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COVID-19 and Socio-Economic Inequalities in Indonesia: A Subnational-level Analysis

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Abstract: *This study examines if COVID-19 has worsened socio-economic inequalities across provinces in Indonesia, and if it has affected the spatial disparity in provincial-level socio-economic indicators. Secondary provincial-level data are used from BPS for March 2015 to March 2020. Results indicate that provinces with more COVID-19 cases tend to have increased inequality in urban areas, but inequality in rural areas decreases, as measured by the Gini Index. Also, provinces with many COVID-19 cases tend to have a decrease in their poverty headcount ratios. Thus, COVID-19 may have various implications on the spatial inequality of the Gini Index and poverty headcount ratio.*

***Keywords*:** COVID-19; Inequality; Poverty; Spatial

***JEL Classification*:** I14; I30; R10

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1. Introduction

COVID-19 was first reported in Wuhan, China in December 2019, spreading worldwide as the virus is highly contagious (Liu, Kuo, Shih, 2020). Based on an assessment by the World Health Organization (WHO) on 11 March 2020, this disease became the fifth documented pandemic since the 1918 'Spanish flu' pandemic, which killed 50 million people. The other four pandemics include the 1957 Asian flu (H2N2), killing 1.5 million; 1968 Hong Kong flu (H3N2), killing 1.0 million; and the 2009 H1N1 pandemic, in which 300,000 died.

The COVID-19 pandemic has negatively influenced the economy around the world as well. Baldwin and di Mauro (2020) stated that COVID-19 can be identified as a medical shock to the economy since it harmed all major economies at the same time. Indeed, the virus is affecting 217 countries and territories around the world and has 2 international conveyances (Worldometer, 2021). The virus has had a negative impact on economic output, and the containment policies – to slow the rate of infection – may also be creating a worse effect on the economy, as policies to flatten the epidemiologic curve are reducing economic activity.

Statistics Indonesia (BPS) indicated that shortly before the outbreak of COVID-19, the poverty rate and income inequality in urban areas, as well as in rural areas, had increased significantly in many provinces in Indonesia (Brata, 2020). Olivia, Gibson, and Nasrudin (2020) identified some potential long-term impacts of the pandemic as well as resulting economic shocks, indicating that this pandemic will affect vulnerable groups such as farmers and contribute to socio-economic inequality in severely affected areas. Indeed, provinces in Bali, Java, and Nusa Tenggara have experienced higher economic contractions than other provinces (BPS, 2020b); the spatial structure of the Indonesian economy is dominated by provinces in Java.

This study thus examines if COVID-19 has worsened socio-economic inequalities across provinces in Indonesia, and if the pandemic has affected the spatial disparity in socio-economic indicators at the provincial level. The economic cost of the direct effect of the pandemic – as well as its indirect effect through containment policies – may be spread unequally across population groups and locations.

The next section provides a literature review. It is then followed by a brief discussion of the COVID-19 pandemic in Indonesia and government responses, especially to address inequality and poverty. Section 4 gauges the impact of COVID-19 on inequality and poverty across provinces in Indonesia, including its spatial inequality issues. The last section is the conclusion.

2. Literature Review

Studies on previous pandemics, especially in developed countries, provide useful evidence to predict the possible distributional impacts of the COVID-19 pandemic.

Furceri, Loungani, Ostry, and Pizzuto (2020) investigated the potential impacts of the COVID-19 pandemic on inequality in terms of income, share between the top and bottom deciles, and prospects of people with low education levels. Using data from 175 countries over 1961–2017, they found that past pandemics increased the Gini Index and raised the income share of the top group. This indicates that the COVID-19 pandemic can also worsen socio-economic inequalities between the rich and poor; they also noted that this impact may be larger than those of the previous pandemics.

To provide evidence for the effect of pandemics on income inequality, Galletta and Giommoni (2020) used the Italian experience with the 1918 'Spanish flu' pandemic as a case study, finding that pandemics increase income inequality. A reduction in the share of income generated by the poorer group of the population is the main cause of the increase in income inequality in the short to medium term. The general effect of the 1918 pandemic tended to have long-lasting consequences, since municipalities that experienced the most damage from the flu reported a less equal distribution of income even after 100 years. Carillo and Jappelli (2020) also used the 1918 'Spanish flu' pandemic, but they focused on its impact on local economic growth in Italy. Using gross domestic regional product (GDRP) and mortality data, they found a strong and significant adverse effect from the pandemic – although this adverse effect mostly disappeared 3 years after the shock. Thus, these two studies suggest that pandemics can have a long-term negative impact on equality, while the impact on economic growth is relatively short.

However, another pandemic – the Black Death in the 14^{th} century (i.e. a bubonic plague pandemic) – had a different impact on equality. According to Alfani (2020), the richest 10% of the population lost their grip on 15%–20% of overall wealth in the aftermath of the Black Death. This decline in inequality was long-lasting, as the wealth concentration did not reach pre-Black Death levels again before the second half of the 17^{th} century. Alfani also posited that this equality improvement was because the plague reduced labour that led to an increase in real wages, and the poorest gained more bargaining power to negotiate better working conditions. In addition, this pandemic's extremely high mortality rate caused the fragmentation of large patrimonies, resulting in the unusual abundance of property then offered. Alfani argued that the possible distributive effects of the COVID-19 pandemic will be more similar to the 1918 'Spanish flu' pandemic, however, than those of the Black Death. The COVID-19 pandemic, therefore, is expected to increase inequality.

The direct impact of the COVID-19 pandemic on inequality has been examined primarily in developing countries. Blundell, Dias, Joyce, and Xu (2020), focusing on the United Kingdom, looked at inequalities before the COVID-19 pandemic, concluding that geographical inequalities are large and persistent. The interaction between the pandemic and existing inequalities, therefore, will lead to future inequalities, but the direct impacts of this pandemic may not always lead to increases in inequality. They argued that the pandemic can also bring opportunities, improving spatial equality across cities or regions, especially because of widespread working from home trends that may reduce the dominance of the city of London.

Sayed and Peng (2020), using data spanning 100 years that cover four pandemics, investigated their impacts on inequality in France, Germany, the United Kingdom, and the United States. In contrast to other studies, such as Furceri, Loungani, Ostry, and Pizzuto (2020) and Galletta and Giommoni (2020), Sayed and Peng found that pandemics with more than 100,000 deaths contributed to a decline in income inequality in the years following the pandemics. Relating the findings to the COVID-19 pandemic, Sayed and Peng argued that the final effects of the pandemic on income inequality remain unclear, as this pandemic has characteristics (e.g. that fatalities are highly concentrated in older age groups)that differentiate it from previous scenarios.

The impact of the COVID-19 pandemic on inequality has been also examined in some developing countries. Jurzyk et al. (2020), for instance, showed that economic growth in Asia before the pandemic was less inclusive and less pro-poor, indicating rising inequality, and this inequality is increasing further during the pandemic because job losses have been concentrated amongst low-income workers, women, and youth. Focusing on South Africa, Visagie and Turok (2020) also concluded that pre-existing inequalities between different types of localities and regions have been magnified by the pandemic.

