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Trade openness, poverty, and income inequality: Subnational evidence from Indonesia

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Abstract

Purpose — This study examines the relationship between trade openness, poverty, and income inequality across 34 Indonesian provinces from 2015 to 2019, while accounting for differences in access to basic services, employment, port infrastructure, and regional income.
Method — The empirical analysis employs panel regression models using fixed effects, random effects, and Least Squares Dummy Variable specifications. Model selection is guided by the Hausman test. Poverty is measured using the poverty headcount, poverty gap, and poverty severity indices, while income inequality is measured using the Gini index.
Findings — Trade openness is positively associated with poverty incidence and income inequality. In the preferred random-effects specification, trade openness increases the poverty headcount with a coefficient of 0.897 ($p < 0.10$), while the preferred fixed-effects specification shows a positive effect on the Gini index with a coefficient of 0.041 ($p < 0.01$). However, its effects on the poverty gap and poverty severity are not statistically significant. Higher regional income and greater access to several basic services are generally associated with lower poverty outcomes.
Implications — Trade expansion should be accompanied by inclusive policies that improve access to basic services, decent employment, and workforce skills. Strengthening these areas can help low-income households benefit more from economic openness while reducing the risks of higher poverty and income inequality.
Originality — This study contributes to the trade–poverty literature by examining multiple dimensions of poverty and income inequality within a provincial panel framework in Indonesia, providing evidence that the distributional effects of trade openness differ across welfare indicators.
Keywords: Trade Openness, Poverty, Income Inequality
JEL Classification: F13; I32; D63

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Introduction

Globalization has deepened international trade and economic integration, potentially supporting long-term growth. However, the developmental benefits of trade openness, particularly in developing countries, remain contested.

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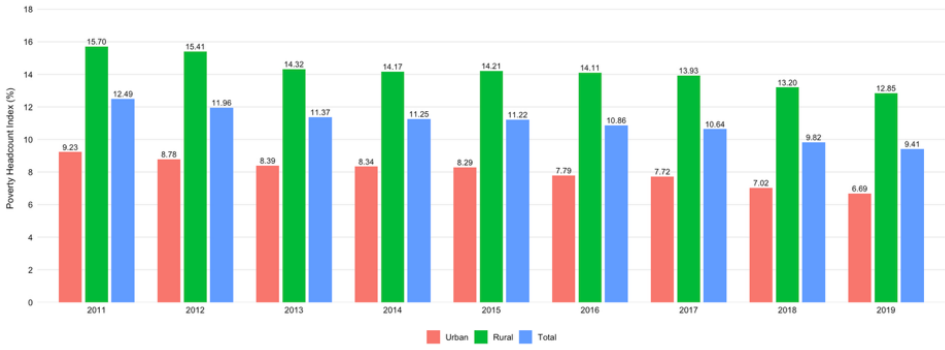
According to international trade theory, the openness of trade can enhance the well-being of individuals in the participating countries, offering the potential to alleviate poverty and reduce income inequality, particularly in developing nations. Nevertheless, alternative perspectives have emerged from research findings in other developing countries. These findings suggest that trade openness may not only fail to mitigate poverty and income inequality but could also intensify these challenges in developing economies.

Figure 1. Number of People Living in Poverty by Urban and Rural Areas in Indonesia



