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ORIGINAL RESEARCH

Economic Tertiarization and Regional Income Inequality in a Decentralized Indonesia: A Bi-dimensional Inequality Decomposition Analysis

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Abstract
This study attempts to explore the determinants of interprovincial income inequality in Indonesia from 2005 to 2013 by using a bi-dimensional inequality decomposition method. It tries, particularly, to analyze how economic tertiarization and concurrent output deindustrialization have affected interprovincial inequality. The bi-dimensional inequality decomposition method decomposes interprovincial inequality as measured by the squared population-weighted coefficient of variation in two dimensions, namely, by regional groups and industrial sectors. While deindustrialization has lowered the relative importance of manufacturing in determining overall interprovincial inequality, manufacturing activities are still very unevenly distributed among regions and provinces. The government needs to implement policies that are conducive to the balanced development of non-oil and gas manufacturing industries based on regional comparative advantages and disadvantages, where further development of economic infrastructures and human resources, particularly outside Java-Bali, is essential. Meanwhile, economic tertiarization has raised the importance of service activities in determining overall interprovincial inequality, particularly inequality within Java-Bali. The tertiary sector accounts for more than half of total GDP in Java-Bali, and many service activities, such as IC, banking, business services and private services, are concentrated in Jakarta and neighboring districts. Particularly, with the advancement of IC technologies, the IC sector has been expanding rapidly. Together with banking, business services and private services, further development of the IC sector is likely to increase interprovincial inequality in Java-Bali unless policies that could facilitate geographical dispersion of these service activities are implemented.

Keywords Regional income inequality · Indonesia · Economic tertiarization · Deindustrialization · Bi-dimensional inequality decomposition

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1 Introduction

As the world's largest island country encompassing more than 13 thousand islands and 300 ethnic groups, Indonesia has undergone substantial structural changes over the last three decades (Fig. 1, Tables 1 and 2). The GDP share of the agricultural sector was 21% in 1983, but has declined gradually to 13% in 2013, while the mining sector has experienced a prominent decrease from 19 to 7%. On the other hand, the tertiary sector has raised its GDP share, particularly after the Asian financial crisis; in 2013, it accounted for about half of total GDP. Meanwhile, the manufacturing sector exhibited an inverted U-shaped pattern. In the 1980s and 1990s, under the Suharto's New Order Regime, its GDP share has increased gradually from 16 to 26%; but, after reaching the peak in the late 1990s, it has become stable. Since the early 2000s, the GDP share has been declining, and in 2013, it went down to 23%. Economic tertiarization seems to have been associated with deindustrialization since the Asian financial crisis. Indonesia's output deindustrialization appears to be pre-mature in the sense that it started at a much lower development level than most developed countries (Rodrik 2016).

Changes in industrial structure are associated with the changes in the geographical distribution of economic activities, as shown in Table 2, where Indonesia is divided into five regions, i.e., Sumatra, Java-Bali, Kalimantan, Sulawesi and Eastern Indonesia (see Fig. 2 for the map of Indonesia). When mining is included, Sumatra and Kalimantan regions lowered their GDP shares from 1983 to 2013 due primarily to the declining share of oil and gas production in the provinces of Aceh, Riau and East Kalimantan (from 27 to 21%

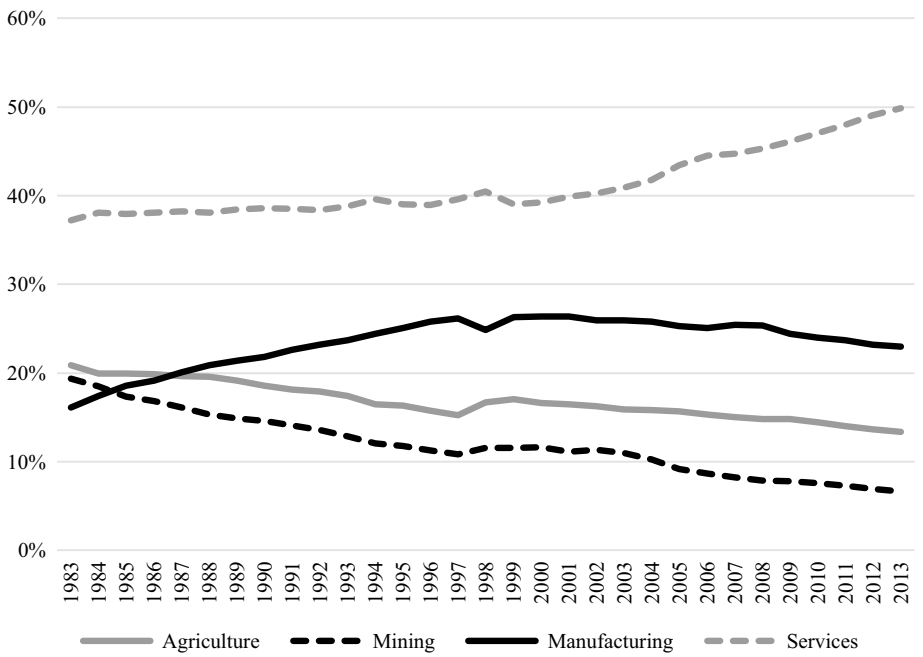

Fig. 1 Change in industrial structure (in %) GDP at 2000 constant prices. *Sources*: Akita et al. (2011) for 1983–2004; Central Bureau of Statistics (various issues), *Gross Regional Domestic Product of Provinces in Indonesia by Industrial Origin* for 2005–2013

Table 1 Change in industrial structure and annual average growth rate by sector (in %) GDP at 2000 constant prices. *Source*: Akita et al. (2011) for the period from 1983 to 2004; Central Bureau of Statistics (various issues), Gross Regional Domestic Product of Provinces in Indonesia by Industry for the period from 2005 to 2013

	Secondary						Tertiary					Total
	1	2	3	4	5	Sub-total	6	7	8	9	Sub-total	
1983–2004												
1983	20.9	19.4	16.1	0.4	6.0	22.5	15.7	4.3	7.5	9.7	37.3	100
1990	18.6	14.6	21.8	0.5	5.8	28.2	16.4	4.3	9.4	8.6	38.6	100
1995	16.3	11.8	25.1	0.7	7.1	32.9	17.6	4.5	9.3	7.5	39.0	100
2000	16.6	11.7	26.4	1.0	5.1	32.5	17.5	5.1	8.3	8.3	39.2	100
2004	15.8	10.2	25.8	1.1	5.2	32.1	18.4	6.0	8.5	8.9	41.8	100
2005–2013												
2005	15.7	9.2	25.3	1.1	5.3	31.7	19.1	6.1	8.5	9.7	43.5	100
2006	15.3	8.7	25.1	1.0	5.4	31.5	19.7	6.4	8.5	9.9	44.5	100
2007	15.0	8.2	25.5	1.1	5.5	32.0	19.4	6.7	8.6	10.0	44.7	100
2008	14.8	7.9	25.4	1.1	5.6	32.0	19.7	6.9	8.6	10.1	45.3	100
2009	14.8	7.8	24.5	1.1	5.7	31.2	19.9	7.3	8.7	10.2	46.1	100
2010	14.4	7.6	24.0	1.1	5.8	30.9	20.4	7.7	8.7	10.3	47.1	100
2011	14.0	7.3	23.7	1.1	6.0	30.7	20.8	8.0	8.8	10.4	48.0	100
2012	13.7	6.9	23.2	1.1	6.1	30.4	21.4	8.3	8.9	10.4	49.0	100
2013	13.4	6.7	22.9	1.1	6.1	30.1	21.8	8.6	8.9	10.5	49.9	100
Annual average GDP growth rate at 2000 constant prices												
1983–1997	4.4	2.5	10.2	12.3	8.2	9.7	7.7	7.4	8.3	4.6	7.1	6.7
1997–1999	1.8	−0.7	−3.4	5.9	−22.6	−6.8	−5.9	−0.7	−10.7	3.6	−4.5	−3.8
1999–2004	2.7	1.7	3.7	7.6	4.2	3.9	5.2	7.9	4.8	5.1	5.5	4.1
2005–2009	4.0	1.2	4.5	4.0	7.4	5.0	6.4	10.0	5.8	6.6	6.9	5.4
2009–2013	3.4	2.0	4.4	6.1	7.6	5.1	8.2	10.0	6.7	6.8	7.9	6.0

1 agriculture, *2* mining, *3* manufacturing, *4* electricity/gas/water, *5* construction, *6* trade/hotel/restaurant, *7* transportation/communication, *8* financial and business services, and *9* other services

in Sumatra and from 9 to 8% in Kalimantan). On the other hand, Java-Bali region raised its GDP share from 58 to 63% in the same period, where the three adjacent provinces of Jakarta, West Java and Banten seem to have contributed most to the rise.[1] Sulawesi region also increased its GDP share from 3 to 5%. As the most populous province in Sulawesi, accounting for almost half of the region's population and one of rapidly growing provinces in Indonesia, South Sulawesi contributed most to the rise.[2] Meanwhile, Eastern Indonesia did not exhibit a significant change in its GDP share.

Despite these structural changes, large disparities in socio-economic indicators persist among its regions and provinces due largely to unequal distributions of resource

[1] Banten was separated from West Java in 2000 as a new province.

[2] Here, the province of South Sulawesi excludes West Sulawesi, which was established in 2004 by being split off from South Sulawesi.

Table 2 Change in geographical structure (in %) GDP at 2000 constant prices. *Source*: Akita et al. (2011) for the period from 1983 to 2004; Central Bureau of Statistics (various issues), Gross Regional Domestic Product of Provinces in Indonesia by Industry for the period from 2005 to 2013

	Provinces	GDP including mining					GDP excluding mining				
		Share			Growth rate		Share			Growth rate	
		1983	2005	2013	1983–2004	2005–2013	1983	2005	2013	1983–2004	2005–2013
	Sumatra	26.9	21.8	20.8	2.3	5.1	18.9	19.2	19.2	3.8	6.1
11	Aceh		2.1	1.4		0.6		1.7	1.4		3.5
12	North Sumatera		5.2	5.4		6.1		5.7	5.7		6.1
13	West Sumatera		1.7	1.8		5.9		1.9	1.8		6.0
14	Riau		4.6	4.1		4.0		2.3	2.5		6.9
15	Jambi		0.7	0.8		6.9		0.7	0.8		6.9
16	South Sumatera		2.9	2.9		5.4		2.4	2.5		6.6
17	Bengkulu		0.4	0.4		6.0		0.4	0.4		5.9
18	Lampung		1.7	1.7		5.7		1.9	1.8		5.9
19	Bangka Belitung		0.5	0.5		4.9		0.5	0.5		5.7
21	Riau Islands		1.8	1.9		6.1		1.8	1.9		6.4
	Kalimantan	9.2	9.1	8.0	2.7	4.1	6.4	7.3	6.1	4.0	3.8
61	West Kalimantan		1.4	1.2		4.3		1.5	1.3		4.2
62	Central Kalimantan		0.8	0.9		6.2		0.9	0.8		5.5
63	South Kalimantan		1.4	1.4		5.5		1.2	1.1		5.6
64	East Kalimantan		5.5	4.5		3.3		3.8	2.8		2.5
	Java-Bali	57.5	61.3	63.0	4.1	6.0	68.0	66.5	66.7	4.2	6.1
31	Jakarta		17.8	18.3		6.0		19.5	19.5		6.0
32	West Java		14.3	14.5		5.8		15.3	15.2		6.0
33	Central Java		8.4	8.4		5.6		9.2	8.9		5.6
34	Yogyakarta		1.0	0.9		4.7		1.1	1.0		4.7
35	East Java		15.1	15.7		6.2		16.3	16.5		6.1