Indonesia – especially Java – experienced the 1918 ‘Spanish flu’ pandemic. Chandra (2013) studied this impact, focusing on mortality rates across locations in Java. Based on his estimation, Chandra found that the population loss totalled 4.26 million to 4.37 million people in Java, although the usual estimate for all of Indonesia is 1.50 million. He also found that in terms of population loss, the west and west-central areas were more severely affected than other areas. The West Java cities of Banten and Cirebon were amongst the top five places most affected in the country.

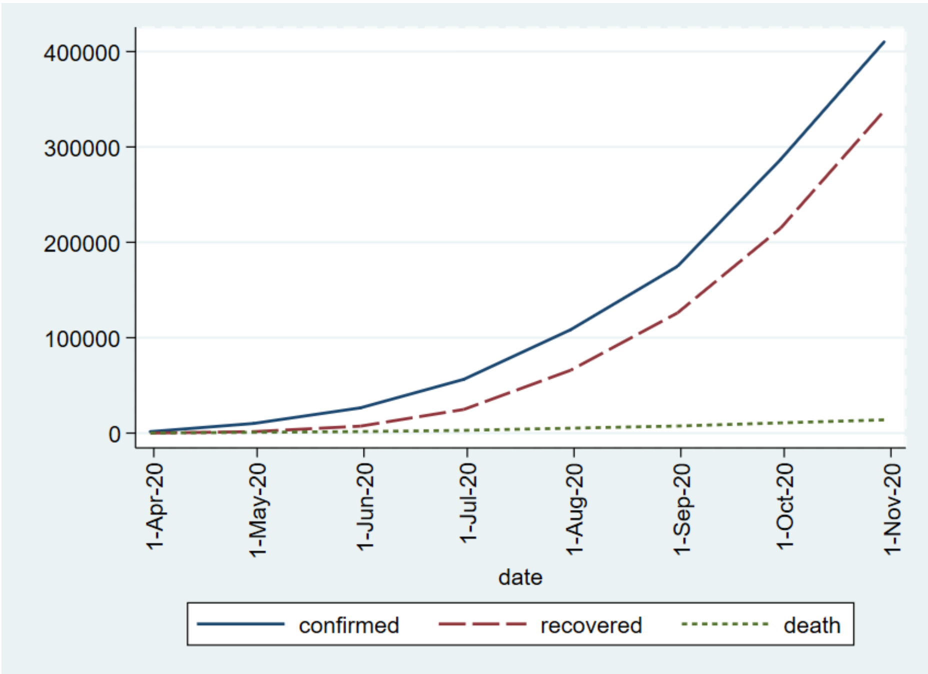
Inequalities between the rich and poor, including spatial inequalities, were a serious issue long before the COVID-19 pandemic (Leigh and van der Eng, 2010; World Bank, 2015; Akita and Miyata, 2018). Education, wealth, and employment contribute to income inequality in Indonesia (Wicaksono, Amir, and Nugroho, 2017), and democracy has not improved equality (Kawamura, 2019). Suryahadi, Izzati, and Suryadarma (2020) conducted simulations, based on various economic growth scenarios, predicting serious implications from the recent pandemic on poverty in Indonesia. However, they did not take into account the spatial implication of the pandemic on socio-economic inequalities. Thaariq, Wahyu, Ningrum, and Aidha (2020) found that there is a strong correlation between the possible number of people at risk of being infected and the number experiencing multidimensional poverty in Indonesia. This study also noted that people who are classified as at risk of being infected mostly live in urban areas, although around 80% of the total multidimensional poor population in Indonesia are villagers. These two studies give an insight into the possibility that the COVID-19 has had spatial impacts on inequality in Indonesia.

3. The COVID-19 Pandemic in Indonesia

3.1. Cases of COVID-19

The President of Indonesia, Joko Widodo, confirmed the first two cases of COVID-19 in the country on 2 March 2020. As Indonesia has the fourth-densest population in the world, it has suffered over a longer period than many other less-populous countries (Djalante et al., 2020). Figure 1 illustrates cases of COVID-19 in Indonesia.

Figure 1: Cases of COVID-19 in Indonesia, March to October 2020

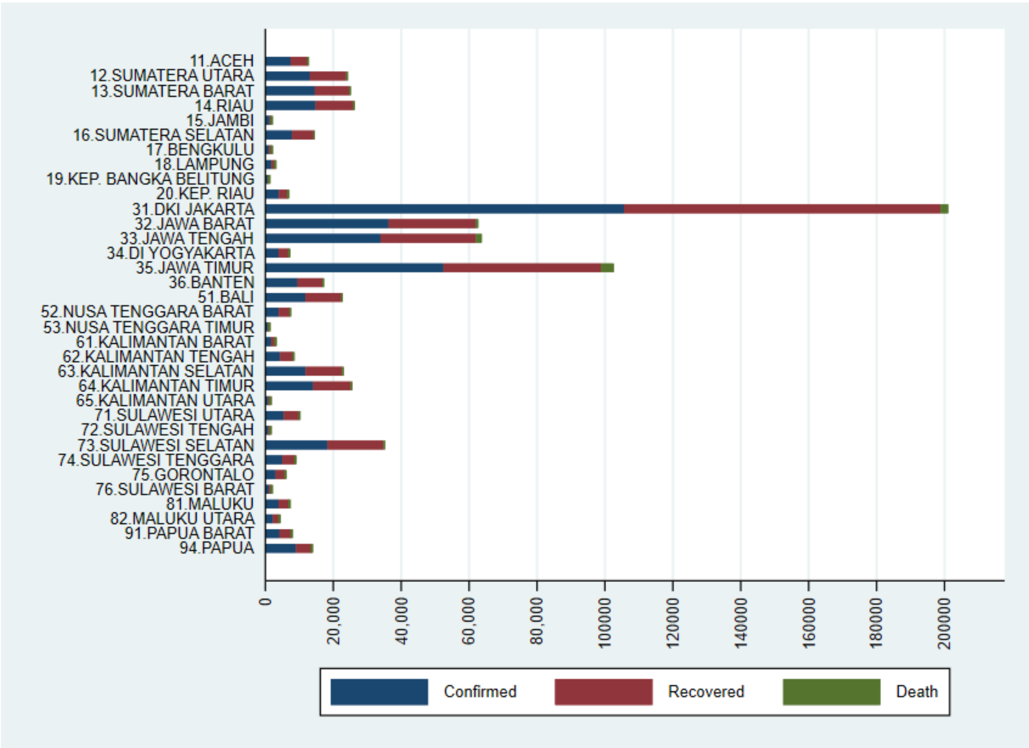


Source: KPC PEN (2021).

