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Economic growth, unemployment, poverty, and income inequality in Indonesia: Evidence from a simultaneous panel data approach

Nur Aisya Aurellia*, Timbang Sirait

*Politeknik Statistika STIS, Jalan Otto Iskandardinata No. 64C, Jakarta Timur, DKI Jakarta, 13330

*Corresponding Author: 212112267@stis.ac.id

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Abstract

Social welfare is an important indicator in assessing a country's socio-economic condition. High economic growth, such as that experienced in Indonesia, shows no evidence of prosperity because empirical evidence indicates unemployment, poverty, and income inequality. Indonesia still prioritizes high economic growth without adequately considering its inclusiveness. These indicate that existing development is not fully inclusive and sustainable. The objectives of this study explicitly account for endogeneity and bidirectional relationships among welfare indicators during the 2019–2023 period. The research method used in this study is a simultaneous panel data approach with two-stage least squares, because the previous discussions were still carried out in a single-equation (one-stage). The best model selected is FE2SLS with FGLS-SUR. The results show that there is a simultaneity between economic growth and unemployment, poverty, and income inequality, and there is only a one-way causality relationship between poverty and income inequality, where poverty affects income inequality but not vice versa. Capital and labor have a positive effect on economic growth. On the other hand, the dominance of the informal sector has a positive effect on unemployment. Meanwhile, the number of social assistance recipients has a negative effect on income inequality. This study provides policies on the strategy development that not only focus on increasing economic growth but also simultaneously alleviate those problems to support the achievement of the 2020-2024 RPJMN targets and SDGs. For the next studies, it can be expanded to the fiscal and monetary policies and doing in-depth regional analysis.

Keywords: Economic Growth; Unemployment; Poverty; Income Inequality; Simultaneous Panel

1. Introduction

Social welfare is an important indicator in assessing the social and economic conditions of a country. From a legal perspective, as outlined in UU 11/2009 on Social Welfare, welfare is legally defined as the fulfillment of material, social, and spiritual needs that enable individuals to live decently and perform their social roles. At the global level, welfare constitutes a central objective of the Sustainable Development Goals (SDGs), particularly those related to poverty reduction, decent work, and inequality. In this context, economic growth is commonly used as a proxy for development performance; however, growing empirical evidence suggests that aggregate growth alone does not guarantee broad-based welfare improvements.

In practice, many developing countries, including Indonesia, continue to prioritize high economic growth without adequately considering its inclusiveness. Countries with relatively strong growth performance may still experience persistent unemployment, poverty, and income inequality, indicating that development outcomes are unevenly distributed. This implies that welfare cannot be adequately

assessed solely through output expansion, but must be examined alongside labor market outcomes, poverty alleviation, and income distribution.

This development paradox is evident in Indonesia's recent performance. At the ASEAN level, Indonesia recorded the highest gross domestic product and one of the highest economic growth rates in 2022, yet simultaneously experienced the highest unemployment rate, along with relatively high poverty and income inequality compared to other member countries [1]. At the national level, although Indonesia showed economic recovery following the COVID-19 pandemic, key socio-economic indicators have not yet reached the targets set in the RPJMN 2020–2024. Economic growth rebounded from a contraction of –2.07 percent in 2020 to 5.05 percent in 2023 [2], but remained below the RPJMN target. During the same period, the unemployment rate declined from 7.07 percent to 5.86 percent [3], still exceeding the targeted range of 3.6–4.3 percent [4]. Poverty levels also decreased from 10.19 percent in 2020 to 9.36 percent in 2023 [5], yet remained above the RPJMN target of 6.0–7.0 percent [4]. Meanwhile, income inequality, measured by the Gini ratio, stagnated at around 0.38–0.39 during 2019–2023 [6], exceeding the national target. These patterns suggest the presence of structural interdependence among economic growth, labor absorption, poverty, and income inequality.