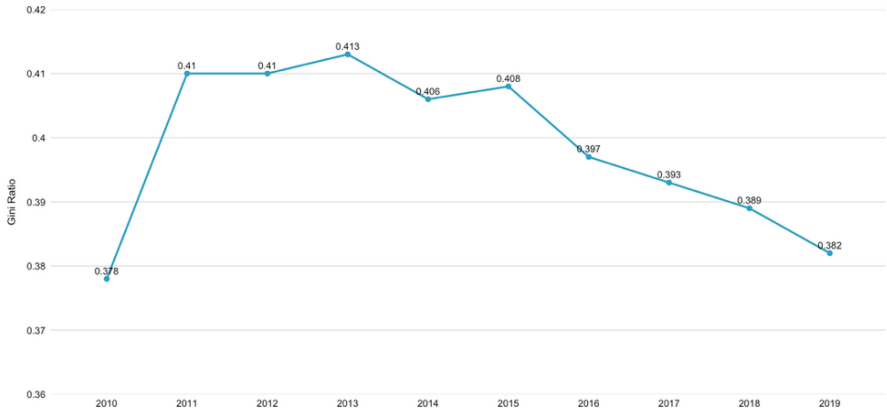
Source: Statistic Indonesia (2020)

Studies in Pakistan also found that reductions in import tariffs have enlarged Pakistan's level of poverty, which is robust to different poverty measures (Ul-Haq et al., 2022). Investigation in Indonesia reveals that the import duty reduction increased poverty incidence in rural areas and at the national level, while income distribution inequality increased at all levels – urban, rural, and national (Sukoco et al., 2020). In sub-Saharan Africa, trade liberalization led to poverty reduction in the long run, while trade openness had adverse effects in the short run (Yameogo and Omojolaibi, 2021).

Research conducted by Bashir et al. (2023) discovered that trade openness, urbanization, inflation, and household consumption expenditure significantly increased income inequality in developing countries. In Southern African Development Community (SADC) countries, trade openness significantly worsens income inequality in the long run (Gonese et al., 2022). Further findings suggest that income inequality can be reduced through high economic growth, a high human capital index, strong financial development, and enhanced institutional quality. The benefits of trade openness of increasing human capital productivity have not been realized in developing countries due to less-well-trained and less-skilled workers (Khan et al., 2015).

In Southern Africa Development Community (SADC) countries, trade openness significantly worsens income inequality in the long run (Gonese et al., 2022). Further findings suggest that income inequality can be reduced through high economic growth, a high human capital index, strong financial development, and enhanced institutional quality. The fruits of the trade openness to increase the productivity of human capital have not been achieved in developing countries due to less groomed and less skilled workers (Khan et al., 2015).

Figure 2. Income Distribution Inequality in Indonesia



Source: Statistic Indonesia (2020)

Trade openness tends to increase income inequality, while the marginal effect shows that institutional quality has a corrective effect on the trade openness-income inequality nexus (Goh and Law, 2019). Not only in developing countries, but also in advanced economies like China (Dorn et al., 2022), East Asia (Hayam, 2022), and European economies (Sarıgül, 2024), it was found that greater trade openness worsens income redistribution. These findings suggest that governments should increase efforts to boost the participation of poor and vulnerable populations in external markets so that trade openness can support poverty alleviation. Institutions, especially political regimes, could help explain the ambiguity of the trade-poverty relationship (Fambeu, 2021).

Starting from 1995, the Indonesian government has implemented significant modifications to its international trade policy regulations. These changes involve substantial reductions in import tariffs and the elimination of non-tariff barriers. These adjustments were undertaken in alignment with Indonesia's commitment to becoming a part of the World Trade Organization (WTO).

The discourse surrounding free trade has persisted for an extended period, particularly among structuralist economists, who argue that developed nations' advocacy for free trade primarily serves their interests at the expense of developing countries like Indonesia. According to the perspective of structuralist economists, the application of free market policies is deemed inconsequential for the advancement of emerging economic sectors in developing nations. They provide three key reasons to support their stance: firstly, private enterprises are inherently risk-averse; secondly, international markets for new economic sectors already boast established leaders; and thirdly, other nations implement protectionist policies to shield their industries from global economic market competition.

