



Simultaneous Equation Model: Stunting, Unemployment, Poverty, and Economic Growth in Indonesia

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ARTICLE INFO	ABSTRACT
<p>Published Online: 03 March 2025</p> <p>Corresponding Author: Tria Apriliana</p> <p>KEYWORDS: Economic Growth; Poverty; Stunting; Unemployment; 2SLS</p>	<p>This study examines the middle income trap (MIT), where countries struggle to move from middle- to high-income status due to slowed growth, stagnant productivity, and structural challenges. Despite Indonesia being classified as middle-income for over 30 years and recently upgraded to upper middle-income, it has yet to reach high-income status. However, if Indonesia fully harnesses its economic potential, it could become a high-income country by 2045, significantly affecting its aggregate demand and supply. This study aims to determine the impact of poverty, unemployment, and stunting on economic growth and the impact of economic growth, unemployment, and stunting on poverty. This research used two stage least square (TSLS) analytical tool. The results show that poverty, unemployment, and stunting have a significant effect on economic growth. Additionally, poverty, unemployment, and stunting individually also have a significant impact on economic growth. Economic growth, unemployment, and stunting have a significant effect on poverty. Furthermore, economic growth, unemployment, and stunting individually also have a significant impact on poverty.</p>

I. INTRODUCTION

Middle Income Trap (MIT) is a condition in which a country faces difficulties in moving to a higher income level after reaching the middle-income category. Countries trapped in the MIT typically experience a slowdown in economic growth, stagnant productivity, and challenges in achieving structural economic transformation. Some factors causing MIT include dependency on specific industrial sectors without economic diversification, instability in economic policies, low quality of human resources, and high economic inequality (Kharas, H, 2010).

Middle-income countries rely on high value-added production to generate low-cost exports using domestic labor, technology, and foreign capital, but this model is not sustainable in the long run (Leven, B, 2021). Gill and Kharas state that a country must reach a per capita income of USD 27,000 within 10 years; otherwise, the country will be categorized as being trapped in the MIT. After experiencing significant economic growth, several Asian countries such as the Philippines, India, Malaysia, Thailand, Vietnam, Laos, and Indonesia are now classified as middle income countries (MIC), while some countries like Hong Kong, South Korea, Taiwan, and Singapore have successfully reached the category of high income countries (HIC) (Egawa, A, 2013).

History records that Indonesia has been classified as a middle-income country since 1985 and remained in that category until 2018. This indicates that the economic development efforts carried out over more than 30 years have not been sufficient to push Indonesia into the high-income group. However, according to the World Bank's 2020 report, Indonesia upgraded to the upper middle-income country category for the first time, after having been categorized as a developing country since 1960. Based on this condition, Indonesia has the potential to become an advanced high-income country by 2045, provided that all its economic potential can be fully utilized. The transition from a low-income country to a middle-income country has a significant impact on the aggregate demand and supply within a country (Carnovale, 2012).

To escape the MIT, the Ministry of Finance (2020) stated that Indonesia needs to achieve an average economic growth of 6 percent per year from 2020 to 2030. One of Indonesia's significant potentials is the demographic bonus expected between 2030 and 2040, when the number of people in the productive age group (15–64 years) exceeds that of non-productive individuals. However, the main challenges that must be addressed to achieve sustainable economic growth are the high rates of stunting, unemployment, and poverty. These issues can hinder the improvement of human resource

quality and labor productivity. Therefore, appropriate economic policies are needed to optimize economic growth and create inclusive development, enabling Indonesia to escape the middle-income trap and become an advanced country by 2045.

II. LITERATURE REVIEW AND HYPOTHESES

The economic growth rate is the rate at which the gross domestic product increases from the previous year. There are several variables that contribute to GDP growth. The first is the availability of a certain amount of capital and labor resources in line with economic changes. The second factor is the change in the efficiency of using production factors. An increase in efficiency is called an increase in productivity, meaning that over time, the same amount of production factors will generate a larger output (Dornbusch, Rudiger dkk. 2004).

