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The Nexus Between Poverty, Unemployment, Economic Growth, and Agriculture in Indonesia

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Authors' contributions

The sole author designed, analysed, inteprted and prepared the manuscript.

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ABSTRACT

Aims: This empirical paper seeks to estimate the dynamic linkage amid poverty, economic growth, unemployment, and agriculture in Indonesia
Methodology: This paper relies on annual data from 2000 to 2021, collected from the World Bank. ARDL-Bounds testing is applied to examine the dynamic short- and long-run association, as well as co-integration model. The Granger Causality (GC) test is also added to unravel the causal direction amid poverty, unemployment, economic growth, and agricultural productivity.
Results: The co-integration relationship among the variables is evident. In the long run, economic growth and agricultural productivity are negatively associated with poverty rates. Economic growth and farm productivity, therefore, are verified to have beneficial roles in assisting poverty eradication. Conversely, unemployment is confirmed as a driver of poverty in Indonesia. The GC test signifies a bidirectional causality between agricultural productivity and poverty, unemployment and poverty, as well as agricultural productivity and economic growth.
Conclusion: Following the findings, enhancing farm productivity and fostering economic growth are pivotal instruments for fostering poverty alleviation in Indonesia.

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Keywords: Poverty; agricultural productivity; unemployment; economic growth.

1. INTRODUCTION

Promoting sustainable growth by reducing the number of individuals living below the poverty line is one of the major challenges for emerging countries such as Indonesia. It is globally agreed that eradicating extreme poverty is part of the Sustainable Development Goals (SGD) targets that need to be achieved in the year 2030 [1]. As of 2023, the number of Indonesians who are classified as poor and vulnerable groups remains significant, posing concerns for policymakers to promote proper social assistance, infrastructure development, and subsidy programs [2]. Whilst the poverty rate is following a downward trend, 2% of the population in Indonesia still lives below the extreme threshold of $2.15 [3]. Furthermore, around 18% of the population is categorized as moderate poverty [4].

Numerous aspects have been connected in order to identify poverty dynamics such as economic growth and unemployment [5]. Economic growth and its composition are supposed to play a vital role in assisting poverty alleviation via numerous indirect channels [6]. Conversely, unemployment is argued to be a key driver of poverty. As Diao et al. [7] noted, economic growth is a necessary condition for a nation to move from a traditional to a modern economy. Hence, economic growth tends to be followed by poverty reduction since it can create job opportunities in both formal and informal sectors. Total output growth increases economic capacity and national income, which in turn can be applied for developing infrastructure that supports poverty eradication. Nonetheless, Škare & Druže [5] emphasized that the role of growth in addressing poverty is widely accepted, but it is not a sufficient tool.

By employing provincial-level data, Agrawal [8] examined the nexus between economic growth and poverty in Kazakstan. The findings recorded those regions with higher growth rates achieved a faster decline in poverty. In another research, Michálek & Výbošťok [9] found that economic growth negatively affects poverty rates. However, as income inequality increases, poverty tends to scale up. Dauda [10] noticed that lowering the income gap and fostering employment creation are amongst the critical scenarios in promoting poverty alleviation in developing countries.

Amar et al. [11] recorded that economic growth is negatively linked to poverty while unemployment is positively linked to poverty in West Sumatra Province, Indonesia. Similarly, Karo and Yusnida [12] revealed that higher levels of unemployment tend to experience higher levels of poverty rates. Furthermore, Murjani [13] noted that economic growth is confirmed to support poverty reduction while unemployment and inflation rates have a positive impact on poverty. Fosu [14] found that economic growth significantly impacts poverty reduction. However, high initial levels of income disparity limit the effectiveness of GDP growth in supporting poverty alleviation. Economic growth is not a sufficient condition for poverty reduction. Surprisingly, empirical evidence from developing countries noted that economic growth does not impact poverty [15].

Another factor that is connected to poverty is the agriculture sector, which includes forestry, crops, livestock, forestry, and fisheries subsectors [16]. Agriculture is the source of income and livelihood for a billion people in Indonesia, including in rural areas, so its performance can influence national welfare [17]. It can assist in addressing rural and urban poverty through several pathways: income generation, rural development, job creation, price stability, industrial input supply, and food security [18]. Therefore, agriculture performance impacts both economic growth and poverty rates [19]. An empirical study from Thailand recorded that farm productivity has an adverse influence on poverty rates [20]. Moreover, Oseni et al. [21] found that a 1% increase in agricultural productivity leads to a decrease in the likelihood of being poor by 0.25 - 03%.

