8. The GDP is the aggregate GDP, not the per capita GDP. It is used in a nominal term not in a real term to calculate the Gini coefficient, which is just a number without unit. Therefore, the Gini coefficient does not change no matter whether we use real or nominal GDP in this study, and neither do the major conclusions. The authors are appreciative of an anonymous referee pointing this out.
9. According to the *China Statistical Yearbook* and *A Statistical Survey of China*, the sum of the aggregate GDP of the primary, secondary and tertiary industries in each province is equal to the province's GDP during the research period.
10. For a more detailed discussion of the rank correlation coefficient, please refer Fei *et al.* (1979).
11. Using this procedure to calculate the between- and within-group effects of the total Gini coefficients, the values of both effects just differ minimally from the values calculated by equation (2). These values are available upon request.
12. The Northeast Area includes Liaoning, Jilin and Heilongjiang. The Northwest Area includes Shaanxi, Gansu, Qinghai, Ningxia and Xinjiang. The Greater Bohai Sea Area includes Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia and Shandong. The Midland Five Provinces Area includes Anhui, Jiangxi, Henan, Hubei and Hunan. The Southwest and Southern Area includes Guangxi, Hainan, Sichuan, Chongqing, Guizhou and Yunnan. The Southeast Related Coastal Area includes Fujian and Guangdong. The Changjiang River Delta Area includes Shanghai, Jiangsu, and Zhejiang.
13. It is worth noting that using provincial aggregate GDP to calculate the Gini index without taking provincial population size into account may only capture the inequality resulting from population size. As a matter of fact, however, many factors are at play in affecting the inequalities of regional economic development in China, although regional population size is certainly a major one. In addition, regional endowment with regard to natural resources as well as regional economic policies also contribute to the inequalities of regional development. Therefore, this study might also capture inequalities based on different types and quantities of natural resources and different economic policies across regions. The issue of determinants of the Gini coefficient is beyond the discussion of this study, but should be investigated. At this moment, it is left for a future research study. Thus, the Gini coefficient measured on the basis of the aggregate GDP rather than per capita GDP might

be more suitable and reasonable. The authors are appreciative that an anonymous referee has pointed this issue out.

14. A special municipality, just like a province, is under the direct jurisdiction of the central government.

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