Okun's law explains the negative relationship between economic growth and unemployment, while also implying reverse causality, whereby high unemployment constrains growth through lower productivity and output [7],[8],[9]. Similarly, the growth–poverty relationship highlights that insufficient growth limits income generation and job creation, while high poverty weakens human capital accumulation and productivity, ultimately constraining economic growth [10],[11],[12],[13]. Income inequality further complicates these dynamics. High inequality exacerbates poverty by restricting access to education, health services, and productive resources [14], [15],[16], [17], and in the long run may suppress economic growth by limiting investment in human capital and increasing social instability, as suggested by the Kuznets hypothesis and subsequent empirical studies [18], [19], [20],[21]. These interactions are conceptually captured by the poverty–growth–inequality triangle, which emphasizes reciprocal relationships rather than unidirectional effects. Economic growth can reduce poverty when accompanied by equitable income distribution, while excessive inequality tends to undermine growth sustainability and poverty reduction efforts [22], [23], [24], [25], [26]. And therefore, the framework of this study highlights the presence of endogeneity among economic growth, unemployment, poverty, and income inequality.

Despite this theoretical consensus, most empirical studies in Indonesia continue to employ single-equation approaches that analyze growth, unemployment, poverty, and income inequality separately. Such models are limited in capturing feedback effects and simultaneity. Studies adopting a simultaneous framework typically focus on partial relationships, such as growth–poverty–inequality [20], [27], [28], growth–unemployment–poverty [29], or growth–unemployment [8], [30], without jointly modeling all four welfare indicators. In addition, this study contributes to the literature by simultaneously modeling four key welfare indicators (economic growth, unemployment, poverty, and income inequality) using panel data, allowing for reciprocal causality and policy-relevant inference. By employing a panel data simultaneous equation model, this study explicitly accounts for endogeneity and bidirectional relationships among welfare indicators during the 2019–2023 period. The findings are expected to provide a more comprehensive understanding of Indonesia's development dynamics and to support the formulation of integrated and inclusive policies aligned with the RPJMN 2020–2024 and the Sustainable Development Goals.

2. Method

This study analyzes the simultaneous relationship between economic growth, unemployment, poverty, and income inequality in Indonesia using panel data from 34 provinces during 2019–2023. The data used are secondary data sourced from the BPS Statistics (BPS) for gross regional domestic product (lnPDRB), open unemployment rate (TPT), number of poor population (lnMIS), gini ratio (RGI), number of employed people (lnLAB), high school completion rate (SMA), inflation rate (INF), informal employment rate (IFO), average years of schooling (RLS), life expectancy (UHH), and percentage of social assistance beneficiary families (KPM). Data from the DJP Kemenkeu includes local taxes (TAX), and data from the BKPM Kemeninveshil includes PMDN realization (lnPMDN).