Against the background above, this paper aims to examine the dynamic nexus between poverty rate, agricultural productivity, economic growth, and unemployment in Indonesia utilizing annual data collected from the World Bank. The poverty rate relies on the poverty headcount ratio of $3.65. This paper performs the Autoregressive Distributed Lag (ARDL)-Bounds test for providing dynamic connections. Furthermore, the Granger Causality (GC) test is included to ascertain the causal direction between the study variables.

2. MATERIALS AND METHODS

2.1 Model Specification

The objective of this empirical paper is to unravel the dynamic linkage amid poverty, agricultural productivity, unemployment rates, and economic growth. Following a previous study by Osinubi [22], Hence, the empirical model is specified as follows:

$$POV_t = \gamma_0 + \gamma_1 AGRIP_t + \gamma_2 UNEM_t + \gamma_3 GDPG_t + \varepsilon_t$$

where POV signifies the poverty rate, AGRIP is agricultural productivity, UNEM is unemployment rates, and GDPG stands for economic growth. ε is the error term. γ_0 is the constant term. γ_1, γ_2, and γ_3 are parameters to be estimated.

2.2 Method

In order to provide reliable findings, this paper consists of three types of estimation methods namely the stationary test, ARDL-Bounds testing, and the GC test.

2.2.1 Stationary test

A stationary test is required before an application of the ARDL-Bounds testing. Therefore, this uses the Augmented Dickey-Fuller (ADF) test. Earlier time-series studies also employed the ADF test [23,24]. It should be noted that the ARDL-Bounds testing is proper for application if the series are level I(0) or first-order I(1) integration. A general equation for the ADF test can be written as follows:

$$\Delta y_t = \pi_0 + \pi_1 y_{t-1} + \sum_{m=0}^{m} \pi_2 \Delta y_{t-1} + \pi_3 T + u_t$$

where Δy signifies the first difference variable, including POV, AGRIP, GDPG, and UNEM. π_0 is the constant term, $\pi_3 T$ is the time trend, and $\pi_1 y_{t-1}$ is the lagged level of the variable. $\pi_2 \Delta y_{t-1}$ is lagged differences of the variable. u_t is the error term. The null hypothesis (H0) of the non-stationary variable (π_1 = 0) is checked against the alternative hypothesis (π_1< 0). To provide reliable findings, this paper incorporates an alternative method namely Phillips-Perron (PP) test. The PP test adopts a non-parametric approach.

2.2.2 ARDL-bounds test

The ARDL-Bounds testing is applied to examine the connection between poverty and its set of determinants. It is developed by Pesaran et al. [25]. The ARDL-Bounds testing is applied since it has the ability to provide short- and long-run parameters, as well as can be utilized to small sample [26,27]. Several past studies have also worked on the ARDL-Bounds testing [28,29,30]. The empirical ARDL (p,q) model can be specified as follows:

$$\Delta POV_t = \theta_0 + \sum_{i=1}^{p} \theta_1 \Delta POV_{t-i} + \sum_{i=0}^{q} \theta_2 \Delta AGRIP_{t-i} + \sum_{i=0}^{q} \theta_3 \Delta UNEM_{t-i} + \sum_{i=0}^{q} \theta_4 \Delta GDPG_{t-i} + \vartheta_1 POV_{t-1} + \vartheta_2 AGRIP_{t-1} + \vartheta_3 UNEM_{t-1} + \vartheta_4 GDPG_{t-1} + \varepsilon_t$$

The long-run connection between poverty and its set of independent variables is evident only if there is a cointegration. Therefore, this paper employs the Bounds test to investigate the presence of the cointegration relationship. The null and alternative hypotheses are written as follows:

H0: $\theta_0, \ldots, \theta_3 = 0$ (no cointegration)
H1: $\theta_0, \ldots, \theta_3 \neq 0$ (cointegration)

There are two types of critical values namely lower and upper bounds. If the cointegration is evidence, the dynamic short-run model is written as follows:

$$\Delta POV_t = \vartheta_0 + \sum_{i=1}^{p} \vartheta_1 \Delta POV_{t-i} + \sum_{i=0}^{q} \vartheta_2 \Delta AGRIP_{t-i} + \sum_{i=0}^{q} \vartheta_3 \Delta UNEM_{t-i} + \sum_{i=0}^{q} \vartheta_4 \Delta GDPG_{t-i} + \phi ECM_{t-1} + \varepsilon_t$$

where the parameter ϕ represents the speed of adjustment toward long-run equilibrium. It must be a negative sign and is statistically significant.