Table 2 (continued)

	Provinces	GDP including mining					GDP excluding mining				
		Share			Growth rate		Share			Growth rate	
		1983	2005	2013	1983–2004	2005–2013	1983	2005	2013	1983–2004	2005–2013
36	Banten		3.4	4.0		7.5		3.8	4.2		7.5
51	Bali		1.2	1.3		6.3		1.4	1.4		6.3
	Sulawesi	3.3	4.4	5.1	4.8	7.5	3.9	4.5	5.1	4.6	7.5
71	North Sulawesi		0.8	0.9		7.3		0.8	0.9		7.4
72	Central Sulawesi		0.7	0.9		8.4		0.8	0.9		7.6
73	South Sulawesi		2.1	2.4		7.1		2.1	2.4		7.5
74	South East Sulawesi		0.5	0.6		7.8		0.5	0.5		7.4
75	Gorontalo		0.1	0.1		7.3		0.1	0.1		7.3
76	West Sulawesi		0.2	0.2		8.5		0.2	0.2		8.4
	Eastern Indonesia	3.1	3.4	3.2	3.7	4.6	2.8	2.5	2.9	3.4	7.7
52	West Nusa Tenggara		0.9	0.8		3.7		0.7	0.7		5.7
53	East Nusa Tenggara		0.6	0.6		5.0		0.7	0.6		5.0
81	Maluku		0.2	0.2		5.6		0.2	0.2		5.6
82	North Maluku		0.1	0.1		6.1		0.1	0.1		6.3
91	West Papua		0.3	0.6		13.0		0.3	0.6		14.8
94	Papua		1.3	0.9		1.3		0.5	0.7		9.4
	Total	100	100	100	3.5	5.7	100	100	100	4.1	6.0

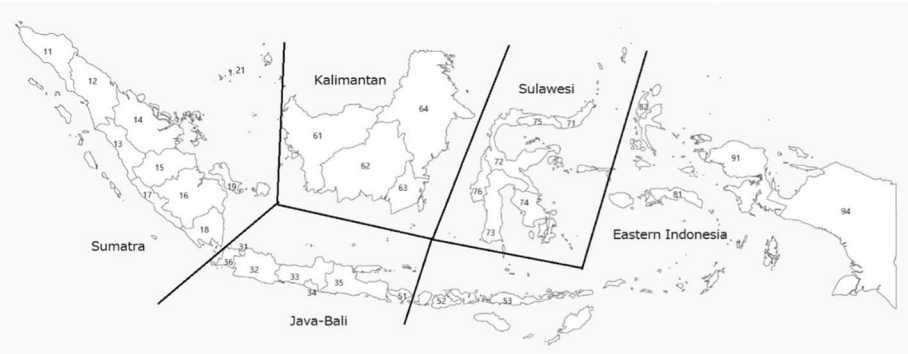

Fig. 2 Map of Indonesia. Note: Provincial codes are given in Tables 2, 3 and 4

endowments, public infrastructure and economic activities. At the provincial level, the ratio of the largest to smallest per capita GDP has been very high at around 15–16 over the last decade, whether the mining sector is included or not (Tables 3, 4). The largest per capita GDP was registered by the capital province of Jakarta. When mining is included, Jakarta is followed by East Kalimantan, Riau Islands,[3] West Papua[4] and Riau in 2013 (Table 3). When mining is excluded, Riau Islands moved to the second position, which is followed by East Kalimantan, West Papua and East Java (Table 4). On the other hand, whether mining is included or not, East Nusa Tenggara registered the smallest in 2013, followed by the provinces of Maluku and North Maluku.[5] These provinces are, in fact, all in Eastern Indonesia. In order to reduce interregional inequalities in welfare levels and to cope with periodic secessionist movements, Indonesia embarked on political, administrative and fiscal decentralization in 2001; but, its effects on interregional inequalities remain uncertain.

Against this background, this study attempts to explore the determinants of interprovincial inequality in per capita GDP in a decentralized Indonesia from 2005 to 2013 by using a bi-dimensional inequality decomposition method. Particularly, it tries to analyze how economic tertiarization and concurrent deindustrialization have affected interprovincial inequality. The bi-dimensional inequality decomposition method decomposes interprovincial inequality in per capita GDP, as measured by the population-weighted coefficient

[3] The province of Riau Islands was established in 2002 by being split off from Riau and includes Batam and Bintan islands, which are located close to Singapore. Due to its large-scale non-oil and gas manufacturing activities, the manufacturing sector accounted for about half of its total GDP in 2013.

[4] Due to the development of a large-scale LNG (liquid natural gas) plant, West Papua (formerly West Irian Jaya) increased its GDP share substantially, though the share was still very small at 0.9% in 2013 (Table 2). The manufacturing sector, including LNG, accounted for almost half of West Papua's GDP. We should note that West Papua's population is less than 1 million, the second least populous province in Indonesia next to North Kalimantan, the youngest province established in 2012. Despite its very high per capita GDP, the province registered the highest incidence of poverty in Indonesia at around 20%, indicating the presence of natural resource enclaves.

[5] The two Nusa Tenggara provinces (East and West) have been the poorest provinces in Indonesia, in which about 15% of their population lived below the national poverty line in 2013. We should note, however, that unemployment rate is very low in East Nusa Tenggara at less than two-thirds of the national rate, indicating a high level of informality in employment. Meanwhile, North Maluku, which was separated from Maluku as a new province in 1999 and one of the least populous provinces in Indonesia, is a peculiar province; though the province registers the third lowest per capita GDP, its incidence of poverty is relatively low.

Table 3 Average annual growth rate of per capita GDP including mining: 05-09 and 09-13. *Source*: Central Bureau of Statistics (various issues), Gross Regional Domestic Product of Provinces in Indonesia by Industry

Code	Province	Per capita GDP						Growth rate of per capita GDP			
		2005		2009		2013		05-09		09-13	
		Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank
	Sumatra										
11	Aceh	9180	5	7427	17	7955	19	−5.3	33	1.7	27
12	North Sumatera	7593	9	8505	10	10,598	7	2.8	26	5.5	7
13	West Sumatera	6523	14	7750	15	9402	13	4.3	14	4.8	10
14	Riau	17,388	4	17,690	4	18,099	5	0.4	30	0.6	30
15	Jambi	4853	23	5798	23	6746	24	4.4	13	3.8	18
16	South Sumatera	7426	10	8498	11	9918	8	3.4	21	3.9	17
17	Bengkulu	4080	27	4766	27	5598	27	3.9	18	4.0	15
18	Lampung	4170	25	4887	26	5906	26	4.0	15	4.7	11
19	Bangka Belitung	8392	7	9075	6	9875	10	2.0	28	2.1	24
21	Riau Islands	23,898	3	25,330	3	26,729	3	1.5	29	1.3	28
	Kalimantan										
61	West Kalimantan	5834	19	6675	19	7162	21	3.4	22	1.8	26
62	Central Kalimantan	7393	11	8538	9	9737	11	3.6	20	3.3	20
63	South Kalimantan	7142	13	8336	13	9421	12	3.9	19	3.1	22
64	East Kalimantan	33,102	2	33,396	2	31,559	2	0.2	31	−1.4	33
	Java-Bali										
31	Jakarta	34,333	1	41,400	1	49,241	1	4.7	11	4.3	14
32	West Java	6280	16	7350	18	8583	16	3.9	16	3.9	16
33	Central Java	4516	24	5416	24	6759	23	4.5	12	5.5	6
34	Yogyakarta	5189	21	5864	22	6993	22	3.1	25	4.4	13
35	East Java	7160	12	8673	7	11,015	6	4.8	10	6.0	3
36	Banten	6490	15	8585	8	9308	14	7.0	1	2.0	25
51	Bali	6257	17	7710	16	8605	15	5.2	9	2.7	23
	Sulawesi										
71	North Sulawesi	6129	18	7848	14	9884	9	6.2	3	5.8	5
72	Central Sulawesi	5195	20	6618	20	8347	17	6.1	4	5.8	4
73	South Sulawesi	4870	22	6011	21	7742	20	5.3	8	6.3	2
74	S.E. Sulawesi	4100	26	5091	25	6285	25	5.4	7	5.3	8
75	Gorontalo	2261	33	2815	32	3394	30	5.5	6	4.7	12
76	West Sulawesi	3120	29	4056	29	4960	28	6.6	2	5.0	9
	Eastern Indonesia										
52	West Nusa Teng.	3674	28	4295	28	4383	29	3.9	17	0.5	31
53	East Nusa Teng.	2423	32	2682	33	3101	33	2.5	27	3.6	19
81	Maluku	2638	30	3012	30	3167	32	3.3	23	1.3	29
82	North Maluku	2568	31	2919	31	3320	31	3.2	24	3.2	21

Table 3 (continued)

Code	Province	Per capita GDP						Growth rate of per capita GDP			
		2005		2009		2013		05-09		09-13	
		Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank
91	West Papua	7761	8	9854	5	18,252	4	6.0	5	15.4	1
94	Papua	9125	6	8444	12	8157	18	− 1.9	32	− 0.9	32
	Total	7831		9125		10,805		3.8		4.2	
	Ratio Max/Min	15.2		15.4		15.9					

of variation (hereafter, *WCV*), in two dimensions, i.e., by regional groups and GDP components (industrial sectors). The *WCV* satisfies several desirable properties as a measure of inequality, such as anonymity, income homogeneity, population homogeneity and the Pigou-Dalton transfer principle (Anand 1983). Furthermore, it is decomposable by factor components (Shorrocks 1982). Since the squared *WCV* belongs to the population-weighted generalized entropy class of inequality measures, it is also decomposable by population sub-groups (Shorrocks 1980). Therefore, the bi-dimensional inequality decomposition method can examine the contributions of GDP components (industrial sectors) to within-region and between-region inequalities in a coherent framework.[6]

2 Literature Review

Numerous studies have been performed to analyze regional development dynamics and interregional inequalities in Indonesia. Among the recent studies that have examined the determinants of interregional inequalities using regional GDP data are Akita and Lukman (1995), Garcia and Soelistianingsih (1998), Tadjoeddin et al. (2001), Akita and Alisjahbana (2002), Akita (2003), Milanovic (2005), Resosudarmo and Vidyattama (2006), Hill (2008), Hill et al. (2008), Akita and Miyata (2010), Vidyattama (2010), Akita et al. (2011), Vidyattama (2013), Hill and Vidyattama (2014), and Hill and Vidyattama (2016).