In 2001, the Committee on Economic, Social and Cultural Rights (CESR) articulated a definition of poverty, characterizing it as a persistent or chronic state of human deprivation. This condition involves a lack of essential resources, capabilities, choices, security, and powers needed of enjoy an adequate standard of living, as well as civil, cultural, economic, political, and social rights. This definition posits poverty as both a cause and a consequence of human rights violations. People in poverty not only face numerous obstacles in accessing rights and public facilities (such as education, housing, food, healthcare, and decent employment) but also find themselves trapped in a vicious cycle where their lack further hinders their ability to escape the web of poverty.

The non-utilitarian perspective considers the context of poverty as the loss of fundamental values such as basic rights and freedoms. The concept suggests that poverty is fundamentally a lack of individual freedom to lead a desired life - a severe deprivation of basic capabilities - and that such freedom has extraordinary ethical value (Sen, 1999). Sen proposed that human well-being should be assessed based on the capabilities or abilities of individuals. Capability poverty defines poverty by the low achievement of access to food, health, education, housing, and sanitation. The goal of the capability-based approach is to demonstrate that government policies focused solely on alleviating income poverty are insufficient to eradicate poverty.

This approach emphasizes that addressing poverty requires a broader perspective that incorporates basic human development rights, such as the fundamental needs mentioned earlier: food, health, education, housing, and sanitation. In other words, the emphasis is not just on increasing income but on ensuring that individuals have the capabilities to lead a dignified and fulfilling life by accessing essential resources and opportunities. Countries should not focus only on increasing the incomes of the poor to reduce poverty; they also need to improve the provision of necessary facilities and increase life expectancy to eliminate poverty (Amar et al., 2020).

This research aimed to assess the tangible effects of trade openness on poverty and income inequality in Indonesia from 2015 to 2019. The study used four poverty indicators, encompassing the definition of absolute poverty defined by the Poverty Headcount Index (P0) and Poverty Gap (P1), and relative poverty measured by the Poverty Severity Index (P2) and Gini Index. Using a fundamental rights-based poverty approach, the model incorporates independent variables reflecting the extent to which basic rights of the community's basic rights are fulfilled. These variables include access to education, healthcare, infrastructure, sanitation, and decent work, all of which will be elaborated upon in the research methodology.

Methodology

This research relies on secondary data from the Central Statistics Agency (BPS), the Ministry of Health, and the Ministry of Public Works and Housing for 34 provinces in Indonesia, spanning 2015 to 2019.

Adopting a fundamental rights-based poverty approach, the measurement of poverty is grounded in people's access to essential rights that need to be satisfied. In addition to control variables such as education, health, infrastructure, and per capita GRDP, the authors have incorporated variables related to main port access, community access to proper sanitation, and decent occupation. Based on data from the Central Statistics Agency (*BPS*), five major ports in Indonesia are used for trade activities, including exports and imports.

These ports are: Belawan (North Sumatra), Tanjung Priok (Jakarta), Tanjung Emas (Central Java), Tanjung Perak (East Java), and Makassar (South Sulawesi). This categorization underpins the inclusion of a dummy variable in the model, where the dummy variable equals 0 if province i does not have a major port, and equals 1 if province i possesses one of the major ports. To measure poverty and inequality, this study employs four indicators: the Poverty Headcount Index (P0), Poverty Gap Index (P1), Poverty Severity Index (P2), and Gini Index.

The Poverty Headcount Index (P0) measures the proportion of the population living below the poverty line, while the Poverty Gap Index (P1) captures the average expenditure shortfall of poor individuals relative to the poverty line; a higher value indicates a greater distance from the poverty threshold. The Poverty

Severity Index (P2) further accounts for inequality in expenditure among the poor, where a higher value reflects greater disparity within the poor population. Finally, the Gini Index measures overall expenditure inequality, using household expenditure as a proxy for income. A Gini value closer to zero indicates a more equal distribution of expenditure across the population.

The primary independent variable is trade openness, defined as the ratio of the total value of exports and imports to the Gross Regional Domestic Product (GRDP). This indicator is referred to as trade volume relative to GRDP. A higher ratio indicates a greater reliance on and integration with global markets. Sachs and Warner (1995) utilized this indicator to measure a country's orientation to the world economy.