Between March and October 2020, the reported number of COVID-19 cases significantly increased, as did the number of recovered cases – yet this number has slowed every month. Although it remains a challenge for the government, the growth of recovered cases is still higher than that of confirmed cases. Deaths also show a declining trend, and it is lower than those of confirmed and recovered cases.

Comparing recovered and death cases to confirmed cases, the recovery rate is on an increasing trend, while the death rate is declining. Although this recovery rate is better than the global rate, which was around 70.0% in October 2020, the death rate is still higher than the global rate, which was around 2.4% in early December 2020. This implies that Indonesia is still facing a significant challenge in dealing with COVID-19.

Figure 2: Cases of COVID-19 by Province, October 2020



Source: KPC PEN (2021).

Most confirmed COVID-19 cases in Indonesia are on the island of Java (Figure 2). The more populous a region, the faster the spread of the virus. According to BPS, the population of Java is 145 million, equivalent to almost 55% of Indonesia's population. The four provinces with the highest number of cases are Jakarta, East Java, Central Java, and West Java, suggesting that Java is the indeed the centre of the COVID-19 pandemic in Indonesia. Since this island plays a dominant role in the Indonesian economy, the COVID-19 situation in Java can have an economic impact on other islands.

3.2. Government Responses to Address Inequality and Poverty

The government, therefore, has implemented two policies to stop the spread of the virus and to avoid a recession, focusing on the poor and those who are potentially poor or of a vulnerable group (Olivia, Gibson, Nasrudin, 2020). The response centres on *Pemulihan Ekonomi Nasional* (National Economic Recovery Programme, or Programme PEN), which focuses on health and the economy. It aims to strengthen health management, provide incentives for medical workers, cover treatment costs, and arrange tax incentives and import relaxation for goods and services needed to handle the pandemic. Until the end of 2020, the health sector contributed 10.95% of Rp579.78 trillion ($39.89 billion) of Programme PEN's expenditure.

The spending for the economic aspect, which covered almost 90% of the budget, took a unique approach by focusing on both supply and demand. Consumption has become the main driver of Indonesian economic growth (Resosudarmo and Abdurohman, 2018). Thus, to maintain consumption, the government has arranged subsidies and incentives for investment and export–import. On the supply side, the objectives are to support micro, small, and medium-sized enterprises; state-owned enterprises; and other corporations. The biggest portion of the economic response went to social protection – Rp220.39 trillion ($15.20 billion, or around 38.01% of the total budget) – and then to micro, small, and medium-sized enterprises at Rp112.44 trillion ($7.75 billion, or around 19.39% of the total budget). This social protection targets formal workers as well as informal ones, like farmers and small traders.

In the meantime, to observe the impact of Programme PEN, Indonesian economic growth must be examined (BPS, 2020a). The Indonesian economy has contracted from 4.96% in the fourth quarter of 2019 to 2.97% in the first quarter of 2020. In the second quarter of 2020, growth dropped further to –5.32% due to an economic slowdown and mobility restrictions imposed by the government. However, in Indonesia, mobility restrictions were a risky policy, as economic and social activities were unprepared for a long-distance approach, public administration was in disarray, politics were crumbling, and society was socially divided. The mobility restrictions did not significantly reduce cases during the second quarter of 2020; cases actually increased from 1,677 (per 1 April 2020) to 56,853 (per 30 June 2020).

Economic growth in the third quarter of 2020, although still negative, improved to –3.49% year-on-year or 5.05% quarter-to-quarter growth from the second quarter of 2020. Gross domestic product growth was supplemented by 64.13% growth from the sectors of industry, agriculture, trading, construction, and mining. Yet the improvement in the growth rate was under the shadow of the sharp increase of COVID-19 cases from 57,770 cases (per 1 July 2020) to 287,008 cases (per 30 September 2020). In term of employment, between February to August 2020, 2.56 million people lost their jobs, 1.77 million people were temporarily unemployed, and 24.03 million people had with shorter working hours (BPS, 2020b).

Fourth quarter 2020 growth improved further to –2.19% year-on-year, but quarter-to-quarter growth dropped slightly to –0.42%. Domestic economic improvement was supported by the stimulus and the positive trend in international economics. The government argued that economics improved because of Programme PEN's impacts from the increase of consumption from the government and households and of basic commodities (Indrawati, 2021). Consumption in other sectors, however, shows positive – but still modest – growth. To reach recovery, growth in transport and communications must be 20.2%; restaurants and hotels, 9.6%; and clothes and footwear, 3.6%.

The claim of Programme PEN's success still needs further observation. Except for the stimulus programme, the economy has improved with increased social mobility. The social mobility increase, however, occurred in line with the sharp increase in COVID-19 cases from 291,182 cases (per 1 October 2020) to 743,198 cases (per 31 December 2020). Investment has not been restored to previous levels, as many business actors are still waiting for clearer signs of economic recovery. Corporations have maintained a high level of cash as indicated by the relatively minimal use of commercial financing, with a negative growth of banking credit throughout 2020 of 2.41% (Kompas.com, 2021). Meanwhile, micro, small, and medium-sized enterprises are still struggling with the impact, as many lack digital literacy and face obstacles like late payments.

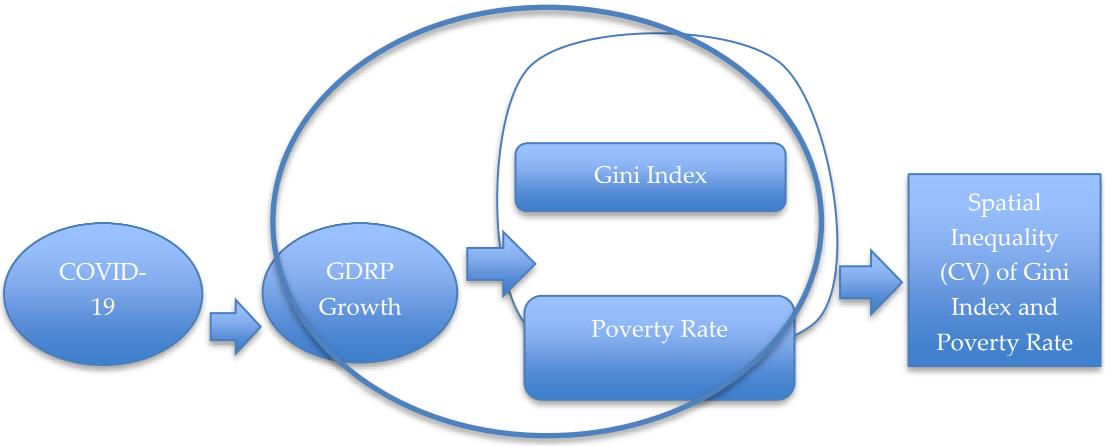
The prediction of future economic growth depends on the successful management of the pandemic as well as vaccinations in Indonesia. To improve management, the President replaced the Minister of Health on 23 December 2020 and re-allocated Rp47.07 trillion of the Programme PEN budgets to begin vaccinations in January 2021. Increasing mobility restrictions has not remained a top policy choice.