Stunting is a deviation in body length from what is expected for an infant's developmental age, according to the WHO Child Growth Standards; it is defined as a body length/height measurement that falls below -2 standard deviations for the corresponding age group. The primary concern is not solely the reduced height, but also that the critical period for spinal growth and brain cell development occurs from pregnancy until the age of two years (Onis & Branca, 2016). Stunting is influenced by various factors at the individual, household, and community levels. Factors such as eating habits, birth weight, infection history, and the child's gender play a significant role in the risk of stunting. Additionally, household wealth status and parental education are also important factors associated with a higher risk of stunting. Poor access to water, sanitation, and hygiene in the community further increases the risk of stunting (Mulyaningsih et al., 2021; Takele et al., 2022; Thurstans et al., 2022).

Unemployment is a situation in which individuals lose their jobs and, as a result, experience changes in their daily practices as well as a loss of resources and socio-economic conditions that were previously taken for granted. This situation creates vulnerabilities that can lead to social disaffiliation and a decline in social status, which in turn can increase poverty and social inequality (Carmo & d’Avelar, 2021).

Poverty is the lack of income in the form of money to maintain a basic level of household expenditure. Measurement by money because the concept of money is quite clear and it can be easily measured. Numerous studies have shown that the level of household expenditure in the form of money correlates positively with key poverty variables that are difficult to measure, such as social status, social deprivation and its various variants, and access to various opportunities (Apriliana, T., & Wahyuningsih, N. D, 2019). Poverty reduction, in this context, is seen as an achievement of economic growth through the development

of human resources that enable people to contribute to and benefit from economic growth (Olopade, B, C. et al. 2019).

Based on the theoretical overview and related works, the study proposes a model with 6 hypotheses:

- H1: poverty has an impact on economic growth in Indonesia.
- H2: unemployment has an impact on economic growth in Indonesia.
- H3: stunting has an impact on economic growth in Indonesia.
- H4: economic growth has an impact on poverty in Indonesia.
- H5: unemployment has an impact on poverty in Indonesia.
- H6: stunting has an impact on poverty in Indonesia.

III. RESEARCH METHOD

The variables used in this study are economic growth, stunting, unemployment, and poverty. The data and information in this study are sourced from the Indonesian Central Bureau of Statistics (BPS) in 34 provinces in Indonesia for the period 2020 to 2023, which were obtained from the respective provincial BPS websites.

The hypothesis in this study was tested using the two stage least square (2SLS) method. The two-stage least square model is presented below:

$$\text{Economic Growth}_t = \alpha_0 + \alpha_1 \text{Poverty}_t + \alpha_2 \text{Unemployment}_t + \alpha_3 \text{Stunting}_t + \varepsilon_1$$

$$\text{Poverty}_t = \beta_0 + \beta_1 \text{Economic Growth}_t + \beta_2 \text{Unemployment}_t + \beta_3 \text{Stunting}_t + \varepsilon_2$$

where α_0 and β_0 are constants, and α_1 , α_2 , β_1 , β_2 are coefficients.

The first step taken in 2SLS is model identification. Model identification is necessary to determine how to solve the existing system of simultaneous equations or whether the system has a solution. There are three identification issues in simultaneous equations: the first is under-identified, in which case we cannot solve the existing system because we lack information regarding the predetermined variables; the second is exactly identified, where the existing system can be solved using the OLS method, known as the recursive method; and the third is over-identified, where there is an excess of information concerning the predetermined variables. If the OLS method is used for this problem, then the parameter estimates obtained may not be unique. Therefore, methods such as 2SLS can be used to address this issue.

A commonly used method for addressing identification issues in simultaneous equation systems is to employ order and rank testing procedures, wherein in this study we used the order test using formulas.

$(K-k) = (m-1)$: exactly identified

$(K-k) > (m-1)$: over identified

$(K-k) < (m-1)$: under identified

Where:

- K = The number of predetermined variables including the current exogenous variables and lagged endogenous variables in the model
- k = The number of predetermined variables in a particular structural equation
- M = The number of current endogenous variables in the model
- m = The number of current endogenous variables in a particular equation

After identifying the model, the next step is to test the classical assumptions, which consist of normality, heteroskedasticity, multicollinearity, and autocorrelation tests. The purpose of the normality test is to determine whether the residual data are normally distributed. The normality of the data is assessed using the Jarque-Bera test, with the criterion that if the probability is greater than 0.05, then the residual data are considered to be normally distributed.