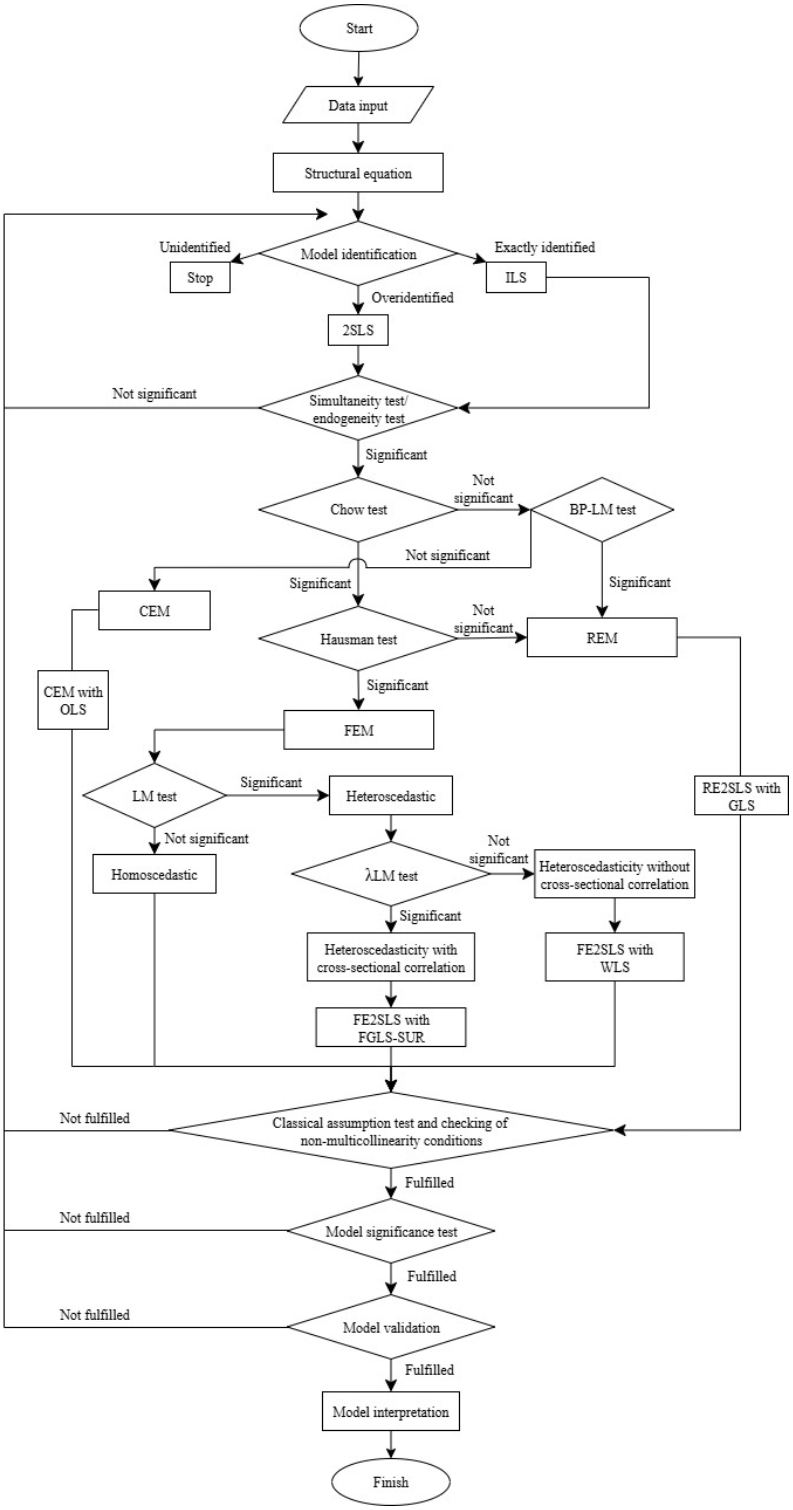

Figure 1. Flow chart of analysis stages with panel data simultaneous regression

As presented in Figure 1 above, it shows the stages of inferential analysis begin with model specification and model identification, then the simultaneity test (Hausman specification test), selection of the best model, classical assumption testing, model significance testing, and model validation. To answer the research objectives, the analysis method used is a simultaneous equation model with panel data. In this study, 4 structural equations will be built as follows.

Structural equation of economic growth

$$lnPDRB_{it} = \alpha_1 + \beta_{11}TPT_{it} + \beta_{12}lnMIS_{it} + \beta_{13}RGI_{it} + \gamma_{11}lnPMDN_{it} + \gamma_{12}lnLAB_{it} + u_{1it} \quad (1)$$

Structural equation of unemployment

$$TPT_{it} = \alpha_2 + \beta_{21}lnPDRB_{it} + \gamma_{21}SMA_{it} + \gamma_{22}INF_{it} + \gamma_{23}IFO_{it} + u_{2it} \quad (2)$$

Structural equation of poverty

$$lnMIS_{it} = \alpha_3 + \beta_{31}lnPDRB_{it} + \beta_{32}RGI_{it} + \gamma_{31}RLS_{it} + \gamma_{32}UHH_{it} + u_{3it} \quad (3)$$

Structural equation of income inequality

$$RGI_{it} = \alpha_4 + \beta_{41}lnPDRB_{it} + \beta_{42}lnMIS_{it} + \gamma_{41}TAX_{it} + \gamma_{42}KPM_{it} + u_{4it} \quad (4)$$

All exogenous variables in this study are based on the related grand theories, such as Cobb-Douglas theory, explains that economic output is influenced by two main components, namely capital (lnPMDN) and labor (lnLAB) [31]. Furthermore, human capital theory explains that higher education can reduce the risk of unemployment and poverty [32]. Then, the Phillips curve theory states that inflation is explained by the short-run negative relationship with unemployment [31]. And other theories, such as the labor-market segmentation theory [33], the health capital model [34], tax redistribution theory [35], and welfare state theory [36].