Based on provincial GDP data from 1975 to 1992, Akita and Lukman (1995) conducted an inequality decomposition analysis by GDP components (i.e., industrial sectors) using the *WCV* to explore the determinants of inter-provincial inequality. Hill et al. (2008) and Hill and Vidyattama (2016) used updated data sets of provincial GDP, respectively, for the periods from 1970–2004 and 1975–2010, to analyze inter-provincial inequality in per capita GDP with the *WCV*. Meanwhile, Garcia and Soelistianingsih (1998) examined the absolute and conditional β-convergence among provinces using provincial GDP for the period from 1975 to 1993.[7] Hill et al. (2008) updated the provincial data set to analyze β-convergence for the period 1975–2002, while Vidyattama (2013) examined whether the spatial neighborhood effect is significant in β-convergence using provincial and district-level GDP data from 1999 to 2008.

[6] The detailed account of the method is given in Sect. 3.

[7] Barro and Sala-i-Martin (1991) advanced the method for β-convergence analysis among countries and regions, which is described in detail in Sect. 3.

Table 4 Average annual growth rate of per capita GDP excluding mining: 05-09 and 09-13. *Source*: Central Bureau of Statistics (various issues), Gross Regional Domestic Product of Provinces in Indonesia by Industry

Code	Province	Per capita GDP						Growth rate of per capita GDP			
		2005		2009		2013		05-09		09-13	
		Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank
	Sumatra										
11	Aceh	6790	9	6785	15	7429	18	0.0	32	2.3	28
12	North Sumatera	7501	5	8406	7	10,480	6	2.8	28	5.5	7
13	West Sumatera	6314	11	7515	12	9139	10	4.4	17	4.9	10
14	Riau	7767	4	8854	4	10,209	7	3.3	24	3.6	21
15	Jambi	4248	23	5136	23	5907	23	4.7	11	3.5	22
16	South Sumatera	5457	18	6582	16	8019	15	4.7	14	4.9	9
17	Bengkulu	3952	25	4594	26	5411	27	3.8	21	4.1	17
18	Lampung	4044	24	4789	25	5789	24	4.2	18	4.7	11
19	Bangka Belitung	6946	7	7748	10	8665	11	2.7	29	2.8	25
21	Riau Islands	22,246	2	23,954	2	25,474	2	1.8	31	1.5	31
	Kalimantan										
61	West Kalimantan	5764	16	6561	17	7025	20	3.2	25	1.7	30
62	C. Kalimantan	6909	8	7758	9	8623	12	2.9	27	2.6	27
63	S. Kalimantan	5603	17	6525	18	7469	17	3.8	20	3.4	23
64	East Kalimantan	20,492	3	19,984	3	18,322	3	−0.6	33	−2.2	33
	Java-Bali										
31	Jakarta	34,229	1	41,299	1	49,144	1	4.7	13	4.3	15
32	West Java	6096	14	7171	14	8439	14	4.1	19	4.1	18
33	Central Java	4470	21	5356	22	6684	22	4.5	15	5.5	6
34	Yogyakarta	5152	19	5824	20	6946	21	3.1	26	4.4	14
35	East Java	7020	6	8482	6	10,789	5	4.7	12	6.0	4
36	Banten	6483	10	8575	5	9299	9	7.0	2	2.0	29
51	Bali	6217	12	7665	11	8541	13	5.2	10	2.7	26
	Sulawesi										
71	North Sulawesi	5816	15	7445	13	9415	8	6.2	5	5.9	5
72	Central Sulawesi	5088	20	6378	19	7672	16	5.6	7	4.6	13
73	South Sulawesi	4384	22	5524	21	7180	19	5.8	6	6.6	3
74	S.E. Sulawesi	3866	26	4831	24	5702	25	5.6	8	4.1	16
75	Gorontalo	2241	33	2785	32	3358	30	5.4	9	4.7	12
76	West Sulawesi	3103	28	4014	28	4910	28	6.4	4	5.0	8
	Eastern Indonesia										
52	West Nusa Teng.	2667	29	3189	29	3713	29	4.5	16	3.8	19
53	East Nusa Teng.	2391	32	2649	33	3061	33	2.6	30	3.6	20
81	Maluku	2616	30	2991	30	3143	32	3.3	23	1.2	32
82	North Maluku	2447	31	2799	31	3199	31	3.4	22	3.3	24

Table 4 (continued)

Code	Province	Per capita GDP						Growth rate of per capita GDP			
		2005		2009		2013		05-09		09-13	
		Value	Rank	Value	Rank	Value	Rank	Value	Rank	Value	Rank
91	West Papua	6160	13	8377	8	16,777	4	7.7	1	17.4	1
94	Papua	3244	27	4264	27	5555	26	6.8	3	6.6	2
	Total	7111		8414		10,086		4.2		4.5	
	Ratio Max/Min	15.3		15.6		16.1					

Tadjoeddin et al. (2001) and Akita and Alisjahbana (2002) estimated regional income inequality for the period from 1993 to 1998; but they used district-level GDP data.[8] While Tadjoeddin et al. (2001) measured regional inequality using the Gini coefficient, Theil indices and the *WCV*, Akita and Alisjahbana (2002) conducted a two-stage inequality decomposition analysis using the Theil indices to investigate the determinants of regional inequality in per capita GDP across districts. As discussed above, Vidyattama (2013) also used district-level GDP data, but the study focused on an analysis of β-convergence across districts for 1999–2008.

Akita et al. (2011) conducted a bi-dimensional inequality decomposition analysis using provincial GDP data from 1983 to 2004 to explore the determinants of interprovincial inequality in per capita GDP. Our study is similar to Akita et al. (2011) in terms of the method. But it updates their study and analyzes interprovincial inequality from 2005 to 2013. Our study also differs from theirs in that it uses GDP data by 33 industrial sectors, while their study used GDP data by 9 industrial sectors. Since these 33 sectors include 3 manufacturing subsectors and 18 tertiary subsectors, our study could analyze, in more detail, how economic tertiarization and concurrent deindustrialization have affected the determinants of interprovincial inequality (see Table 12 in "Appendix" for the sector classification).[9]

3 Methods and the Data

3.1 Methods

3.1.1 Analysis of β Convergence Across Provinces

Since provinces in Indonesia have similar preferences, savings rates, technologies and institutions, they have similar steady states. Thus, they are likely to converge in the absolute sense; that is, poor provinces tend to grow faster than rich provinces. To examine whether

[8] Districts here refer to regencies (*kabupaten*) and cities (*kota*). Since the two decentralization laws (Law 22/1999 on regional government and Law 25/1999 on fiscal decentralization) were implemented in 2001, a number of new districts have been created by being split off from existing districts. In 2001, there were around 350 districts; but since then the number of districts has increased substantially and now there were more than 500 districts.

[9] Tertiary subsectors are sectors from 16 to 33 in Table 12.

Indonesian provinces have converged in per capita GDP in the absolute sense over the study period, we conduct an analysis of β convergence by using the following non-linear regression equation (Barro and Sala-i-Martin 1991).

$$\left(\frac{1}{T}\right)\ln\left(\frac{y_{iT}}{y_{i0}}\right) = a - \frac{1-e^{-\beta T}}{T}\ln\left(y_{i0}\right) + u_i \tag{1}$$

where y_{i0}, y_{iT}, β and u_i are, respectively, per capita GDP of province i in the initial year, per capita GDP of province i in the terminal year, speed of convergence and error term. $\left(\frac{1}{T}\right)\ln\left(\frac{y_{iT}}{y_{i0}}\right)$ in Eq. (1) is the average annual growth rate of per capita GDP between 0 and T. If there is absolute convergence among the provinces, $b = -\frac{1-e^{-\beta T}}{T}$ should have a negative sign.

3.1.2 Bi-dimensional Decomposition of Interprovincial Inequality by the Squared Population-Weighted Coefficient of Variation

To analyze the effects of the changes in industrial and spatial structures on interprovincial inequality, we conduct a bi-dimensional decomposition analysis using the squared population-weighted coefficient of variation (squared *WCV*). Suppose that a country consists of m regions and region i is composed of n_i provinces. Then, interprovincial inequality in per capita GDP can be measured by the following squared *WCV*.

$$CV^2 = \frac{1}{y^2}\sum_{i=1}^{m}\sum_{j=1}^{n_i}\frac{p_{ij}}{p}\left(y_{ij}-y\right)^2 \tag{2}$$

where y_{ij}, p_{ij}, y and p are, respectively, per capita GDP of province j in region i, population of province j in region i, per capita GDP of a country and total population of a country. Interprovincial inequality in per capita GDP can also be measured by the population-weighted generalized entropy class of measures (hereafter referred to as *WGE*) as follows.

$$\left.\begin{aligned} WGE_\alpha &= \frac{1}{\alpha(\alpha-1)}\sum_{i=1}^{m}\sum_{j=1}^{n_i}\frac{p_{ij}}{p}\left[\left(\frac{y_{ij}}{y}\right)^\alpha - 1\right] \quad \text{when } \alpha \neq 0, 1 \\ WGE_0 &= \sum_{i=1}^{m}\sum_{j=1}^{n_i}\left(\frac{p_{ij}}{p}\right)\ln\left(\frac{y}{y_{ij}}\right) \\ WGE_1 &= \sum_{i=1}^{m}\sum_{j=1}^{n_i}\left(\frac{p_{ij}}{p}\right)\left(\frac{y_{ij}}{y}\right)\ln\left(\frac{y_{ij}}{y}\right) \end{aligned}\right\} \tag{3}$$

WGE_0 and WGE_1 are usually called the Theil indices L and T, respectively.

When $\alpha = 2$, we have

$$WGE_2 = \frac{1}{2}\sum_{i=1}^{m}\sum_{j=1}^{n_i}\frac{p_{ij}}{p}\left[\left(\frac{y_{ij}}{y}\right)^2 - 1\right] = \frac{1}{2y^2}\sum_{i=1}^{m}\sum_{j=1}^{n_i}\frac{p_{ij}}{p}\left(y_{ij}-y\right)^2 \tag{4}$$

From Eqs. (2) and (4), we have $WGE_2 = \frac{1}{2}CV^2$. In other words, squared *WCV* belongs to *WGE*. *WGE* can be decomposed additively into the within- and between-region

inequality components; thus, squared *WCV* can be written as follows (Shorrocks 1980; Anand 1983).[10]

$$CV^2 = CV_W + CV_B. \tag{5}$$

$CV_W = \sum_{i=1}^{m} \left(\frac{p_i}{p}\right)\left(\frac{y_i}{y}\right)^2 CV_i^2$ is the within-region inequality component, while $CV_B = \frac{1}{y^2}\sum_{i=1}^{m} \frac{p_i}{p}\left(y_i - y\right)^2$ is the between-region inequality component, where p_i, y_i and CV_i^2 are, respectively, total population of region i, per capita GDP of region i and squared *WCV* among provinces in region i. It should be noted that CV_W is not a weighted average of CV_i^2, since the weights do not sum to unity.

We suppose next that total provincial GDP is composed of K GDP components (industrial sectors). Since squared *WCV* can also be decomposed additively by GDP components, region i's within-region inequality can be expressed as follows (Shorrocks 1982).

$$CV_i^2 = \sum_{k=1}^{K} w_{ik} COV_{ik}. \tag{6}$$

$COV_{ik} = \frac{1}{y_i y_{ik}} \sum_{j=1}^{h_i} \frac{p_{ij}}{p_i}\left(y_{ij} - y_i\right)\left(y_{ijk} - y_{ik}\right)$ is the population-weighted coefficient of covariation (hereafter referred to as *WCOV*) between total per capita GDP and per capita GDP from component k in region i, where w_{ik}, y_{ik} and y_{ijk} are, respectively, GDP share of component k in region i, per capita GDP from component k in region i and per capita GDP from component k in province j and region i.