2.2.2 Data

This paper utilizes yearly data on poverty rates, unemployment rates, economic growth, and farm productivity, in the context of Indonesia. The series used spans from 2000 to 2021, collected from World Development Indicators of the World Bank. This paper relies on a small sample. The poverty rate is the explained variable whereas agricultural productivity, economic growth, and unemployment rates are explanatory variables.

The poverty rate is measured by a poverty headcount ratio of $3.65 a day (2017 PPP). The $3.65 threshold is more relevant to measure poverty in countries classified as middle-income. It is considered as a moderate poverty line. Agricultural productivity is estimated manually. It is agricultural value added (constant 2015 US$) divided by the number of people working in the agricultural sector. The unemployment rate is proxied by the percentage of the labor force who are unemployed. Gross Domestic Product (GDP) growth serves as a proxy for economic growth.

3. RESULTS AND DISCUSSION

3.1 Trend of Variables

To begin with the results and discussion, this paper displays the trends of the study variables, i.e., poverty rates (POV), agricultural productivity (AGRIP), the rate of unemployment (UNEM), and economic growth (GDPG) over the period 2000 – 2021 in Fig. 1. Poverty rates decline gradually, demonstrating a decreasing pattern. Conversely, agricultural productivity has an upward pattern, showing an increase in agricultural performance. From 2000 to 2008, unemployment rates had an upward trend, but it switched to a downward trend for the subsequent years. From 2000 to 2019, GDP growth experienced steady growth, indicating economic stability and development. Nonetheless, a sharp decline occurred in 2020, likely due to the pandemic outbreak.

3.2 Stationary Test

Tables 1 and 2 depict the results of the stationary test for all the variables. The results of the ADF test denote that UNEM and GDP are stationary at their level, I[0]. Conversely, POV and AGRIP are non-stationary at their level. Instead, they are stationary at their first difference, indicating first-order integration, I[1]. Similarly, the PP method demonstrates that the vast majority of variables, i.e., POV, AGRIP, and UNEM, are non-stationary at their level. However, POV, AGRIP, and UNEM switch to become stationary variables after the first difference is taken into account. Given that none of the variables are I[2]; Hence, the ARDL is suitable for application.

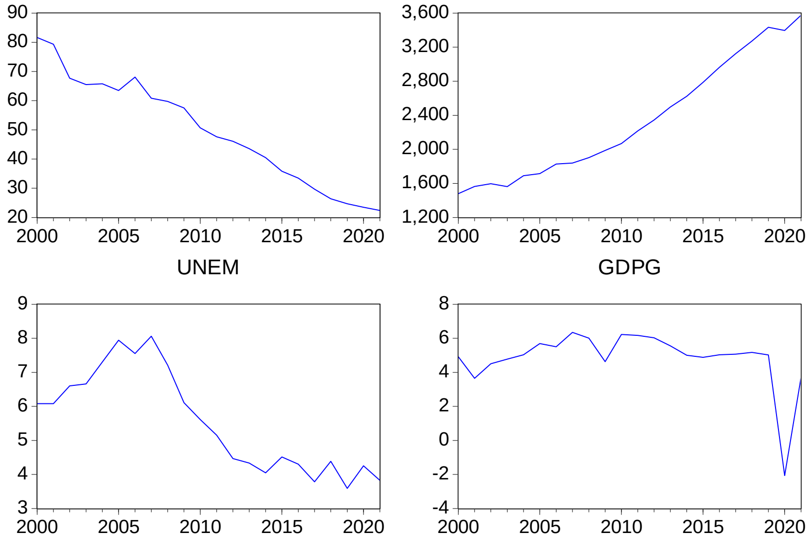

Fig. 1. Trend of Variables

Table 1. ADF test results

	Level		First difference	
	Statistic	Prob.	statistic	Prob.
POV	-2.8895	0.1850	-5.1761	0.0026
AGRIP	-1.6206	0.7496	-4.9863	0.0038
UNEM	-4.3481	0.0152	-4.3636	0.0130
GDPG	-3.5995	0.0544	-8.0082	0.0000

Note: AGRIP is agricultural productivity. UNEM denotes unemployment rates. GDPG shows economic growth.