3. Result and Discussion

In accordance with the research objectives, four simultaneous models will be constructed. Before constructing the models, it is necessary to identify the models using order and rank criteria. Model identification for the structural equation of economic growth, unemployment, poverty, and income inequality has met the order criteria because $(K - k) > (m - 1)$ and meets the rank criteria with the rank of each matrix $M - 1 = 3$. The four structural equations are overidentified, so the simultaneous equation estimation method used is two-stage least square (2SLS).

Next, a simultaneity test was conducted using the Hausman specification test. The results of the simultaneity test showed that there was a simultaneity problem between endogenous explanatory variables and endogenous variables in each structural equation constructed.

Then, the best model was selected through the Chow test (comparing pooled 2SLS and FE2SLS), followed by the Hausman test (comparing FE2SLS and RE2SLS). The results show that both the Chow test and the Hausman test, the best model selected is FE2SLS. This result was continued with the test of variance-covariance structure (LM test) and cross-sectional correlation (λ_{LM} test). The LM test shows a heteroscedastic variance-covariance structure in all structural equations, and the results of the λ_{LM} test also shows the existence of cross-individual correlation issues in all four equations. Therefore, it can be concluded that the best model used in this study is FE2SLS with FGLS-SUR for all four structural equations.

Before the model is used, classical assumption tests must be conducted, including normality tests using the Jarque-Bera test and the detection of non-multicollinearity using the VIF value. The Jarque-Bera test shows that all structural equations satisfy the normality assumption, and each structural equation shows that all VIF values are less than 10, so there is no multicollinearity. Furthermore, the results of model validation using RMSE, MAPE, and U-Theil's also show that all structural equations have a good level of validity and precision (Table 1).

Table 1. Model Validation

Structural Equation	Validation Measure		
	RMSE	MAPE	U
Economic growth ($\widehat{lnPDRB}$)	0.0558	0.3386	0.0023
Unemployment ($\widehat{TPT}$)	0.6210	9.0457	0.0571
Poverty ($\widehat{lnMIS}$)	0.0308	0.4039	0.0025
Income inequality ($\widehat{RGI}$)	0.0070	1.6157	0.0100

The parameter estimates of the structural equation model can be written as follows.

3.1. Structural equation of economic growth

$$\widehat{lnPDRB}_{it} = (7.7527 + \hat{\mu}_{1i})^{**} - 0.0263TPT_{it}^{**} - 0.0441lnMIS_{it}^{**} - 3.2572RGI_{it}^{**} + 0.0303lnPMDN_{it}^{**} + 0.3502lnLAB_{it}^{**} \quad (5)$$

Notes:
**) significant at 5% significancy level and μ_{1i} is the individual effects of the province-i of the economic growth equation

The results of equation (5) show that unemployment (TPT), poverty (lnMIS), income inequality (RGI), capital (lnPMDN), and labor (lnLAB) are statistically significant at 5 percent significancy level on economic growth (lnPDRB). All endogenous explanatory variables have a negative effect but not for all exogenous variables. Unemployment, poverty, capital, and labor have the absolute coefficient under 1 and therefore inelastic. Meanwhile, if income inequality increase a 1 point, then economic growth (lnPDRB) decrease 325.72 percent, assuming ceteris paribus.

This result consistent with the findings that unemployment reduces labor productivity and economic output [37], [38]. Poverty suppresses consumption and weakens demand, as well as limits access to education and health, thereby hindering human capital development [13], [39],[40], [41]. High inequality limits access to education, narrows opportunities, reduces productivity, and hinders long-term growth, necessitating a more equitable distribution of income to support sustainable development [42], [43].

Furthermore, the realization of capital (lnPMDN) has a significant positive impact on economic growth with a coefficient of 0.0303, meaning that a 1 percent increase in PMDN drives GDP by 0.0303 percent, assuming other variables remain constant. This finding aligns with conditions in Indonesia, where PMDN continues to increase and has become one of the main components of capital forming GDP, reaching Rp 674.9 trillion or 47.6 percent of total national investment in 2023, growing by 22.1 percent from the previous year [44]. This increase indicates the expansion of production capacity and the strengthening of economic infrastructure, which ultimately drives aggregate output growth. These results are consistent with studies that the domestic investment strengthens economic growth through increased capital accumulation, technological innovation, and production capacity, thereby creating a positive cycle that supports sustainable growth [45], [46].