Similarly, the between-region inequality can be decomposed additively by GDP components as follows.

$$CV_B = \sum_{k=1}^{K} w_k COV_k. \tag{7}$$

$COV_k = \frac{1}{(y)(y_{\cdot k})} \sum_{i=1}^{m} \frac{p_i}{p}\left(y_i - y\right)\left(y_{ik} - y_{\cdot k}\right)$ is *WCOV* between total per capita GDP and per capita GDP from component k, where w_k and $y_{\cdot k}$ are, respectively, GDP share of component k and per capita GDP from component k in a country.

Substituting Eqs. (6) and (7) into Eq. (5), we obtain the following bi-dimensional decomposition equation:

$$CV^2 = \sum_{i=1}^{m} \left(\frac{p_i}{p}\right)\left(\frac{y_i}{y}\right)^2 \sum_{k=1}^{K} w_{ik} COV_{ik} + \sum_{k=1}^{K} w_k COV_k \tag{8}$$

If we divide this equation by CV^2, we have

$$1 = \sum_{i=1}^{m} \left(\frac{p_i}{p}\right)\left(\frac{y_i}{y}\right)^2 \sum_{k=1}^{K} w_{ik} s_{ik} + \sum_{k=1}^{K} w_k s_k = \sum_{i=1}^{m}\sum_{k=1}^{K} c_{ik} + \sum_{k=1}^{K} c_k$$

where $s_{ik} = \frac{COV_{ik}}{CV^2}$ and $s_k = \frac{COV_k}{CV^2}$. $c_{ik} = \left(\frac{p_i}{p}\right)\left(\frac{y_i}{y}\right)^2 w_{ik} s_{ik}$ is the contribution of region i's within-region inequality for component k to overall interprovincial inequality, while

[10] Similarly, WGE_0 (Theil index L) and WGE_1 (Theil index T) can be decomposed additively into the within- and between-region inequality components: $L = L_W + L_B$ and $T = T_W + T_B$.

$c_k = w_k s_k$ is the contribution of between-region inequality for component k to overall interprovincial inequality. If there are 3 regions and 9 industrial sectors, then including components for the between-region inequality, there are $(3+1)\times 9 = 36$ components in Eq. (8).

By dividing Eq. (6) by CV_i^2, we have

$$1 = \sum_{k=1}^{K} w_{ik} r_{ik}. \tag{9}$$

where $r_{ik} = \frac{COV_{ik}}{CV_i^2}$ is called the relative concentration coefficient of GDP component k in the within-region inequality of region i. If r_{ik} is greater (smaller) than one, then GDP component k is an inequality-increasing (decreasing) component in region i. In other words, if GDP component k was eliminated, the within-region inequality of region i would have been smaller (larger). Similarly, by dividing Eq. (7) by CV_B, we have

$$1 = \sum_{k=1}^{K} w_k r_k \tag{10}$$

where $r_k = \frac{COV_k}{CV_B}$ is the relative concentration coefficient of GDP component k in the between-region inequality.

It should be noted that squared *WCV* can be decomposed also into the *WCV* and *WCOV* terms as follows.

$$CV^2 = \sum_{k=1}^{K} \left(w_k^2 CV_k^2 + \sum_{h \neq k} w_k w_h COV_{kh} \right) \tag{11}$$

where CV_k^2 and COV_{kh} are, respectively, *WCV* for GDP component K and *WCOV* between GDP components k and h. When an economy consists of 3 industrial sectors, Eq. (11) can be written as follows (Akita and Lukman 1995).

$$CV^2 = w_1^2 CV_1^2 + w_2^2 CV_2^2 + w_3^2 CV_3^2 + 2w_1 w_2 COV_{12} + 2w_1 w_3 COV_{13} + 2w_2 w_3 COV_{23}$$

3.2 The Data

Interprovincial inequality is measured by using provincial GDP at constant 2000 prices for the period from 2005 to 2013. The data set is constructed based on various issues of *Gross Regional Domestic Product of Provinces in Indonesia by Industrial Origin* published by the Central Bureau of Statistics (CBS, various issues). It contains provincial GDP by 33 industrial sectors for 33 provinces (see Table 12 in "Appendix" for the sector classification). To conduct a bi-dimensional decomposition analysis, 33 industrial sectors are classified into the 9 sectors: (1) agriculture; (2) mining; (3) manufacturing; (4) electricity, gas and water; (5) construction; (6) trade, hotel and restaurant; (7) transportation and communication; (8) financial and business services and (9) other services. On the other hand, 33 provinces are grouped into the 3 regions: Region 1 includes Sumatra and Kalimantan; Region 2 includes Java and Bali; and Region 3 consists of Sulawesi and Eastern Indonesia (see Table 2).

Natural resources are unevenly distributed, and even under the law on fiscal decentralization implemented in 2001 and revised in 2004, not all the benefits from resource-based

activities have accrued to provincial economies.[11] As in most previous studies, therefore, interprovincial inequality is calculated including and excluding mining. Since Jakarta, as the center of economic activities, accounts for 18% of total GDP and its per capita GDP is more than 4.5 times the national average, the inclusion of Jakarta as a separate province will affect interprovincial inequality substantially; thus, interprovincial inequality is measured also by merging Jakarta with West Java presumptively.

4 Empirical Results

4.1 Levels and Trends of Interprovincial Inequalities

Figure 3 presents interprovincial inequality in per capita GDP at constant 2000 prices for the period from 1983 to 2013 as measured by the squared *WCV*, where interprovincial inequality for 1983–2004 is obtained from Akita, Kurniawan and Miyata (2011).[12] When mining is included, there was a clear declining trend over the period. But the declining speed has been getting smaller. The squared *WCV* was 1.16 in 1983, but it declined prominently to 0.86 in 1989. Interprovincial inequality became stable for the period from 1989 to 1997, at around 0.83–0.85 by the squared *WCV*. Indonesia faced the severe financial crisis between 1997 and 1999, during which interprovincial inequality fell sharply to 0.76. After the financial crisis, however, interprovincial inequality became stable again; the squared *WCV* was around 0.75 between 1999 and 2004.

For the study period from 2005 to 2013, interprovincial inequality exhibited a slight declining trend; the squared *WCV* decreased from 0.74 to 0.67. To examine whether there was a β convergence across 33 provinces for the period, a β convergence analysis is performed using Eq. (1). Since there are differences between the Java-Bali region and the other regions in terms of preference, technology, savings rate and institution, a dummy variable is introduced in the regression Eq. (1 for Java-Bali provinces; 0 for the other provinces). The result is presented in Table 5. The coefficient of the log initial per capita GDP is statistically significant at the 5% level and has a negative sign, implying a conditional β convergence across provinces rather than an absolute β convergence over the study period. That is, provinces with smaller initial per capita GDP tended to grow faster than districts with larger per capita GDP after controlling for differences between the Java-Bali region and the other regions. However, if the period is divided into two subperiods, 2005–2009 and 2009–2013, conditional β convergence occurred in the first subperiod (2005–2009) and there was no significant β convergence in the second subperiod (2009–2013). In the first sub-period, the speed of convergence was 1.4% a year, implying that it takes almost

[11] Under fiscal decentralization, revenues generated by natural resources must be shared between the central government and regional governments. Provinces and districts are entitled to receive 15.5% of oil revenue, 30.5% of gas revenue, and 80% of revenues from other natural resources (i.e., forestry, fishery, general mining and geothermal energy); with a few exceptions, of the amount allocated to the producing regions, 20% goes to the province, 40% to the producing districts, and the remaining 40% is shared equally among the non-producing districts in the province (Bahl and Tumennasan 2004; Brodjonegoro and Martinez-Vazquez 2005; Soesastro and Atje 2005). It should be noted, however, that the special autonomous provinces of Aceh, West Papua and Papua receive 70% of their oil and gas revenues (Brodjonegoro and Martinez-Vazquez 2005; Agustina et al. 2012).

[12] It should be noted that interprovincial inequality for 1983-2004 is measured across 26 provinces, while for 2005-2013, across 33 provinces.

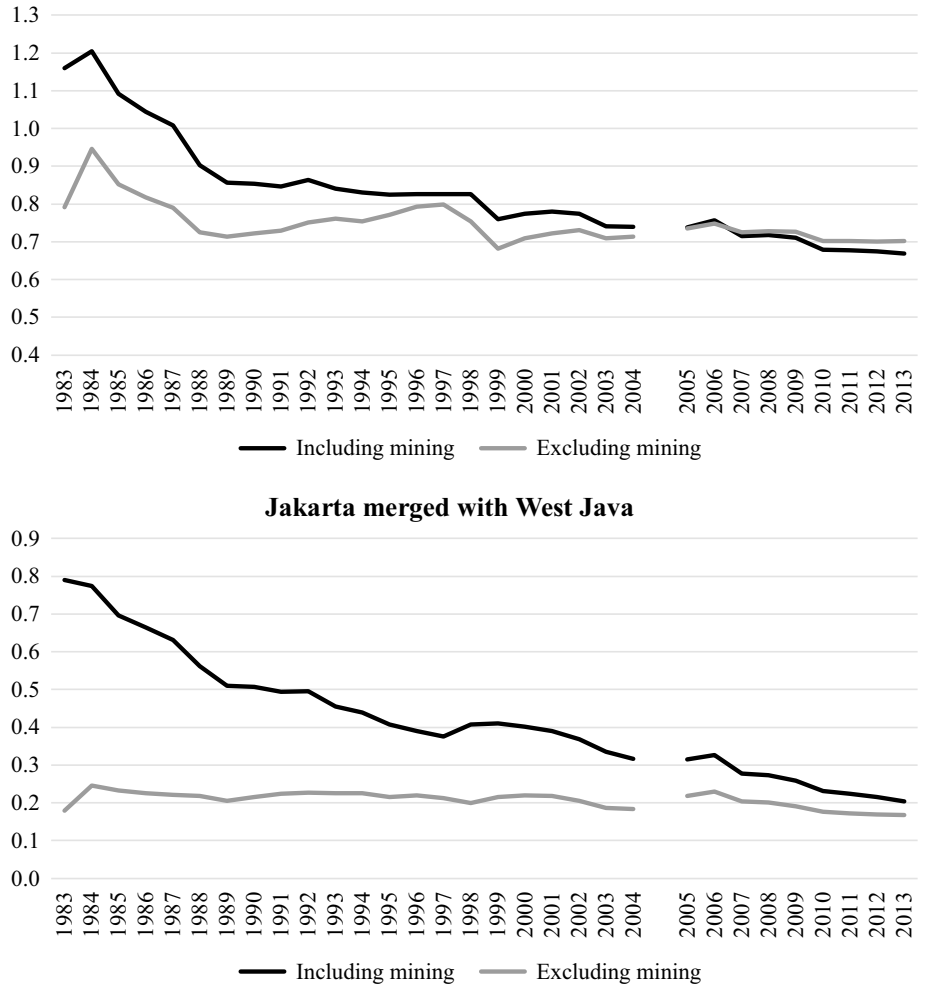

Fig. 3 Inter-provincial Inequality in Per Capita GDP at Constant 2000 Prices by squared *WCV*. Note: Inter-provincial inequality for 1983–2004 is across 26 provinces, while for 2004–2013, it is across 33 provinces. *Sources*: Akita et al. (2011) for 1983–2004; Central Bureau of Statistics (various issues), *Gross Regional Domestic Product of Provinces in Indonesia by Industrial Origin* for 2005–2013

50 years for the difference between the current and steady state levels of per capita GDP to reduce by half.