The measurement method adopted in this research involves the panel regression model, incorporating fixed effect, random effect, and least squares dummy variable (LSDV) methods. The choice of this timeframe is deliberate, as the authors aim to utilize the most recent data sources and mitigate potential biases introduced by the Covid-19 pandemic's impact in 2020. Dummy variable data for major ports based on the definition of major ports as specified by BPS. This study estimates four panel regression models using different measures of poverty and income inequality as the dependent variables. The first model uses the Poverty Headcount Index (P0) as the dependent variable:

$$P0_{it} = \alpha + \beta_1 \mathrm{TO}_{it} + \beta_2 \mathrm{ports}_i + \beta_3 \mathrm{Health}_{it} + \beta_4 \mathrm{Education}_{it} + \beta_5 \mathrm{Infrastructure}_{it} + \beta_6 \mathrm{sanitation}_{it} + \beta_7 \mathrm{occupation}_{it} + \beta_8 \mathrm{Lngrdp}_{it} + \varepsilon_{it} \quad (1)$$

The second model uses the Poverty Gap Index (P1) as the dependent variable while retaining the same set of explanatory variables:

$$P1_{it} = \alpha + \beta_1 \mathrm{TO}_{it} + \beta_2 \mathrm{ports}_i + \beta_3 \mathrm{Health}_{it} + \beta_4 \mathrm{Education}_{it} + \beta_5 \mathrm{Infrastructure}_{it} + \beta_6 \mathrm{sanitation}_{it} + \beta_7 \mathrm{occupation}_{it} + \beta_8 \mathrm{Lngrdp}_{it} + \varepsilon_{it} \quad (2)$$

The third model replaces the dependent variable with the Poverty Severity Index (P2) to capture differences in the severity of poverty:

$$P2_{it} = \alpha + \beta_1 \mathrm{TO}_{it} + \beta_2 \mathrm{ports}_i + \beta_3 \mathrm{Health}_{it} + \beta_4 \mathrm{Education}_{it} + \beta_5 \mathrm{Infrastructure}_{it} + \beta_6 \mathrm{sanitation}_{it} + \beta_7 \mathrm{occupation}_{it} + \beta_8 \mathrm{Lngrdp}_{it} + \varepsilon_{it} \quad (3)$$

The fourth model uses the Gini Index as the dependent variable to assess income distribution inequality:

$$\mathrm{Gini}_{it} = \alpha + \beta_1 \mathrm{TO}_{it} + \beta_2 \mathrm{ports}_i + \beta_3 \mathrm{Health}_{it} + \beta_4 \mathrm{Education}_{it} + \beta_5 \mathrm{Infrastructure}_{it} + \beta_6 \mathrm{sanitation}_{it} + \beta_7 \mathrm{occupation}_{it} + \beta_8 \mathrm{Lngrdp}_{it} + \varepsilon_{it} \quad (4)$$

Table 1 summarizes the variables included in the four model specifications, including their definitions and corresponding data sources.

Table 1. List of Variables

Variable	Description
P0	Poverty headcount index in province i and year t
P1	Poverty gap in province i and year t
P2	Poverty severity index in province i and year t
Gini	Gini index in province i and year t
TO	Sum of export and import in province i year t
Ports	Dummy variables of major ports in Indonesia
Health	Ratio of population to the number of health centers in province i in year t
Education	School of participation rate for children aged 13 – 15 years in province i and year t
Infrastructure	Ratio of road length to population in province i and year t
Sanitation	Percentage of households with access to proper sanitation in province i and year t
Occupation	Percentage of formal sector labor force in province i and year t
Lngrdp	Natural logarithm of per capita gross regional domestic product (GRDP) in province i and year t

Source: Processed by Author

The Hausman test is conducted to determine whether a fixed-effects model or a random-effects model is more appropriate. If the Hausman test yields a significant result (p-value less than $\alpha = 5\%$), the fixed effects model is preferred. Conversely, if the Hausman test result is not significant (p-value greater than $\alpha = 5\%$), the random effects model is deemed more suitable.