4. Growth and Socio-Economic Inequalities: Gauging the Impact of COVID-19

To gauge the impact of the COVID-19 pandemic on inequalities, data on inequalities after the pandemic are needed. However, BPS will not release these data until early 2021 for September 2020. Therefore, inequalities in September 2020 must be estimated.

Figure 3 illustrates the link between the COVID-19 pandemic and inequality through economic growth. Several studies have predicted the negative impact of the COVID-19 pandemic on economic growth at the national level (e.g. Suryahadi, Izzati, and Suryadarma, 2020). For instance, the World Bank provided a worse economic growth scenario for 2020 (World Bank, 2020), while *The Economist* Intelligence Unit predicted that Indonesia could still achieve positive economic growth in 2020 (EIU, 2020).

Figure 3: Empirical Framework for Estimating Inequalities for after the COVID-19 Pandemic



GDRP = gross domestic regional product.
Source: Authors.

4.1. Growth and Inequality before COVID-19

First, the correlation between provincial economic growth and socio-economic inequalities is estimated by:

$$IQ_{it} = \alpha_0 + \alpha_1 logGDRP_{it} + \varepsilon_{it} \quad (1)$$

where *IQ* represents indicators of socio-economic inequality, *GDRP* is the gross domestic regional product in constant 2010 prices, *i* indicates province, *t* indicates time, and ε is an error term.

Beside the Gini Index, the model is also applied for the poverty headcount ratio as another indicator of inequality. Inequality indices are also provided at different locations: at the urban level (*U*), rural level (*R*), and the total of urban and rural (*UR*). Therefore, the model (i.e. Equation 1) is used for *U*, *R*, and *UR* for each inequality indicator.

BPS publishes poverty and income or expenditure inequality data for March (published in July) and September (published in January) based on the National Socioeconomic Survey, known as SUSENAS. For this study, the half-yearly data set used is from March 2015 until March 2020. Inequality data for Kalimantan

Utara are only available from March 2015, as it is a new province; all inequality data are only available until March 2020. Therefore, panel data consist of 11 periods and 34 provinces.

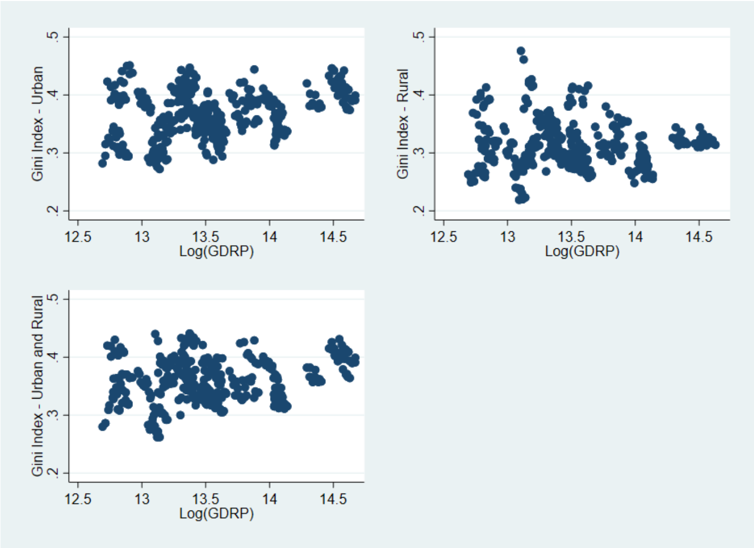
In addition, the spatial spill-over aspect of migration between Java and out of Java provinces is concerning. One difficulty in introducing a migration variable into the model is that migration data are only available every 5 years. Thus, a dummy variable was created based on interprovince recent migration from the latest available publication, BPS (2016). A province has value of 1 if its percentage of recent migration to provinces in Java is above the median of all non-Java provinces, and 0 if this percentage is below the median (Dmig_med). There are 14 provinces that have a higher percentage of recent migration to provinces in Java: Bali, Bengkulu, Jambi, Kalimantan Barat, Kalimantan Selatan, Kalimantan Tengah, Kalimantan Timur, Kalimantan Utara, Kepulauan Bangka Belitung, Kepulauan Riau, Lampung, Nusa Tenggara Timur, Sumatera Barat, and Sumatera Selatan.

Since this additional variable is time-invariant, a simple ordinary least squares (OLS) version of the model is used in which both inequality indexes and the GDRP are the mean values of the data during the period:

$$IQ_{(March2015\text{-}March2020)i} = \alpha_0 + \alpha_1 logGDRP_{(March2015\text{-}March2020)I} + \alpha_2 Dmig\_med_i \quad (2)$$

Inequality indexes with GDRP are first plotted to visualise the correlation between these two variables. Figure 4 indicates that the Gini Index and GDRP tend to have a positive correlation at the urban level as well as at the urban and rural level; however, this correlation is relatively weak at the rural level, implying that inequality issues in urban areas are more serious than in rural areas. Therefore, the economic crisis due to the COVID-19 pandemic will tend to affect Gini Index in urban areas.

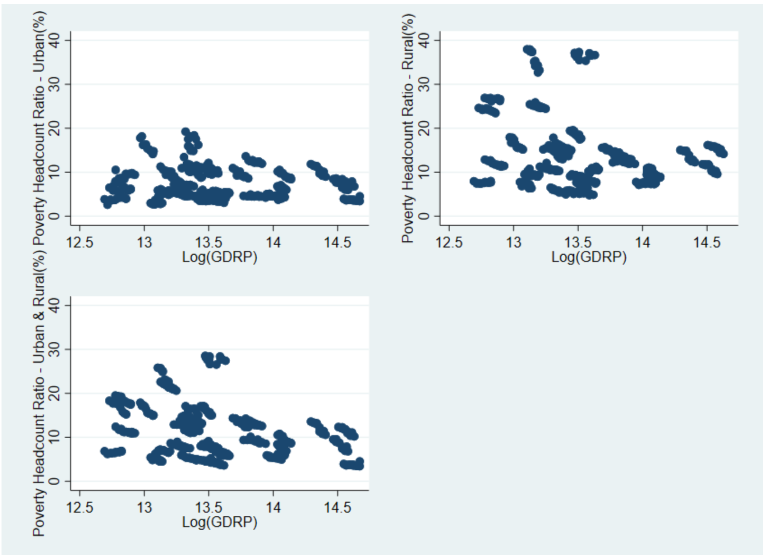
Figure 4: Scatter of Gini Index against Log(GDRP), March 2015 to March 2020



Source: Authors.

In contrast, Figure 5 shows that the GDRP has a clear positive correlation with poverty at the rural level and at the urban and rural level. It indicates that the effect of the COVID-19 pandemic on poverty through the economic crisis can be more serious in rural areas.

Figure 5: Scatter of Poverty Headcount Ratio against Log(GDRP), March 2015 to March 2020



Source: Authors.