Table 2. PP test results

	Level		First difference	
	Statistic	**Prob.**	**statistic**	**Prob.**
POV	-2.8895	0.1850	-5.1761	0.0026
AGRIP	-1.6206	0.7496	-4.9793	0.0039
UNEM	-2.1182	0.5069	-4.4030	0.0121
GDPG	-3.5995	0.0544	-10.8488	0.0000

Note: AGRIP is agricultural productivity. UNEM denotes unemployment rates. GDPG shows economic growth.

Table 3. The Optimal Lag Test

Lag	Alternative methods			
	FPE	**AIC**	**HQIC**	**SBIC**
0	3.30E+06	26.3596	26.3985	26.5588
1	6481.23	20.0849	20.2792	21.0806*
2	4129.83*	19.3999*	19.7498*	21.1922

*Note: *denotes the optimal lag length*

3.3 Model Selection

The necessary stage before using the ARDL is the optimal lag length test; therefore, this paper employs the Akaike Criteria Information (AIC) approach to check the maximum lag length. The results are shown in Table 3. The outcomes from AIC denote that the optimal lag length is two. Fig. 1 presents the results of the model selection. This paper also utilizes AIC in order to determine the ARDL (p,q) lag structure. By specifying two as the maximum lag length as suggested by the AIC, ARDL (1,1,2,0) is the most fit model.

3.4 Cointegration Test

Having determined the ARDL lag structure, this paper examines the presence of long-run links among the study variables using the Bounds test. The empirical results of the cointegration tests are depicted in Table 4. The estimated F-statistic (14.634) exceeds the upper bound (5.61) at a 1% critical value. There is a cointegration connection between poverty, economic growth, agricultural productivity, and unemployment in Indonesia. In other words, there is no spurious regression.

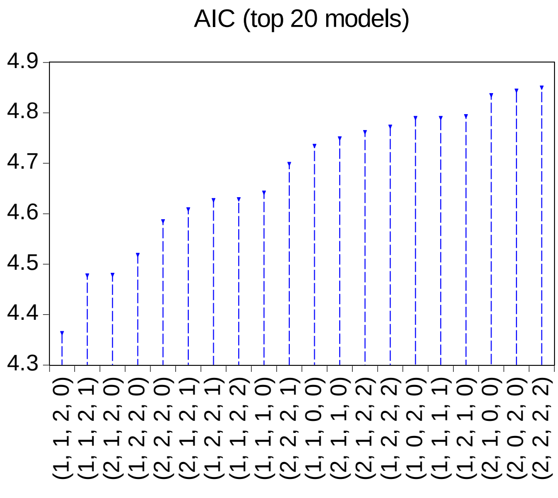

Fig. 2. ARDL Model Selection

Table 4. The Bounds Test Results

	Value	Sign.	I(0)	I(1)
F-statistic	**14.634**	**10%**	**2.72**	**3.77**
k	3	5%	3.23	4.35
		2.5%	3.69	4.89
		1%	4.29	5.61

Note: I(0) and I(1) denote upper and lower bounds, respectively. k signifies the number of explanatory variables

Table 5. ARDL-Estimates

Long run	**Coefficient**	**Std. err.**	**t-stat.**	**Prob.**
AGRIP	-0.02190***	0.00177	-12.39	0.000
UNEM	2.68997***	0.85695	3.14	0.009
GDPG	-1.50139**	0.55767	-2.69	0.020
Short run				
ECM	-0.72098***	0.12036	-5.99	0.000
∆AGRIP	0.01152	0.00954	1.21	0.250
∆UNEM	0.55984	0.75806	0.74	0.474
∆UNEM(-1)	1.62383**	0.66181	2.45	0.030
∆GDPG	-1.08248***	0.33671	-3.21	0.007
Constant	62.9787***	13.55898	4.64	0.001

*Note: AGRIP is agricultural productivity. UNEM denotes unemployment rates. GDPG shows economic growth. *p<10, **<5, and ***p<1*

3.5 Dynamic ARDL Estimates

Table 5 demonstrates the results of the short-run and long-run ARDL estimates. In the long run, agricultural productivity is negatively associated with the poverty rate at a 1% critical value. The estimated parameter of AGRIP is -0.029. This finding confirms the presence of a strong linkage between agriculture performance and poverty in Indonesia as expected. In other words, the farm sector is confirmed to have a pivotal position in addressing poverty in Indonesia. This empirical finding also demonstrates that an improvement in farm productivity leads to a decrease in poverty rates, and vice versa.