The presence of time-invariant dummy variables can cause bias in the fixed effects panel regression results, leading to issues such as omitted variable bias, even in the absence of perfect multicollinearity in the model. To address this, we employ a panel regression using the least squares dummy variable (LSDV) method, incorporating regional/unit-of-analysis (provincial) control variables. Consequently, both regression methods fixed effects or random effects and LSDV are presented in the estimation results.

Results and Discussion

In equations 1 and 2, with dependent variables Poverty headcount (P0) and poverty gap (P1), respectively, the p-values were not significant; the chosen model is REM. An LSDV regression method is also employed, incorporating regional controls (provinces) to account for the presence of time-invariant dummy variables related to major ports.

Table 2. Descriptive Statistics

Variable	Measurement	Observation	Mean	Std. Deviation	Min	Max
P0	Percentage	170	11.191	5.932	3.47	28.54
P1	Percentage	170	2.07	1.62	0.46	9.37
P2	Percentage	170	0.585	0.635	0.08	4.19
Gini	Percentage	170	0.36	0.038	0.27	0.441
TO	Ratio	167	0.52	0.45	0.03	1.68
Ports	Dummy	170	0.147	0.355	0	1
Education	Percentage	170	94.867	3.585	78.14	99.72
Health	Ratio	170	21,762.06	11,373.30	5,801.33	52,982.83
Infrastructure	Ratio	170	3.649	2.152	0.423	13.042
Sanitation	Percentage	170	67.322	14.285	23.9	94.67
Occupation	Percentage	170	41.852	11.356	18.51	72.96
Ln GRDP	Nominal	170	40,704.37	30,701.87	11,087.91	174,812.50

Source: Processed by Author

The coefficient of trade openness is positive across all four welfare indicators. However, in the preferred specifications, the association is statistically significant only for

the poverty headcount (P0) and the Gini index, while the coefficients for the poverty gap (P1) and poverty severity (P2) are not statistically significant. These findings suggest that greater trade openness is associated with a higher incidence of poverty and greater income inequality in Indonesia, although the relationship is not statistically evident for the depth and severity of poverty.

Table 3. Estimation Results of Model 1 & 2

Variables	P0: LSDV	P0: RE	P1: LSDV	P1: RE
TO	1.278**	0.897*	0.618*	0.291
	(0.522)	(0.495)	(0.316)	(0.265)
Ports	-3.984***	1.562	-1.220**	0.311
	(0.974)	(2.500)	(0.588)	(0.686)
Education	0.152	0.015	-0.063	-0.119**
	(0.133)	(0.117)	(0.08)	(0.052)
Health	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Infrastructure	-0.257***	-0.219***	-0.038	-0.004
	(0.084)	(0.084)	(0.051)	(0.049)
Sanitation	-0.020**	-0.023***	-0.001	-0.005
	(0.008)	(0.008)	(0.005)	(0.004)
Occupation	-0.026	-0.039*	-0.014	-0.023*
	(0.022)	(0.022)	(0.013)	(0.013)
Ln GRDP	-6.135***	-4.668***	-1.628**	-0.514
	(1.135)	(0.941)	(0.686)	(0.403)
Constant	69.120***	66.530***	26.790***	20.780***
	(13.140)	(12.240)	(7.940)	(5.921)
Observations	167	167	167	167
R-squared	0.995	—	0.976	—

Source: Processed by Author

In equations 3 and 4, with dependent variables poverty severity (P2) and the Gini index, respectively, the resulting p-values were significant; the chosen model is FEM. An LSDV regression method is also employed by incorporating regional control (provinces) to account for the presence of time-invariant dummy variables related to major ports.