The number of employed people also has a significant positive impact on economic growth, with a coefficient of 0.3502, meaning that a 1 percent increase in the labor force drives gross regional domestic product (GRDP) by 0.3502 percent, greater than the impact of PMDN on output. This result is relevant to Indonesia's economic structure, which is still dominated by labor-intensive sectors such as agriculture and manufacturing, where the manufacturing sector in 2023 absorbed 13.83 percent of the national workforce and contributed 18.67 percent to GDP [47], [48]. Increasing the number of workers drives growth through increased productivity and consumption, as well as the role of labor, particularly in the high-tech sector, in driving innovation, reducing production costs, increasing competitiveness, and strengthening investment. Therefore, the existence of effective employment in strategic sectors is key to sustainable growth and improving social welfare [49], [50].

3.2. Structural equation of unemployment

$$\widehat{TPT}_{it} = (67.3444 + \hat{\mu}_{2i})^{**} - 6.1063lnPDRB_{it}^{**} + 0.0456SMA_{it} - 0.0024INF + 0.1409IFO_{it}^{**} \quad (6)$$

Notes:
**) significant at 5% significancy level and μ_{2i} is the individual effects of the province-i of the unemployment equation

The results of equation (6) show that economic growth (lnPDRB) and informal employment rate (IFO) are statistically significant at 5 percent significancy level on unemployment (TPT). Meanwhile, high school completion rate (SMA) and inflation rate (INF) are statistically insignificant but economically relevant on unemployment. Economic growth is elastic, but informal employment rate is not.

The result of equation (6) is consistent with the estimation in equation (5), which shows a negative reciprocal relationship between economic growth and unemployment, in line with Okun's law and the

findings that high growth reduces unemployment through increased labor demand, particularly in labor-intensive sectors such as services, agriculture, and industry, driven by both private and government domestic spending [8], [51].

Meanwhile, the completion rate of high school education has not been proven to have a significant negative impact on the unemployment rate, indicating that an increase in the number of high school graduates does not automatically reduce the unemployment rate. This is due to limited labor absorption and skill mismatch between graduates and labor market needs, where high school graduates generally lack relevant technical competencies and are often excluded from the formal labor market due to administrative requirements, such as a minimum bachelor's degree, imposed by companies [52], [53]. This situation creates a labor market paradox, where many job vacancies are available but difficult to fill due to qualification mismatches, leading high school graduates to be more likely to enter the informal sector or become unemployed. Data from Indonesia for the years 2019–2023 also shows that the unemployment rate for high school graduates is consistently higher than that of other educational levels, such as university or diploma graduates, indicating the intense job competition that is not balanced by adequate formal job opportunities. The importance of aligning education with skill requirements and increasing education without structural improvements in the labor market actually exacerbates mismatches and increases the risk of unemployment among new graduates [54], [55].

The inflation rate has a negative but insignificant effect on unemployment, indicating that while theoretically inflation increases tend to reduce the unemployment rate according to the Phillips curve framework, its impact in this data is not statistically significant. These results are consistent with studies that inflation has no significant effect on unemployment in the short term [56],[57]. The weak transmission of inflation to the labor market may be due to market rigidities, wage adjustment lags, and the dominance of food and energy prices in inflation, so its significance depends heavily on each country's structural and institutional conditions.

The availability of informal jobs has a significant positive effect on the unemployment rate, with a coefficient of 0.1409, meaning that a 1 percent increase in the proportion of informal jobs increases the unemployment rate by 0.1409 percent, assuming all other variables remain constant. This indicates Indonesia's labor market conditions, where 83.34 million people, or 60.12 percent of the working population, were employed in the informal sector in 2023 [58]. The informal sector generally has low productivity, minimal labor protection, and difficulty transitioning to the formal sector, making its workers vulnerable to job losses and economic shocks. The dominance of informal employment, due to its unstable and low-income nature, prolongs poverty, hinders transition to the formal sector, and contributes to rising unemployment [59]. Consistently, structural changes in the labor market are driven by digitalization, the pandemic, climate change, and economic uncertainty, to which the government responded with UU 11/2020 on Job Creation, aiming to enhance flexibility while strengthening worker protection [60].