The purpose of the heteroskedasticity test is to determine whether the regression model is heterogeneous (having unequal residual variances from one observation to another) or homogeneous (having equal residual variances across observations) (Ghozali, 2013). In this study, we used the White test to detect heteroskedasticity issues. The criterion is that if the p-value Obs*R-squared is greater than 0.05, it indicates that the model has homogeneous variance.

The purpose of the autocorrelation test is to determine whether there is a relationship between the errors at time t and those in the previous period (t-1). If such a relationship exists, it indicates that there is an autocorrelation problem in the model. In this study, the Durbin-Watson test was used to detect autocorrelation. If the Durbin-Watson value is between d_U and $4-d_U$, autocorrelation is not present in the model.

The purpose of the multicollinearity test is to determine whether there is any relationship among the independent variables in the model. In this study, we used the paired correlation matrix test with the criterion that if the correlation value is less than 0.8, it indicates that there is no multicollinearity among the independent variables (Ajija, Shochrul, et al. 2011). The purpose of this test is to ensure that the estimation results meet the BLUE criteria. Next is the formulation of the 2SLS estimation model, and finally, hypothesis testing.

IV. RESEARCH RESULTS AND DISCUSSION

4.1 Results

The identification results of the simultaneous equations system using the order testing procedure indicate that all equations are over-identified, so the method used is Two Stage Least Square (2SLS).

The results of the basic assumption test indicate that both models have normally distributed residuals, with each model showing probabilities of 0,128 and 0,145, both of which are

greater than 0,05. The heteroscedasticity test results show that there is no heteroscedasticity issue in either model, with each model having an Obs*R-squared probability of 0,327 and 0,706, both above 0,05, indicating that each model has equal variances. The autocorrelation test using the Breusch-Godfrey Serial Correlation LM Test indicates that there is no autocorrelation problem in either model, with the first model having an Obs*R-squared value of 0,238 and the second model having a value of 0,076, both of which exceed 0,05. This means there is no indication of autocorrelation in any model. Lastly, the multicollinearity test results show that there is no indication of multicollinearity among the independent variables in both models, as no correlation value exceeds 0,8.

After conducting the model identification test, as well as the basic and classical assumption tests, the estimation was then carried out using 2SLS, as follows:

Table 4.1 TSLs Results for Model 1

Variables	Coefficients	Std. Error	Prob.
Poverty	-0,111*	0,057	0,053
Unemployment	-0,799***	0,246	0,001
Stunting	-0,161**	0,071	0,027
R-squared	0,096		
F-statistic	4,684		
Prob (F-statistic)	0,004		

*Significant at $\alpha = 10\%$; **Significant at $\alpha = 5\%$; ***Significant at $\alpha = 1\%$

Source: Calculation result

The results indicate that the probability value of the F-statistic is 0,004, which is less than 0,05; hence H_1 is accepted, meaning that poverty, unemployment, and stunting have a significant effect on economic growth. Additionally, poverty, unemployment, and stunting individually also have a significant impact on economic growth. Furthermore, it was found that the coefficient of determination (R^2) is 0,096 or 9,6%. This indicates that poverty, unemployment, and stunting can explain 9,6% of economic growth, while the remaining 90,4% is explained by other unobserved variables.

Table 4.2 TSLs Results for Model 2

Variables	Coefficients	Std. Error	Prob.
Economic Growth	-0,252*	0,129	0,053
Unemployment	-1,272***	0,369	0,001
Stunting	-0,008	0,110	0,940
R-squared	0,102		
F-statistic	4,999		
Prob (F-statistic)	0,002		

*Significant at $\alpha = 10\%$; **Significant at $\alpha = 5\%$; ***Significant at $\alpha = 1\%$

Source: Calculation result

The results indicate that the probability value of the F-statistic is 0,002, which is less than 0,05; hence H_1 is

accepted, meaning that economic growth, unemployment, and stunting have a significant effect on poverty. Furthermore, economic growth, unemployment, and stunting individually also have a significant impact on poverty. In addition, the coefficient of determination (R^2) is 0,102 or 10,2%. This indicates that economic growth, unemployment, and stunting can explain 10,2% of the variation in poverty, while the remaining 89,8% is explained by other unobserved variables.