Despite a declining trend, interprovincial inequality is still very high. In 2013, the ratio of the largest to smallest per capita GDP (Jakarta/East Nusa Tenggara) was very high at 15.9, and Jakarta's per capita GDP was 4.6 times the national average and 1.6 times the second largest (East Kalimantan) (see Table 3). These observations suggest that Jakarta is an outlier. If Jakarta is presumptively merged with the adjacent province of West Java and interprovincial inequality is measured among 32 provinces, the squared *WCV* is reduced substantially. According to Fig. 3, the squared *WCV* was 0.79 in 1983, but has declined gradually to 0.20 in 2013. These inequality values are much smaller than the values among 33 provinces. Over the study period from 2005 to 2013, a statistically significant

Table 5 Convergence across provinces. *Source*: Central Bureau of Statistics (various issues), Gross Regional Domestic Product of Provinces in Indonesia by Industry

Explanatory variables	2005–2013		2005–2009		2009–2013	
	Coefficient	t-value	Coefficient	t-value	Coefficient	t-value
Log per capita GDP in 2005	−0.0133**	−2.22	−0.0159**	−2.65		
Log per capita GDP in 2009					−0.0080	−0.97
Java-Bali (dummy)	0.0129	1.35	0.0187*	1.95	0.0070	0.55
Constant	0.0585***	5.03	0.1709***	3.26	0.1076	1.46
Speed of convergence	0.0141		0.0164		0.0082	
Number of observations	33		33		33	
R squared	0.1670		0.2411		0.0346	

***Significant at the 1% level; ** significant at the 5% level; * significant at the 10% level

β convergence is observed also across 32 provinces. The speed of convergence at 1.7% is, however, faster than that among 33 provinces. Among the 32 provinces, East Kalimantan had the highest per capita GDP, which was 10.2 times the smallest in 2013 (Table 3). The per capita GDP of West Java, which now includes Jakarta, was only 1.5 times the national average.

As in the previous studies, interprovincial inequality among 33 provinces is measured by excluding mining. The squared *WCV* has been smaller than that including mining, but this was until 2006. The difference in the squared *WCV* has been getting smaller; in 1983, it was 0.37, but declined to 0.01 in 2006. Since 2007, the squared *WCV* with mining excluded has been larger than that with mining included. Natural resources are distributed very unevenly, thus interprovincial inequality in per capita GDP from mining is very high. However, as the GDP share of mining has decreased gradually (see Table 1), its contribution to total interprovincial inequality has been getting smaller. This has apparently reduced the difference.

Like in the case where mining is included, if Jakarta is merged with West Java hypothetically, the level of interprovincial inequality is decreased substantially. Over the period from 1983 to 2013, the squared *WCV* has been very stable, ranging between 0.17 and 0.24, though there was a slight declining trend from 2005. In 2013, Riau Islands, which includes Batam and Bintan islands, now had the largest per capita GDP (see footnote 3, for the economy of Riau Islands), which is followed next by East Kalimantan and West Java (see Table 4). The largest to smallest per capita GDP (Riau Islands/East Nusa Tenggara) was 8.3 in 2013.

4.2 Interprovincial Inequalities by Industrial Sectors

As discussed above, whether mining is included or not, interprovincial inequality has been declining gradually over the period from 2005 to 2013. But, it is still high, even if Jakarta is merged with West Java hypothetically. To explore the determinants of interprovincial inequality, we calculate interprovincial inequality by industrial sector for each region by the *WCV*. The result is presented in Table 6, while the change in industrial structure by region is shown in Table 7. Whether mining is included or not, Region 2 (Java-Bali) had the largest interprovincial inequality at 0.9 by the *WCV*. When mining is included, Region 1 (Sumatra and Kalimantan) had the second largest inequality, since it includes two major

Table 6 Interprovincial inequality by industrial sector measured by *WCV. Source*: Central Bureau of Statistics (various issues), Gross Regional Domestic Product of Provinces in Indonesia by Industry

	1	2	3	4	5	6	7	8	9	Total	
										Including mining	Excluding mining
Indonesia											
2005	0.43	2.85	0.93	0.77	1.48	0.87	1.02	2.96	1.12	0.86	0.86
2009	0.42	2.88	0.83	0.76	1.48	0.86	1.21	2.78	1.10	0.84	0.85
2013	0.45	2.81	0.74	0.71	1.41	0.81	1.30	2.56	1.10	0.82	0.84
Indonesia (Jakarta merged with West Java)											
2005	0.42	2.85	0.89	0.76	0.57	0.48	0.47	1.12	0.42	0.56	0.47
2009	0.40	2.88	0.79	0.73	0.58	0.47	0.48	1.02	0.39	0.51	0.44
2013	0.43	2.81	0.70	0.70	0.59	0.48	0.50	0.93	0.39	0.45	0.41
Region 1											
2005	0.23	1.71	1.44	0.53	0.42	0.56	0.53	0.55	0.34	0.73	0.57
2009	0.20	1.80	1.32	0.55	0.45	0.53	0.51	0.51	0.32	0.67	0.50
2013	0.18	1.73	1.17	0.51	0.54	0.50	0.49	0.52	0.32	0.57	0.42
Region 2											
2005	0.33	0.55	0.48	0.55	1.75	0.84	1.21	2.73	1.31	0.90	0.91
2009	0.33	0.51	0.46	0.55	1.80	0.82	1.42	2.63	1.30	0.90	0.91
2013	0.35	0.52	0.39	0.50	1.69	0.77	1.48	2.50	1.30	0.89	0.90
Region 2 (Jakarta merged with West Java)											
2005	0.25	0.52	0.37	0.53	0.58	0.32	0.40	0.94	0.44	0.35	0.35
2009	0.24	0.49	0.38	0.52	0.60	0.32	0.43	0.88	0.40	0.34	0.34
2013	0.28	0.51	0.31	0.47	0.58	0.32	0.46	0.82	0.39	0.32	0.32
Region 3											
2005	0.32	1.84	0.73	0.59	0.73	0.27	0.44	0.47	0.33	0.41	0.31
2009	0.35	1.49	0.81	0.63	0.72	0.32	0.48	0.43	0.33	0.37	0.35
2013	0.37	1.07	1.91	0.65	0.71	0.37	0.50	0.53	0.39	0.46	0.46

1 agriculture, *2* mining, *3* manufacturing, *4* electricity/gas/water, *5* construction, *6* trade/hotel/restaurant, *7* transportation/communication, *8* financial and business services, and *9* other services

resource-rich provinces, Riau and East Kalimantan.[13] As the GDP share of mining has declined, however, Region 1's interprovincial inequality has been getting smaller. When mining is excluded, Region 3 (Sulawesi and Eastern Indonesia) had the second largest interprovincial inequality in 2013. It should be noted that Region 1 reduced its interprovincial inequality over the period even if mining is excluded.

In Indonesia as a whole, mining had the largest interprovincial inequality among 9 industrial sectors in 2013, and this was followed by financial and business services and construction. On the other hand, the smallest was registered by agriculture, followed by the electricity, gas and water sector and manufacturing. Each region, however, shows a distinct pattern of interprovincial inequalities. In Region 1, the mining sector had the largest interprovincial inequality, reflecting very uneven spatial distribution of natural resources within

[13] In Riau and East Kalimantan, mining contributed more than 40% of their GDP and these two provinces accounted for 70% of Region 1's GDP from mining in 2013.

Table 7 Change in Industrial Structure by Region (in %). *Source*: Central Bureau of Statistics (various issues), Gross Regional Domestic Product of Provinces in Indonesia by Industry

			Secondary				Tertiary					Total
	1	2	3	4	5	Sub-total	6	7	8	9	Sub-total	
Region 1												
2005	20.1	22.2	21.7	0.5	4.5	26.7	13.9	5.8	3.6	7.8	31.0	100
2009	20.0	19.6	19.8	0.5	5.4	25.7	14.9	6.8	4.4	8.7	34.8	100
2013	19.3	17.8	17.8	0.5	5.7	24.0	16.3	7.8	5.3	9.4	38.8	100
Region 2												
2005	11.7	1.4	29.3	1.6	5.5	36.3	22.5	6.1	11.6	10.3	50.5	100
2009	10.7	1.3	28.7	1.4	5.6	35.8	23.1	7.4	11.2	10.5	52.1	100
2013	9.1	1.1	26.9	1.4	6.0	34.3	25.0	8.9	11.0	10.6	55.5	100
Region 3												
2005	29.3	18.7	7.8	0.6	6.3	14.7	12.9	7.1	4.3	13.0	37.3	100
2009	27.7	14.1	8.2	0.6	7.5	16.3	14.3	8.3	5.3	13.9	41.8	100
2013	25.2	9.9	10.6	0.7	8.3	19.6	15.9	9.0	6.3	14.1	45.4	100

1 agriculture, *2* mining, *3* manufacturing, *4* electricity/gas/water, *5* construction, *6* trade/hotel/restaurant, *7* transportation/communication, *8* financial and business services, and *9* other services

the region, and it was followed by manufacturing and construction. Despite a declining trend, the manufacturing sector had a high interprovincial inequality in the region, indicating that manufacturing activities, mainly resource-based activities, have been developed very unevenly across provinces. The agricultural sector, on the other hand, had a very small interprovincial inequality and exhibited a slight declining trend.

In Region 2, financial and business services had the largest interprovincial inequality, which was followed by construction and the transportation and communication sector. Particularly, the financial and business services sector had a very large interprovincial inequality, though it exhibited a declining trend. When Jakarta is merged with West Java, however, the sector's inequality drops substantially. This implies that there is a very large disparity between Jakarta and the other Java-Bali provinces in financial and business activities. Though inequalities are smaller, construction and the transportation and communication sector also reduce their inequalities when Jakarta is merged with West Java. These observations imply that Region 2's very high interprovincial inequality is due mainly to a very high disparity in construction and tertiary activities between Jakarta and the other Java-Bali provinces. We should note here that in Jakarta, the tertiary sector accounted for three quarters of its total GDP in 2013, which is compared to 47% in the other Java-Bali provinces. This means that about 40% of Region 2's GDP from the tertiary sector is generated by Jakarta.[14] When Jakarta is merged with West Java, Region 2's interprovincial inequality drops conspicuously from 0.9 to a little above 0.3 by the *WCV*, and in 2013, Region 2 had the smallest interprovincial inequality among three regions whether mining is included or not.