Table 4. Estimation Results of Model 3 & 4

Variables	P2: LSDV	P2: FE	Gini: LSDV	Gini: FE
TO	0.306	0.306	0.041***	0.041***
	-0.188	-0.188	-0.012	-0.012
Ports	-0.695**	—	0.104***	—
	-0.35	—	-0.022	—
Education	-0.080*	-0.080*	0.002	0.002
	-0.048	-0.048	-0.003	-0.003
Health	0	0	0	0
	0	0	0	0
Infrastructure	-0.029	-0.029	-0.005***	-0.005***
	-0.03	-0.03	-0.002	-0.002
Sanitation	0.001	0.001	0	0
	-0.003	-0.003	0	0
Occupation	-0.007	-0.007	0.001**	0.001**
	-0.008	-0.008	-0.001	-0.001
Ln GRDP	-0.545	-0.545	-0.120***	-0.120***
	-0.408	-0.408	-0.026	-0.026
Constant	14.650***	14.250***	1.304***	1.333***
	-4.718	-4.653	-0.301	-0.297
Observations	167	167	167	167
R-squared	0.945	0.156	0.936	—

Source: Processed by Author

The findings from Mbah et al. (2022) in Nigeria support the notion that trade openness exhibits a significant positive correlation with both short-term and long-term poverty, suggesting that trade expansion may worsen poverty. These results line up with relevant findings by Onakoya et al., (2019) & Turongpun (2022), indicating that while trade openness provides growth opportunities, it does not effectively contribute to poverty reduction. The expansion of trade within the context of globalization, as highlighted in these studies, appears to yield disappointing outcomes in eradicating poverty, potentially due to the exacerbation of income inequality associated with free trade practices. The phenomenon also represents the inability and failure of developing countries to diversify production and exports despite numerous trade diversification efforts.

The negative impact of trade openness on the poor in a country is emphasized by Rodrik and Kennedy (2001), who contend that this process necessitates the conversion of labor into human capital. In the case of developing countries, the full transformation of the workforce into a skilled and trained population is often impractical, contributing to the persistence of poverty. The complexity of this transformation means the process is time-consuming and requires substantial effort, making it gradual rather than instantaneous. If a country needs to enhance exports and international trade to improve its financial health, it requires a technically educated and specialized labor force (Altaf and Faridi, 2019).

The research findings indicate that trade openness can worsen poverty and contribute to an unequal distribution of income in Indonesia. The explanation provided suggests that in developing countries like Indonesia, trade openness tends to favor the absorption of a highly skilled and technologically advanced workforce. Consequently, only a specific group of individuals benefits from this phenomenon. Given that most of the population in developing countries has skills below average, those without skills may struggle to enter the labor market, leading to unemployment or low-wage employment. This situation is a key factor contributing to rising poverty.

Indeed, weak government regulations can amplify this phenomenon in developing countries. The significance of policies, such as minimum wage regulations, mandatory nine-year schooling, and the fulfillment of basic rights for society at large, is crucial. Additionally, government efforts to consistently improve the quality of its population by enabling them to acquire skills play a vital role in mitigating the negative impact of trade openness on poverty and income inequality. A robust regulatory framework and proactive government interventions are essential in creating an environment that fosters equitable economic development and addresses the challenges posed by globalization and trade openness.

The observations of Sattar and Khan (2021) highlight that in low-income countries, trade openness tends to absorb highly skilled and high-tech labor, benefiting only a specific group of individuals. This dynamic results in unemployment or low wages for most people, leading to higher poverty levels. Likewise, Hossain et al., (2022) discovered that trade openness tends to escalate income inequality in Asian regions. In addition, Hamza and Fayçal, (2023) reveal the openness of trade contributes to the increase of wage inequalities in Tunisia. These perspectives collectively emphasize the potential negative impacts of trade openness on income distribution and wage equality in emerging economies.