To investigate the correlation amongst GDRP, Gini Index, and poverty, the basic model is estimated, then another covariate is added into the basic model. In the basic versions, Table 2 shows a positive and statistically significant relationship between the GDRP and the Gini Index only at the urban level. This finding suggests that a decrease in GDRP may help improve equality in expenditure distribution across provinces, especially at the urban level. It also confirms that economic growth tends to increase inequality.

In the extended model, the variable of migration is added. The result shows that the coefficient of GDRP loses its significance, although it still has the same sign in all estimations. This indicates that economic growth is not the only determinant of income distribution.

Meanwhile, the dummy variable of migration has a negative coefficient and is statistically significant in all estimations. This indicates that provinces with higher recent migration rates to Java tend to have lower inequality, confirming the benefit of migration in improving equality in home provinces. Therefore, concerning the current economic crisis, it suggests that when there is an outflow of migrants from Java back to their home provinces, inequality will increase in the home provinces. Migrants who have problems with their jobs or income in Java can negatively influence equality in their home provinces.

Table 2: Regression Results: Gross Domestic Regional Product on Gini Index

	Basic			Extended		
	Urban	**Rural**	**Urban + Rural**	**Urban**	**Rural**	**Urban + Rural**
	(1)	(2)	(3)	(4)	(5)	(6)
log10gdrp	0.024* (1.884)	-0.008 (-0.599)	0.019 (1.601)	0.020 (1.645)	–0.011 (–0.808)	0.014 (1.267)
dmig_med				–0.025** (–2.114)	–0.035*** (–2.961)	–0.038*** (–3.764)
_cons	0.044 (0.253)	0.425** (2.220)	0.106 (0.661)	0.098 (0.564)	0.482** (2.451)	0.187 (1.253)
N	34	33	34	34	33	34
R^2	0.104	0.010	0.068	0.215	0.216	0.341
F	3.550	0.359	2.562	5.762	4.550	9.704

Notes:

1. *t* statistics in parentheses.
2. Robust standard errors, $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Source: Authors.

Table 3: Regression Results: Gross Domestic Regional Product on Poverty Headcount Ratio

	Basic			Extended		
	Urban	**Rural**	**Urban + Rural**	**Urban**	**Rural**	**Urban + Rural**
	(1)	(2)	(3)	(4)	(5)	(6)
log10gdrp	–0.301 (–0.287)	–4.119* (–1.731)	–3.576** (–2.309)	–0.377 (–0.347)	–4.660* (–1.902)	–4.111** (–2.461)
dmig_med				–0.588 (–0.452)	–6.168** (–2.518)	–4.143** (–2.209)
_cons	11.346 (0.785)	69.582** (2.116)	59.514*** (2.779)	12.617 (0.843)	79.513** (2.322)	68.467*** (2.949)
N	34	33	34	34	33	34
R^2	0.002	0.062	0.095	0.009	0.216	0.217
F	0.082	2.998	5.333	0.154	3.676	4.508

Notes:

1. *t* statistics in parentheses.
2. Robust standard errors, $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Source: Authors.

The results of the basic estimation in Table 3 show that the GDRP has a negative and statistically significant correlation with the poverty headcount ratio at the rural level and at the urban and rural level. The relationship between the GDRP and poverty is also consistent in the extended estimations. Results indicate that economic growth provides benefits for the poor, especially in rural areas. Therefore, when the COVID-19 pandemic negatively affects the local economy, this can lead to an increased poverty rate in the most affected provinces.

The results of the extended model show that migration has a negative and statistically significant relationship with poverty at the rural level and at the urban and rural level. This means that provinces with high recent migration rates to Java reduce the poverty rate, possibly because of money transfers from migrants in Java to their families in their home provinces. Therefore, while the COVID-19 pandemic largely affects Java, some other provinces tend to have increased poverty rates as a further impact of the deep economic shock in Java.

These results confirm that the GDRP tends to have a positive correlation to inequality as measured by the Gini Index, especially at the urban level. However, since this correlation is relatively weak, it is difficult to expect that the economic crisis will significantly reduce the Gini Index. Yet economic growth has an important negative relationship with poverty in which an economic slowdown increases the poverty rate, especially at the rural level. In other words, the COVID-19 pandemic can adversely impact poverty in many provinces. Since reducing poverty takes years, the pandemic leaves a serious problem in dealing with poverty.

4.2. COVID-19 and Inequalities

Based on Tables 2 and 3, the Gini Index and poverty headcount ratio are then estimated in September 2020 by inserting the GDRP in September 2020 as published by BPS in early November 2020. The estimated results are presented in Table 4 for the Gini Index and in Table 5 for the poverty headcount ratio.

Table 4: Estimated Gini Index, September 2020

Province	Basic			Extended		
	Urban	Rural	Urban + Rural	Urban	Rural	Urban + Rural
Aceh	0.37	0.32	0.36	0.37	0.33	0.38
Sumatera Utara	0.38	0.31	0.37	0.38	0.33	0.38
Sumatera Barat	0.37	0.32	0.36	0.35	0.30	0.34
Riau	0.38	0.31	0.37	0.38	0.33	0.38
Jambi	0.37	0.32	0.36	0.34	0.30	0.34
Sumatera Selatan	0.38	0.31	0.37	0.35	0.29	0.34
Bengkulu	0.36	0.32	0.35	0.33	0.30	0.33
Lampung	0.38	0.31	0.37	0.35	0.30	0.34
Kep. Bangka Belitung	0.36	0.32	0.36	0.34	0.30	0.33
Kep. Riau	0.37	0.32	0.37	0.35	0.30	0.34
DKI Jakarta	0.40		0.38	0.39		0.39
Jawa Barat	0.39	0.31	0.38	0.39	0.32	0.39
Jawa Tengah	0.39	0.31	0.38	0.39	0.32	0.39
DI Yogyakarta	0.37	0.32	0.36	0.37	0.33	0.37
Jawa Timur	0.39	0.31	0.38	0.39	0.32	0.39
Banten	0.38	0.31	0.37	0.38	0.33	0.38
Bali	0.37	0.32	0.36	0.34	0.30	0.34
Nusa Tenggara Barat	0.37	0.32	0.36	0.37	0.33	0.37
Nusa Tenggara Timur	0.36	0.32	0.36	0.34	0.30	0.33
Kalimantan Barat	0.37	0.32	0.36	0.34	0.30	0.34
Kalimantan Tengah	0.37	0.32	0.36	0.34	0.30	0.34
Kalimantan Selatan	0.37	0.32	0.36	0.34	0.30	0.34
Kalimantan Timur	0.38	0.31	0.37	0.35	0.29	0.35
Kalimantan Utara	0.36	0.32	0.36	0.34	0.30	0.33
Sulawesi Utara	0.36	0.32	0.36	0.36	0.34	0.37
Sulawesi Tengah	0.37	0.32	0.36	0.37	0.33	0.38
Sulawesi Selatan	0.38	0.31	0.37	0.38	0.33	0.38
Sulawesi Tenggara	0.37	0.32	0.36	0.37	0.33	0.37
Gorontalo	0.35	0.32	0.35	0.36	0.34	0.37
Sulawesi Barat	0.35	0.32	0.35	0.36	0.34	0.37
Maluku	0.35	0.32	0.35	0.36	0.34	0.37
Maluku Utara	0.35	0.32	0.35	0.36	0.34	0.37
Papua Barat	0.36	0.32	0.36	0.36	0.34	0.37
Papua	0.37	0.32	0.36	0.37	0.33	0.38

Source: Authors’ calculations.