3.3. Structural equation of poverty

$$\widehat{lnMIS}_{it} = (10.7490 + \hat{\mu}_{3i})^{**} - 0.6509 lnPDRB_{it}^{**} - 1.0768 RGI_{it} + 0.2099 RLS_{it} + 0.0222 UHH_{it} \quad (7)$$

Notes:
**) significant at 5% significancy level and μ_{3i} is the individual effects of the province-i of the poverty equation

The results of equation (7) show that economic growth (lnPDRB) is statistically significant at 5 percent significancy level on poverty (lnMIS) but inelastic. Meanwhile, income inequality (RGI), average years of schooling (RLS), and life expectancy (UHH) are statistically insignificant but economically relevant on unemployment.

The result of equation (7) is consistent with the estimation in equation (5), which shows a negative reciprocal effect between poverty and economic growth. The high growth through production expansion and labor absorption increases income and purchasing power, including among the poor [61], [62], [63]. Meanwhile, income inequality has a negative but insignificant effect on poverty, consistent with the 2023 mapping showing inter-provincial variations, where provinces with high inequality do not always

have high poverty rates, such as DKI Jakarta and West Java, which have the second and third highest income inequality but low poverty rates.

The average length of schooling has a negative but insignificant effect on poverty, indicating that additional years of formal education do not necessarily reduce poverty because they are not always accompanied by improvements in the quality and relevance of skills. Theoretically, education is a tool for social mobility, but low quality, unequal distribution of teachers, limited facilities, and curricula that are not aligned with labor market needs pose challenges. These findings align with previous results showing that high school graduates are more likely to be unemployed because they lack the technical skills or competencies required by the labor market or lack access to suitable job opportunities. When longer education does not lead to income, the risk of poverty remains high, especially without access to decent work. The increase in the length of schooling must be accompanied by improvements in education quality and connectivity with the job market to effectively reduce poverty [64].

Life expectancy has a positive but insignificant effect on poverty. Theoretically, an increase in life expectancy indicates improvements in health services and quality of life, but empirically, it has not been able to directly reduce poverty. The higher life expectancy can increase the risk of poverty for low-income groups if it is not balanced with adequate social protection. In Indonesia, this weak significance may be influenced by regional disparities in access to healthcare and suboptimal elderly welfare policies, so that an increase in life expectancy does not automatically indicate an improvement in economic welfare [65].

3.4. Structural equation of income inequality

$$\widehat{RGI}_{it} = (0.8411 + \hat{\mu}_{4i})^{**} - 0.0458 lnPDRB_{it}^{**} + 0.0066 lnMIS_{it} + 0.0022 TAX_{it} - 0.0010 KPM_{it}^{*} \quad (8)$$

Notes:
**) significant at 5% significancy level, *) significant at 10% significancy level, and μ_{4i} is the individual effects of the province-i of the Gini ratio equation

The results of equation (8) show that economic growth (lnPDRB) is statistically significant at 5 percent significancy level on income inequality (RGI), but percentage of social assistance beneficiary families (KPM) at 10 percent significancy level. Both of these variables are inelastic. In addition, poverty (lnMIS) and local taxes (TAX) are statistically insignificant but economically relevant on income inequality.

This result of equation (8) is consistent with the results in equation (5), which shows a negative reciprocal relationship between income inequality and economic growth. Economic growth can reduce inequality through increased income for low-income groups [66]. However, this relationship follows the inverted U-shaped Kuznets curve pattern, where inequality has the potential to increase again in the advanced growth stage. Meanwhile, the finding on poverty indicates that high poverty widens income inequality because wealth distribution becomes increasingly concentrated among the upper class [67], [68].