In Region 3, the mining sector had the largest interprovincial inequality in 2005, which is followed by manufacturing and construction. But, it lowered its inequality substantially over the study period. On the other hand, due mainly to the rapid development of liquid natural gas (LNG) in West Papua, the manufacturing sector raised its interprovincial

[14] Jakarta accounted for 70% of Region 2's GDP from the financial and business services sector. It also constituted 60% of Region 2's GDP from the information and communication sector.

inequality and surpassed mining (see footnote 4, for the economy of West Papua). In 2013, it had the largest interprovincial inequality.

4.3 Bi-dimensional Decomposition Analysis

To explore the determinants of interprovincial inequality in a unified region-industry framework, this study conducts a bi-dimensional inequality decomposition analysis using the squared *WCV* [see Eqs. (5) and (8)]. Table 8 presents the result for the case where mining is included. Much of interprovincial inequality is accounted for by the within-region inequality component, contributing more than 95% of overall inequality.[15] Region 2 dominated the within-region component and raised its contribution to overall interprovincial inequality from 68 to 80% over the study period. Much of this increase was, however, attributable to the rise in the contribution of the tertiary sector, particularly the trade, hotel and restaurant sector and the transportation and communication sector. Meanwhile, Region 1 reduced its contribution from 27 to 15%, and much of this decrease was due to the declining contributions of mining and manufacturing. With its small GDP share and low interprovincial inequality, Region 3 had a very small contribution.

When Jakarta is merged with West Java hypothetically, the contribution of the between-region inequality component is increased; but the within-region component still accounted for more than 85% of overall inequality. Region 1 is now the main contributor to overall interprovincial inequality, though its contribution has been decreasing gradually due to the declining contributions of mining and manufacturing. In 2013, Region 1's within-region inequality accounted for 48% of overall inequality. On the other hand, with Jakarta amalgamated with West Java, the contribution of Region 2 is reduced substantially, though over the study period it has risen from 25% to 34%. This is again due to the rising contribution of the tertiary sector, particularly the trade, hotel and restaurant sector and the transportation and communication sector. Meanwhile, Region 3's contribution was 5% in 2013, and the main contributor was manufacturing.

Table 9 presents the result for the case where mining is excluded. The within-region inequality component accounted for 95% of overall interprovincial inequality, where the contribution of Region 2 to overall inequality is increased to 87%, while that of Region 1 is reduced to 6% in 2013. Region 2's tertiary sector dominated the within-region component and raised its contribution to overall interprovincial inequality from 65 to 71% over the study period. When Jakarta is merged with West Java, the between-region inequality component raised its contribution conspicuously. It now accounted for 23% of overall interprovincial inequality in 2013, of which 10 percentage points were due to manufacturing's between-region inequality. As in the case where mining is included, when Jakarta is merged with West Java, the contribution of Region 2's within-region inequality is reduced prominently. However, Region 2 raised its contribution due to the rising contribution of the tertiary sector, and in 2013, its within-region inequality accounted for 47% of overall inequality. Meanwhile, Region 1 lowered its contribution from 39 to 25% due primarily to the declining contribution of manufacturing.

We can now identify several important determinants of interprovincial inequality in Indonesia. First, mining's interprovincial inequality is still the main determinant of Region 1's within-region inequality, though its contribution has been declining gradually. When

[15] If interprovincial inequality is measured by *WGE*(1) (i.e., Theil index *T*), the contribution of the between-region inequality component gets larger, but the within-region inequality component still constitutes more than 90% of overall inequality.

Table 8 Bidimensional decomposition of inter-provincial inequality by squared *WCV* including mining: contribution to overall inequality (in %). *Source*: Central Bureau of Statistics (various issues), Gross Regional Domestic Product of Provinces in Indonesia by Industry

			Secondary sector				Tertiary sector					Total	CV^2
	1	2	3	4	5	Subtotal	6	7	8	9	Subtotal		
2005													
Total (B) + (W)	−1.0	13.6	21.0	0.4	8.0	29.4	16.7	6.6	24.4	10.3	58.0	100.0	0.739
Between-region (B)	0.3	0.8	1.7	0.0	0.1	1.9	0.8	0.2	0.2	0.1	1.4	4.4	0.033
Within-region (W)	−1.3	12.8	19.3	0.4	7.8	27.5	16.0	6.4	24.2	10.2	56.7	95.6	0.706
Region 1 (W1)	0.7	12.0	10.1	0.0	0.6	10.7	1.8	0.8	0.4	0.0	3.1	26.6	0.540
Region 2 (W2)	−2.2	0.0	9.1	0.3	7.2	16.6	14.1	5.5	23.8	10.1	53.5	68.0	0.805
Region 3 (W3)	0.1	0.7	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.1	1.0	0.170
2009													
Total (B) + (W)	−1.7	10.1	17.6	0.5	9.1	27.2	18.2	9.7	25.1	11.3	64.3	100.0	0.711
Between-region (B)	0.0	0.2	1.7	0.1	0.1	1.9	1.0	0.2	0.4	0.2	1.8	3.9	0.028
Within-region (W)	−1.7	9.9	15.9	0.4	9.0	25.3	17.3	9.5	24.7	11.1	62.5	96.1	0.683
Region 1 (W1)	0.4	9.6	7.1	0.1	0.6	7.8	1.8	0.8	0.5	0.0	3.0	20.8	0.453
Region 2 (W2)	−2.2	0.0	8.7	0.3	8.3	17.3	15.4	8.7	24.2	11.1	59.3	74.4	0.807
Region 3 (W3)	0.1	0.3	0.1	0.0	0.1	0.2	0.1	0.1	0.0	0.1	0.3	0.9	0.136
2013													
Total (B) + (W)	−1.9	6.9	13.9	0.4	9.9	24.2	19.8	12.9	25.5	12.5	70.7	100.0	0.669
Between-region (B)	−0.2	0.0	1.7	0.1	0.1	1.9	1.3	0.3	0.5	0.2	2.4	4.0	0.027
Within-region (W)	−1.6	6.9	12.2	0.4	9.7	22.3	18.5	12.6	25.0	12.3	68.4	96.0	0.642
Region 1 (W1)	0.1	6.8	4.4	0.0	0.7	5.1	1.6	0.7	0.4	-0.1	2.7	14.7	0.327
Region 2 (W2)	−2.0	0.0	7.3	0.3	8.9	16.5	16.8	11.8	24.5	12.2	65.3	79.8	0.789
Region 3 (W3)	0.2	0.2	0.5	0.0	0.2	0.7	0.1	0.1	0.1	0.1	0.4	1.5	0.207

Table 8 (continued)

			Secondary sector				Tertiary sector					Total	CV^2
	1	2	3	4	5	Subtotal	6	7	8	9	Subtotal		
Jakarta Merged with West Java													
2005													
Total (B) + (W)	1.8	32.3	34.5	0.5	3.9	38.9	10.6	4.1	8.9	3.4	27.0	100.0	0.315
Between-region (B)	0.8	2.0	4.0	0.1	0.3	4.4	1.8	0.5	0.6	0.3	3.2	10.4	0.033
Within-region (W)	1.0	30.3	30.5	0.5	3.5	34.5	8.8	3.6	8.3	3.1	23.8	89.6	0.282
Region 1 (W1)	1.7	28.3	23.8	0.1	1.3	25.2	4.3	1.9	1.0	0.1	7.2	62.3	0.540
Region 2 (W2)	−0.9	0.4	6.7	0.3	2.1	9.1	4.5	1.6	7.3	2.9	16.3	24.9	0.125
Region 3 (W3)	0.2	1.6	0.1	0.0	0.2	0.3	0.1	0.1	0.0	0.1	0.3	2.4	0.170
2009													
Total (B) + (W)	0.4	28.3	32.2	0.7	5.0	38.0	13.2	5.7	10.6	3.9	33.4	100.0	0.258
Between-region (B)	0.0	0.6	4.7	0.1	0.4	5.2	2.7	0.6	1.2	0.5	4.9	10.8	0.028
Within-region (W)	0.3	27.7	27.5	0.6	4.6	32.8	10.5	5.1	9.4	3.4	28.4	89.2	0.230
Region 1 (W1)	1.0	26.5	19.7	0.1	1.8	21.6	4.9	2.2	1.2	−0.1	8.2	57.3	0.453
Region 2 (W2)	−1.0	0.4	7.6	0.4	2.6	10.6	5.5	2.7	8.1	3.3	19.5	29.4	0.116
Region 3 (W3)	0.4	0.8	0.3	0.0	0.3	0.6	0.2	0.2	0.1	0.2	0.7	2.4	0.136
2013													
Total (B) + (W)	−1.0	22.9	28.5	0.8	6.4	35.7	17.0	8.0	12.5	4.9	42.3	100.0	0.204
Between-region (B)	−0.7	−0.1	5.6	0.2	0.4	6.2	4.2	1.1	1.8	0.7	7.8	13.1	0.027
Within-region (W)	−0.2	23.0	22.9	0.6	6.0	29.5	12.8	6.9	10.7	4.2	34.5	86.9	0.177
Region 1 (W1)	0.4	22.2	14.4	0.2	2.3	16.9	5.3	2.3	1.4	−0.2	8.8	48.3	0.327
Region 2 (W2)	−1.3	0.2	6.8	0.4	3.2	10.5	7.0	4.2	9.0	4.0	24.3	33.6	0.101
Region 3 (W3)	0.7	0.6	1.7	0.0	0.5	2.2	0.4	0.4	0.2	0.4	1.5	4.9	0.207

1 agriculture, , *2* mining, *3* manufacturing, *4* electricity/gas/water, *5* construction, *6* trade/hotel/restaurant, *7* transportation/communication, *8* financial and business services, and *9* other services

Table 9 Bidimensional decomposition of inter-provincial inequality by squared *WCV*: contribution to overall inequality (%). *Source*: Central Bureau of Statistics (various issues), Gross Regional Domestic Product of Provinces in Indonesia by Industry

		Secondary sector				Tertiary sector					Total	CV^2
	1	3	4	5	Subtotal	6	7	8	9	Subtotal		
2005												
Total (B) + (W)	− 2.7	21.7	0.5	9.4	31.7	20.5	7.6	30.3	12.7	71.0	100.0	0.736
Between-region (B)	− 0.5	2.5	0.1	0.2	2.8	1.5	0.2	0.9	0.3	2.9	5.2	0.038
Within-region (W)	− 2.3	19.3	0.4	9.2	28.9	19.0	7.4	29.4	12.4	68.2	94.8	0.697
Region 1 (W1)	0.2	8.1	0.0	0.4	8.5	1.7	0.7	0.4	0.0	2.9	11.6	0.321
Region 2 (W2)	− 2.7	11.1	0.4	8.8	20.2	17.2	6.7	28.9	12.3	65.1	82.7	0.828
Region 3 (W3)	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.2	0.5	0.098
2009												
Total (B) + (W)	− 3.0	18.0	0.6	10.2	28.8	21.0	10.9	29.2	13.1	74.2	100.0	0.726
Between-region (B)	− 0.6	2.5	0.1	0.2	2.8	1.6	0.3	0.9	0.3	3.1	5.2	0.038
Within-region (W)	− 2.4	15.5	0.5	10.1	26.0	19.4	10.6	28.3	12.8	71.1	94.8	0.688
Region 1 (W1)	0.0	5.4	0.0	0.5	5.9	1.5	0.6	0.4	0.0	2.5	8.4	0.246
Region 2 (W2)	− 2.5	10.0	0.4	9.5	19.9	17.7	10.0	27.8	12.8	68.3	85.7	0.830
Region 3 (W3)	0.2	0.1	0.0	0.1	0.2	0.1	0.1	0.0	0.1	0.3	0.7	0.122
2013												
Total (B) + (W)	− 2.8	14.3	0.5	10.5	25.3	21.7	13.9	28.1	13.8	77.6	100.0	0.702
Between-region (B)	− 0.8	2.4	0.1	0.1	2.6	1.9	0.4	0.9	0.3	3.6	5.4	0.038
Within-region (W)	− 2.0	11.9	0.4	10.3	22.6	19.8	13.5	27.2	13.5	74.0	94.6	0.664
Region 1 (W1)	− 0.1	3.4	0.0	0.4	3.9	1.3	0.5	0.3	0.0	2.1	6.0	0.179
Region 2 (W2)	− 2.2	8.0	0.3	9.7	18.1	18.3	12.9	26.8	13.4	71.4	87.3	0.807
Region 3 (W3)	0.2	0.5	0.0	0.1	0.7	0.1	0.1	0.1	0.1	0.5	1.4	0.210