Table 5: Estimated Poverty Headcount Ratio, September 2020

Province	Basic			Extended		
	Urban	Rural	Urban + Rural	Urban	Rural	Urban + Rural
Aceh	7.28	13.88	11.15	7.52	16.49	12.87
Sumatera Utara	7.09	11.39	9.00	7.29	13.68	10.39
Sumatera Barat	7.24	13.44	10.78	6.89	9.83	8.29
Riau	7.10	11.53	9.11	7.30	13.83	10.52
Jambi	7.26	13.68	10.98	6.91	10.10	8.53
Sumatera Selatan	7.16	12.30	9.78	6.79	8.54	7.15
Bengkulu	7.41	15.76	12.79	7.10	12.46	10.61
Lampung	7.19	12.76	10.18	6.83	9.05	7.61
Kep. Bangka Belitung	7.40	15.54	12.60	7.08	12.21	10.39
Kep. Riau	7.24	13.42	10.76	6.89	9.81	8.27
DKI Jakarta	6.94		7.11	7.09		8.23
Jawa Barat	6.96	9.60	7.44	7.13	11.65	8.60
Jawa Tengah	7.02	10.32	8.06	7.19	12.46	9.32
DI Yogyakarta	7.31	14.33	11.55	7.56	17.00	13.32
Jawa Timur	6.95	9.40	7.26	7.11	11.42	8.40
Banten	7.12	11.75	9.31	7.32	14.09	10.75
Bali	7.26	13.72	11.02	6.92	10.15	8.57
Nusa Tenggara Barat	7.32	14.49	11.68	7.57	17.18	13.48
Nusa Tenggara Timur	7.36	15.04	12.16	7.04	11.64	9.89
Kalimantan Barat	7.28	13.88	11.15	6.93	10.33	8.73
Kalimantan Tengah	7.32	14.44	11.64	6.98	10.96	9.29
Kalimantan Selatan	7.28	13.88	11.15	6.93	10.33	8.73
Kalimantan Timur	7.11	11.64	9.21	6.73	7.79	6.49
Kalimantan Utara	7.38	15.28	12.37	7.06	11.92	10.13
Sulawesi Utara	7.33	14.61	11.79	7.59	17.32	13.60
Sulawesi Tengah	7.29	14.14	11.38	7.54	16.79	13.14
Sulawesi Selatan	7.15	12.18	9.68	7.36	14.57	11.18
Sulawesi Tenggara	7.32	14.49	11.68	7.57	17.18	13.48
Gorontalo	7.48	16.63	13.54	7.77	19.60	15.62
Sulawesi Barat	7.46	16.43	13.37	7.75	19.38	15.42
Maluku	7.47	16.51	13.44	7.76	19.47	15.50
Maluku Utara	7.48	16.65	13.56	7.77	19.63	15.64
Papua Barat	7.38	15.27	12.36	7.65	18.07	14.26
Papua	7.27	13.78	11.07	7.51	16.38	12.77

Source: Authors' calculations.

In addition, the change in poverty is estimated by comparing the number of the poor in March 2020 and September 2020. Since population data are not available for September 2020, these data are estimated by using population growth between September 2019 and March 2020. Then, this estimated population is multiplied with the estimated poverty headcount ratio in September 2020 based on the extended estimation results in Table 5. To have an indication of the poverty change during the COVID-19 pandemic, the number of poor in March 2020 and the estimated number of poor in September 2020 are then compared. The result of this simple method for urban and rural level are provided in Table 6.

Table 6: Estimated Change in the Number of Poor Persons, March 2020 to September 2020

Province	Urban	Rural
Aceh	–39,914	–30,570
Sumatera Utara	–111,879	334,049
Sumatera Barat	50,750	71,397
Riau	36,163	283,065
Jambi	–41,080	97,704
Sumatera Selatan	–170,275	–234,065
Bengkulu	–50,771	–35,213
Lampung	–56,529	–278,461
Kep. Bangka Belitung	34,145	40,686
Kep. Riau	31,378	–1,269
DKI Jakarta	273,551	
Jawa Barat	15,856	165,768
Jawa Tengah	–513,266	–50,952
DI Yogyakarta	–111,111	29,109
Jawa Timur	–161,162	–615,515
Banten	224,442	220,485
Bali	109,291	73,035
Nusa Tenggara Barat	–180,043	110,154
Nusa Tenggara Timur	–20,329	–546,932
Kalimantan Barat	41,274	62,864
Kalimantan Tengah	27,049	100,617
Kalimantan Selatan	68,026	119,835
Kalimantan Timur	59,558	–20,200
Kalimantan Utara	9,768	8,052
Sulawesi Utara	31,706	86,055
Sulawesi Tengah	–10,739	48,159
Sulawesi Selatan	112,893	133,839
Sulawesi Tenggara	5,573	63,863
Gorontalo	19,720	–26,060
Sulawesi Barat	–5,856	88,709
Maluku	13,047	–68,084
Maluku Utara	12,141	109,637
Papua Barat	7,785	–81,478
Papua	30,143	–463,953

Source: Authors' calculations.

The table gives a preliminary indication of the increase in the number of poor both at the urban and rural levels in some provinces, while other provinces show an increase in urban or rural areas. However, there are also provinces that show a decrease in the number of poor. It seems that many provinces with a close connection with Java through migration tend to have an increase in the number of poor, such as Bali, Bangka Belitung, Sumatera Barat, and provinces in Kalimantan. Meanwhile, Banten, Jakarta, and Jawa Barat are three provinces in Java that show a large increase in the number of the poor, reflecting a direct impact of COVID-19.

To formally identify the impact of the COVID-19 pandemic on inequality, a correlation analysis is then conducted between the inequalities in September 2020 that were estimated in the second step (*E* in the left-hand variables) and cumulative confirmed COVID-19 cases from March 2020 until September 2020 ($CC19_{Sept2020}$):

$$IQE_{Sept2020} = \alpha_0 + \alpha_1 LogCC19_{Sept2020} + \varepsilon \qquad (3)$$

Cumulative confirmed COVID-19 cases and deaths (in log) are used to represent the COVID-19 variable. COVID-19 is strongly correlated with the inequality indices when the regression coefficients are positive and statistically significant. This model is also applied to the Gini Index and poverty headcount ratio at the urban, rural, and urban and rural levels. The results are presented in Table 7 and Table 8.