4.2 Discussion

Based on the statistical results in the first model, it is found that poverty, unemployment, and stunting have a significant impact on economic growth both individually and collectively. The effect of poverty on economic growth is negative; as the percentage of the poverty rate increases, economic growth slows down. This occurs because poverty reduces the purchasing power of the public due to low incomes. Household consumption, a key component of the Gross Domestic Product (GDP), decreases when consumption falls, leading to slower economic growth. High poverty levels worsen economic inequality, which can hinder investment and infrastructure development in poor areas, thus impeding economic growth. Additionally, poverty becomes a fiscal burden for the government since it must allocate a large budget for poverty alleviation programs, thereby reducing the funds available for other productive investments. Poverty can reduce economic growth, especially in countries with low economic growth rates. When poverty is high, economic growth tends to be slower due to limited human and financial resources (Asongu & Eita, 2023). Income inequality exacerbates the impact of poverty on economic growth. High inequality can reduce the positive effects of economic growth on poverty reduction, thereby slowing overall economic progress (Adeleye et al., 2020) (Vanegas & Roe, 2024) (Mansi et al., 2020).

The effect of unemployment on economic growth is negative, meaning that as the unemployment rate increases, economic growth slows down. High unemployment reduces the number of productive workers contributing to economic growth, resulting in national output falling below its potential. High unemployment becomes both a social and economic burden by increasing public dependence on government subsidies and reducing tax revenue contributions. Additionally, prolonged unemployment has psychological and social impacts, as it can lead to social instability—such as rising crime rates—that hinders the investment climate and economic development. Several studies have shown that high unemployment rates impede economic growth. For instance, in ASEAN countries, high unemployment levels obstruct economic growth (Elaine et al., 2024). A similar phenomenon was observed in the GCC countries, where unemployment has a significant negative effect on long-term economic growth (Alam et al., 2024). In Sub-Saharan Africa, unemployment has also been found to have a negative effect on GDP growth, indicating that

unemployment can hinder the potential for economic growth (Correa, 2023). In Arab countries, it has been shown that when the unemployment rate reaches a certain threshold, its impact on GDP becomes negative and significant, supporting Okun's law which states that there is a negative relationship between unemployment and economic output (Louail & Ben Haj Hamida, 2021).

Stunting negatively affects economic growth by reducing labor productivity due to cognitive impairments and slower brain development, so individuals with a history of stunting tend to have lower skills and limited job opportunities. Research indicates that individuals who experience stunting generally earn lower wages, with every 1 cm increase in height associated with a wage increase of 4% for men and 6% for women (McGovern et al., 2017) (Nasser et al., 2022). Stunting has a direct negative impact on GDP; 1% increase in cases of child stunting can lead to a 0,4% decrease in GDP per capita. In the South Asian Association for Regional Cooperation (SAARC) region, 1% increase in the stunting rate can even result in a 3,4% decrease in GDP per capita (Nasser et al., 2022).

Based on the statistical results in the second model, it is known that economic growth and unemployment have a significant effect on poverty both individually and simultaneously, whereas stunting does not have a significant individual effect on poverty. Economic growth has a negative impact on poverty because it can increase community income, create more job opportunities, and expand access to basic services such as education and healthcare. When the economy grows, investments and productivity increase, which drives up wages and household welfare, especially for low-income groups. Moreover, economic growth enables the government to collect more revenue through taxes, which can be allocated to social programs aimed at reducing poverty. With increasing economic opportunities and an improved standard of living, the number of people living in poverty tends to decrease along with sustained economic growth. The study results indicate that economic growth has a strong influence on reducing poverty, both in the short term and the long term, with about 40% of the variation in poverty explained by changes in economic growth (Dávila, 2023). The presence of strong social policies, such as government cash transfers, can reduce poverty. In countries with extensive government transfer schemes, economic growth is more effective in reducing both absolute and relative poverty (Sirén, 2024). In the SADC region, economic growth, together with advancements in information and communication technology, has demonstrated an impact on reducing poverty, although inflation remains a challenge (Olamide et al., 2022).