The adverse relationship between agricultural productivity and poverty demonstrates that the agriculture sector, including crops, livestock, and fisheries subsectors, can be applied as formal instrument for achieving one of the Sustainable Development Goal (SDG) principles namely poverty eradication. The agriculture sector can contribute to income per capita and then poverty eradication through several pathways. First, the agriculture sector is firmly connected with income generation and rural livelihood. An improvement in productivity leads to an increase in farmers' income. Second, an increase in farm productivity will be beneficial for the nation's food security target. A sufficient supply of food is critical to ensure affordable prices so the poor can access it. Last of all, strong agricultural performance is required to supply raw materials for manufactural industries

The unemployment rate is empirically found to have a positive impact on poverty rates at a 1% critical level. The estimated parameter of UNEM is 2.690. This finding implies that unemployment volatile impacts the poverty dynamic. In practice, a lack of job opportunities can drive an increase in the number of individuals living beyond the poverty threshold. In other words, a scale-up in unemployment leads to a boost in poverty rates. This evidence is consistent with previous studies by Lechheb et al. [31] and Murjani [13]. The positive relationship between unemployment and poverty should be navigated by policymakers to draft proper policies. It is widely discussed that the presence of the unemployed and the poor drive a poverty trap. Unemployment is argued as a mutual friend of poverty [31]. Limited access to education and financial services is considered as factors exacerbating the linkage between poverty and unemployment.

Furthermore, economic growth is found to have a negative effect on poverty rates at a 5% level of significance. The estimated parameter of GDPG is -1.501. This finding demonstrates that Total output growth is verified to have a beneficial role in addressing poverty in Indonesia. Theoretically, economic growth is a signal for overall economic condition, including social and economic aspects such as poverty rates, unemployment rates, and business activities. A negative linkage between economic growth and poverty rates is consistent with earlier investigations in Indonesia [13], West Sumatra [11], and South Africa [31]

Economic growth will be followed by an increase in government revenue which in turn can be used for social programs and infrastructure that benefit the poor. In addition, total output growth can be positively linked with job opportunities that are accessible for individuals in both rural and urban areas, including the poor. Nonetheless, it should be noted that economic growth is not a sufficient condition for poverty alleviation [32]. To tackle this issue, inclusive growth is firmly required in order to ensure that all groups, including the poor and vulnerable, have the same opportunities to participate and benefit from economic growth.

Table 6. Diagnostic Test Results

Tests	Statistic	Prob.
Breusch-Godfrey	0.097	0.761
Harvey	0.929	0.519
Ramsey RESET	1.707	0.218
Jarque-Bera test	1.167	0.558

In terms of short-run models, this paper focuses on the ECM coefficient. The lagged value of the ECM is found to have a negative sign and is statistically significant at a 1% level. The process of adjustment to long-run equilibrium is verified. The estimated parameter is -0.72 shows that a deviation from the long-run equilibrium is around 72% given any shock in the economy.

3.6 Diagnostic and Stability Tests

To check the reliability ARDL' findings, this paper incorporates diagnostic and stability tests. The results in Table 5 signify that the issues of serial correlation and heteroscedasticity are not evident given that the Bresuch-Godfrey and Glesjer tests do not reject their null hypotheses. In addition, the Ramsey RESET test does not reject the null hypothesis. This result implies that the functional form of the computed model, i.e., ARDL (1,1,2,0) model is well defined. Furthermore, the Jarque Bera test points out that the error terms have a normal distribution.

This paper uses the Cumulative Sum (CUSUM)- and square (CUSUMQ) of recursive residuals to examine the stability of coefficients. Using a 5% critical value, the CUSUM and CUSUMSQ tests are applied in order to mitigate potential issues namely the natural structural break of the series [33]. The outcomes of the stability investigations are presented in Figs. 3 and 4, respectively. The estimated parameters (blue plots) are found to be stable since they fluctuate between upper and lower critical values.