Furthermore, local taxes have not been proven to have a significant negative impact on income inequality, indicating that increasing local taxes does not necessarily reduce inequality because the redistributive function of taxes can be hindered or even exacerbate inequality if their management is unfair and unequal. Optimizing local revenue through taxes has not always been accompanied by public spending that favors vulnerable groups, so that in regions with high fiscal capacity, tax revenues are often enjoyed more by the upper-middle class, while low-income groups continue to bear the tax burden without receiving equal public services. This inequality has the potential to widen further between individuals and regions if not balanced by effective transfer mechanisms or social spending. BPS data shows that income inequality tends to be higher in regions with high local tax revenues, such as Jakarta, which in 2023 recorded the highest tax revenue of Rp43.5 trillion alongside an inequality index of 0.431, the second highest nationally. A regressive or misdirected tax system can disproportionately burden low-income individuals, while the wealthy enjoy greater fiscal benefits. Without tax administration and public spending that prioritize equity, increases in local taxes could actually reinforce existing inequality structures [69].

The finding on KPM is consistent with the theory and studies that show that large-scale social assistance can reduce inequality when distributed appropriately [70], but it also aligns with studies that show the potential for the opposite effect if distribution is mismanaged [67]. In the Indonesian context, the impact of KPM remains limited due to data accuracy and weak targeting, where most recipients of social assistance are not from poor households [71]. This result indicates that the effectiveness of social assistance programs in reducing inequality is not yet optimal because it is still hampered by issues of data updating and targeting accuracy, so that even though the direction of the relationship is in line with theory, the strength of its influence remains low.

As presented in Figure 2 below, it shows the simultaneity of economic growth, unemployment, poverty, and income inequality. It can be seen that there is a negative reciprocal relationship between economic growth and unemployment, economic growth and poverty, and economic growth and income inequality. Furthermore, there is a positive one-way causal relationship between poverty and income inequality, whereby poverty affects income inequality, but not vice versa. Low-income inequality does not necessarily reduce poverty if it is not accompanied by inclusive economic growth and equitable access to economic opportunities, education, and basic services. This highlights the need for synergy in creating inclusive economic development that can reduce unemployment, poverty, and income inequality.

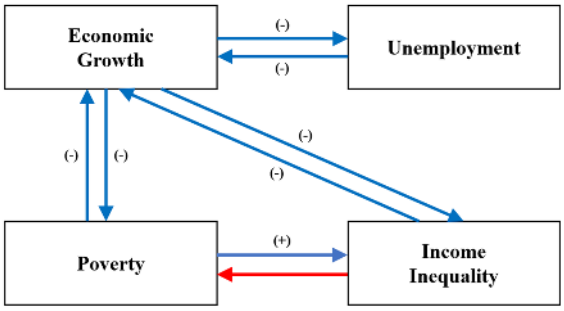

Figure 2. Simultaneity of economic growth, unemployment, poverty, and income inequality

Based on equations (5) and (6), a 1 percent decrease in unemployment (TPT) increases economic growth (lnPDRB) by 0.0263 percent, while a 1 percent increase in economic growth reduces unemployment by 6.1063 percent, ceteris paribus. Similarly, equations (5) and (7) show that a 1 percent decrease in poverty (lnMIS) increases economic growth by 0,0441 percent, while a 1 percent increase in economic growth reduces poverty by 0.6509 percent, ceteris paribus. Furthermore, according to equations (5) and (8), a 1 point decrease in income inequality (RGI) increases economic growth by 325.72 percent, while a 1 percent increase in economic growth only reduces income inequality by 0.000458 point, ceteris paribus. Therefore, increasing economic growth is more profitable than reducing unemployment and poverty, respectively. But, reducing income inequality is more profitable than increasing economic growth.

4. Conclusion

Economic growth, unemployment, poverty, and income inequality are simultaneously interdependent, where there is a negative reciprocal relationship between economic growth and unemployment, economic growth and poverty, and economic growth and income inequality. Meanwhile, there is only a one-way positive relationship between poverty and income inequality, with poverty affecting income inequality, but not vice versa. To achieve high economic growth, it is necessary to reduce unemployment, poverty, and income inequality, and increase capital, particularly domestic investment and labor in economic activities. High economic growth plays a role in reducing unemployment, while the dominance of the informal sector actually drives up unemployment. Poverty can be reduced through high economic growth. Income inequality can be reduced alongside increased economic growth and the provision of targeted social assistance. Increasing economic growth and reducing income inequality are more profitable. For future research, researchers can expand the fiscal

and monetary policies to capture the overall impact of government interventions and doing in-depth regional analysis.

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