Table 9 (continued)

		Secondary sector				Tertiary sector					Total	CV^2
	1	3	4	5	Subtotal	6	7	8	9	Subtotal		
Jakarta Merged with West Java												
2005												
Total (B) + (W)	− 2.0	47.2	1.1	5.7	54.1	18.7	5.8	17.1	6.3	47.9	100.0	0.219
Between-region (B)	− 1.5	8.2	0.4	0.6	9.3	5.0	0.7	2.9	1.0	9.6	17.4	0.038
Within-region (W)	− 0.4	39.0	0.7	5.1	44.8	13.7	5.1	14.1	5.3	38.3	82.6	0.181
Region 1 (W1)	0.7	27.3	0.1	1.3	28.8	5.9	2.2	1.5	0.1	9.7	39.2	0.321
Region 2 (W2)	− 1.7	11.4	0.6	3.6	15.6	7.6	2.7	12.6	5.0	27.9	41.9	0.125
Region 3 (W3)	0.5	0.3	0.0	0.2	0.5	0.2	0.2	0.1	0.2	0.7	1.6	0.098
2009												
Total (B) + (W)	− 3.4	42.4	1.4	6.7	50.4	20.8	7.8	17.9	6.6	53.0	100.0	0.191
Between-region (B)	− 2.4	9.5	0.5	0.6	10.5	6.1	1.1	3.5	1.1	11.8	19.9	0.038
Within-region (W)	− 1.0	32.9	0.9	6.1	39.9	14.6	6.7	14.4	5.5	41.2	80.1	0.153
Region 1 (W1)	0.0	20.5	0.2	1.7	22.4	5.8	2.2	1.5	0.0	9.6	32.0	0.246
Region 2 (W2)	− 1.7	11.9	0.7	4.1	16.7	8.5	4.2	12.7	5.1	30.6	45.6	0.116
Region 3 (W3)	0.7	0.4	0.0	0.3	0.8	0.3	0.3	0.2	0.3	1.1	2.6	0.122
2013												
Total (B) + (W)	− 4.7	36.1	1.4	7.6	45.0	23.8	10.2	18.3	7.4	59.7	100.0	0.167
Between-region (B)	− 3.4	10.0	0.5	0.6	11.2	8.0	1.8	3.9	1.3	15.0	22.8	0.038
Within-region (W)	− 1.3	26.1	0.8	6.9	33.9	15.8	8.4	14.4	6.1	44.7	77.2	0.129
Region 1 (W1)	− 0.3	14.3	0.2	1.9	16.3	5.6	2.0	1.5	0.0	9.0	25.0	0.179
Region 2 (W2)	− 1.9	9.6	0.6	4.5	14.7	9.7	5.9	12.6	5.6	33.8	46.5	0.102
Region 3 (W3)	0.9	2.2	0.0	0.6	2.8	0.6	0.5	0.3	0.5	1.9	5.7	0.210

1 agriculture, 2 mining, 3 manufacturing, 4 electricity/gas/water, 5 construction, 6 trade/hotel/restaurant, 7 transportation/communication, 8 financial and business services, and 9 other services

Table 10 Decomposition of *WCV* by manufacturing subsectors in region 1 (Sumatra and Kalimantan). *Source*: Central Bureau of Statistics (various issues), Gross Regional Domestic Product of Provinces in Indonesia by Industry

Manufacturing sector	2005				2013			
	w (%)	CV	r	Contribution (%)	*w* (%)	CV	r	Contribution (%)
Petroleum refinery	9.0	2.5	1.3	11.5	7.0	2.1	0.8	5.7
Liquid natural gas (LNG)	24.5	3.7	2.0	49.1	11.9	3.7	1.5	18.0
Non-oil and gas manufacturing	66.5	1.3	0.6	39.4	81.1	1.3	0.9	76.3
Manufacturing total	100.0	1.4		100.0	100.0	1.2		100.0

w is GDP share in %, while *r* is relative concentration ratio. Contribution is the contribution of each manufacturing subsector to inter-provincial inequality in per capita GDP for the manufacturing sector

mining is excluded, however, the manufacturing sector dominated Region 1's inequality, as it accounted for more than half of the inequality. As measured by the *WCV*, its inequality was 1.2 in 2013, which was still very high (see Table 6). To see which manufacturing subsectors contribute most to manufacturing's interprovincial inequality in Region 1, we conducted an inequality decomposition analysis by manufacturing subsectors using Eq. (9). The result is presented in Table 10. Among three manufacturing subsectors, non-oil and gas manufacturing has played an increasingly important role in determining manufacturing's interprovincial inequality as its contribution has risen from 39 to 76%. Non-oil and gas manufacturing activities are very unevenly distributed in Region 1 with the *WCV* being 1.3, which is very high. They are concentrated in two provinces, i.e., North Sumatra and Riau Islands; their combined share was 48% in Region 1's GDP from non-oil and gas manufacturing in 2013.[16] If we add South Sumatra and Riau (third and fourth largest contributors), the share increases to 67%. Meanwhile, no significant non-oil and gas manufacturing activities exists in the provinces of Bengkulu, Central Kalimantan and Aceh with their shares being merely 0.4%, 1.4% and 1.6%, respectively, in 2013.[17]

Second, the tertiary sector has played an important role in determining Region 2's within-region inequality. Among four tertiary sectors, the financial and business services sector and the trade, hotel and restaurant sector contributed a lot to Region 2's inequality. Even if Jakarta is merged with West Java hypothetically, these two sectors have played an important role and their combined contribution to Region 2's inequality was 50% in 2013. Though the contribution is not large as compared to these two sectors, the transportation and communication sector raised its contribution to Region 2's inequality notably. To explore which subsectors among 18 tertiary subsectors contribute most to Region 2's within-region inequality, we conducted an inequality decomposition analysis by tertiary subsectors using Eq. (9). The result is presented in Table 11. Five subsectors can be identified as major contributors, namely, wholesale and retail trade, information and communication, banking, business services, and private services. Among these five subsectors, wholesale and retail trade is an inequality-decreasing component as its relative concentration coefficient is smaller than one [see Eq. (9)]. On the other hand, information and

[16] North Sumatra includes the Medan metropolitan area, which consists of Medan city, Binjai city, Deli Serdang regency and Karo regency. This area is the biggest metropolitan area outside Java and serves as a hub for western Indonesia.

[17] In these three provinces, non-oil and gas manufacturing accounted for merely 4–6% of their total GDP in 2013, which was much smaller than Region 1's figure of 14%.

Table 11 Decomposition of *WCV* by tertiary subsectors in region 2 (Java and Bali). *Source*: Central Bureau of Statistics (various issues), Gross Regional Domestic Product of Provinces in Indonesia by Industry

	2005				2013			
	w (%)	CV	r	Contribution (%)	*w* (%)	CV	r	Contribution (%)
Tertiary subsector								
Wholesale and retail trade	35.5	0.8	0.6	20.1	36.6	0.7	0.5	19.4
Hotel	1.8	1.8	0.8	1.5	1.6	1.7	0.7	1.2
Restaurants	7.3	1.0	0.7	4.8	6.9	1.0	0.7	5.1
Trade/hotel/restaurant total	44.6	0.8		26.4	45.1	0.8		25.7
Railways transportation	0.1	0.7	0.5	0.1	0.1	0.9	0.6	0.1
Road transportation	4.3	0.6	0.4	1.9	3.8	0.8	0.5	2.0
Sea transportation	1.0	2.1	1.5	1.5	0.7	2.0	1.5	1.0
River, lake and ferry transportation	0.0	1.7	−0.1	0.0	0.0	2.1	−0.1	0.0
Air transportation	0.9	1.4	−0.1	−0.1	1.1	1.1	−0.1	−0.2
Services allied to transportation	1.6	1.3	0.8	1.3	1.5	1.3	1.0	1.5
Information and communication	4.2	1.9	1.4	5.7	8.8	2.0	1.6	13.6
Transportation/communication total	12.1	1.2		10.3	16.0	1.5		18.1
Bank	11.4	3.3	2.3	26.3	8.7	2.9	2.2	19.2
Non-bank financial institution	2.0	2.5	1.8	3.4	2.0	2.3	1.7	3.5
Services allied to finance	0.2	3.0	2.1	0.4	0.2	3.0	2.2	0.4
Real estate	5.1	1.6	1.1	5.8	4.8	1.5	1.2	5.6
Business services	4.3	2.8	2.0	8.4	4.0	2.8	2.2	8.7
Financial and business services total	22.9	2.7		44.3	19.8	2.5		37.4
General government	8.3	0.6	0.4	3.3	6.3	0.6	0.4	2.2
Private services	9.5	1.7	1.2	11.8	10.4	1.6	1.2	12.7
Social and community services	2.5	2.2	1.6	3.9	2.4	2.2	1.6	3.9
Other services total	20.4	1.3		19.0	19.1	1.3		18.8
Tertiary sector total	100.0	1.4		100.0	100.0	1.3		100.0
Jakarta Merged with West Java								
Tertiary subsector								
Wholesale and retail trade	35.5	0.3	0.6	22.0	36.6	0.3	0.7	24.3
Hotel	1.8	1.4	0.8	1.4	1.6	1.4	0.6	1.1
Restaurants	7.3	0.3	0.5	3.8	6.9	0.3	0.6	3.9
Trade/hotel/restaurant total	44.6	0.3		27.2	45.1	0.3		29.3
Railways transportation	0.1	0.5	0.9	0.1	0.1	0.4	0.9	0.1
Road transportation	4.3	0.3	0.5	2.0	3.8	0.3	0.4	1.6
Sea transportation	1.0	0.6	1.1	1.1	0.7	0.5	0.9	0.6
River, lake and ferry transportation	0.0	1.7	−1.1	0.0	0.0	2.1	−1.5	0.0
Air transportation	0.9	1.4	−0.7	−0.6	1.1	1.0	−0.3	−0.4

Table 11 (continued)