The inclusion of the main port dummy variable as a control yielded a notable negative correlation that significantly impacted P0, P1, and P2. This implies that if a province is equipped with a main port, it can effectively reduce poverty, holding other factors constant. The presence of a main port is likely to enhance regional trade transactions, leading to job creation, increased regional income, and an overall improvement in welfare. Finding aligns with this study how significant impact of seaports on economic growth in EU regions (Mudronja et al., 2020).

Rakhman and Saputri (2020) discovery of a significant 1.11 percent influence between ports and the economy is noteworthy. However, the main port dummy variable exhibited a different trend, displaying a significantly positive correlation with the Gini index. This implies that the possession of a main port by a province can contribute to an increased unequal distribution of income, assuming other factors remain constant. This phenomenon may be attributed to the limited accessibility of the main port to the entire public. Individuals with significant capital resources are more likely to use port infrastructure effectively, particularly because trade between ports typically involves large volumes. Previous research also suggests that port location can attract companies to establish factories nearby because of cost-effective transportation.

The control variable for access to education, measured by the school enrollment rate for the age group of 13-15 age group, shows a significant negative correlation with variables P1 and P2. This suggests that increased community access to educational facilities can reduce both the depth and severity of poverty. Improved access to education often plays a pivotal role in enhancing economic opportunities, reducing poverty levels, and fostering overall socio-economic development. Higher education has the potential to uplift the poor and enhance their quality of life, encompassing wealth and health aspects (Hofmarcher, 2021; Marsinta et al., 2020). The notion that poverty can only benefit from education aligns with the findings presented, suggesting that the compulsory schooling policy of nine years can positively impact the socio-economic conditions of the poor. The observed decrease in the poverty depth index and poverty severity index implies that policies promoting education can improve the overall well-being of impoverished populations.

The control variable for access to health facilities, represented by the ratio of population to the number of health centers, demonstrates a significant negative correlation with P0 and P1. This indicates that increasing people's access to health facilities can contribute to the correction of absolute poverty. Enhanced access to affordable health facilities can positively impact an individual's well-being, enabling them to work or study more effectively. This, in turn, can lead to upgrade economic conditions, highlighting the interconnectedness of health and poverty alleviation. Gupta and Mitra (2004) discovered that while economic growth generally diminishes poverty, substantial advancements in health are equally crucial for effective poverty reduction. The better access to public health services, the higher the household income will be (Arsyad et al., 2020). The findings also indicate that improved health not only directly lessens poverty but also fosters economic growth through heightened productivity.

In the control variable for infrastructure access, represented by the ratio of road length to population, a significant negative correlation is observed, notably affecting P0 and the Gini index. This suggests that improving people's access to infrastructure can lead to a reduction in both poverty and income inequality. However, the findings also imply that road infrastructure has not proven effective in reducing the depth and disparity of spending among the poor, likely because roads are accessible primarily to individuals with vehicles.

The control variable for access to proper sanitation, specifically the percentage of households with access to proper sanitation, exhibits a significant negative correlation, particularly impacting P0. This implies that enhancing access to proper sanitation within the community can contribute to an improvement in the overall quality of life. This increase in the quality of life is expected to empower individuals, enabling them to engage in activities that can lead to prosperity and contribute to the alleviation of poverty. Budiono and Purba (2022) asserted that access good sanitation has been proven to reduce poverty gap in Indonesia. On the contrary, households facing financial constraints may encounter challenges in enhancing their sanitation facilities (Cameron et al., 2019).