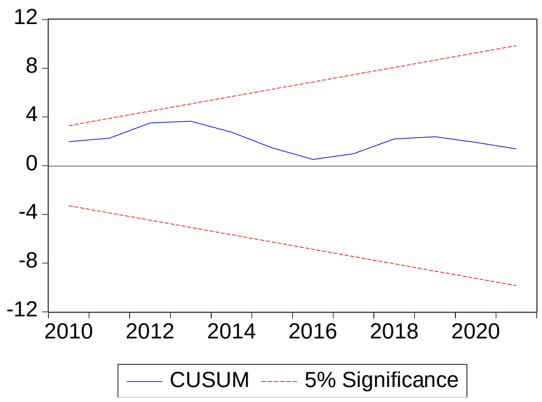

Fig. 3. The CUSUM test

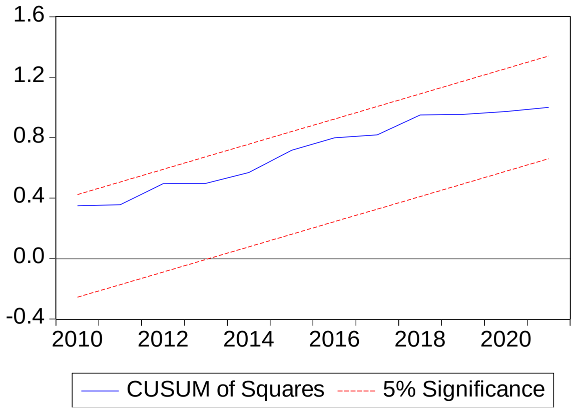

Fig. 4. The CUSUMSQ test

Table 7. Causality Test

Model (H0) x does not grange cause y	chi2	Prob.
POV ← AGRIP	6.2092**	0.013
POV ← UNEM	7.0818***	0.008
POV ← GDPG	1.8840	0.170
AGRIP ← POV	12.0120***	0.001
AGRIP ← UNEM	12.4100***	0.000
AGRIP ← GDPG	1.7004	0.192
UNEM ← POV	0.0306	0.861
UNEM ← AGRIP	0.4656	0.495
UNEM ← GDPG	8.8730***	0.003
GDPG ← POV	1.3543	0.245
GDPG ← AGRIP	3.8272**	0.050
GDPG ← UNEM	0.4710	0.493

Note: ← denotes causal direction.

3.7 The Causality Test

This empirical paper incorporates the GC test in order to unravel the causal direction between agricultural productivity, poverty rates, economic growth, and unemployment given that ARDL-Bounds testing does not necessarily represent a causal nexus. Table 6 jointly presents the results of the causality analysis. The outcomes signify a bidirectional causality between AGRIP and POV and a unidirectional causality flowing from UNEM to POV. These empirical outcomes denote that a change in unemployment rates and agricultural productivity causes a change in poverty rates.

Furthermore, there is a unidirectional causality running from GDPG toward UNEM, as well as a unidirectional causality running from AGRIP to GDPG. Given that the causal direction running from economic to poverty rates is not evident, it can be inferred that economic growth has an indirect effect on poverty dynamics. GDP growth shows an increase in economic capacity which can contribute to poverty alleviation via several pathways namely infrastructure development, job creation, and innovation. Conversely, agriculture productivity is found to have a direct influence on poverty reduction.

4. CONCLUSION

This paper empirically examines the relationship between poverty rates, unemployment, economic growth, and agricultural productivity in Indonesia for the period 2000 – 2021 using data collected from the World Bank. This paper employs the ARDL-Bounds testing to determine the dynamic relationship, as well as the cointegration model. Additionally, the GC test is utilized to ascertain the causal direction of study variables.

The long-run relationship between poverty rates, unemployment rates, economic growth, and farm productivity is verified given that the Bounds test implies the presence of cointegration. In the long run, GDP growth and agricultural productivity are negatively associated with poverty rates. Hence, Agricultural performance and economic growth, therefore, are verified to have pivotal positions in addressing poverty in Indonesia. Conversely, the unemployment rate is positively connected with poverty rates, meaning it contributes to poverty. The GC causality test signifies a unidirectional causality flowing from unemployment to poverty and a bidirectional causality between poverty and agricultural productivity. In the efforts to address poverty in Indonesia; following the findings, this paper advocates promoting inclusive economic growth and enhancing farm productivity while simultaneously drafting programs for specifically reducing unemployment rates.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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