The basic estimations in Table 7 that use the Gini Index from the basic model of Table 4 shows that COVID-19, as measured by confirmed cases and deaths, has a different influence on the Gini Index at different locations. At the urban level, this pandemic has a positive and statistically significant coefficient, while the opposite sign is found at the rural level. This means that provinces with more COVID-19 tend to have an increase in inequality in urban areas, but inequality in rural areas decrease. The extended estimations generally show the same results, except for rural areas in which the coefficients lose significance and change to a positive sign.

Table 7: Regression Results: COVID-19 on Gini Index

	Basic			Extended		
	Urban	**Rural**	**Urban + Rural**	**Urban**	**Rural**	**Urban + Rural**
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable: COVID-19 confirmed cases						
log10_confirmed	0.015*** (5.852)	–0.005*** (–4.931)	0.010*** (5.272)	0.020*** (5.342)	0.005 (1.167)	0.021*** (4.390)
_cons	0.319*** (34.233)	0.334*** (97.925)	0.328*** (47.922)	0.290*** (22.112)	0.299*** (18.266)	0.287*** (16.264)
N	34	33	34	34	33	34
R^2	0.487	0.344	0.440	0.441	0.027	0.350
F	34.249	24.317	27.794	0.424	-0.004	0.330
Independent variable: COVID-19 deaths						
log10_death	0.012*** (6.054)	–0.004*** (–5.565)	0.008*** (4.921)	0.015*** (5.574)	0.003 (0.919)	0.016*** (4.672)
_cons	0.348*** (82.832)	0.325*** (263.518)	0.348*** (105.378)	0.331*** (66.742)	0.311*** (39.340)	0.329*** (45.133)
N	34	33	34	34	33	34
R^2	0.475	0.354	0.405	0.393	0.019	0.318
F	36.656	30.970	24.220	0.374	-0.013	0.296

Notes:

1. *t* statistics in parentheses.
2. Robust standard errors, $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Source: Authors.

Table 8 shows the results of the impact of COVID-19 on the poverty headcount ratio. From the basic estimations, the two COVID-19 indicators have a negative and statistically significant coefficient at all locations. However, the results of the extended estimations tend to have an insignificant coefficient, except for at the urban and rural level. This finding indicates that provinces that suffered COVID-19 tend to have a decrease in their poverty headcount ratios. Since the death rate due to COVID-19 is relatively low, then it is possible that a government subsidy or stimulus for the poor plays a role in helping the poor maintain their living conditions.

Table 8. Regression Results: COVID-19 on the Poverty Headcount Ratio

	Basic			Extended		
	Urban	Rural	Urban + Rural	Urban	Rural	Urban + Rural
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable: COVID-19 confirmed cases						
log10_confirmed	–0.189***	–2.470***	–2.255***	–0.046	–0.771	–1.244**
	(–6.696)	(–5.601)	(–6.734)	(–0.629)	(–0.850)	(–2.107)
_cons	7.923***	22.353***	18.875***	7.410***	16.378***	15.265***
	(75.972)	(14.171)	(15.275)	(26.242)	(4.815)	(6.637)
N	34	33	34	34	33	34
R^2	0.549	0.493	0.556	0.007	0.014	0.074
F	44.842	31.371	45.352	0.395	0.722	4.438
Independent variable: COVID-19 deaths						
log10_death	–0.148***	–1.881***	–1.759***	–0.040	–0.660	–1.001*
	(–6.644)	(–5.992)	(–6.584)	(–0.642)	(–0.890)	(–1.942)
_cons	7.543***	17.323***	14.340***	7.327***	14.946***	12.825***
	(160.282)	(27.082)	(25.384)	(49.010)	(8.830)	(10.374)
N	34	33	34	34	33	34
R^2	0.515	0.471	0.520	0.008	0.017	0.074
F	44.147	35.902	43.354	0.412	0.793	3.770

Notes:

1. *t* statistics in parentheses.
2. Robust standard errors, $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Source: Authors.

In general, this finding is in line with other studies, such as Blundell, Dias, Joyce, and Xu (2020) in the United Kingdom, and Visagie and Turok (2020) in South Africa. It also implies that inequality, as indicated by the Gini Index at the urban level, should be concerned with COVID-19, especially since urban areas are the most affected. However, the possible role of COVID-19 in reducing inequality at the rural level should also be evaluated to identify the underlying process. Furthermore, since COVID-19 variables negatively impact the poverty rate at all locations, it is possible that various government subsidies have an important influence on the poverty rate.

Regarding underreporting COVID-19 statistics, the health criteria for implementing COVID-19 tests is a concern, calling into question the level of surveillance and testing. According to the WHO, the minimum number of *Tes Cepat Molekuler* (TCM) and polymerase chain reaction (PCR) tests in Indonesia is 38,000 per day. The benchmark is 1 person tested per 1,000 per week. However, only four provinces have achieved this minimum case detection benchmark for the last 3 weeks, as of February 2020: DKI Jakarta, West Sumatra, East Kalimantan, and West Papua (WHO, 2020). Based on this information, a dummy variable representing this benchmark (notated as *benchmark*) was created. The four provinces that achieved the benchmark are marked with the value of 1, and 0 otherwise. This dummy variable is added into the model used in Table 7 and Table 8.

The results of the robustness test are presented in Table 9 and Table 10. On the Gini Index, the results confirm that there are no changes in terms of the sign of the coefficients of COVID-19 and their level of significance. The dummy variable of the minimum test detection has no statistically significant relationship with the Gini Index in all estimations.

Table 9: Robustness Test of COVID-19 on the Gini Index

	Basic			**Extended**		
	Urban	**Rural**	**Urban + Rural**	**Urban**	**Rural**	**Urban + Rural**
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable: COVID-19 confirmed cases						
log10_confirmed	0.014*** (5.817)	–0.005*** (–4.951)	0.010*** (4.947)	0.021*** (5.183)	0.006 (1.262)	0.023*** (4.284)
benchmark	0.001 (0.162)	0.001 (0.277)	–0.000 (–0.038)	–0.008 (–1.315)	–0.010 (–0.659)	–0.010 (–1.009)
_cons	0.319*** (34.357)	0.334*** (97.653)	0.328*** (45.970)	0.286*** (20.292)	0.298*** (17.686)	0.283*** (14.899)
N	34	33	34	34	33	34
R^2	0.487	0.346	0.440	0.464	0.052	0.371
F	17.128	12.266	13.766	13.841	0.901	9.476
Independent variable: COVID-19 deaths						
log10_deaths	0.011*** (6.222)	–0.004*** (–5.495)	0.007*** (4.710)	0.016*** (5.405)	0.004 (0.949)	0.017*** (4.475)
benchmark	0.003 (0.660)	0.000 (0.102)	0.002 (0.598)	–0.005 (–0.660)	–0.009 (–0.618)	–0.006 (–0.587)
_cons	0.348*** (83.438)	0.325*** (257.663)	0.348*** (104.243)	0.331*** (64.571)	0.311*** (37.823)	0.329*** (43.397)
N	34	33	34	34	33	34
R^2	0.481	0.354	0.408	0.400	0.040	0.325
F	0.447	0.311	0.370	14.814	0.573	10.337
log10_deaths	0.011*** (6.222)	–0.004*** (–5.495)	0.007*** (4.710)	0.016*** (5.405)	0.004 (0.949)	0.017*** (4.475)
benchmark	0.003 (0.660)	0.000 (0.102)	0.002 (0.598)	–0.005 (–0.660)	–0.009 (–0.618)	–0.006 (–0.587)

Notes:

1. *t* statistics in parentheses.
2. Robust standard errors, $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Source: Authors.