The control variable representing access to decent work, indicated by the percentage of formal sector workers, exhibits a noteworthy negative correlation with P0 and P1. This implies that having access to decent work plays a substantial role in decreasing both the overall number of impoverished individuals and the severity of poverty. This may be because formal sector jobs typically offer higher and more stable incomes than informal sector employment. Additionally, the variable of the percentage of formal sector workers shows a positive correlation that significantly impacts the Gini index. Indeed, the positive correlation observed in the variable of access to decent work, particularly its impact on the Gini index, suggests that access to formal sector employment can contribute to increased income inequality in society. This income disparity manifests in various aspects of social life, including differences in lifestyles. The observed imbalance in wage rates between formal and informal labor sectors is likely to influence various aspects, such as lifestyle, thereby widening the gap between individuals classified as poor and non-poor.

The control variable of GRDP per capita demonstrates a significant negative correlation, particularly impacting poverty and income inequality. This aligns with economic theory, suggesting that an increase in per capita income within a region leads to an improvement in people's welfare, thereby contributing to the reduction of poverty and income inequality in society.

Conclusion

The estimation results suggest that trade openness has the potential to increase both poverty and income inequality in Indonesia. On the other hand, the inclusion of a dummy variable representing the main port by province indicates a potential reduction in poverty but an increase in income inequality among individuals within that province. Furthermore, the variable reflecting access to educational facilities suggests that improving community access to education can improve the welfare of individuals living below the poverty line.

Similarly, access to health facilities and formal sector employment demonstrates that progress in these aspects has the potential to alleviate poverty in Indonesia. Regarding access to infrastructure, the analysis indicates that enhancing access to road infrastructure has the potential to alleviate both poverty and income inequality in Indonesia. Moreover, findings related to access of proper sanitation suggest that improving access to proper sanitation can provide a reduction of poverty.

Lastly, the variable of per capita Gross Regional Domestic Product (GRDP) aligns with theoretical expectations, representing that an increase in per capita income is associated with a decrease in both poverty and income inequality in Indonesia. Aligning with the results of Sattar and Khan (2021), their findings show that trade openness can raise poverty levels in low-income countries while contributing to increased income inequality in both low-income and high-income countries. Notably, although Indonesia was classified as an upper-middle-income country by the World Bank in mid-2020, a subsequent economic recession led to its reclassification as a lower-middle-income country in mid-2021 (Agustiyanti, 2021).

However, the specific sectors responsible for this increase in poverty remain unidentified. Furthermore, trade openness data for each province is recorded based on the ports of loading and unloading within each province. This methodology introduces bias in recording a province's export and import values, as these transactions may occur through ports in other provinces.

Free trade is not in favor of the poor. The evaluation asserts that while trade is beneficial for economic growth, it falls short of being sufficient to eliminate poverty

(Dollar and Kraay, 2004). Also, it was discovered in Malaysia that economic growth is necessary but not sufficient for poverty reduction, especially if the objective is rapid and sustained poverty reduction (Mulok et al., 2011). World Bank also confirmed that economic growth alone will not be sufficient to end global poverty (Yusuf et al., 2023). Subsequently, even if trade openness accelerates growth, it does not necessarily translate into improved conditions of the poor.

To mitigate the adverse effects of trade openness, the government must craft a prudent strategy to navigate economic globalization. Currently, a significant portion of Indonesia's export commodities consists of raw materials, which are crucial for production processes in developed countries. However, the sale value of these raw materials is insufficient to bring about a notable improvement in welfare through trade. Moreover, the extensive imports from abroad pose challenges for national companies, hindered by price competition and the significantly lower production costs of foreign goods. In response, the government can play a pivotal role in fostering a conducive domestic business environment by offering various subsidies and support to local industries, promoting continuous innovation, and enabling them to compete effectively with foreign counterparts.

AI declaration

The authors declare that artificial intelligence (AI) tools were used solely to assist in language refinement, grammar checking, and improving the clarity of writing. The use of AI did not influence the research design, data collection, data analysis, interpretation of results, or the development of conclusions. All intellectual contributions, including conceptualization, methodology, analysis, and final content, remain the full responsibility of the authors.

Conflict Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper. The research was conducted independently without any financial, commercial, or personal relationships that could be construed as a potential conflict of interest.

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