	2005				2013			
	w (%)	CV	r	Contribution (%)	*w* (%)	CV	r	Contribution (%)
Services allied to transportation	1.6	0.6	0.6	0.9	1.5	0.5	0.7	1.1
Information and communication	4.2	0.7	1.5	6.0	8.8	0.7	1.6	14.1
Transportation/communication total	12.1	0.4		9.5	16.0	0.5		17.1
Bank	11.4	1.2	2.4	26.9	8.7	1.0	2.3	19.6
Non-bank financial institution	2.0	0.8	1.7	3.4	2.0	0.7	1.7	3.4
Services allied to finance	0.2	1.0	1.8	0.4	0.2	1.0	1.8	0.3
Real estate	5.1	0.5	1.1	5.4	4.8	0.4	0.9	4.4
Business services	4.3	1.0	2.0	8.7	4.0	1.0	2.2	8.9
Financial and business services total	22.9	0.9		44.7	19.8	0.8		36.6
General government	8.3	0.3	0.2	1.7	6.3	0.3	−0.2	−1.3
Private services	9.5	0.6	1.4	12.9	10.4	0.6	1.4	14.6
Social and community services	2.5	0.8	1.6	3.9	2.4	0.7	1.5	3.7
Other services total	20.4	0.4		18.5	19.1	0.4		17.0
Tertiary sector total	100.0	0.5		100.0	100.0	0.4		100.0

w is GDP share in %, while *r* is relative concentration ratio. Contribution is the contribution of each tertiary subsector to inter-provincial inequality in per capita GDP for the tertiary sector

communication, banking, business service, and private services serve as inequality-increasing components in the tertiary sector as their relative concentration coefficients exceed one. This implies that if these four subsectors raise their GDP shares, Region 2's within-region inequality will be even higher. Particularly, the information and communication sector should be paid attention to, as its GDP share has been rising rapidly and its contribution to tertiary sector's inequality has increased from 6 to 14% in the period. We should note that the information and communication sector is concentrated in Jakarta, accounting for about 60% of Region 2's GDP from this subsector. Banking and business services are also concentrated in Jakarta as the province constitutes around 80% of Region 2's GDP from the subsectors; but their GDP shares in the tertiary sector have been declining.

Third, the contribution of manufacturing to Region 2's within-region inequality has been declining as manufacturing's GDP share and interprovincial inequality have both decreased (Tables 6 and 7). However, when Jakarta is merged with West Java, the manufacturing sector contributed 20% of Region 2's within-region inequality in 2013. West Java accounted for 35% of Region 2's GDP from manufacturing, while Jakarta 14%. This is in contrast with the tertiary sector, where West Java and Jakarta constituted, respectively, 17% and 40% of Region 2's GDP from the tertiary sector. The manufacturing sector contributed 41% of West Java's total GDP, much larger than the national figure of 23%. Though smaller than West Java, Banten generated 11% of Region 2's GDP from manufacturing; the manufacturing sector contributed almost half of its total GDP. Manufacturing activities appear to have been shifting from Jakarta to West Java and Banten, particularly to Jakarta's neighboring districts, such as Bogor, Depok, Tangerang and Bekasi, where West Java includes Bogor, Depok and

Bekasi, while Banten includes Tangerang. It should be noted that besides the Jakarta metropolitan area, Region 2 contains the three largest metropolitan areas in Indonesia, namely, the Surabaya, Bandung and Semarang metropolitan areas. With their population exceeding 6 million, they serve to accommodate a variety of manufacturing activities.

Fourth, the construction sector had a relatively high interprovincial inequality and its contribution to overall inequality has risen from 7.8 to 9.7% as its GDP share has increased (see Table 8). Particularly, its contribution to Region 2' within-region inequality was around 10% in 2013, even if Jakarta is merged with West Java. Jakarta generated almost half of Region 2's GDP from construction, and if it is merged with West Java, the share goes up to 65%. Fifth, though the contribution of Region 3 is very small as compared to Regions 1 and 2, it has been rising; but, the increase is due primarily to the development of a large scale LNG plant in West Papua (see Footnote 4). In Region 3, South Sulawesi dominates non-oil and gas manufacturing as it accounted for half of Region 3's GDP from non-oil and gas manufacturing in 2013. Sixth, the contribution of the between-region inequality was not large, but it has been rising when Jakarta is merged with West Java. The major contributor to the between-region inequality appears to have been the manufacturing sector, as it accounted for more than 40% of the between-region inequality. Region 2 dominates the manufacturing sector as it constituted three quarters of GDP from manufacturing in 2013; its manufacturing activities are mostly non-oil and gas activities. According to Table 7, manufacturing contributed 27% of Region 2's total GDP in 2013, which is compared to 18% and 11% in Regions 1 and 3 respectively.

5 Conclusion

This study explored the determinants of interprovincial inequality in Indonesia from 2005 to 2013 using the bi-dimensional inequality decomposition method. The following provides a summary of the findings. First, despite a declining trend, interprovincial inequality was still very high at around 0.7 by the squared population-weighted coefficient of variation; the largest per capita GDP registered by Jakarta was more than 15 times the smallest. Though there was a statistically significant conditional β convergence across provinces in the period from 2005 to 2009, it takes almost 50 years for the difference between the current and steady state levels of per capita GDP to reduce by half.

Second, according to the bi-dimensional inequality decomposition analysis, whether mining is included or not, much of interprovincial inequality is accounted for by the within-region inequality component. While Region 2 (Java-Bali) dominated the within-region component and has raised its contribution to overall inequality due to the rising contribution of the tertiary sector, Region 1 (Sumatra and Kalimantan) has lowered its contribution due to the declining contributions of mining and manufacturing. With its small GDP share and low interprovincial inequality, the contribution of Region 3 (Sulawesi and Eastern Indonesia) was very small.

Third, although mining has reduced its contribution, it is still the main contributor to the within-region inequality of Region 1. If mining is excluded, however, the manufacturing sector dominated Region 1's inequality, where non-oil and gas manufacturing has played an increasingly important role. Fourth, the tertiary sector has played a pivotal role in the within-region inequality of Region 2. Among tertiary subsectors, wholesale and retail trade, information and communication (IC), banking, business services, and private services contributed a lot to Region 2's inequality. Of these five subsectors, IC, banking,

business services and private services are mostly concentrated in Jakarta and have served to increase Region 2's within-region inequality. Particularly, the IC sector has raised its GDP share rapidly and its contribution to Region 2's inequality has increased substantially.

Fifth, the manufacturing sector has reduced its contribution to Region 2's within-region inequality as its GDP share and interprovincial inequality have both declined. Manufacturing activities appear to have been shifting from Jakarta to West Java and Banten, particularly to Jakarta's neighboring districts, such as Bogor, Depok, Tangerang and Bekasi. In West Java and Banten, the manufacturing sector contributed more than 40% of their total GDP, which is much larger than the national figure of 23%.

Sixth, the construction sector had a relatively high interprovincial inequality and its contribution to overall inequality has been rising as its GDP share has increased. In Region 2, construction activities are concentrated in Jakarta, generating almost half of its GDP from construction and have played an increasingly important role in Region 2's within-region inequality. Finally, the between-region inequality was not large. But, if Jakarta is amalgamated with West Java hypothetically, its contribution to overall inequality has risen. The major contributor to the between-region inequality appears to have been the manufacturing sector. Region 2 dominated the sector as it accommodated three quarters of GDP from manufacturing.

While deindustrialization has lowered the relative importance of manufacturing in determining overall interprovincial inequality, manufacturing activities are still very unevenly distributed among regions and provinces. Non-oil and gas manufacturing activities are mostly located in Java-Bali, but they are expected to play an increasingly important role in interprovincial inequalities outside Java-Bali. With the development of economic infrastructures throughout Java-Bali, interprovincial inequality in manufacturing is likely to decrease in the region. But many provinces outside Java-Bali lack economic infrastructures and human resources. Further development of non-oil and gas manufacturing industries would thus increase interprovincial inequalities outside Java-Bali, since these industries tend to be located where economic infrastructures and human resources are relatively abundant. The government needs to implement policies that are conducive to the balanced development of non-oil and gas manufacturing industries based on regional comparative advantages and disadvantages, where further development of economic infrastructures and human resources, particularly outside Java-Bali, is essential.

In contrast, economic tertiarization has raised the importance of service activities in determining overall interprovincial inequality, particularly inequality within Java-Bali. The tertiary sector accounts for more than half of total GDP in Java-Bali, and many service activities, such as IC, banking, business services and private services, are concentrated in Jakarta and neighboring districts. Particularly, with the advancement of IC technologies, the IC sector has been expanding rapidly. Together with banking, business services and private services, further development of the IC sector is likely to increase interprovincial inequality in Java-Bali unless policies that could facilitate geographical dispersion of these service activities are implemented.

This study is not without limitations. The followings are some of the limitations of this study. First, this study focused on interprovincial income inequality during the Yudhoyono presidency due primarily to the unavailability of provincial data at 2000 constant prices after 2014. Second, since sectoral regional GDP data are not available at the district level (*kabupaten*/*kota*), this study is not able to analyze inter-district income inequality by sector. Third, since provincial GDP data for non-oil and gas manufacturing subsectors, such as food processing, textile, wood processing, metal and machinery industries, are not available, this study is not able to analyze interprovincial inequalities for these manufacturing subsectors.

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Appendix

See Table 12.

Table 12 Sector classification

	9 sectors	33 sectors	GDP at constant 2000 prices (share in %)		
			2005	2009	2013
1	Agriculture	Food crops	7.7	7.2	6.2
2		Estate crops	3.3	3.2	3.1
3		Livestock	1.9	1.8	1.7
4		Forestry	0.9	0.8	0.6
5		Fishery	1.8	1.9	1.8
6	Mining	Oil and gas mining	5.9	4.5	3.4
7		Non-oil and gas mining	2.6	2.6	2.5
8		Quarrying	0.7	0.8	0.8
9	Manufacturing	Petroleum refinery	1.3	1.1	0.9
10		Liquified natural gas (LNG)	1.6	1.1	0.8
11		Non-oil and gas manufacturing	22.3	22.3	21.3
12	Electricity/gas/water	Electricity	0.9	0.8	0.8
13		City gas	0.1	0.2	0.1
14		Water supply	0.1	0.1	0.1
15	Construction	Construction	5.3	5.7	6.1
16	Trade/hotel/restaurant	Wholesale and retail trade	15.8	16.6	18.2
17		Hotel	0.7	0.7	0.7
18		Restaurants	2.6	2.6	2.8
19	Transportation/communication	Railways transport	0.1	0.1	0.0
20		Road transport	2.3	2.4	2.5
21		Sea transport	0.6	0.5	0.5
22		River, lake and ferry transport	0.1	0.1	0.1
23		Air transport	0.6	0.7	0.9
24		Services allied to transport	0.7	0.8	0.8
25		Information and communication	1.7	2.8	3.8
26	Financial and business services	Bank	4.0	3.8	3.9
27		Non-bank financial institution	0.7	0.8	0.9
28		Services allied to finance	0.1	0.1	0.1
29		Real estate	2.3	2.4	2.5
30		Business services	1.5	1.5	1.6
31	Other services	General government	5.0	5.0	4.9
32		Private	3.7	4.1	4.5
33		Social and community services	1.0	1.1	1.1
	Total		100.0	100.0	100.0

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