The effect of unemployment on poverty is negative. Generally, high unemployment tends to increase poverty, but in certain cases in developing countries, there is a possibility that high unemployment may indirectly spur a reduction in poverty in the long term. This can occur if rising

unemployment triggers economic policy reforms, investments in the productive sector, or improvements in workforce skills. For example, if high unemployment creates social and political pressure, the government might be driven to increase investments in infrastructure, education, and skill training to boost workforce competitiveness. Additionally, this situation could accelerate the transition of labor from the informal sector to the more productive formal sector, which offers better social protection. Economic policies, such as government spending and monetary policy, can affect the relationship between unemployment and poverty. For instance, an increase in government capital expenditure could reduce the poverty rate by enhancing job opportunities (Omene, 2021).

Stunting has a negative effect on poverty, although it is not significant. Higher stunting rates tend to lower poverty, one possible explanation being that individuals who experience stunting generally have lower physical and cognitive capacities, making them more likely to work in the informal sector or in low-productivity jobs that do not require high skills. These sectors often provide employment even at low wages, thereby reducing unemployment and statistically lowering the poverty rate. In addition, in some cases, regions with high stunting rates may receive more social interventions from the government, such as direct cash transfers, food programs, or health subsidies, which increase purchasing power and lower poverty rates in macroeconomic calculations. Previous research has shown that there is no significant effect of stunting on the Human Development Index (HDI) (Erdi Fadhillah et al., 2022).

V. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Based on the analysis results conducted in the first model, it is concluded that the impact of poverty on economic growth is negative, meaning that as the poverty rate increases, economic growth slows down. The impact of unemployment on economic growth is also negative, such that a higher unemployment rate leads to slower economic growth. High unemployment reduces the number of productive workers contributing to economic growth. Similarly, stunting has a negative impact on economic growth because it reduces labor productivity due to cognitive impairments and slower brain development, resulting in individuals with a history of stunting having lower skills and limited job opportunities.

In the second model, the results indicate that economic growth has a negative effect on poverty because it can increase community income, create more job opportunities, and expand access to basic services such as education and healthcare. When the economy grows, investments and productivity increase, which drives up wages and improves household welfare, especially for low-income groups. The effect of unemployment on poverty is negative, although generally high unemployment tends to increase poverty;

however, in certain cases in developing countries, there is a possibility that high unemployment may indirectly promote poverty reduction in the long term. This can occur if increased unemployment triggers economic policy reforms, investments in the productive sector, or improvements in workforce skills. For example, if high unemployment creates social and political pressure, the government may be compelled to increase investments in infrastructure, education, and skills training to enhance labor competitiveness. Stunting has a negative impact on poverty, though not significantly, as higher stunting rates tend to reduce poverty. One possible explanation is that individuals who experience stunting generally have lower physical and cognitive capacities, making them more likely to work in the informal sector or in low-productivity jobs that do not require high skills. These sectors often provide employment even at low wages, thereby reducing unemployment and statistically lowering the poverty rate.

5.2 Recommendations

Based on the results and conclusions obtained, the recommendations for the government include: improving access to quality education, especially for the poor and vulnerable, in order to enhance workforce skills and economic competitiveness; encouraging community-based economic development, such as empowerment programs for SMEs, cooperatives, and the creative economy, so that the poor can sustainably increase their income; increasing investment in productive sectors such as manufacturing, agriculture, and the digital economy to create more job opportunities; improving public health services, especially in terms of nutrition education, sanitation, and access to clean water to prevent stunting causes, while also providing subsidies or nutritious food assistance to poor families to ensure children receive adequate nutrition; accelerating the development of basic infrastructure such as roads, electricity, and internet in underdeveloped areas to open wider economic access for the poor, and also developing affordable housing programs for low-income groups to provide them with decent living environments that support productivity.

Suggestions for society include being proactive in improving their education and skills, both through formal education and job training provided by the government or the private sector. Poor communities need to take a more active role in utilizing government assistance, such as nutrition programs for pregnant women and toddlers to prevent stunting, as well as improving environmental hygiene by adopting healthy lifestyles and maintaining household sanitation to protect children from diseases that contribute to stunting. Additionally, they should seize business opportunities in the informal sector by developing skills and enhancing access to digital technology to expand their markets. With a synergy between government policies and active community participation, poverty, unemployment, and stunting can be significantly reduced, thereby supporting more inclusive and sustainable economic growth.

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