In Table 10, the same results are found, indicating that both the sign and level of significance of the COVID-19 variable are stable, and the benchmark of case detection has a statistically insignificant relationship with the poverty rate at all levels. Therefore, this test suggests the robustness of the estimation results in the two previous tables. The results also indicate that the benchmark of case detection does not have a different influence on the Gini Index as well as on the poverty headcount ratio.

Table 10: Robustness Test of COVID-19 on the Poverty Headcount Ratio

	Basic			**Extended**		
	Urban	**Rural**	**Urban + Rural**	**Urban**	**Rural**	**Urban + Rural**
	(1)	(2)	(3)	(4)	(5)	(6)
Independent variable: COVID-19 confirmed cases						
log10_confirmed	-0.189***	-2.484***	-2.251***	-0.020	-0.667	-1.058
	(-6.209)	(-5.549)	(-6.266)	(-0.246)	(-0.717)	(-1.617)
benchmark	-0.003	0.231	-0.032	-0.169	-1.821	-1.217
	(-0.069)	(0.383)	(-0.064)	(-0.830)	(-0.679)	(-0.775)
_cons	7.922***	22.378***	18.861***	7.339***	16.177***	14.749***
	(72.417)	(14.058)	(14.585)	(23.922)	(4.612)	(5.956)
N	34	33	34	34	33	34
R^2	0.549	0.494	0.556	0.034	0.035	0.094
F	0.520	0.460	0.528	0.575	0.553	2.597
Independent variable: COVID-19 deaths						
log10_deaths	-0.145***	-1.881***	-1.724***	-0.026	-0.614	-0.882
	(-6.349)	(-5.868)	(-6.318)	(-0.378)	(-0.802)	(-1.601)
benchmark	-0.034	-0.007	-0.400	-0.168	-1.869	-1.358
	(-0.756)	(-0.012)	(-0.755)	(-0.858)	(-0.709)	(-0.907)
_cons	7.541***	17.323***	14.319***	7.318***	15.028***	12.751***
	(158.023)	(26.549)	(25.026)	(46.833)	(8.491)	(9.918)
N	34	33	34	34	33	34
R^2	0.520	0.471	0.525	0.036	0.039	0.100
F	22.526	17.491	22.018	0.624	0.629	2.429

Notes:
1. *t* statistics in parentheses.
2. Robust standard errors, $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Source: Authors.

4.3. COVID-19 and Spatial Disparities

Finally, some dispersion indexes are estimated to discern if the pandemic affects disparities across provinces. The coefficient of variation (*CV*) is used to measure the level of spatial inequality of the Gini Index, as well as the poverty rate for March 2015 to March 2020 and for September 2020 for all types of locations. *CV* is a measure that has been widely used in the study of spatial inequality.

$$CV = (\sigma/\mu) \times 100\% \qquad (4)$$

where σ is standard deviation, and μ is mean. The results are presented in Table 11.

Table 11: Coefficient of Variation: Gini Index and Poverty Headcount Ratio

	March 2015 – March 2020	September 2020 (estimated)	
		Basic	Extended
Gini Index			
Urban	10.20	3.06	4.79
Rural	12.49	1.47	5.51
Urban + Rural	10.02	2.31	5.74
Poverty Headcount Ratio			
Urban	47.71	1.96	4.54
Rural	56.71	14.16	26.47
Urban + Rural	51.71	15.32	24.73

Source: Authors' calculations.

The table shows that spatial inequality across provinces in Indonesia before the COVID-19 pandemic was relatively high, especially for the poverty headcount ratio. Based on location, spatial inequality based on BPS data at the rural level was higher than at the urban level. For instance, the coefficient of variation of the Gini Index of rural areas and of urban areas are 12.49 and 10.20, respectively. Meanwhile, the coefficients of variation of the poverty rate of rural areas and of urban areas are 56.71 and 47.71, respectively.

To calculate the coefficient of variation, the estimated Gini Index and poverty headcount ratio for September 2020 is used. These coefficients of variation are relatively low, but should be interpreted with caution. The true coefficient of variation will be calculated when real data from September 2020's Gini Index and poverty rate are obtained. However, these estimated coefficients of variation give an early indication that COVID-19 can have a different impact on the spatial inequality of the Gini Index and poverty rate.

It is possible that COVID-19 tends to increase the spatial inequality of the Gini Index at the urban level but reduce the spatial inequality of Gini Index at the rural level since the coefficients of variation of the Gini Index at the urban level are relatively higher than those at the rural level in the basic estimations. In addition, COVID-19 possibly reduces the spatial inequality of the poverty headcount ratio at the urban level as well as at the rural level. However, it seems that the influence of COVID-19 in reducing this inequality is higher at the urban level than at the rural level. This probably indicates that the distribution of government subsidies or other social programmes tend to provide benefits for urban areas rather than rural ones.

5. Conclusion

This study investigates whether COVID-19 is worsening socio-economic inequalities across provinces in Indonesia, and whether the pandemic is affecting the spatial disparity in socio-economic indicators at the provincial level in Indonesia. Available secondary data at the provincial level from BPS are used from March 2015 to March 2020.

The results indicate that provinces with more COVID-19 cases tend to have increased inequality in urban areas, but inequality in rural areas is decreasing, as measured by the Gini Index. This means that the distributional implication of COVID-19 at the urban level is larger than at the rural level. It also finds that provinces with many COVID-19 cases and deaths tend to have decreasing poverty headcount ratios.

The study also provides an early indication that COVID-19 can have a different impact on the spatial inequality of the Gini Index and the poverty headcount ratio. It is possible that COVID-19 influences the spatial inequality of the Gini Index at the urban level but reduces the spatial inequality of Gini Index at the rural level. COVID-19 possibly also reduces the spatial inequality of the poverty rate at the urban level but sustains the spatial inequality of the poverty headcount ratio at all levels.

Some policy implications can be derived based on these findings. First, inequality, as indicated by the Gini Index, at the urban level is concerning regarding COVID-19. Second, the possible effect of COVID-19 in reducing inequality at the rural level should also be evaluated to identify the underlying reason. Third, since COVID-19 variables have a negative impact on the poverty headcount at all locations, it is also important to document the possible influence of various government subsidies on poverty. Fourth, the distribution of government subsidies or other social programmes should be improved to provide more equal benefits for both urban and rural areas.

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